Hindcast Wind and Wave Forcing In Support of
URS FEMA Mississippi Coastal Flood Map Update

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To

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HISTORY

OWI was first approached in February, 2006 to participate in a URS FEMA sponsored project to develop updated coastal flood risk maps for the coast of Mississippi (MS). A preliminary proposal and scope of work were developed and OWI was contracted to provide initial support to URS. The proposal and scope of work were refined on July 17, 2006 to describe OWI's contribution in more detail to support the URS FEMA ADCIRC modeling project for the coast of Mississippi. That contribution emphasized the provision of a comprehensive, definitive and reliable database of wind stress, sea level pressure, and wave forcing for calibration hurricanes and high ranked actual historical storms in the area of interest (i.e. Gulf of Mexico (GOM)), through the application of a proven hindcast method consistent with that used in FEMA projects for neighboring coasts. During that period, considerable progress was made in the production and delivery to URS of wind and pressure fields for several actual high-ranked GOM hurricanes for the purposes of facilitating URS's calibration of ADCIRC. Additional work included the implementation of OWI's spectral wave model to the GOM at suitable resolution for the provision of boundary conditions for URS's nearshore SWAN model nests set-up to provide radiation stress forcing to ADCIRC. Sample wave boundary conditions were also delivered to URS for testing purposes. During this period of performance OWI participated in several meetings and provided consultancy as needed. By November of 2006, a final scope of work was proposed which reflected a major change with regard to the wind field modeling that shifts focus from modeling of a population of actual high ranked historical storms along shifted tracks consistent with the EST methodology to the wind and wave modeling of many more synthetic storms along many more tracks, consistent with the Joint Probability Method (JPM) adopted in the project.

QUALIFICATIONS

OWI have contributed significantly over the past 30 years to programs designed to understand, describe and model the surface marine meteorological characteristics of GMEX hurricanes and the corresponding ocean response to the passage of hurricanes. The impact of our work has been immense on practices of design of offshore structures in the GMEX. The most notable programs include the so-called Analysis Phases of major measurement programs such as the Ocean Data Gathering Program (ODGP) for winds and waves, the Ocean Current Measurement Program (OCMP) for continental shelf currents, the Ocean Test Structure (OTS) program for platform response, and a number of Ocean Response to a Hurricane (OHRP) programs which utilized air-dropped current meters to measure mixed layer storm driven currents, and the aforementioned Hurricane Andrew, Lili and Ivan studies. Our trilogy of GMEX Joint Industry Projects (JIP) conducted in the early 1990s and known as GUMSHOE, WINX and GLOW have become established as the de-facto industry standard base of metocean design data in the northern GMEX. Comparable studies have addressed the Bay of Campeche in the southwest GMEX (Cardone and Ramos, 1997). The length restriction of this report limits our ability to describe the hindcast models and methodologies that we have developed and applied in these studies. However, while much of the JIP work has been proprietary, the underlying modeling and analysis methods have been documented and exposed to the scientific and engineering communities in the peer reviewed literature and in proceedings of major conferences (see also reference list attached). Briefly, the OWI group was the first to demonstrate that a numerical spectral ocean wave prediction model could be used to provide an accurate description of the complex pattern of sea states generated by and traveling with tropical cyclones (Cardone et al., 1976). The extremal analysis of the results of hindcasts of the most extreme historical hurricanes which had occurred between 1900 and 1970 carried out with the ODGP hindcast models, provided revised design estimates (Ward et al., 1979; Haring and Heideman, 1978), which are credited (e.g. New York Times, 10/21/92, page D7) with greatly increasing the reliability (as demonstrated in the Andrew experience) of platforms designed since about 1976. The OWI led JIP "Gulf of Mexico Storm

Hindcast of Oceanographic Extremes" (GUMSHOE) served to update the ODGP study and provide more reliable extreme design data in shallow water. The ODGP utilized model grids of about 1/3rd degree spacing. This spacing was refined to about 1/5th degree in GUMSHOE, 1/10th degree for our Andrew hindcast and 1/20th degree for our Lili and Ivan hindcasts. ODGP and GUMSHOE included substantial hindcast model validation studies because wind, wave, surge and current measurements have been made in some notable historical Gulf of Mexico storms (Audrey, 1957; Bertha, 1957; Carla, 1961; Camille, 1969; Edith, 1971; Delia, 1973; Frederic, 1979; Danny, 1985; Juan 1985). These validation studies (e.g. Reece and Cardone, 1982) demonstrated the accuracy of our hindcast methods when applied to specify peak sea states (significant wave height) at an arbitrary site in a Gulf of Mexico hurricane (bias of less than 0.5 m, mean absolute error of less than 1.0 m and scatter index of 10-15%). More recently, the inner core of Lili passed over two NOAA data buoys (42001 and 42041) and excellent skill was achieved in our hindcasts not only at these buoys but in the far-field of the hurricane as well (Cardone et al., 2004). Similarly, Ivan's large size led to buoy measurements of extreme sea states in the inner core (42040) and up to 100 nm east and west of the track (e.g. 42001, 42003). Again, as found in the validation of our Lili hindcast, storm peak sea states of significant wave height (HS) and peak period (TP) were specified with accuracy of 10% or better while more limited comparisons of measured and hindcast wave spectra also showed good agreement. A recently reported completely "blind" verification of the Ivan hindcast at the Matterhorn platform (Leverette et al., 2005) showed essentially perfect agreement between the hindcast and measured time history of HS including specification of the peak HS within 10%, a margin comparable to the intrinsic sampling error of the measurement. Emergency response hindcasts of Katrina and Rita have also been carried out (as discussed further below) to help major operators develop preliminary updated platform design criteria within the context of OWI's update of GUMSHOE known as GOMOS-USA. Modeling work performed for the Materials Management Service (MMS) for Katrina and Rita was recently presented at the 2007 Offshore Technology Conference (Cardone, et al. 2007). OWI's present study of Gulf hurricane, GOMOS, has been used to provide a new and definitive API update guideline metocean criteria for the use offshore in the Northern Gulf of Mexico (Berek at al. 2007).

OWI continues to a very active participant in hurricane wind and wave modeling. Within the past five years OWI were called upon by the US Navy Office of Naval Research (ONR) to contribute definitive hurricane wind field forcing data sets of selected historical storms to a major ONR sponsored program to evaluate the SWAN wave model in Europe. OWI are also on a NOPP team (including the NOAA National Hurricane Research Division (NHRD)), running a major 5-year program to develop a state-of-art hurricane forecasting system (Graber et al., 2002). Most recently, OWI has been selected as the lead party responsible for specification of hurricane atmospheric forcing in the four devastating hurricanes to affect Florida during the 2004 season as part of the new U.S. Army Corps of Engineers sponsored 3-year MORPHOS (Modeling of Relevant Physics of Sediments in Three Dimensions). Finally, OWI are part of the National Academies Panel Interagency Performance Evaluation Task Force (IPET), whose mission is "to obtain the facts by collecting, analyzing, testing, and modeling data and information on the performance of the New Orleans hurricane protection system during Hurricane Katrina". Specifically, OWI are working closely with panel members, particularly the HWnd team at NHRD, to develop a definitive reanalysis of the time and space evolution of the storms wind field with emphasis on the coastal zone. In a paper presented at the 2006 Waves workshop (Jensen et al. 2006), the OWI 3rd generation wave model is described as the least biased and most skillful along all operational 3G wave models in intense Gulf hurricanes.

STUDY COMPONENTS.

This study consists of three major components: (1) support of the surge model calibration phase through the provision of an enhanced set of historical calibration storms; (2) development of wind fields and

pressures fields for a statistically derived large population of synthetic storms representing a variety of storm sizes, intensities and tracks including derivation of boundary wave spectra for the calibration storms and the necessary subset of synthetic storms to URS's shallow water modeler from OWI's calibrated third-generation spectral wave model adapted at high resolution to the full basin; (3) overall technical support and consultation and associated meetings and reporting.

Tasks

1. Wind, Pressure, and Wave Spectra for Surge Calibration Support

The reference set of historical storms selected by URS for calibration of the modeling include Betsy (1965), Rita (2005), Ivan (2004), Camille (1969), Katrina (2005) and Andrew (1992). Collectively, these validation storms are known as the BRICKA set. OWI provided the time and space evolution of the 10-m level marine wind field and pressure field in a convenient digital format so as to allow URS to place the wind fields at the ADCIRC nodes and to allow URS to calibrate the tuning parameters in ADCIRC, especially the surface drag law.

Copious meteorological data exist and which have already been substantially obtained and processed at OWI to develop wind fields to drive its own ocean response models. The pertinent data sets for wind field analysis consist of:

- Aircraft reconnaissance obtained from NOAA and U.S. Air Force hurricane hunter aircraft, including vortex messages and continuous flight level wind speed, direction, D-Value.
- Gridded and image fields of marine surface wind composites from the NHRD HWnd analysis
- Synoptic observations from NOAA buoy and C-MAN stations
- Synoptic observations from transient ships, coastal and land stations
- Composite NWS radar imagery and Doppler radar PBL flow velocity estimates
- Loops of NOAA GOES visual, infrared and water vapor imagery
- NCEP model wind fields
- QUIKSCAT scatterometer winds
- TOPEX altimeter winds and waves
- ERS-2 altimeter winds and waves
- Data from offshore platforms equipped with met packages

The meteorological parameters of greatest importance are the hurricane's track, forward speed, radius of maximum wind, barometric pressure distribution from the hurricane center to the periphery and the ambient pressure system through which the hurricane is moving. In the hindcast method, these parameters are used to drive a numerical model (Thompson and Cardone, 1996) (TC96) to determine a first guess of the surface wind field using OWI's tropical analyst workstation (Cox and Cardone, 2000) and then the available direct wind measurements are assimilated into the first guess fields to provide a refined specification using OWI's Interactive Objective Kinematic Analysis (IOKA) system (Cox et al., 1995). Daily reconnaissance flights were made into most storms since the 1950s as they crossed the Gulf of Mexico collecting pressure, temperature and upper level wind data as well as eye shape and diameter observations by Air Force and NOAA personnel. Since the late 1990s these data were assimilated into the NOAA NHRD's HWnd program and those analyses were relied upon heavily in the recent storms to represent "data" and to add mesoscale structure to the modeled wind fields.

The combination of TC96 and HWnd has become ubiquitous in the programs noted above (NOPP, IPET, MORPHOS etc.) and the OWI and the HWnd team are working increasingly closely. For example, in collaboration with IPET program, the HWnd team had already reanalyzed its suite of HWnd "snapshots" in Katrina and OWI have incorporated these extremely useful data.

In addition to the wind and pressure fields, OWI ran its 3rd generation wave model (OWI3G) on the BRICKA storm population in order to derive boundary spectra at a previously agreed upon boundary to drive a regional implementation of the SWAN model. The OWI3G model was setup on a 6 Nmi grid covering the Gulf of Mexico (Figure 1). Wave model spectra were archived at 54 grid point locations (Figure 1, shown in black) along the agreed boundary of the SWAN modeling.

Figures 2-7 show the summary of wind, pressure and wave conditions for the BRICKA validation storms. Winds (10-meter, 30-minute average, marine exposure) and pressures (sea level) were delivered on a Basin scale grid (18-30.8N 98-80W at 0.1 degree) and Regional scale grid (28.5-30.75N 91-88W at 0.025 degree). The later storms (Ivan 2004, Katrina 2005, Rita 2005) generally show more small scale structure due to the inclusion of Hwind derived snapshot fields while older storms (Betsy 1965, Camille 1969 and Andrew 1992) are more TC96 model derived.

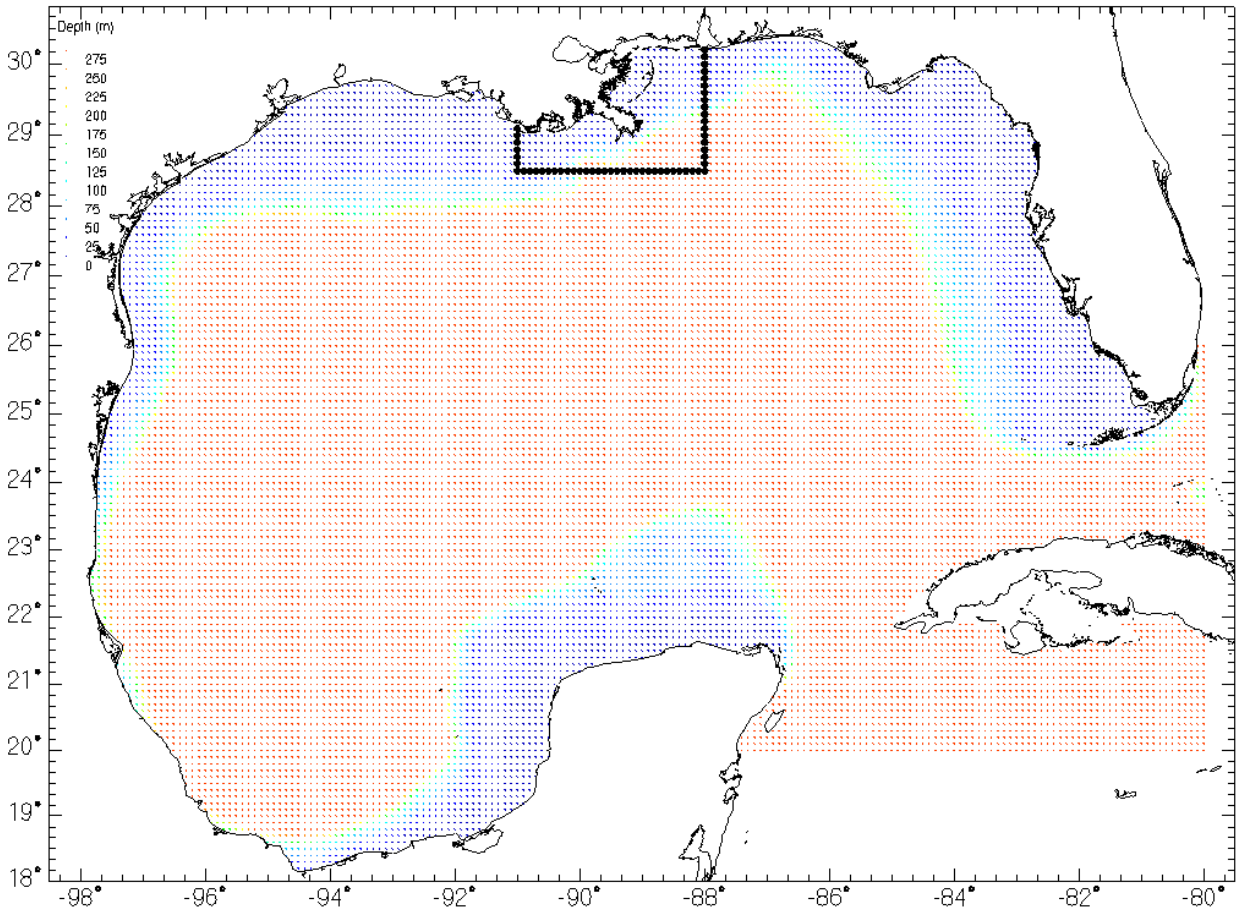

Figure 1 Gulf of Mexico 6-minute (0.1 degree) OWI3G wave model grid with SWAN boundary

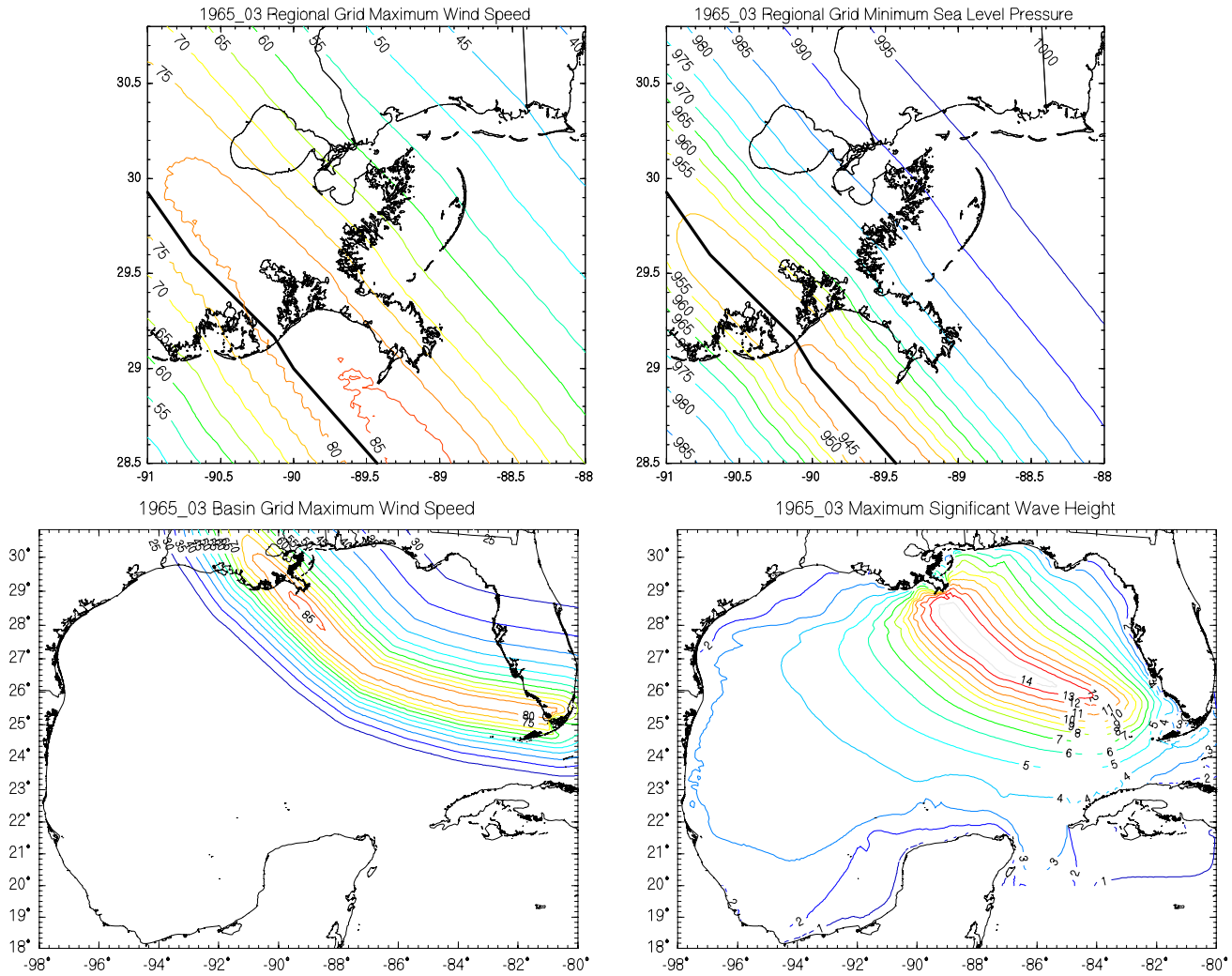

Figure 2 Summary of hindcast winds (10-m, 30-minute average in knots), minimum sea level pressures (mb) and maximum significant wave height (m) hindcast during Betsy 1965

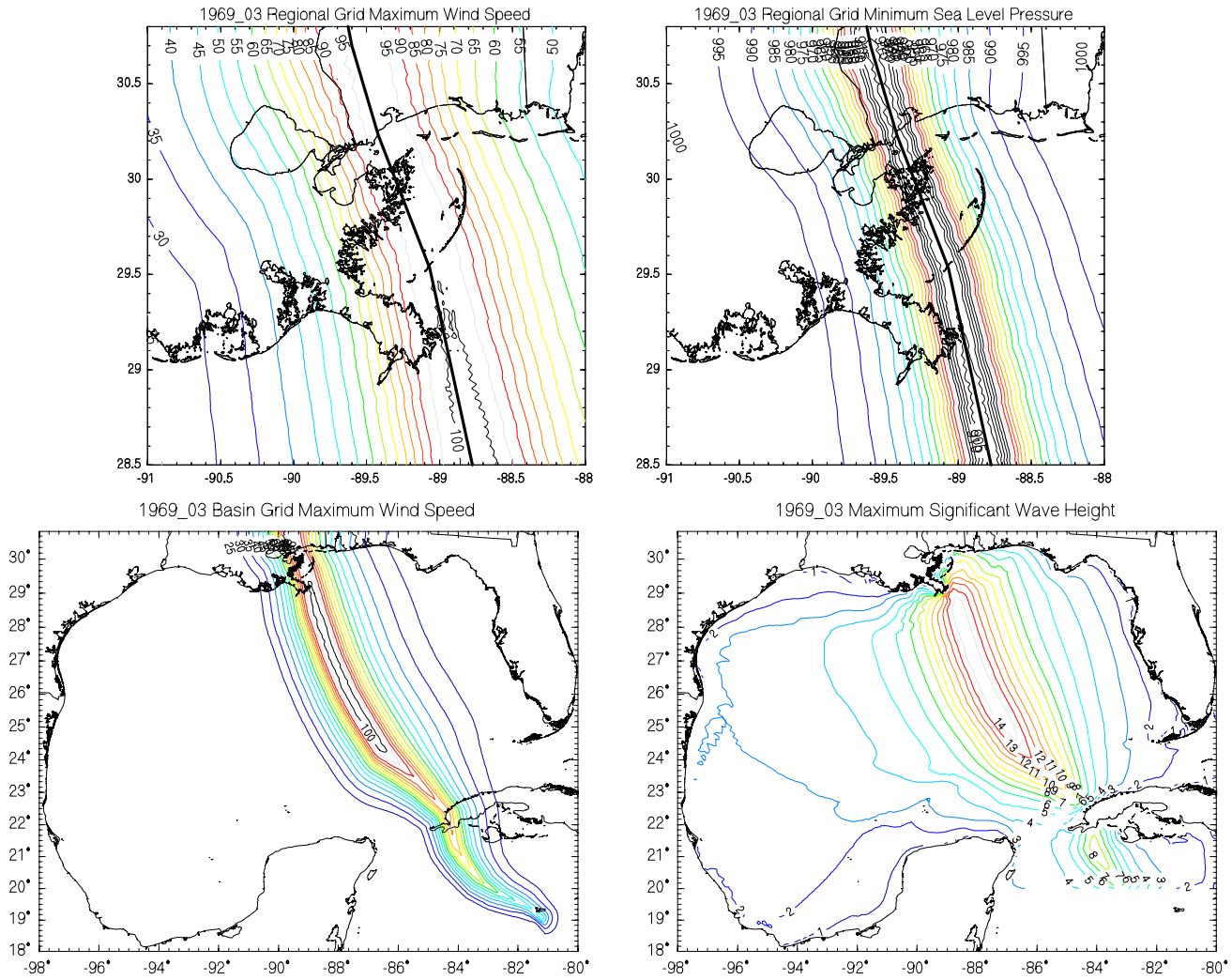

Figure 3 Summary of hindcast winds (10-m, 30-minute average in knots), minimum sea level pressures (mb) and maximum significant wave height hindcast (m) during Camille 1969

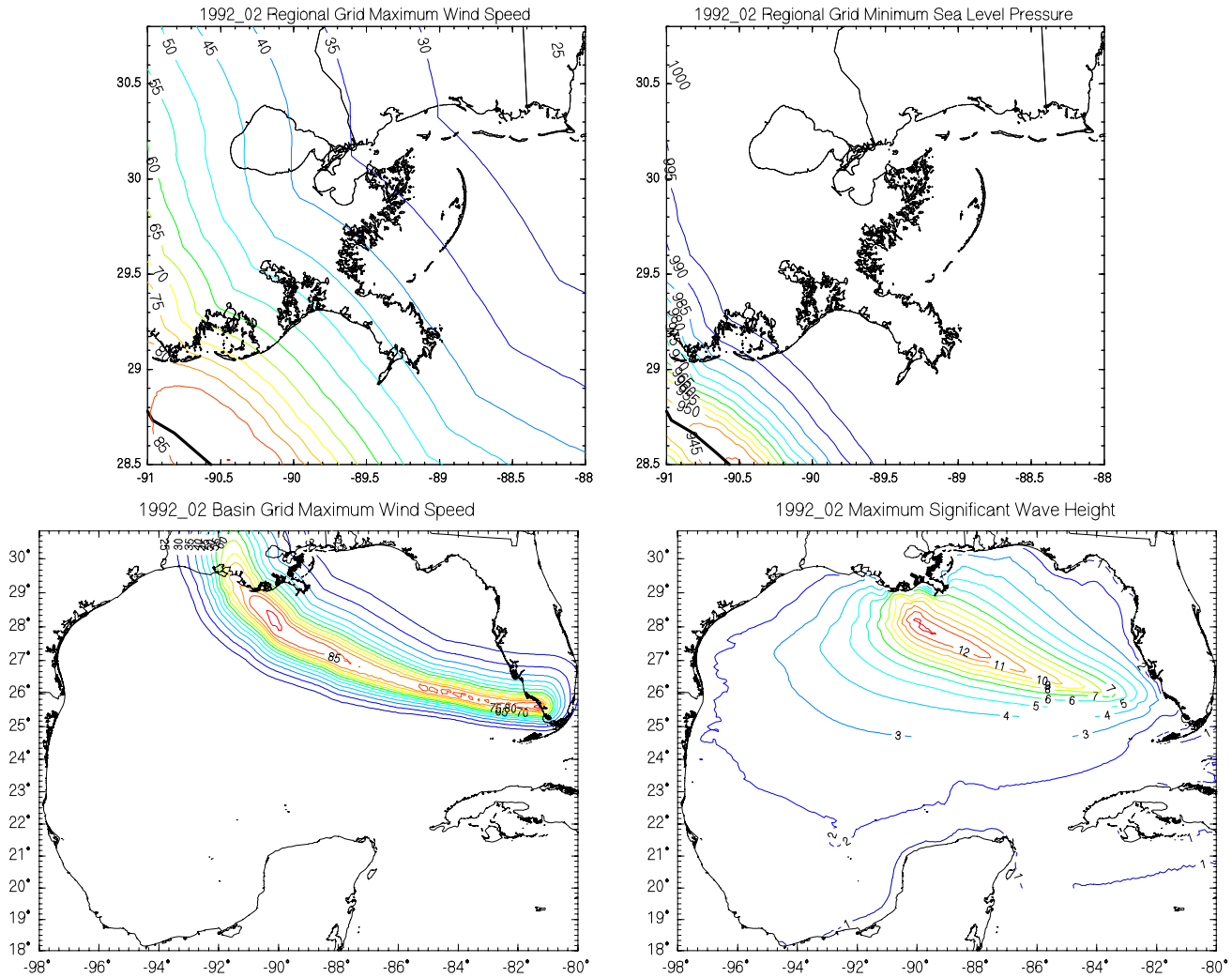

Figure 4 Summary of hindcast winds (10-m, 30-minute average in knots), minimum sea level pressures (mb) and maximum significant wave height hindcast (m) during Andrew 1992

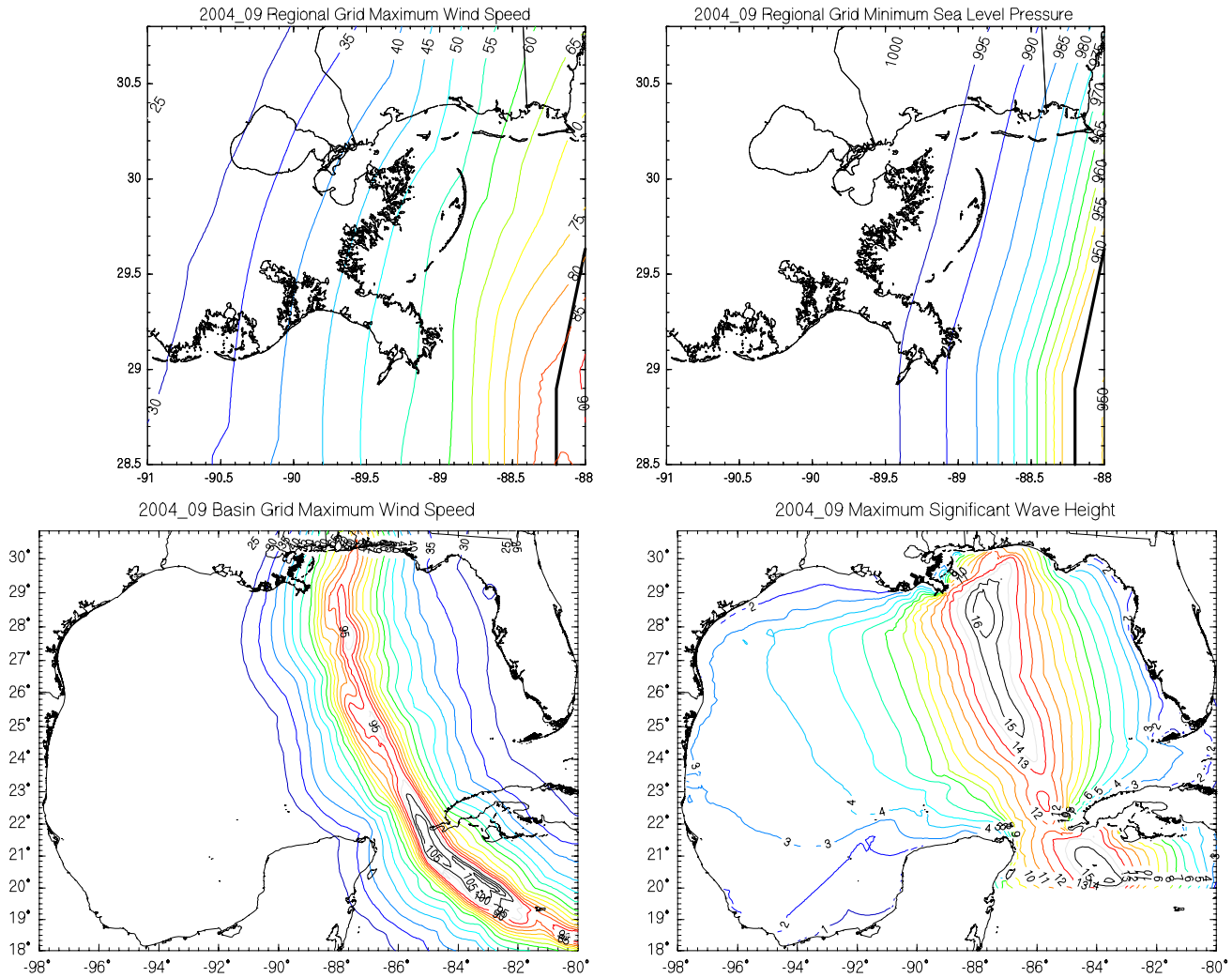

Figure 5 Summary of hindcast winds (10-m, 30-minute average in knots), minimum sea level pressures (mb) and maximum significant wave height hindcast (m) during Ivan 2004

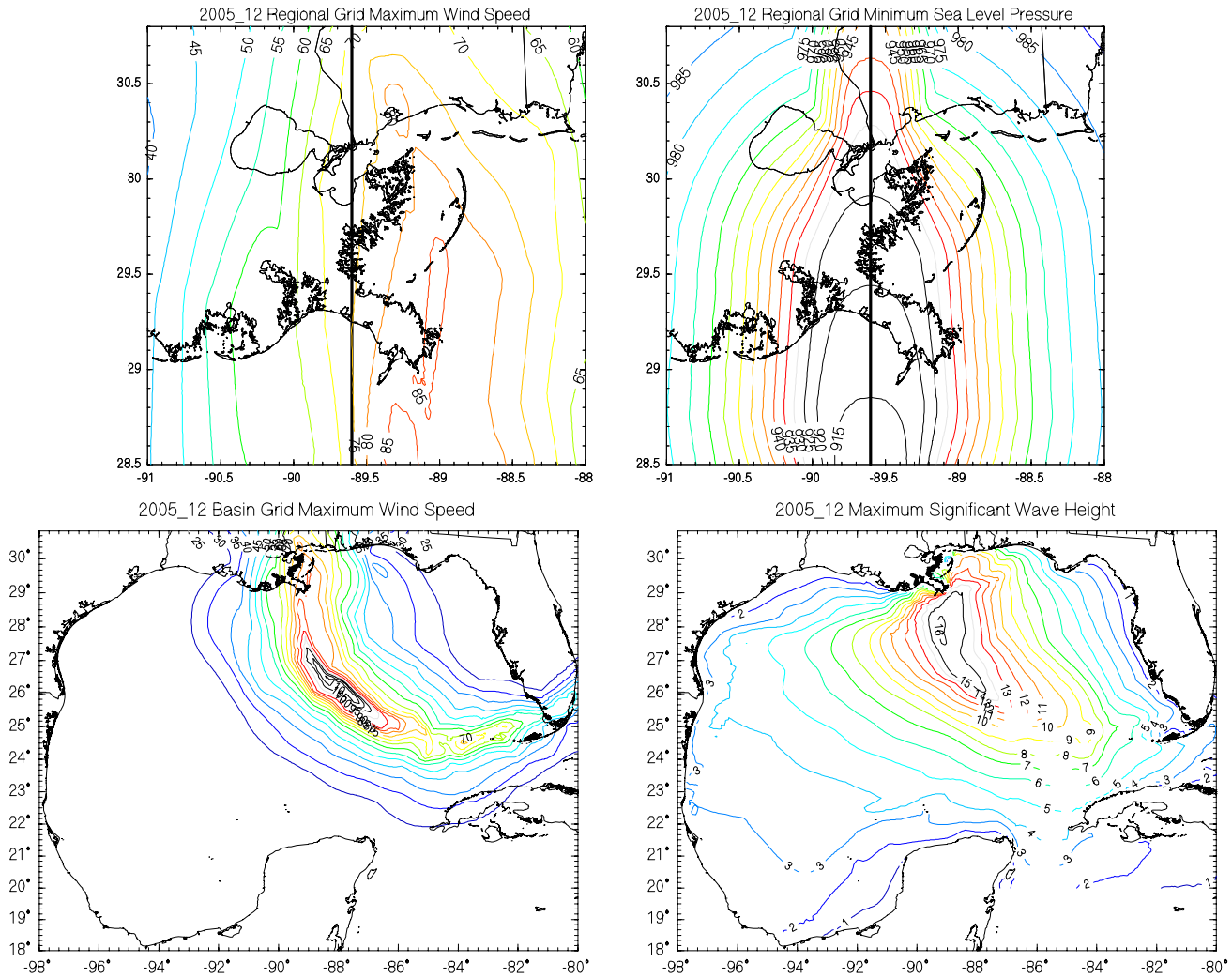

Figure 6 Summary of hindcast winds (10-m, 30-minute average in knots), minimum sea level pressures (mb) and maximum significant wave height hindcast (m) during Katrina 2005

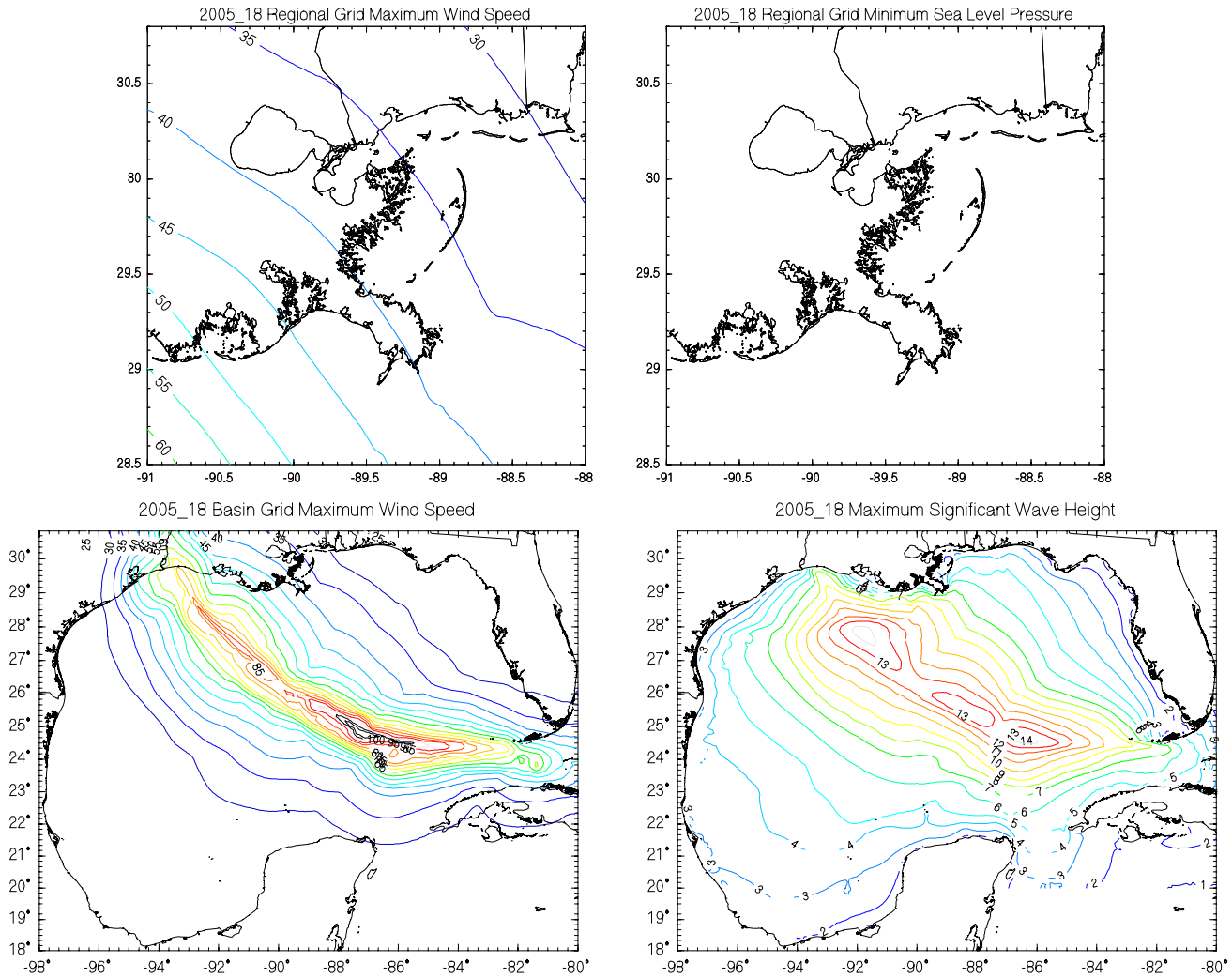

Figure 7 Summary of hindcast winds (10-m, 30-minute average in knots), minimum sea level pressures (mb) and maximum significant wave height hindcast (m) during Rita 2005

2. Wind Stress, Pressure Forcing and Wave Spectra for JPM

OWI generated wind and pressure fields for the full population of JPM hurricanes, delivered on the same grid and in the same format as the calibration storms. The storm parameters of hourly latitude, longitude, sea level pressure, radius of the scale pressure profile (Rp), Holland's B and forward speed were provided by Risk Engineering who is working for URS under a separate contract. Details on the development of the track paths, ranges of parameters, and pre/post filling models applied can be found in the appropriate Risk Engineering reports. This storm parameter file is valid for one single track which targets an arbitrary location along the eastern boundary of MS. OWI then expanded this track along N track iterations along the MS coastline at spacing of Rp at the coastline. The NCDC digitized coastline based on the NWS 38 document was considered the reference used in shifting the land falling tracks.

JPM-OS6

The JPM-OS6 set of storms represents 19 base storm track and parameters used to derive the 100-year conditions in MS. Based on the Rp at landfall, expansion of parallel tracks along NWS38 resulted in 152 individual storm track/parameters generated. Figure 8 shows the tracks of the entire 152 JPM-OS6 storm set, while storm track and parameters for each of the individual storms is shown in Appendix A.

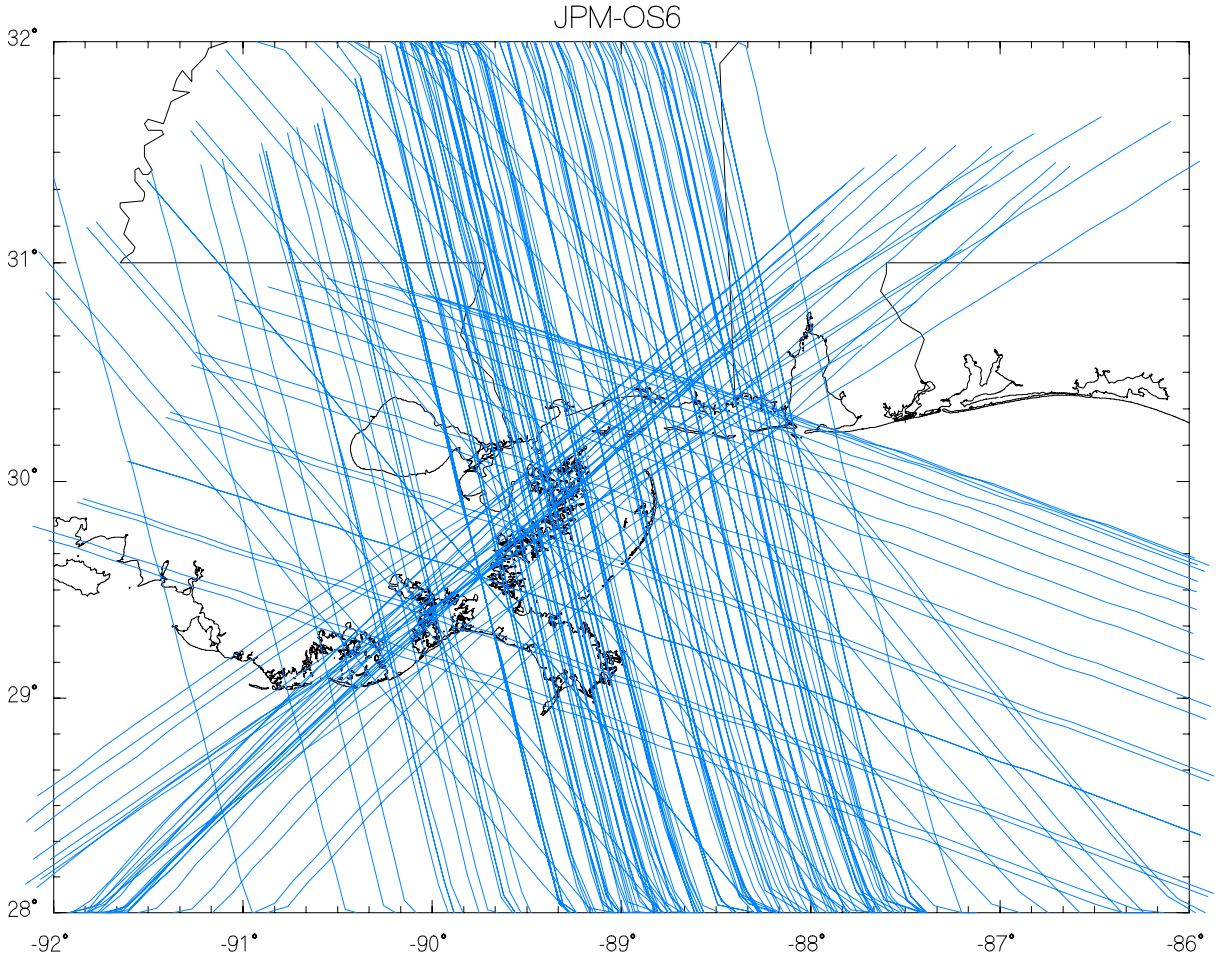

Figure 8 Track paths for the 152 JPM-OS6 storm set

CAT2 Runs

The CAT2 set of storms represents 13 base storm track and parameters used to derive the 10-year conditions in MS. Based on the Rp at landfall, expansion of parallel tracks along NWS38 resulted in 76 individual storm track/parameters generated. Figure 9 shows the tracks of the entire 76 CAT2 storm set, while storm track and parameters for each of the individual storms is shown in Appendix B.

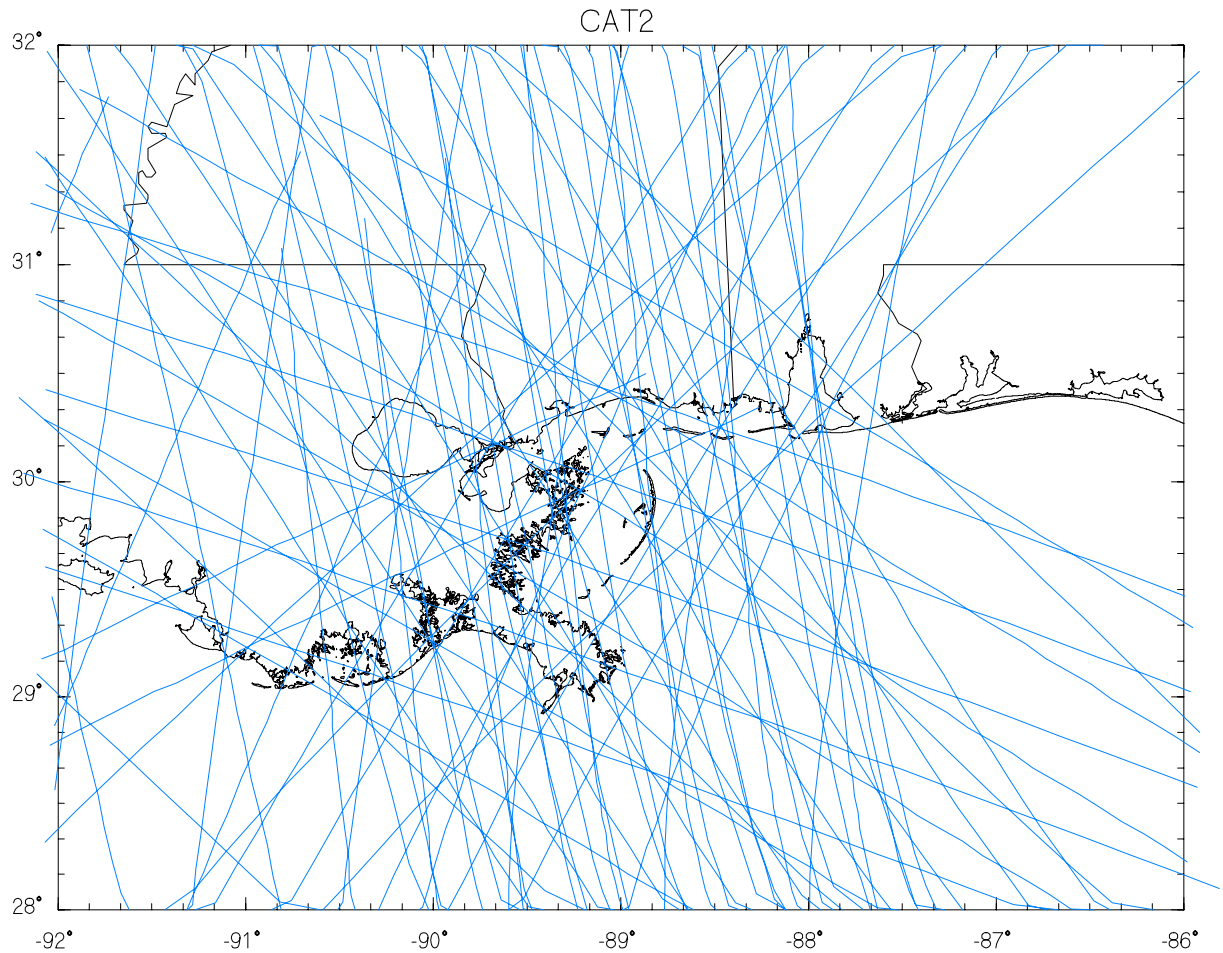

Figure 9 Track paths for the 76 CAT2 storm set

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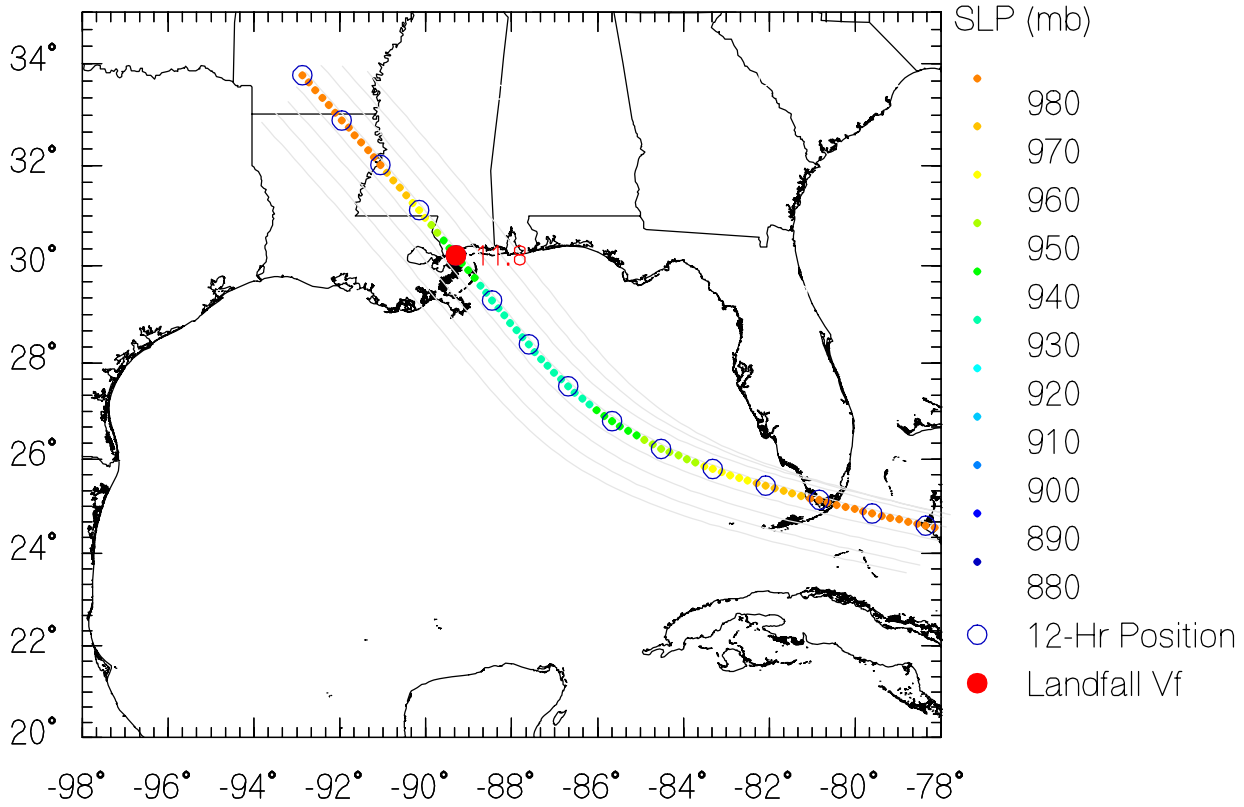
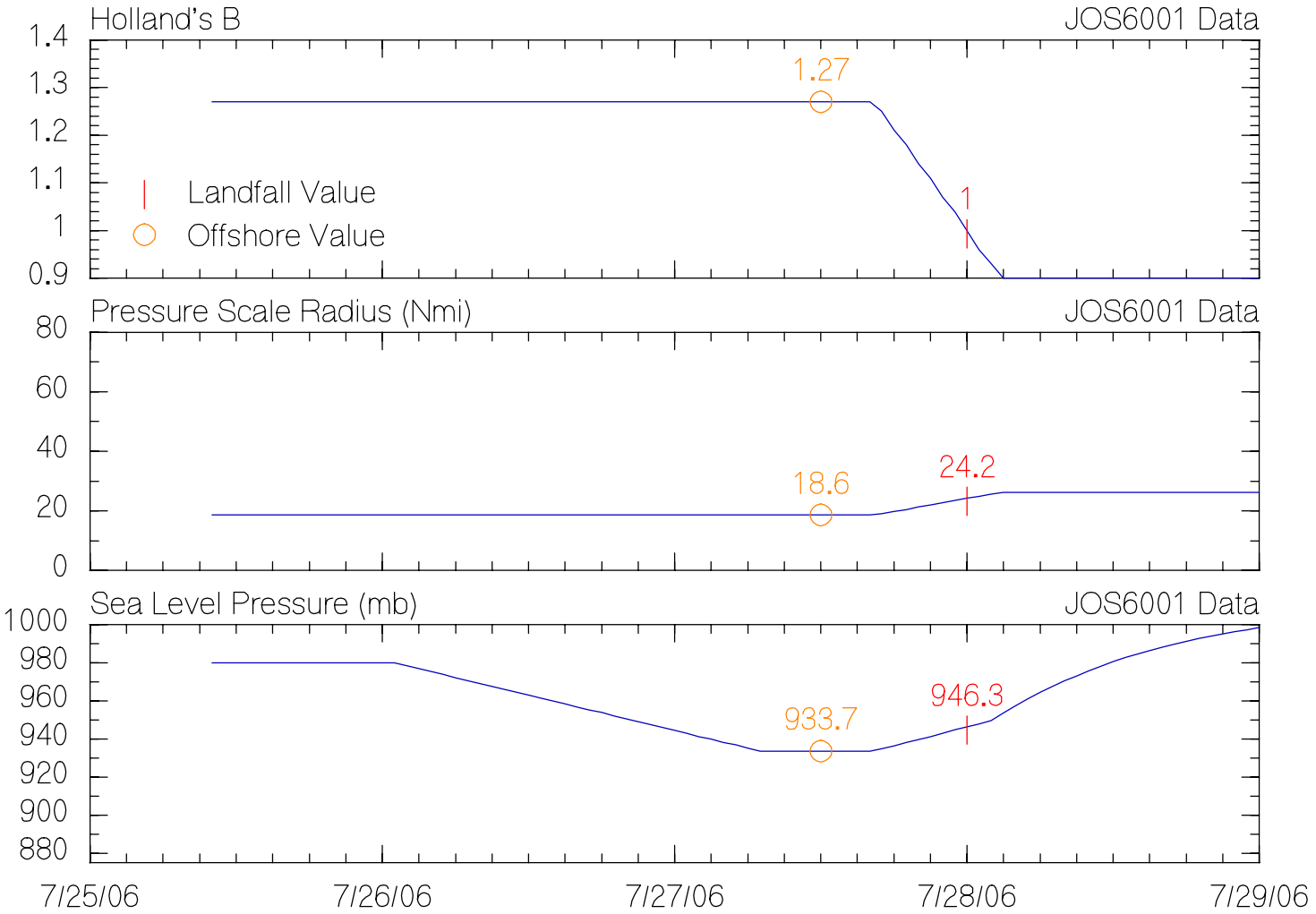
Appendix A

Storm parameters, track and output for JPM-OS6 Storm Set

JOS6001 Data

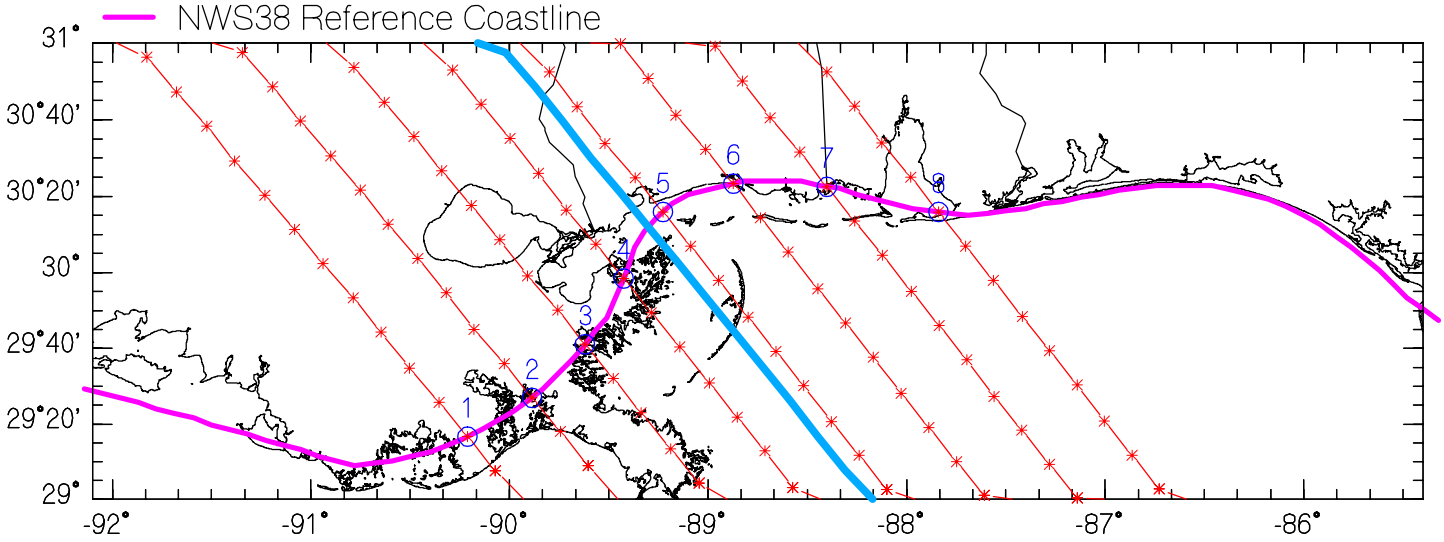


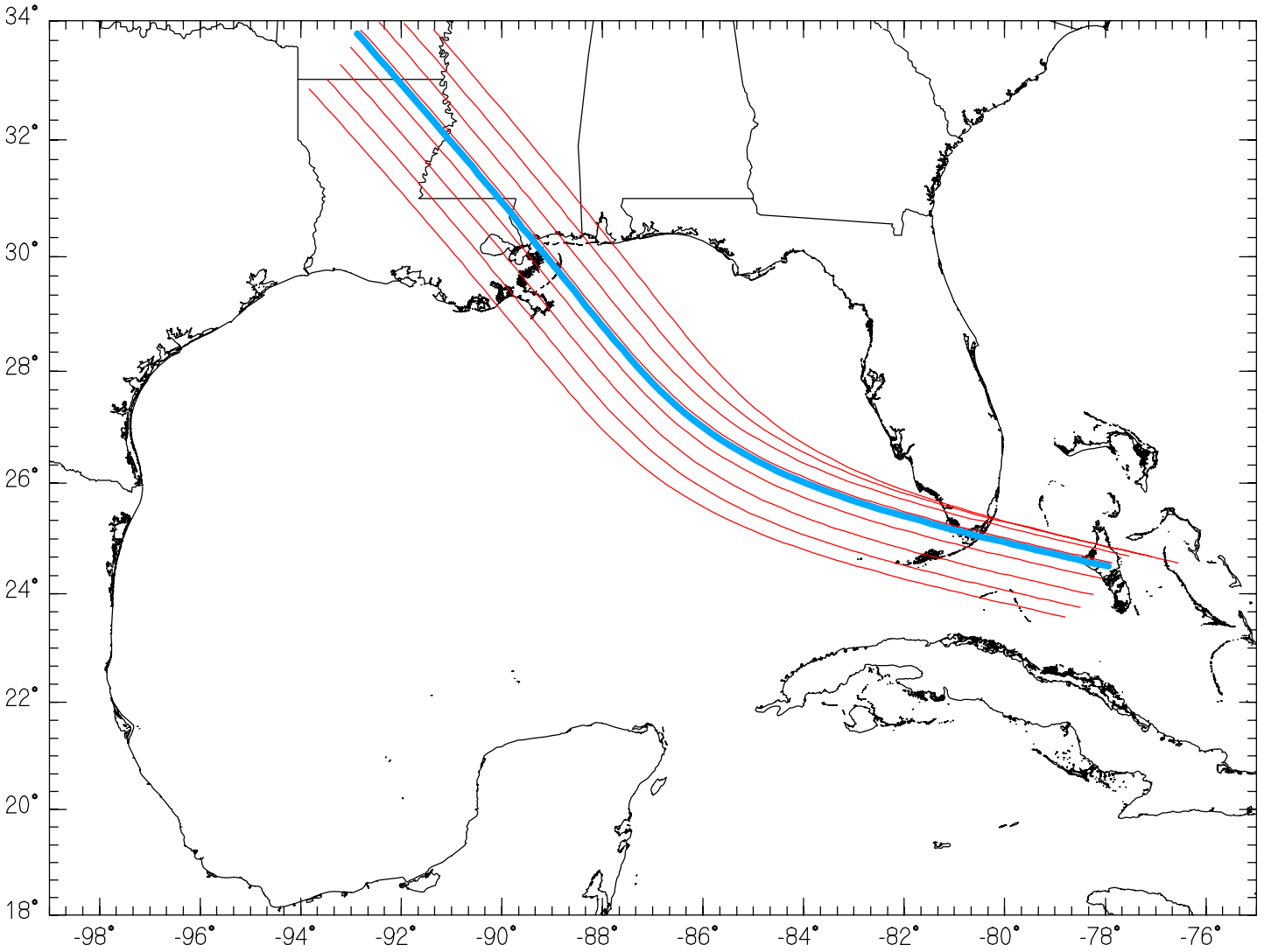


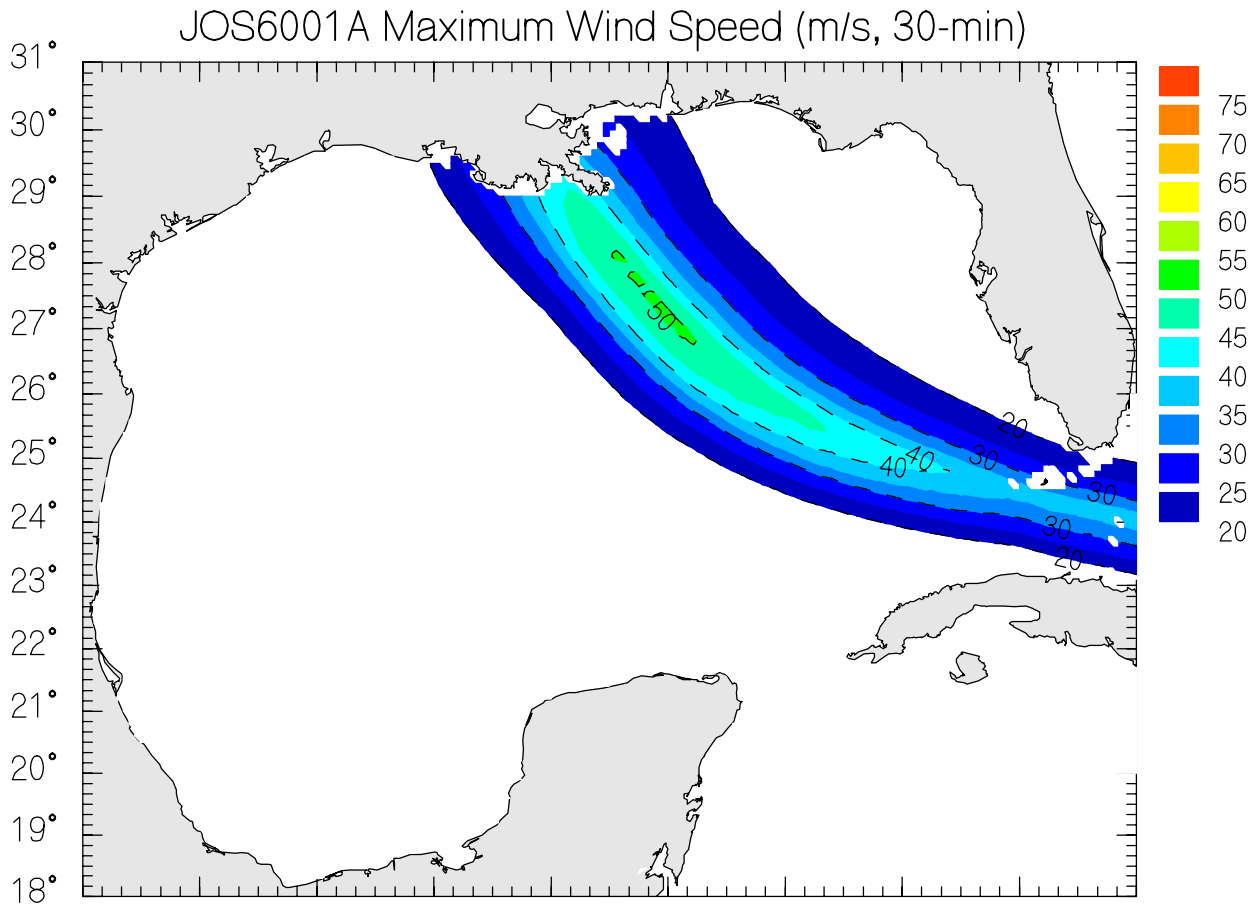
URS JPM-OS6 Production Tracks

JOS6001 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6001A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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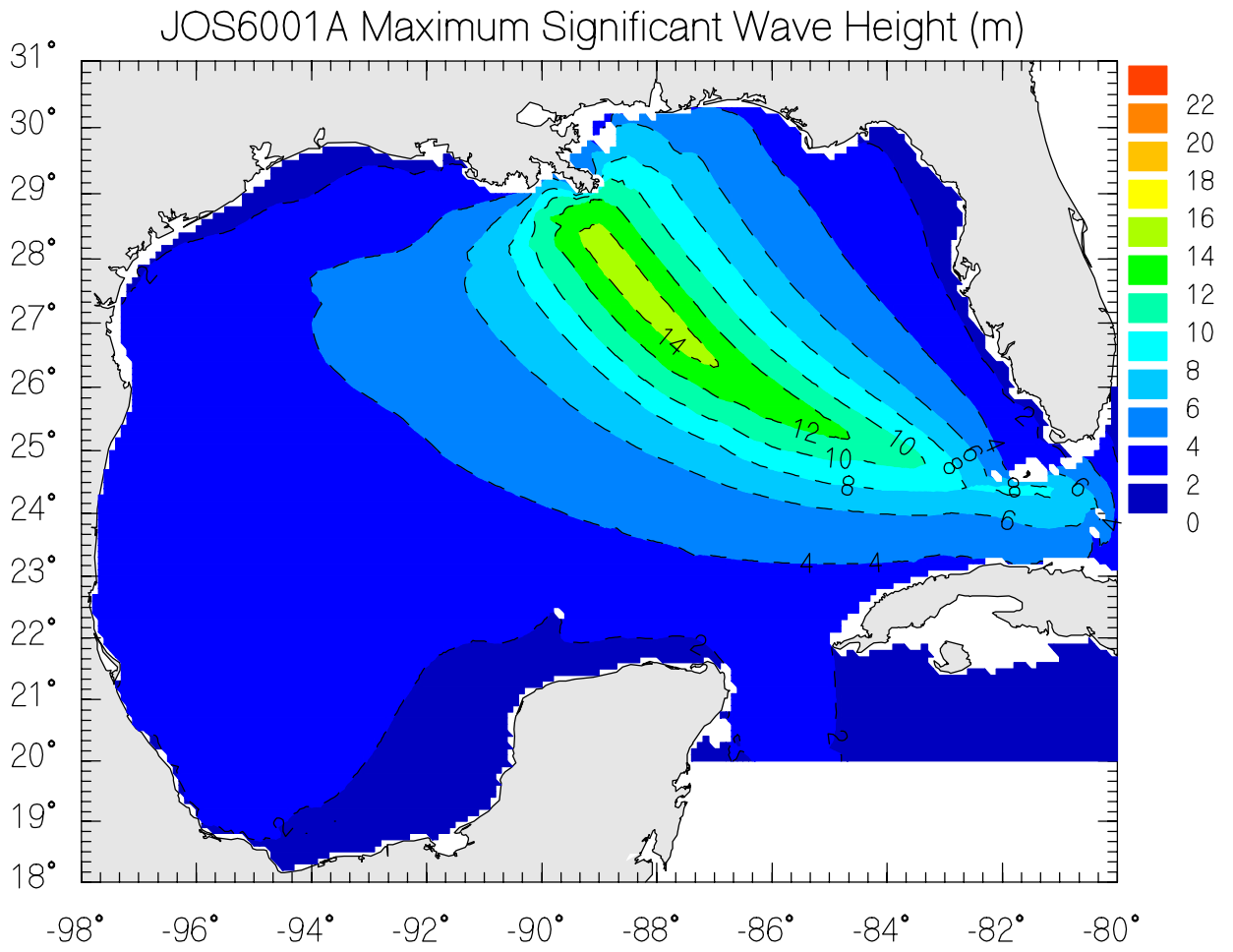
JOS6001A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
14
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18
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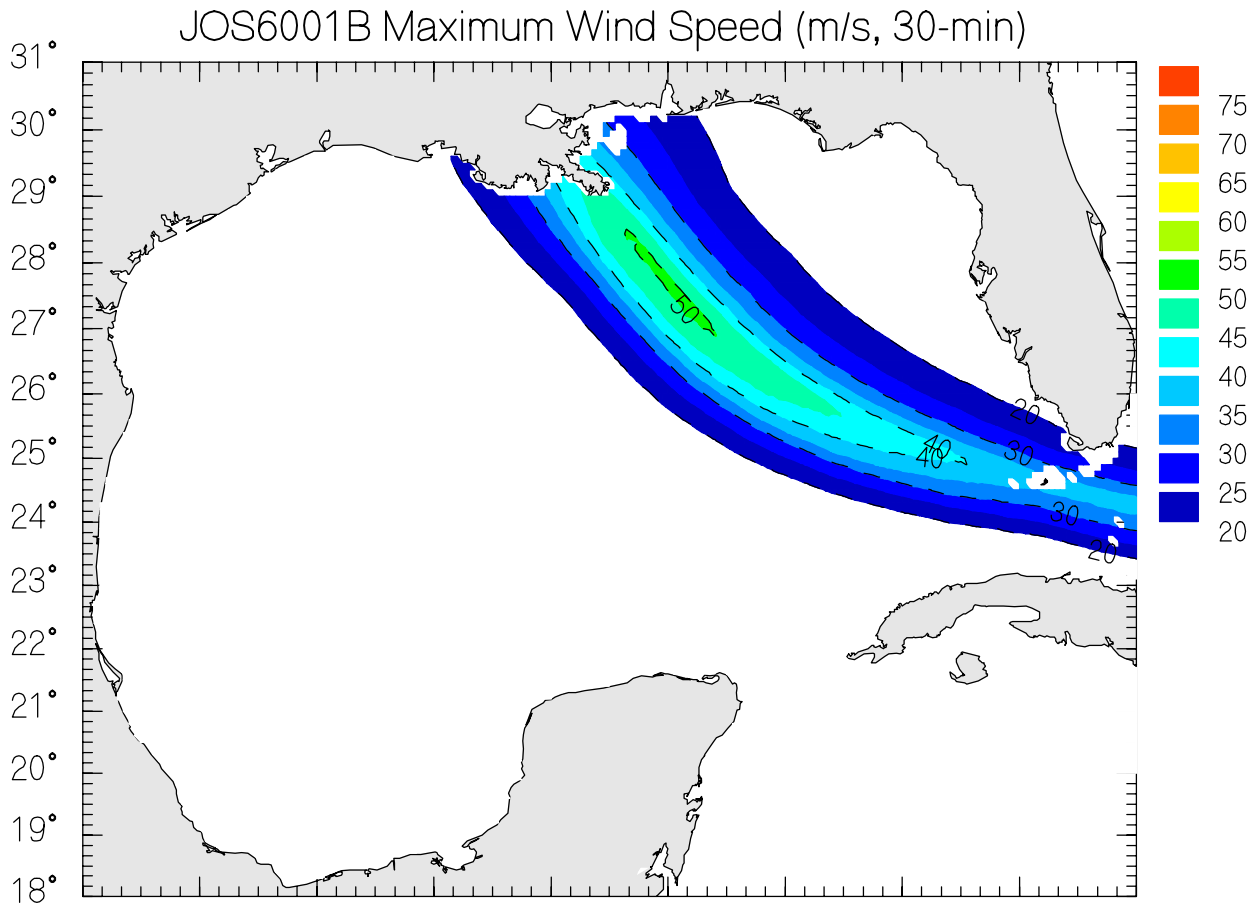
JOS6001B Maximum Wind Speed (m/s, 30-min)
31°
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24°
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21°
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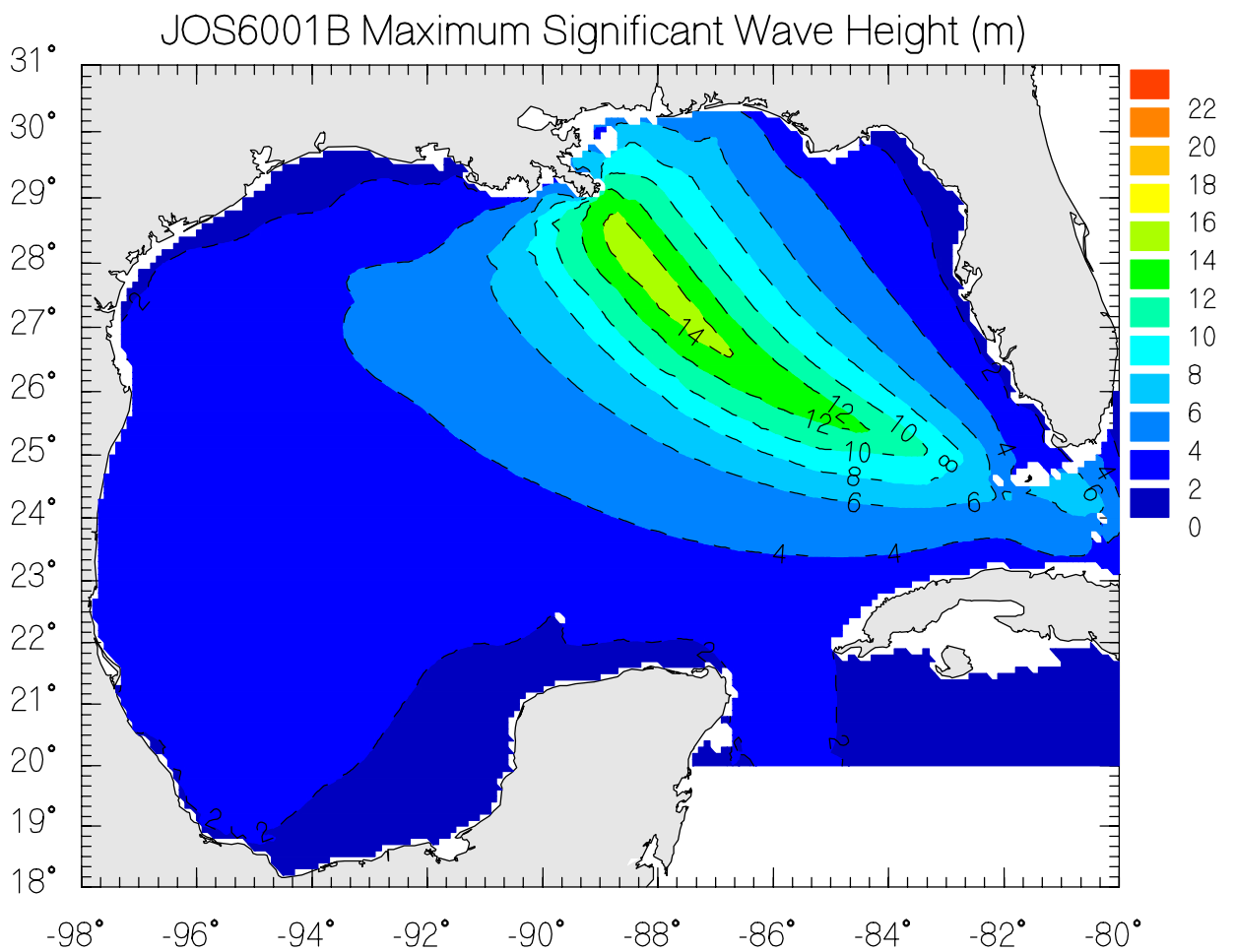
JOS6001B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
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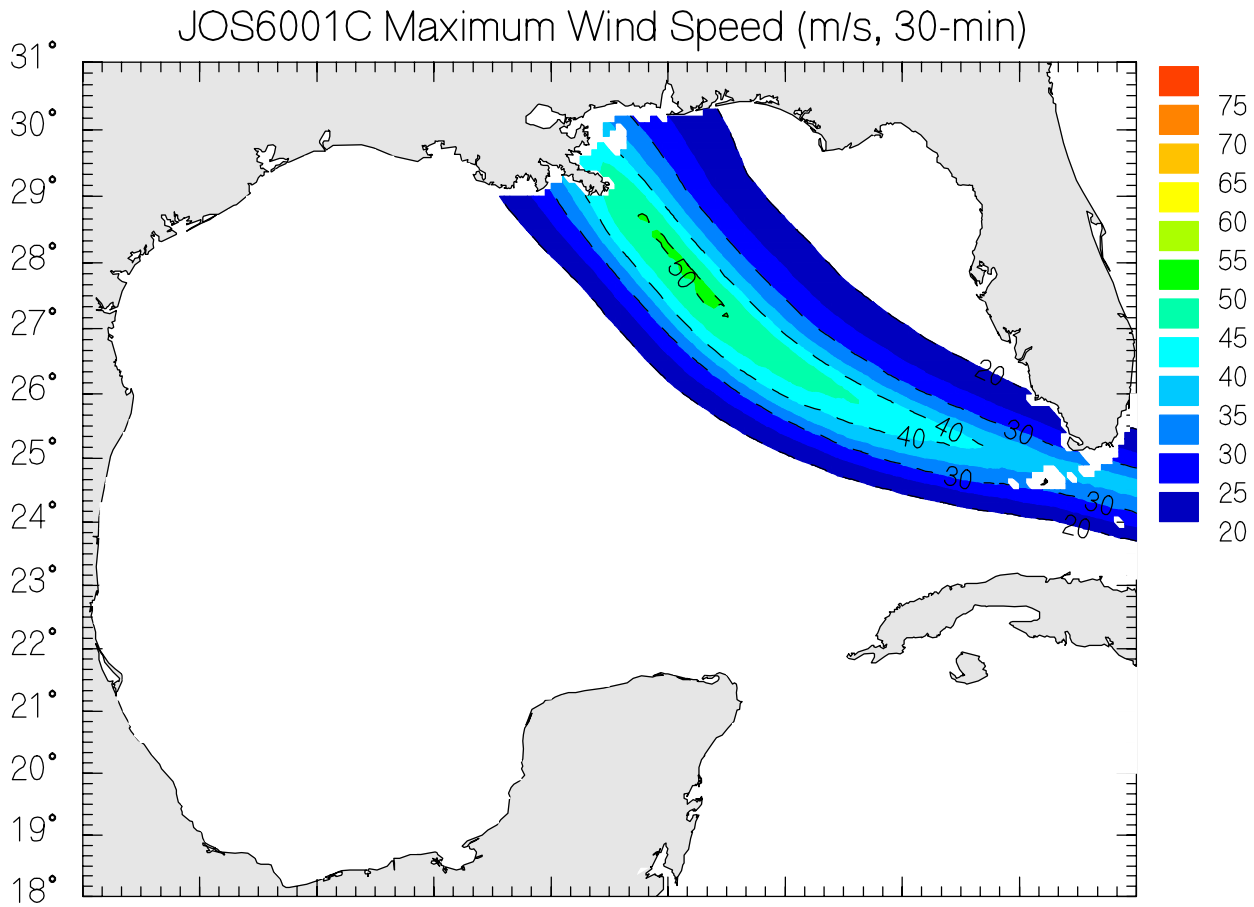
-86°
-84°
-82°
-80°


JOS6001C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
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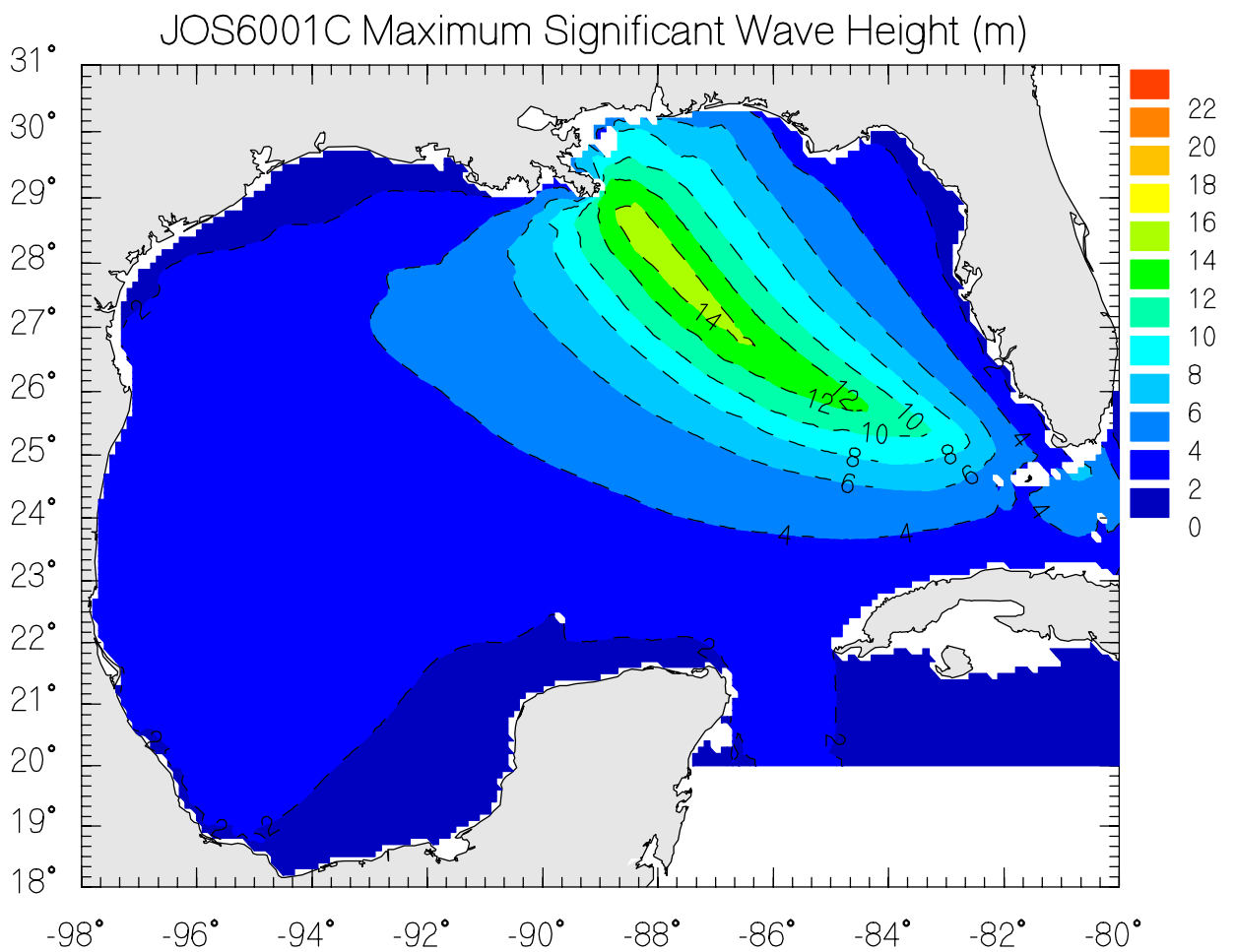
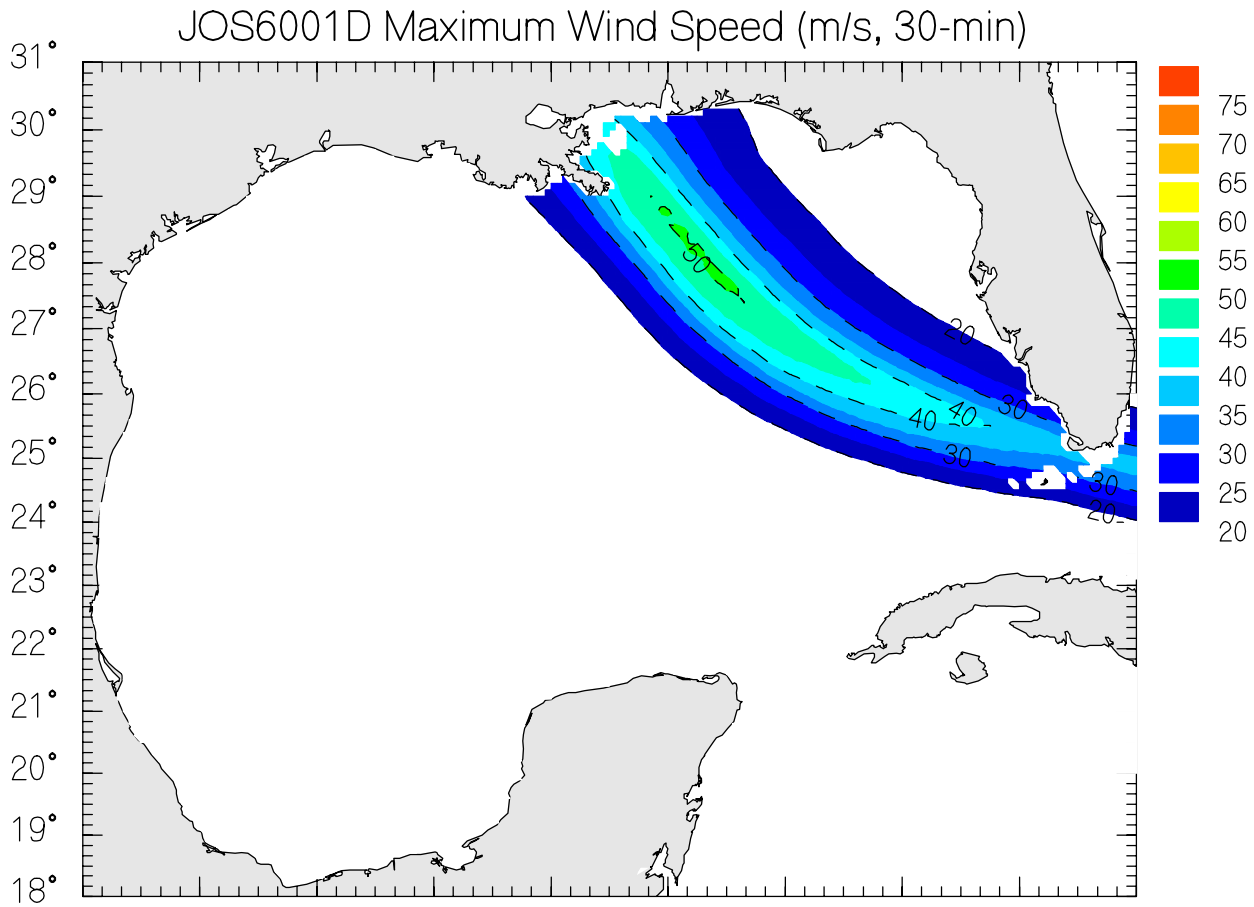
20


JOS6001C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
12
10
10
8
8
6
6
4
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6001D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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35
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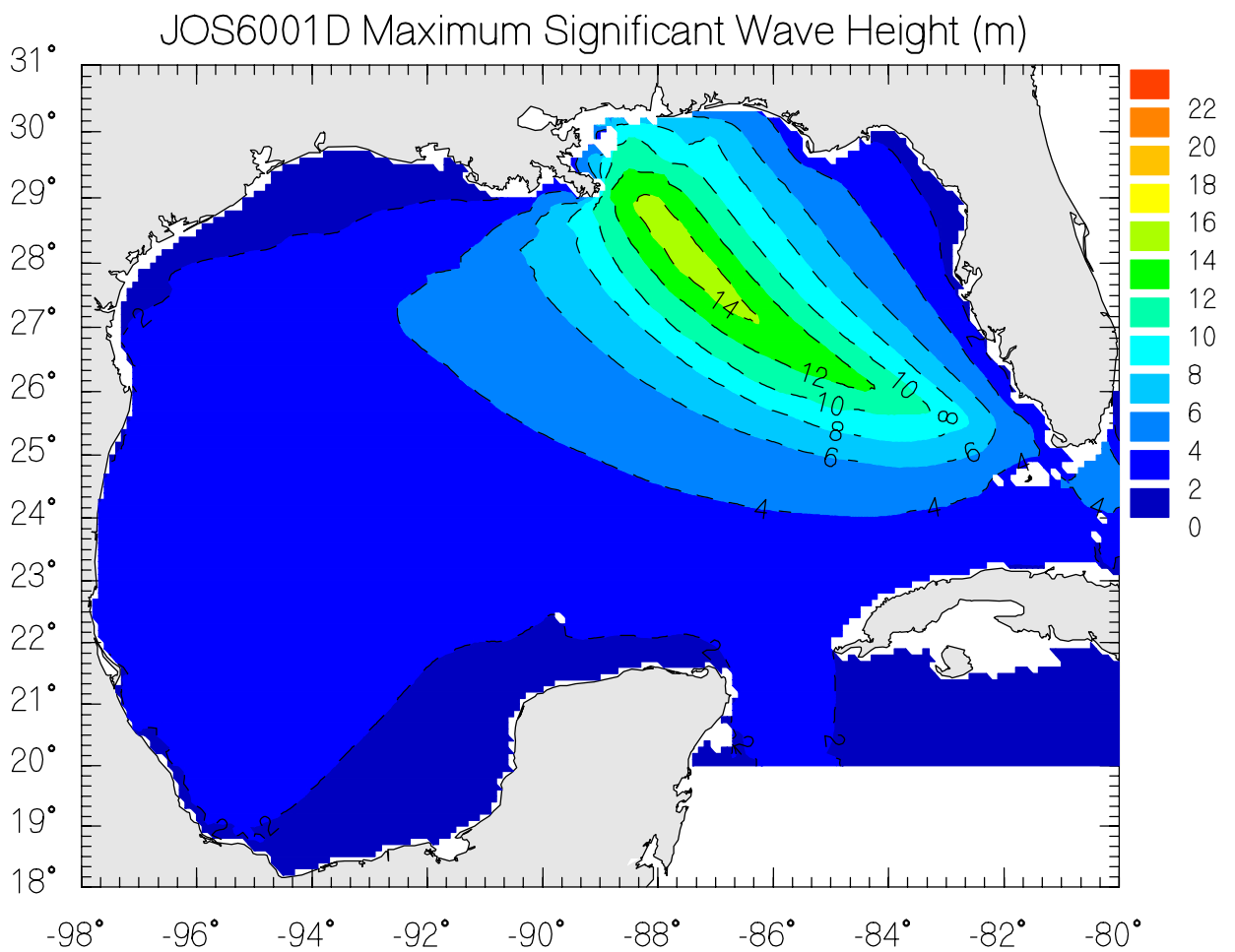
30
20


JOS6001D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
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-82°
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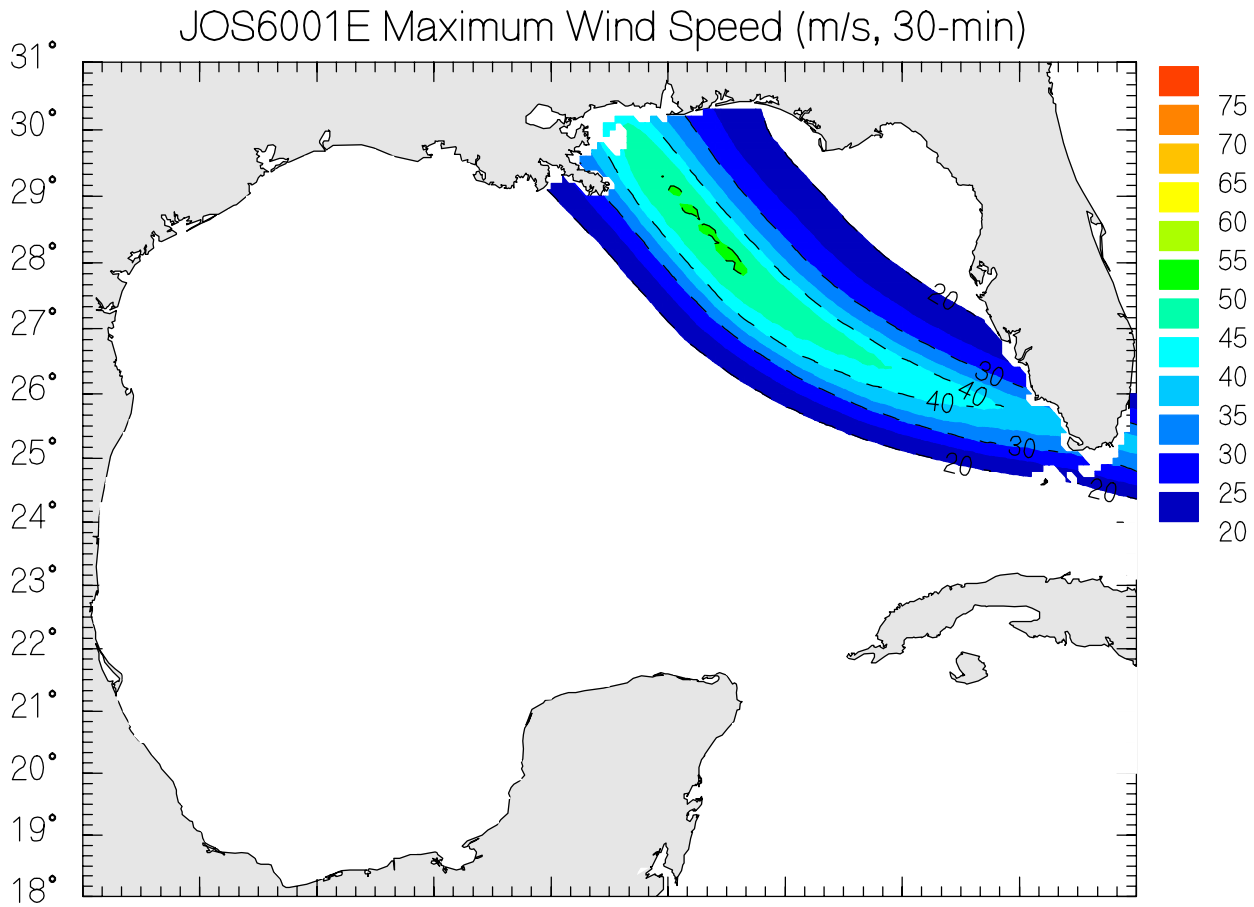
JOS6001E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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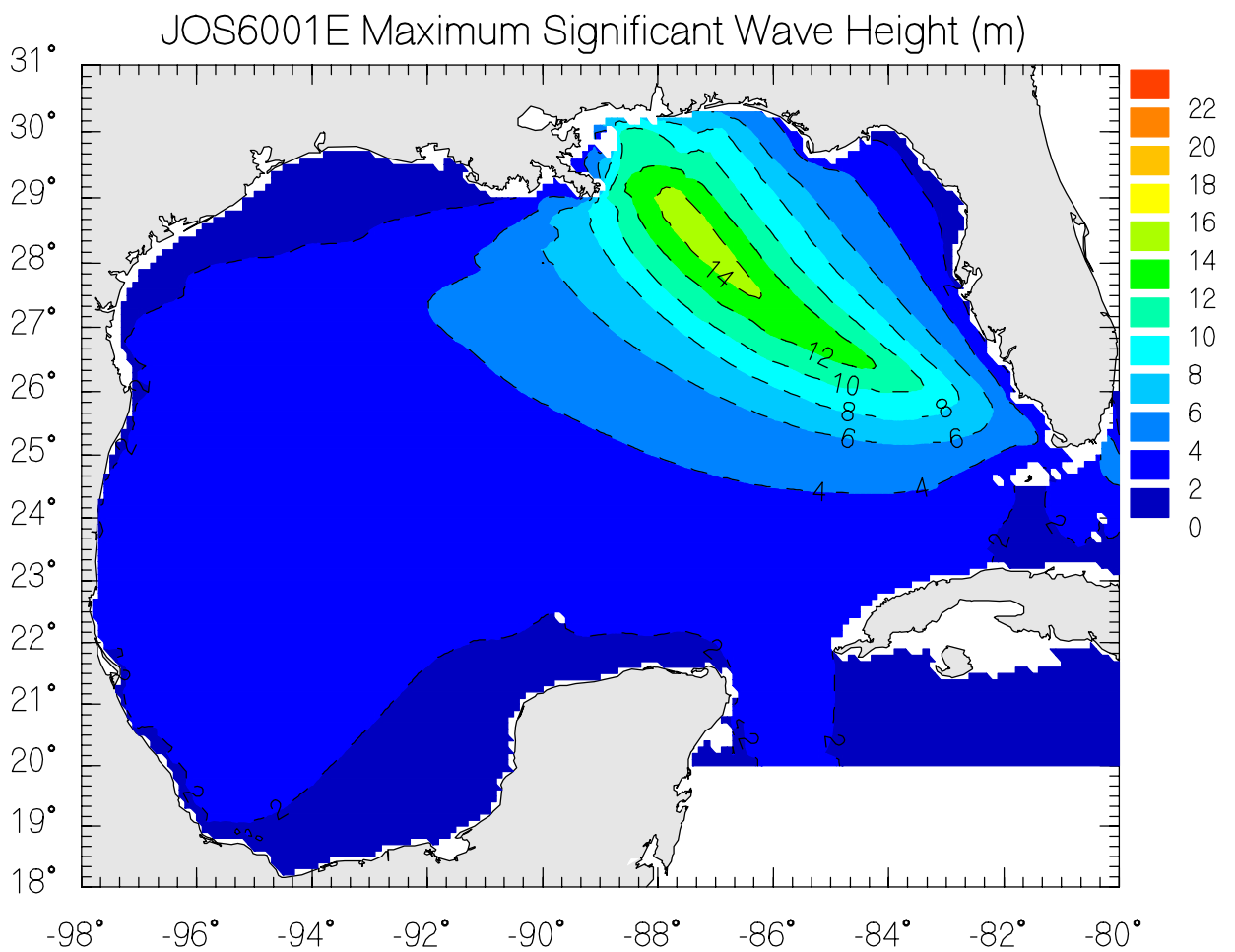
JOS6001E Maximum Significant Wave Height (m)
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28°
27°
26°
25°
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23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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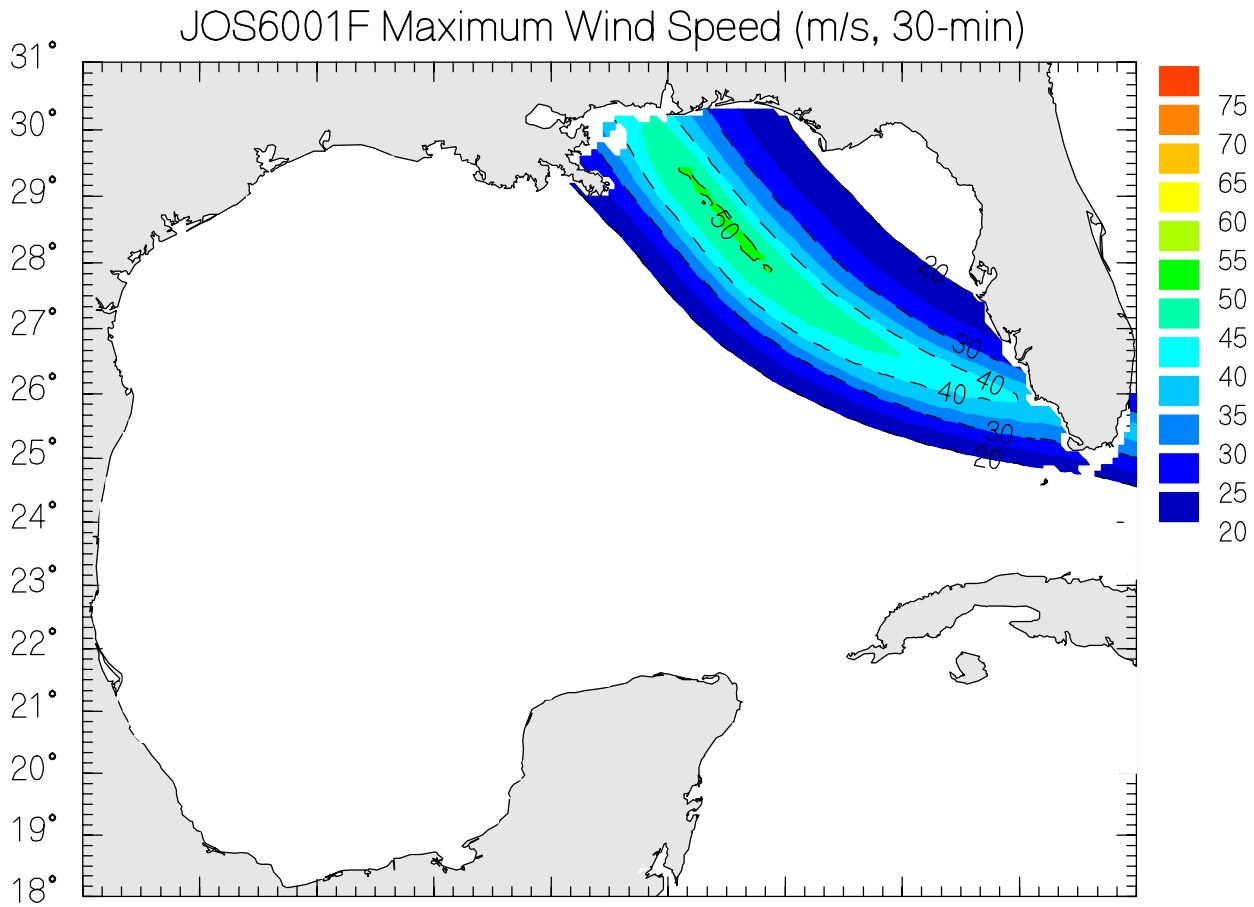
JOS6001F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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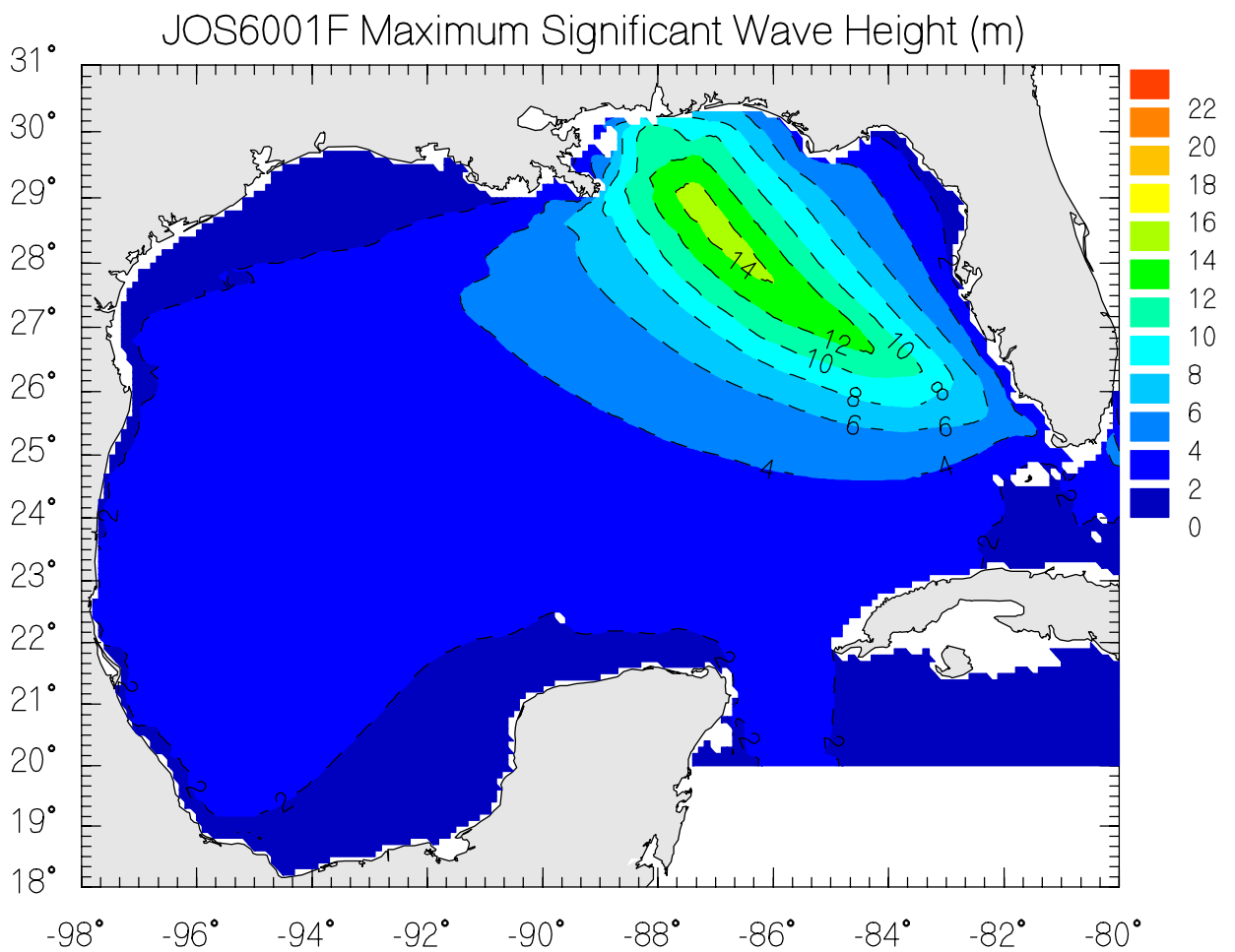
30
20


JOS6001F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
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8
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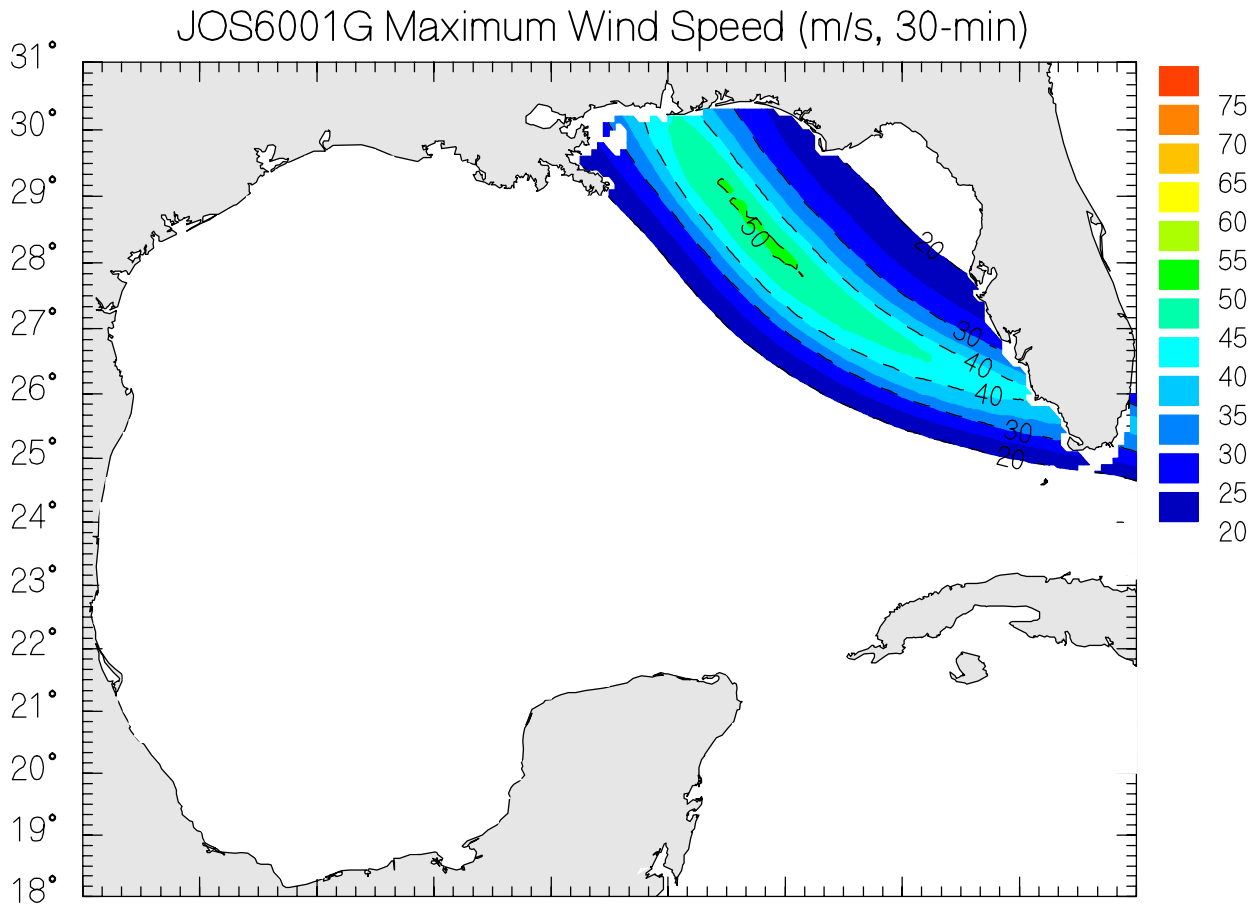
4
2


JOS6001G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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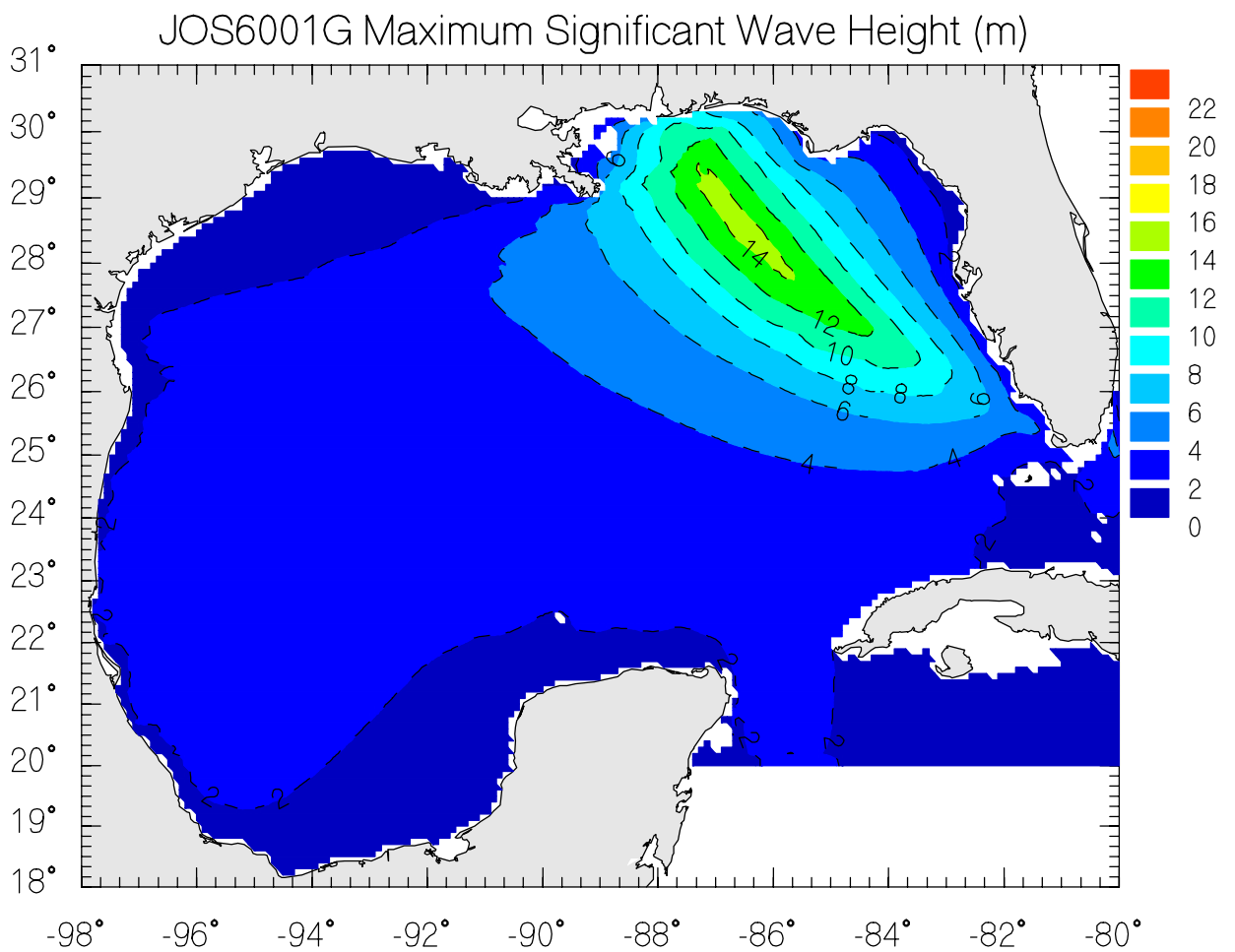
30
40
40
30
20


JOS6001G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
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8
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0
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10
8
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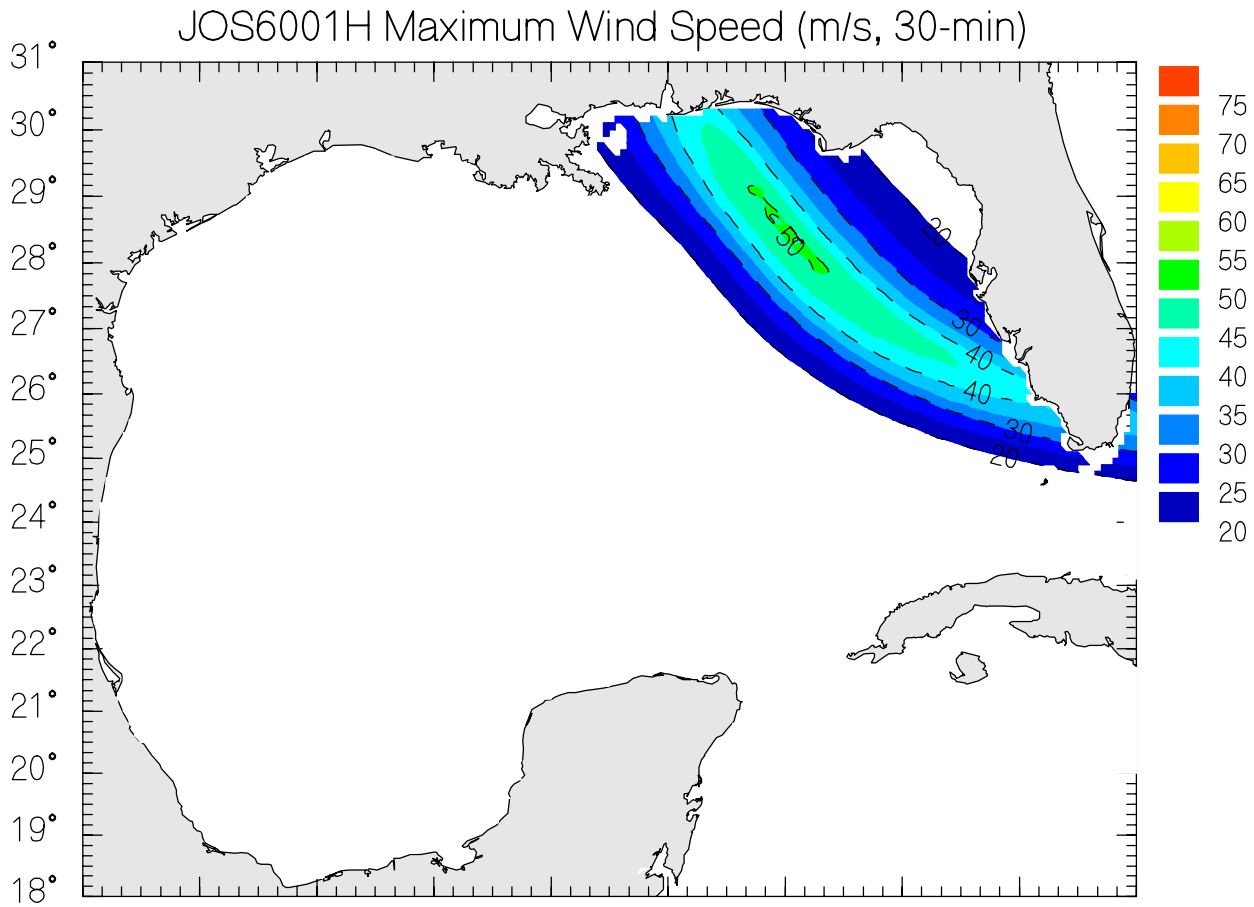
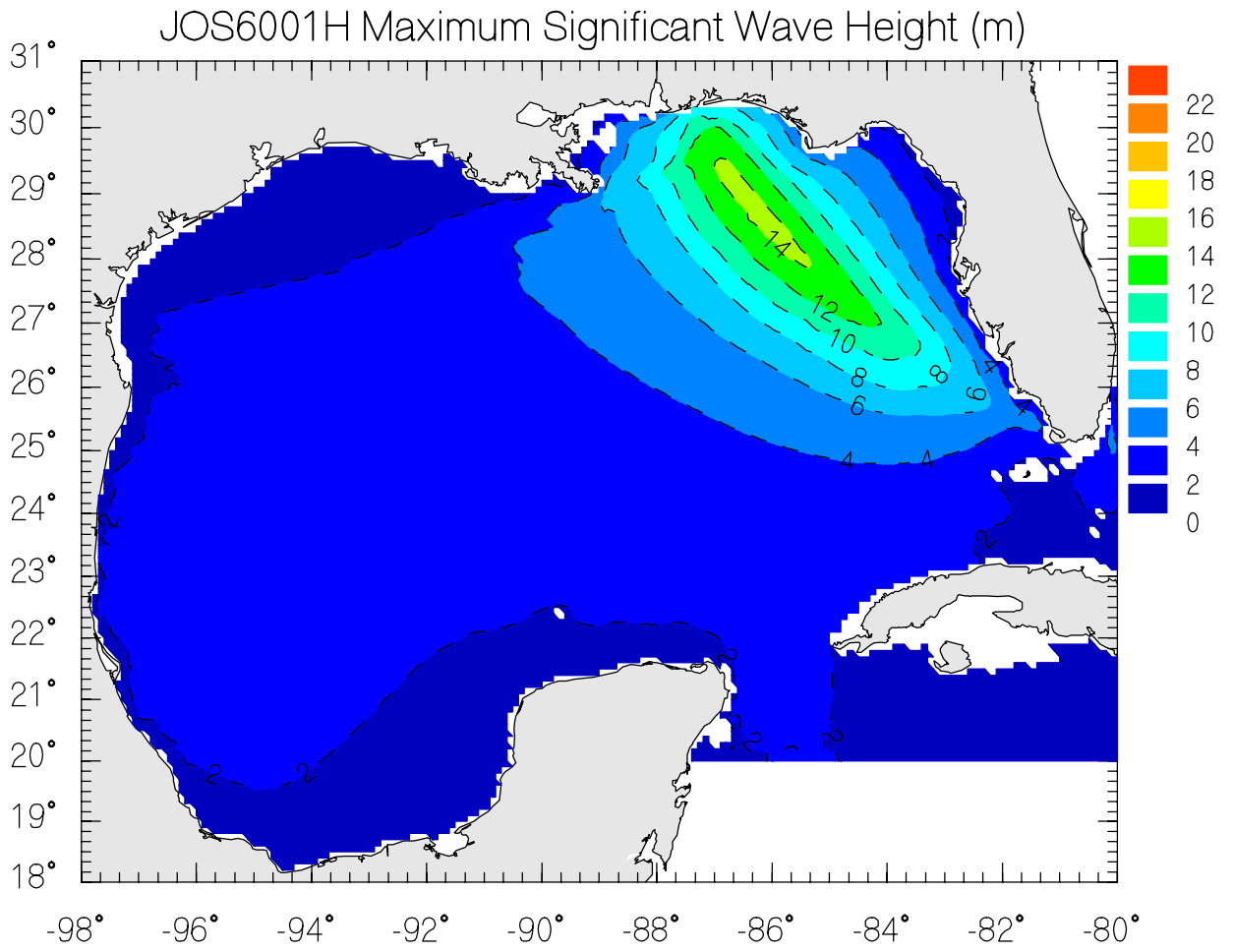
4
2


JOS6001H Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
50
40
30
20


JOS6001H Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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18
16
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14
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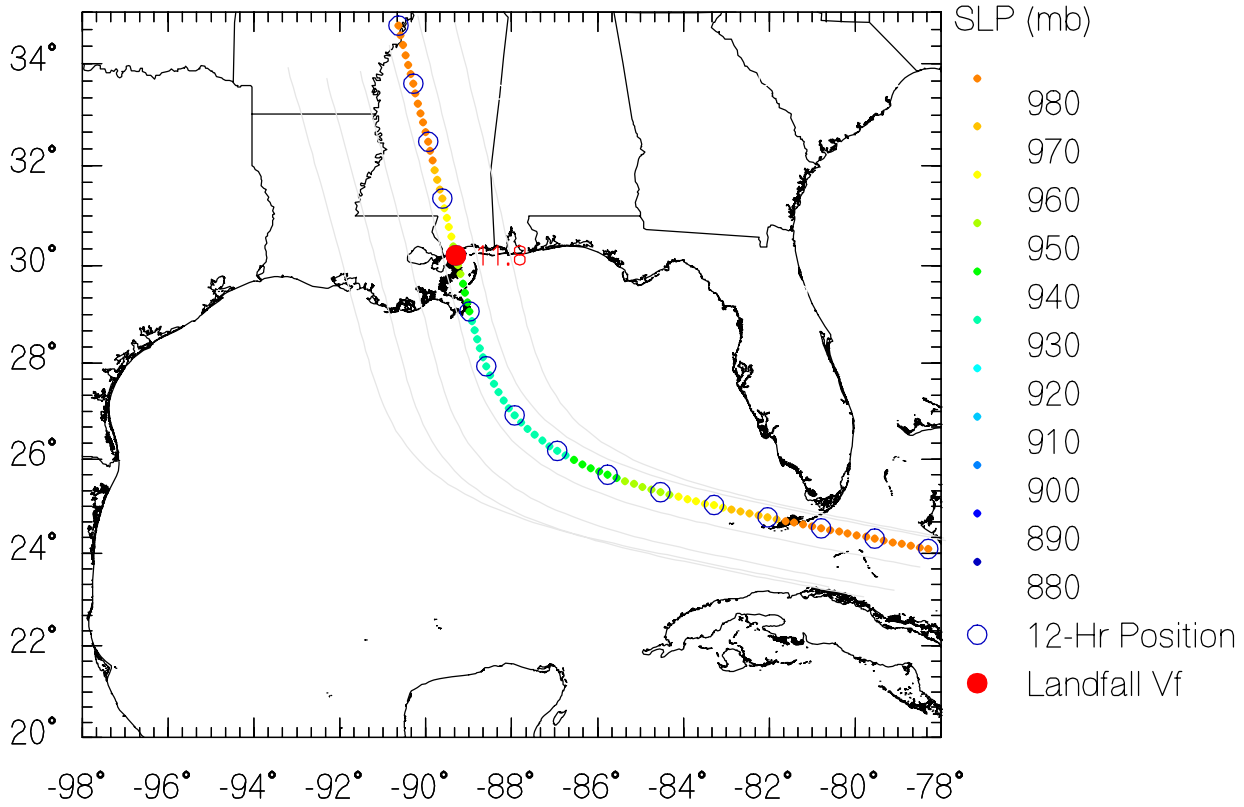
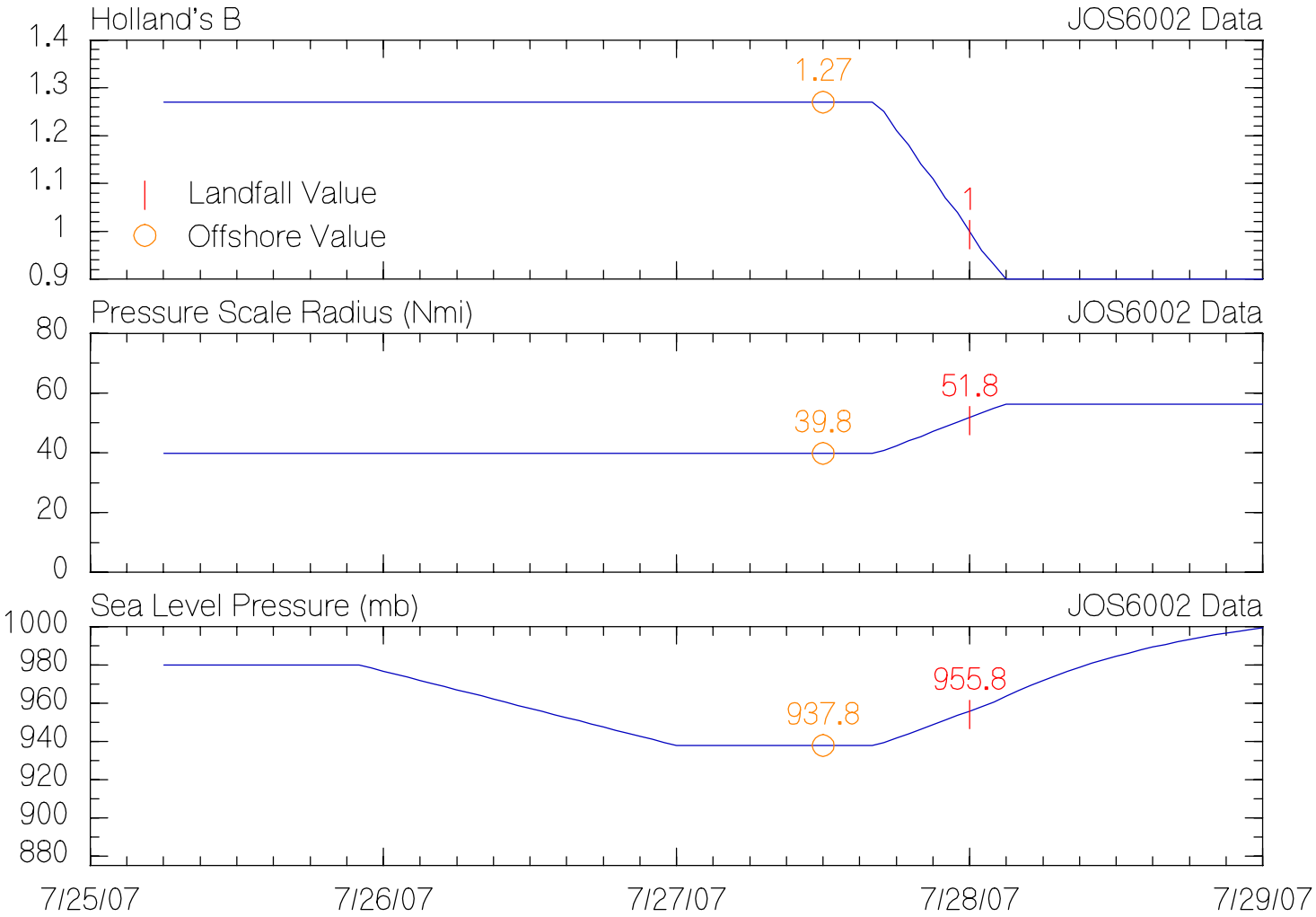
JOS6002 Data



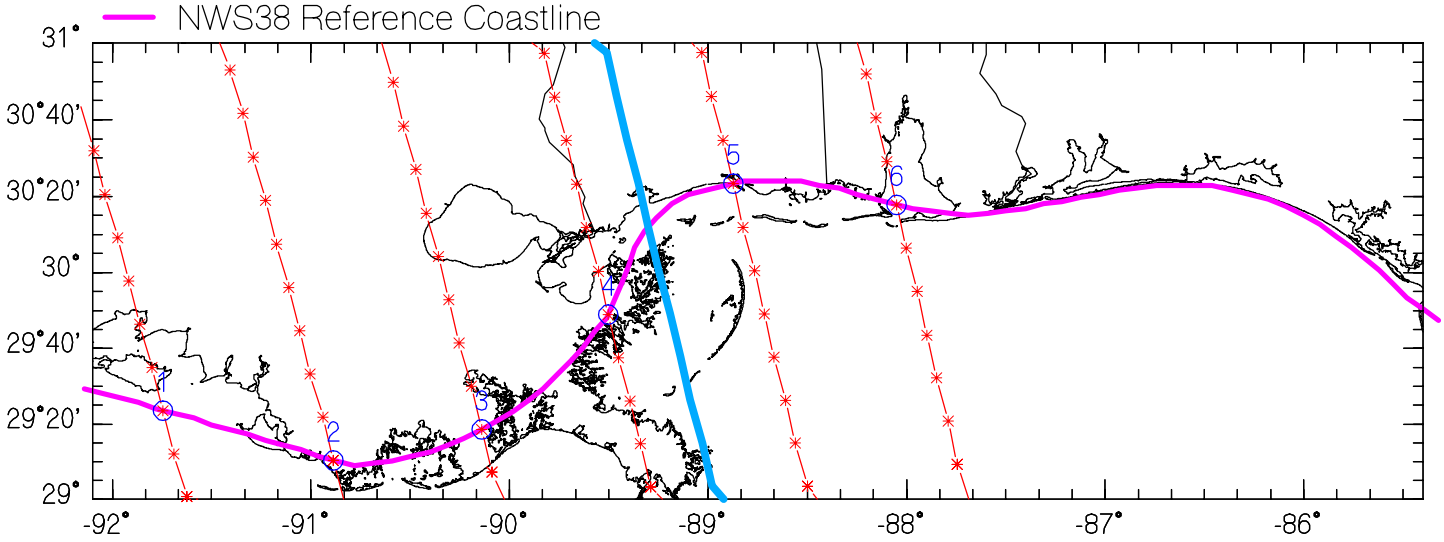


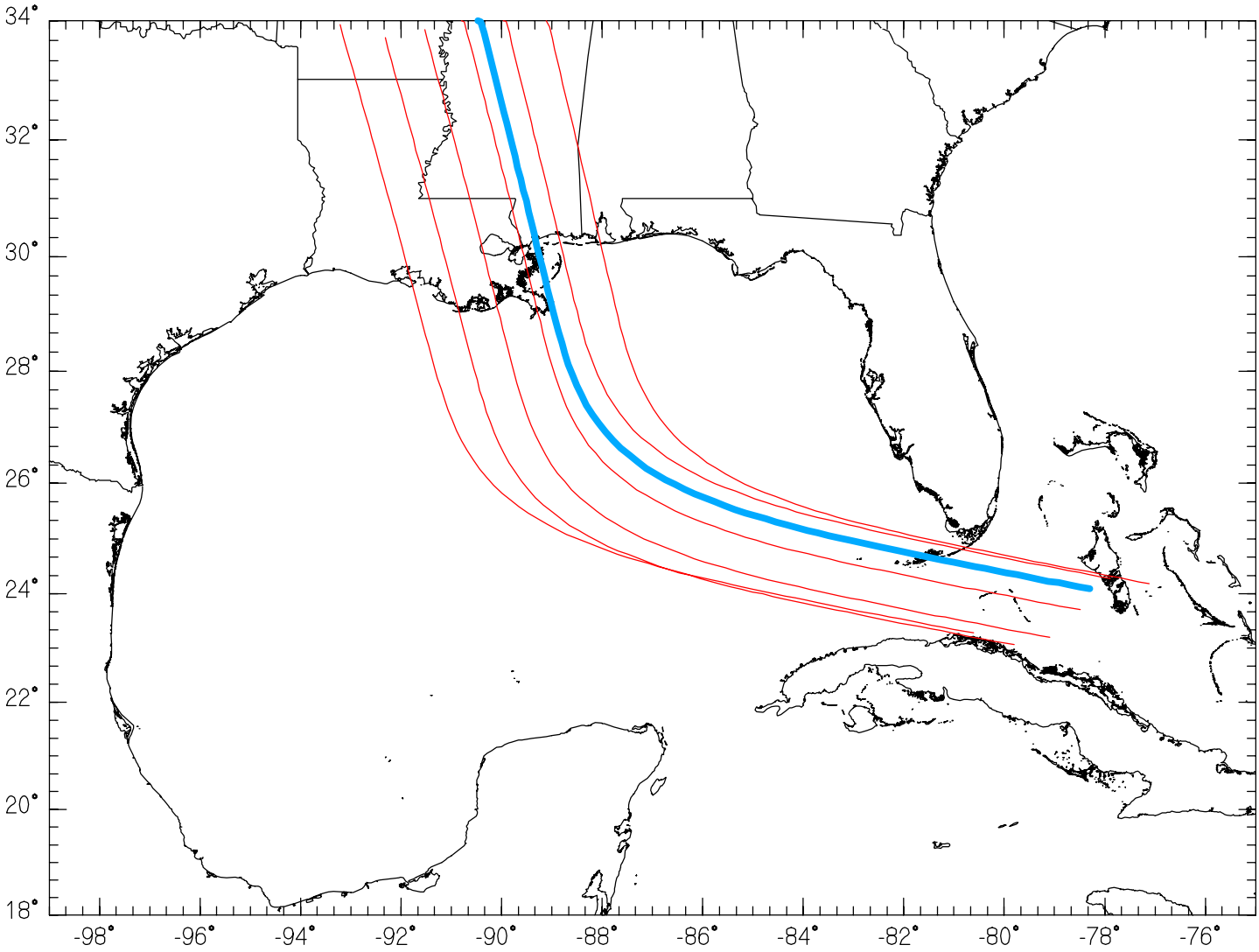
URS JPM-OS6 Production Tracks

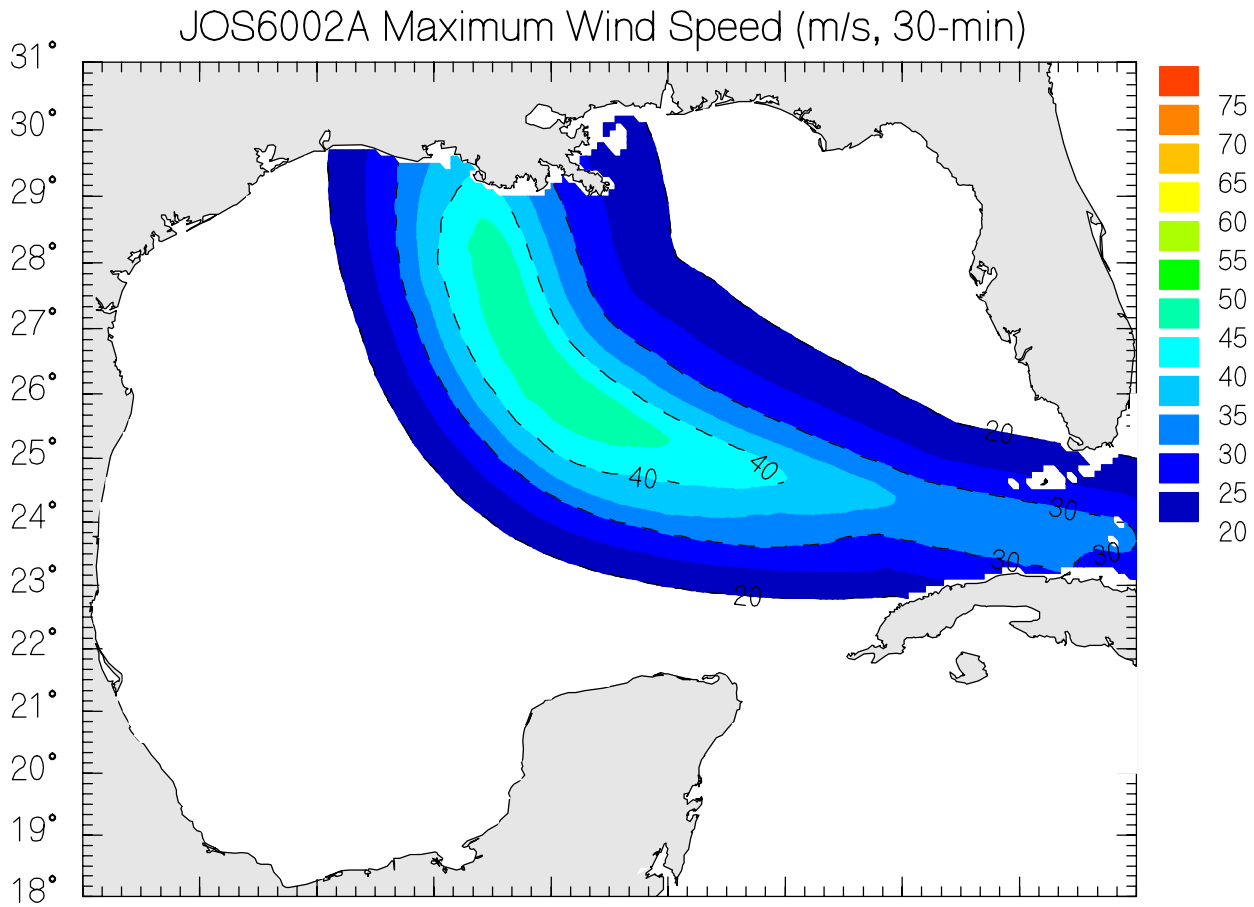
JOS6002 Data

Reference Track — Production Tracks — Production Track Landfall

NWS38 Reference Coastline






JOS6002A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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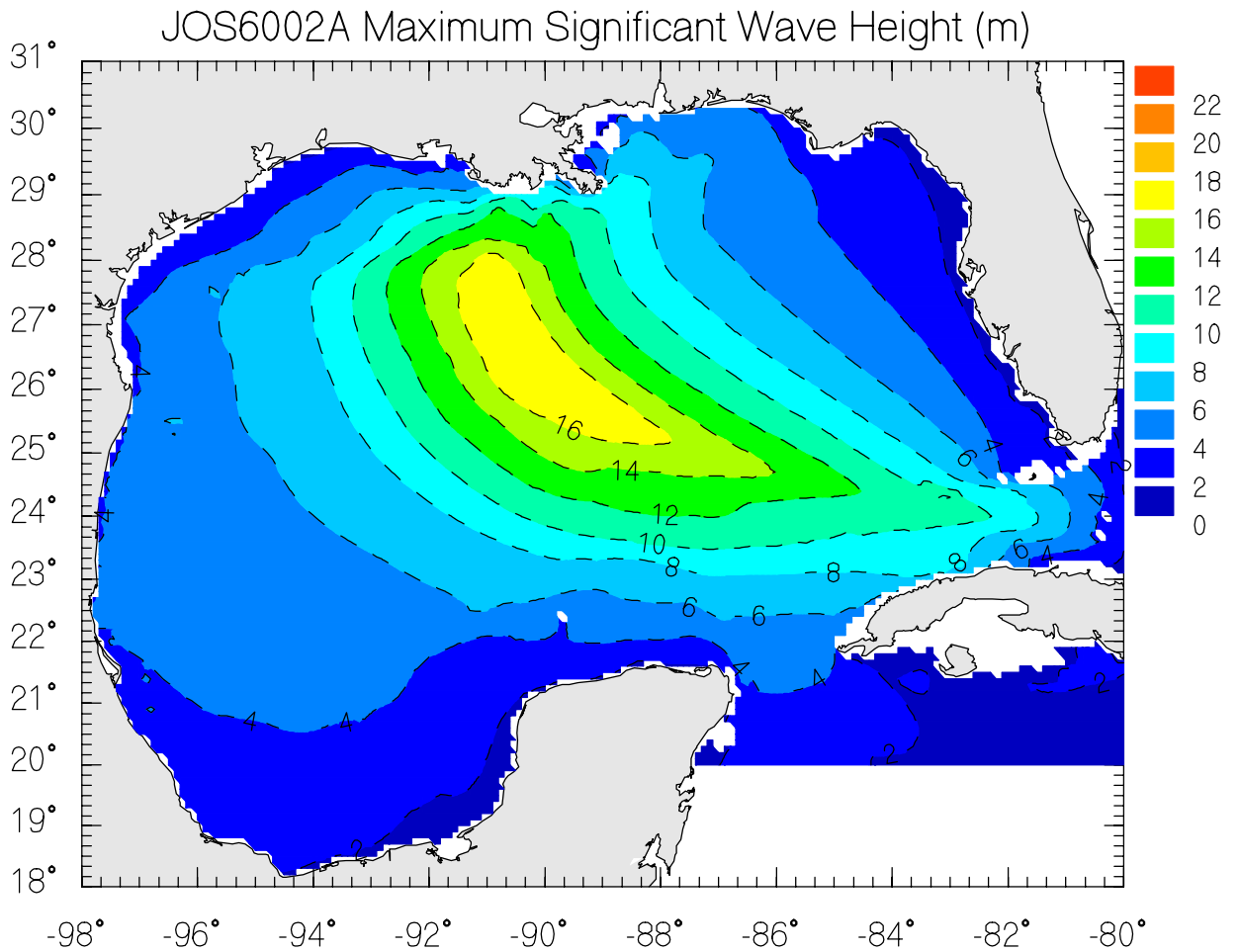
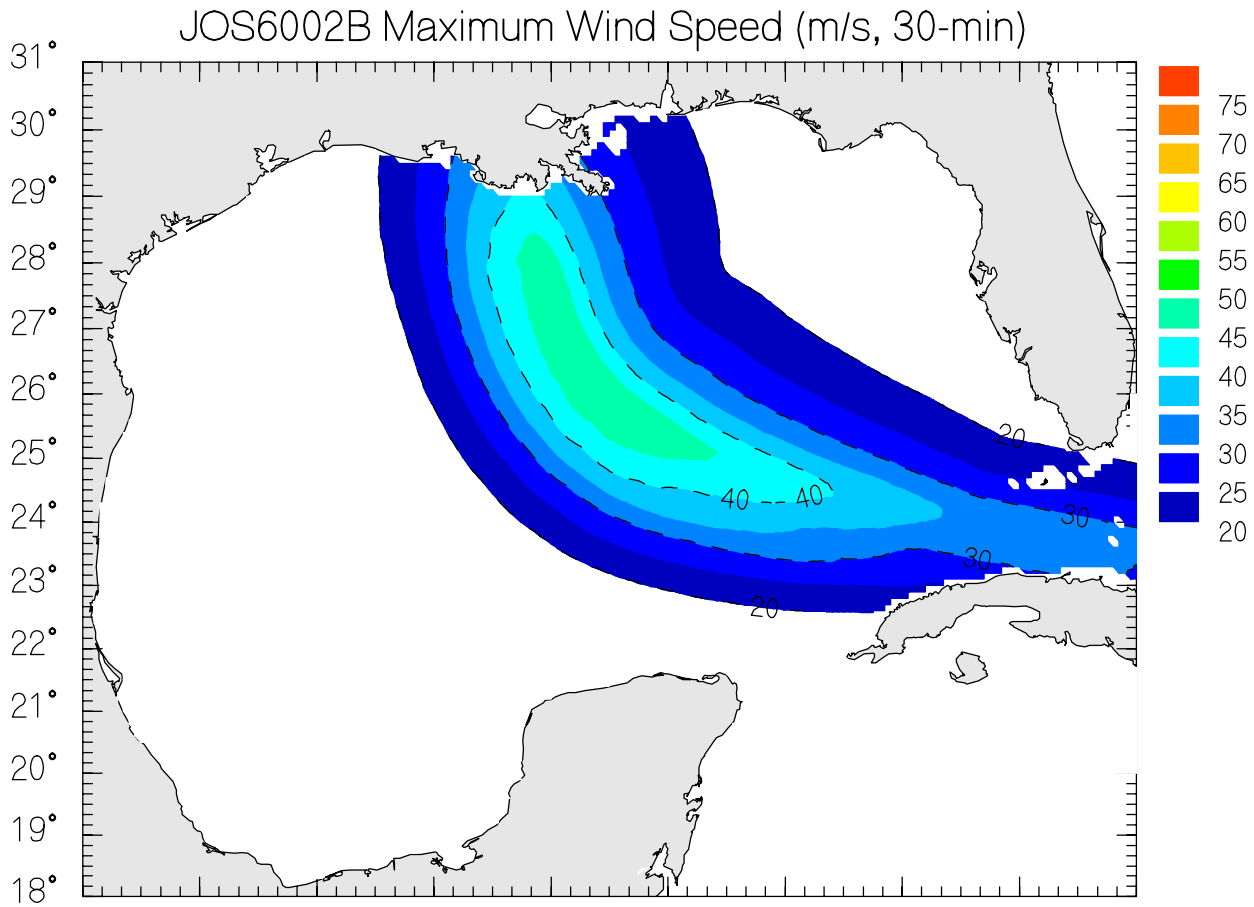
40
20
30
30
30
20


JOS6002A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
16
14
12
10
8
8
6
6
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6002B Maximum Wind Speed (m/s, 30-min)
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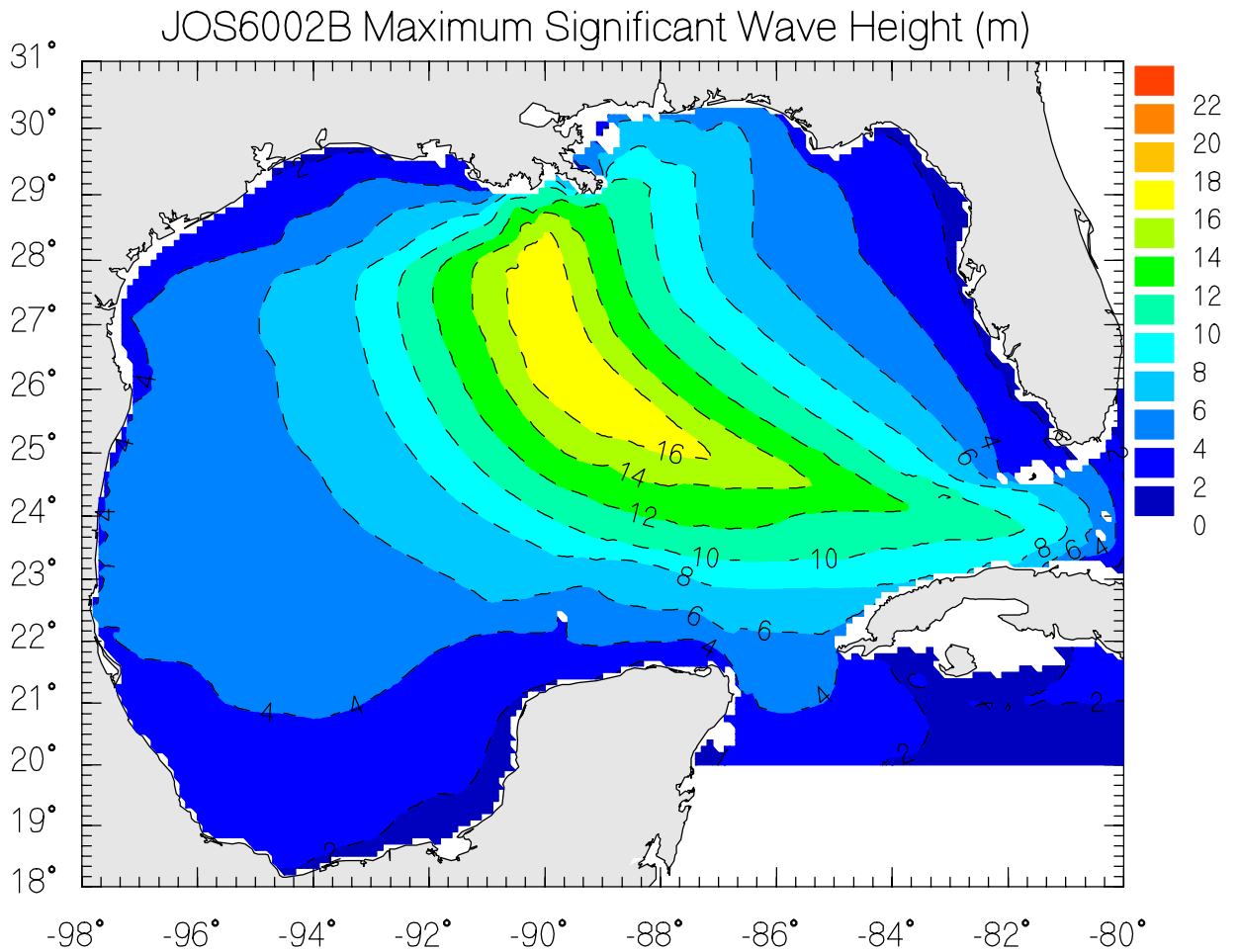
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
40
40
30
30
20
20


JOS6002B Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
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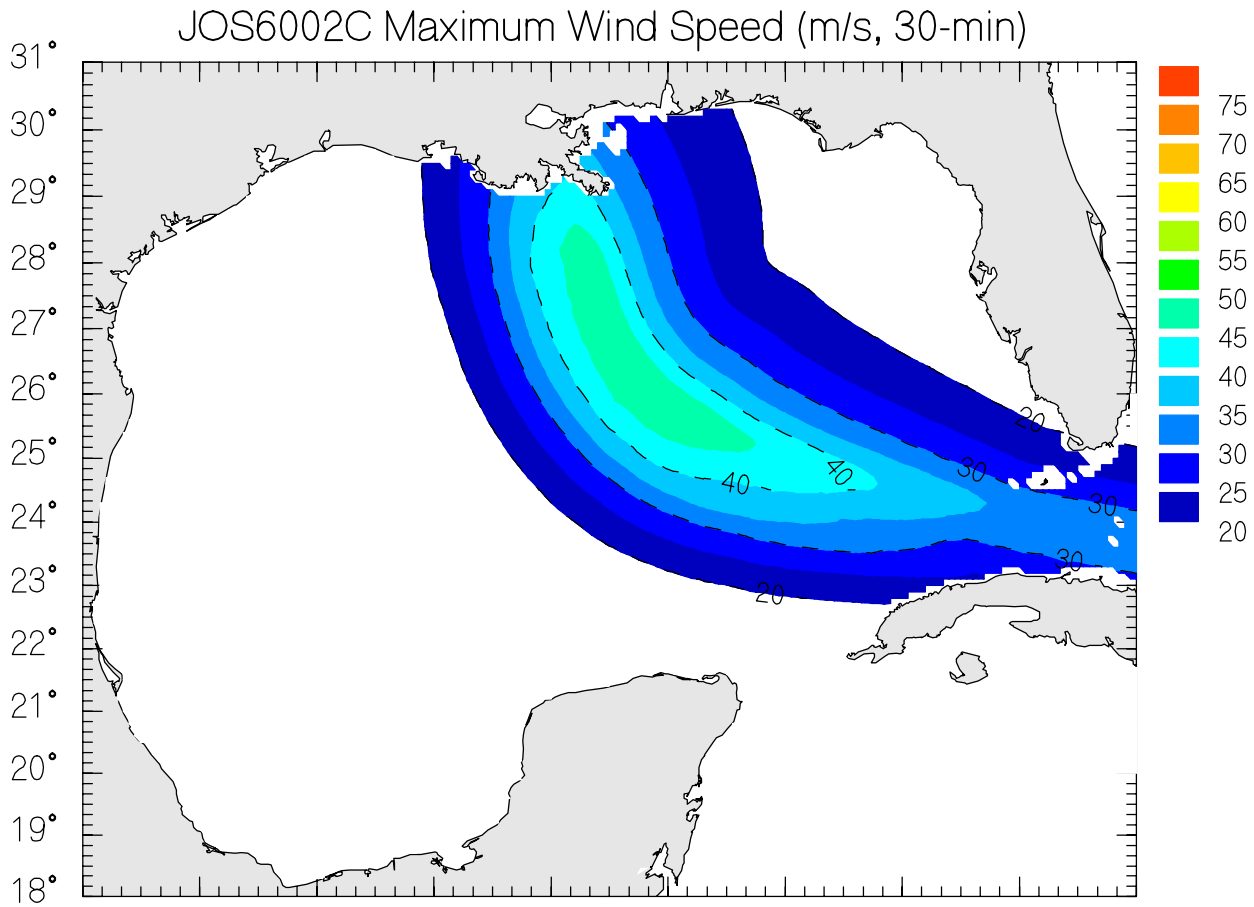
8
6
6
4
4
2


JOS6002C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
40
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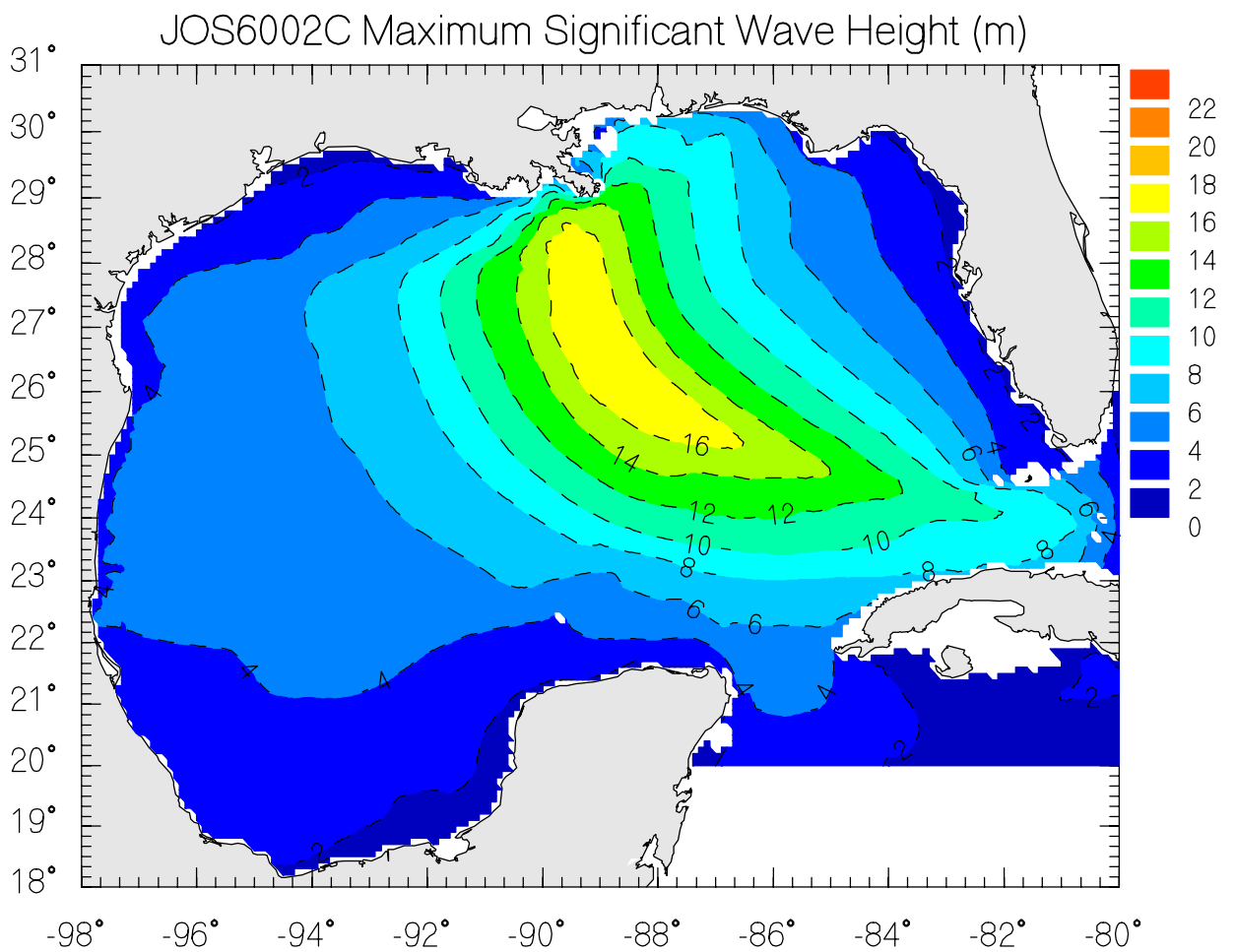
30
30
30
20
20


JOS6002C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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18
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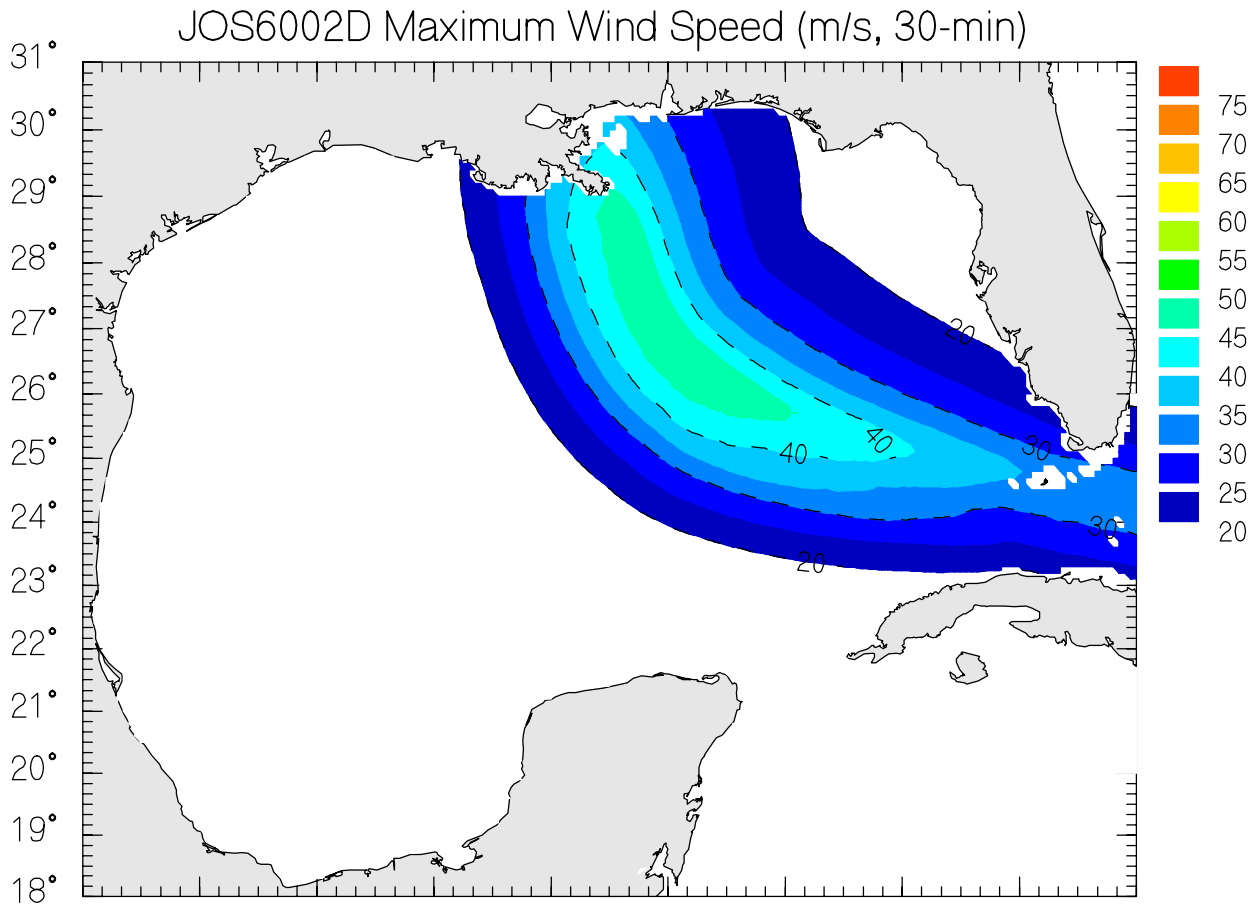
JOS6002D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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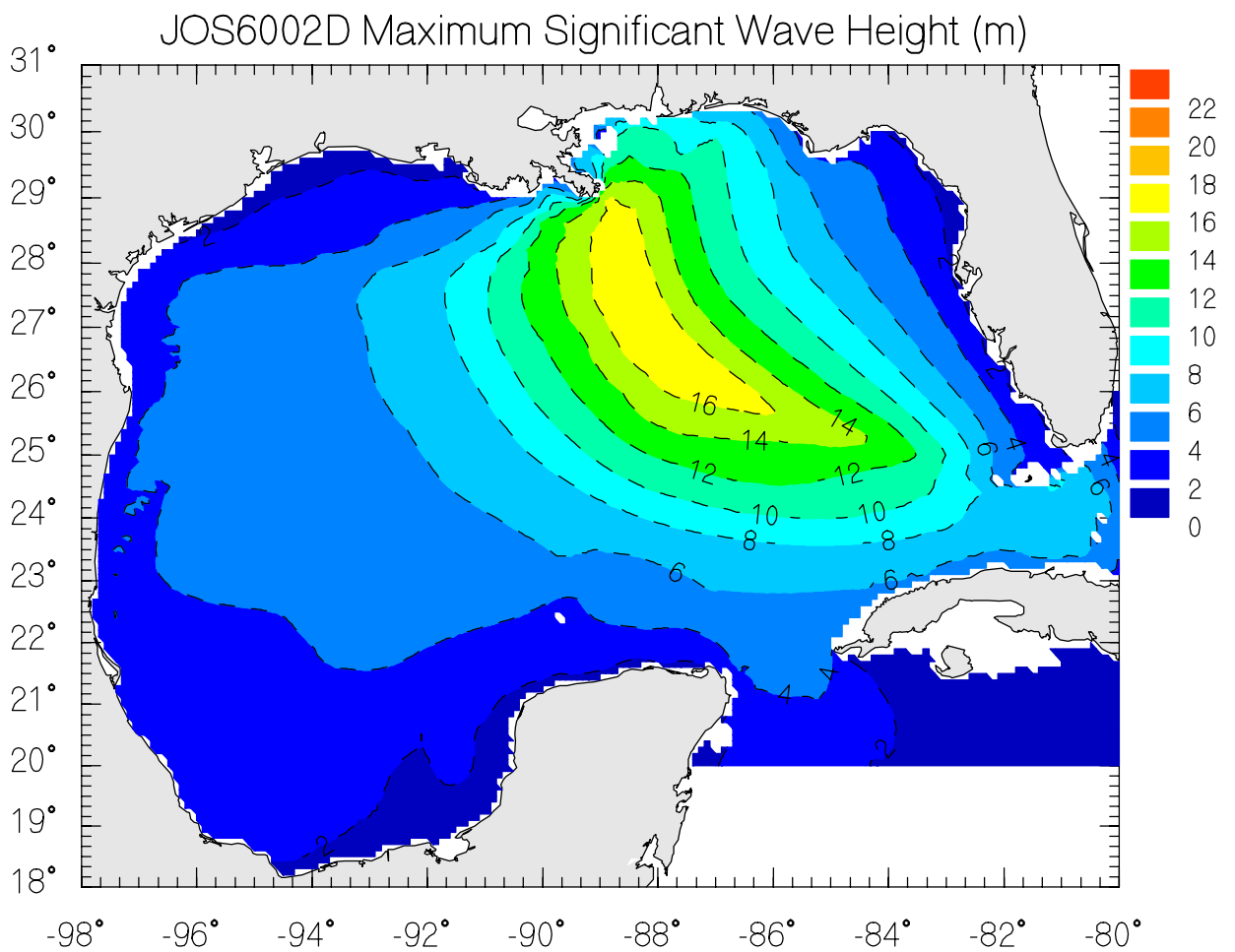
JOS6002D Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
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12
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-92°
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-88°
-86°
-84°
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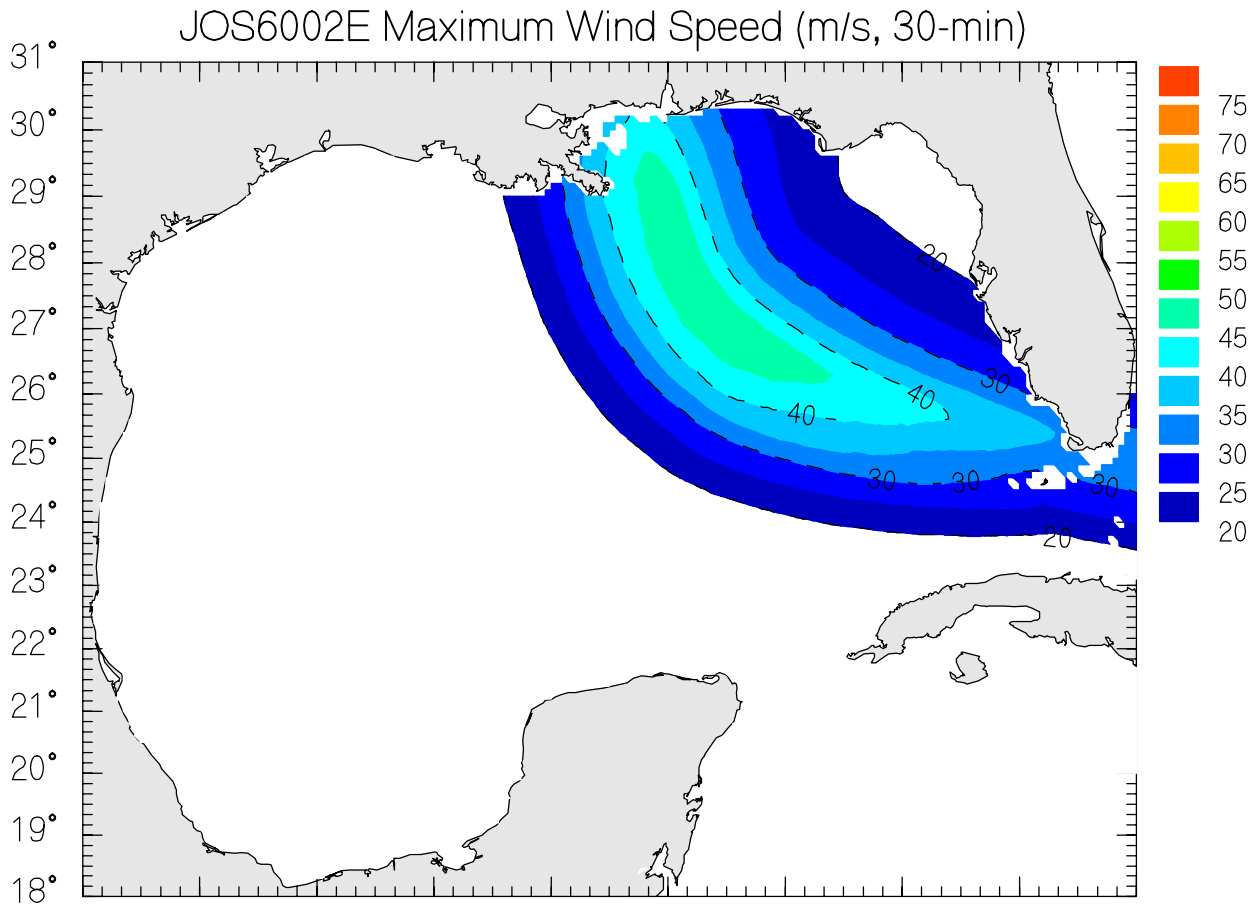
-80°


JOS6002E Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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40
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30
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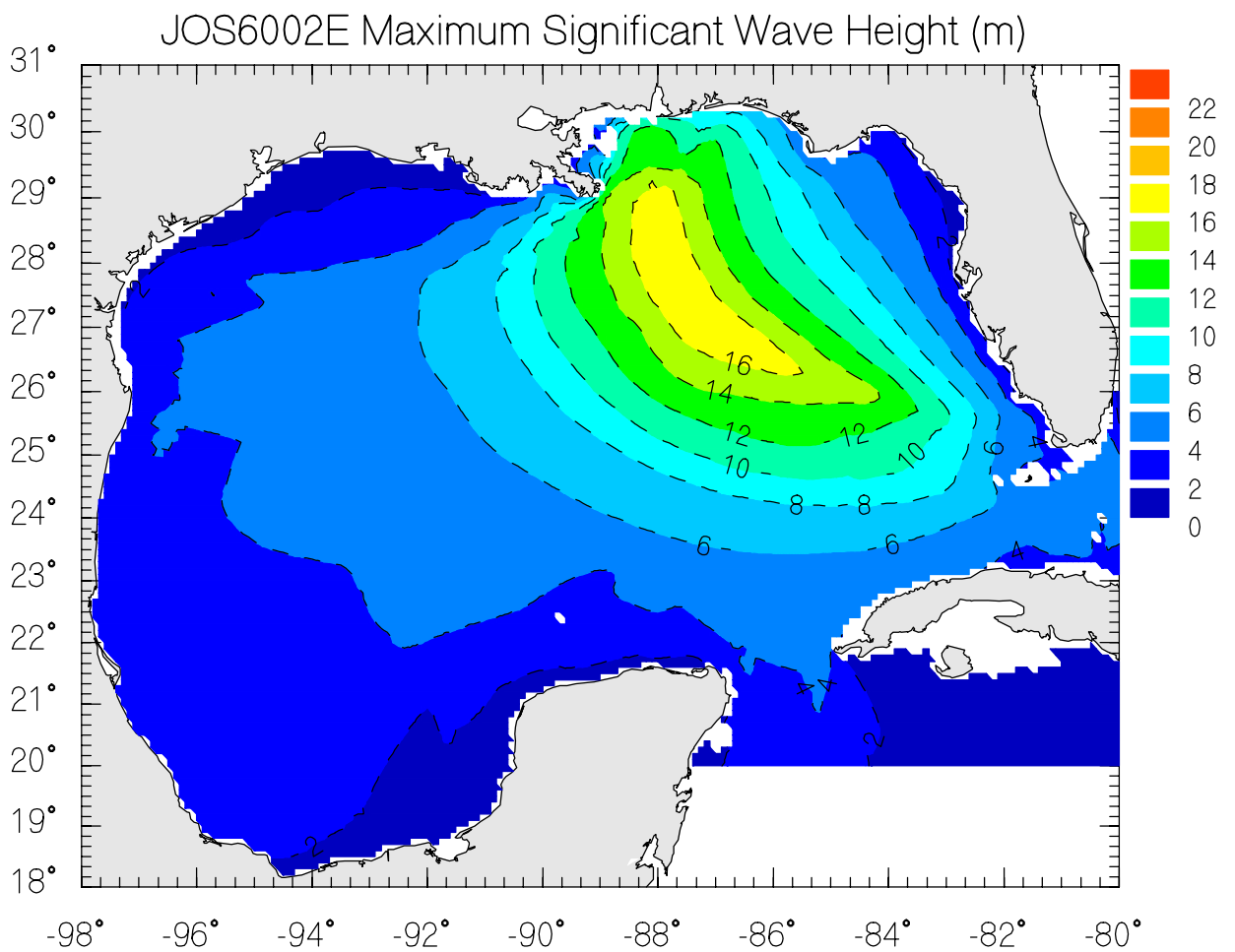
JOS6002E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
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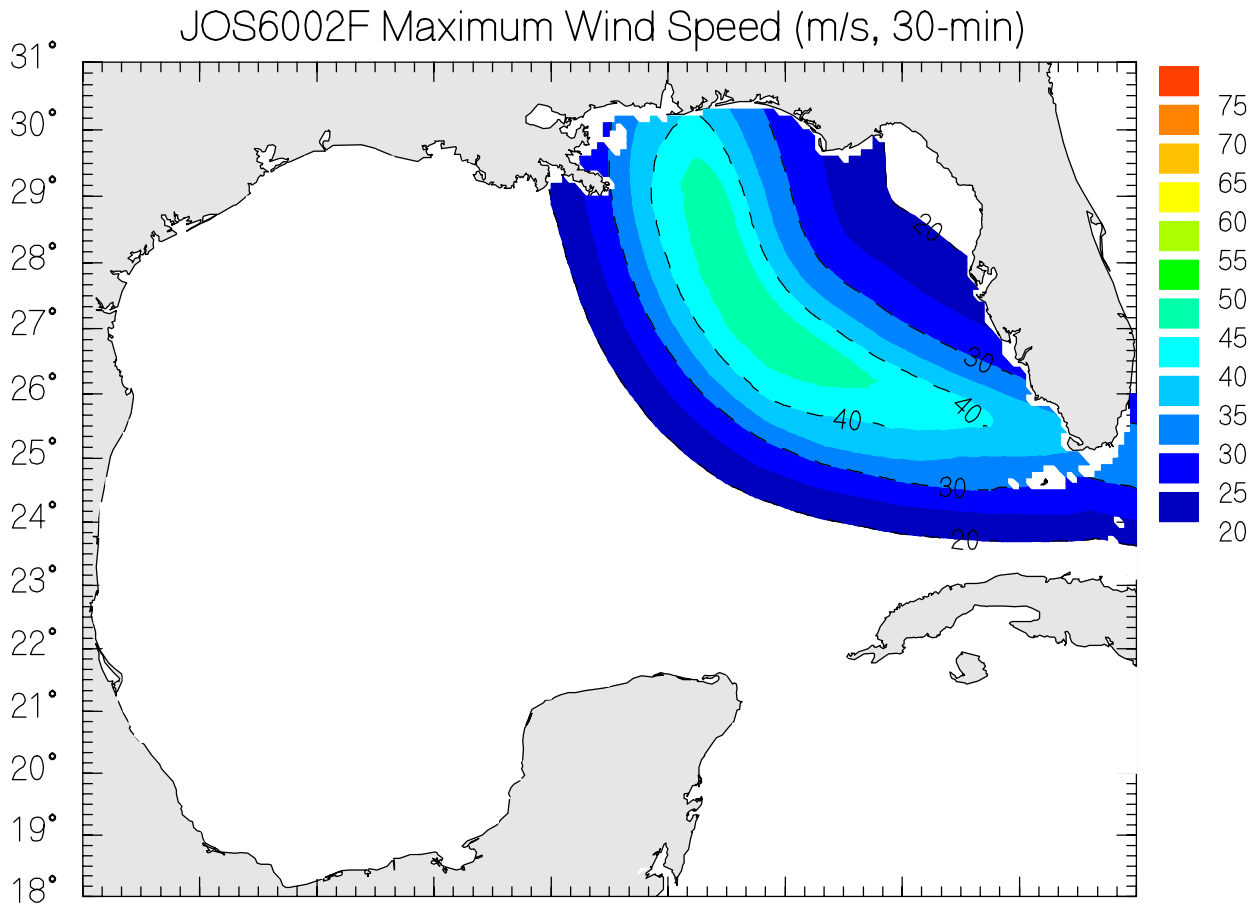
-80°


JOS6002F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
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30
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75
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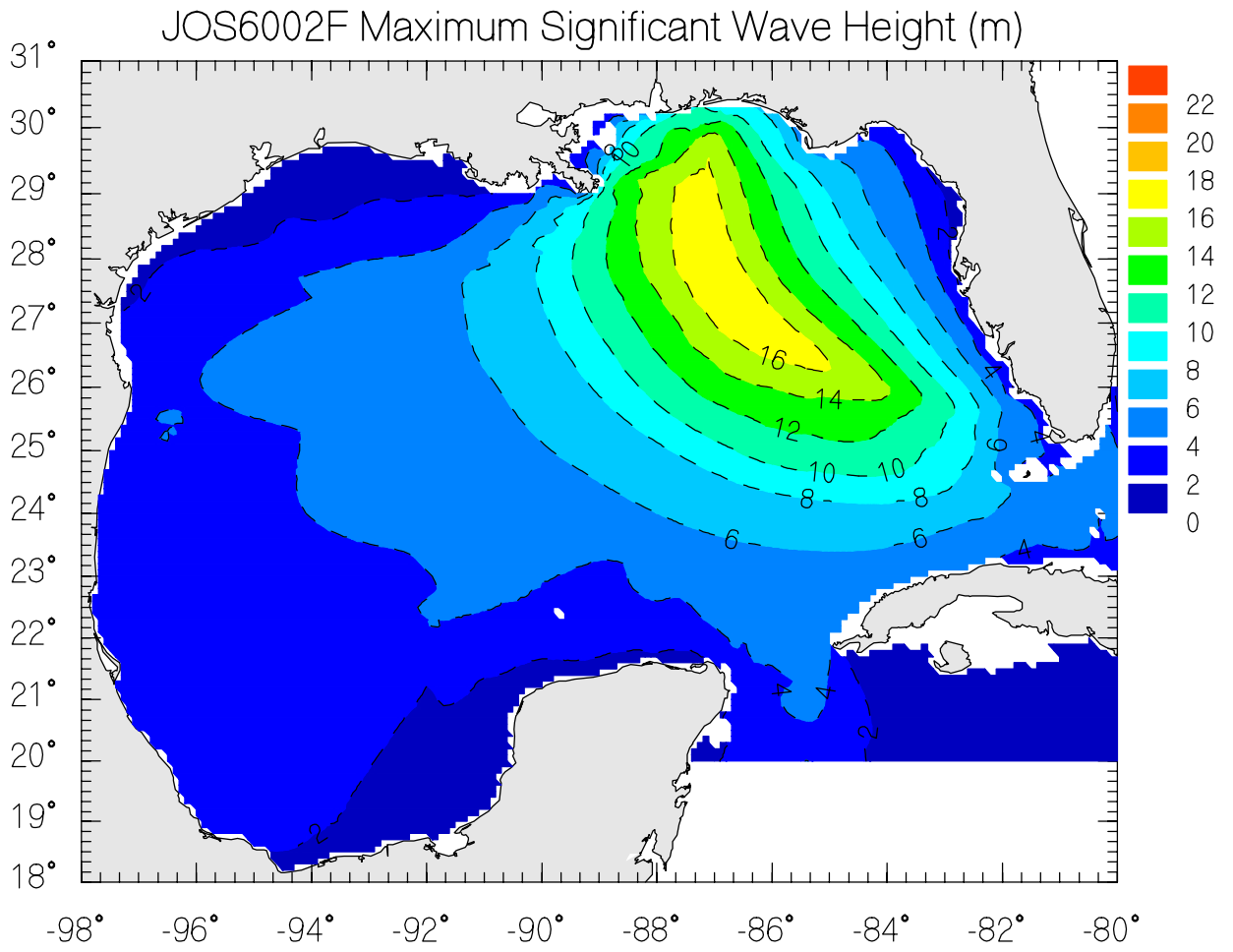
JOS6002F Maximum Significant Wave Height (m)
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30°
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28°
27°
26°
25°
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23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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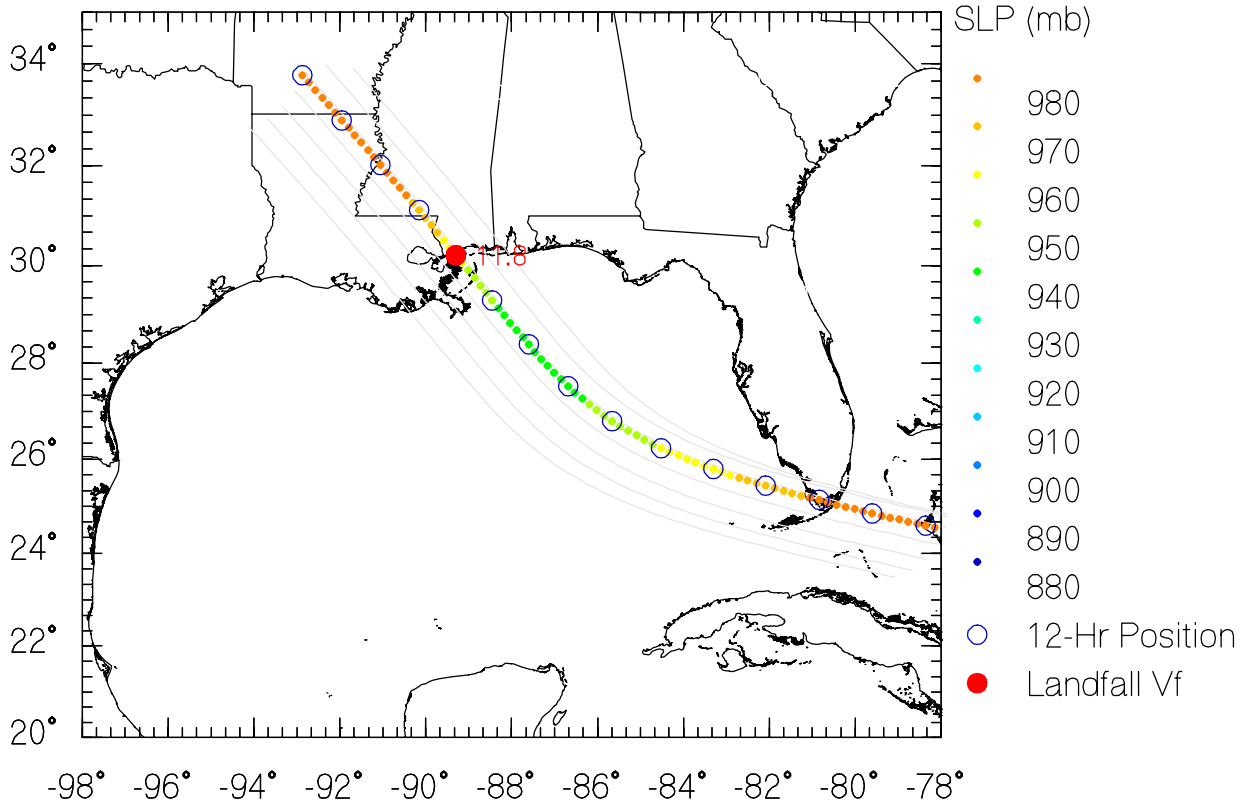
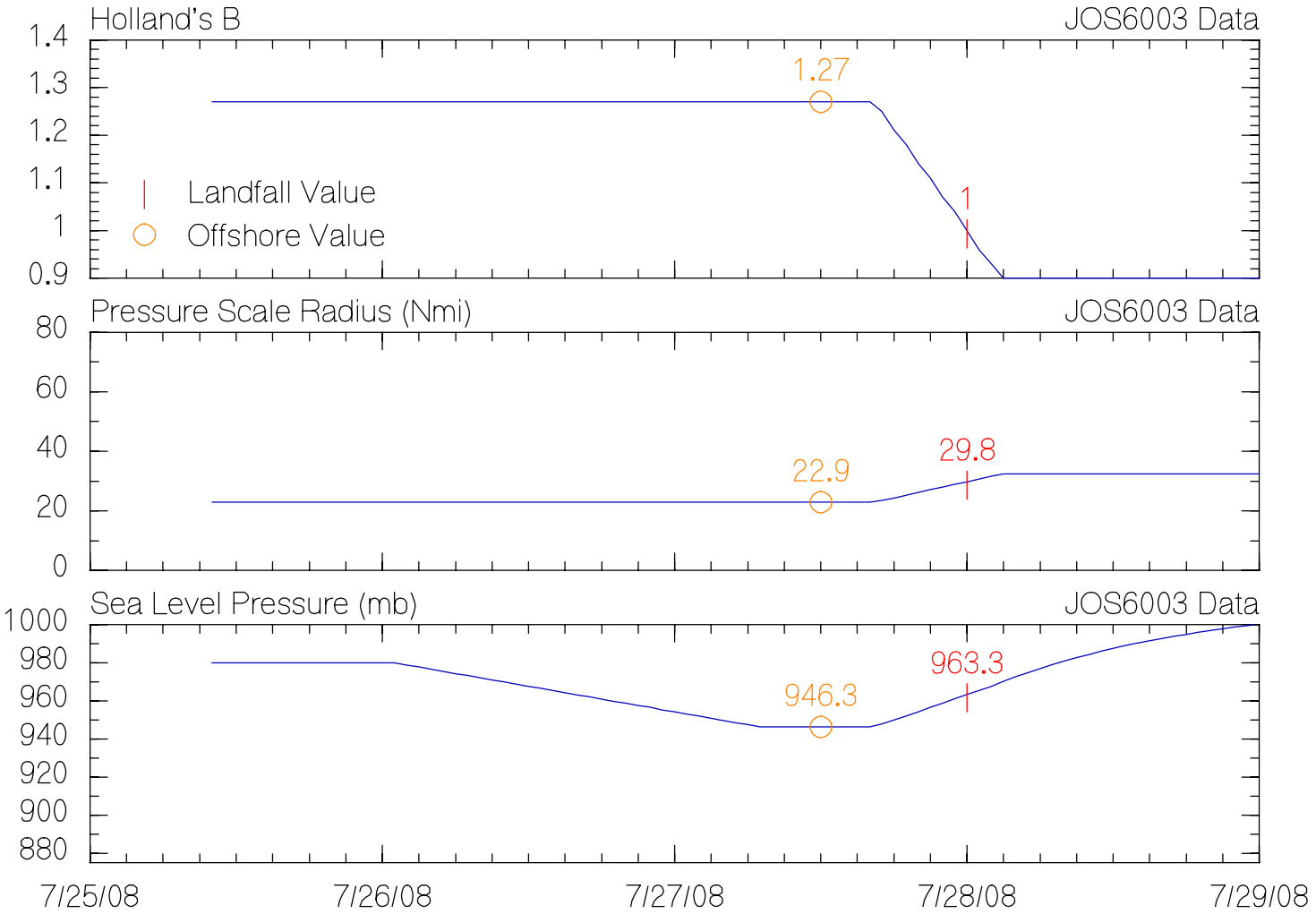
4
2
0

JOS6003 Data

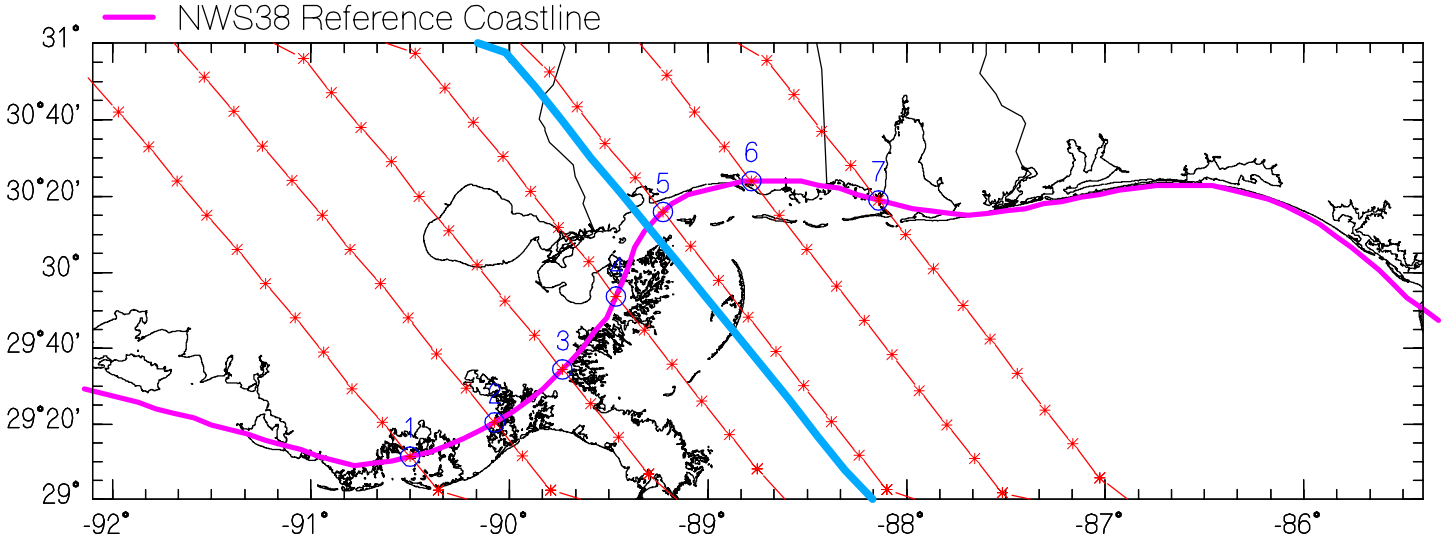


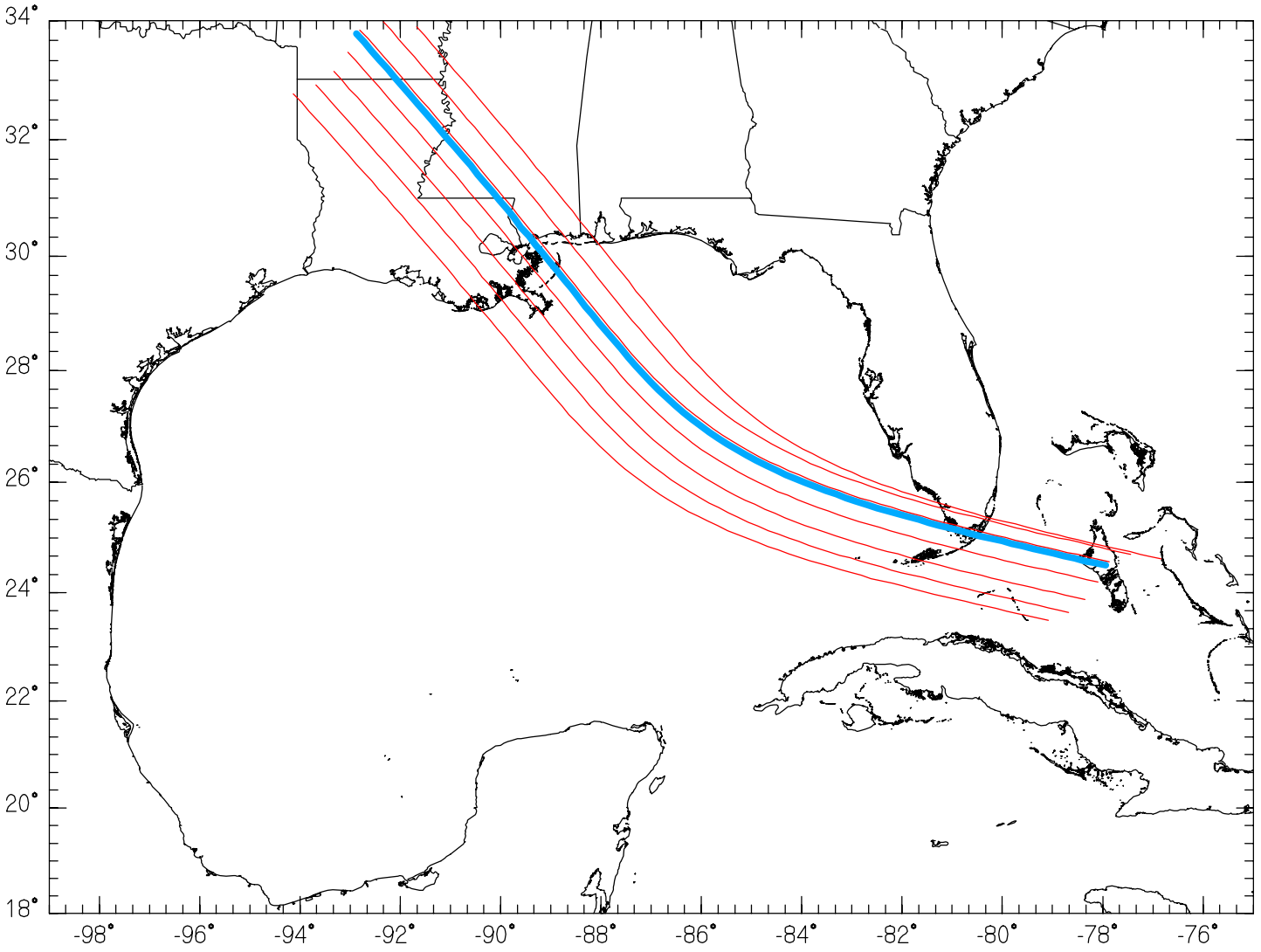


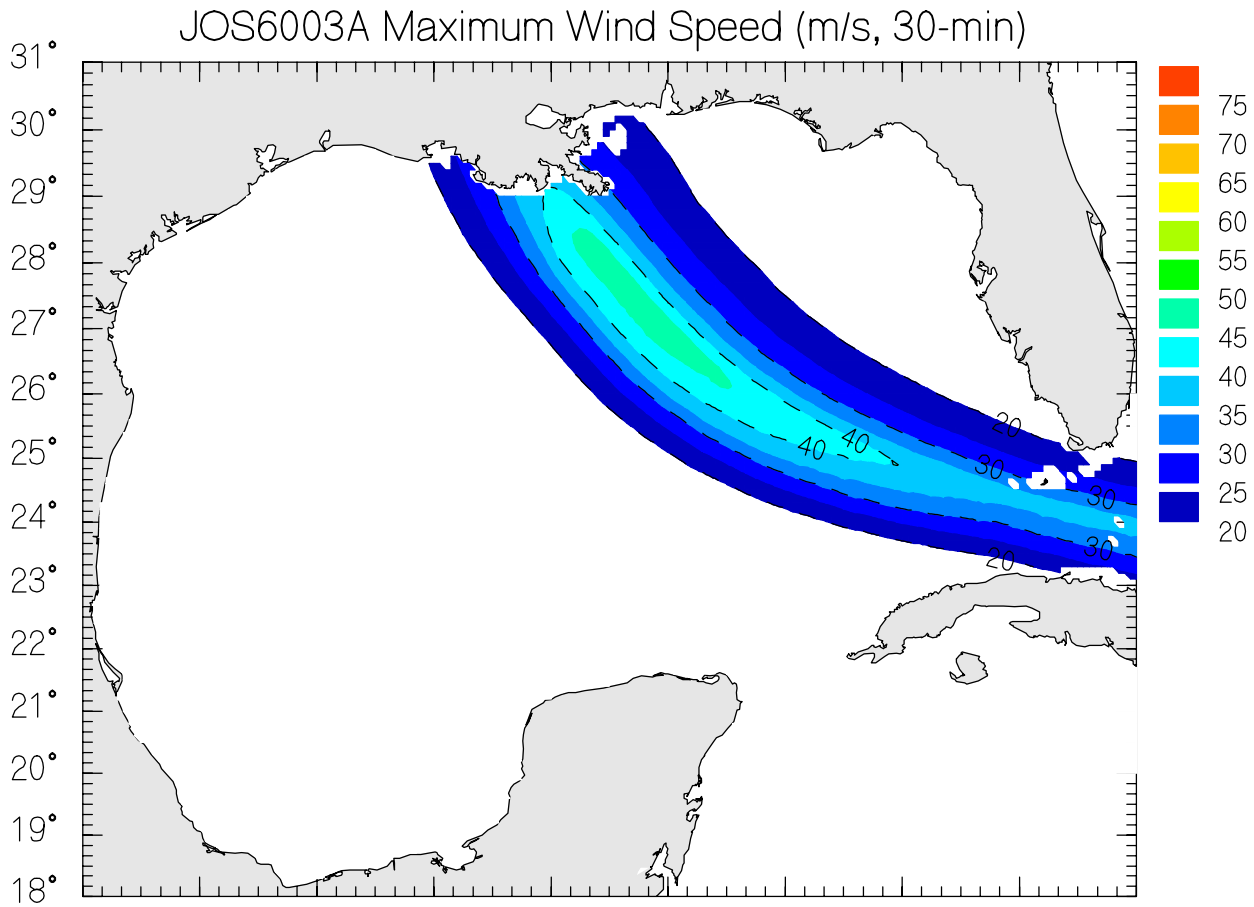
URS JPM-OS6 Production Tracks

JOS6003 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6003A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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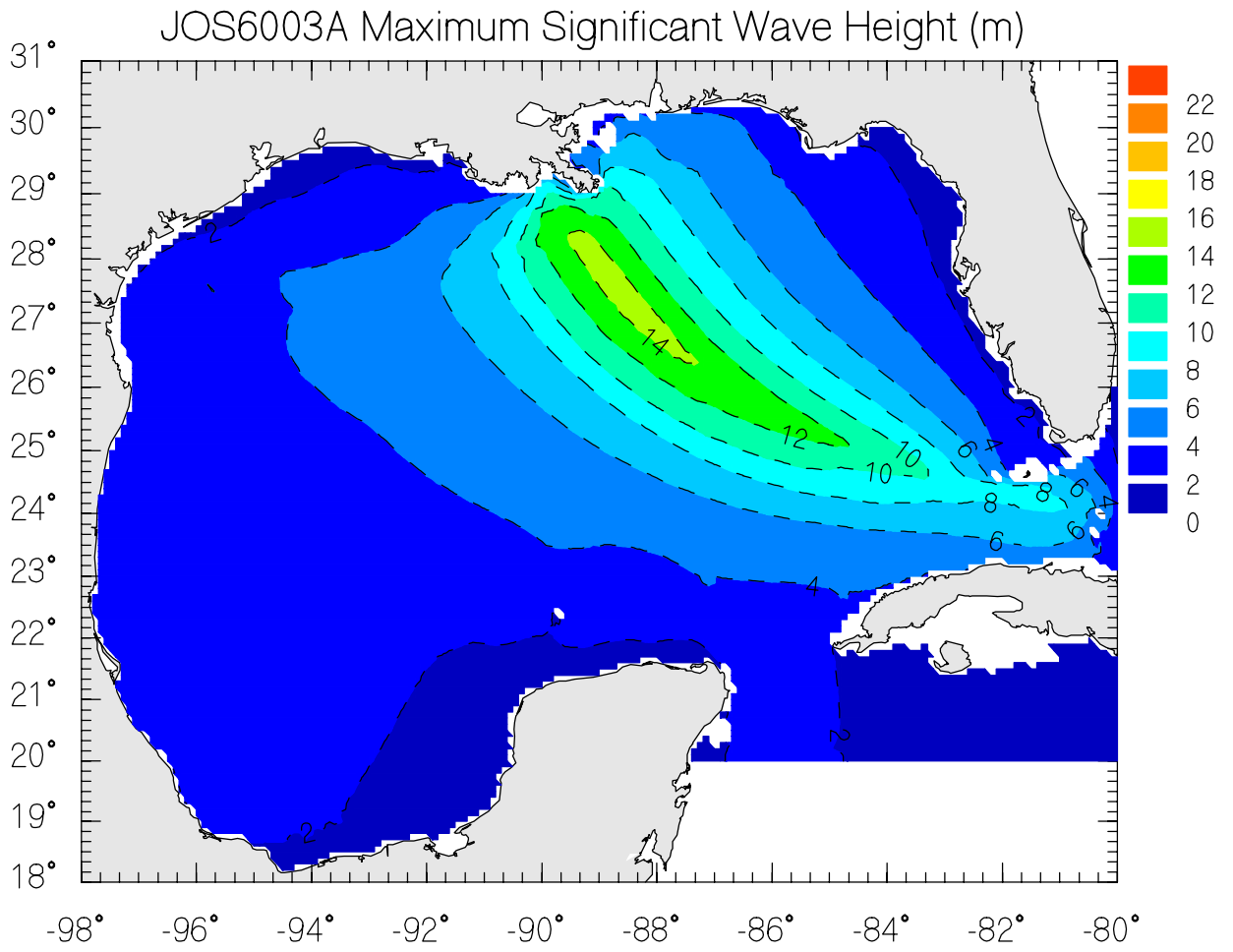
JOS6003A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
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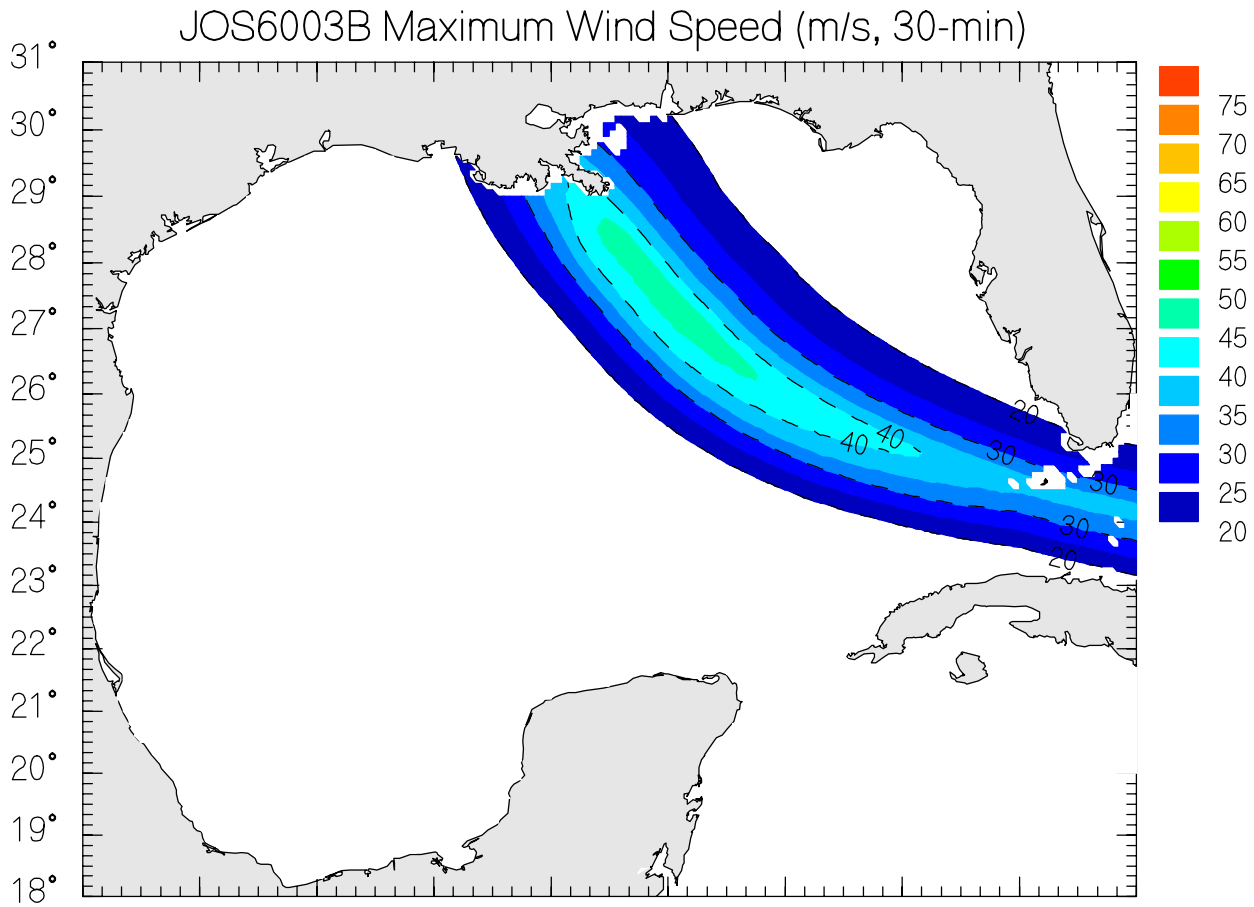
JOS6003B Maximum Wind Speed (m/s, 30-min)
31°
30°
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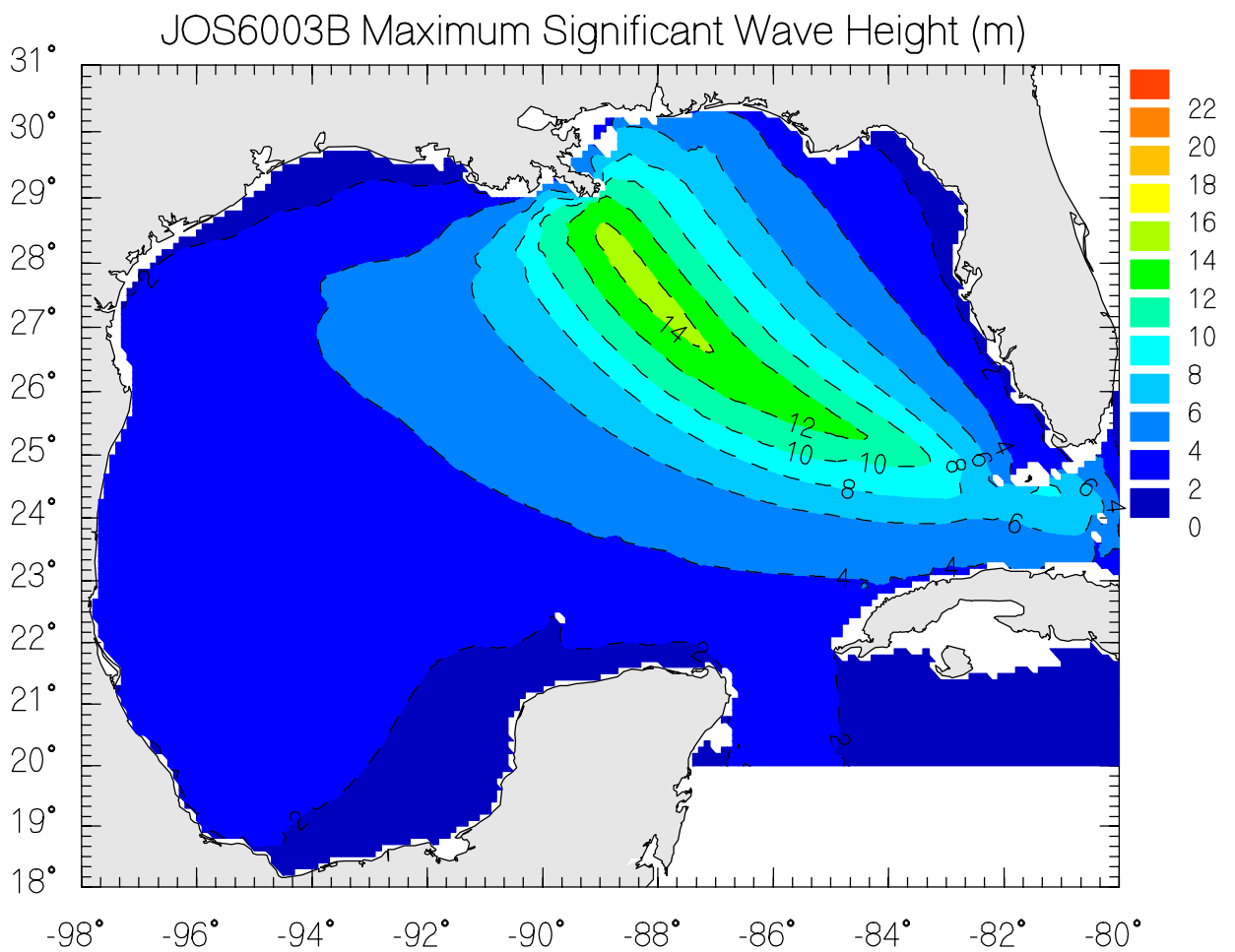
JOS6003B Maximum Significant Wave Height (m)
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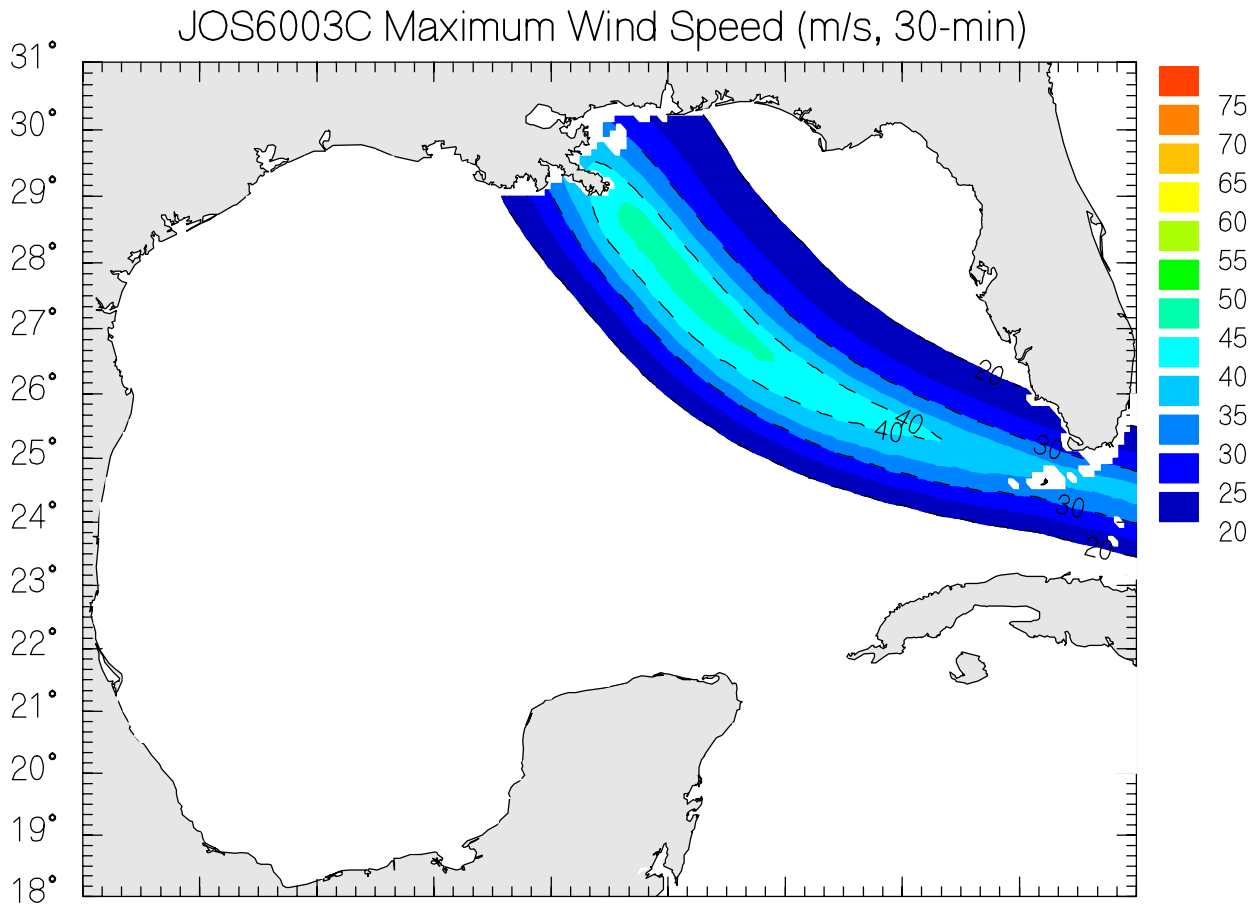
JOS6003C Maximum Wind Speed (m/s, 30-min)
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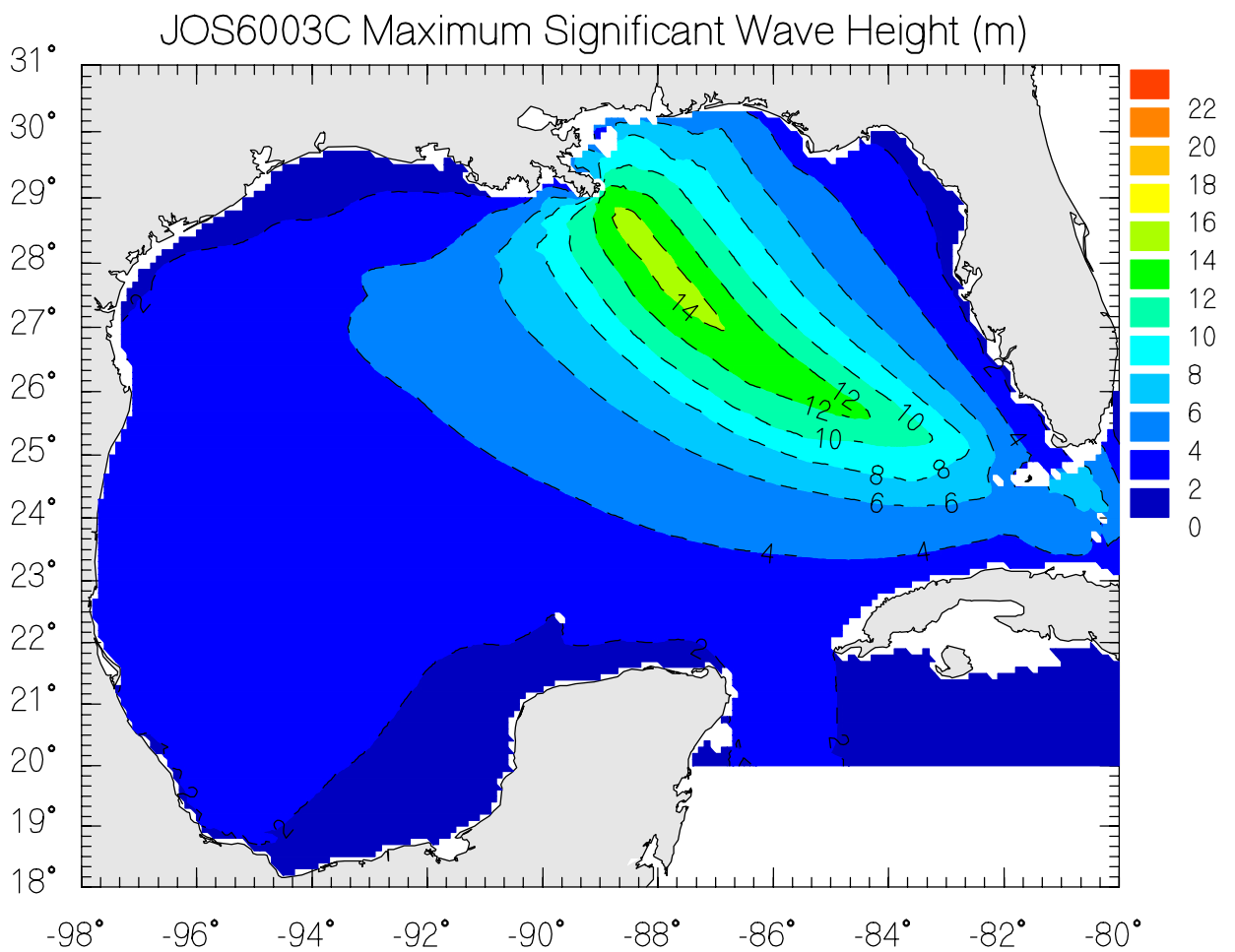
JOS6003C Maximum Significant Wave Height (m)
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19°
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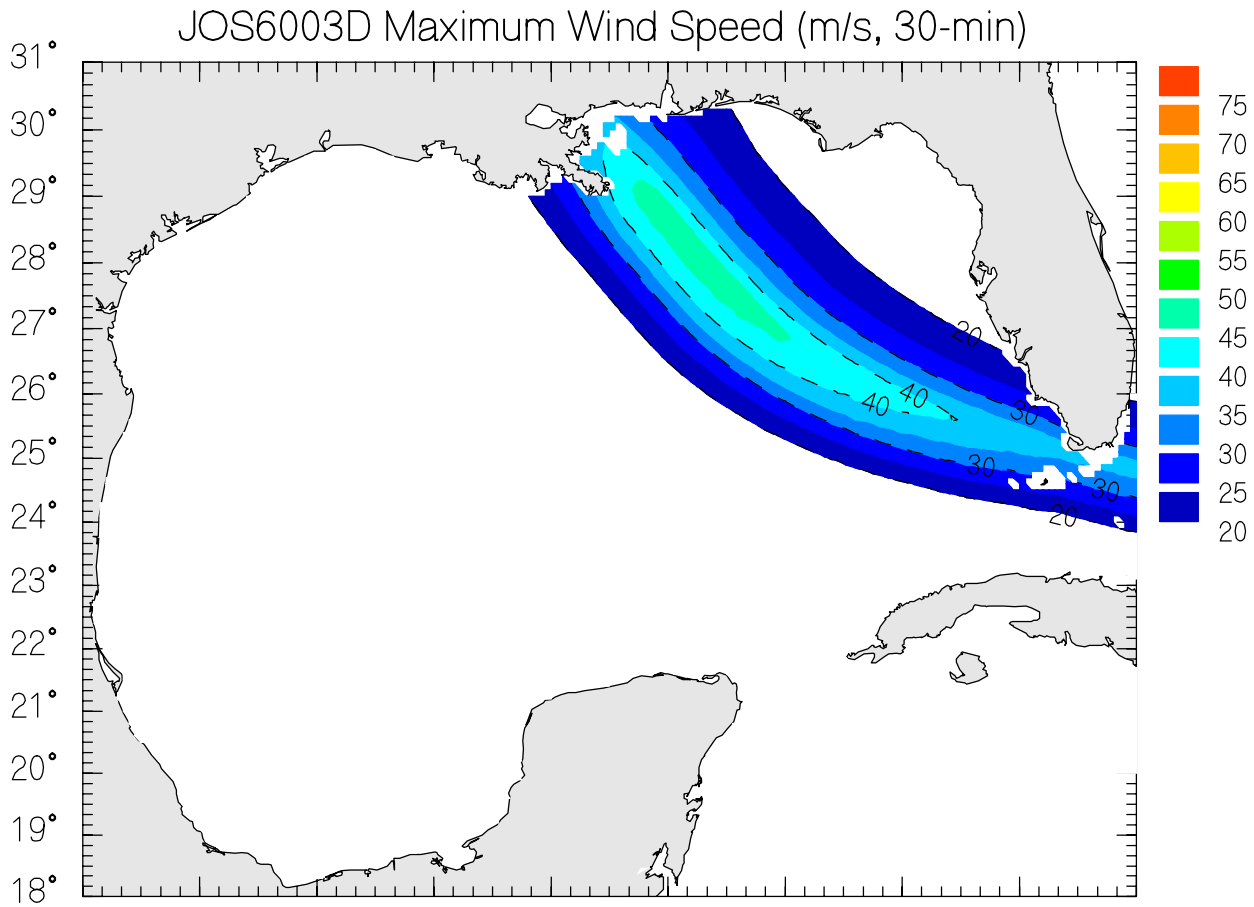
JOS6003D Maximum Wind Speed (m/s, 30-min)
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20°
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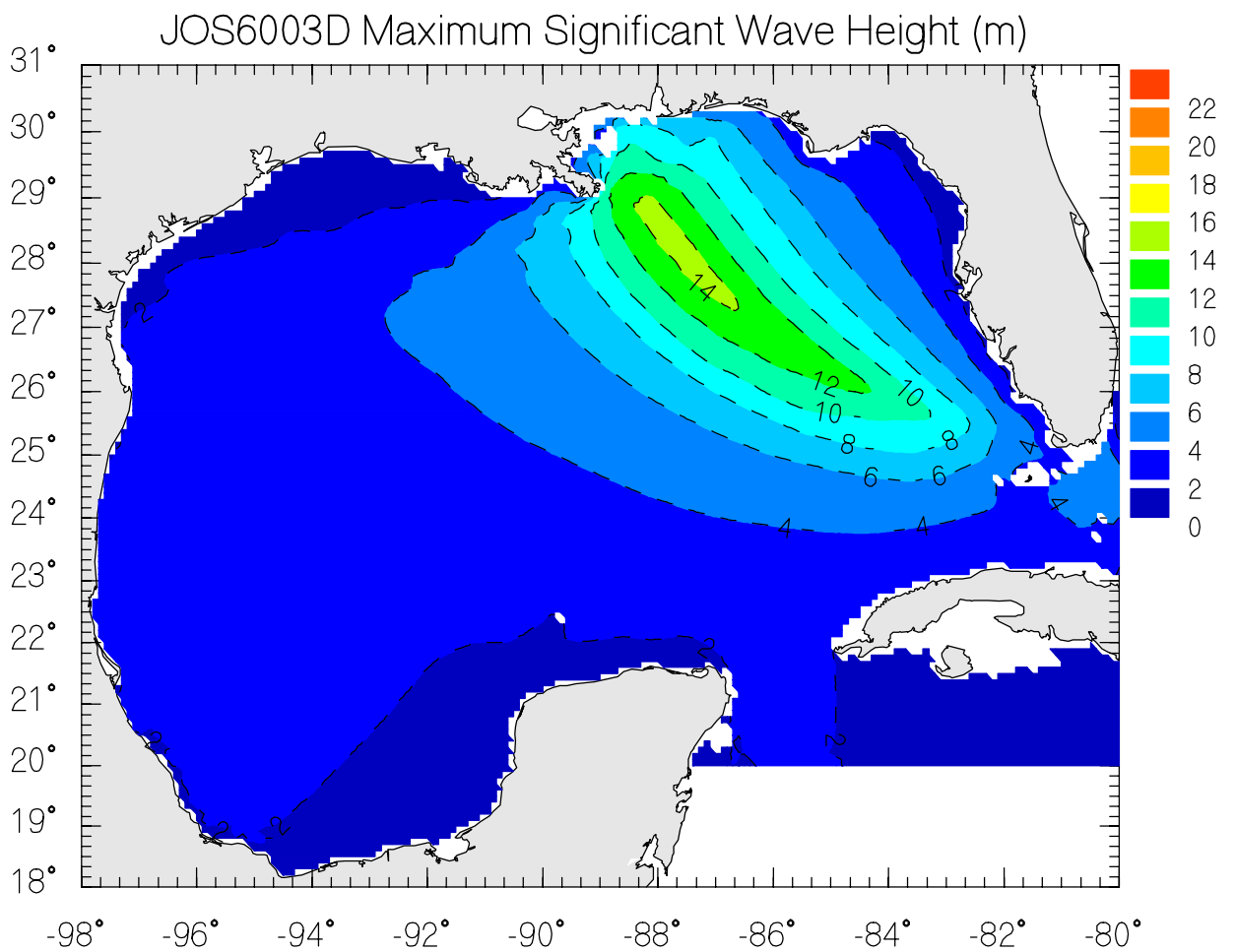
JOS6003D Maximum Significant Wave Height (m)
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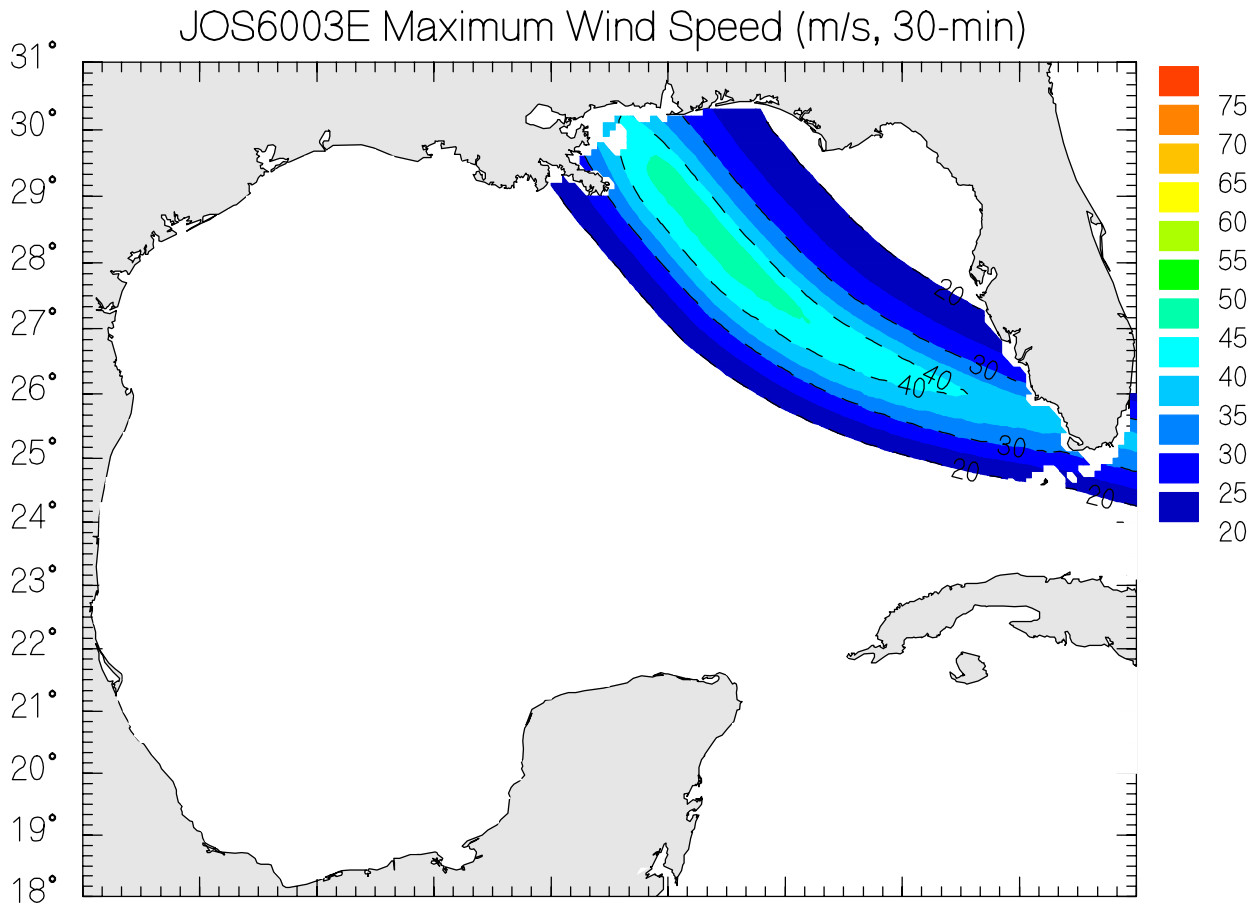
JOS6003E Maximum Wind Speed (m/s, 30-min)
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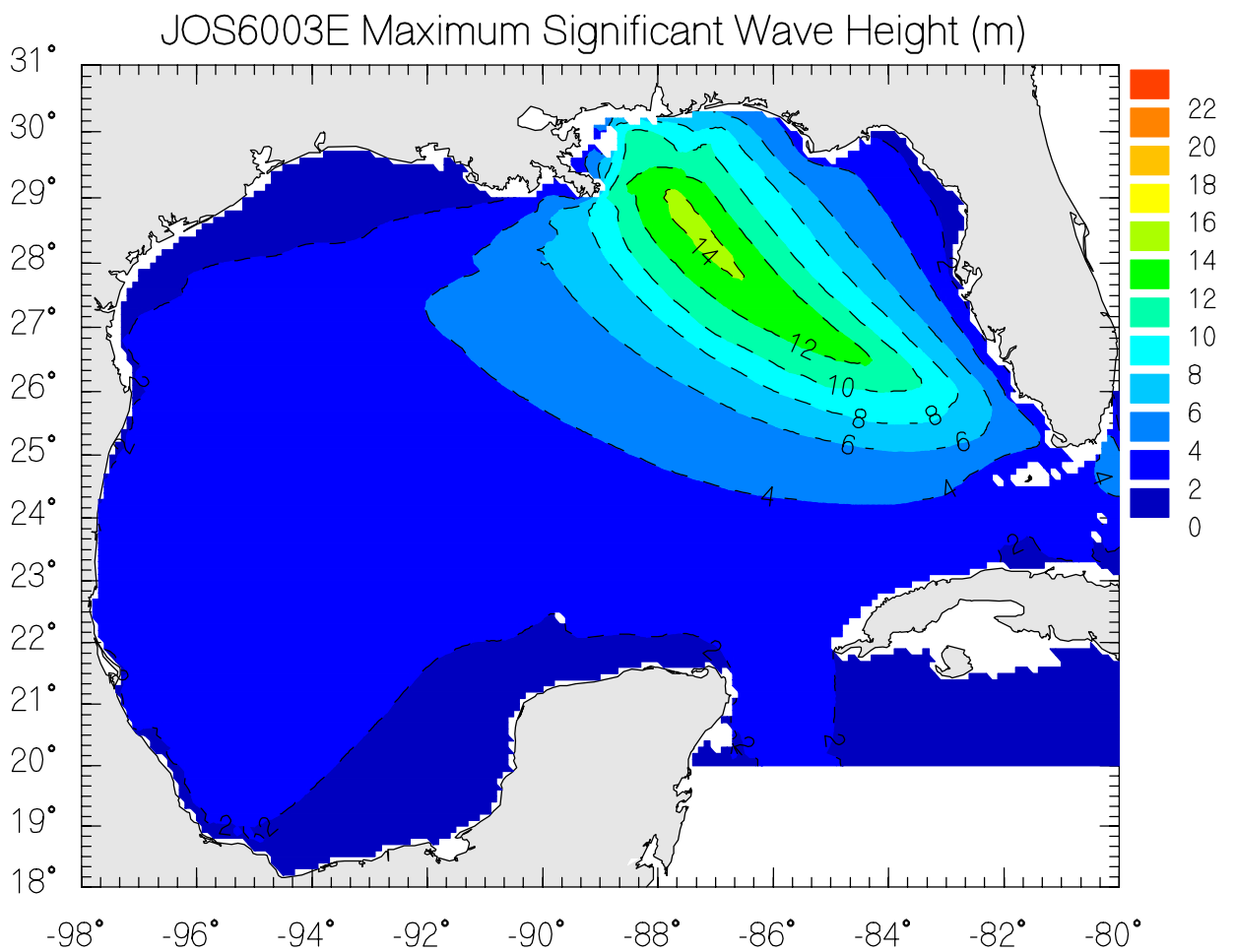
JOS6003E Maximum Significant Wave Height (m)
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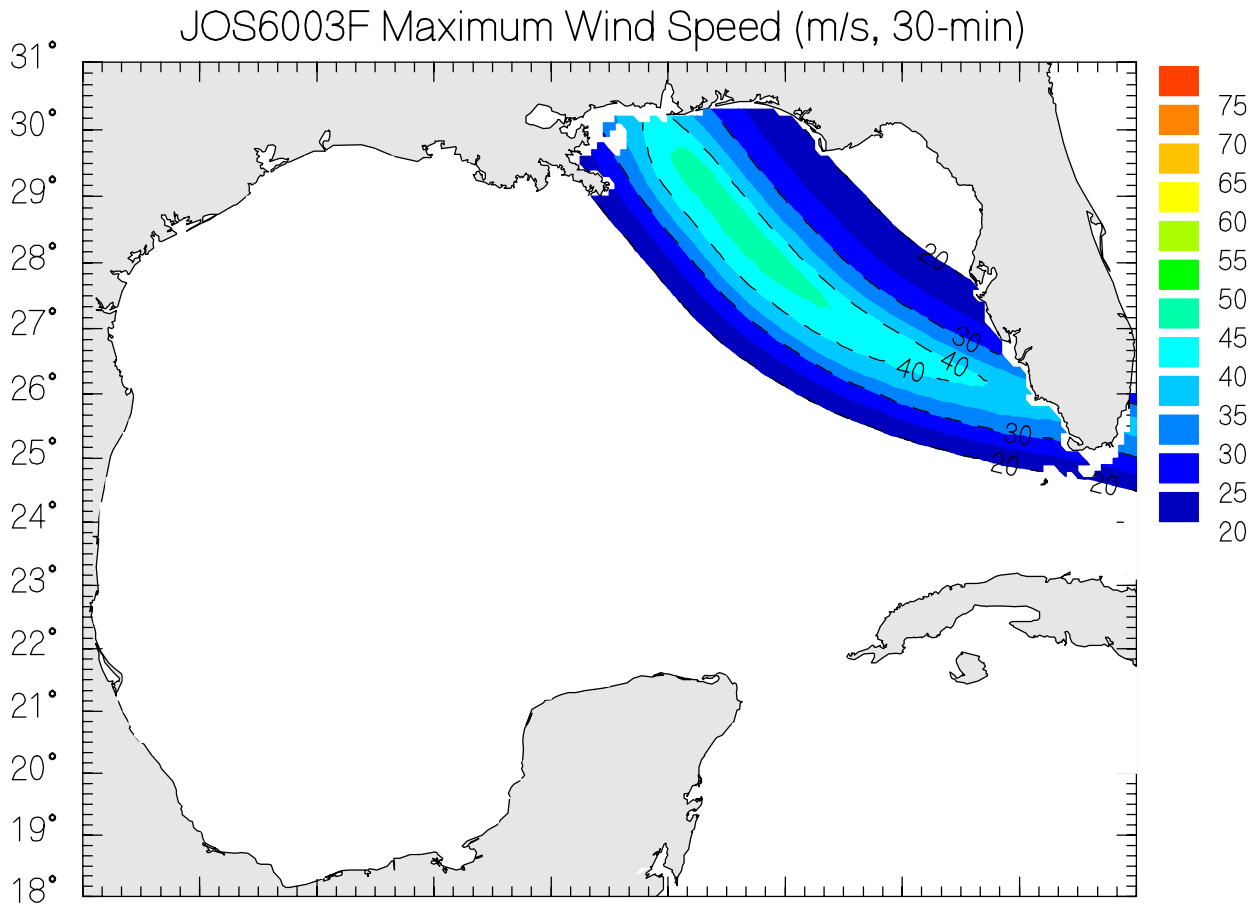
JOS6003F Maximum Wind Speed (m/s, 30-min)
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20°
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25
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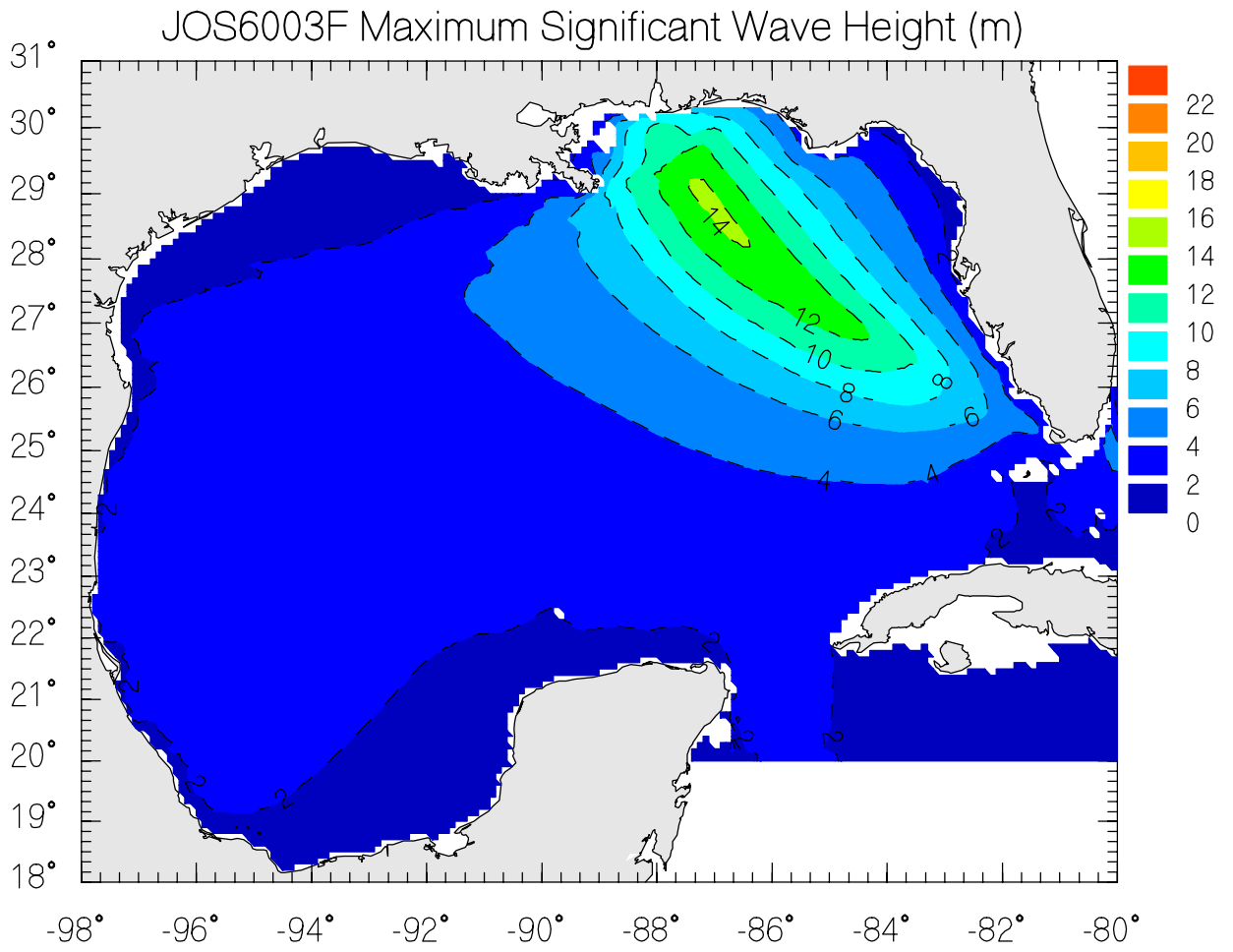
JOS6003F Maximum Significant Wave Height (m)
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28°
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19°
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-90°
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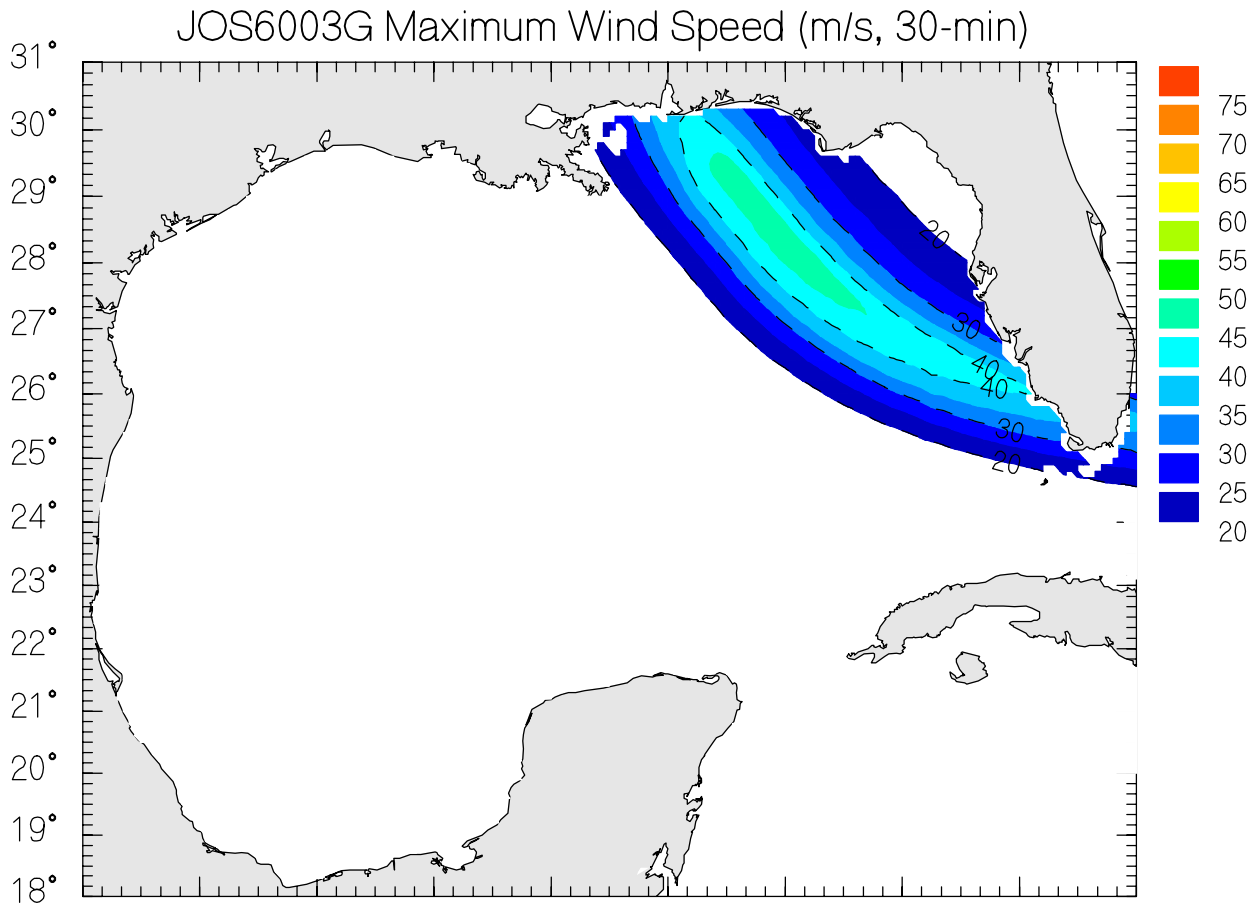
JOS6003G Maximum Wind Speed (m/s, 30-min)
31°
30°
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28°
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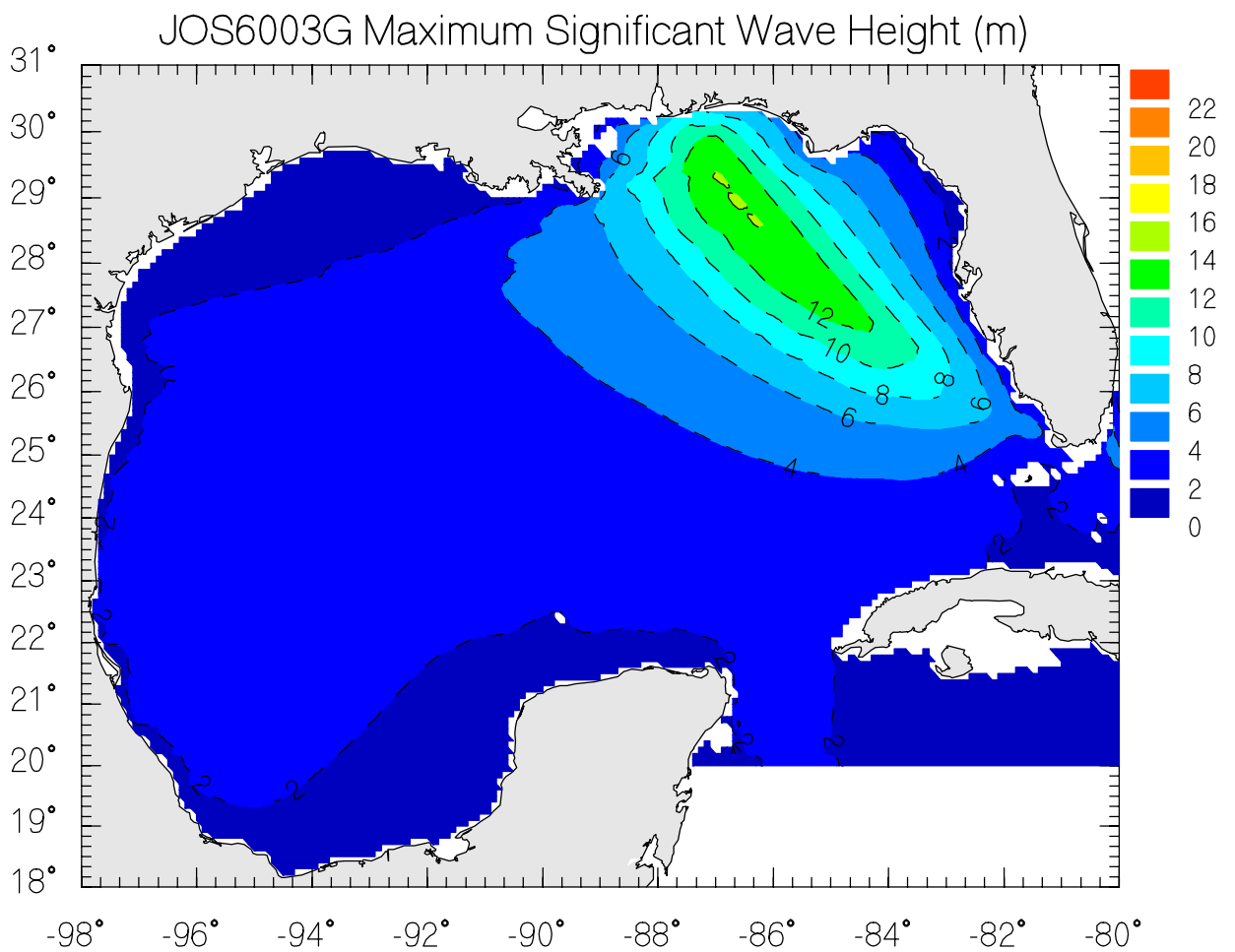
JOS6003G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
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20°
19°
18°
-98°
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-94°
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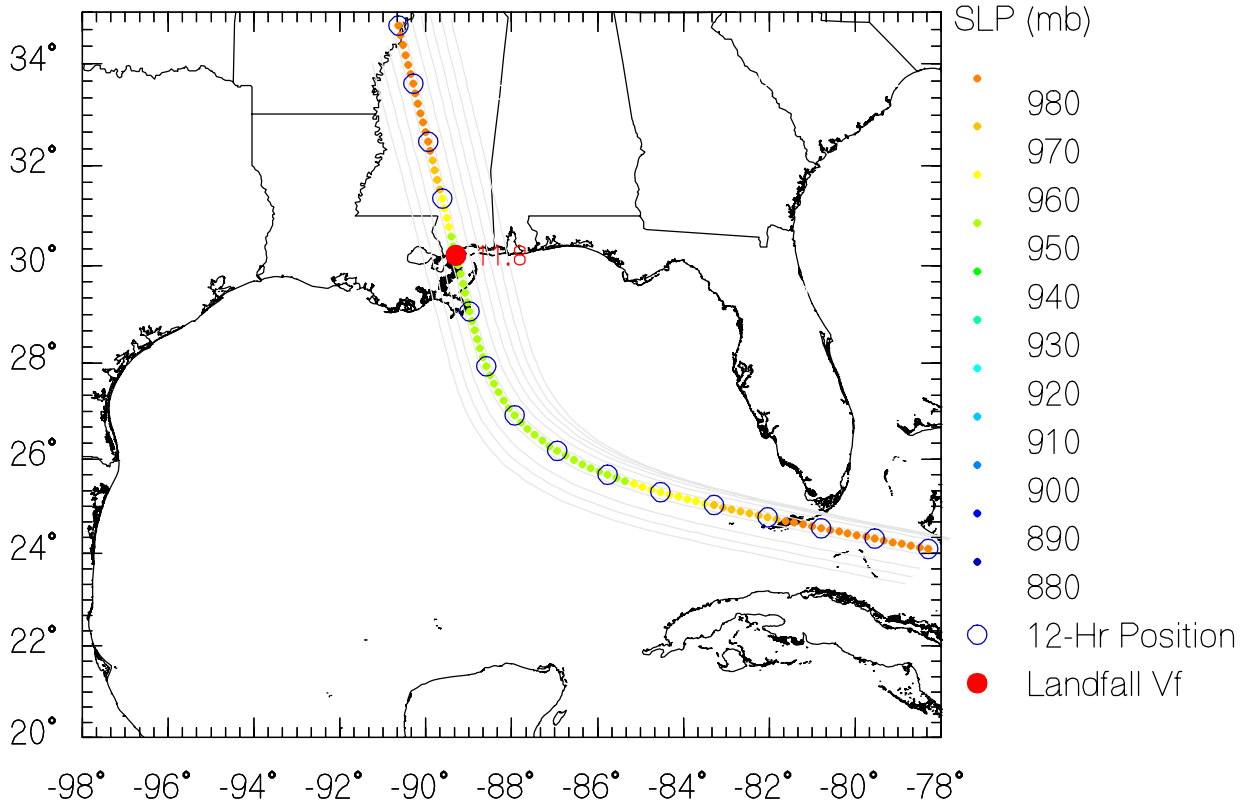
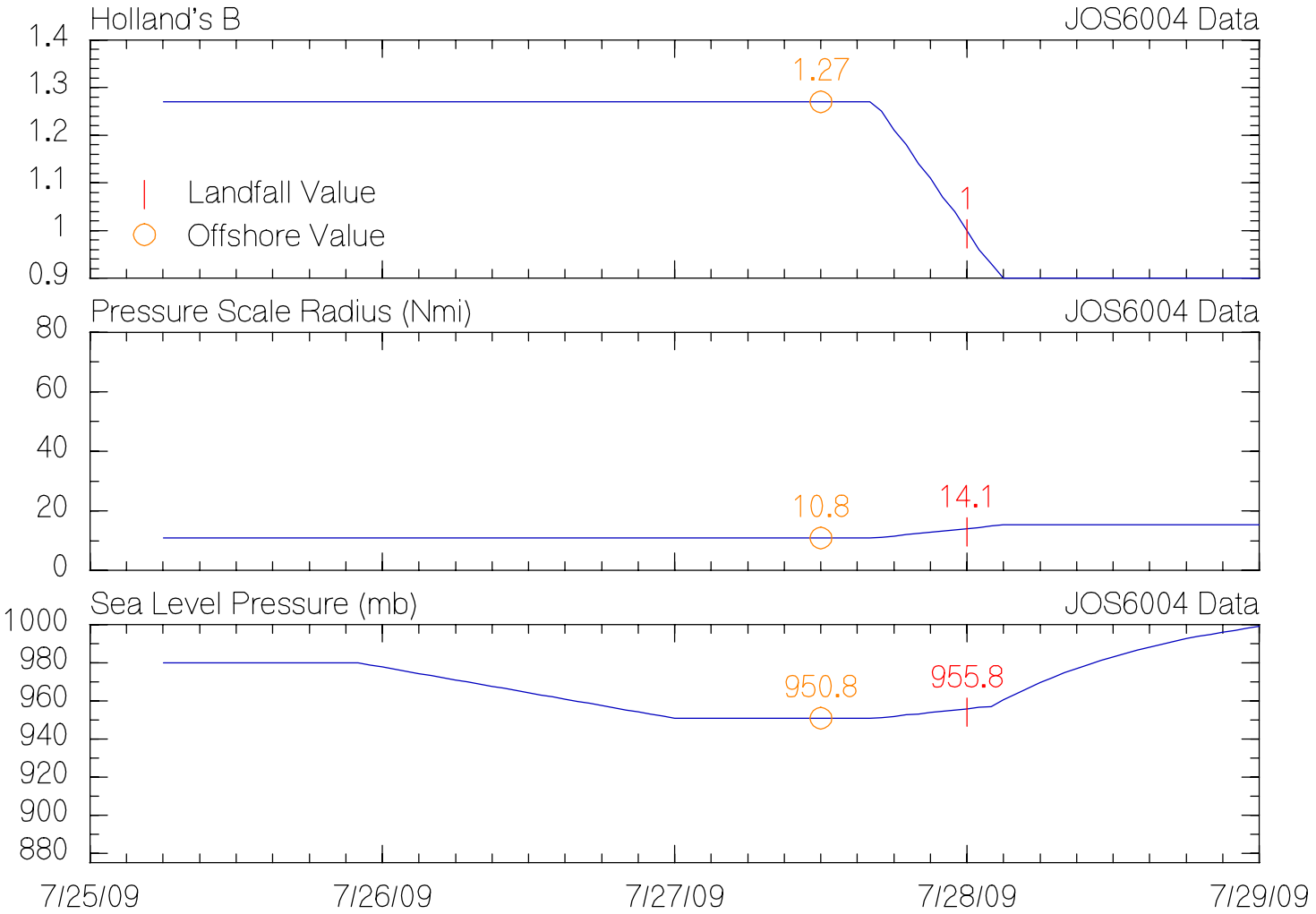
JOS6004 Data

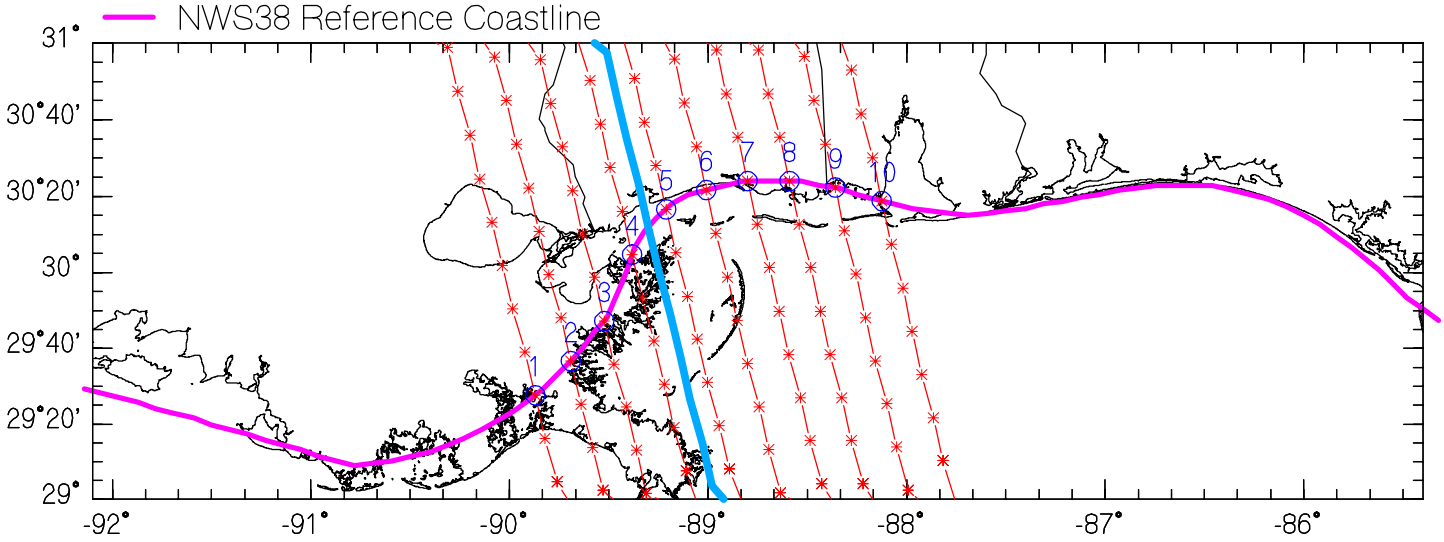


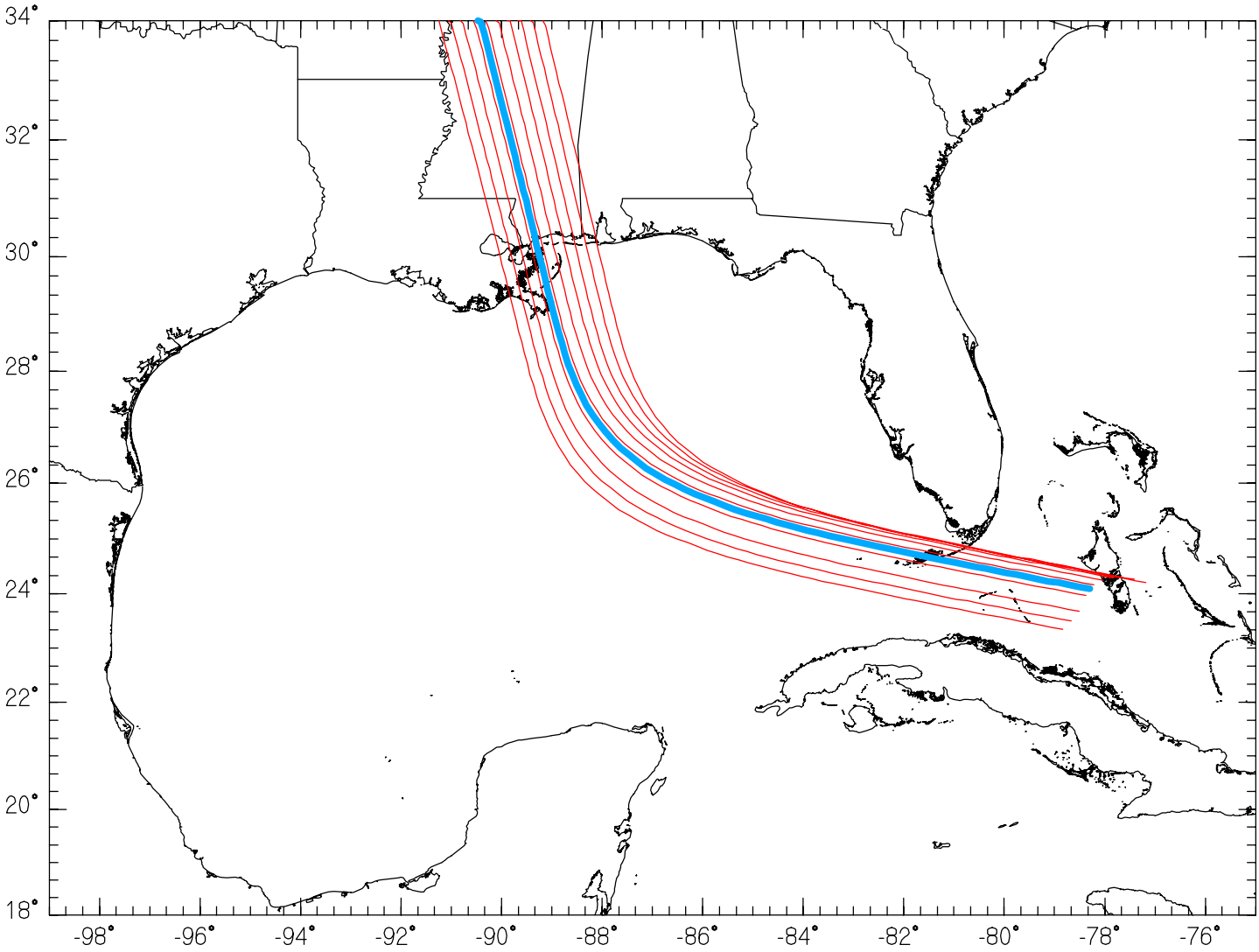


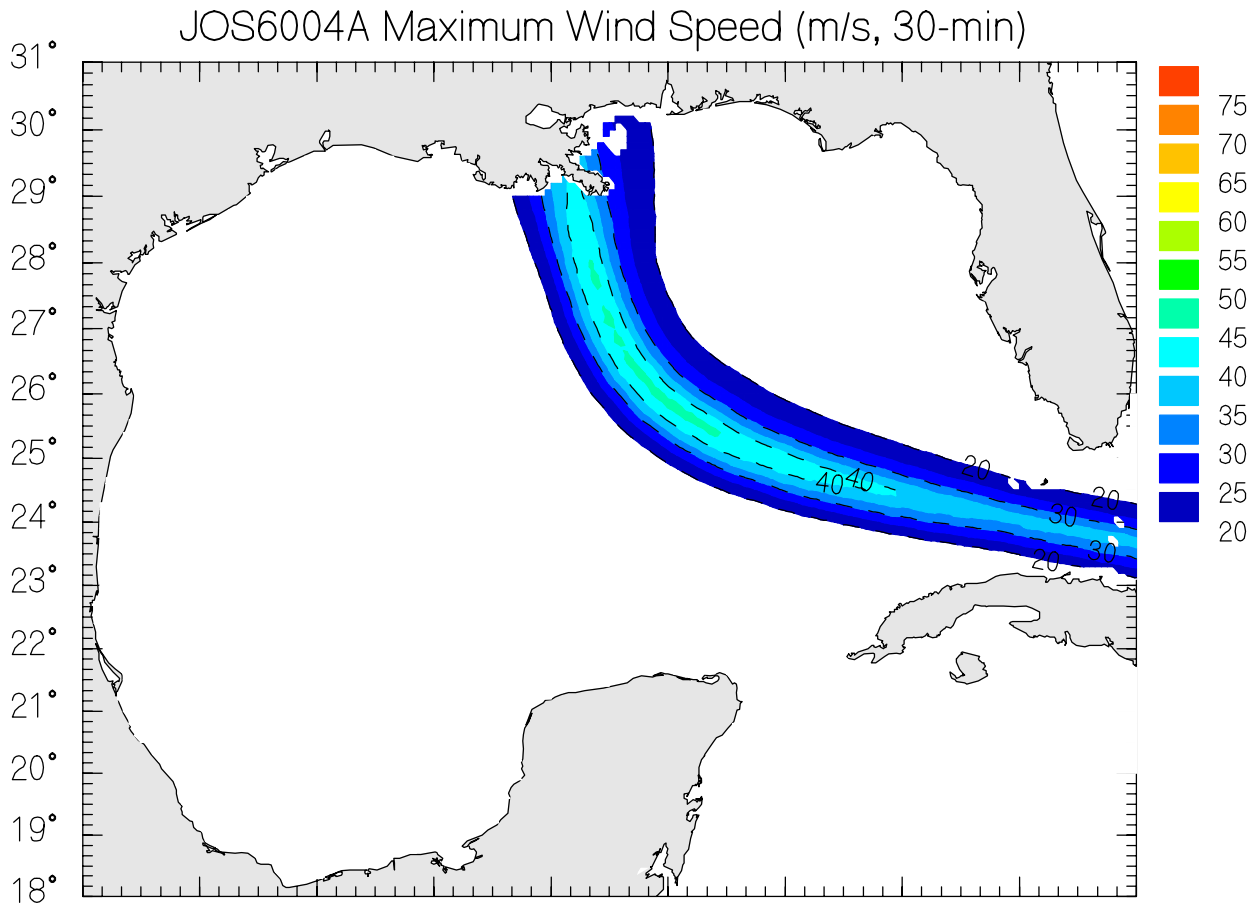
URS JPM-OS6 Production Tracks

JOS6004 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6004A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
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21°
20°
19°
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20
30
30
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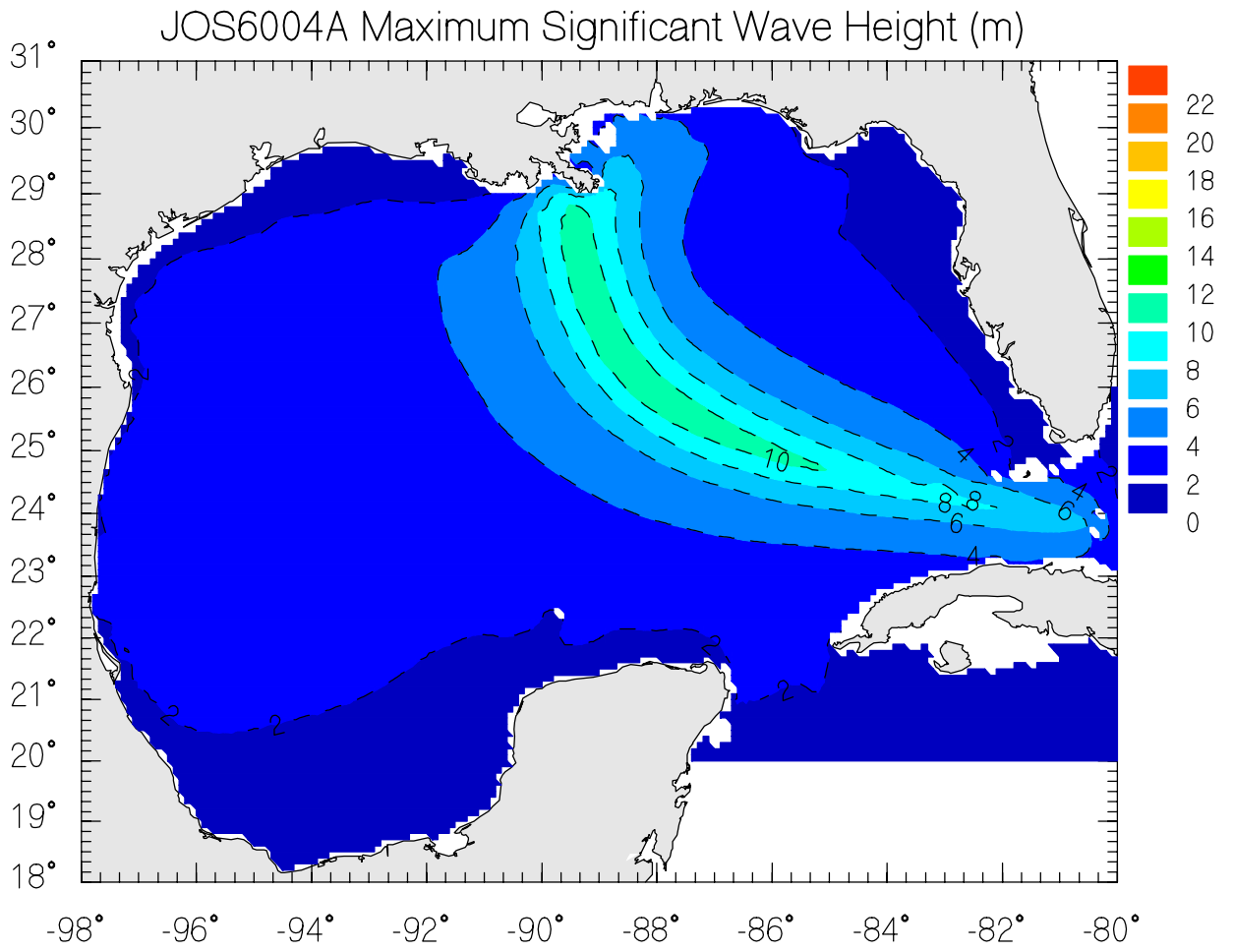
JOS6004A Maximum Significant Wave Height (m)
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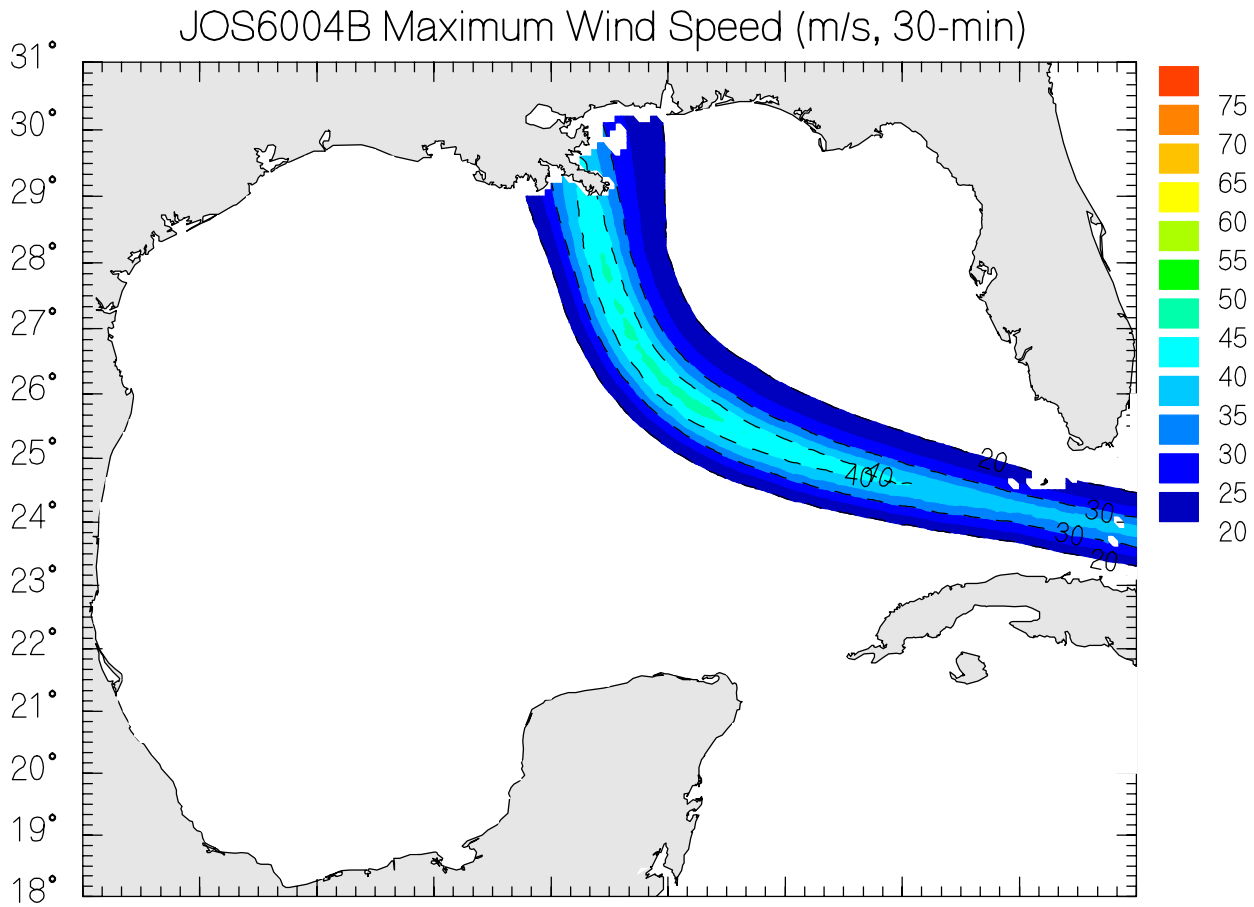
-80°


JOS6004B Maximum Wind Speed (m/s, 30-min)
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30°
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28°
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21°
20°
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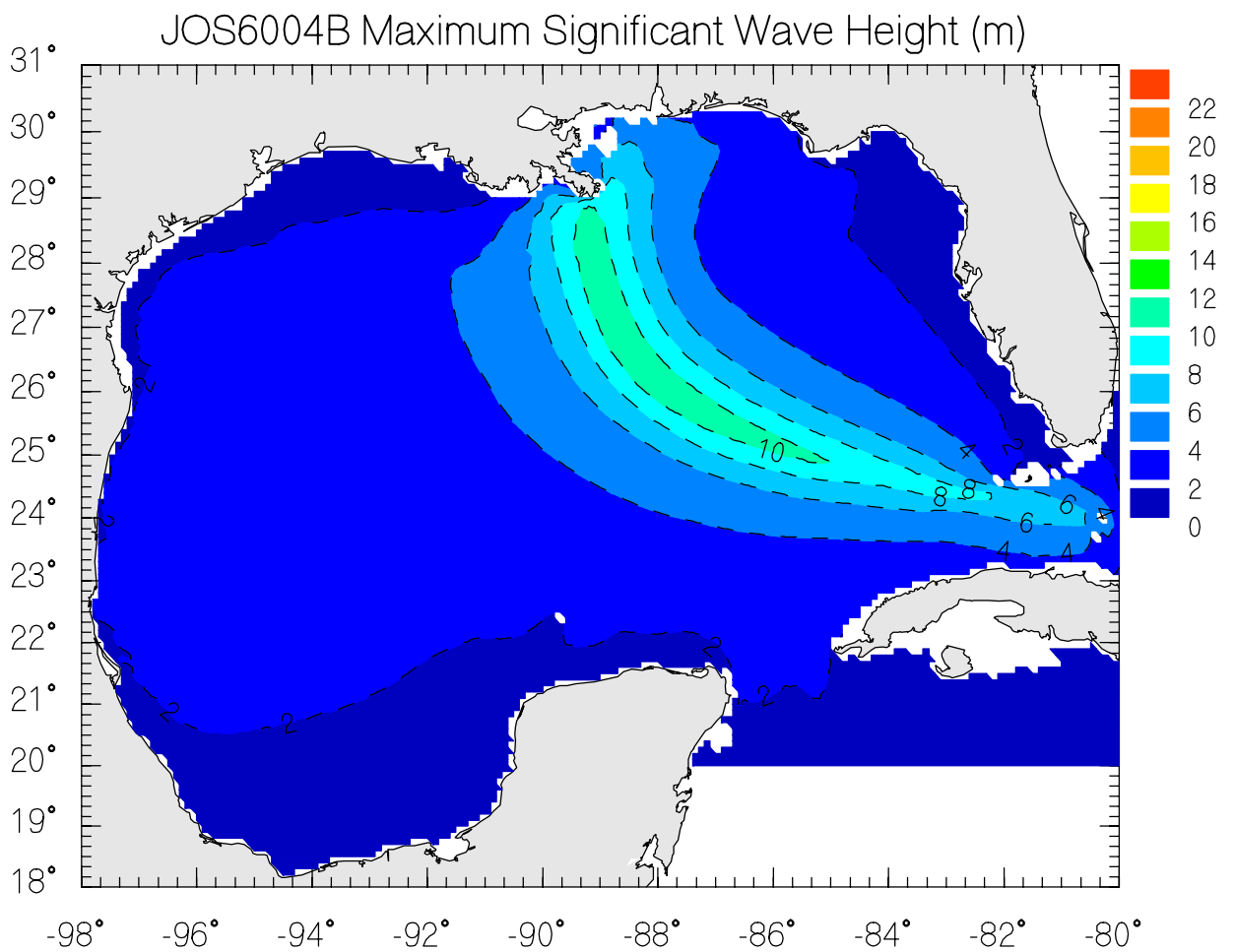
JOS6004B Maximum Significant Wave Height (m)
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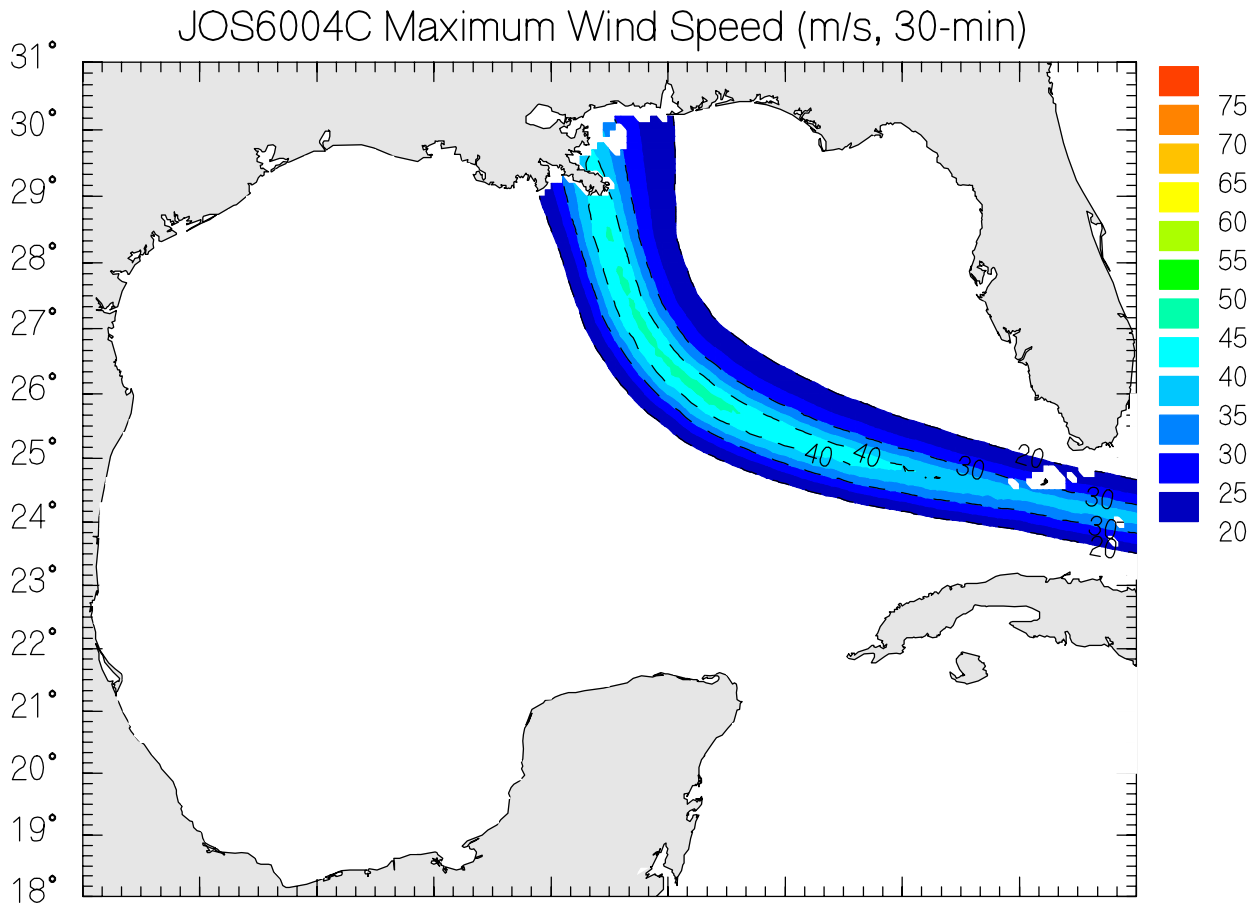
JOS6004C Maximum Wind Speed (m/s, 30-min)
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30°
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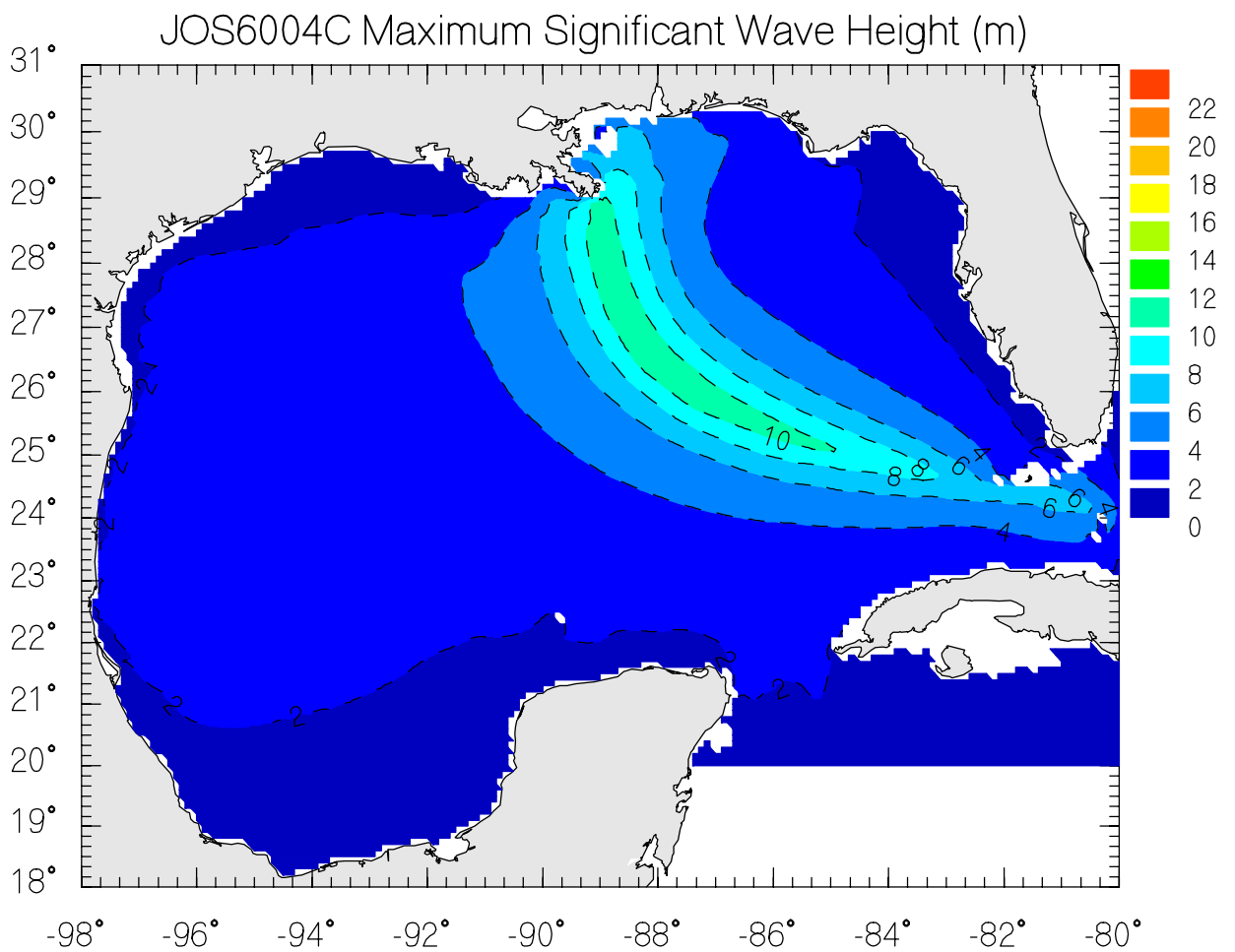
JOS6004C Maximum Significant Wave Height (m)
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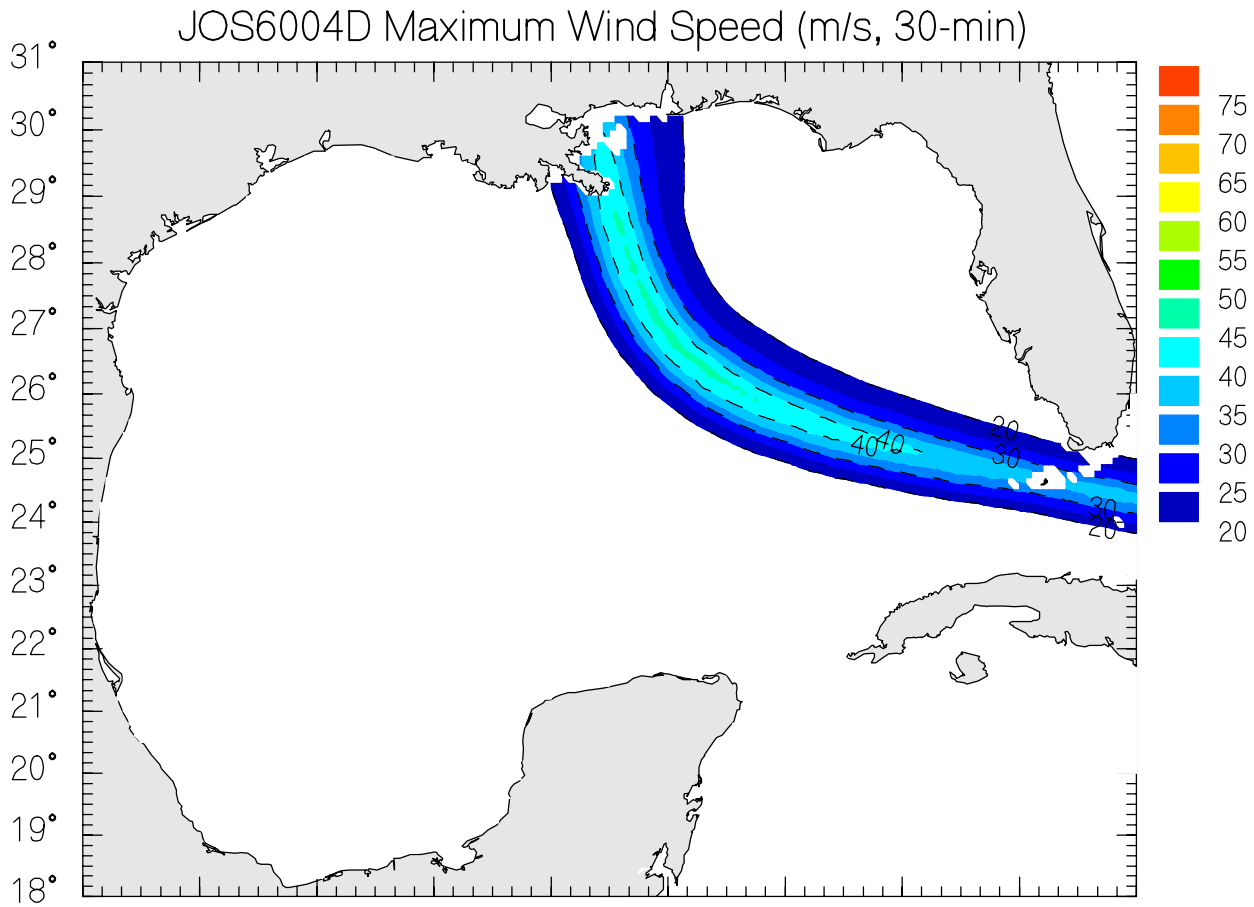
JOS6004D Maximum Wind Speed (m/s, 30-min)
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28°
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21°
20°
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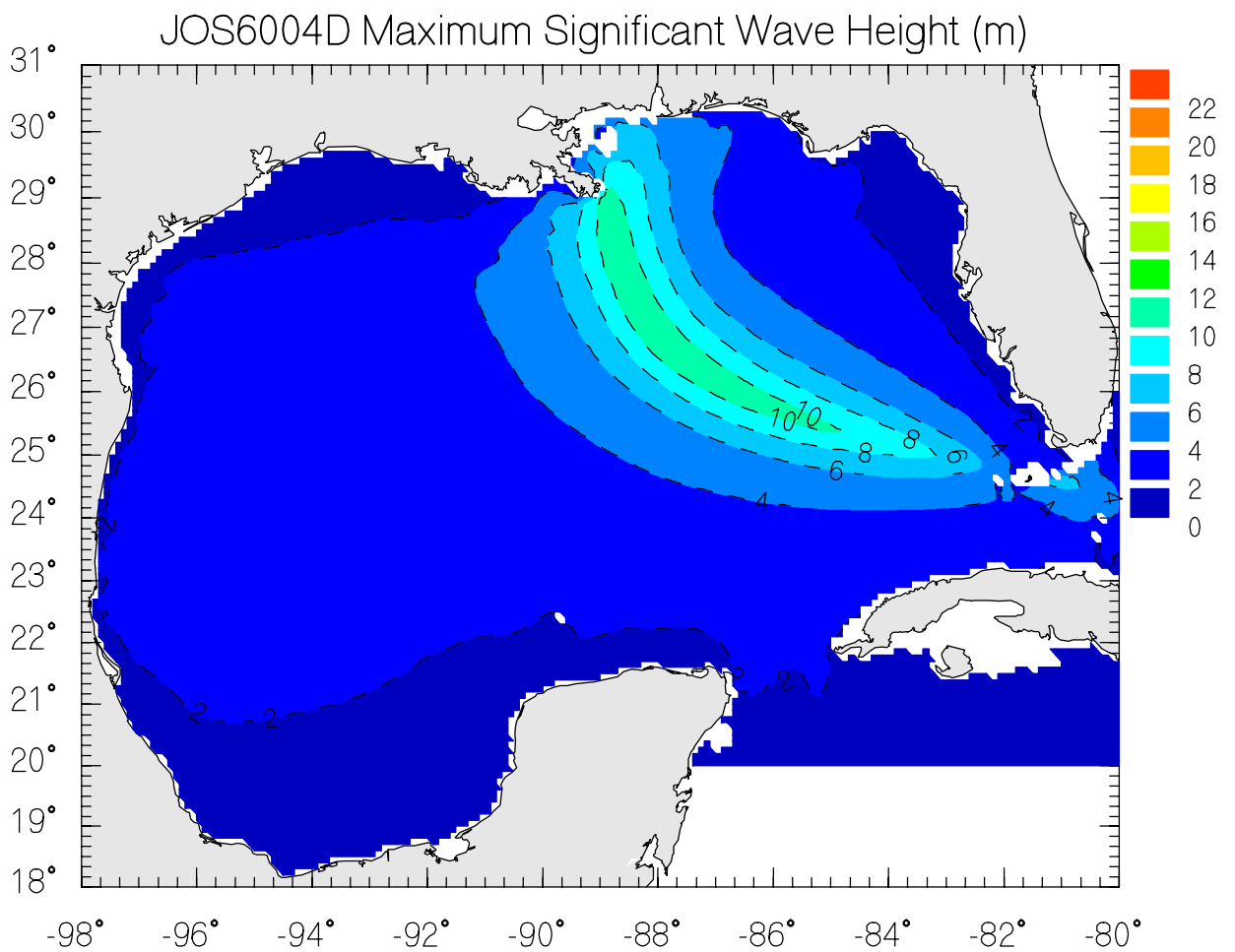
JOS6004D Maximum Significant Wave Height (m)
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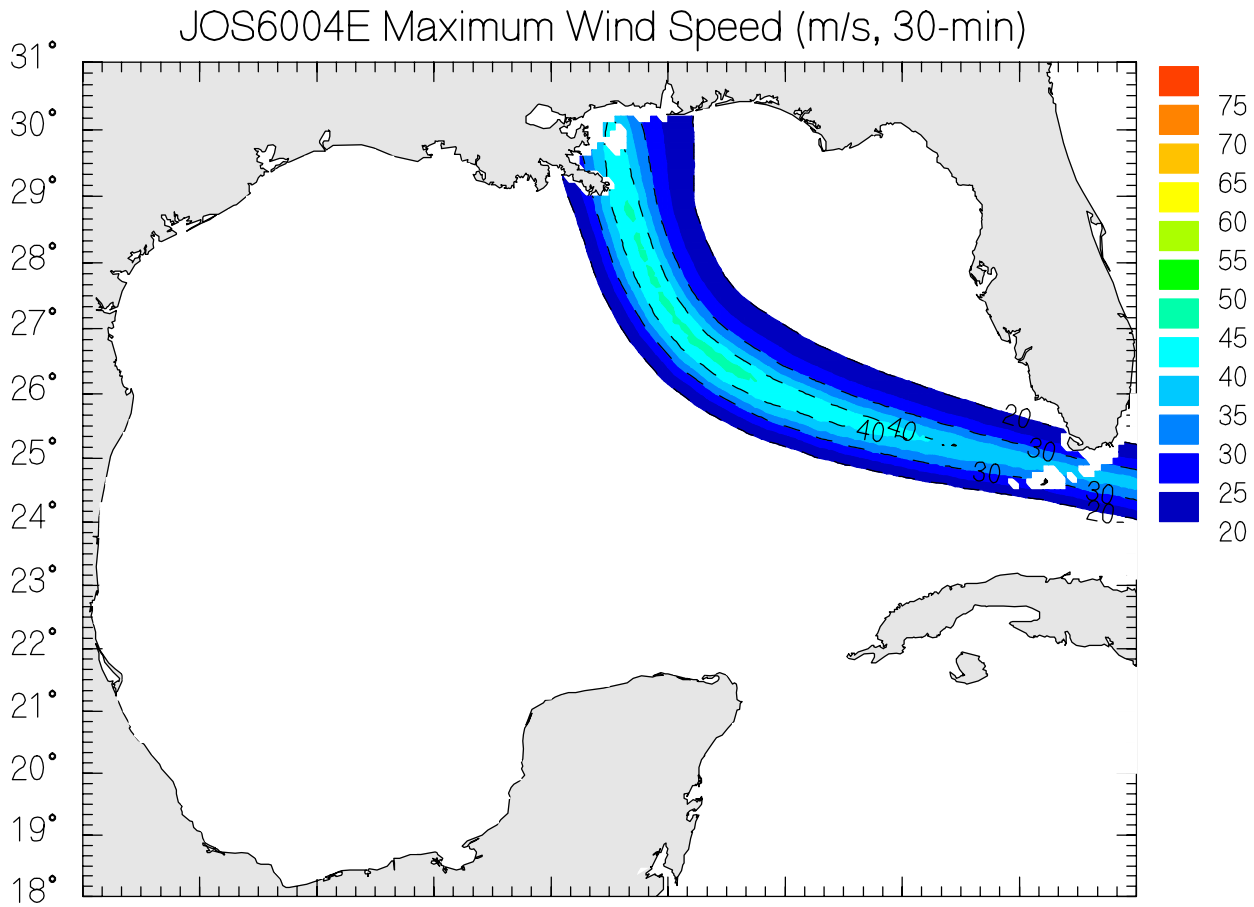
JOS6004E Maximum Wind Speed (m/s, 30-min)
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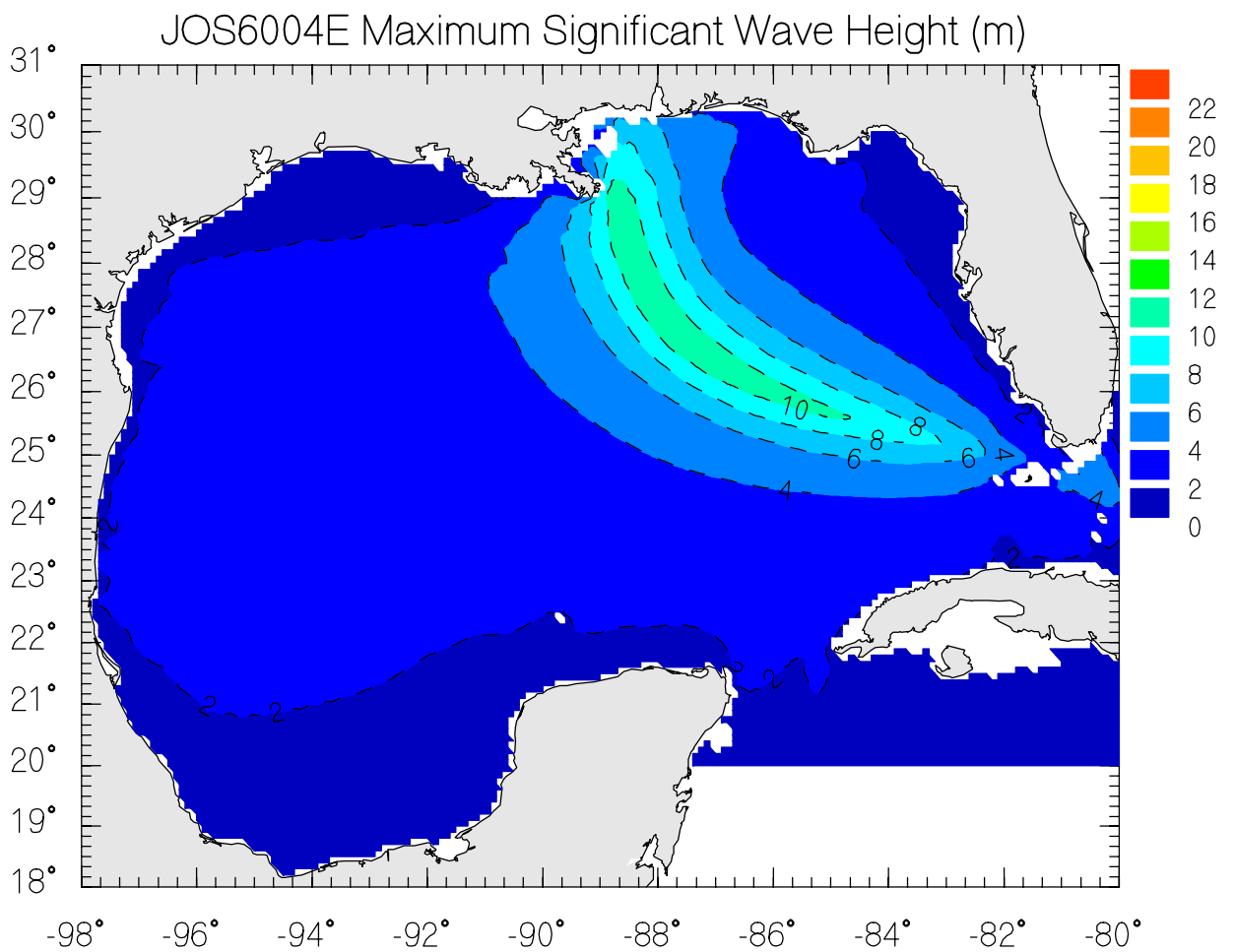
JOS6004E Maximum Significant Wave Height (m)
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19°
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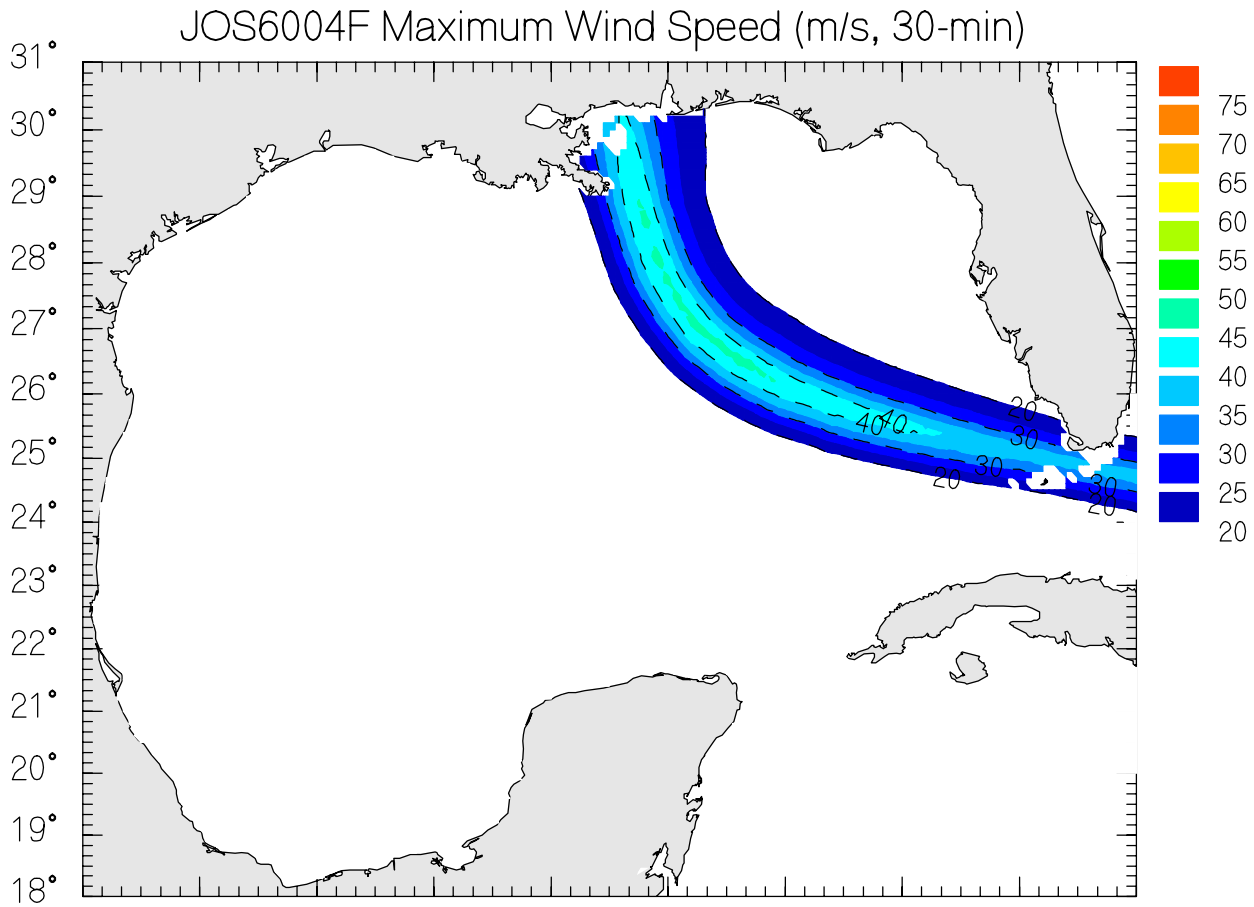
JOS6004F Maximum Wind Speed (m/s, 30-min)
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29°
28°
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26°
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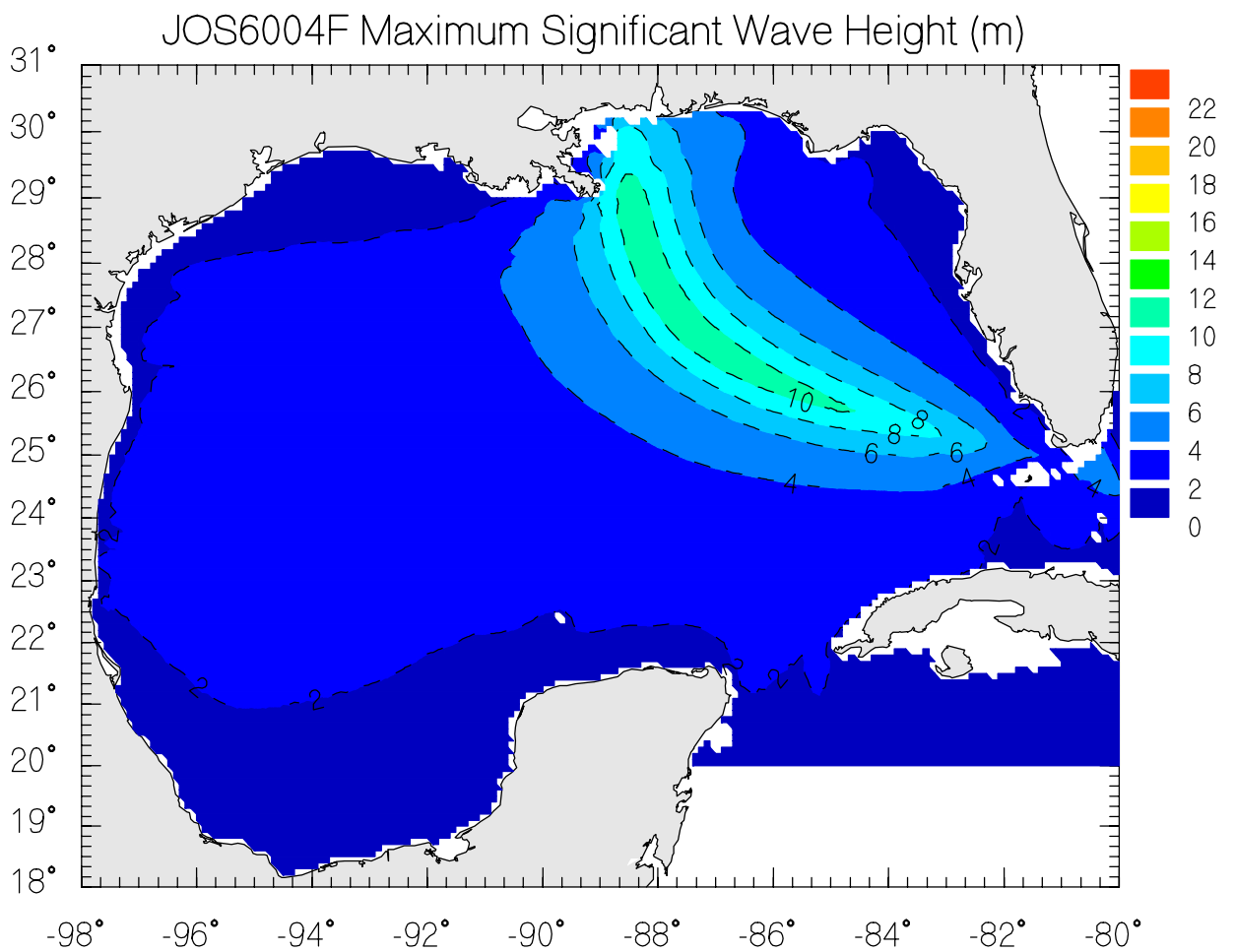
JOS6004F Maximum Significant Wave Height (m)
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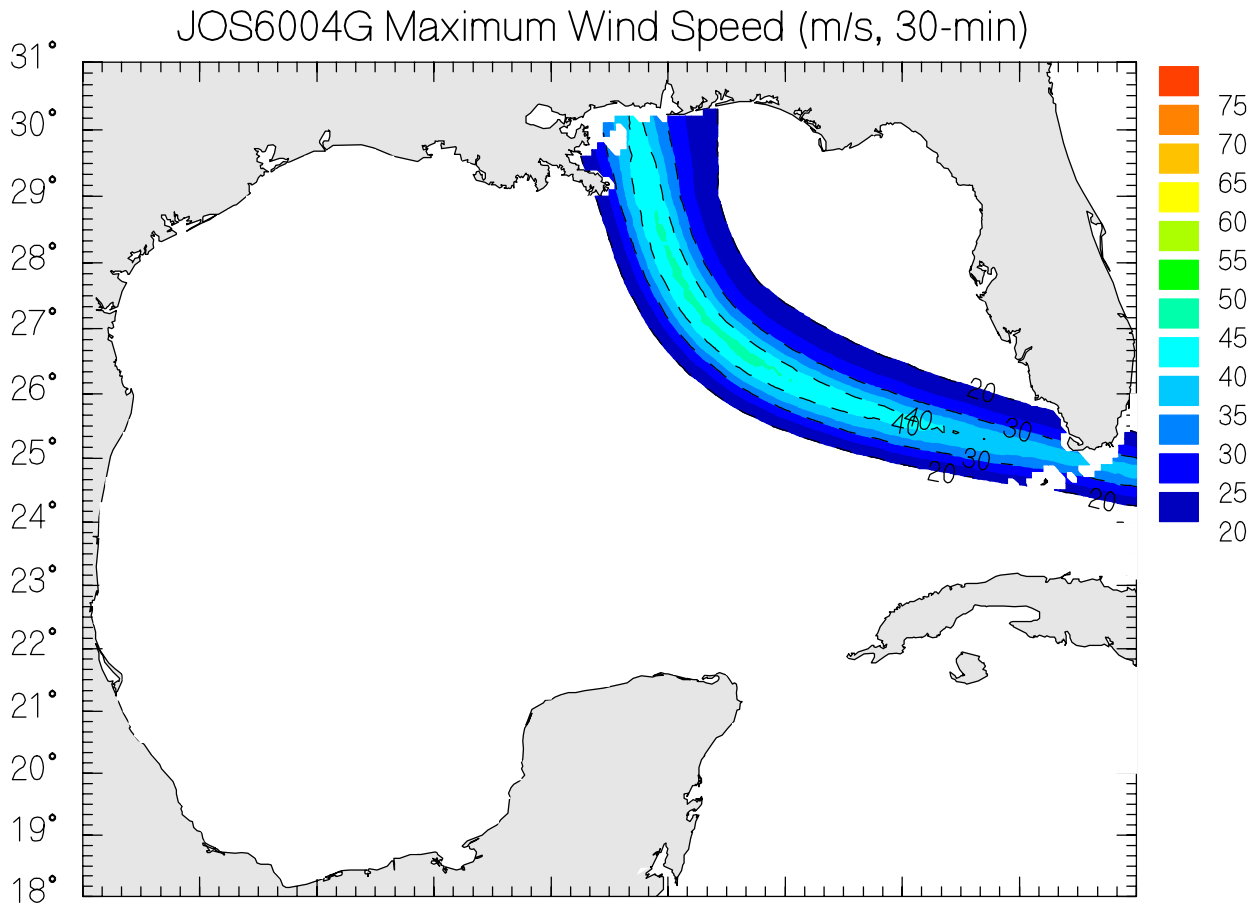
JOS6004G Maximum Wind Speed (m/s, 30-min)
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28°
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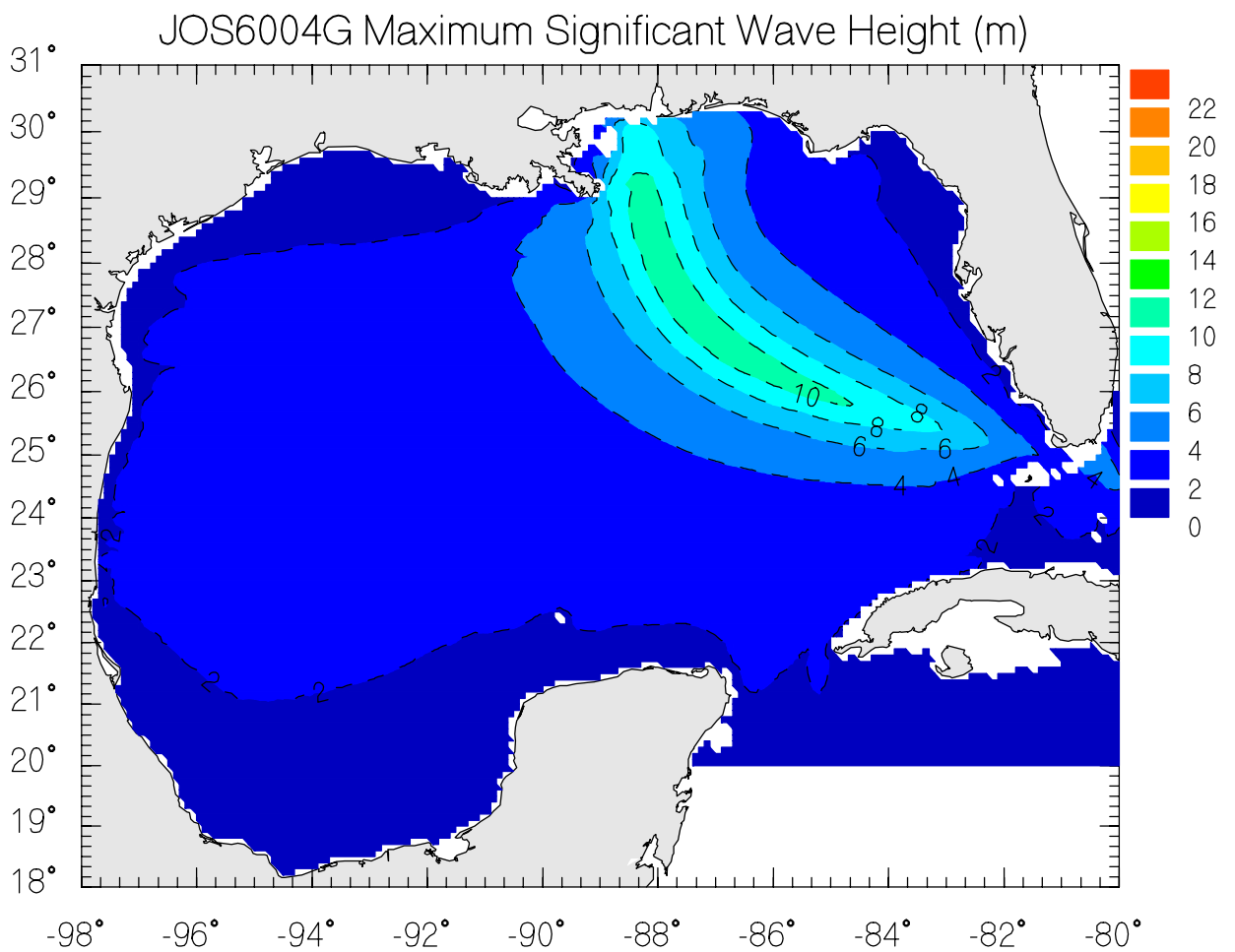
JOS6004G Maximum Significant Wave Height (m)
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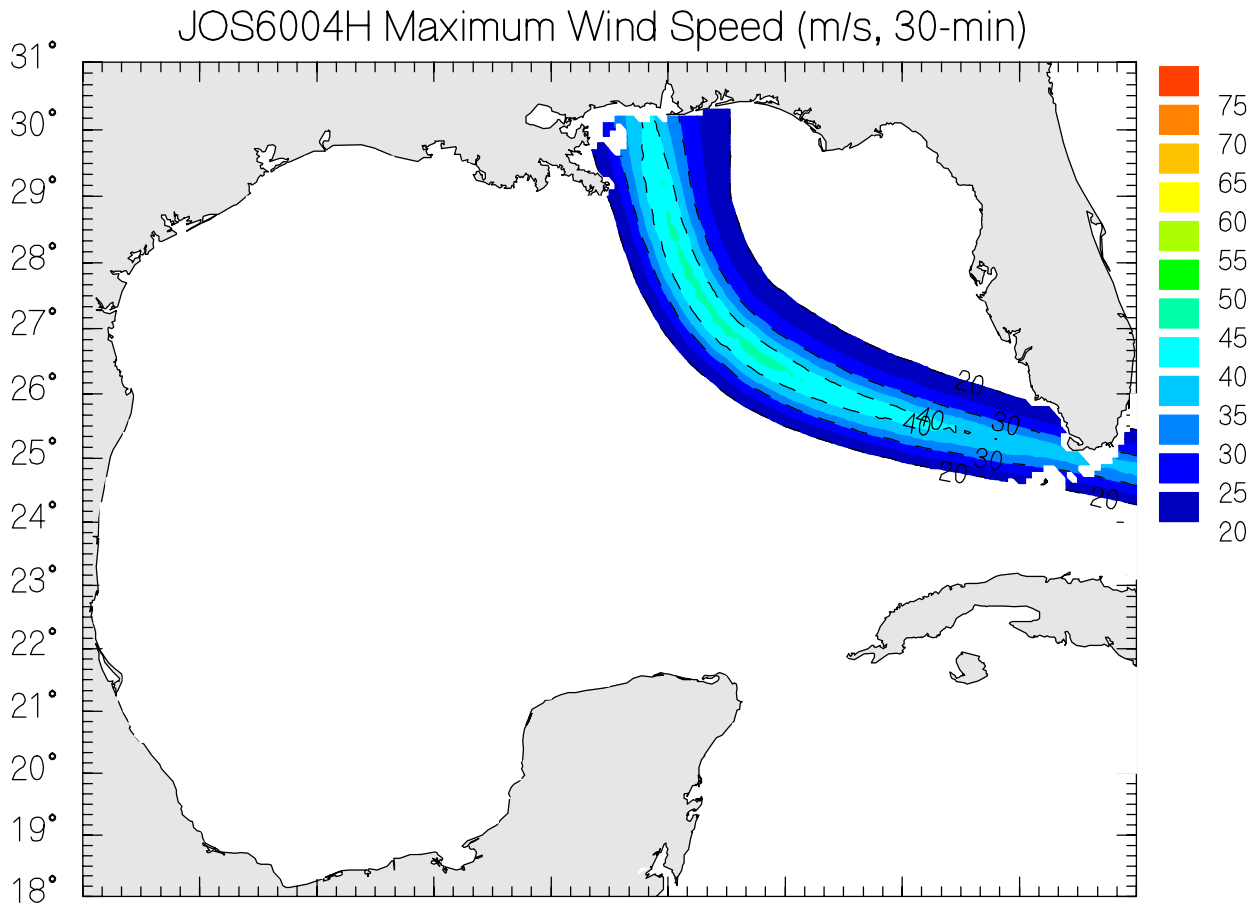
JOS6004H Maximum Wind Speed (m/s, 30-min)
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22°
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20°
19°
18°
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60
55
50
45
40
35
30
25
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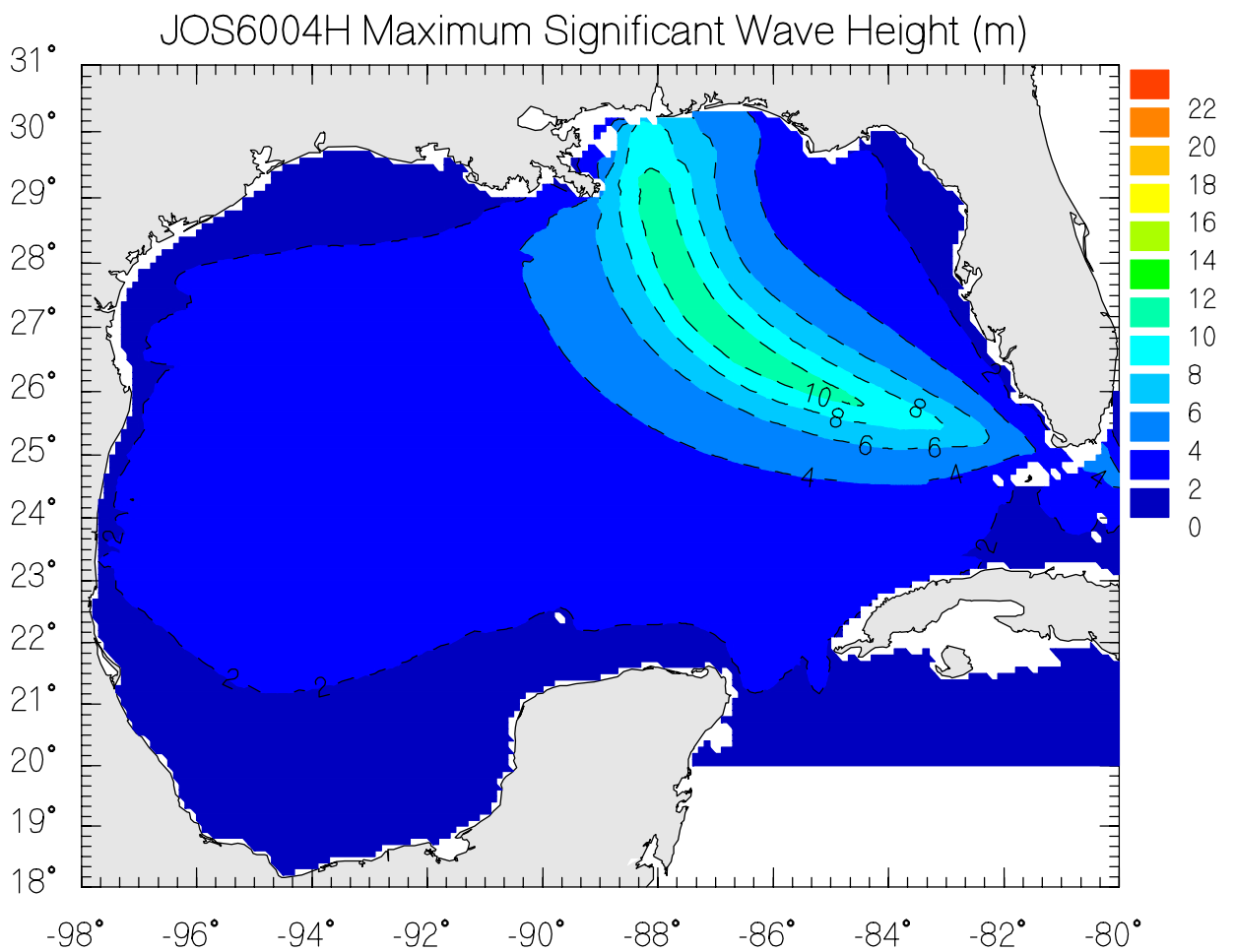
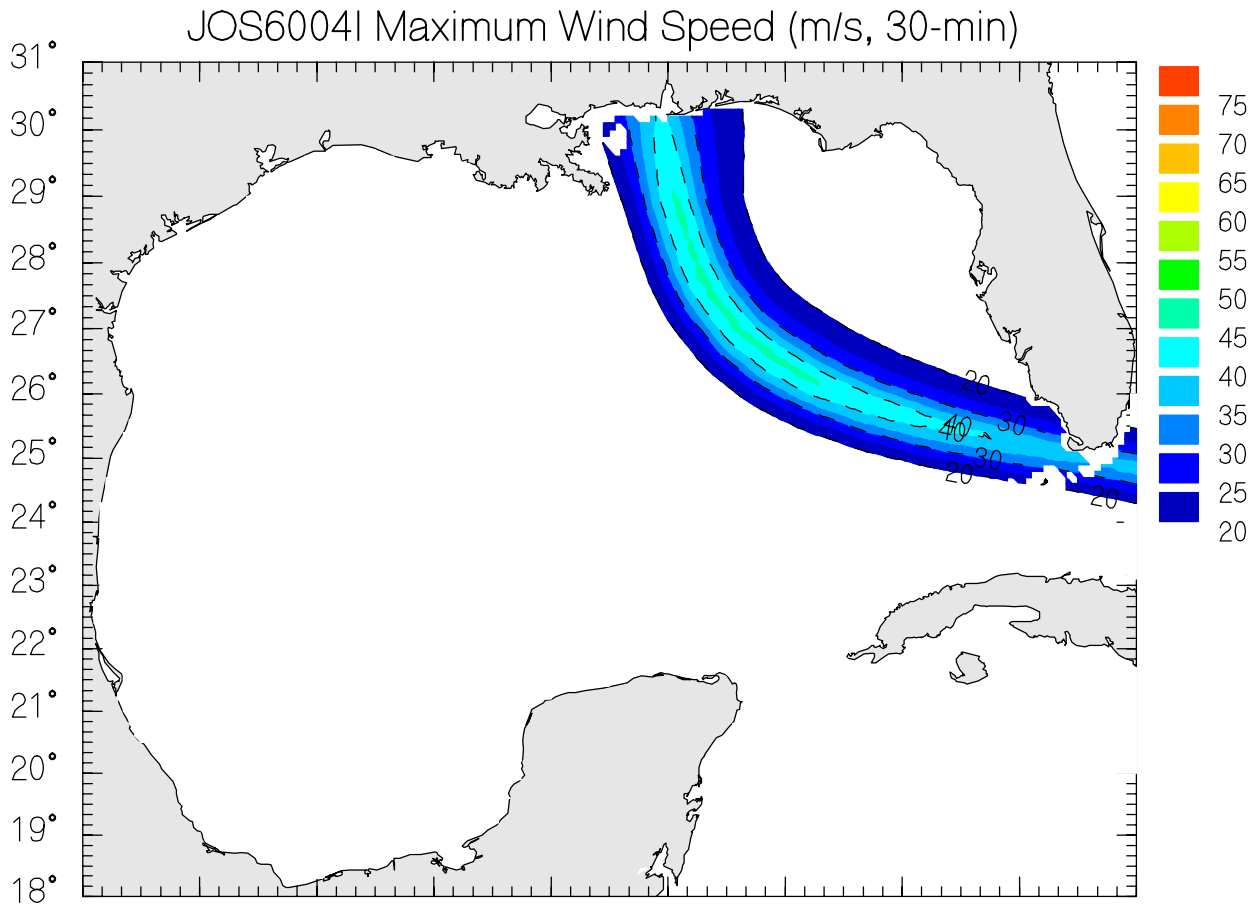
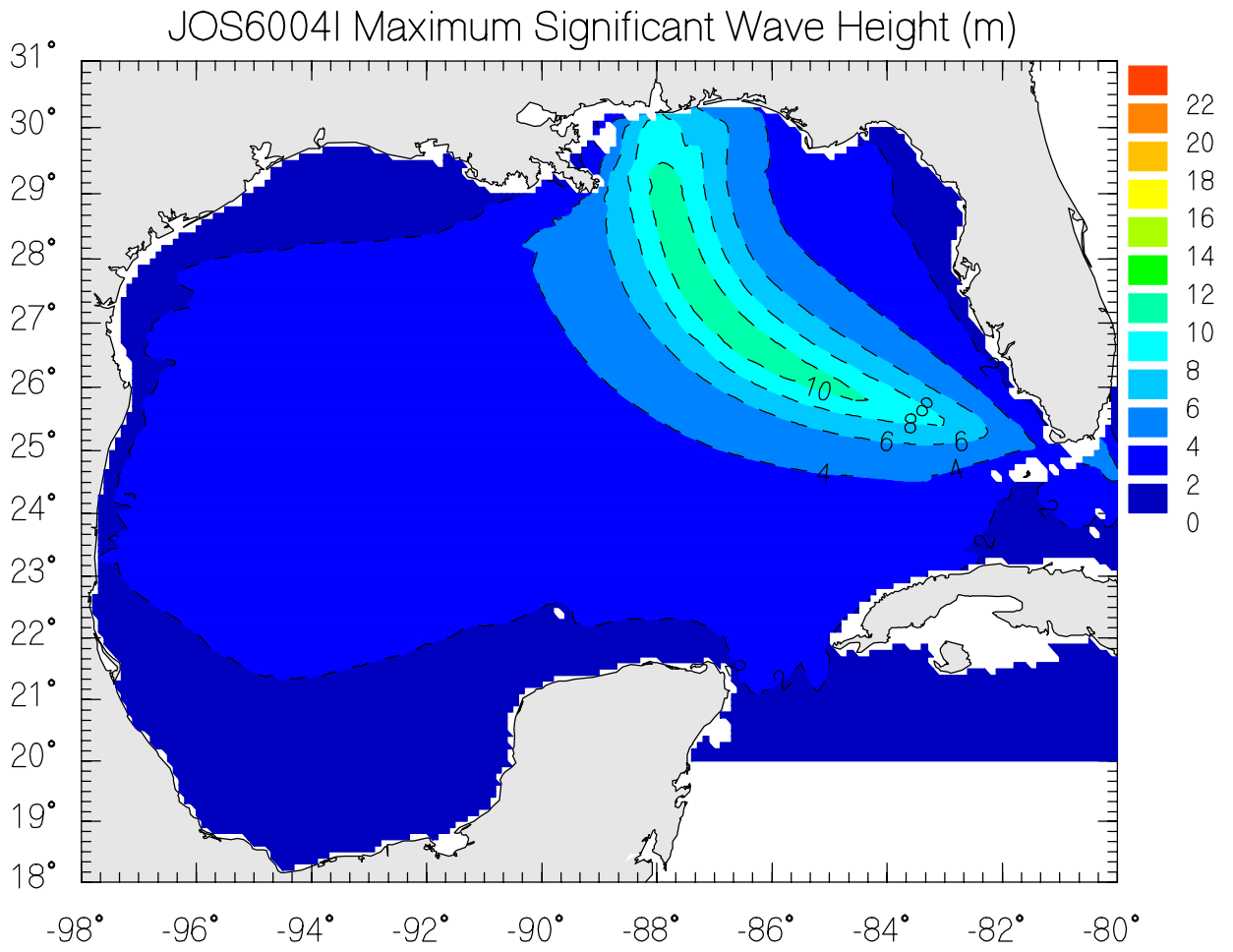

JOS6004H Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
10
8
8
6
6
4
4
2
2
2
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6004I Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
20
30
40
30
20
20


JOS6004I Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
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4
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2
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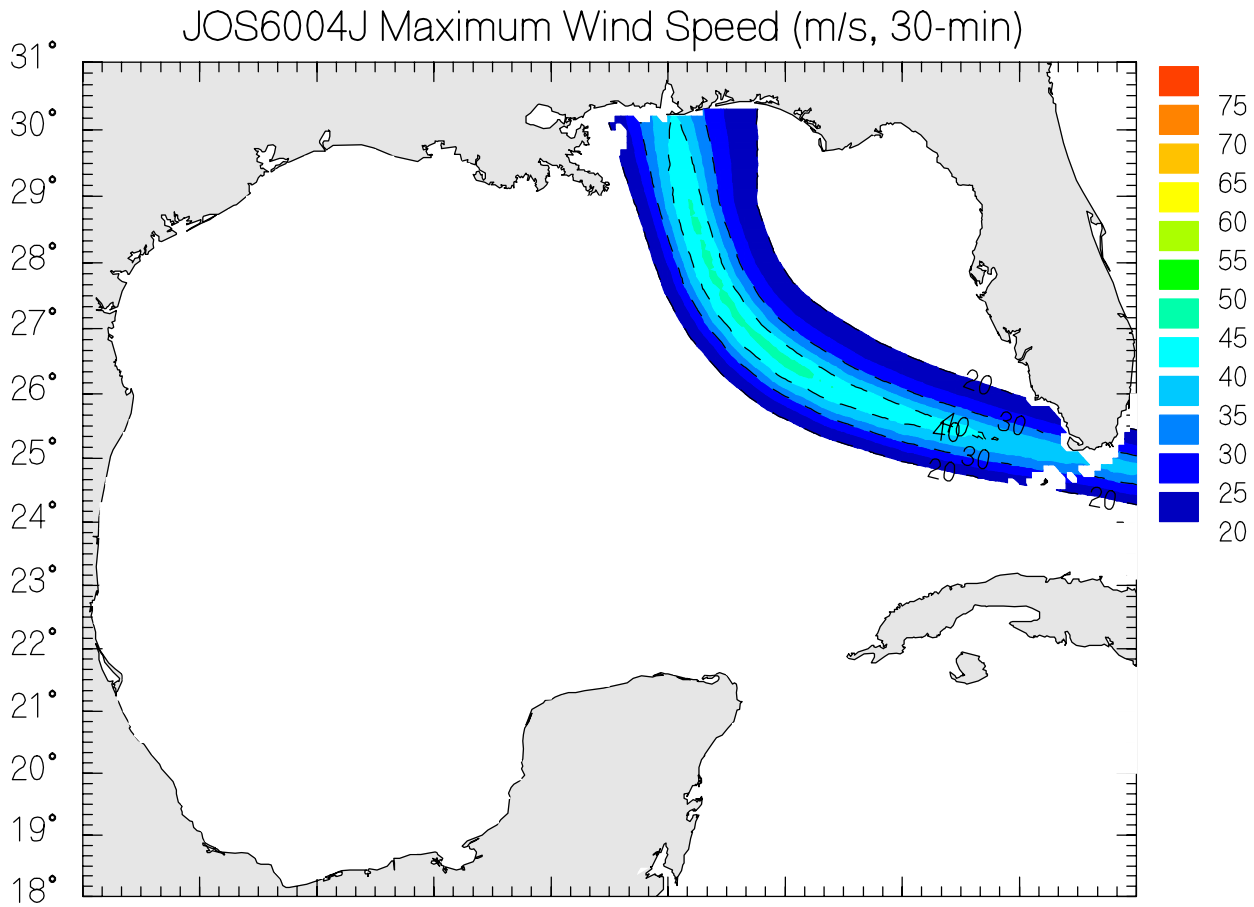
2
2


JOS6004J Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
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50
45
40
35
30
25
20
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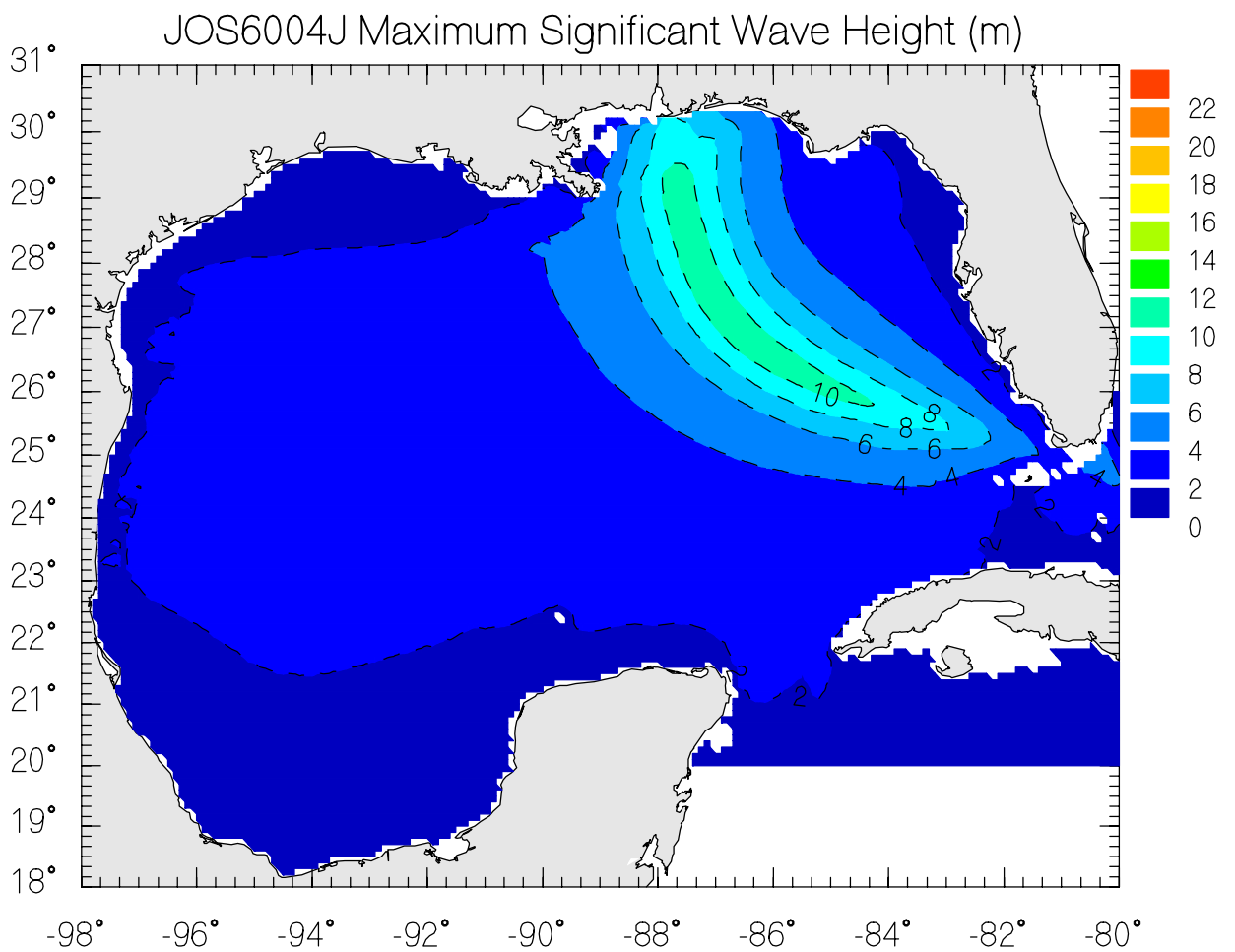
30
40
30
20
20


JOS6004J Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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12
10
8
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4
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0
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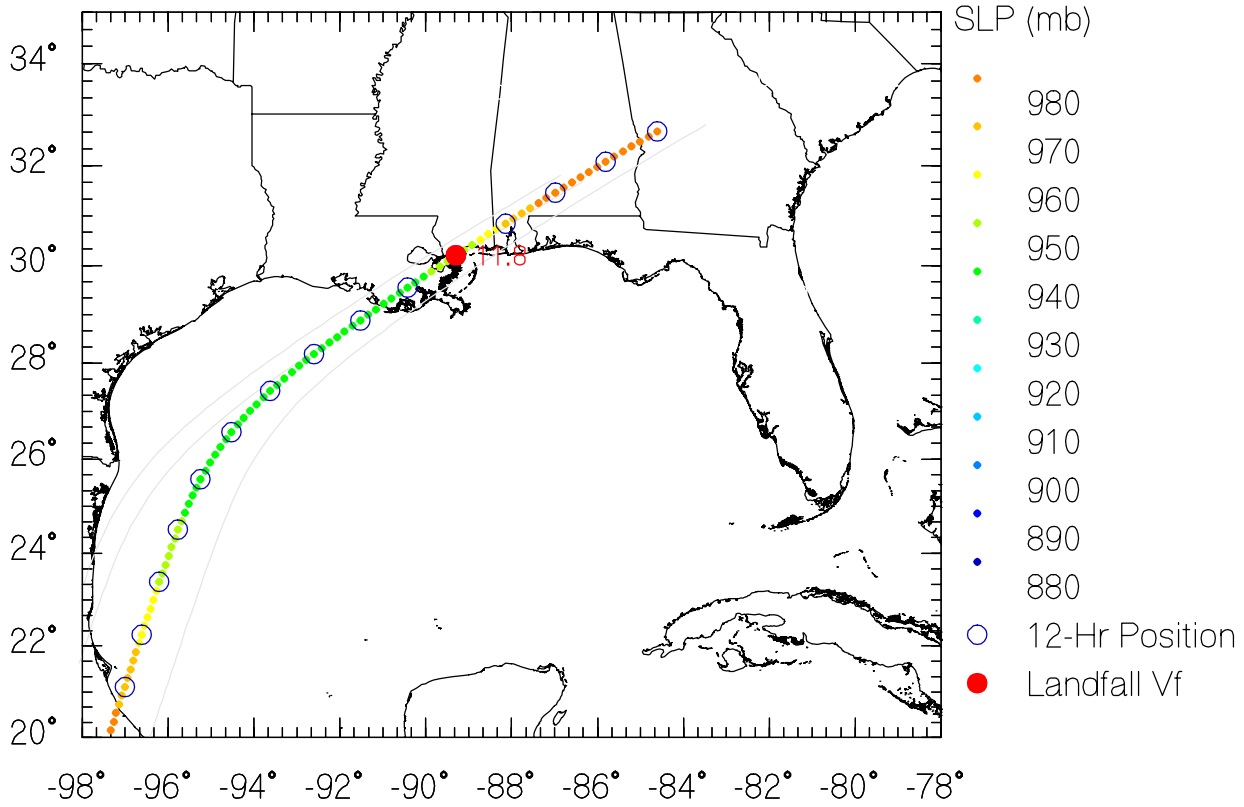
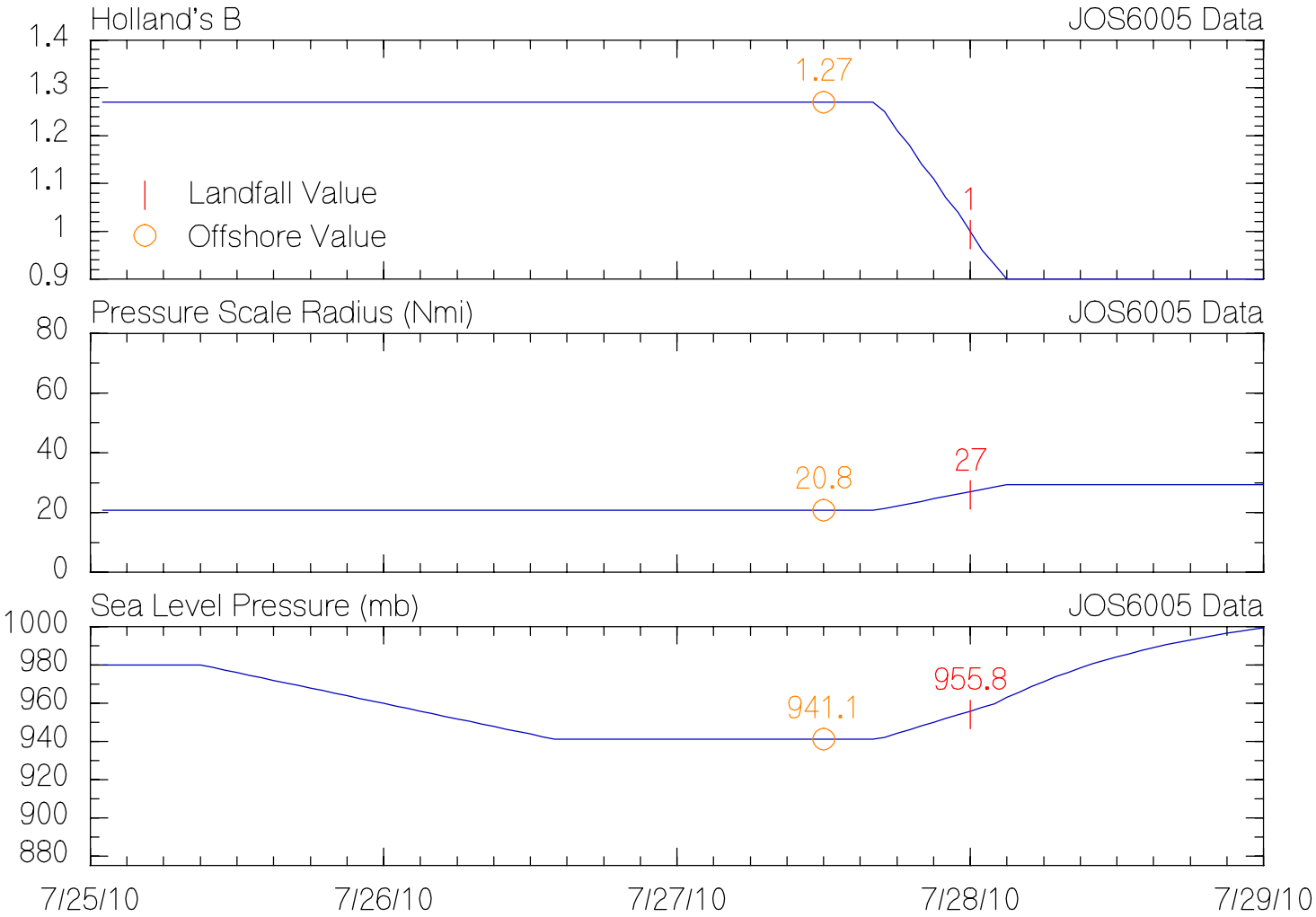
8
6
4
2

JOS6005 Data



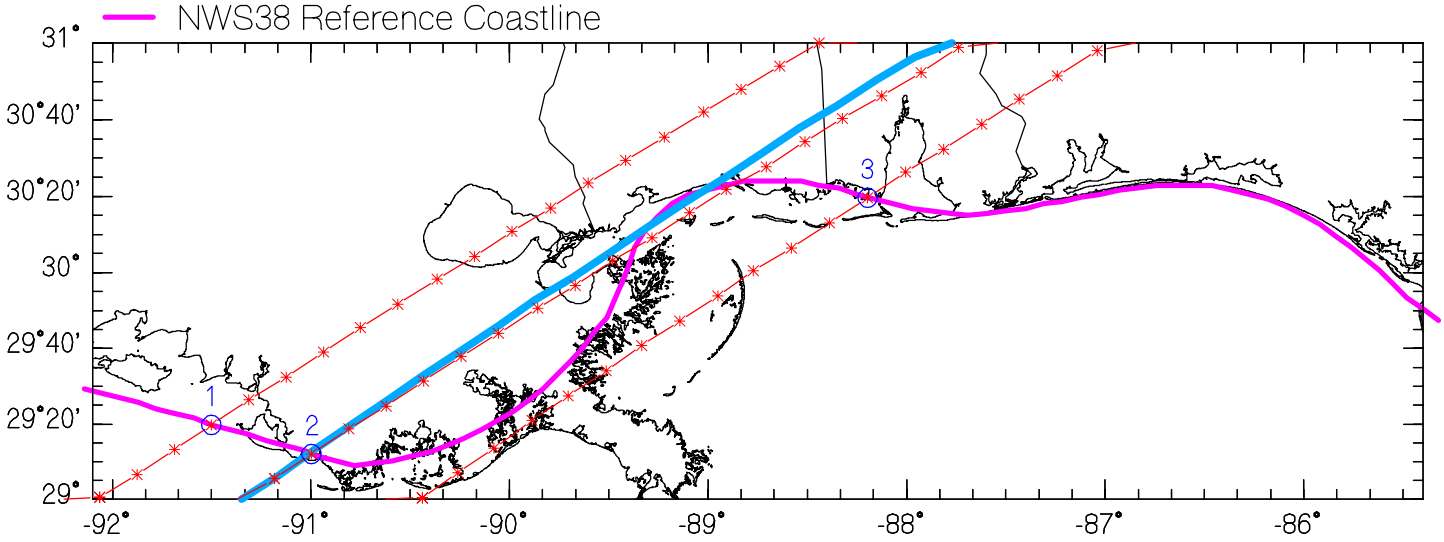


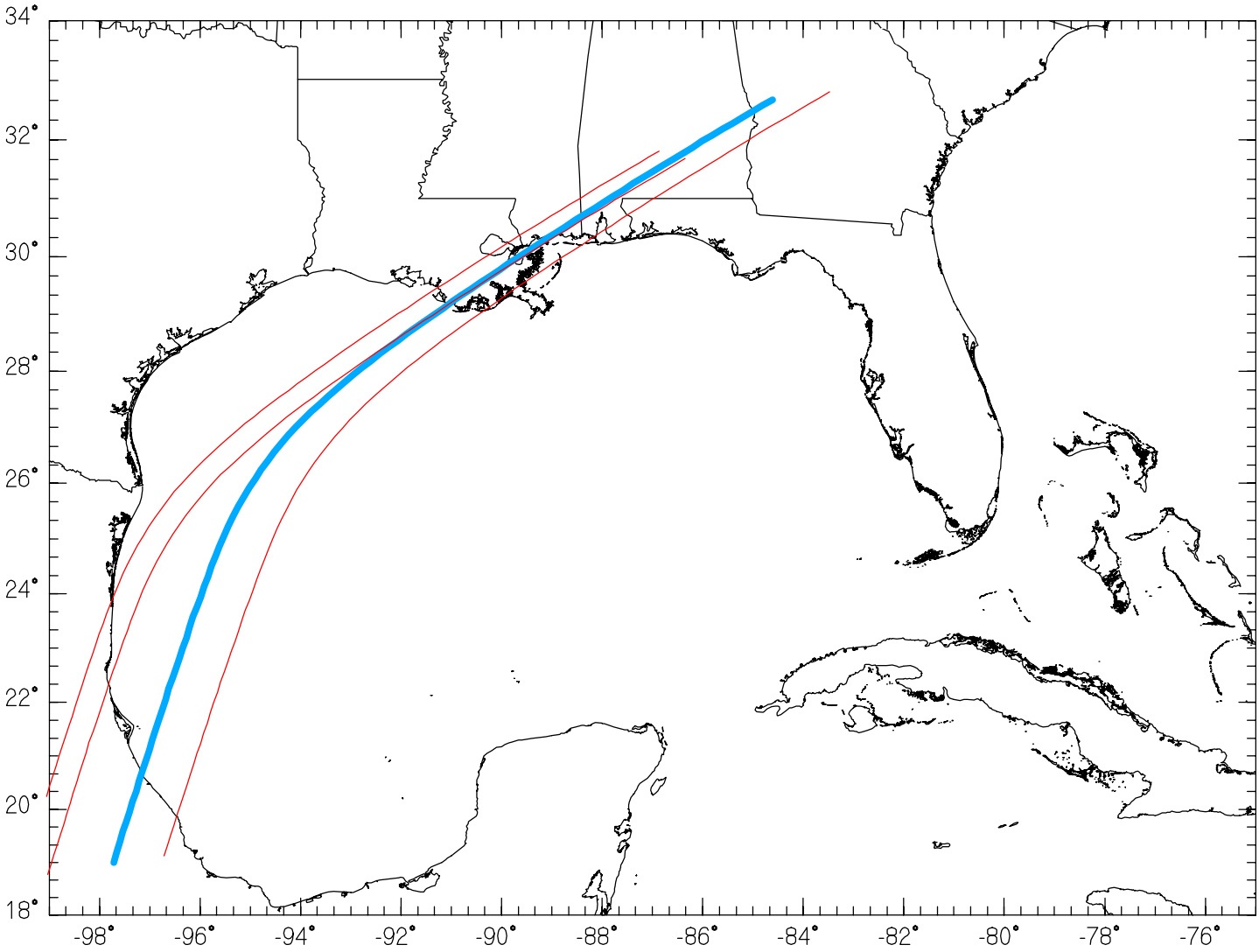
URS JPM-OS6 Production Tracks

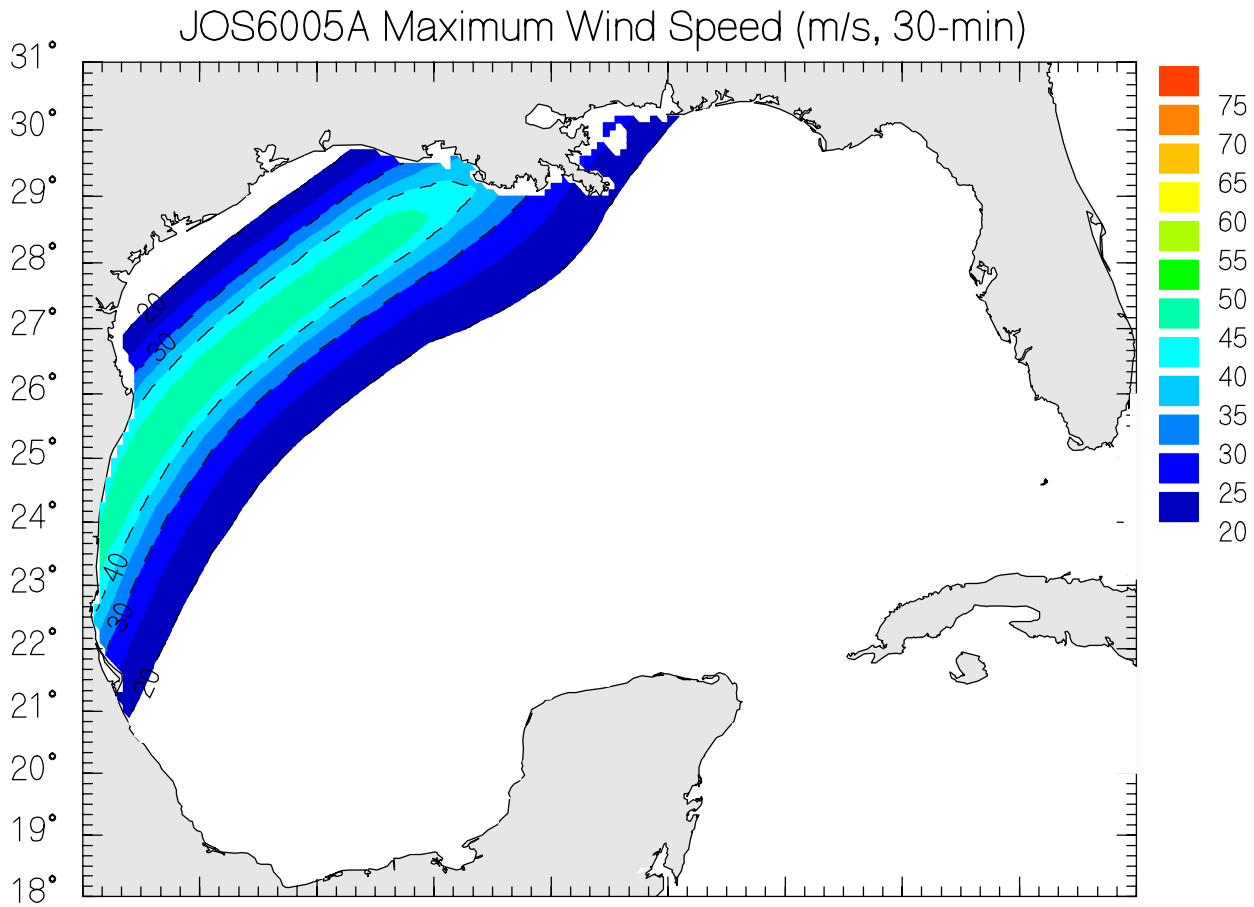
JOS6005 Data

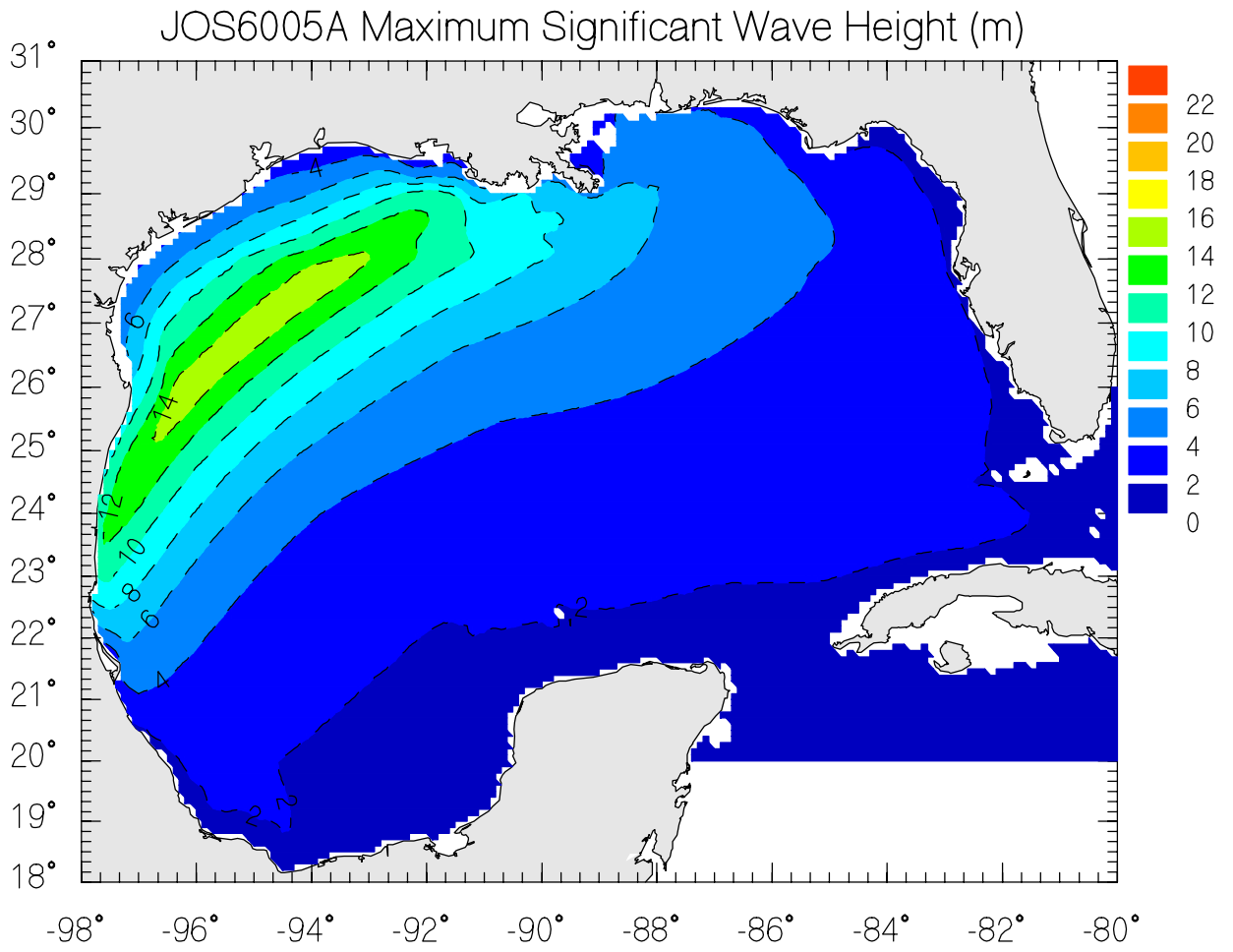
Reference Track — Production Tracks — Production Track Landfall

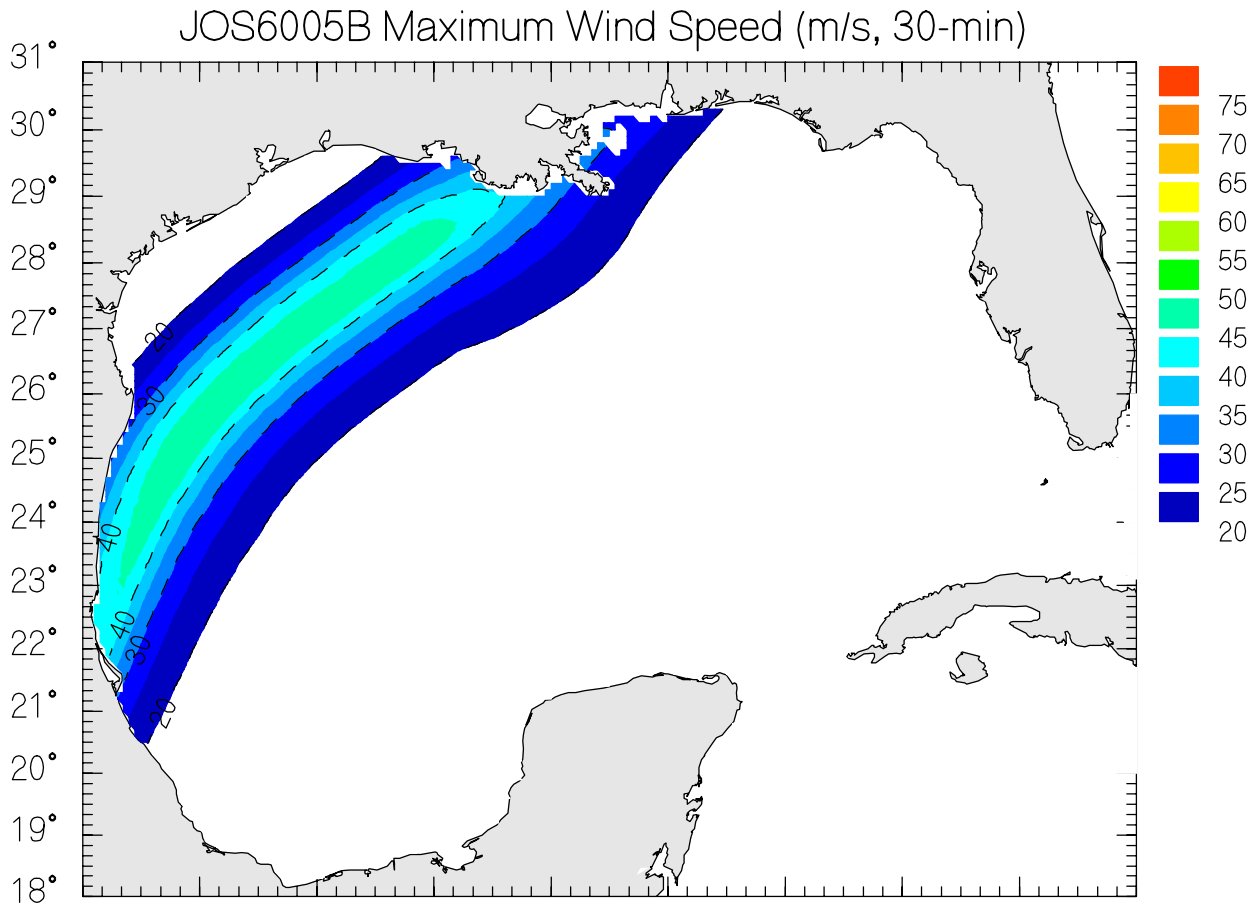
NWS38 Reference Coastline

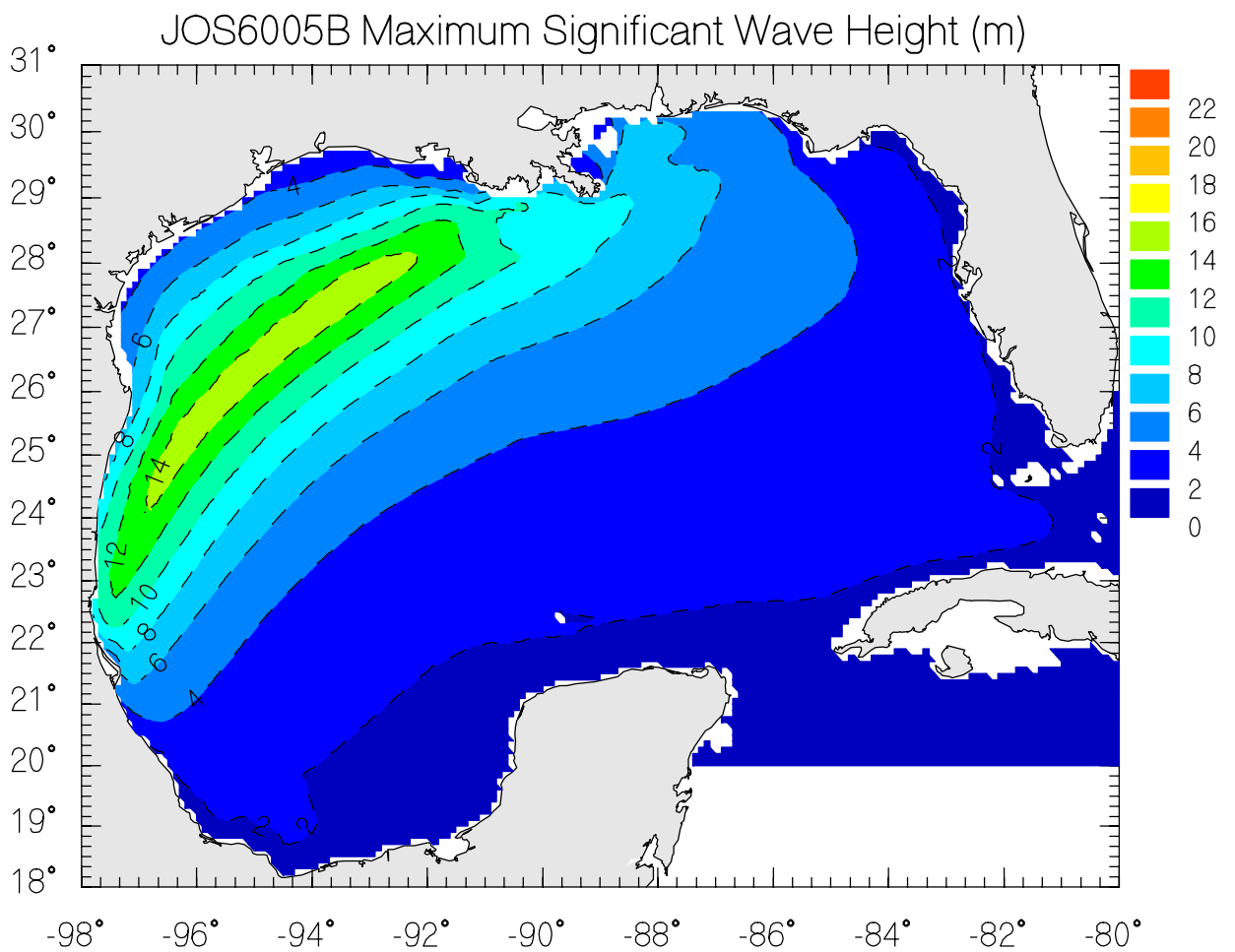


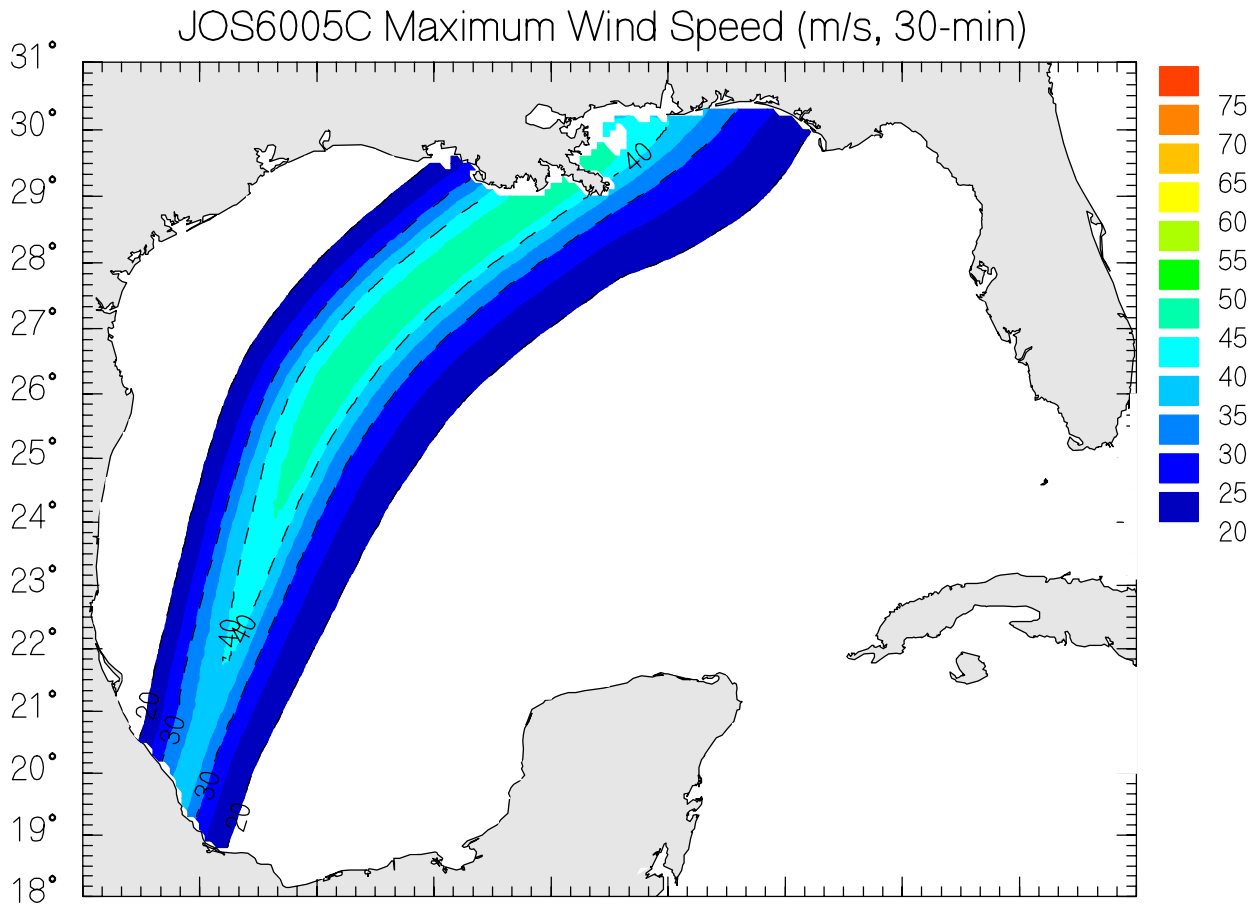



JOS6005A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
20
30
40
30
20
75
70
65
60
55
50
45
40
35
30
25
20


JOS6005A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
4
6
14
12
10
8
6
4
2
2
2
22
20
18
16
14
12
10
8
6
4
2
0
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6005B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6005B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0


JOS6005C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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60
55
50
45
40
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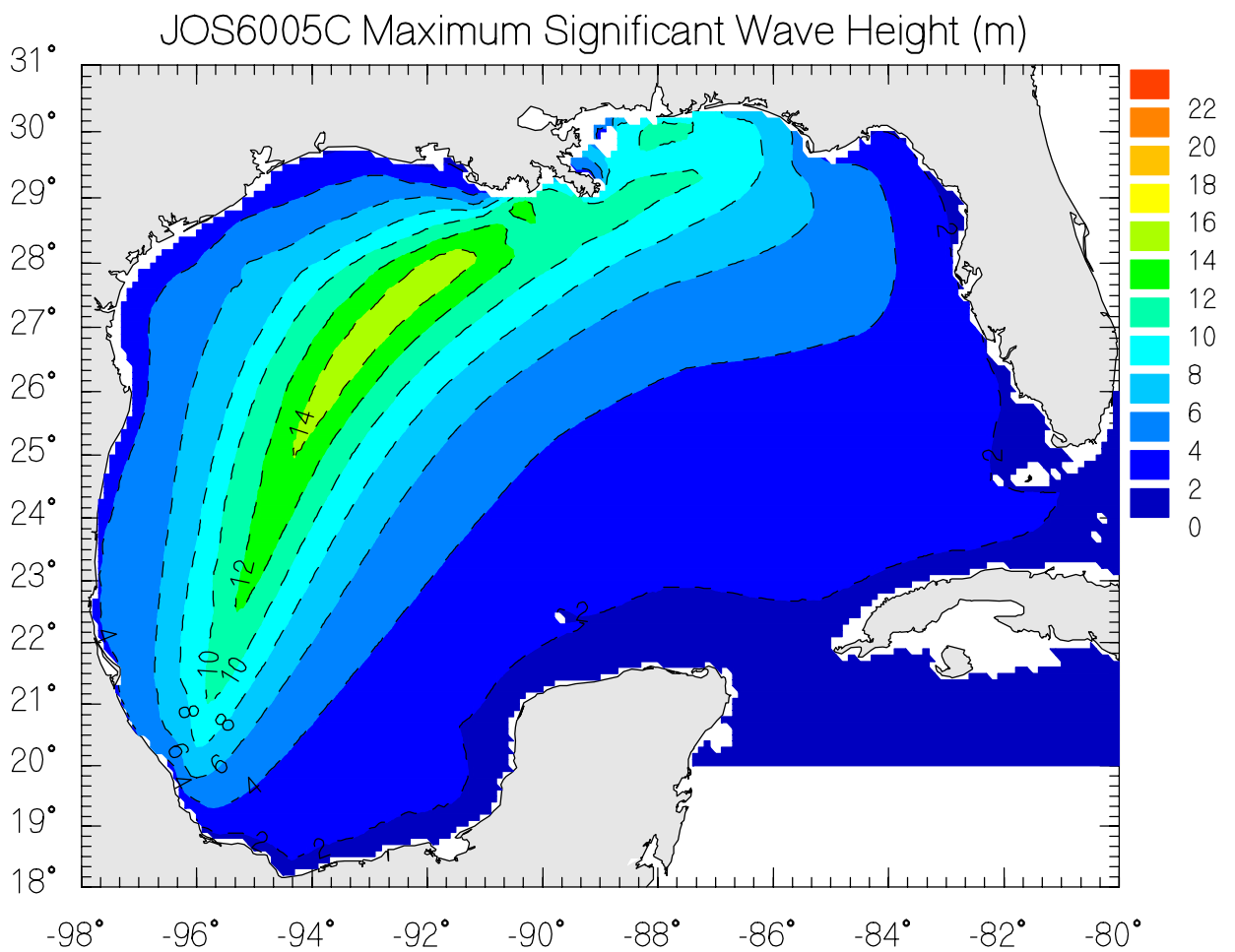
30
25
20
40
40
40
30
30
20
20


JOS6005C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
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12
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4
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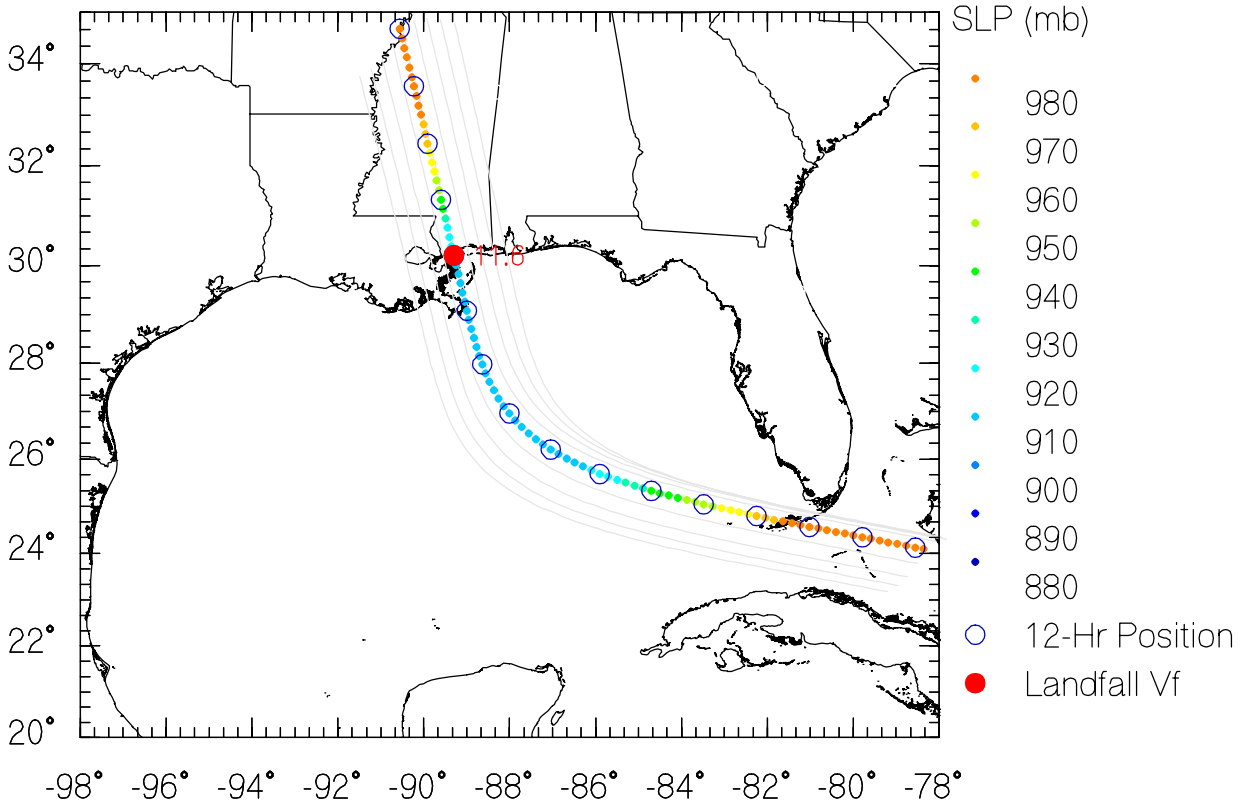
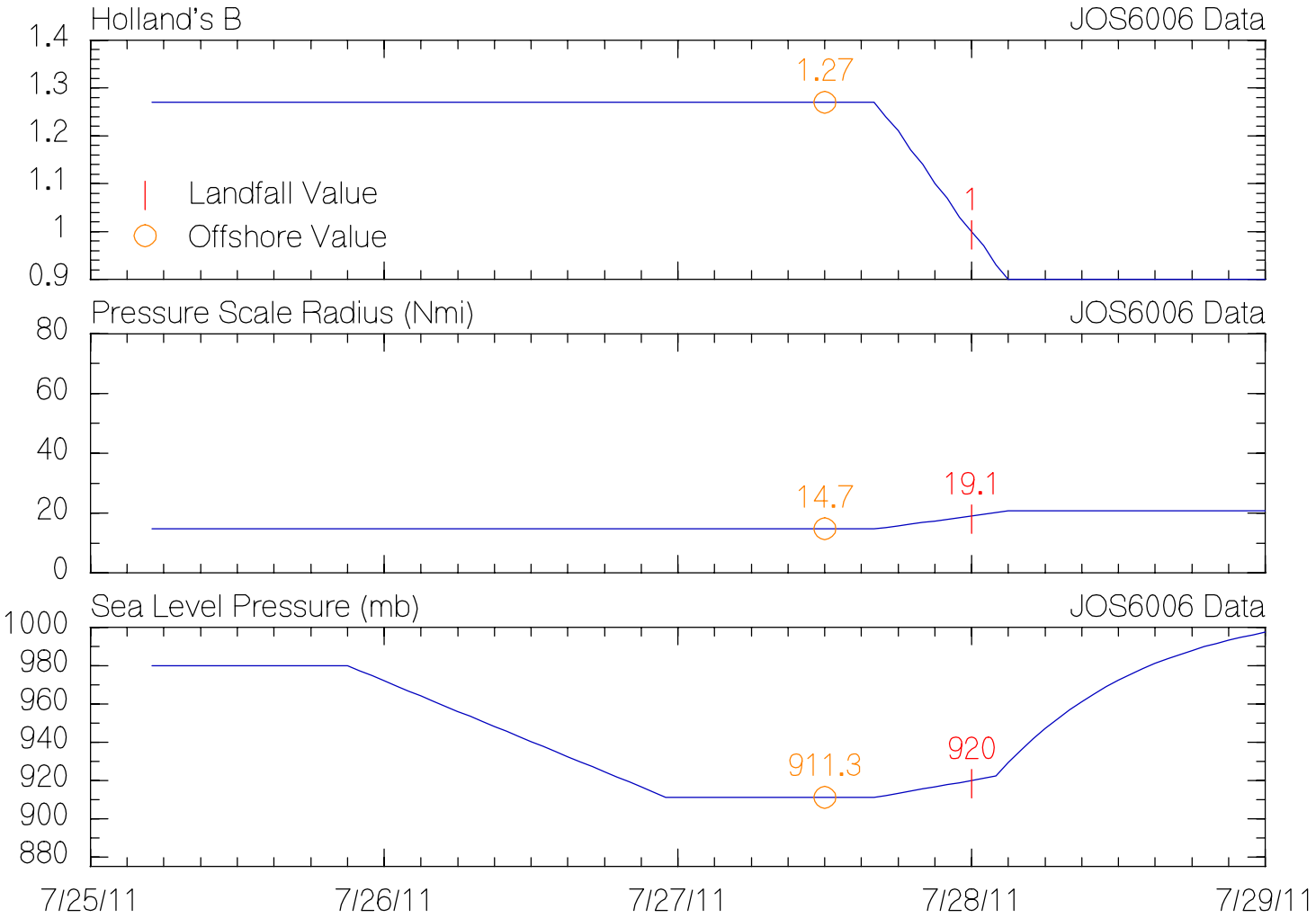
2

JOS6006 Data



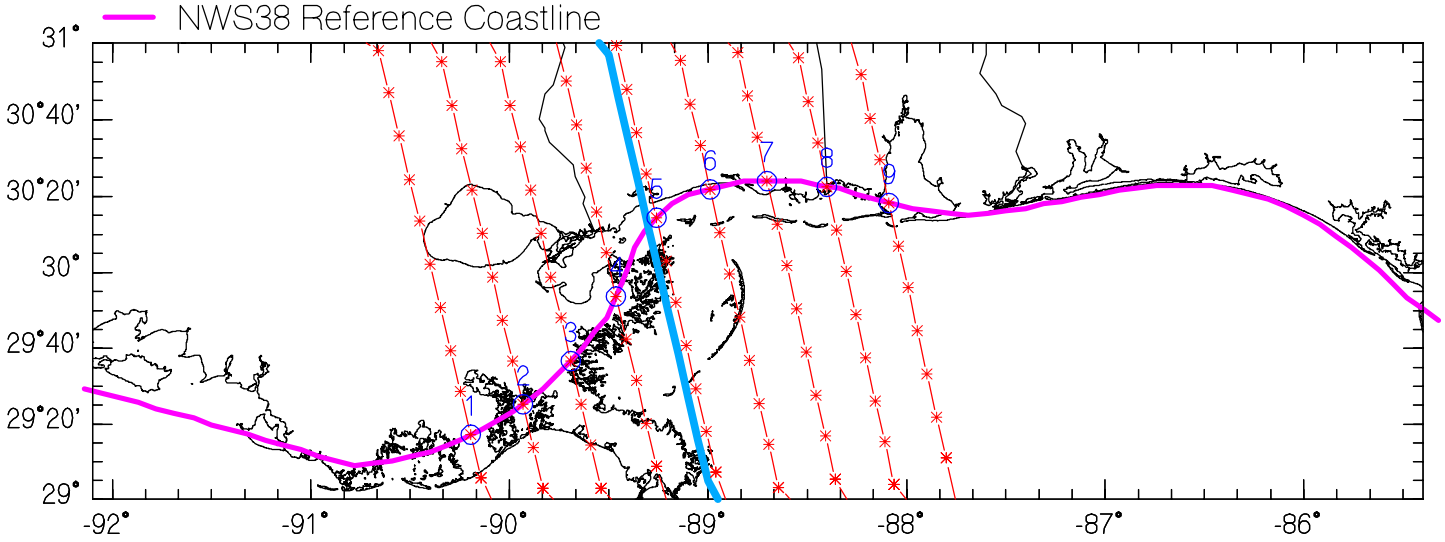


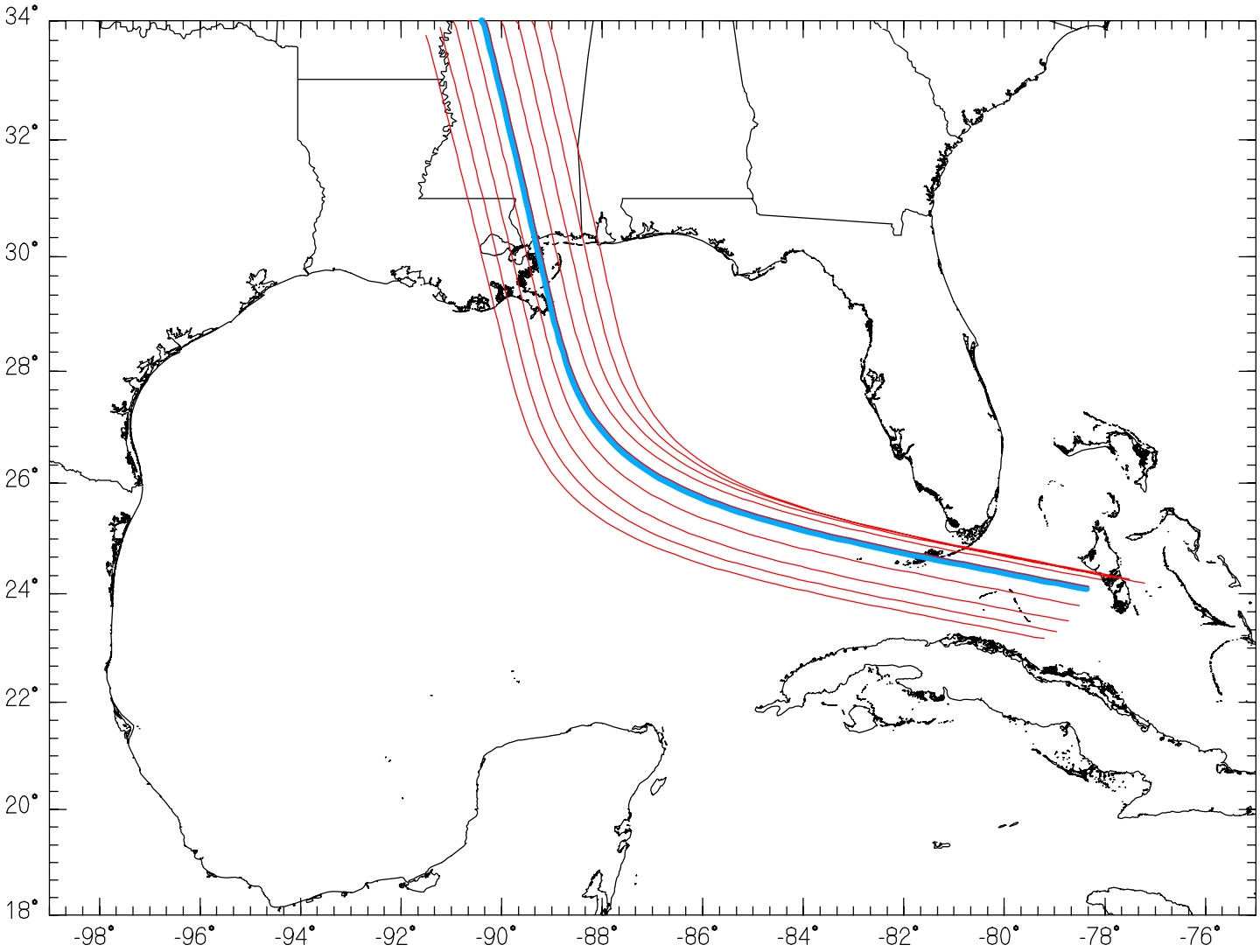
URS JPM-OS6 Production Tracks

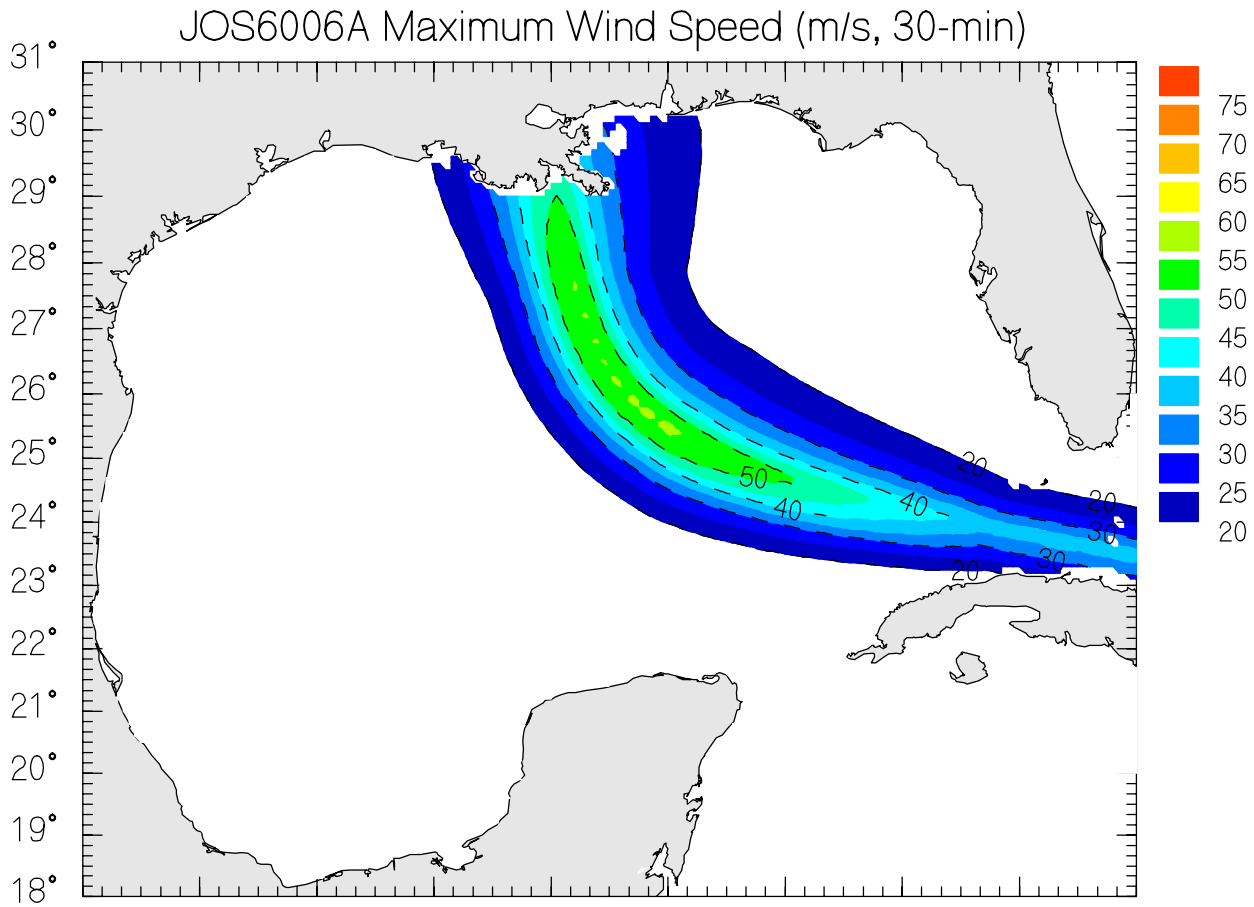
JOS6006 Data

Reference Track — Production Tracks — Production Track Landfall

NWS38 Reference Coastline






JOS6006A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
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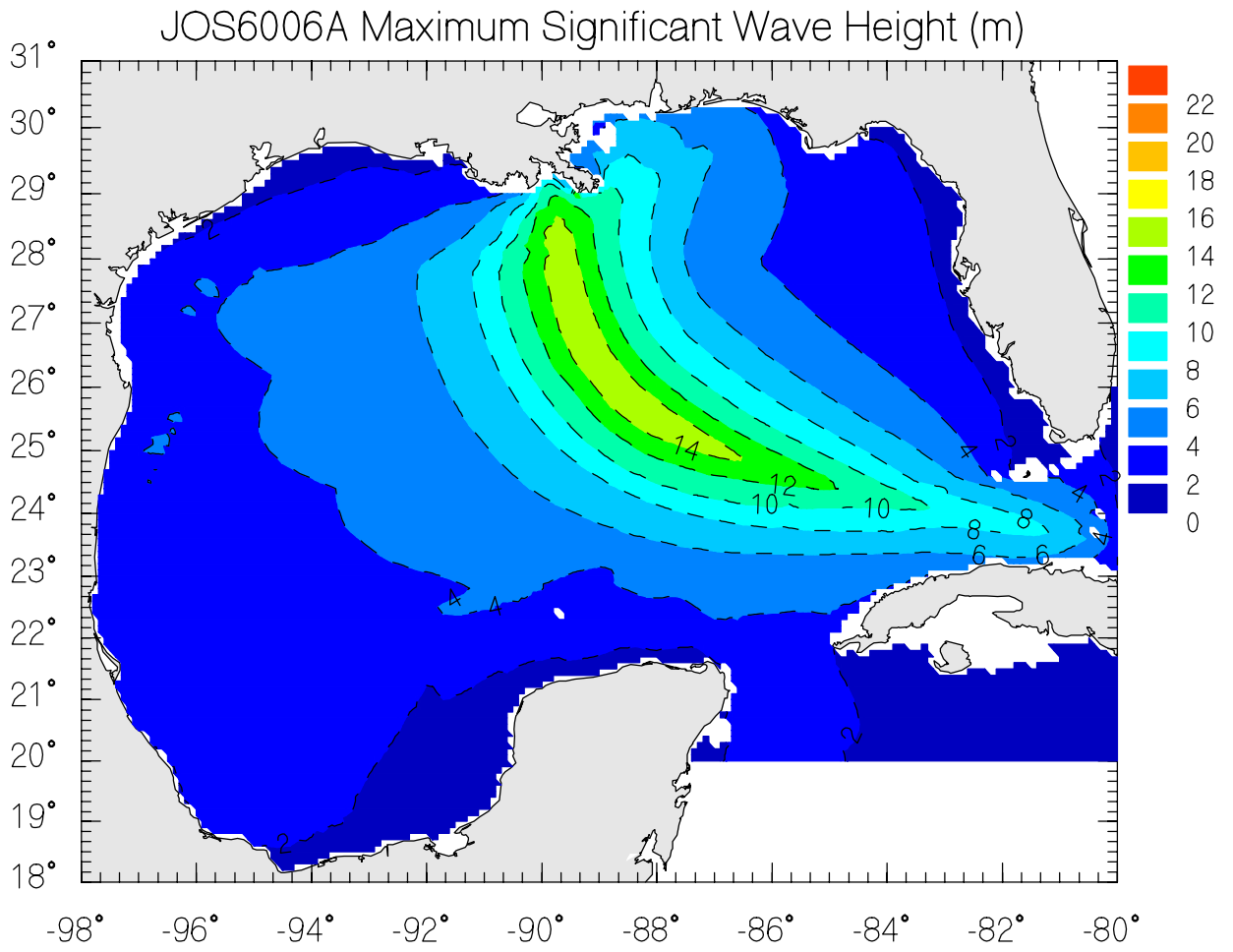
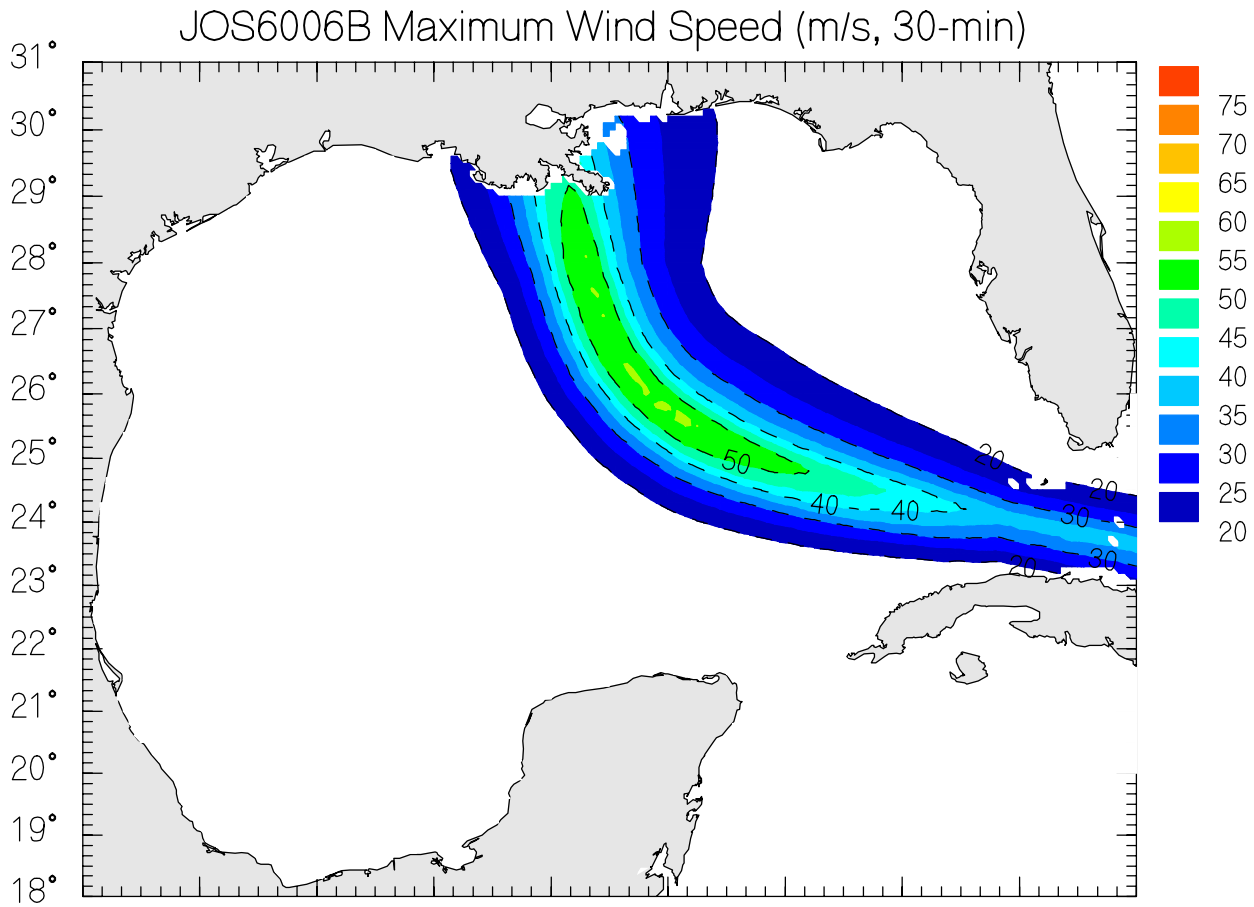
50
40
40
30
30
20
20
20


JOS6006A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
10
8
8
6
6
4
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6006B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
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55
50
45
40
35
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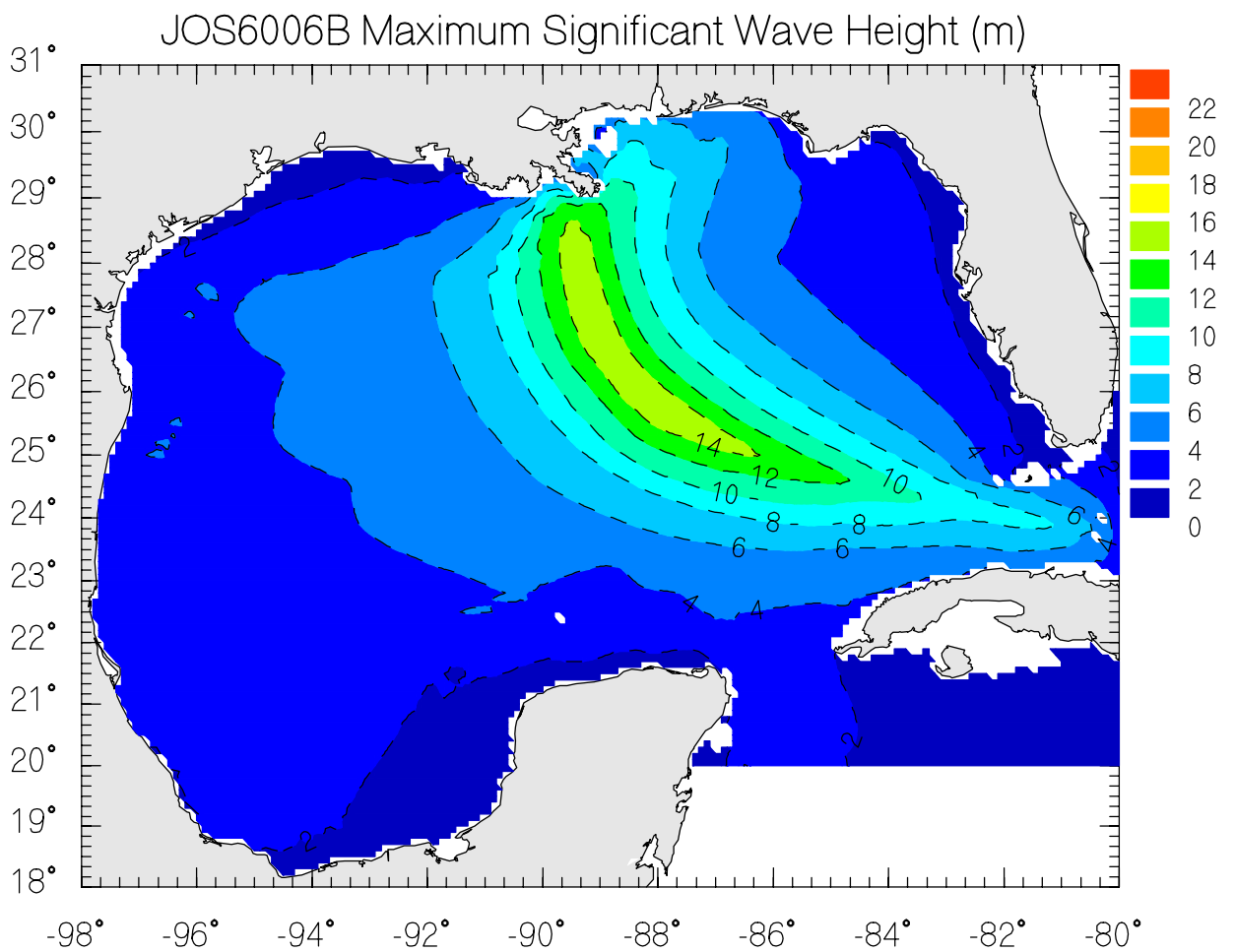
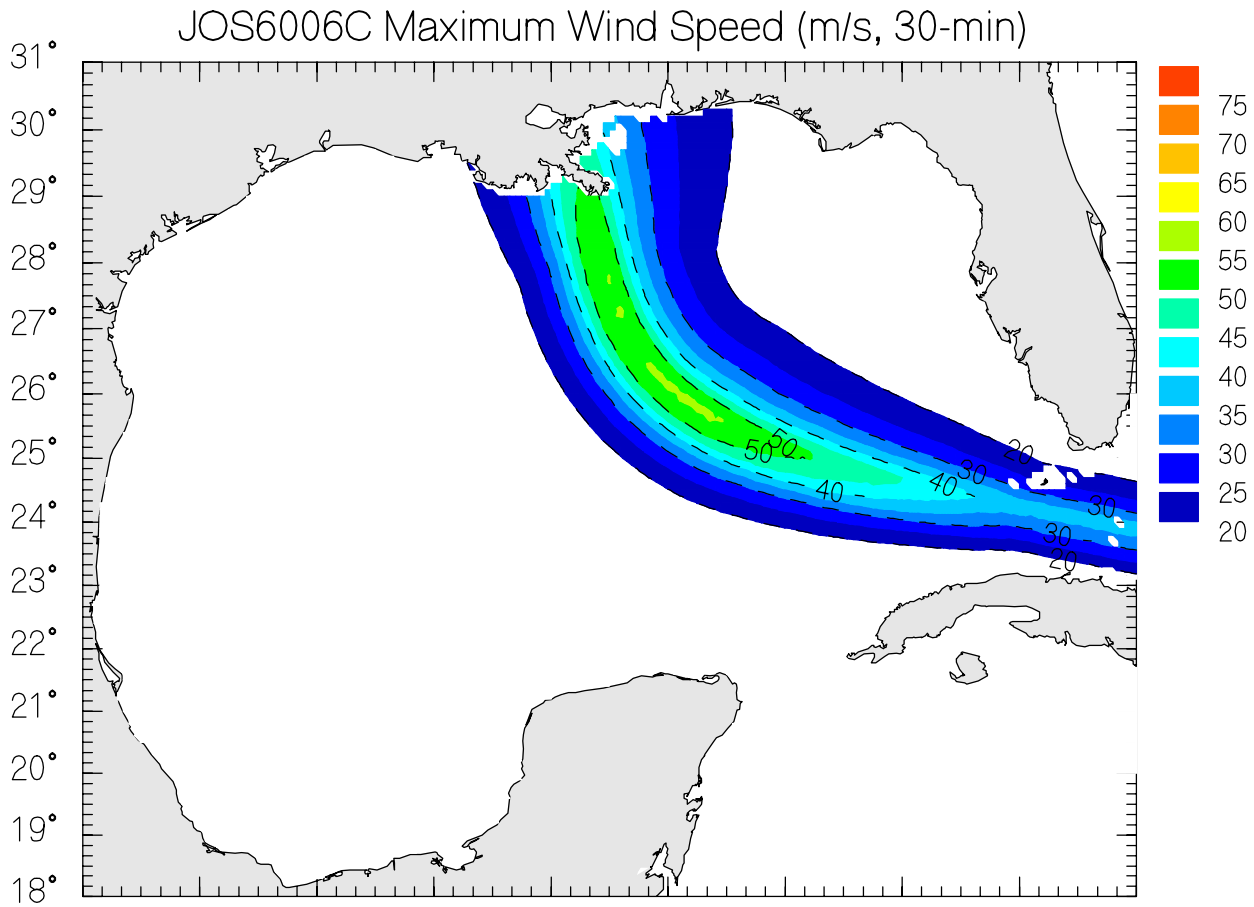
20
20


JOS6006B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
10
8
8
6
6
4
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6006C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
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55
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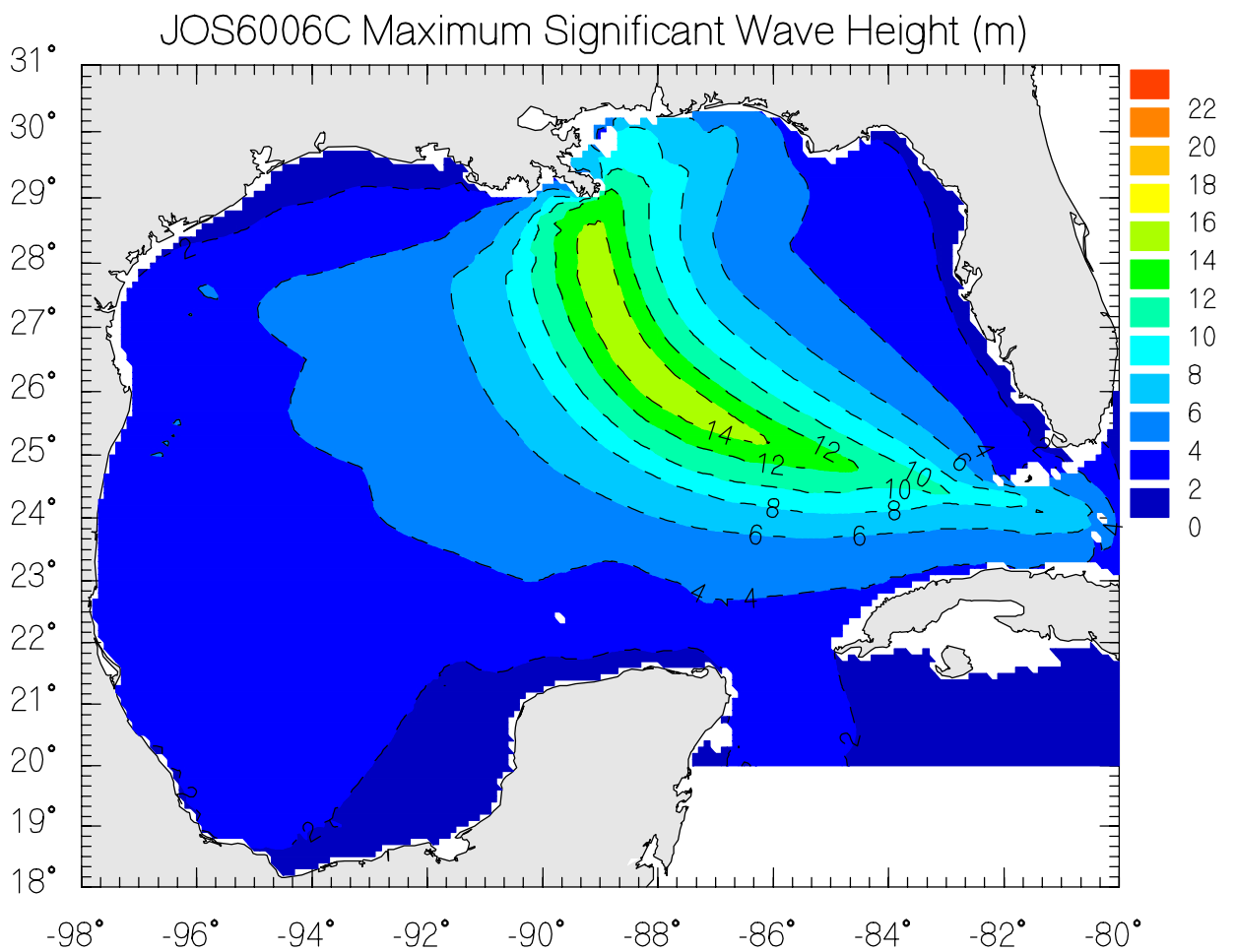
45
40
35
30
25
20


JOS6006C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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-80°
22
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14
12
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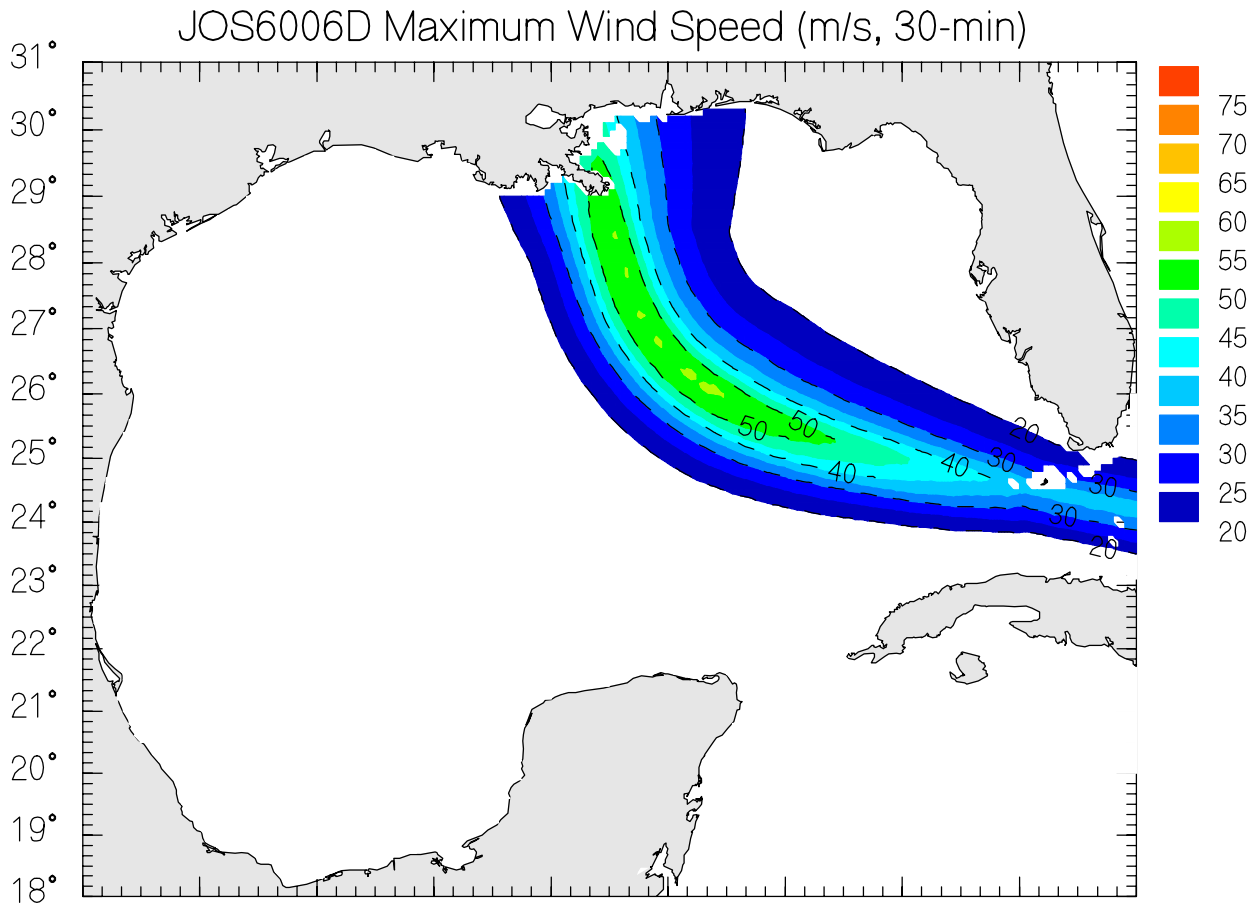
4
2
0


JOS6006D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
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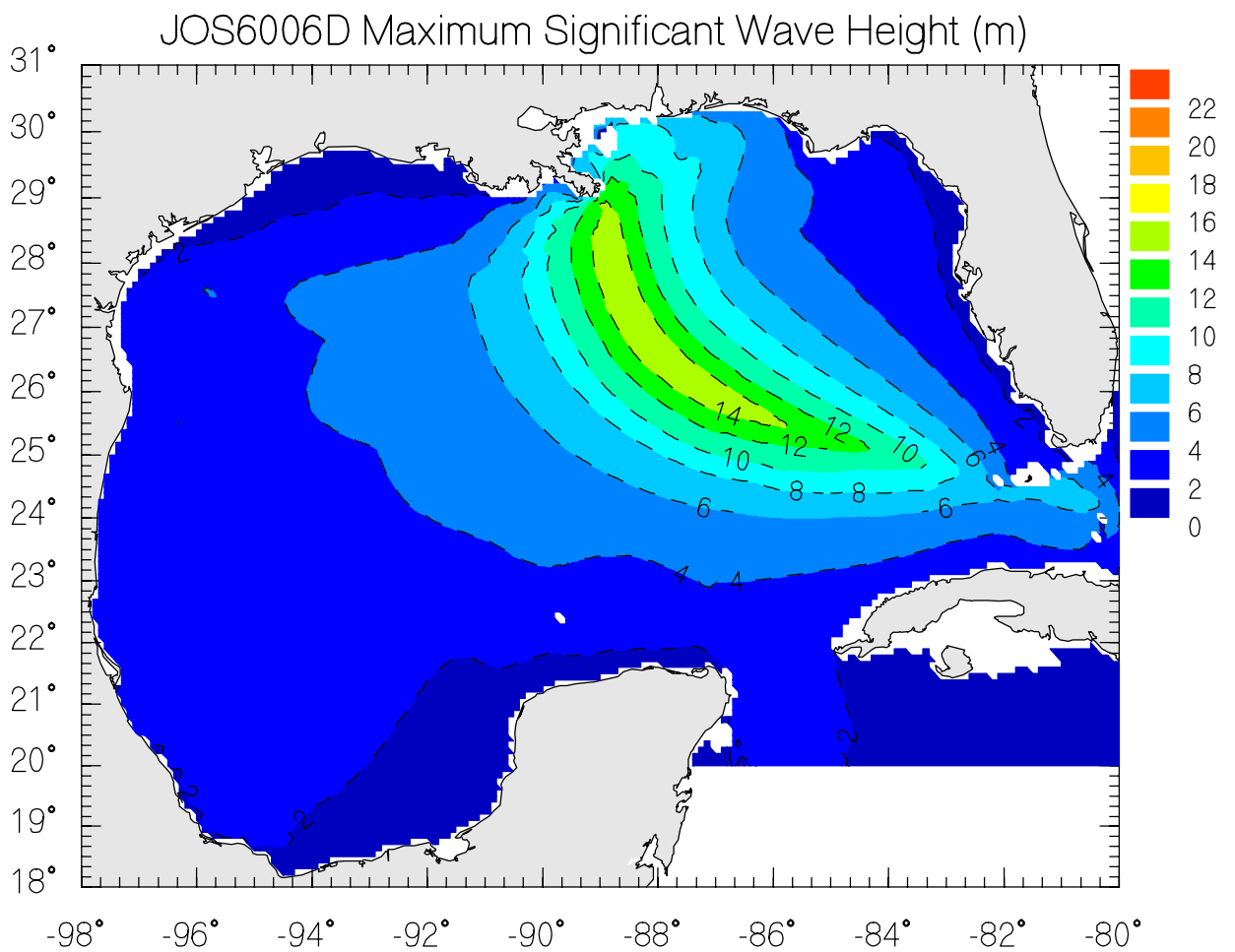
30
20


JOS6006D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
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12
10
8
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-98°
-96°
-94°
-92°
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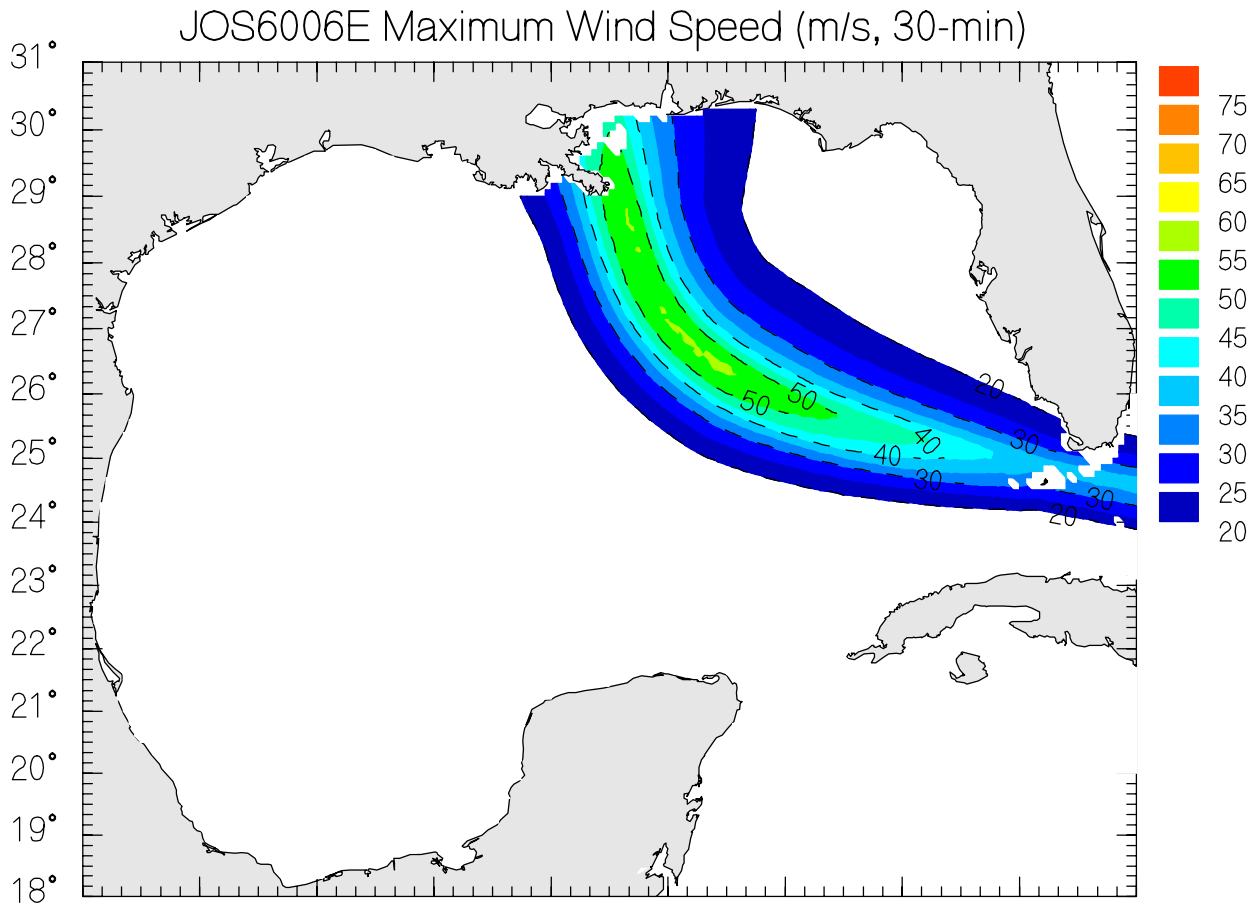
-88°
-86°
-84°
-82°
-80°


JOS6006E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
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45
40
35
30
25
20
50
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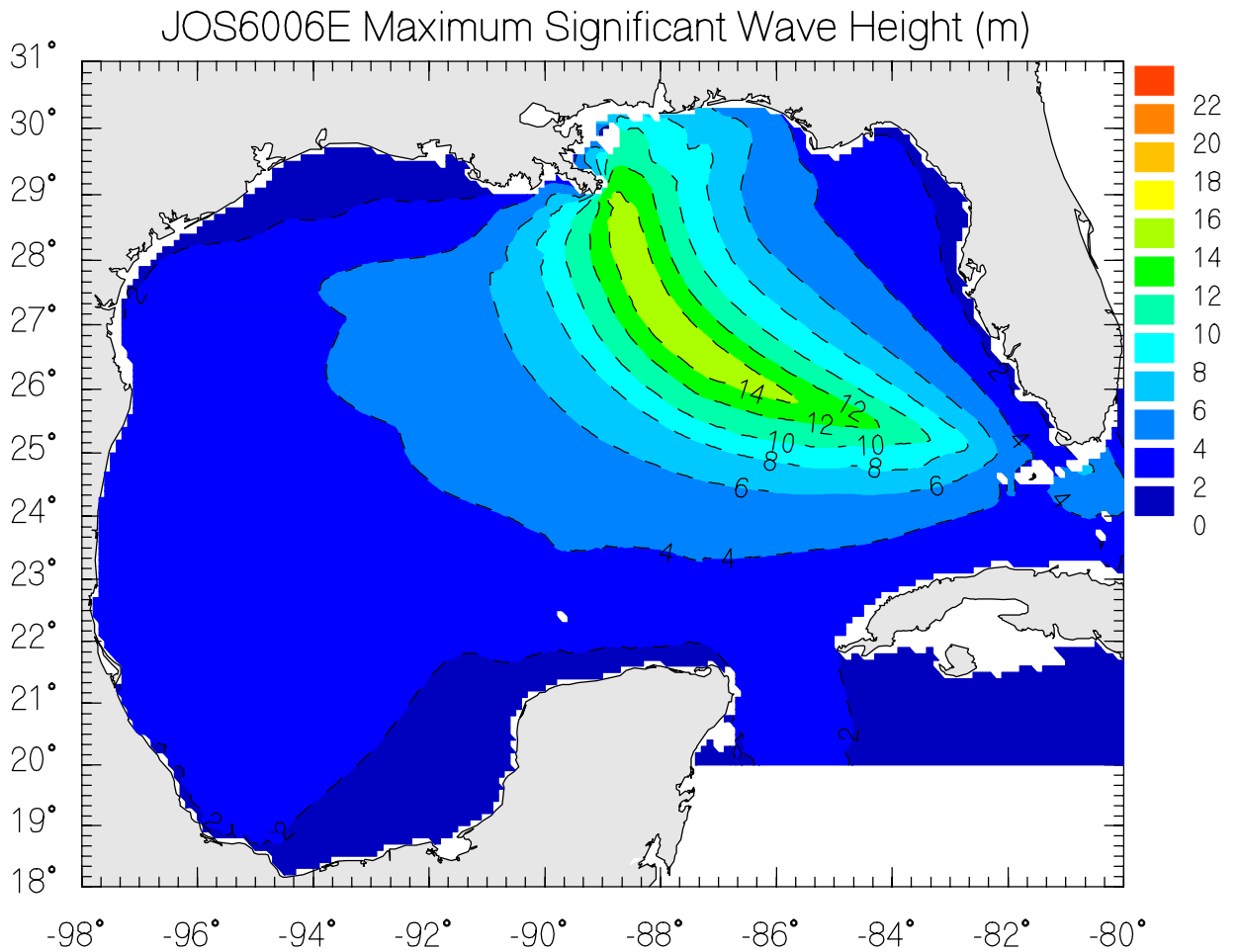
30
20


JOS6006E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
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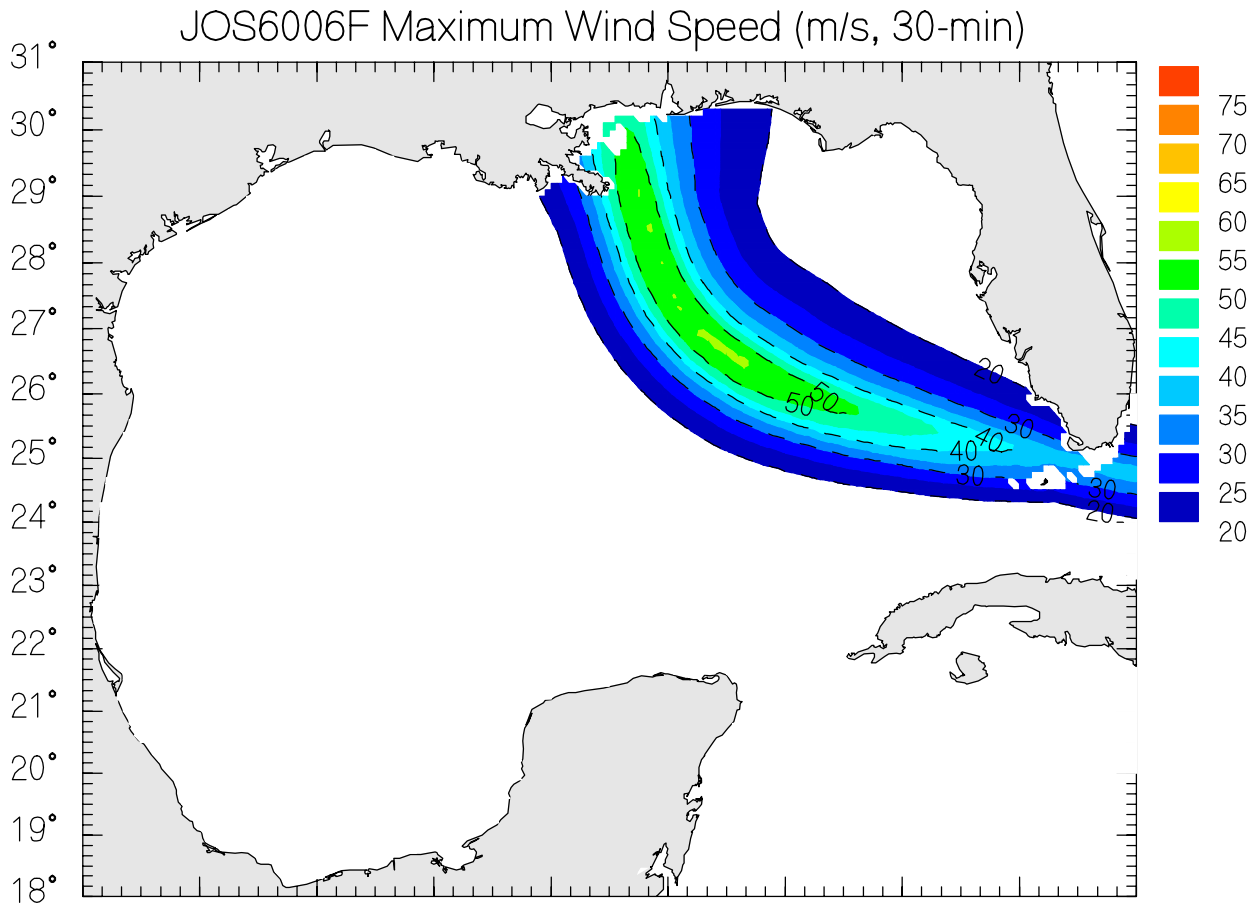
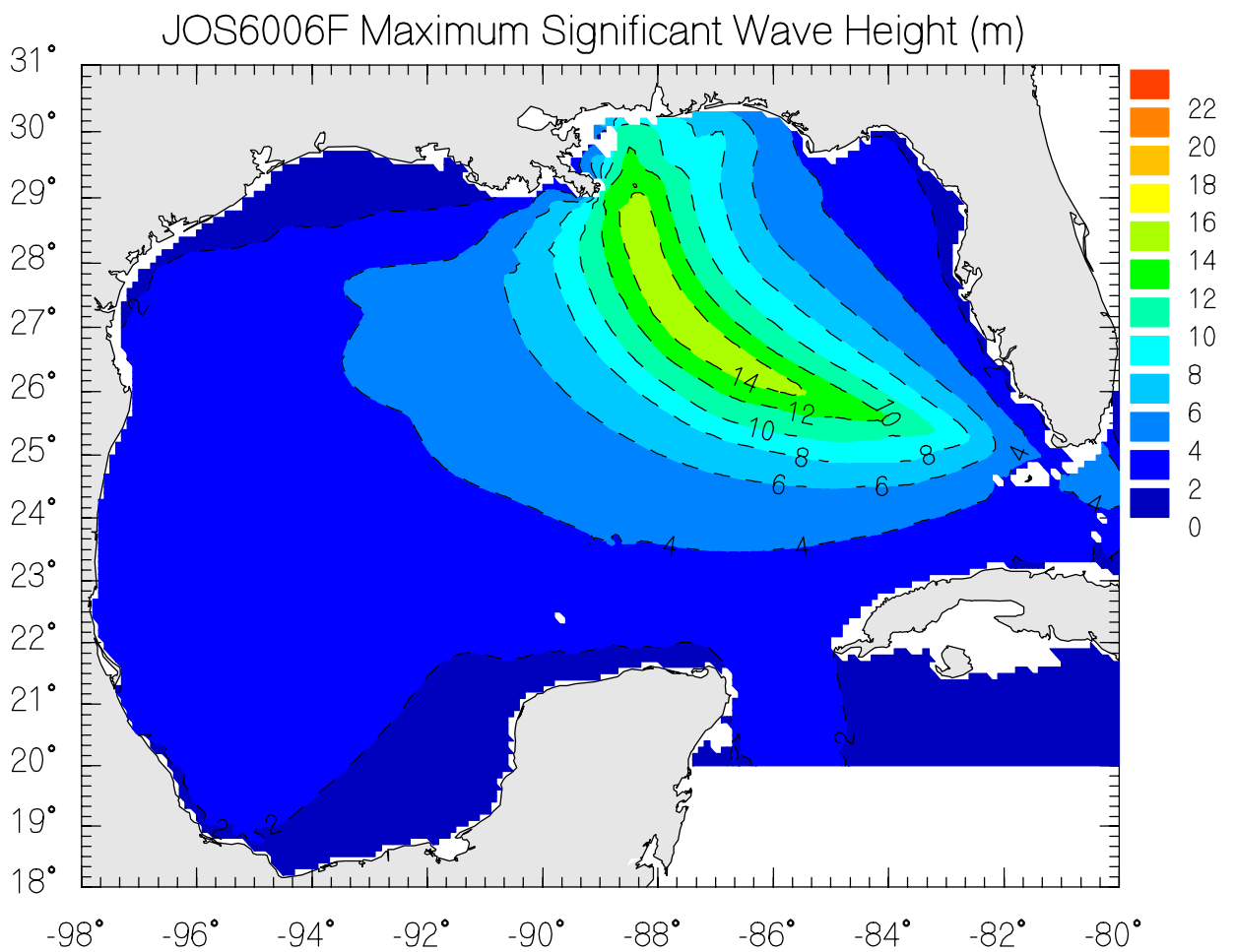
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6006F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6006F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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20
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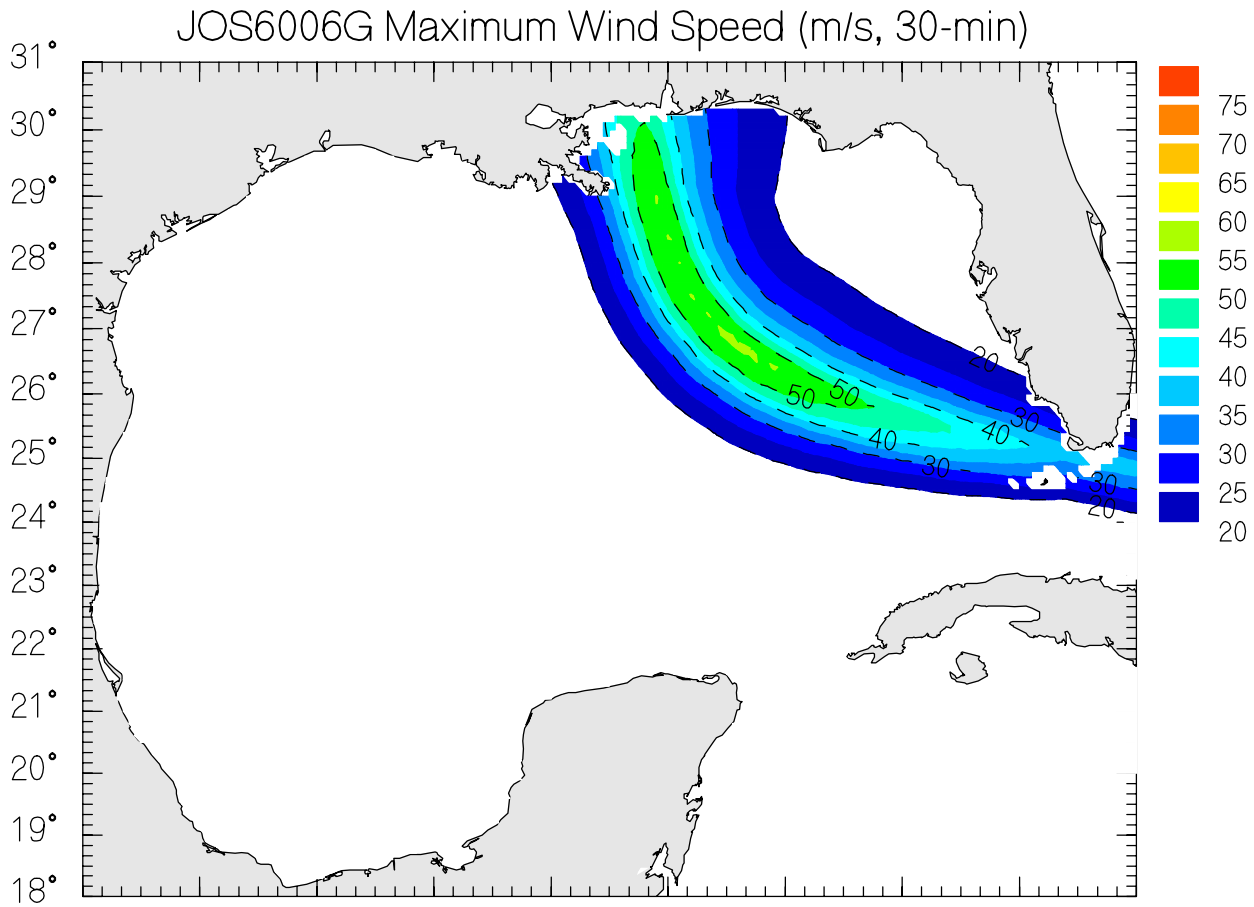
4
2
0


JOS6006G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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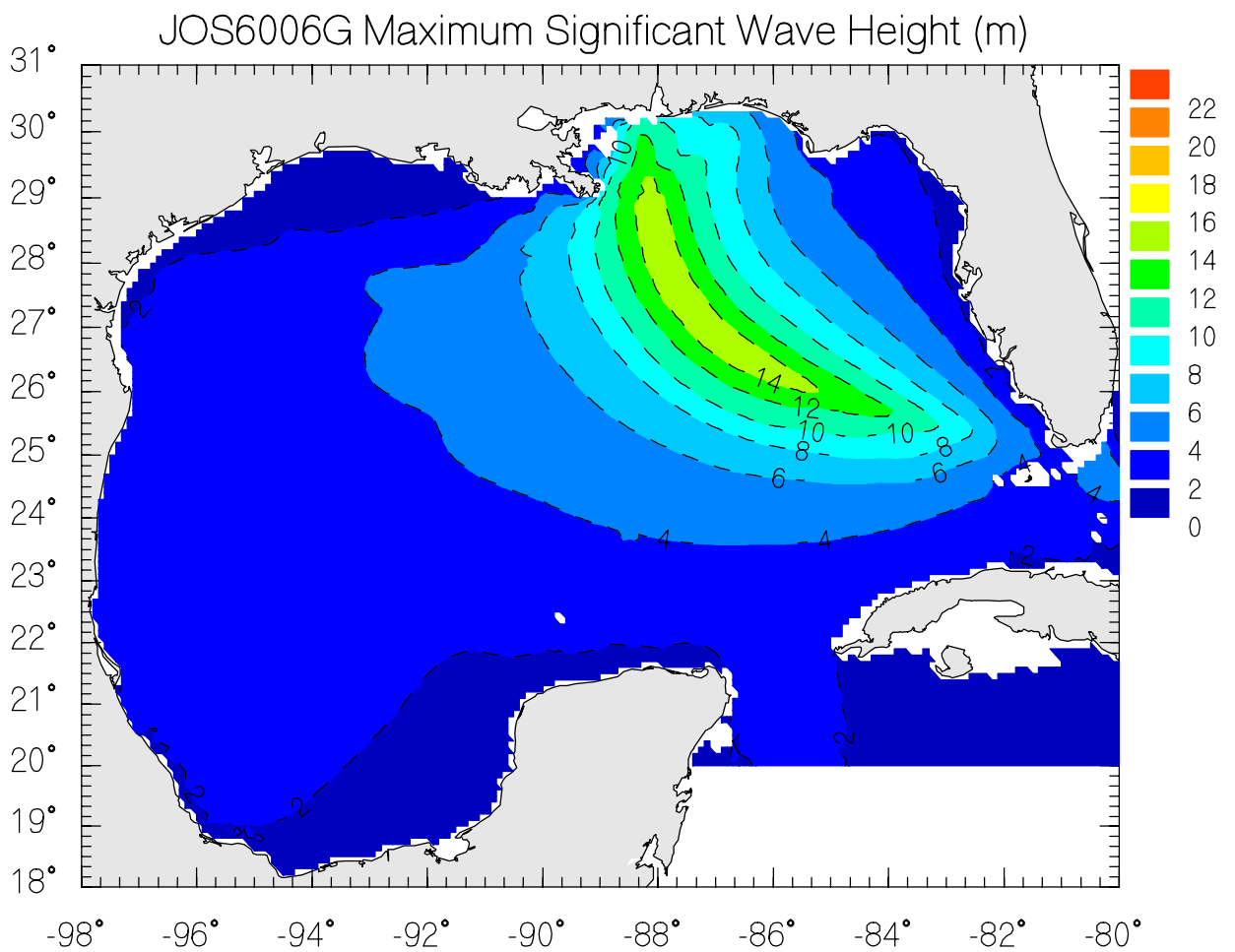
60
55
50
45
40
35
30
25
20


JOS6006G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
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23°
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20°
19°
18°
-98°
-96°
-94°
-92°
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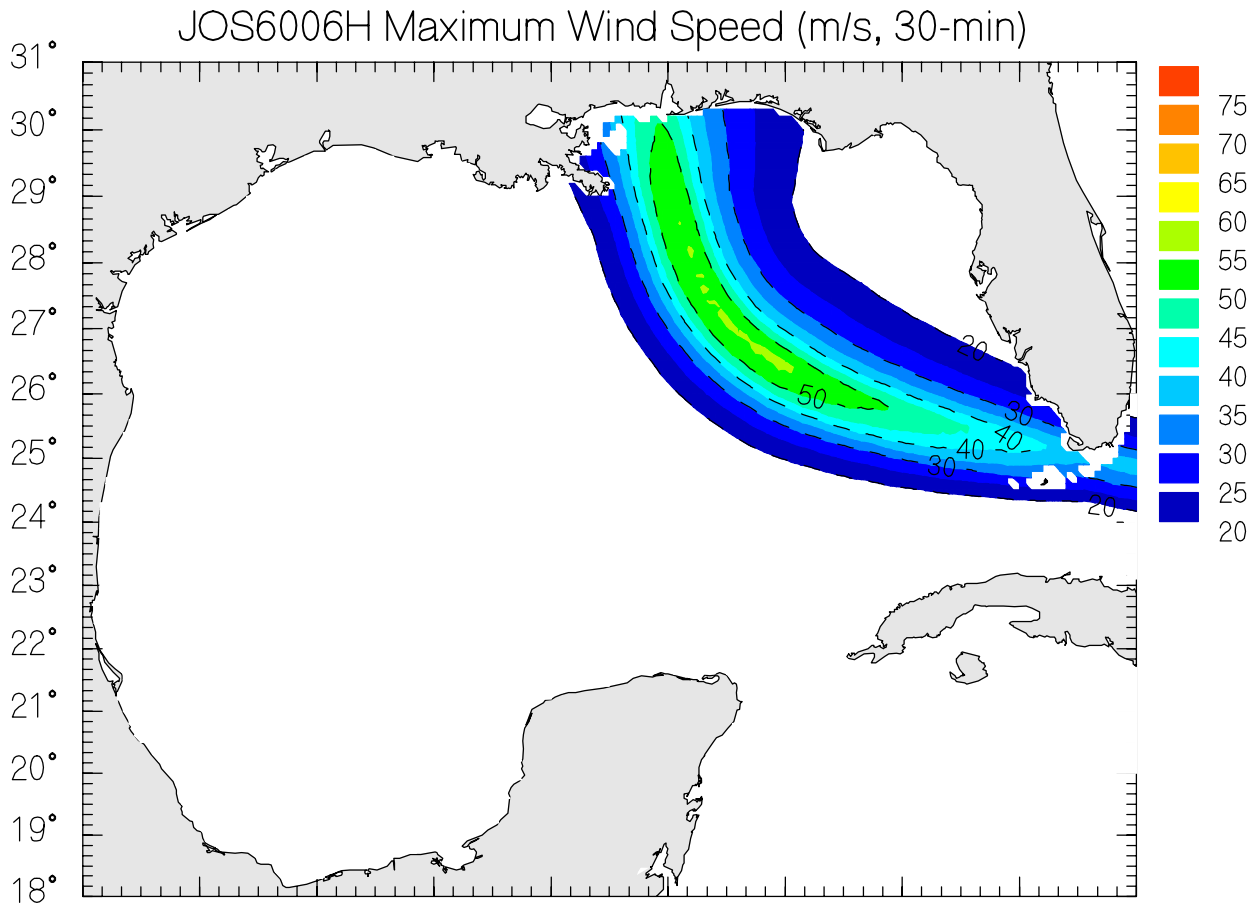
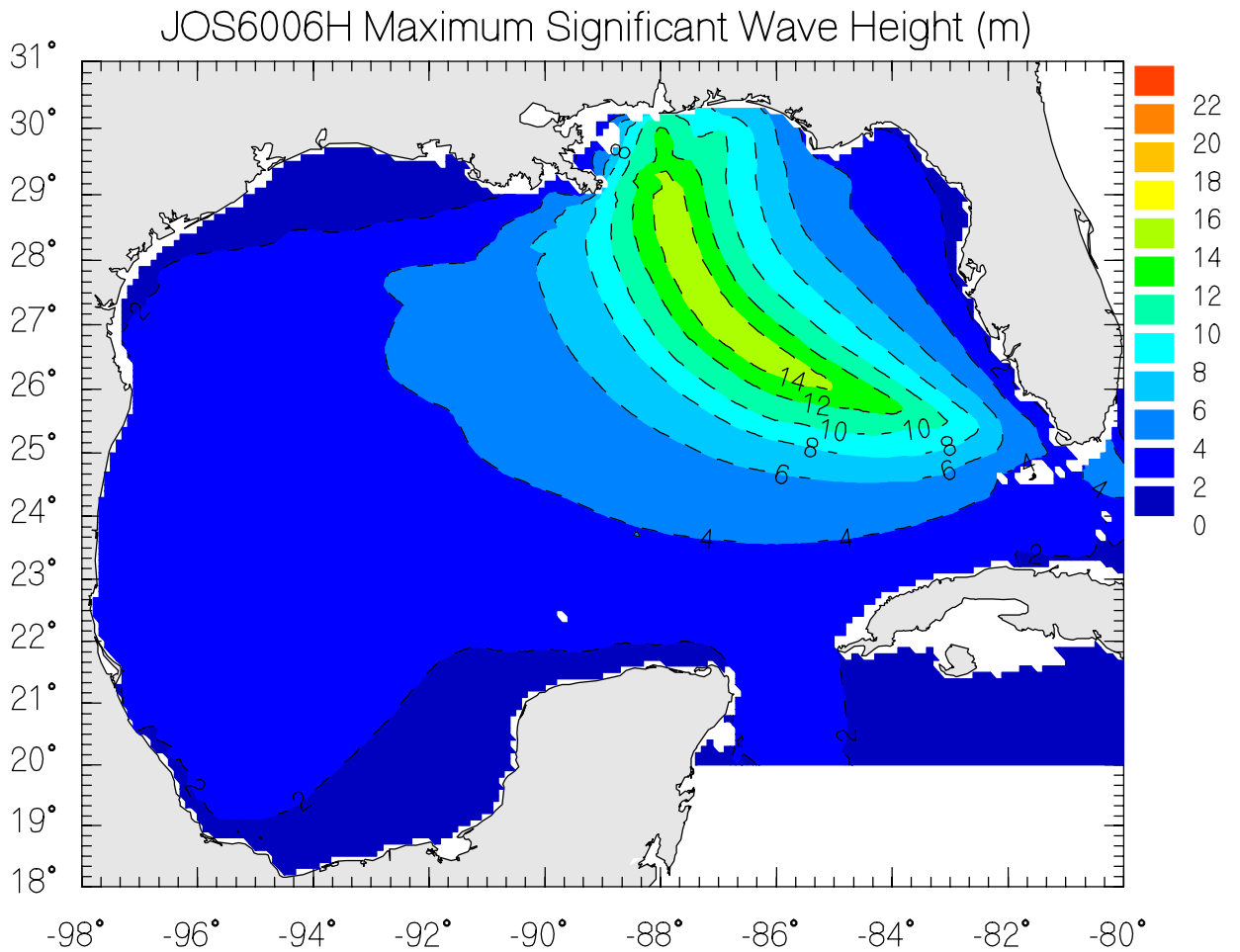
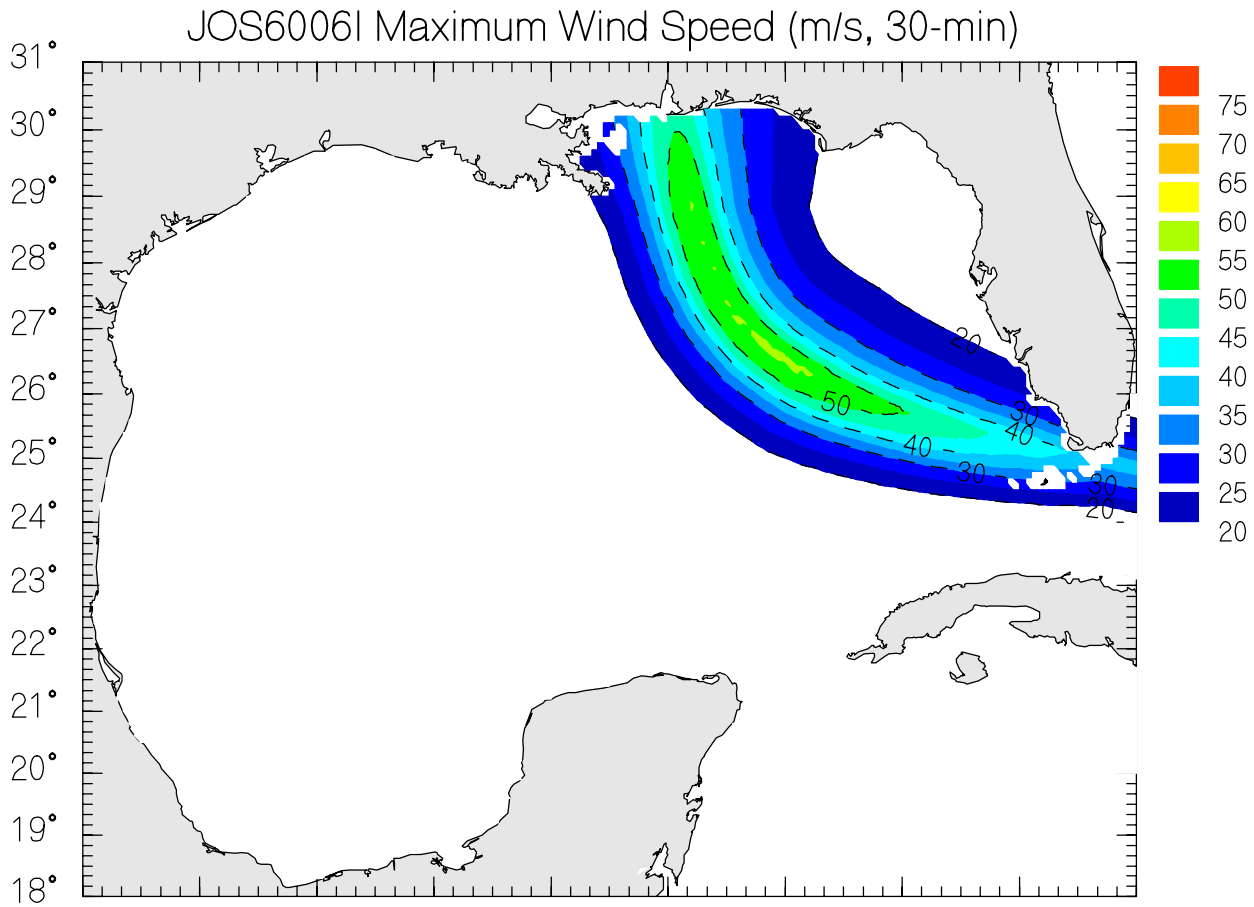

JOS6006H Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
50
40
30
20


JOS6006H Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
8
6
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6006I Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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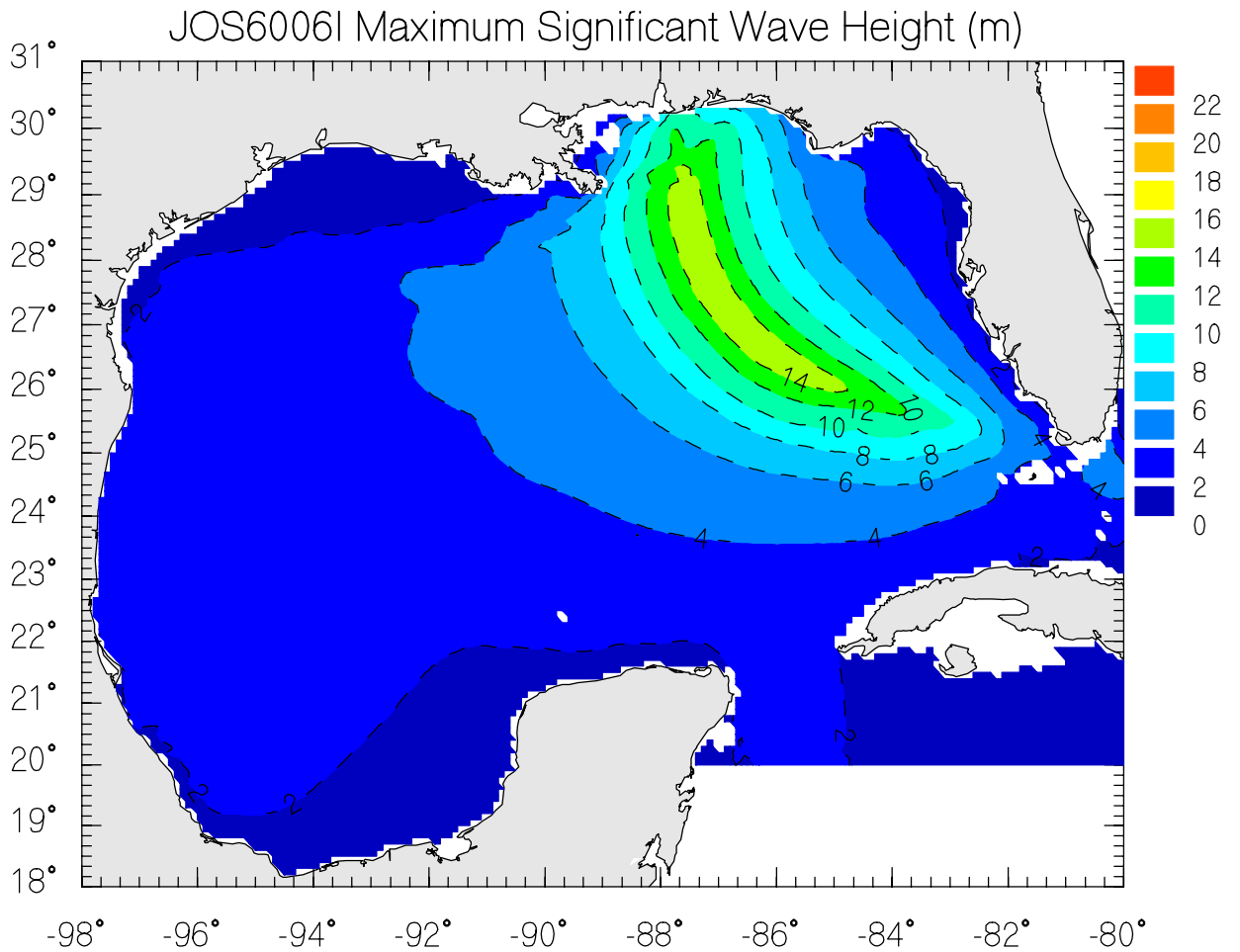
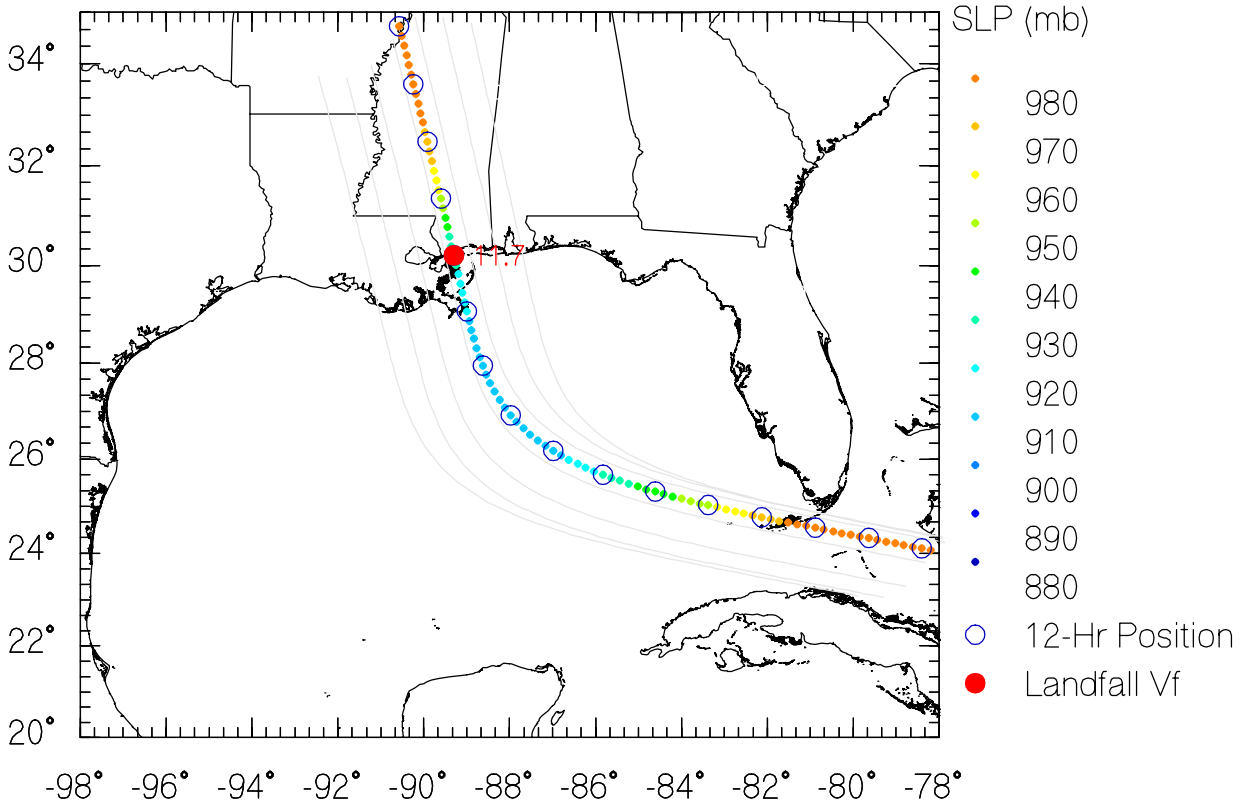
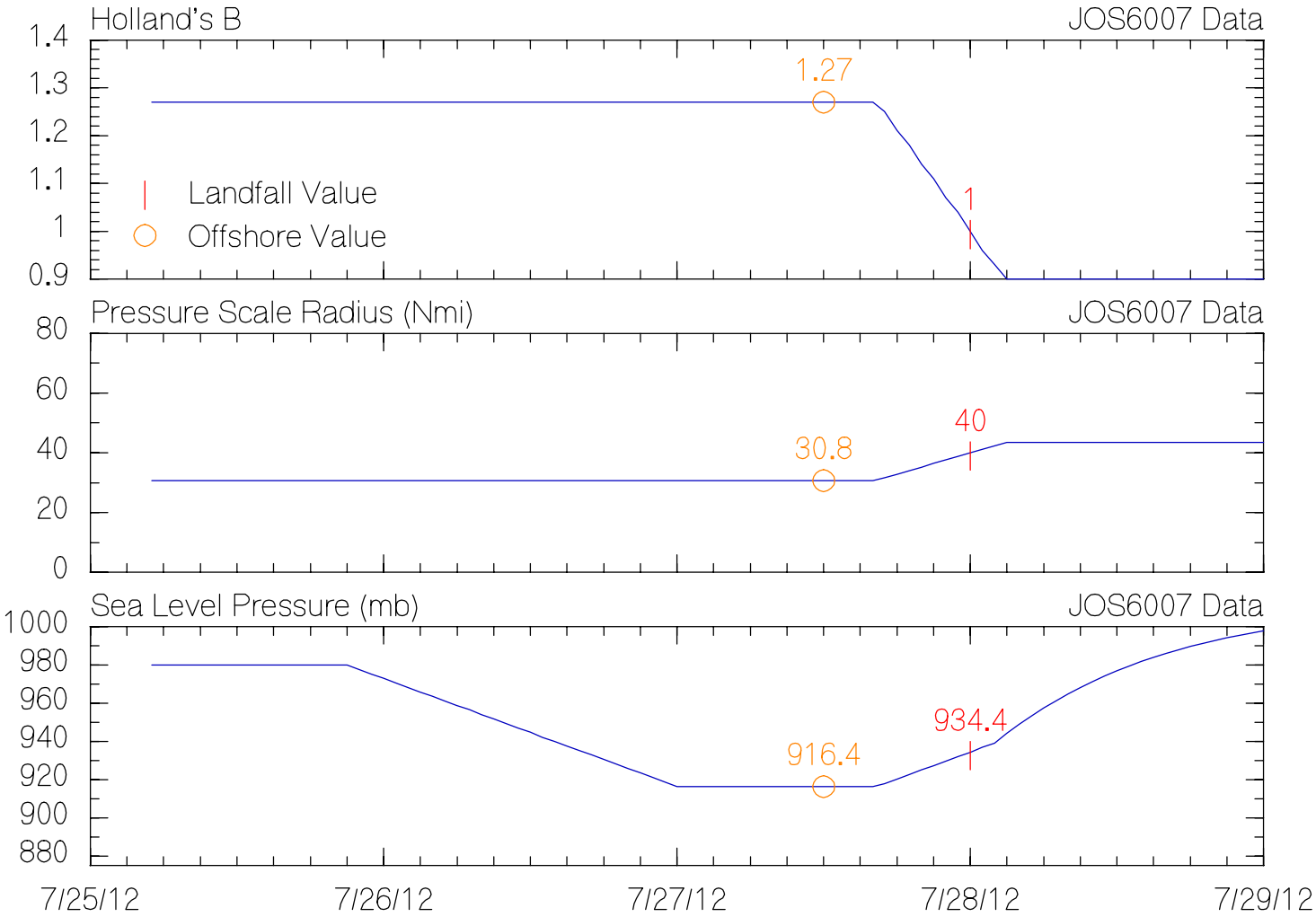
25
20
50
40
30
20


JOS6006I Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
8
6
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°

JOS6007 Data

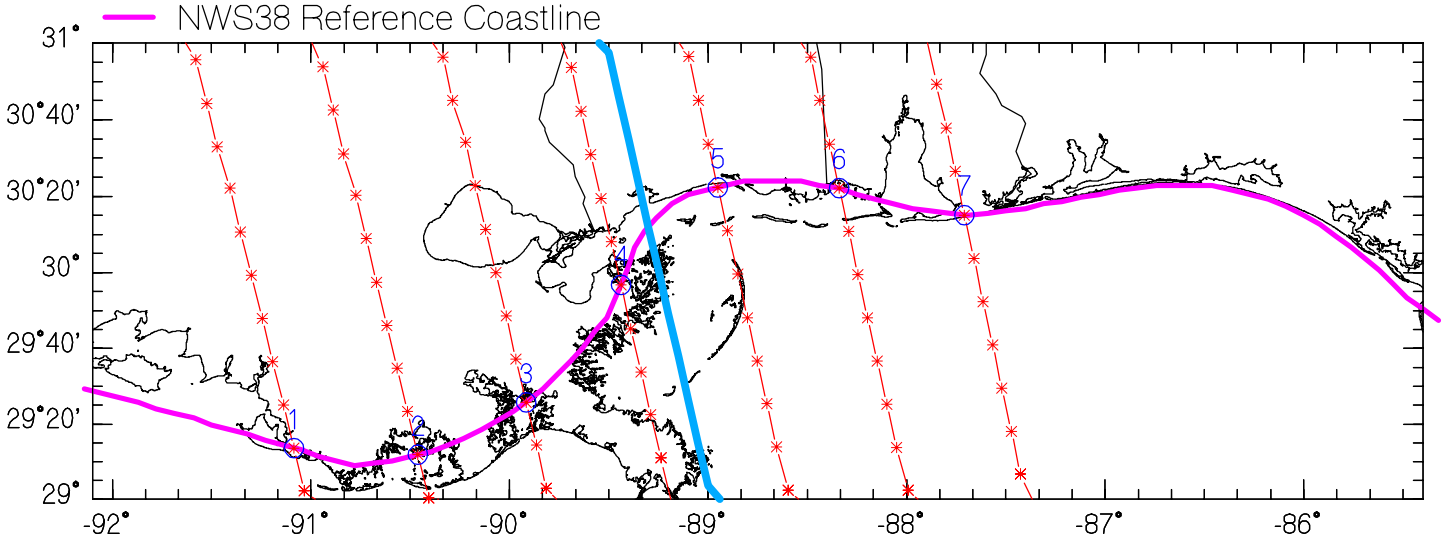


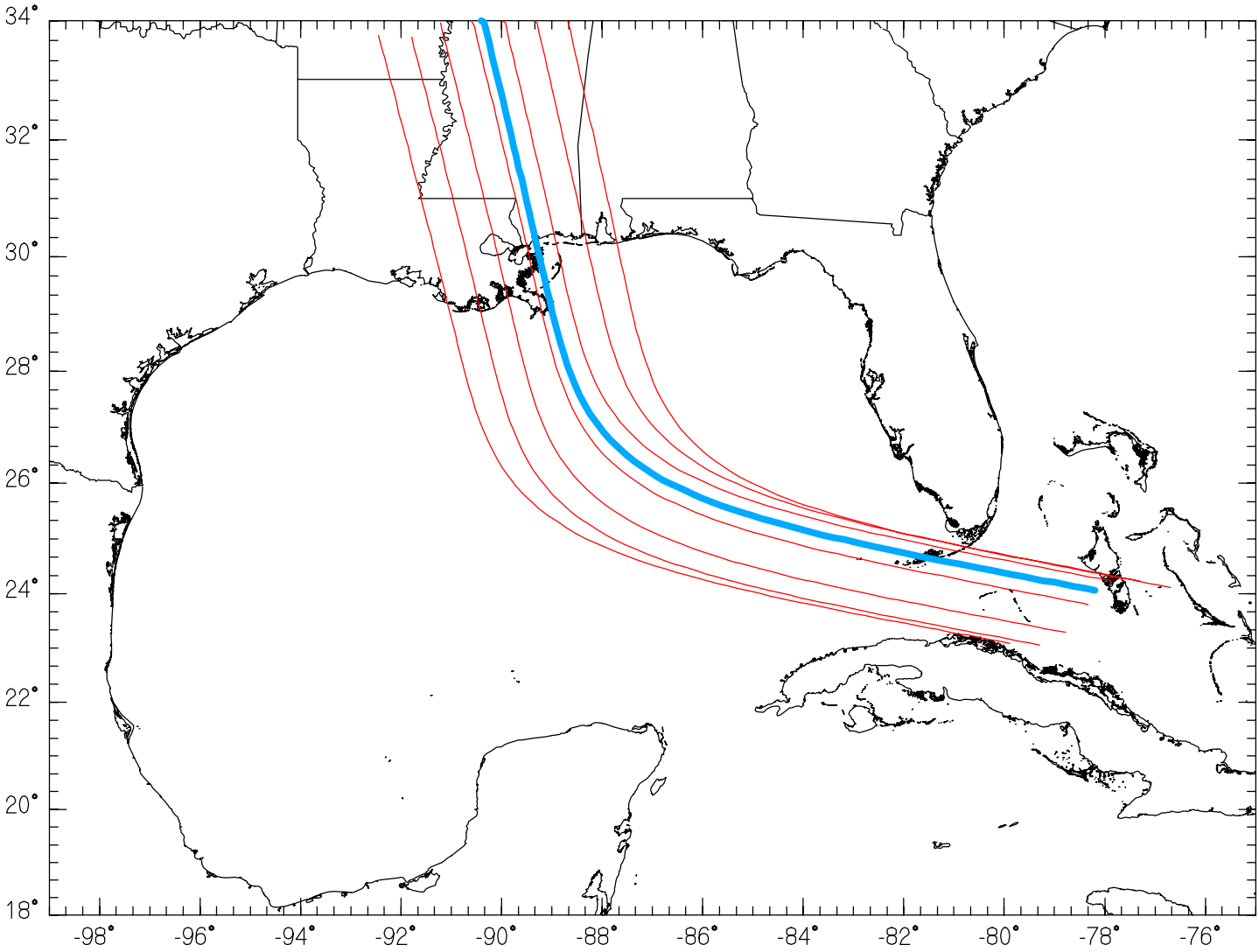


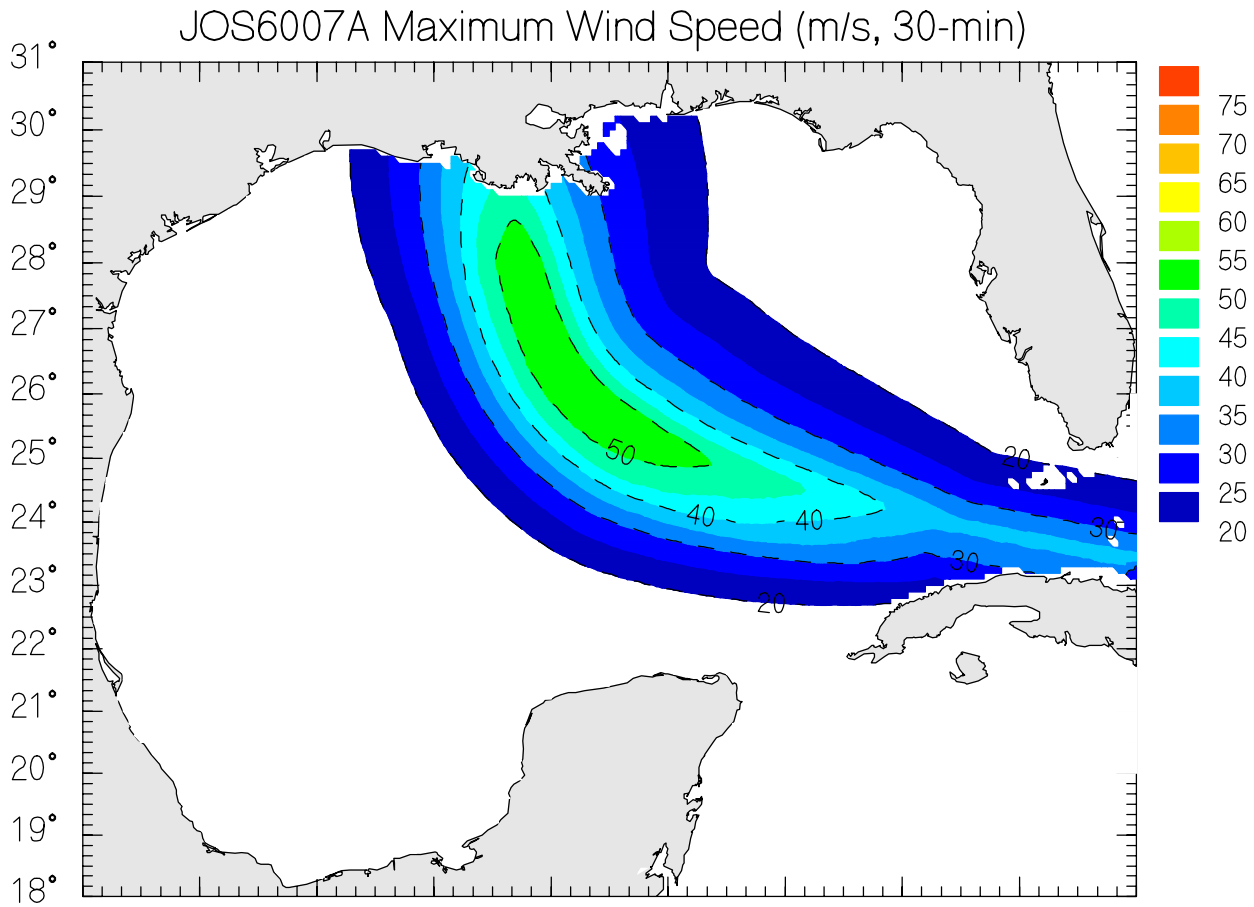
URS JPM-OS6 Production Tracks

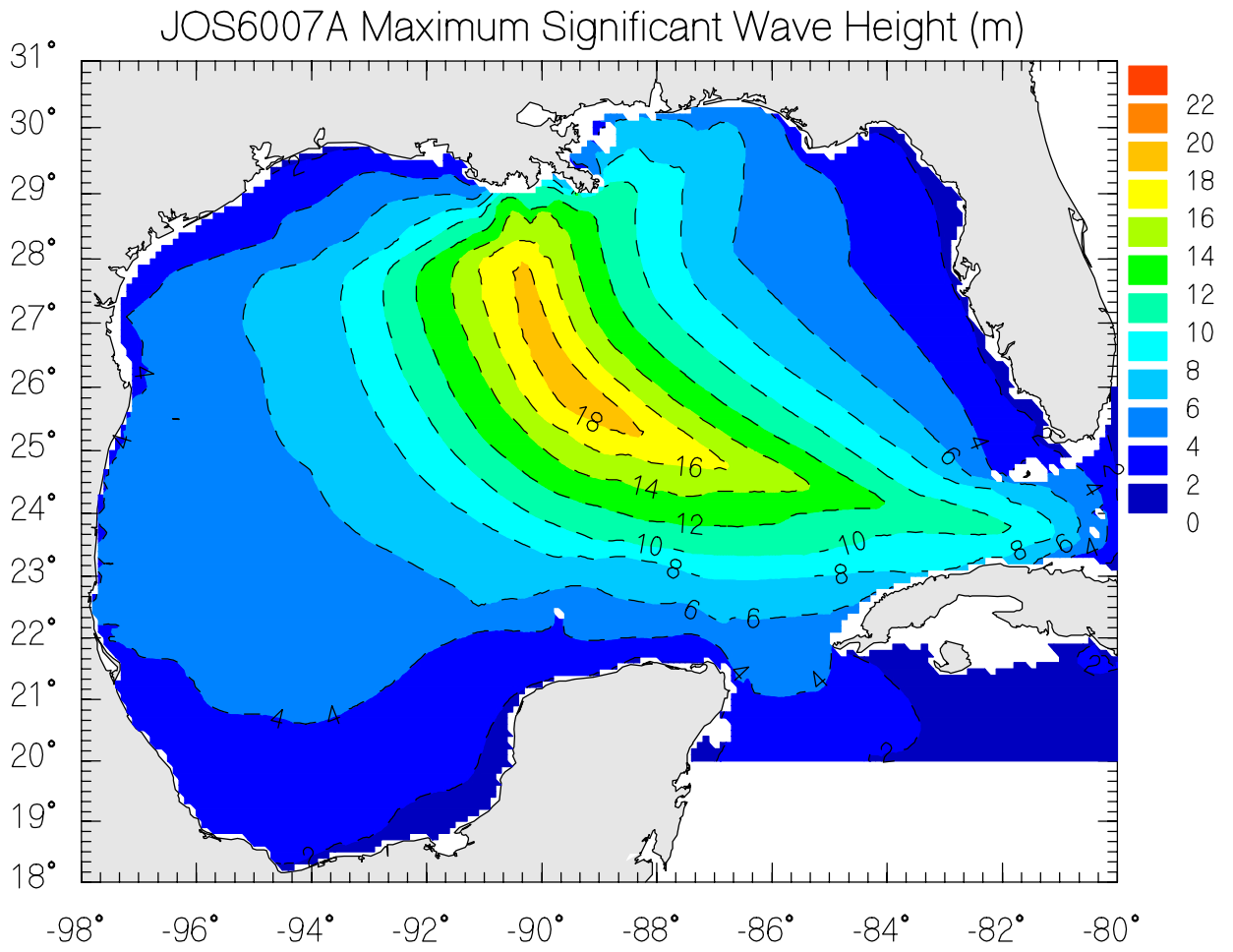
JOS6007 Data

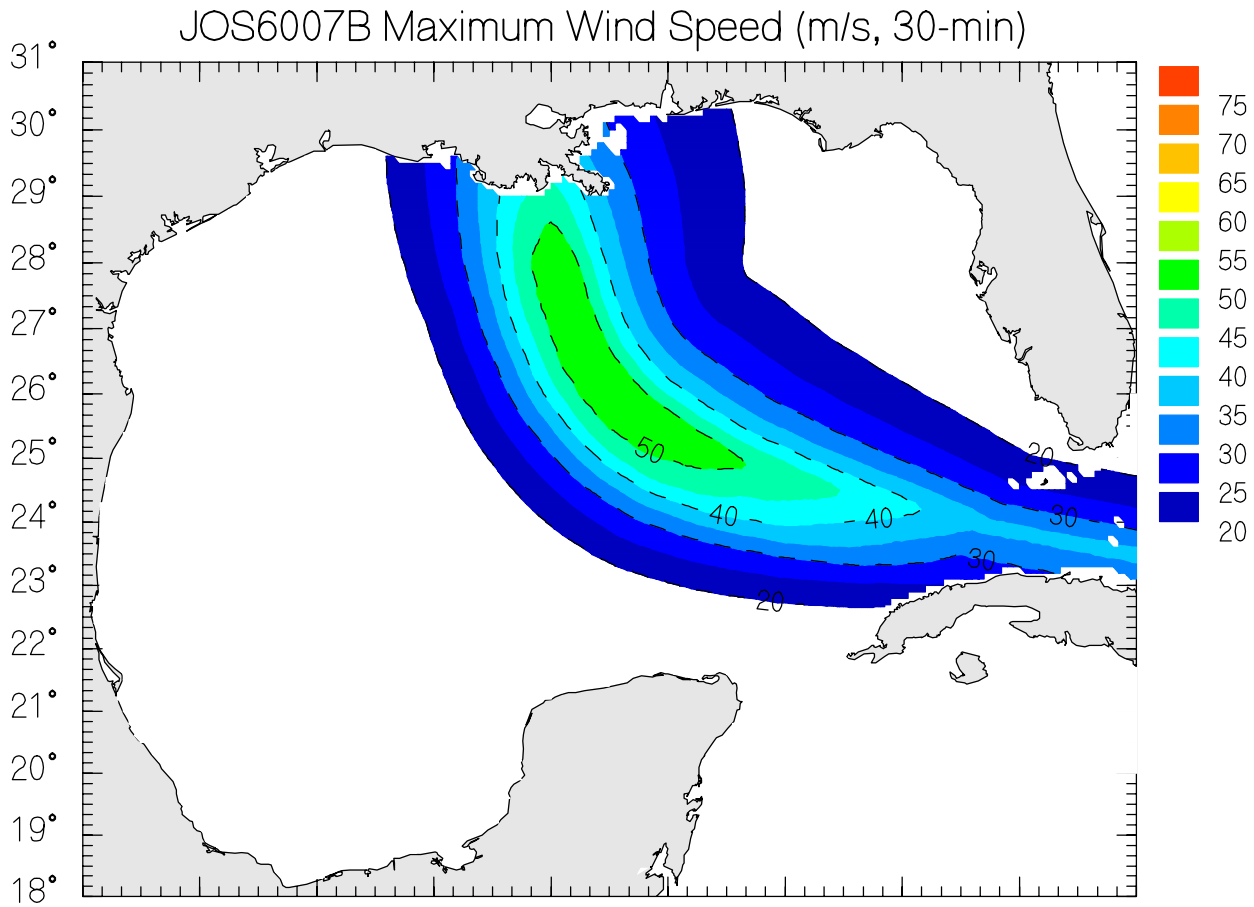
Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline

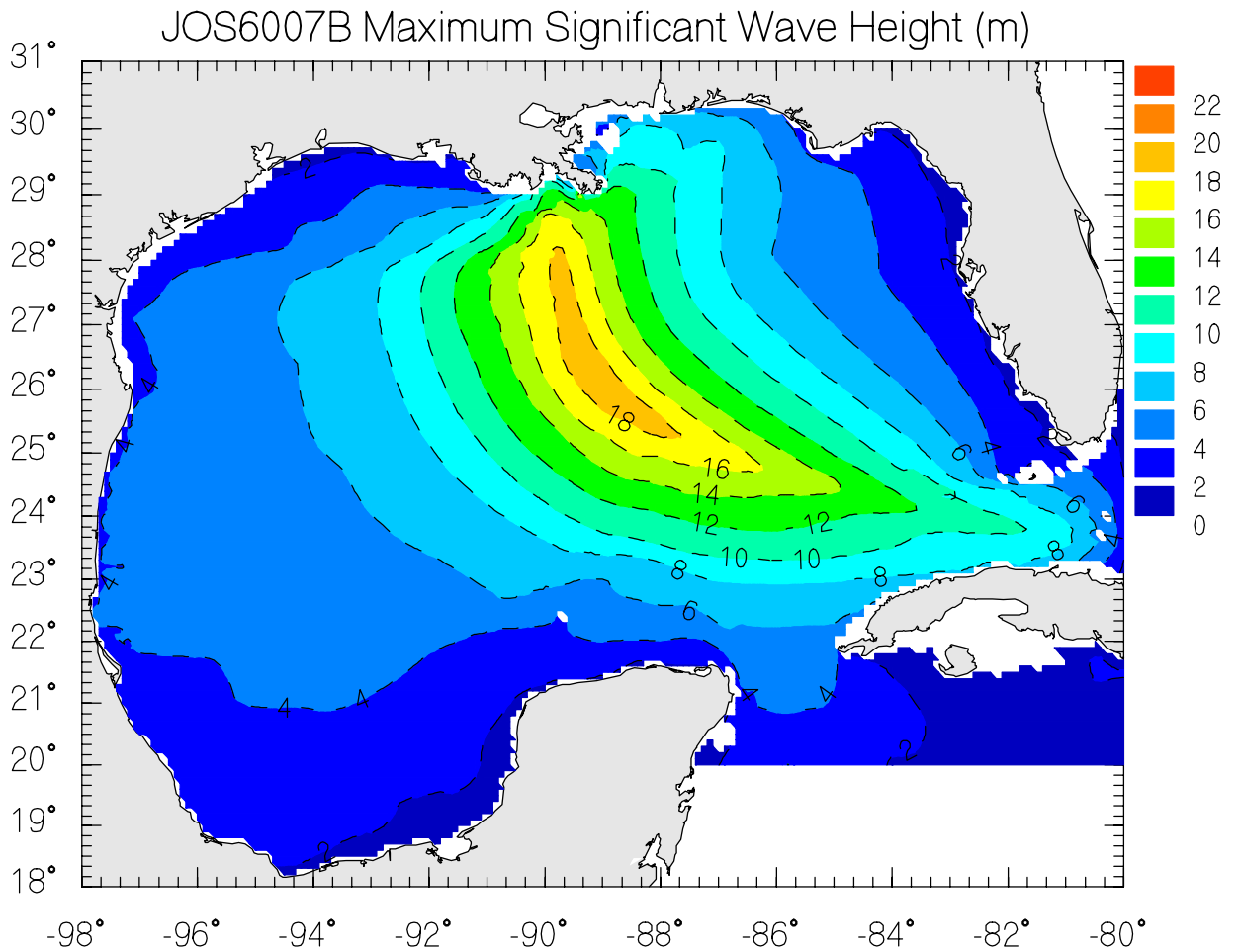


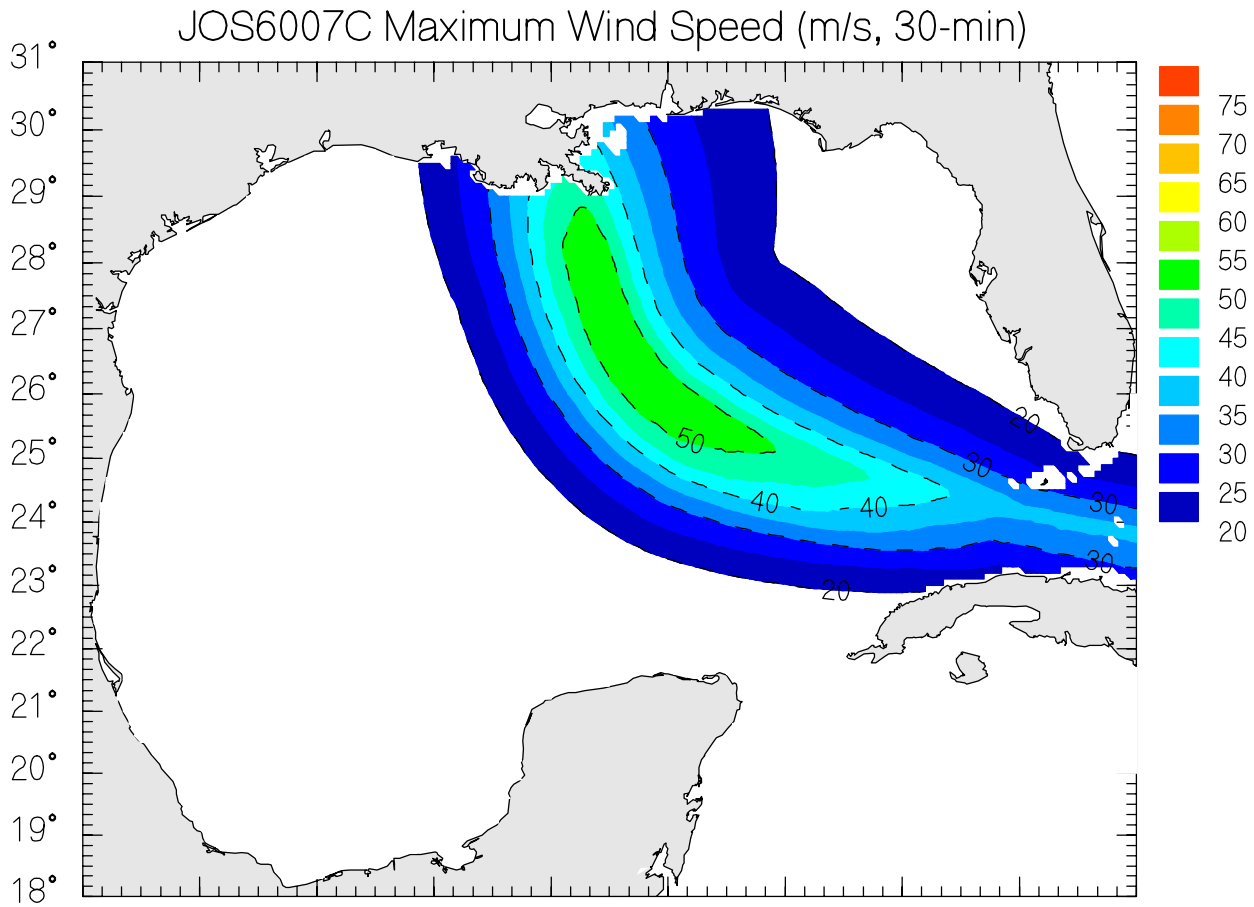


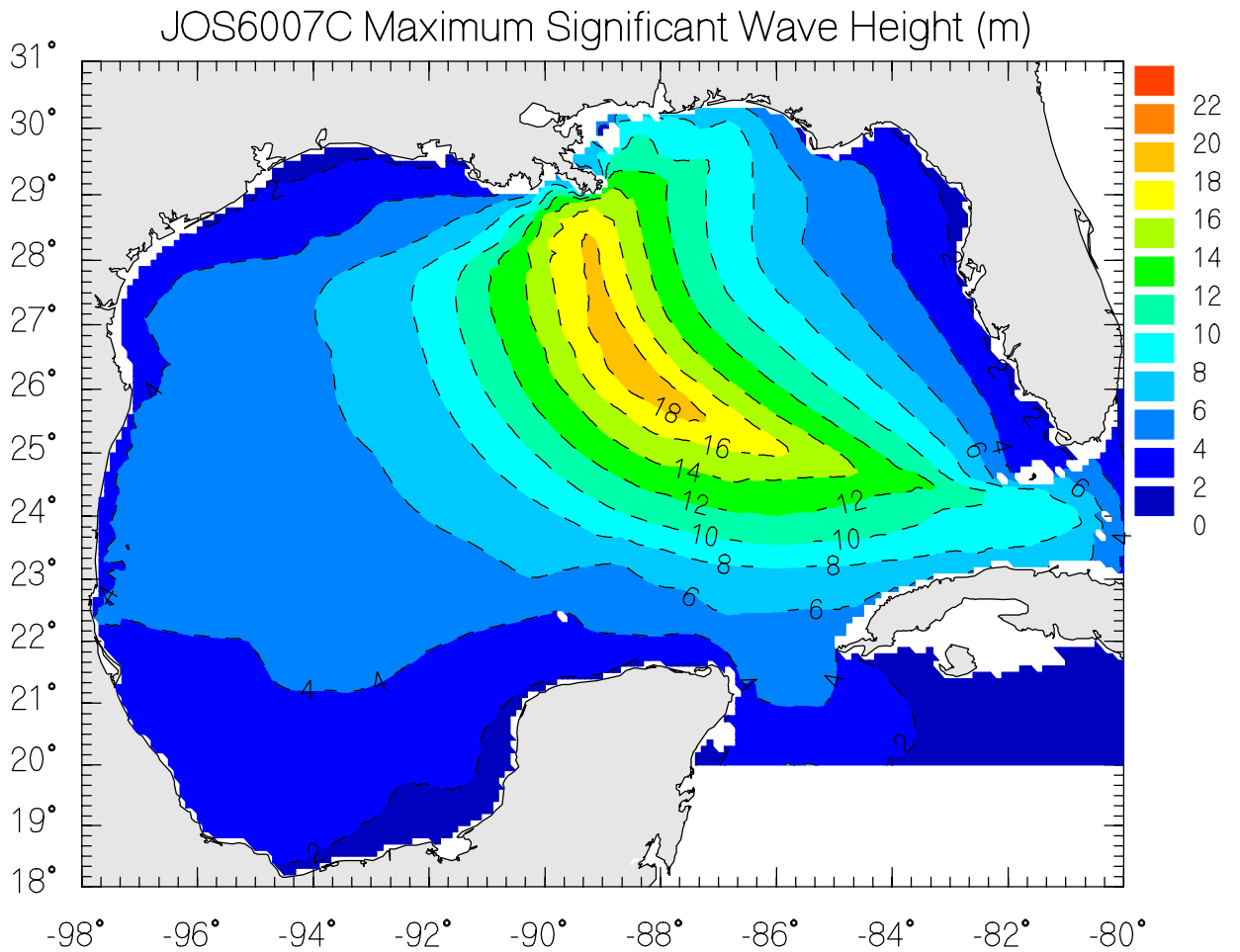

JOS6007A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
50
40
40
30
30
20
20

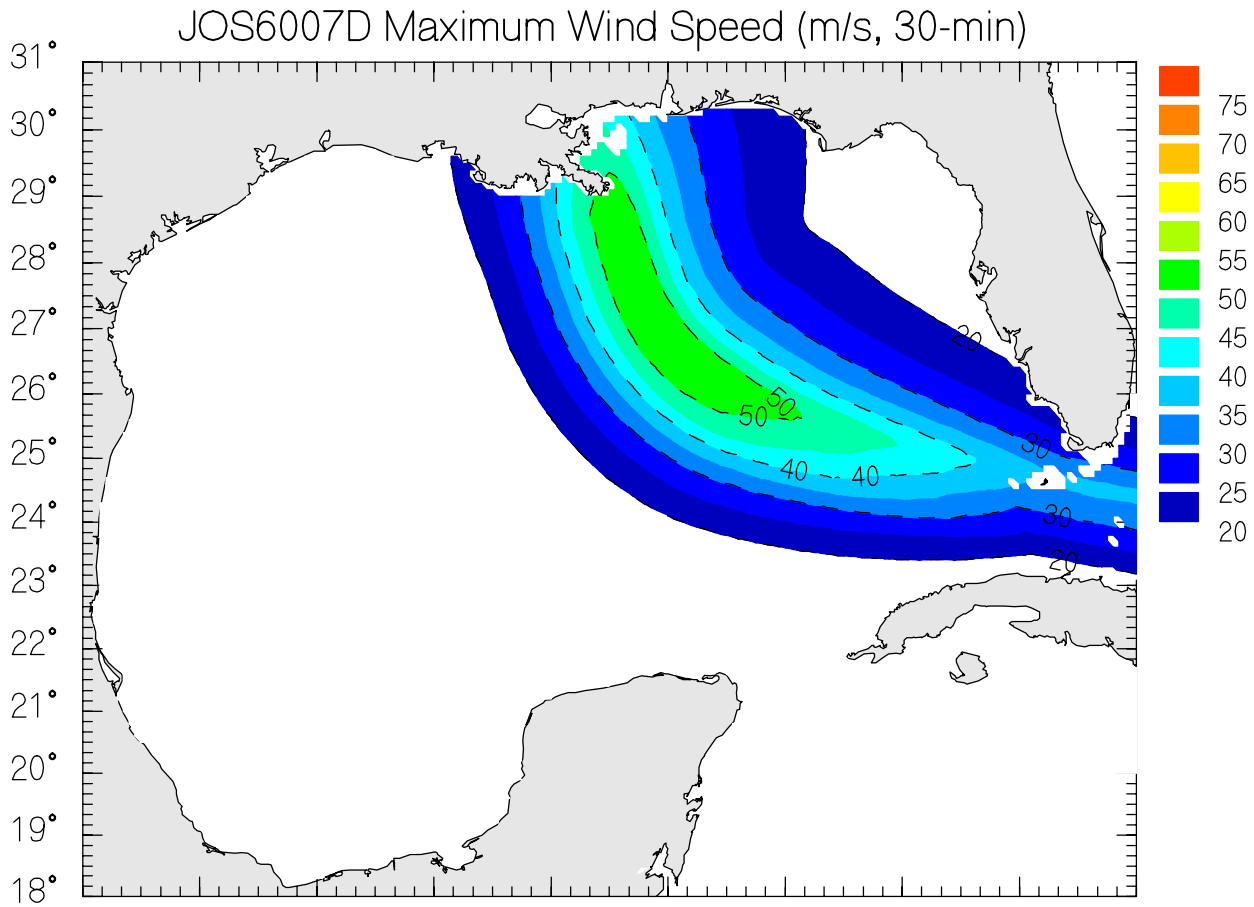

JOS6007A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
18
16
14
12
10
10
8
8
6
6
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°

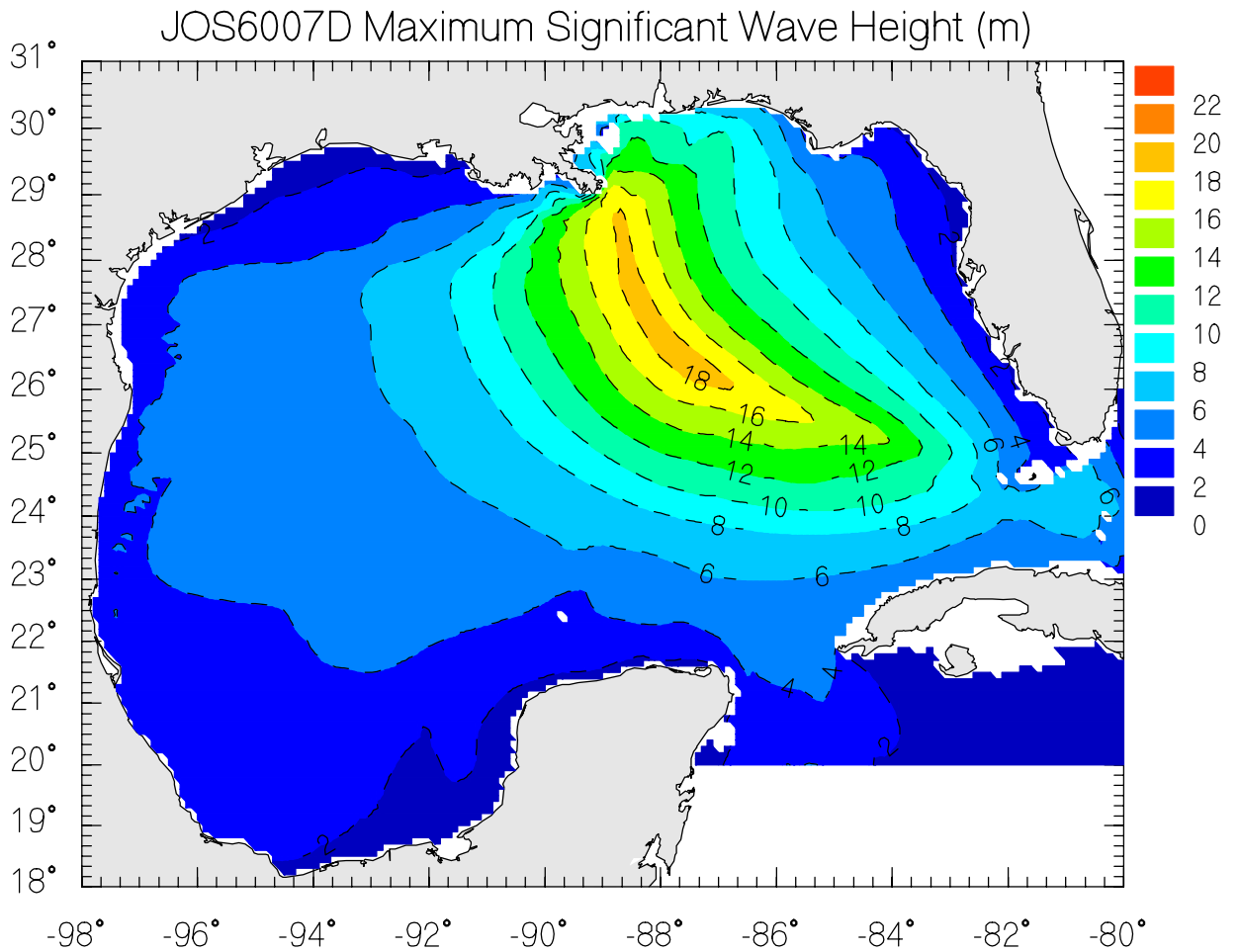

JOS6007B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
50
40
40
30
30
20
20

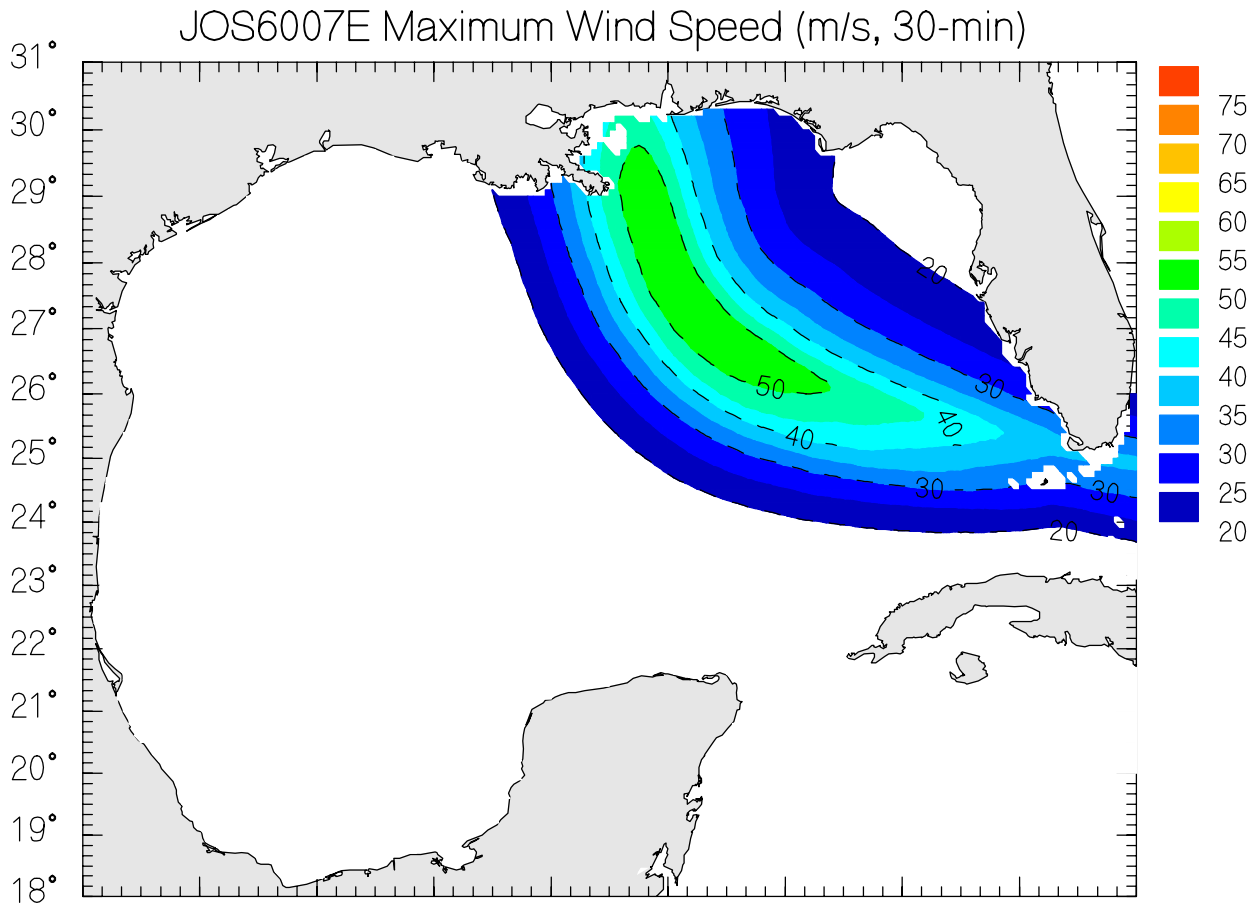

JOS6007B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
18
16
14
12
12
10
10
8
8
6
6
6
8
4
4
2
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6007C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
50
40
40
30
30
30
20
20


JOS6007C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
18
16
14
12
12
10
10
8
8
6
6
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6007D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
50
40
30
20


JOS6007D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
18
16
14
12
10
8
6
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6007E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
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18°
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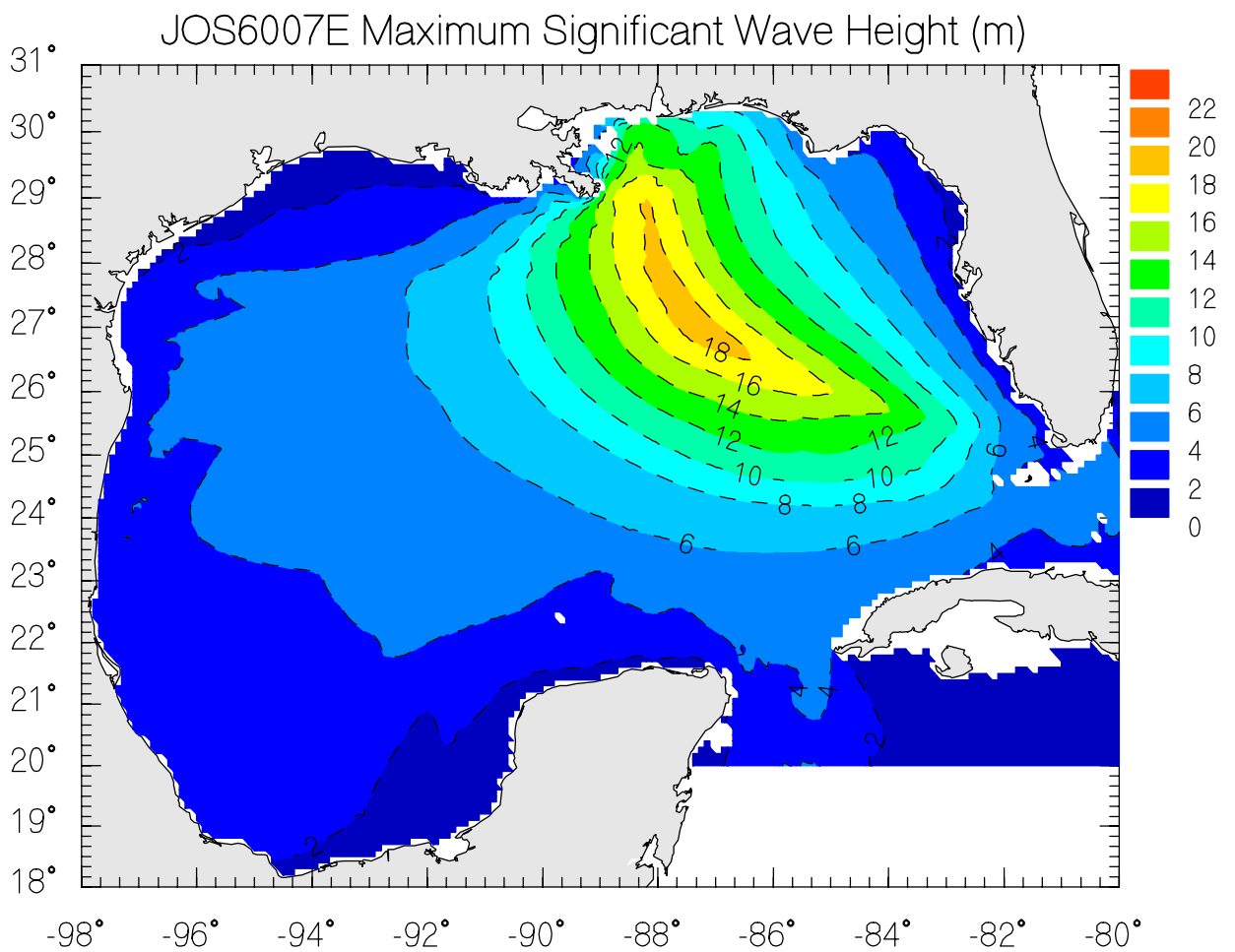
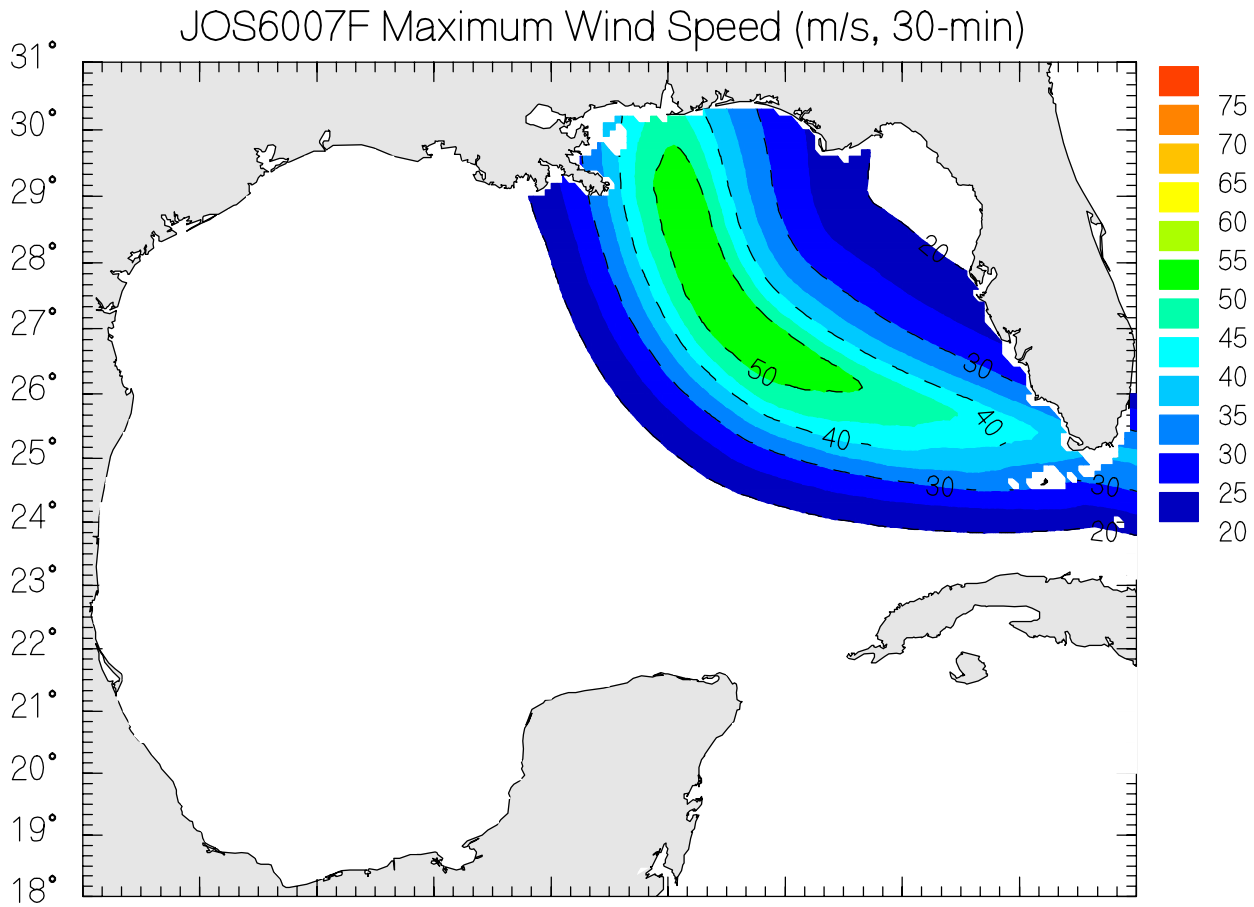
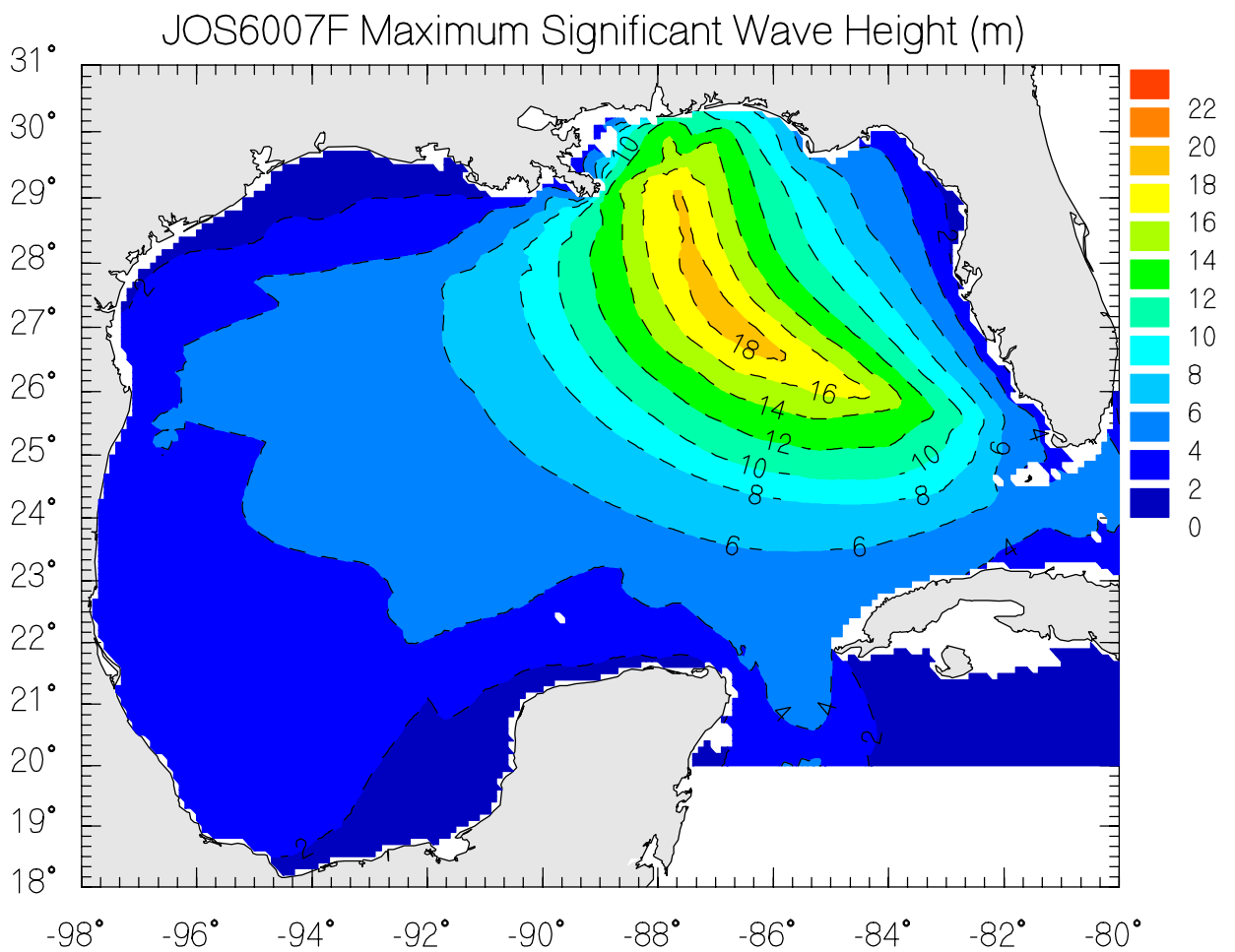
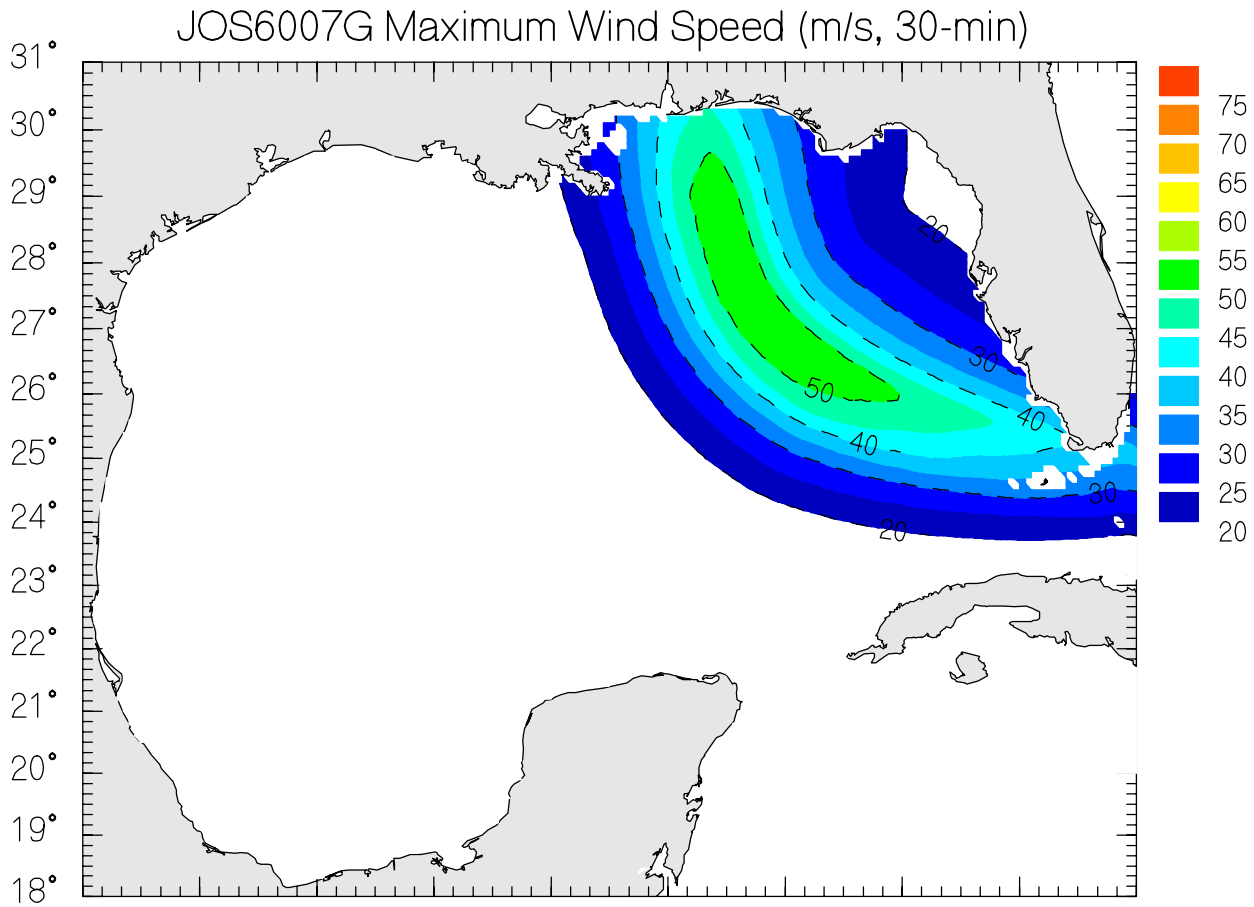
25
20
50
40
30
20


JOS6007E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
18
16
14
12
10
8
6
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6007F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
50
40
30
20


JOS6007F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
18
16
14
12
10
8
6
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6007G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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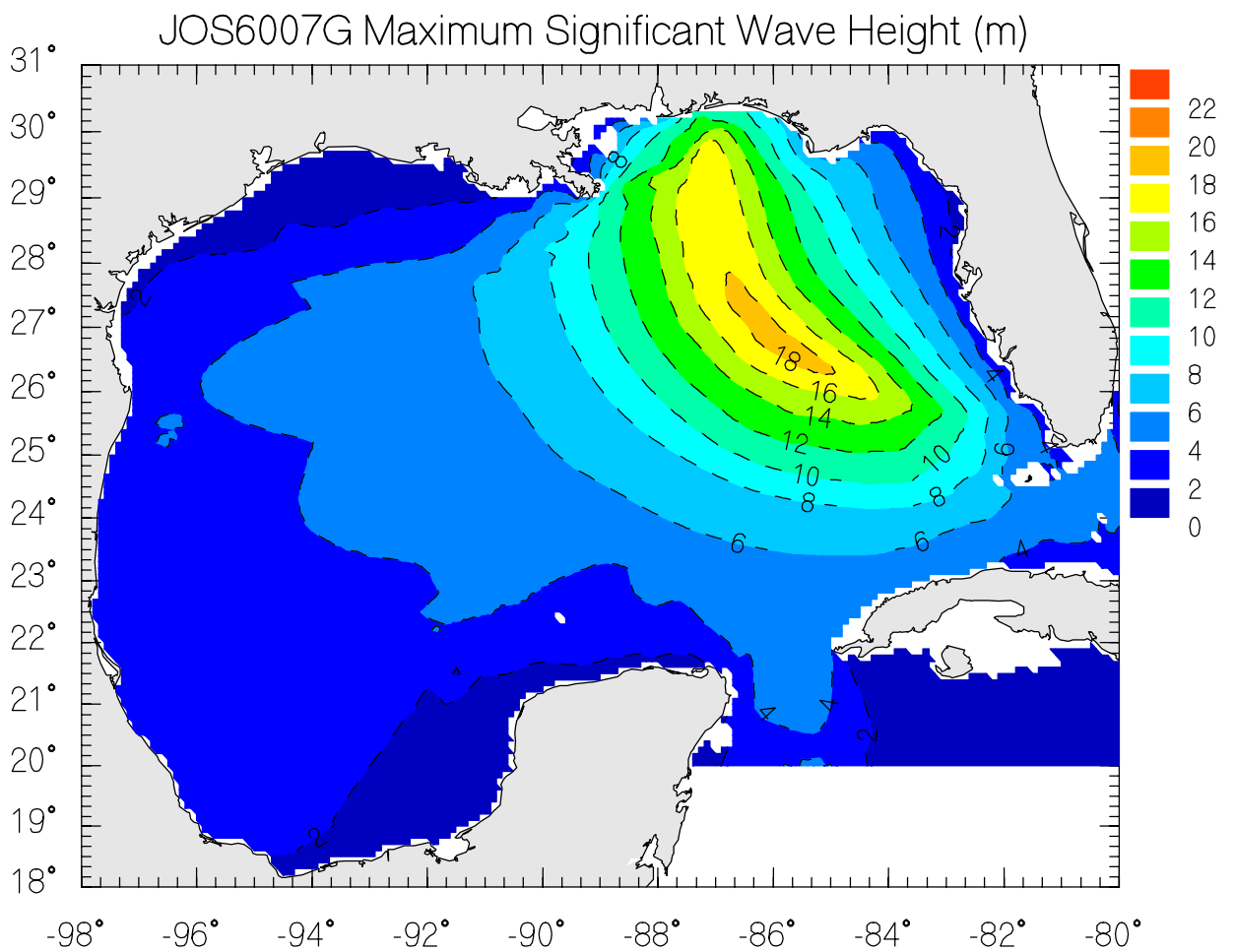
25
20
50
40
30
20


JOS6007G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
18
16
14
12
10
8
6
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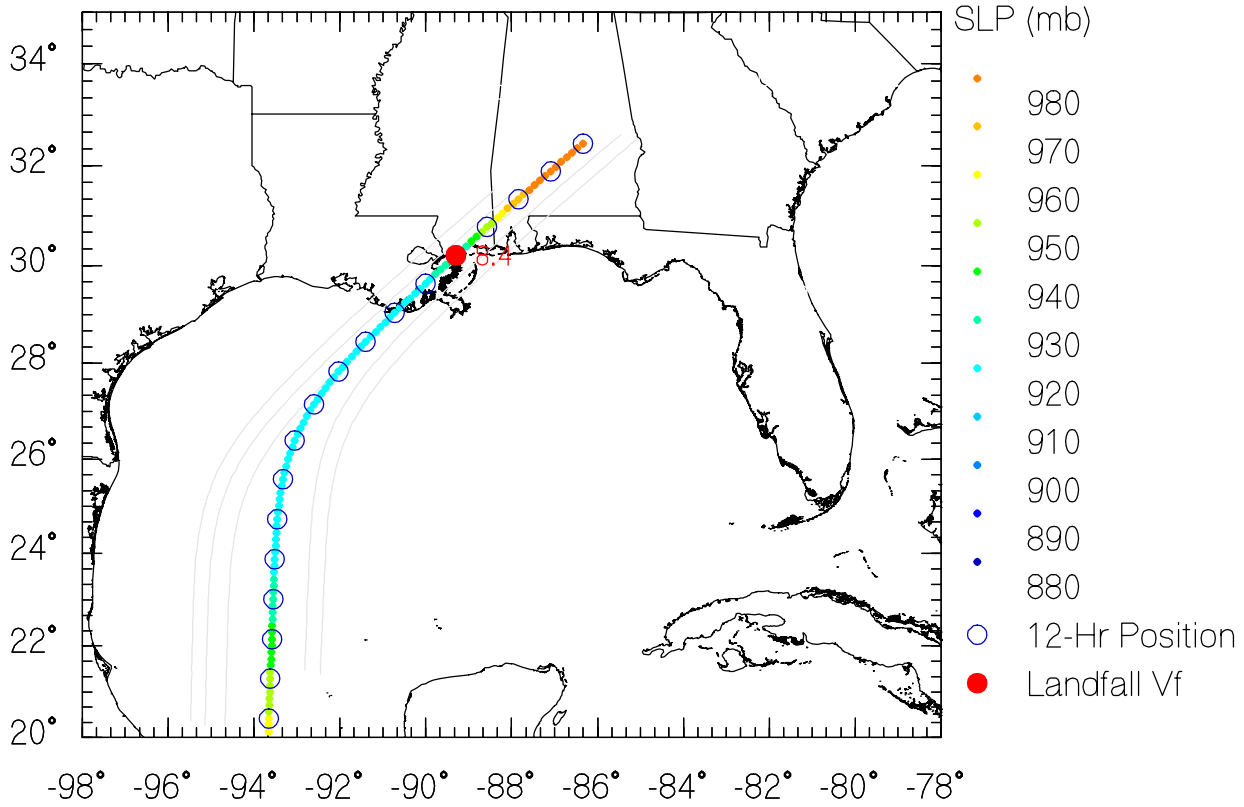
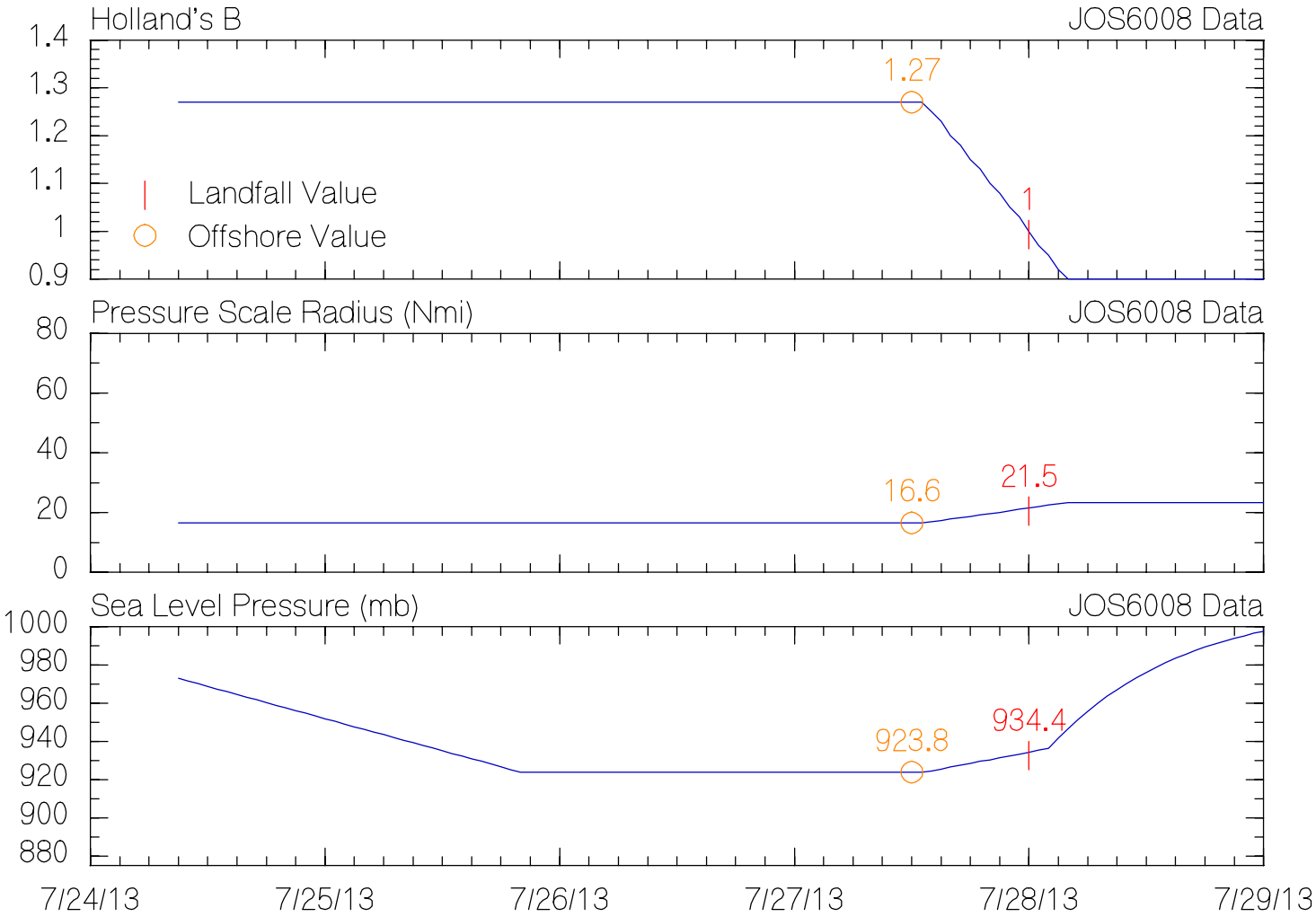
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°

JOS6008 Data

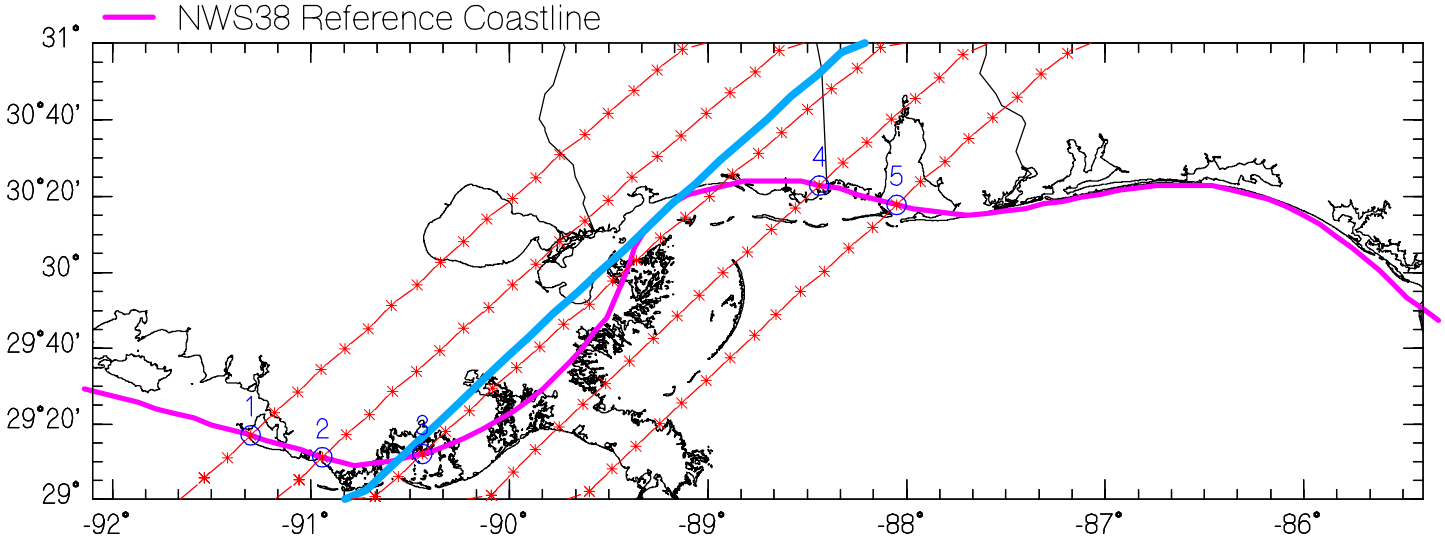


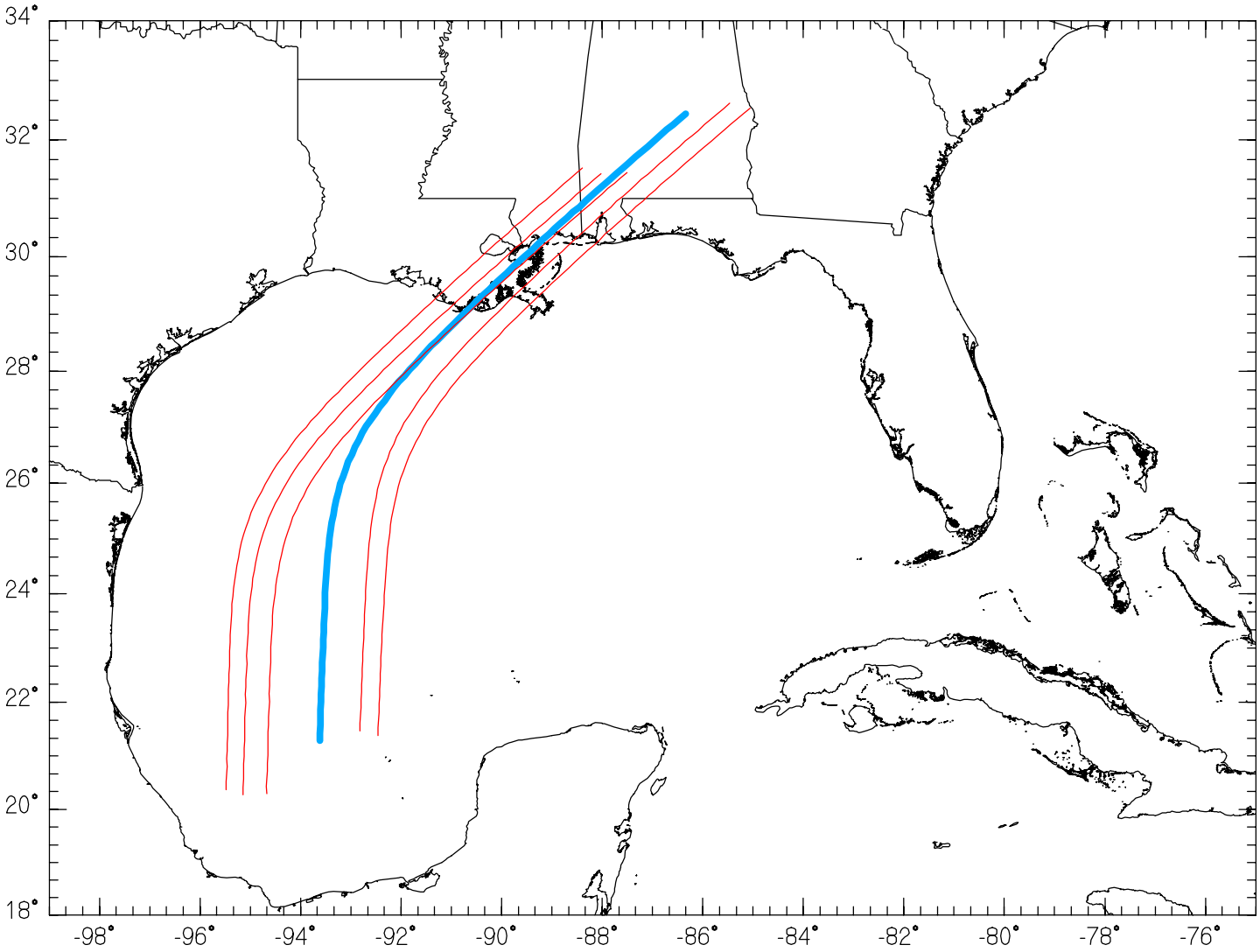


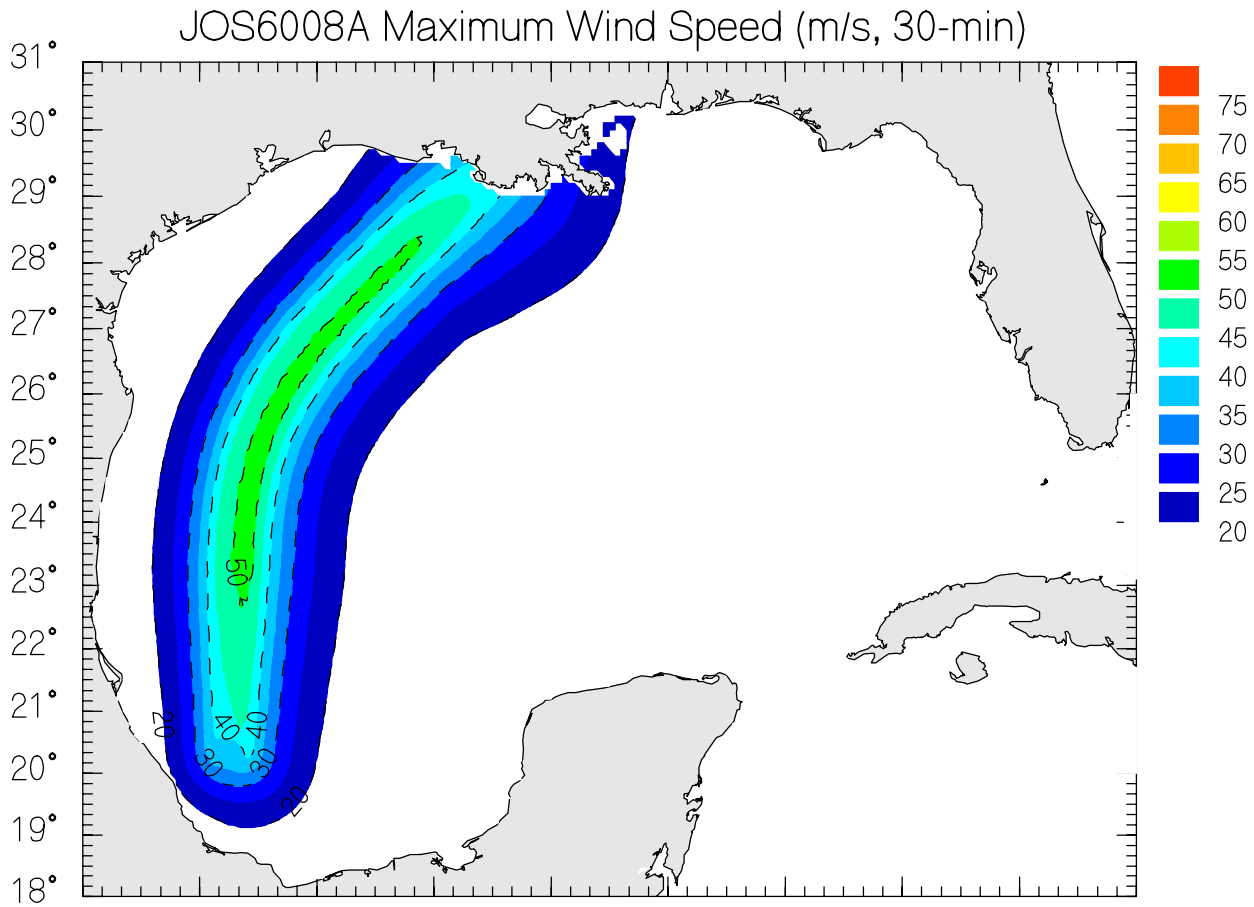
URS JPM-OS6 Production Tracks

JOS6008 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6008A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
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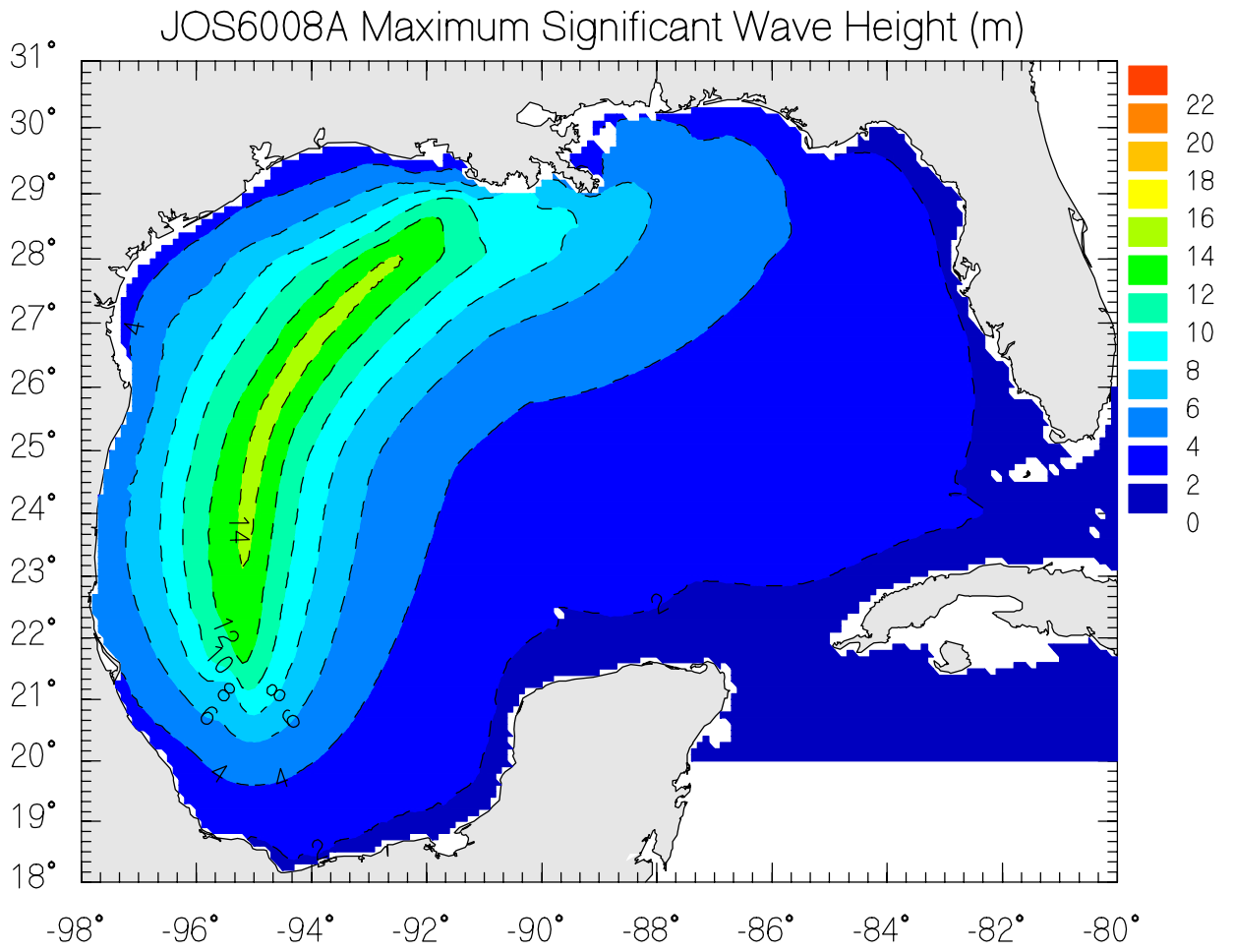
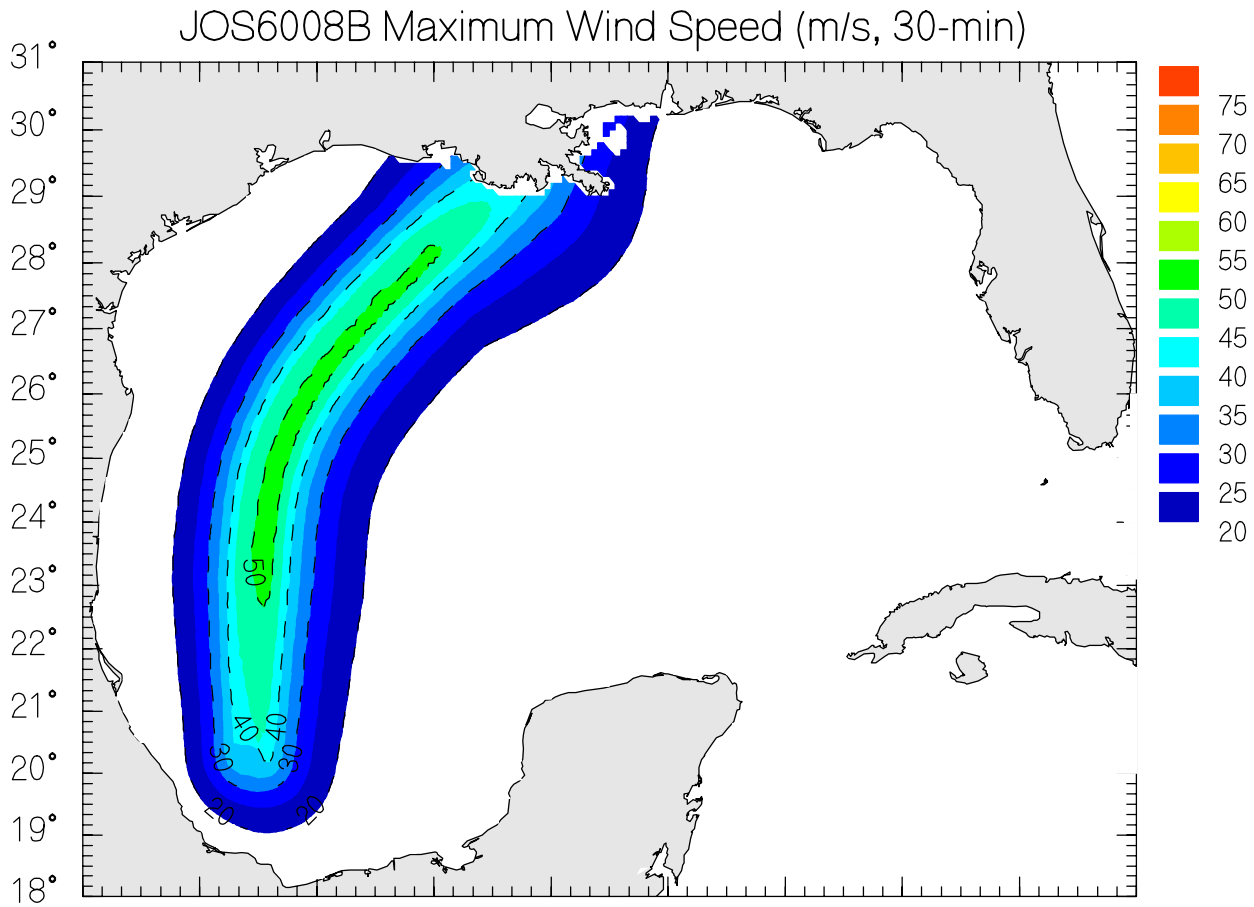
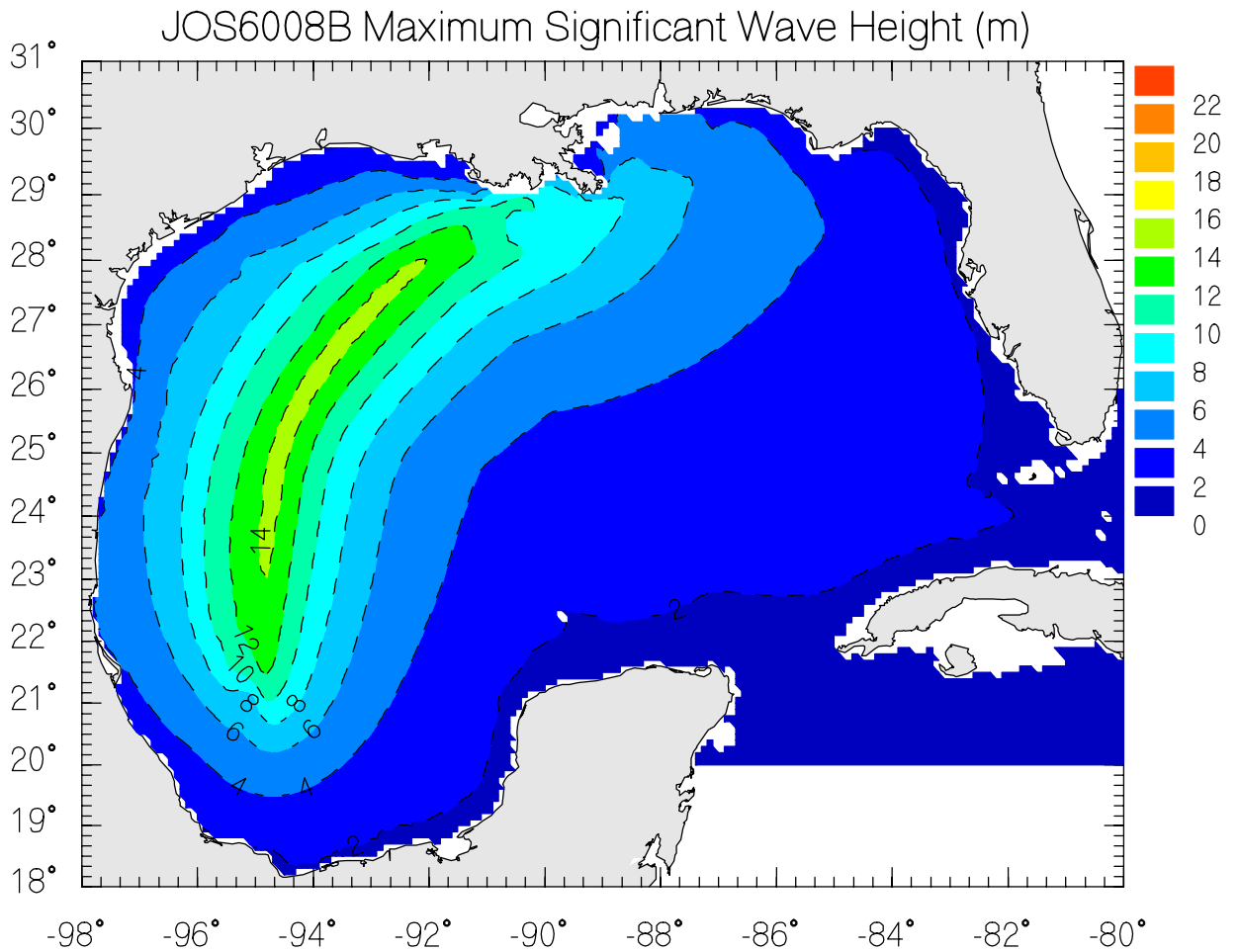
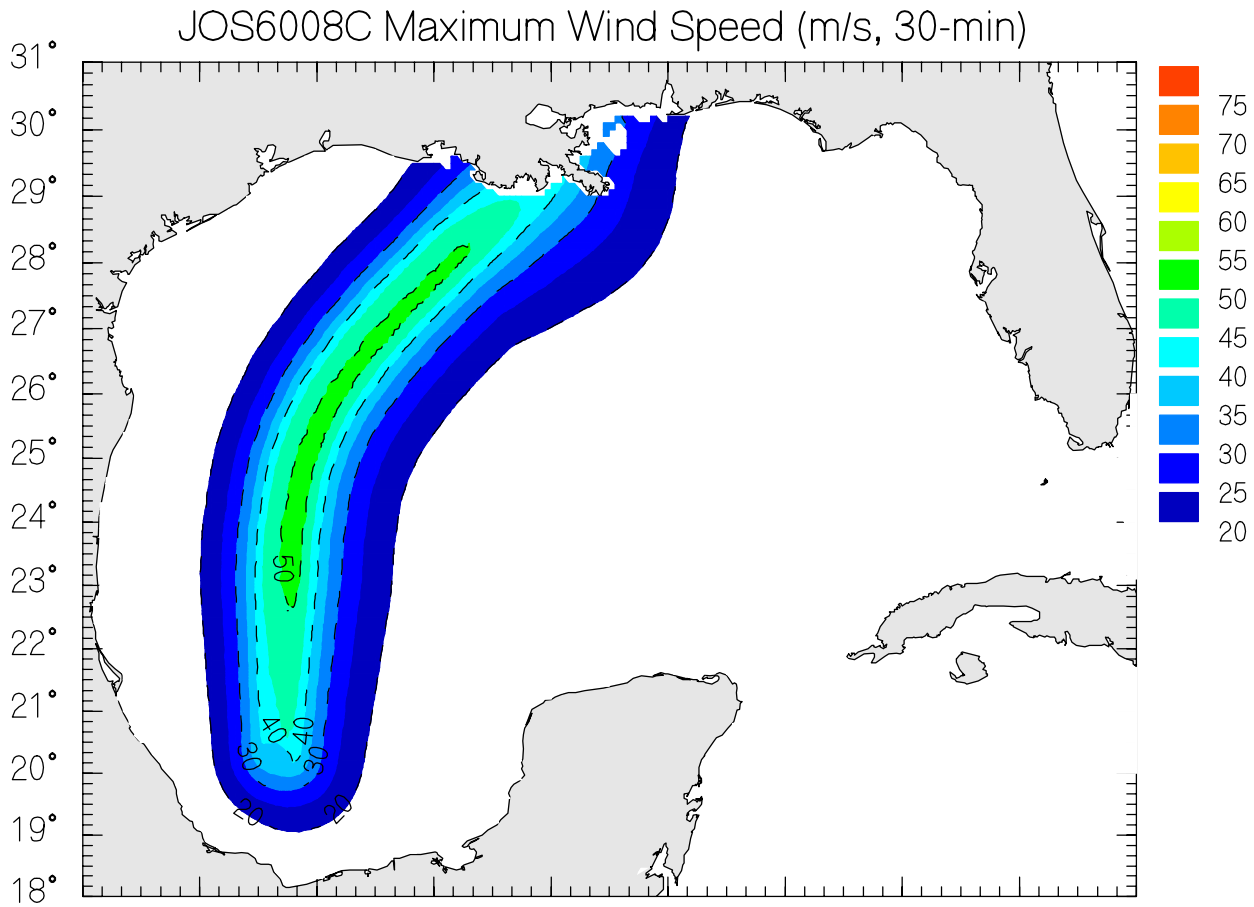
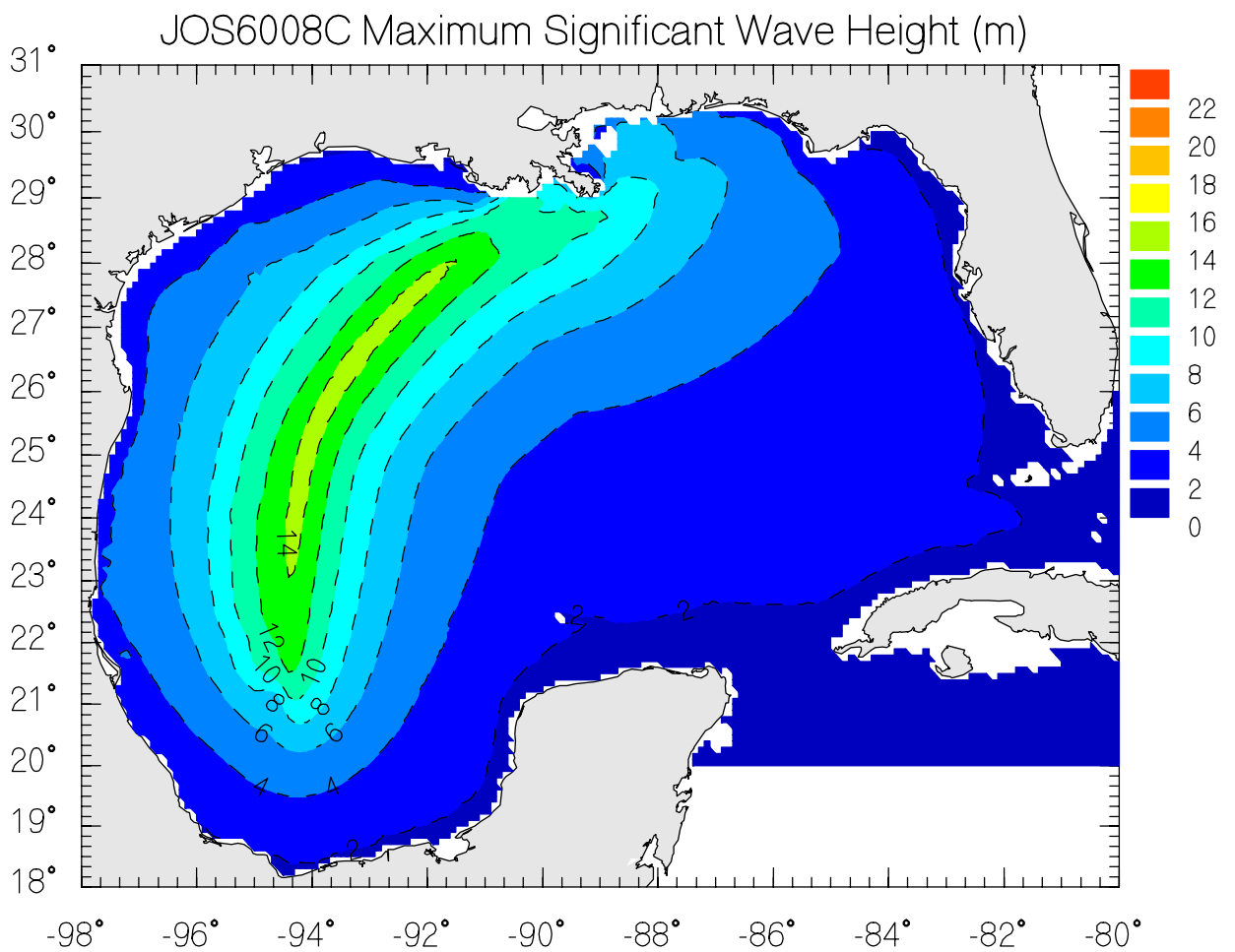
25
20
50
40
30
20

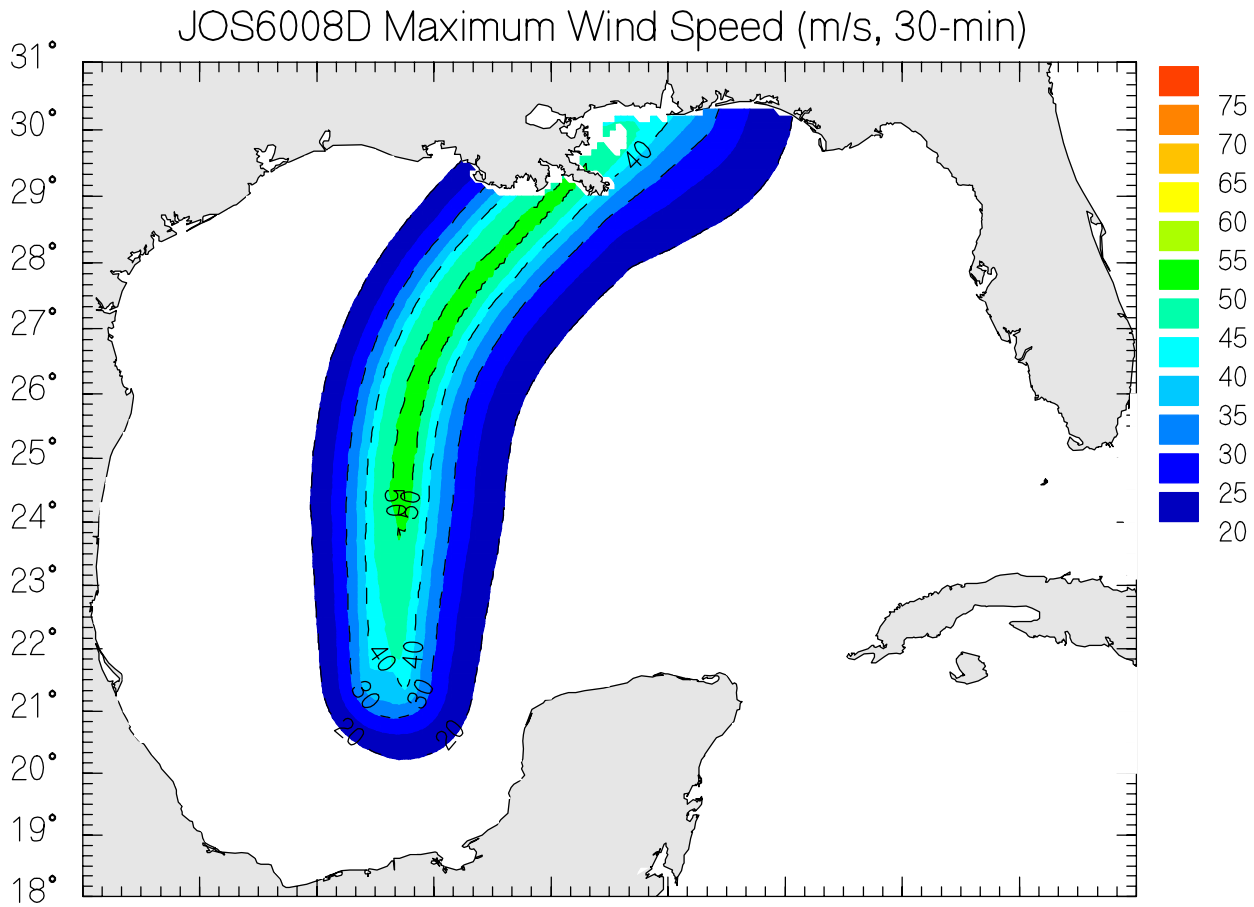

JOS6008A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
8
6
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°

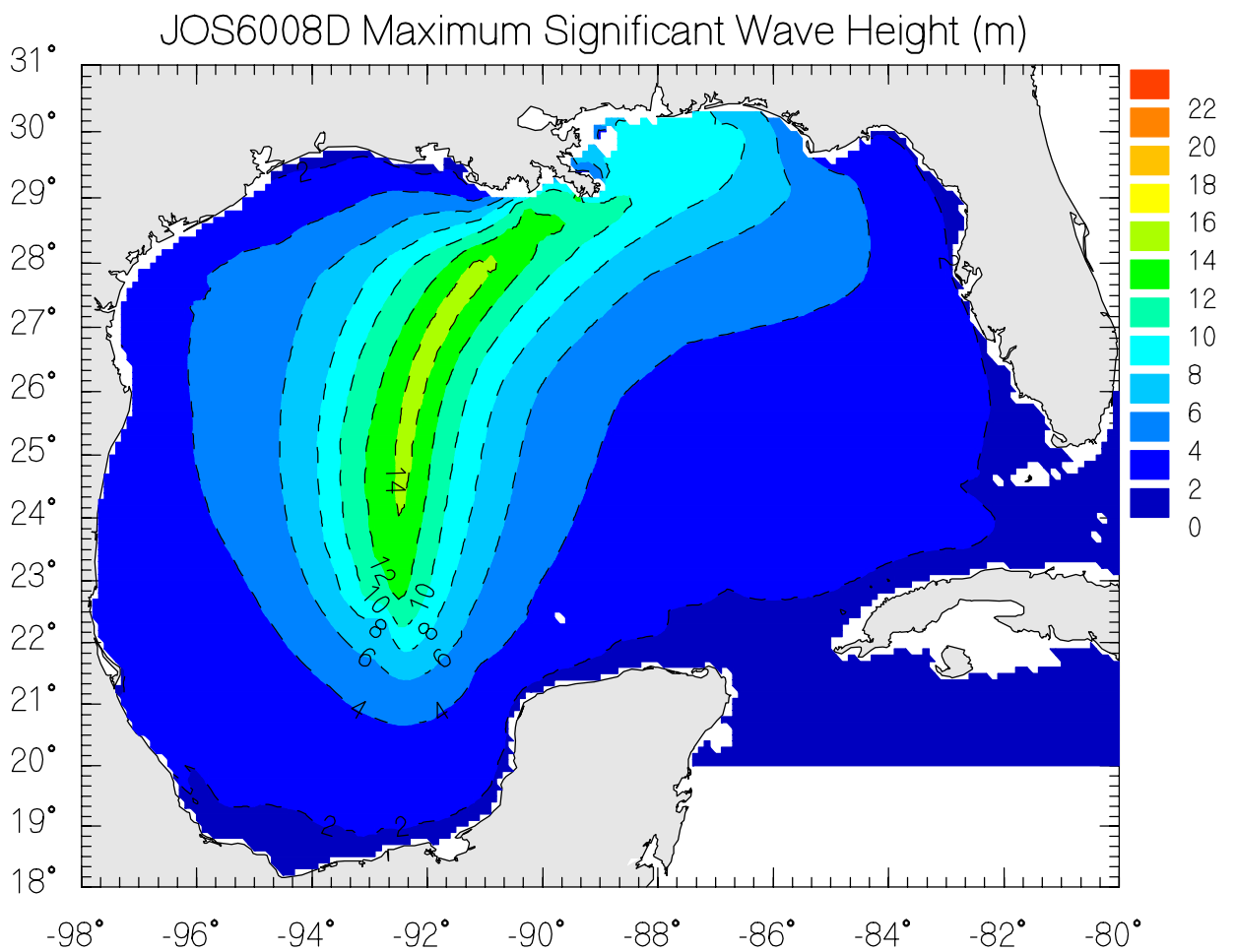

JOS6008B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
>50
40
30
20


JOS6008B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
>14
12
10
8
6
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6008C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
50
40
30
20


JOS6008C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
8
6
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6008D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6008D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
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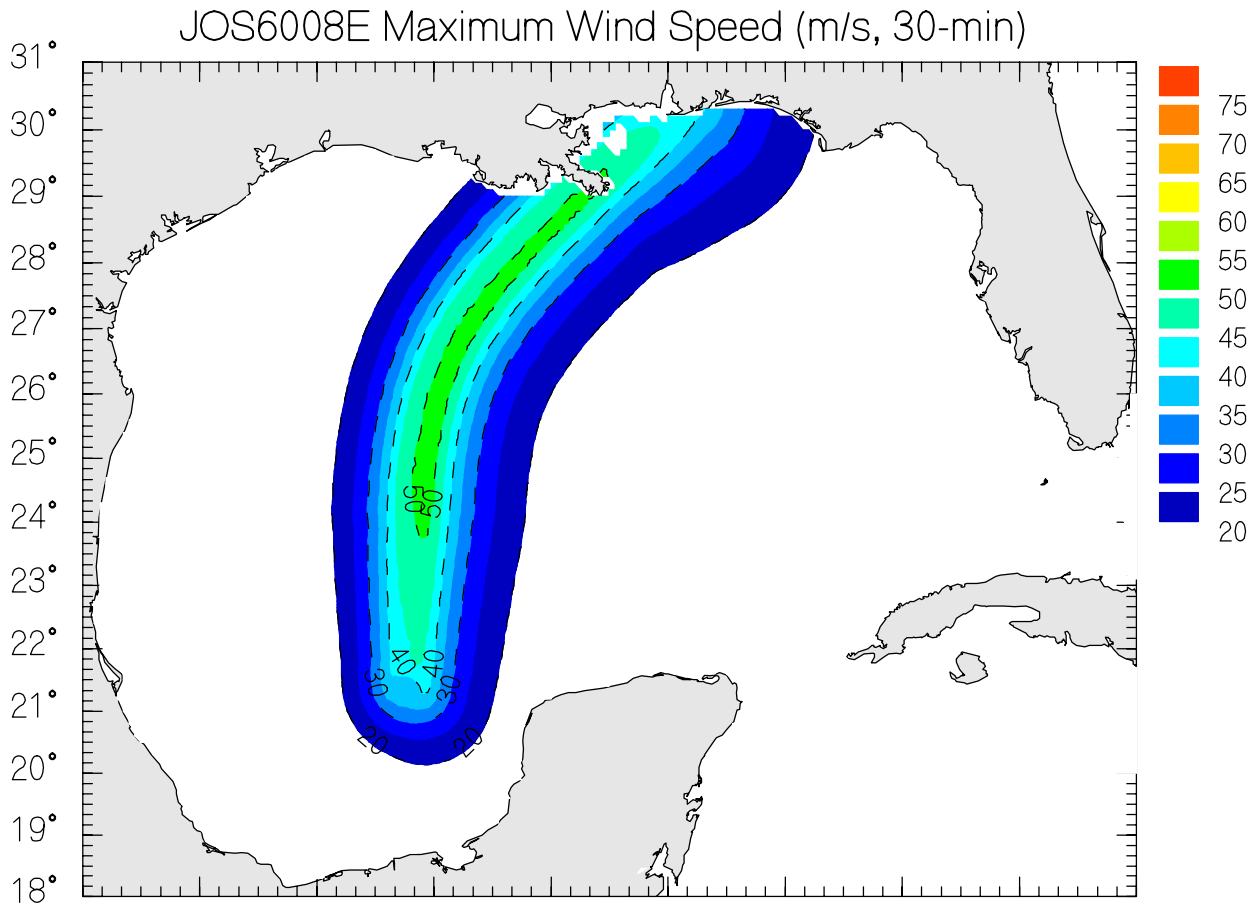
JOS6008E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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40
35
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25
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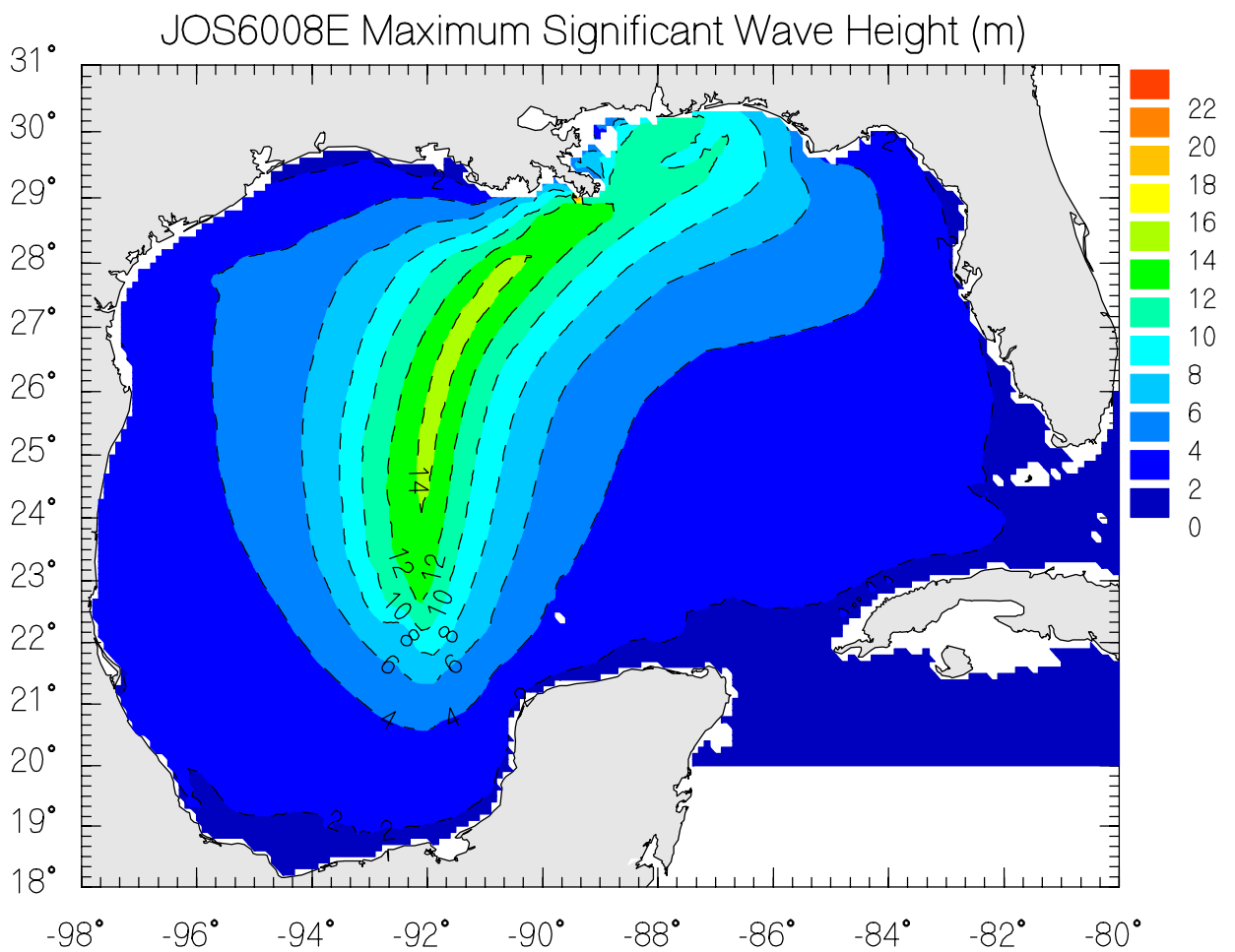
JOS6008E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
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-82°
-80°
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6
4
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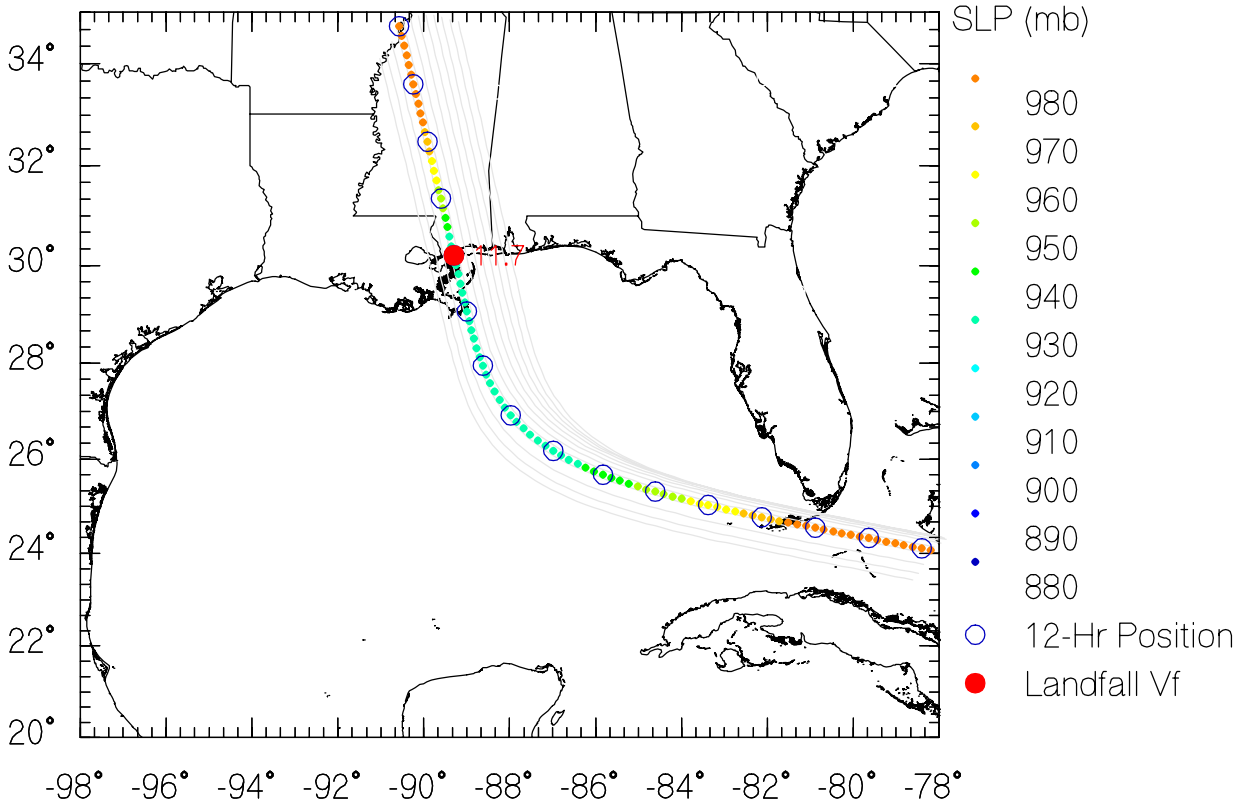
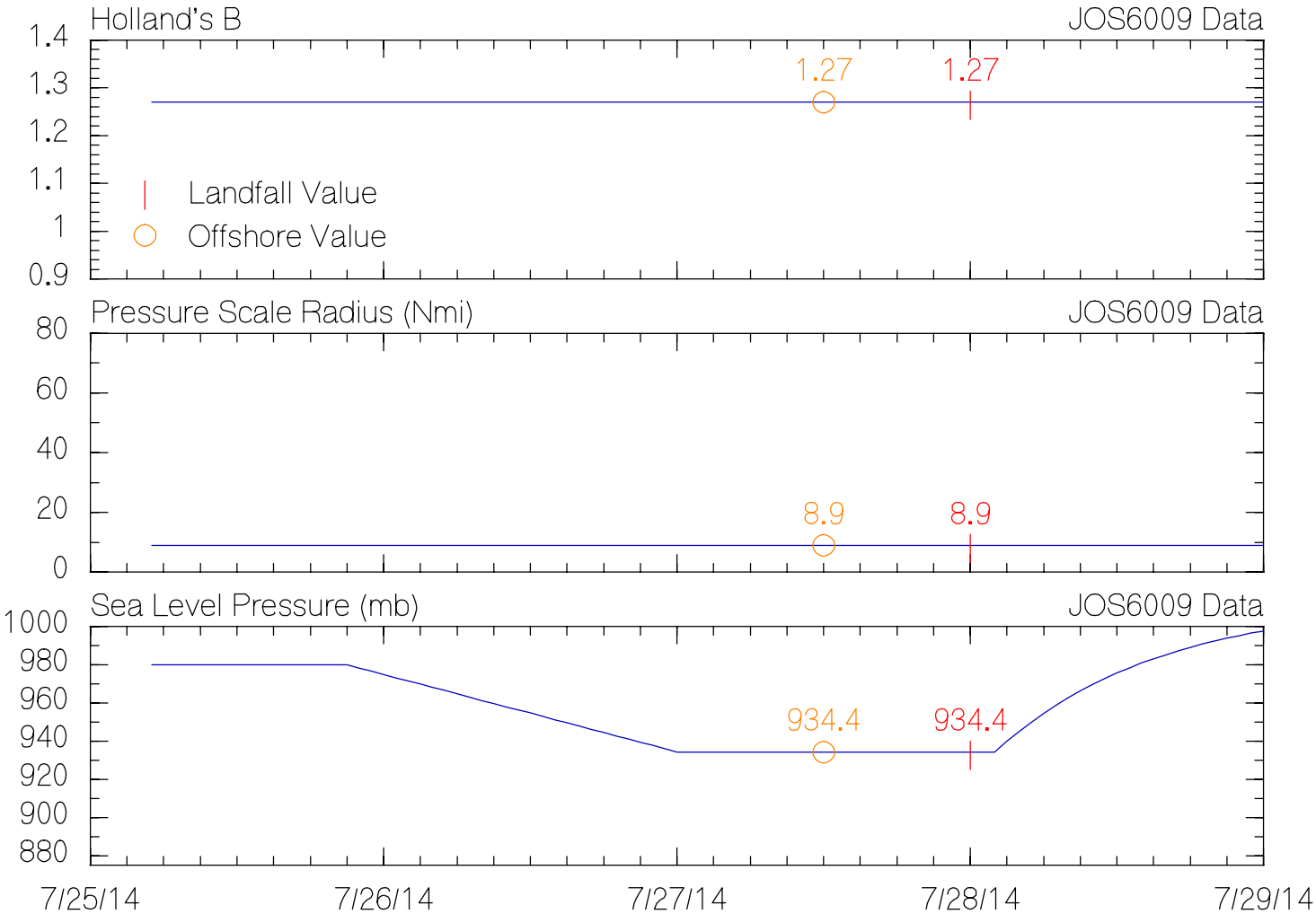
0

JOS6009 Data

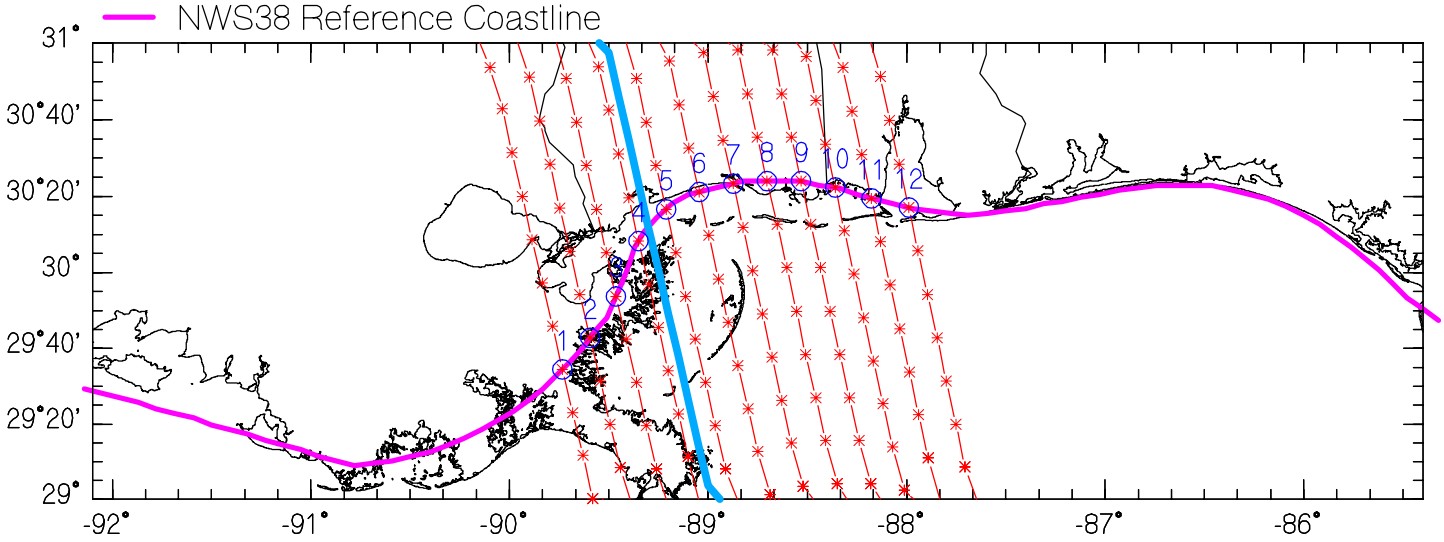


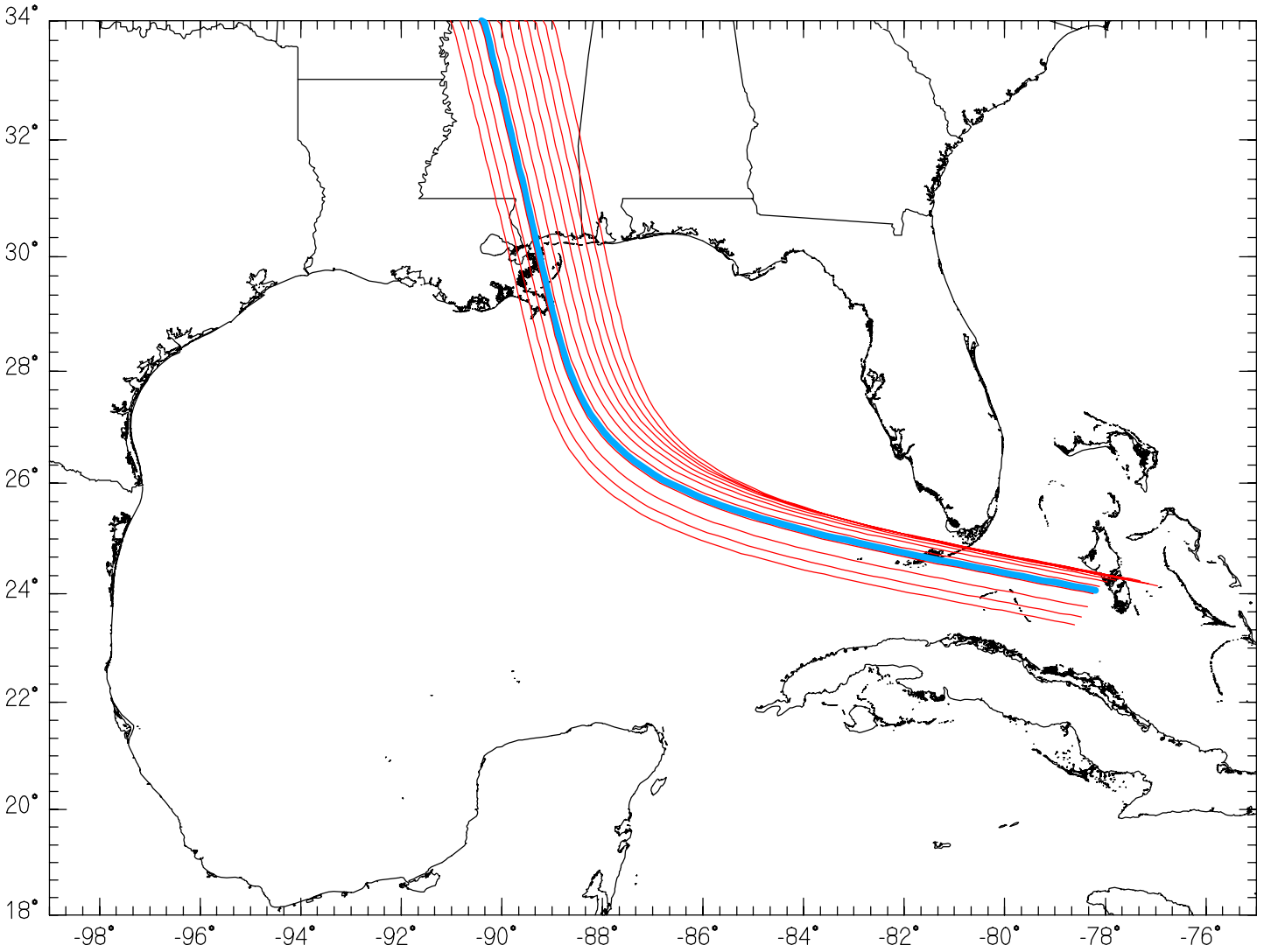


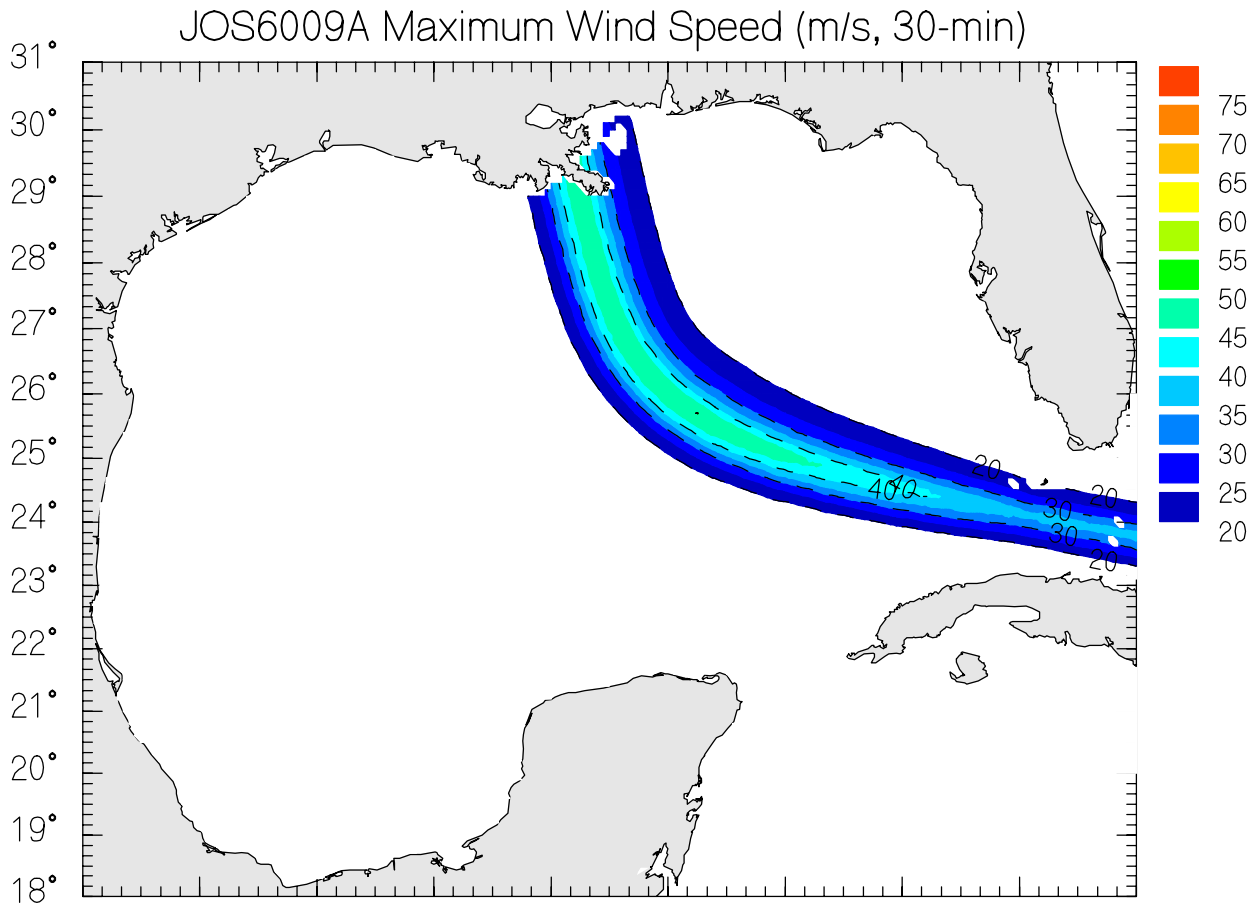
URS JPM-OS6 Production Tracks

JOS6009 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6009A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
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50
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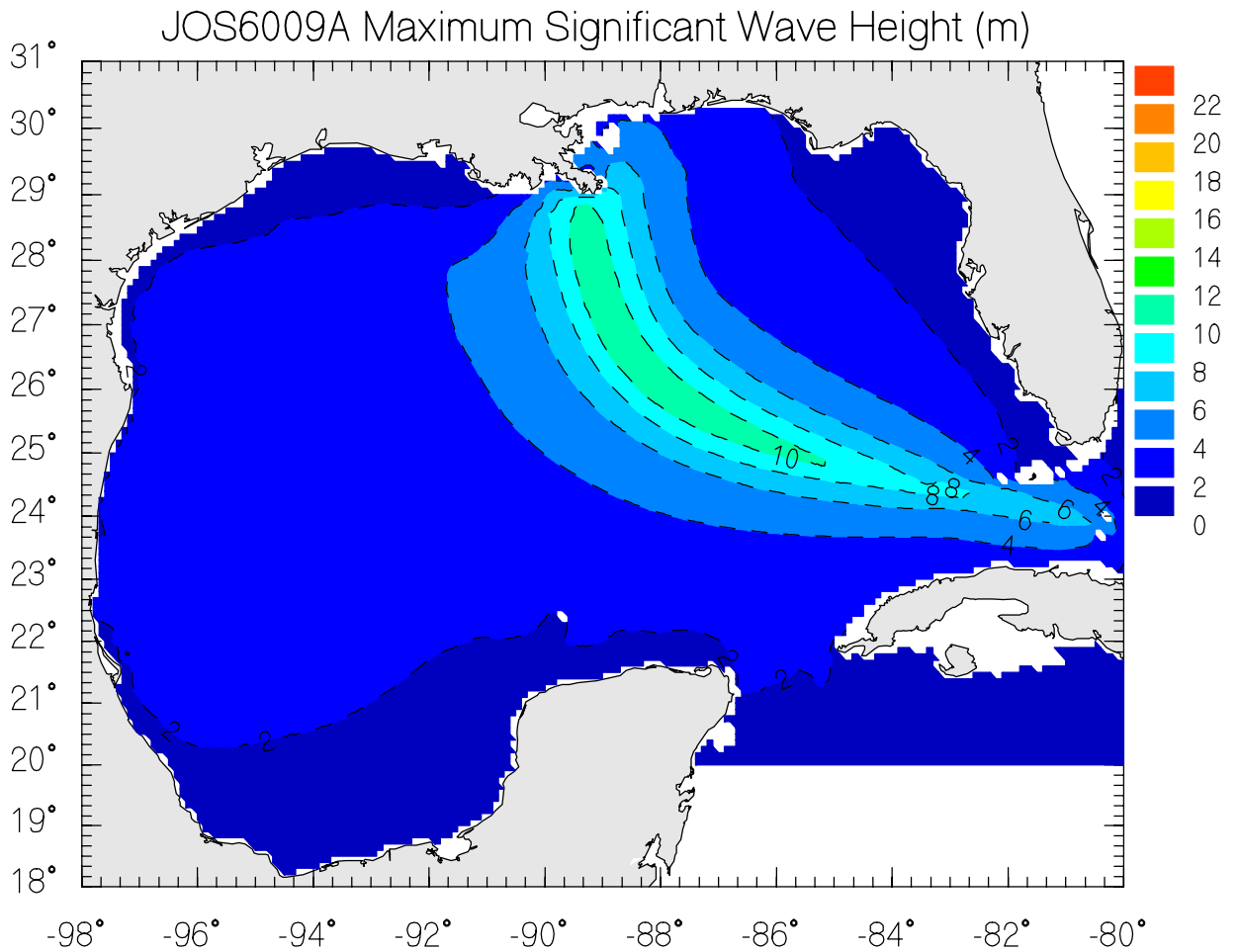
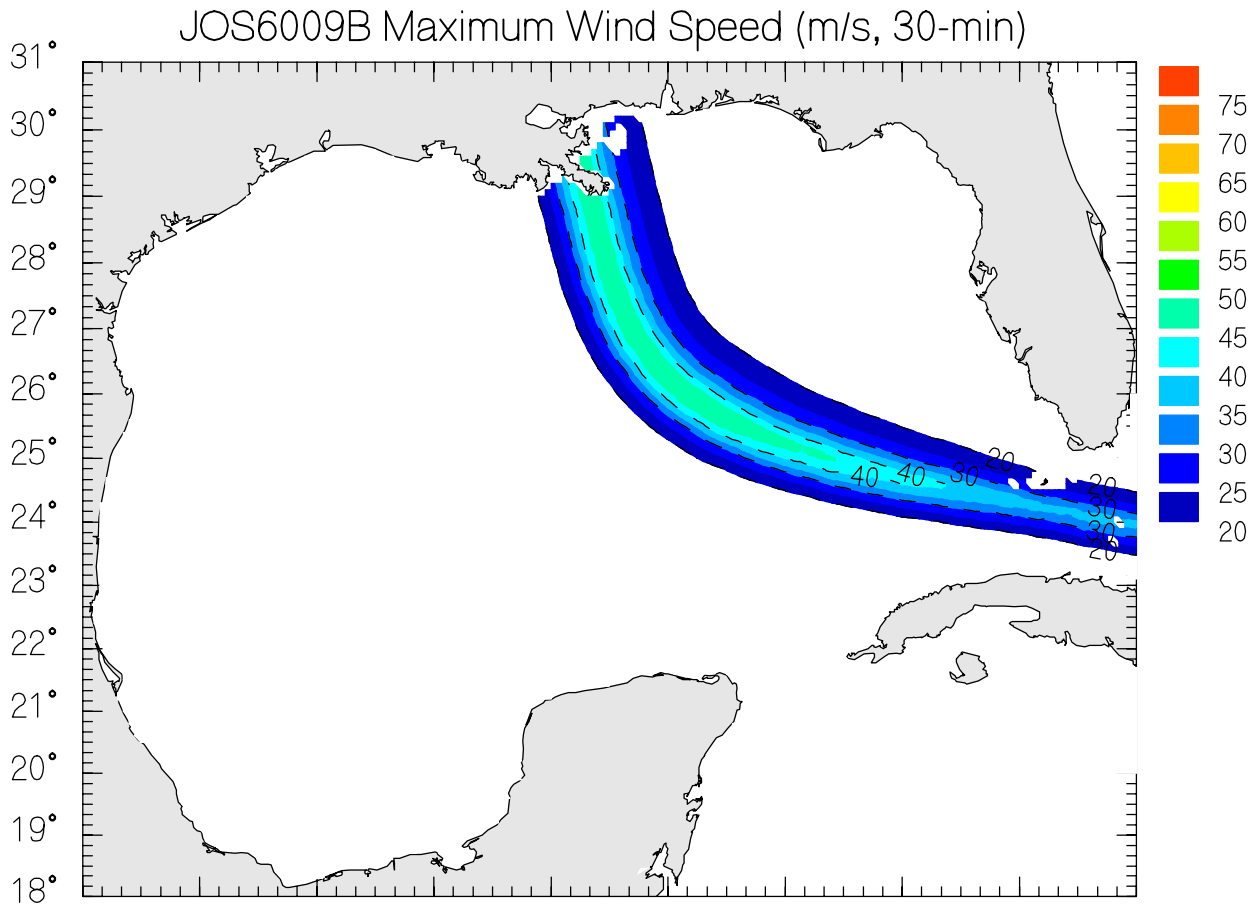
40
35
30
25
20
40
30
20


JOS6009A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0
10
8
6
4
2


JOS6009B Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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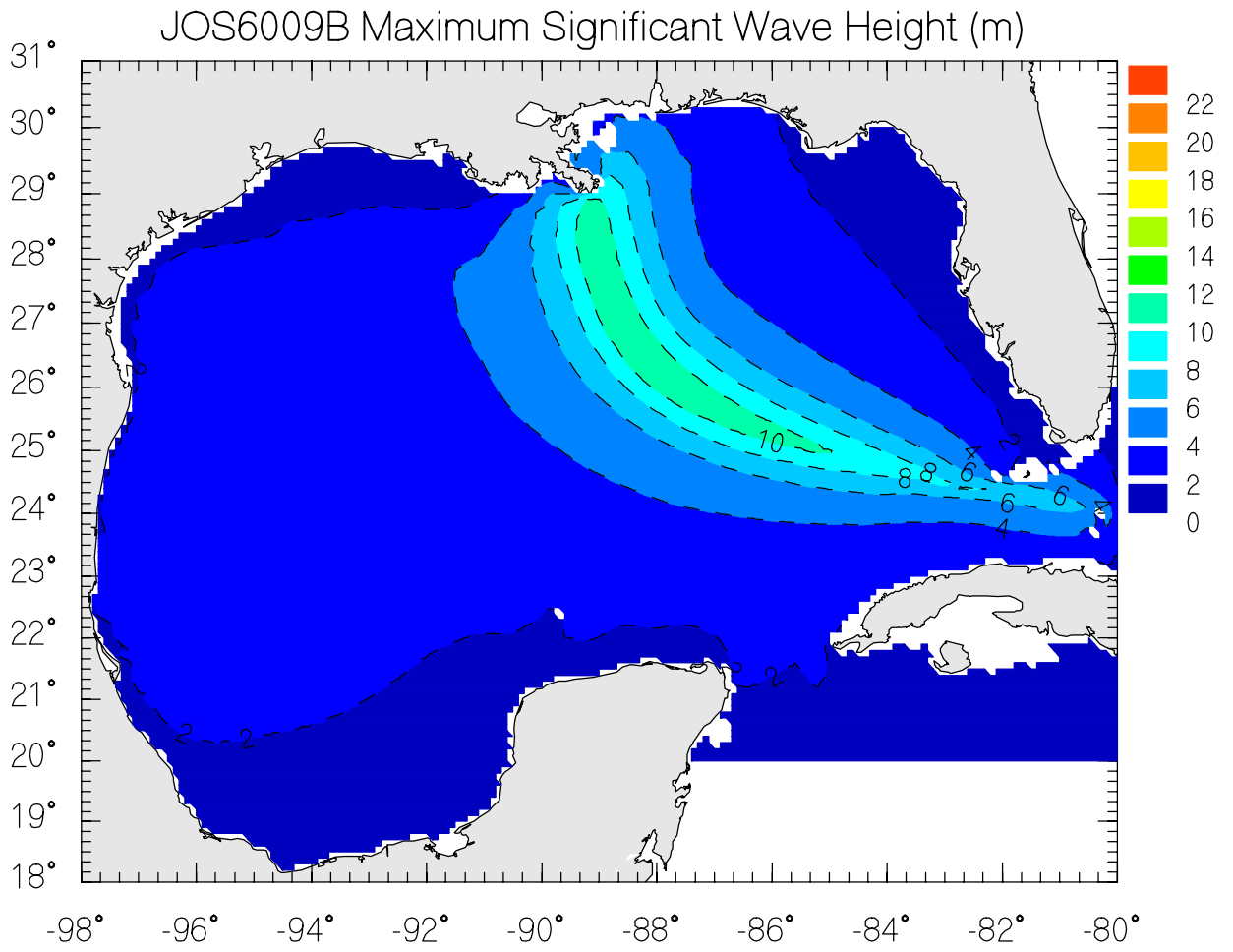
30
20
30
30
30
20


JOS6009B Maximum Significant Wave Height (m)
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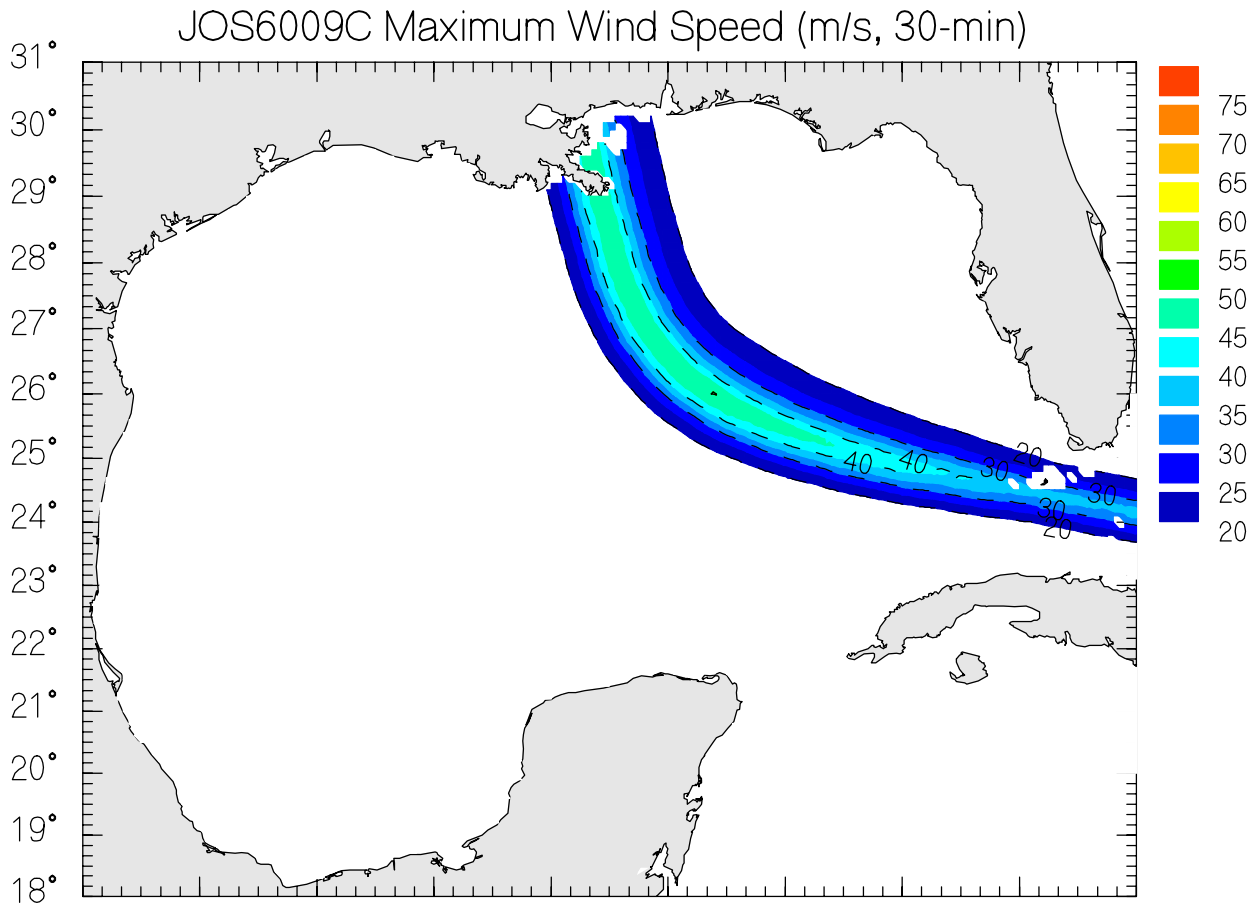
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
10
8
8
6
6
6
4
4
4
2
2
2
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6009C Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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60
55
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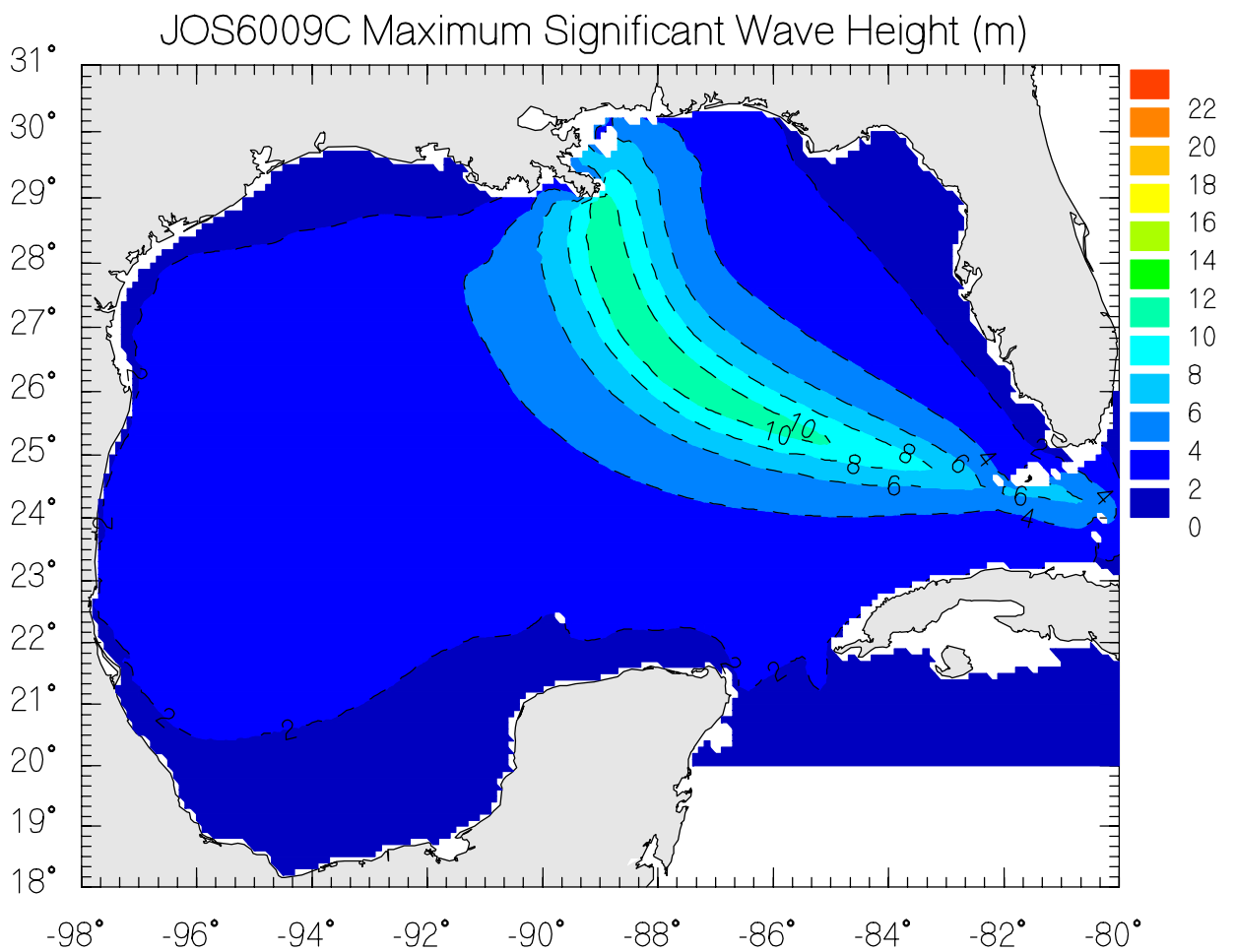
30
30
20


JOS6009C Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
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6
6
6
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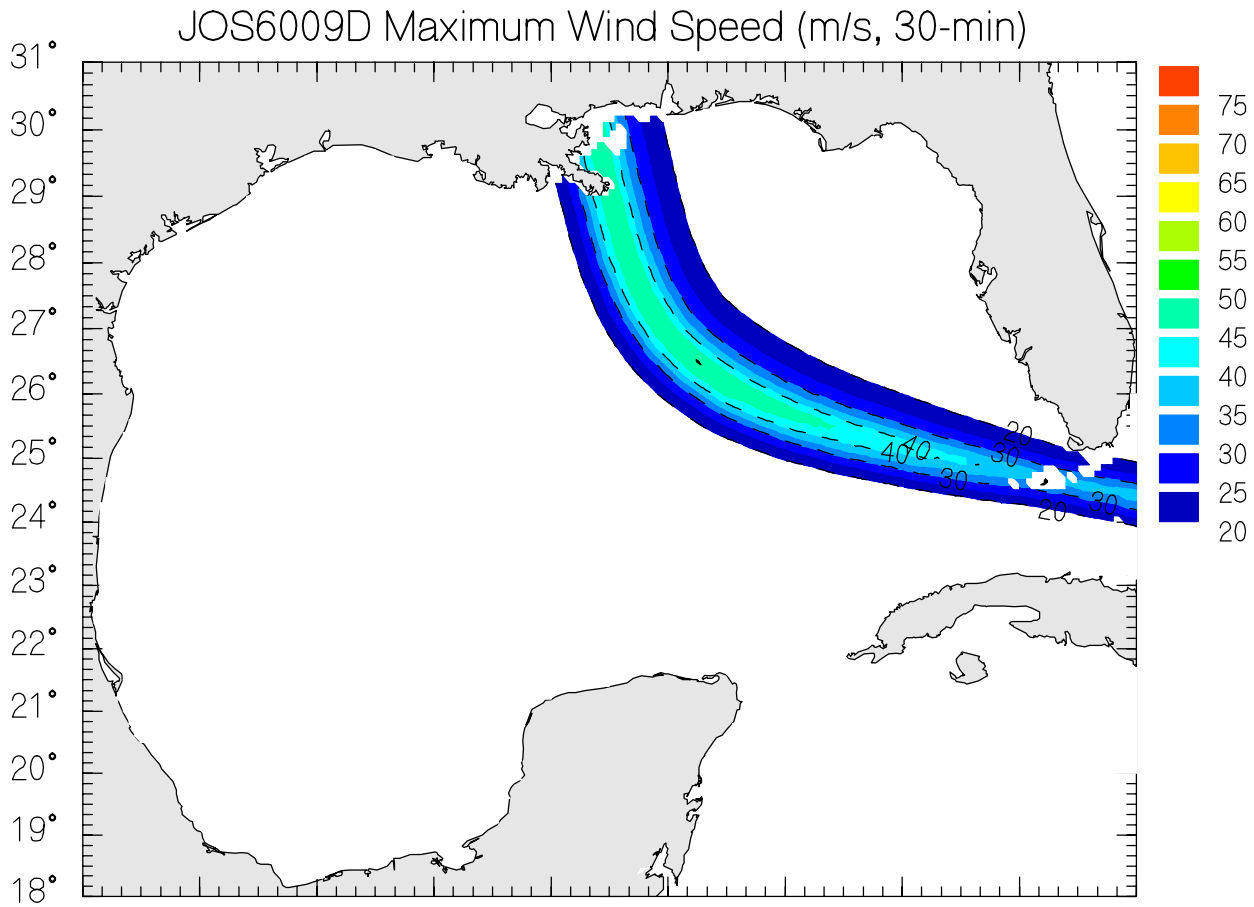
2
2
2
2


JOS6009D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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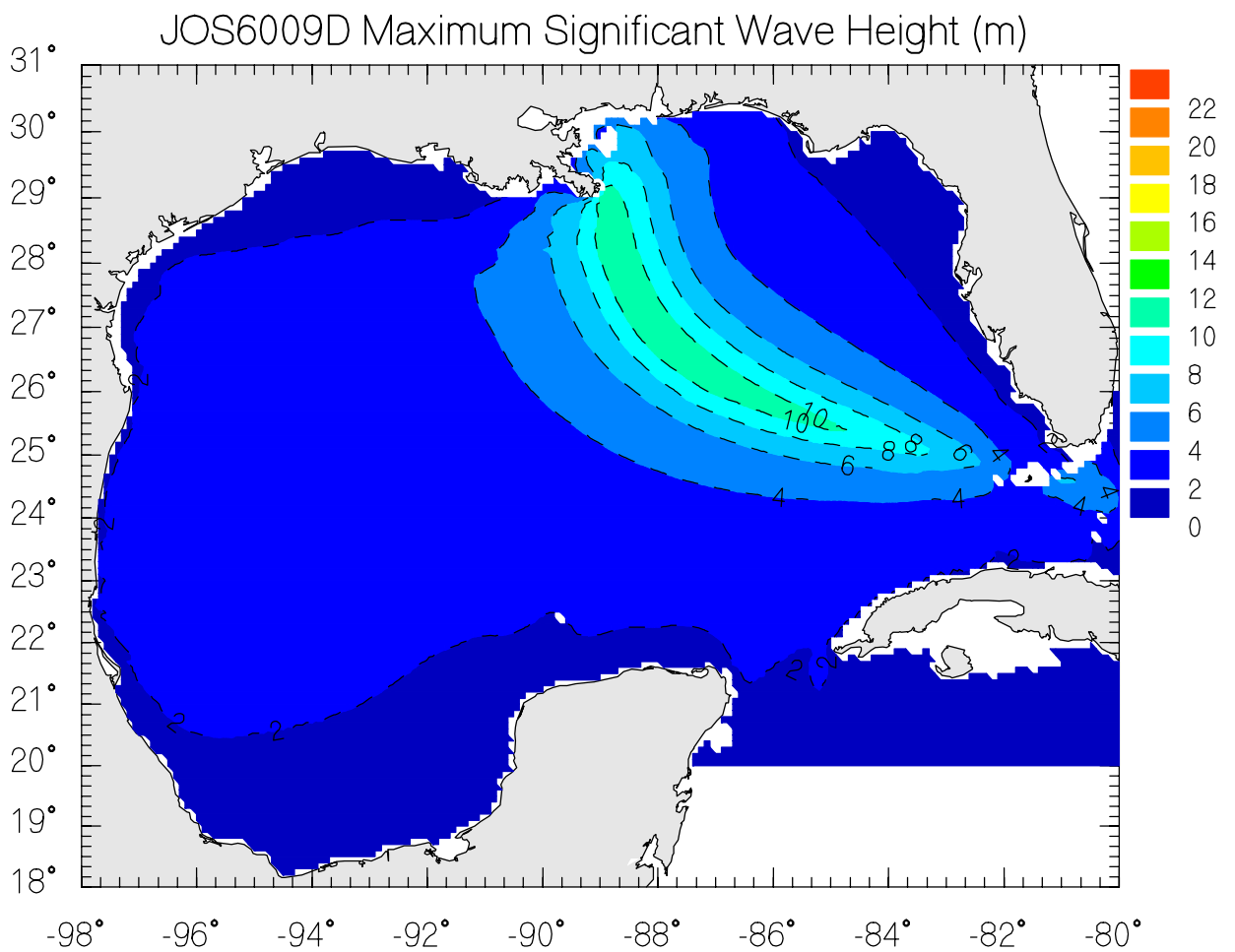
40
35
30
25
20


JOS6009D Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
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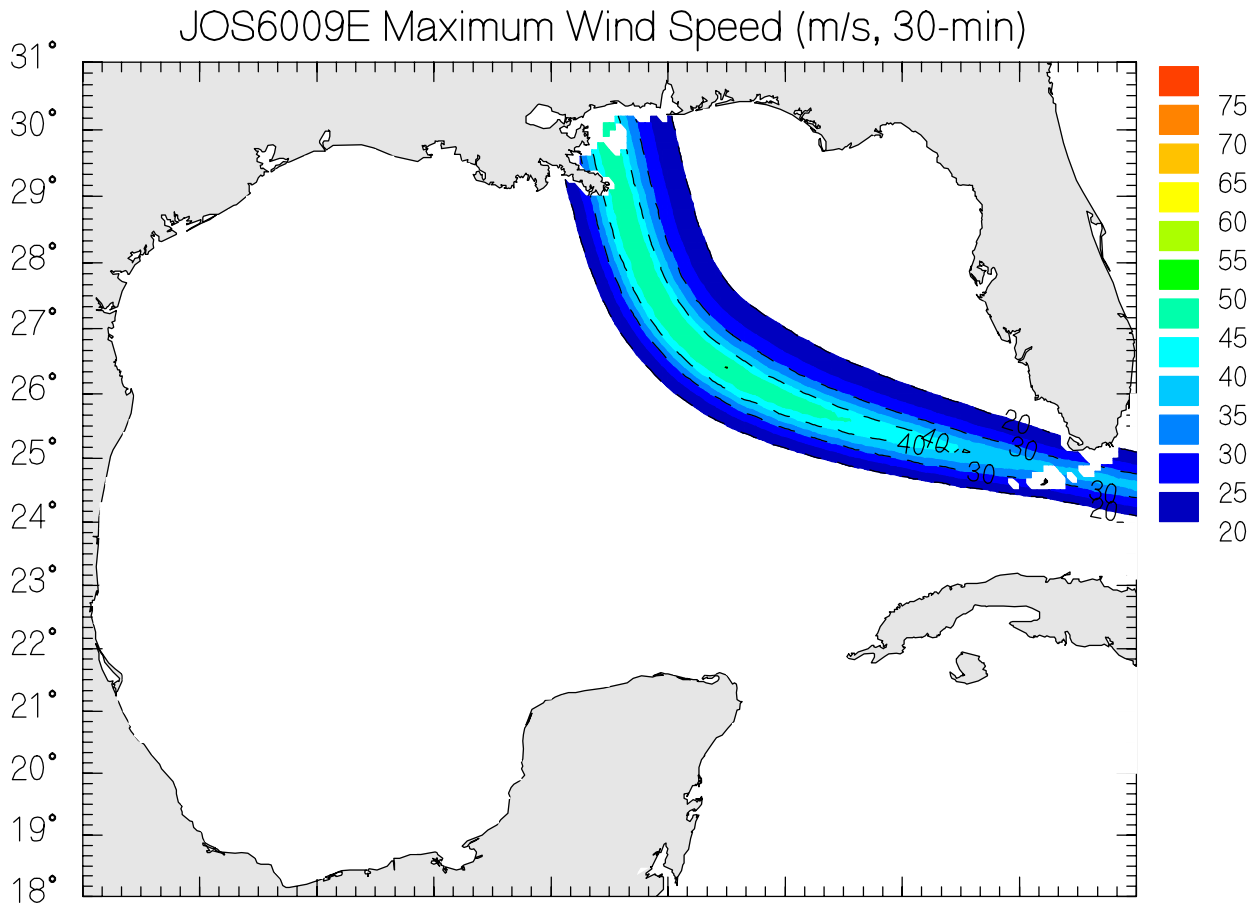
JOS6009E Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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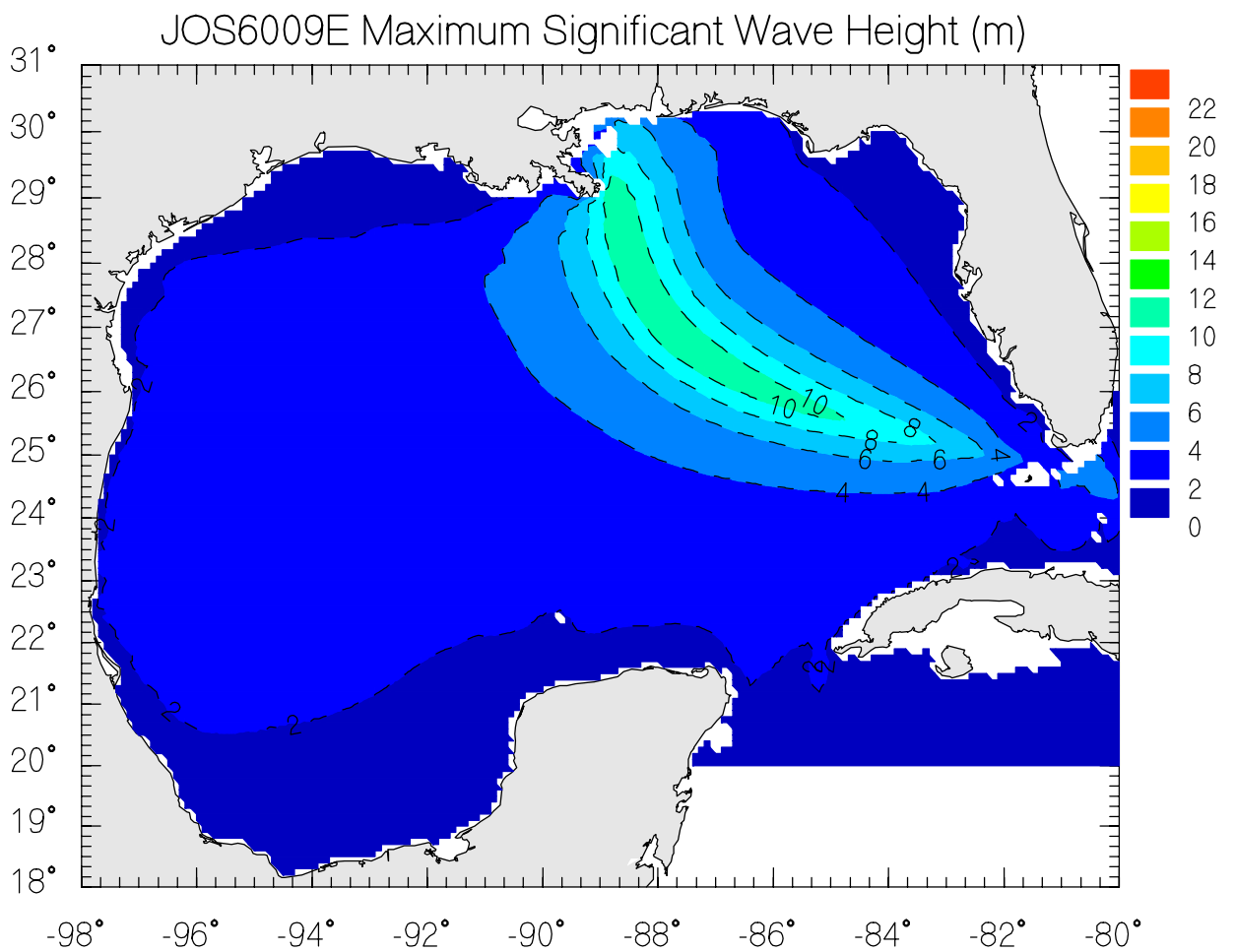
40
35
30
25
20


JOS6009E Maximum Significant Wave Height (m)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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22
20
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14
12
10
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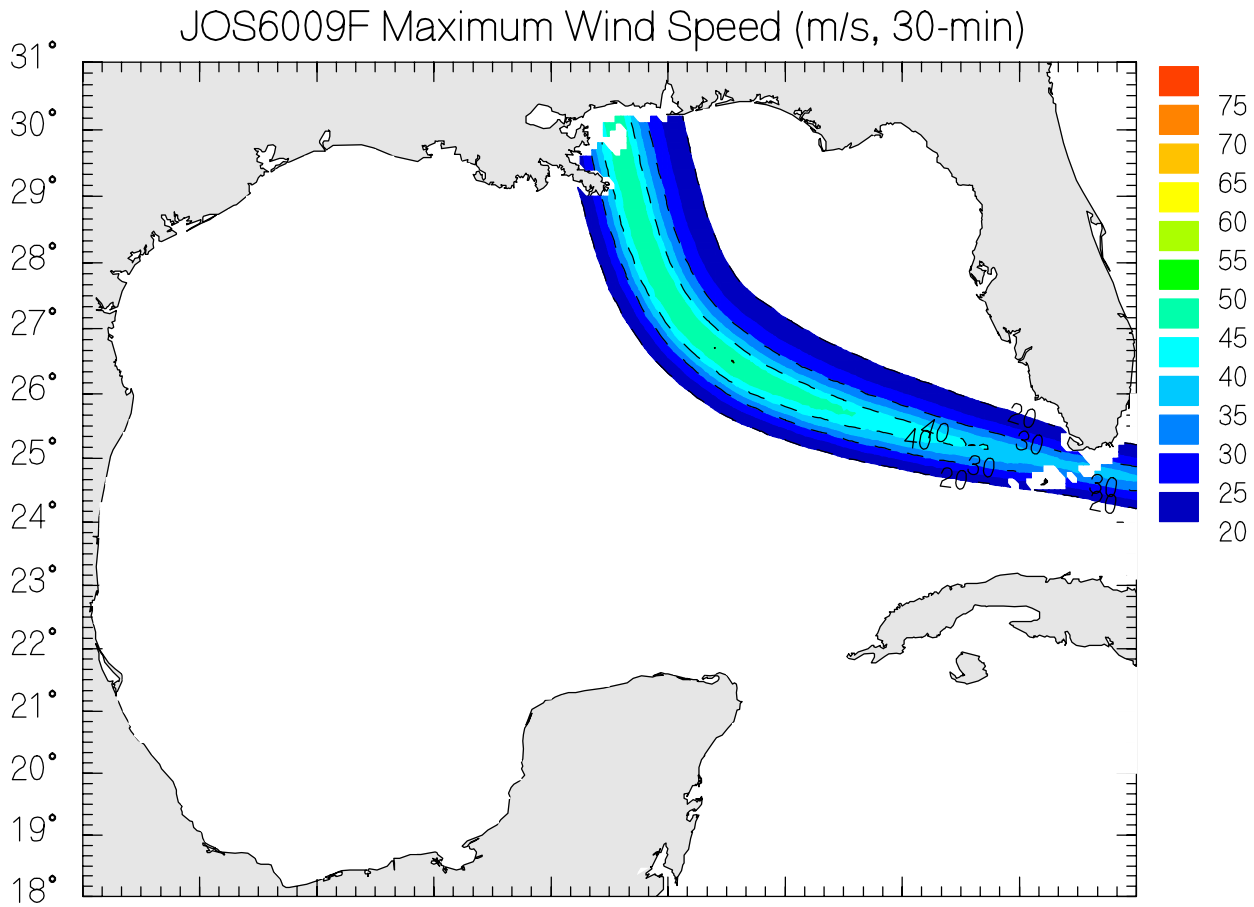
6
4
2
0


JOS6009F Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
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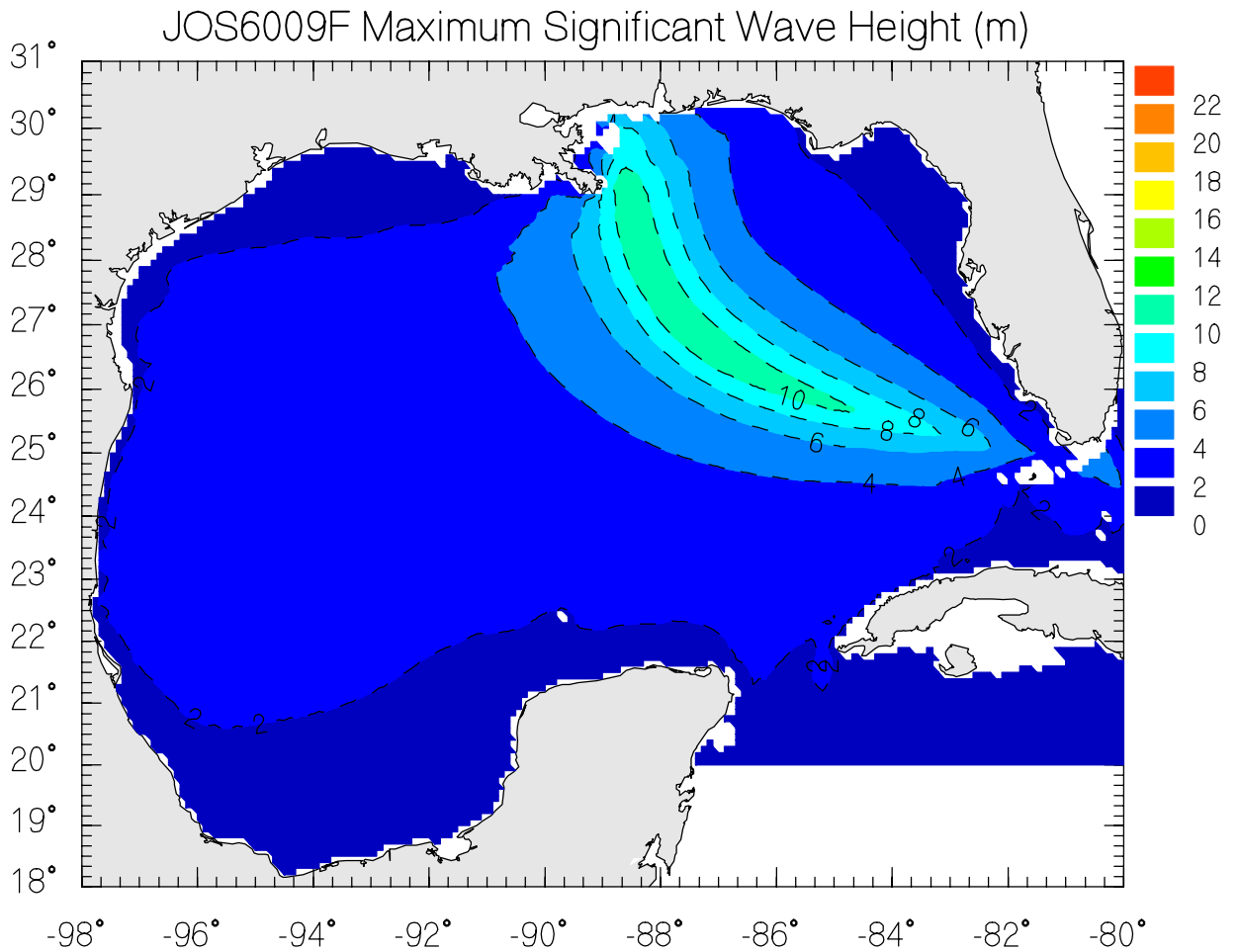
25
20
40
30
20


JOS6009F Maximum Significant Wave Height (m)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
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-88°
-86°
-84°
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-80°
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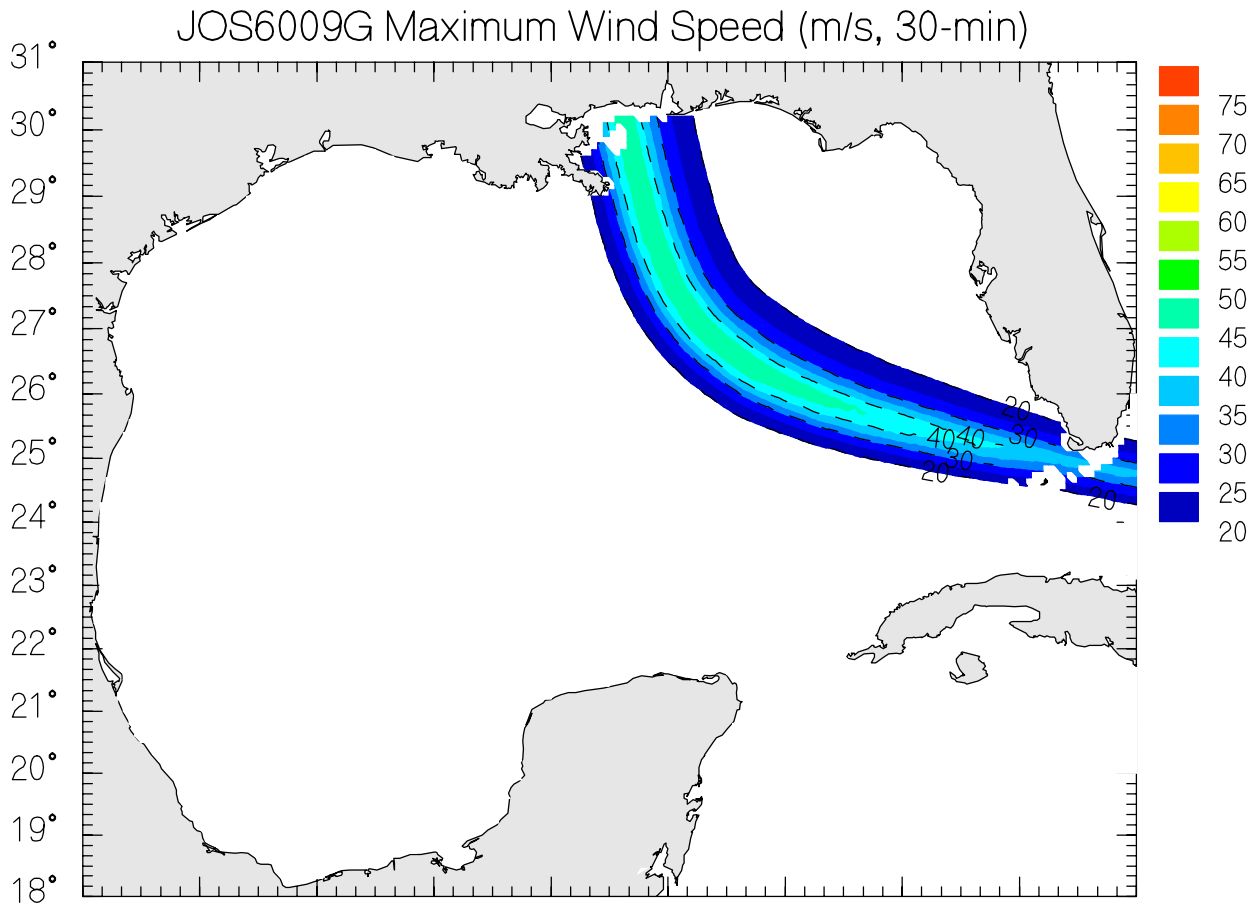
8
6
4
2


JOS6009G Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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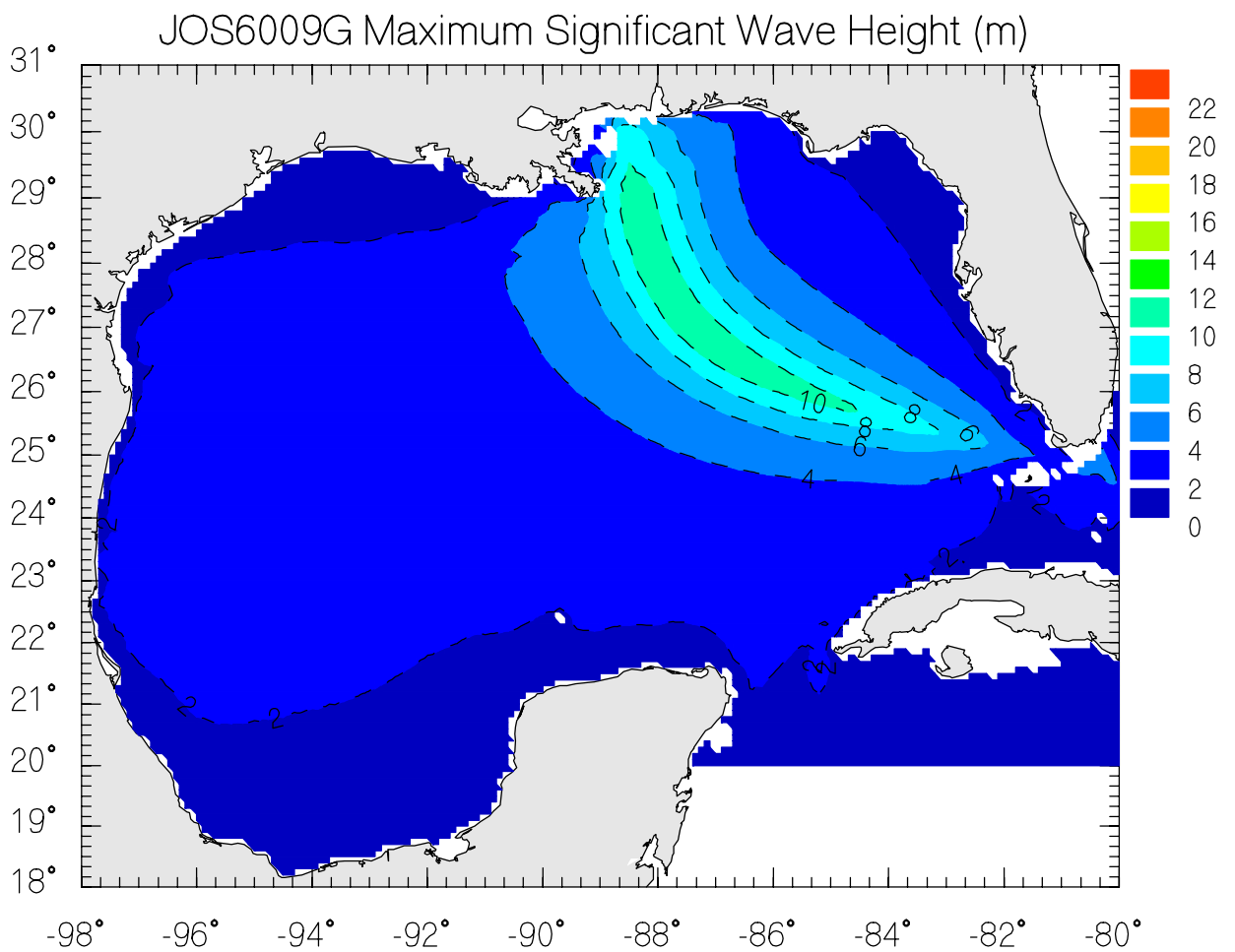
60
55
50
45
40
35
30
25
20


JOS6009G Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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22
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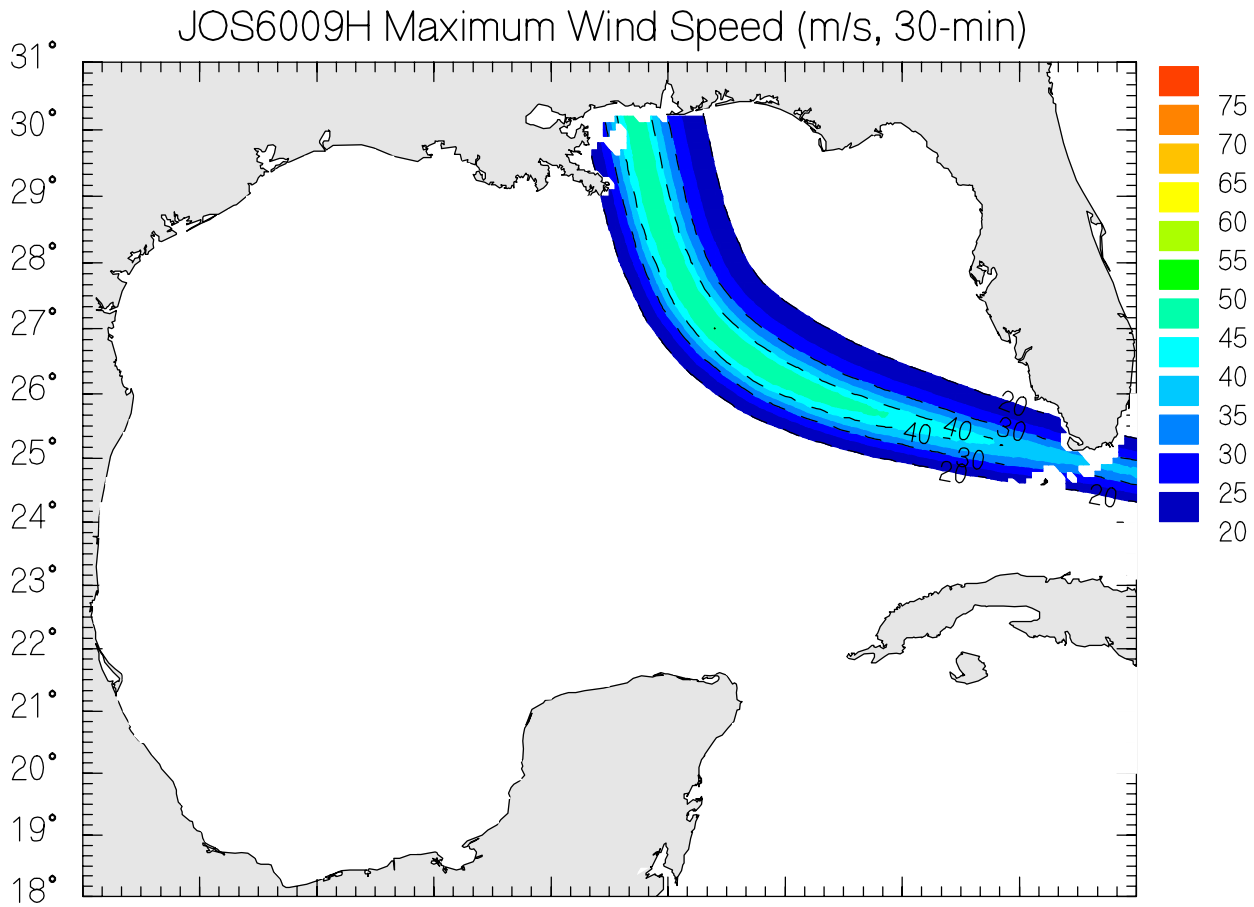
JOS6009H Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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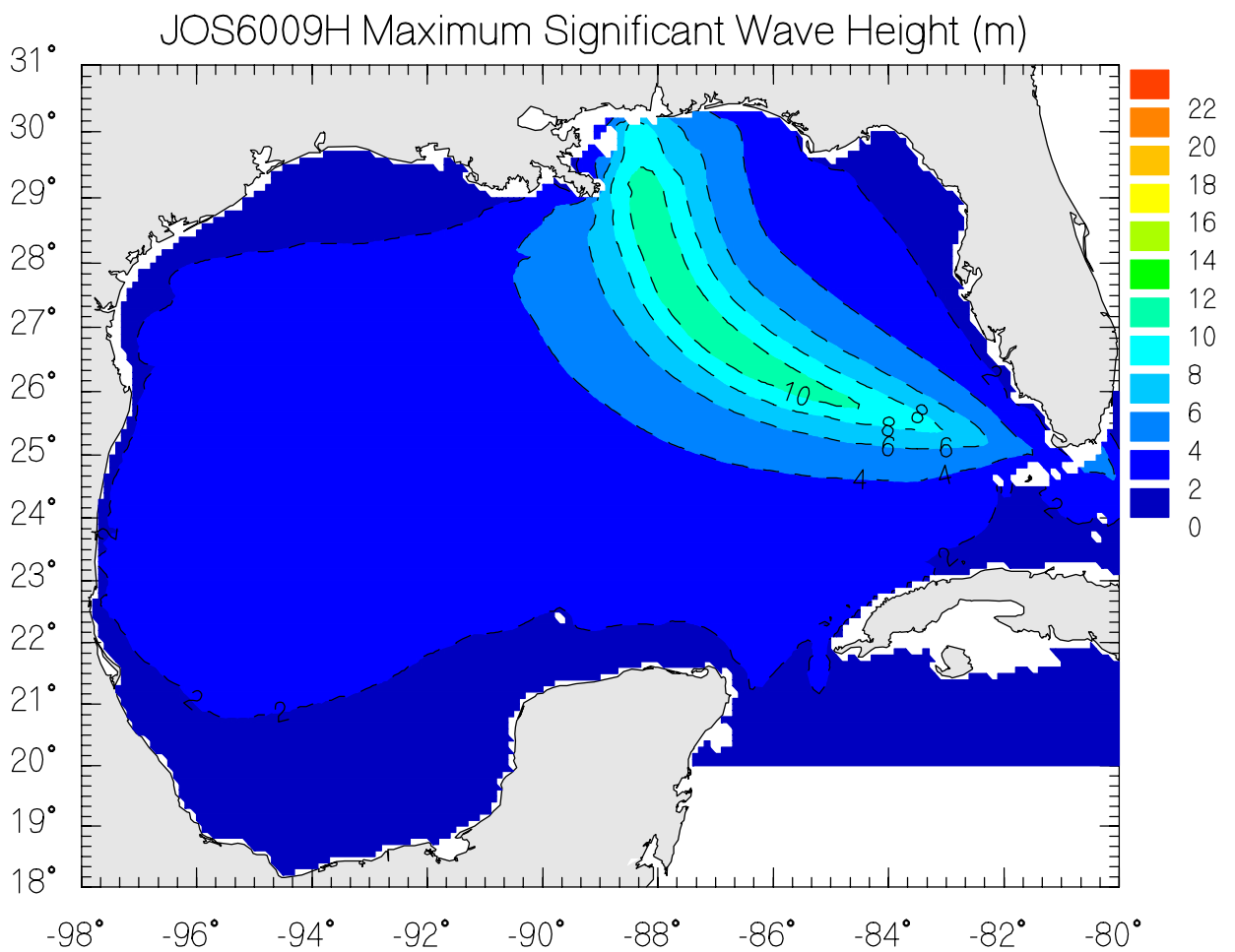
JOS6009H Maximum Significant Wave Height (m)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
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-88°
-86°
-84°
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-80°
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12
10
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4
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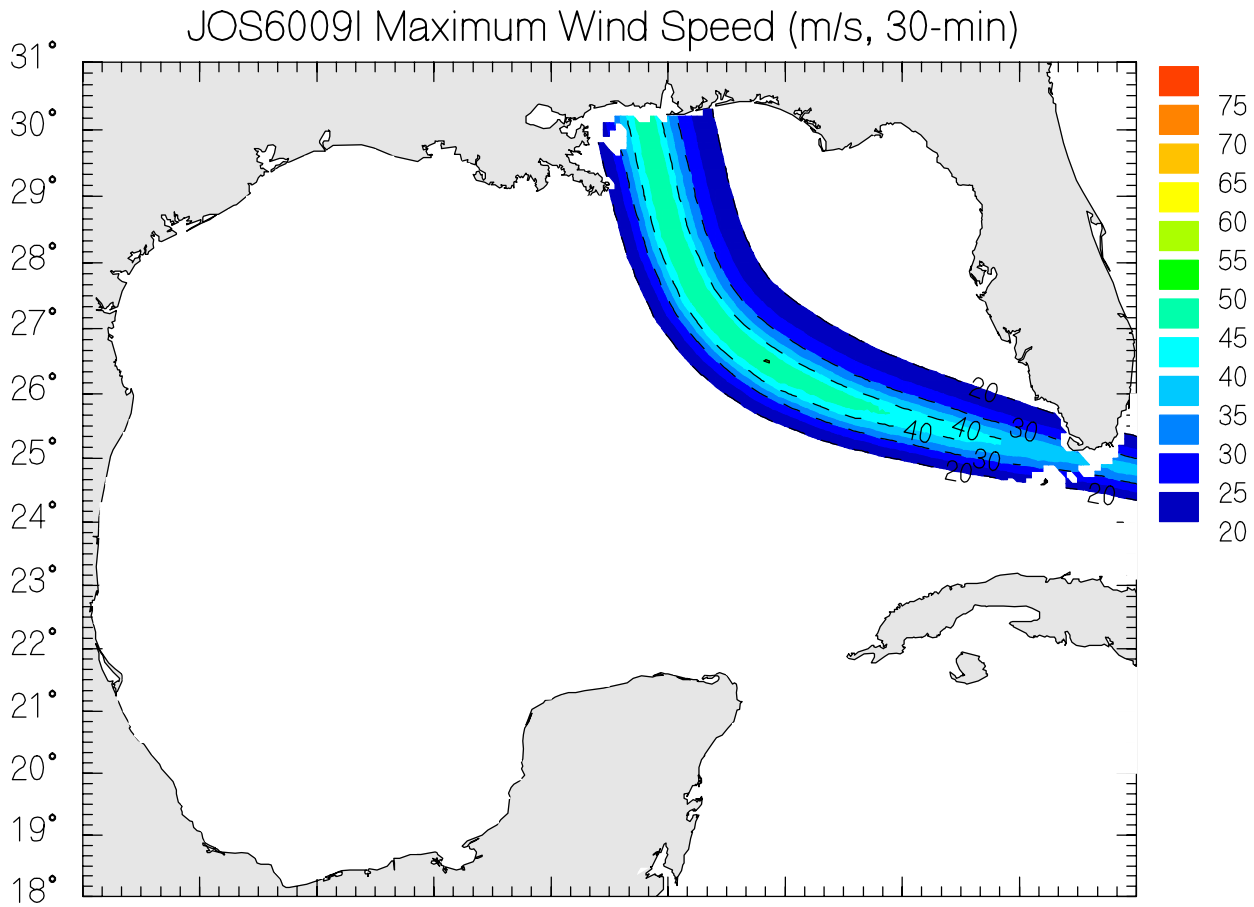
4
2


JOS6009I Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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60
55
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45
40
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30
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20
20
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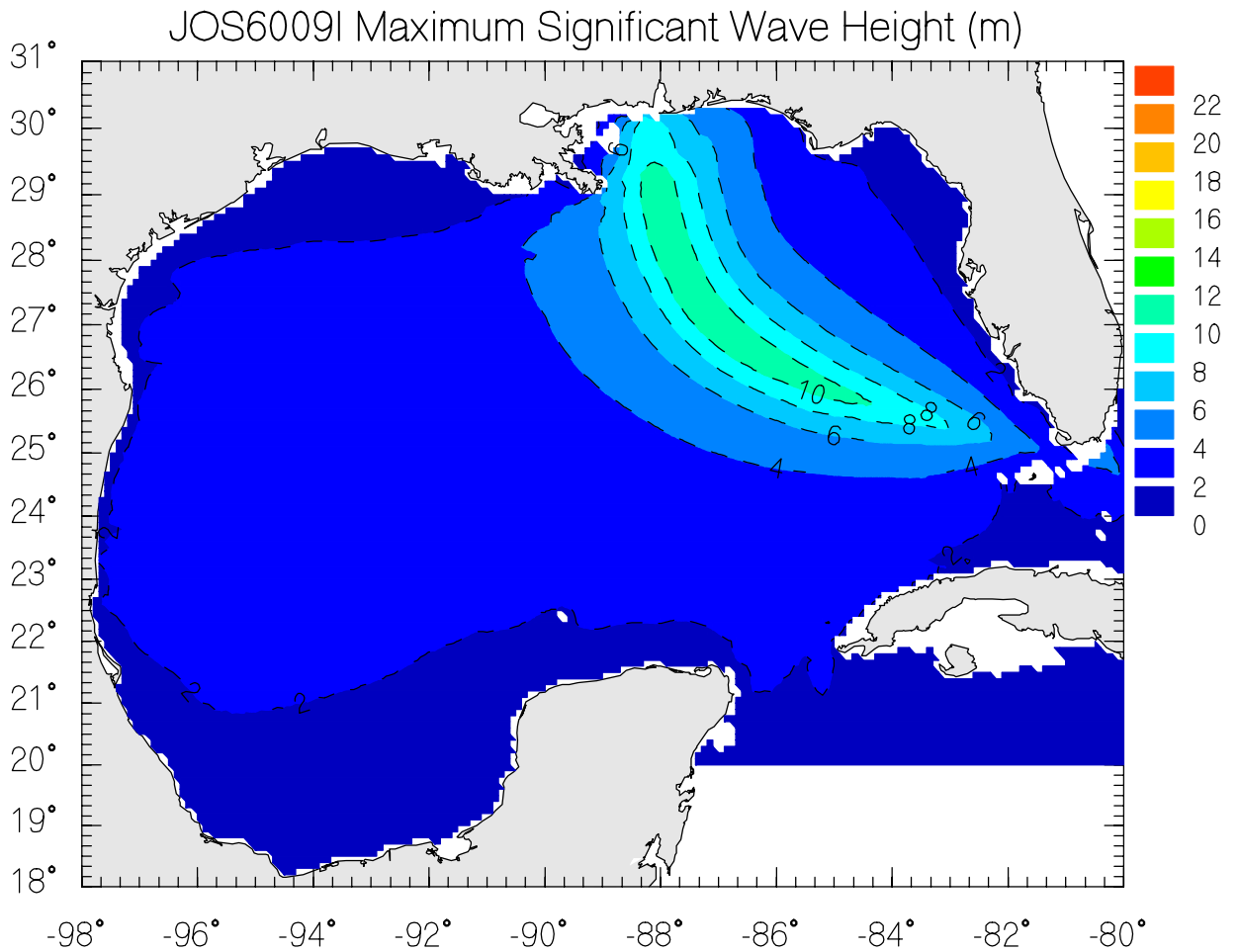
40
30
30
20
20


JOS6009I Maximum Significant Wave Height (m)
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28°
27°
26°
25°
24°
23°
22°
21°
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18°
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22
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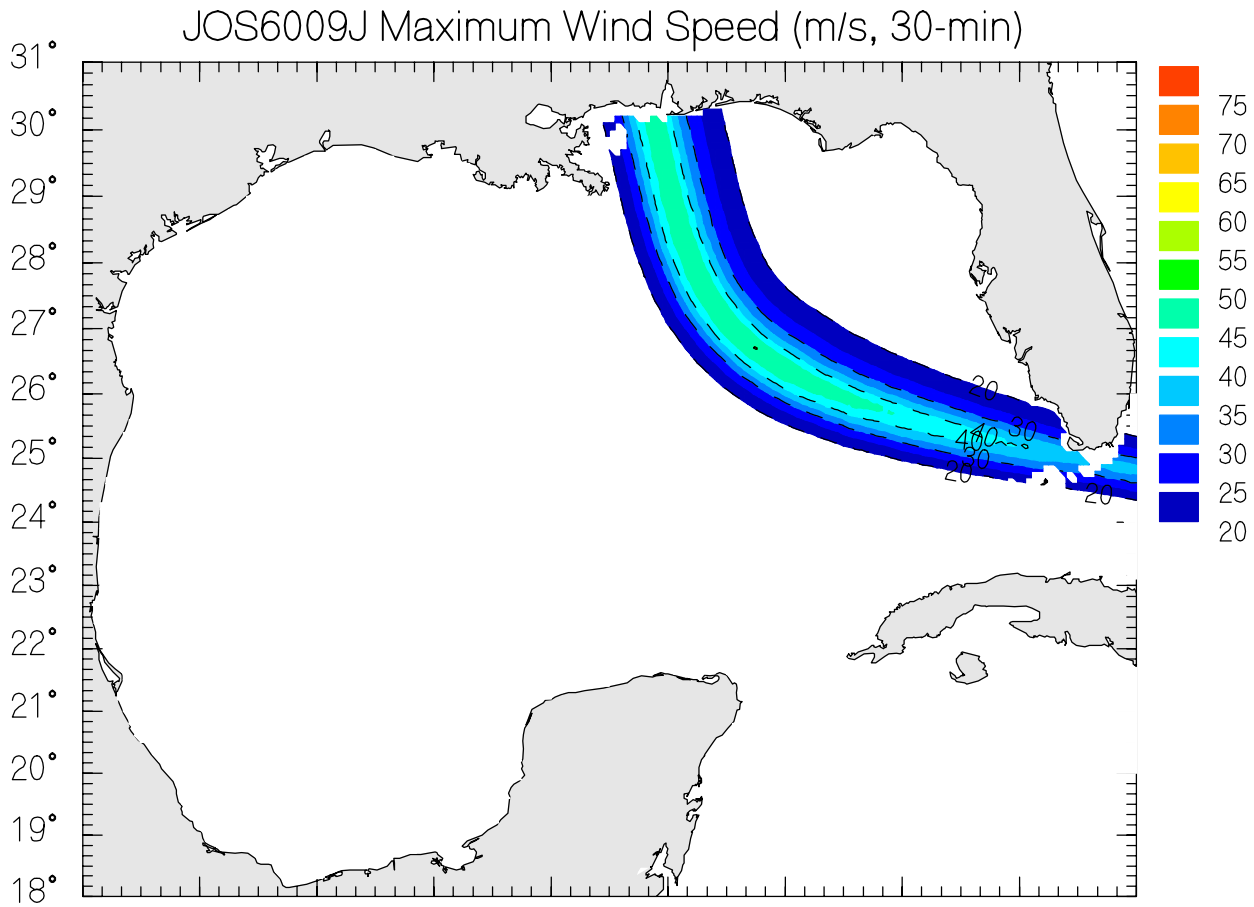
2


JOS6009J Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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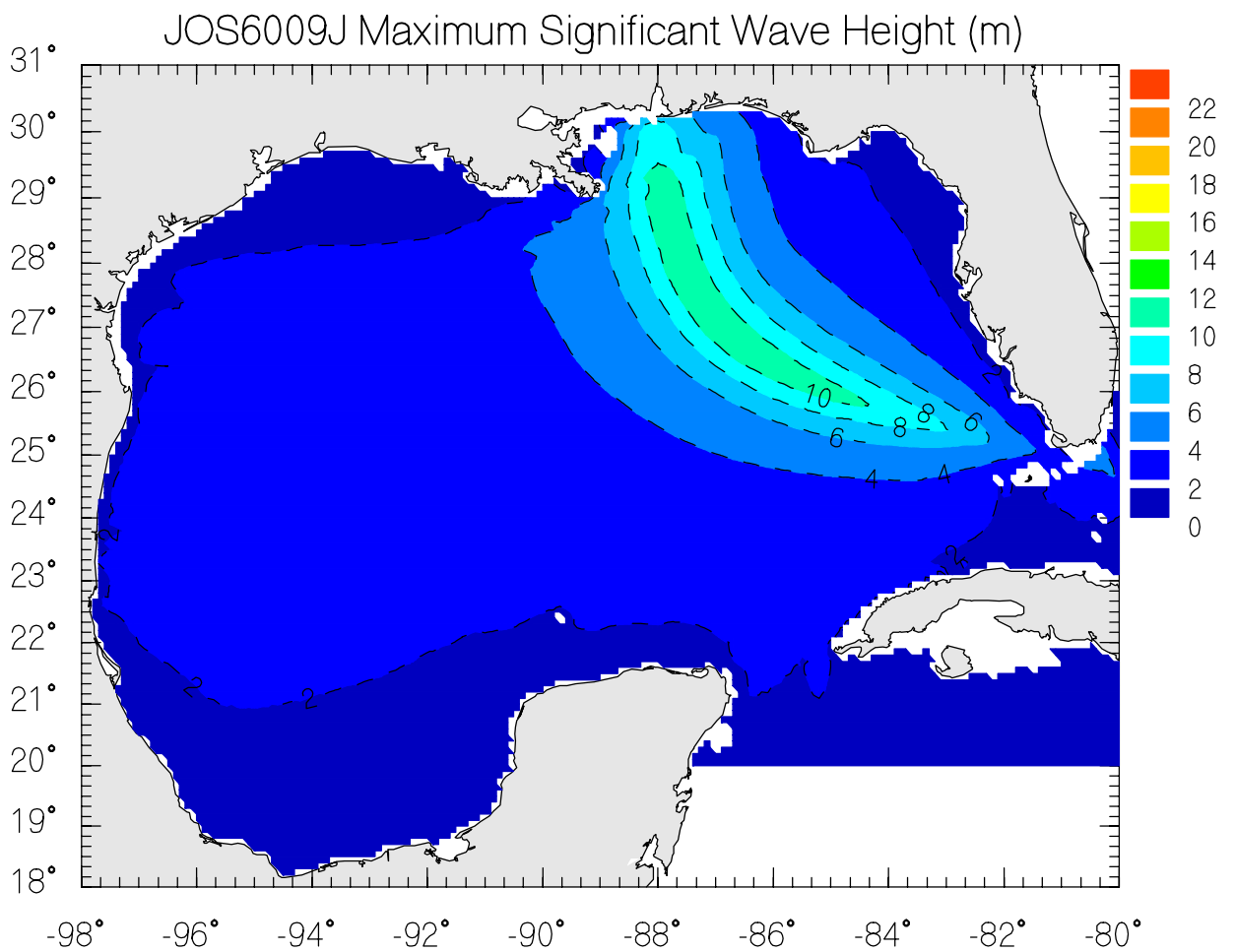
25
20


JOS6009J Maximum Significant Wave Height (m)
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28°
27°
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23°
22°
21°
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19°
18°
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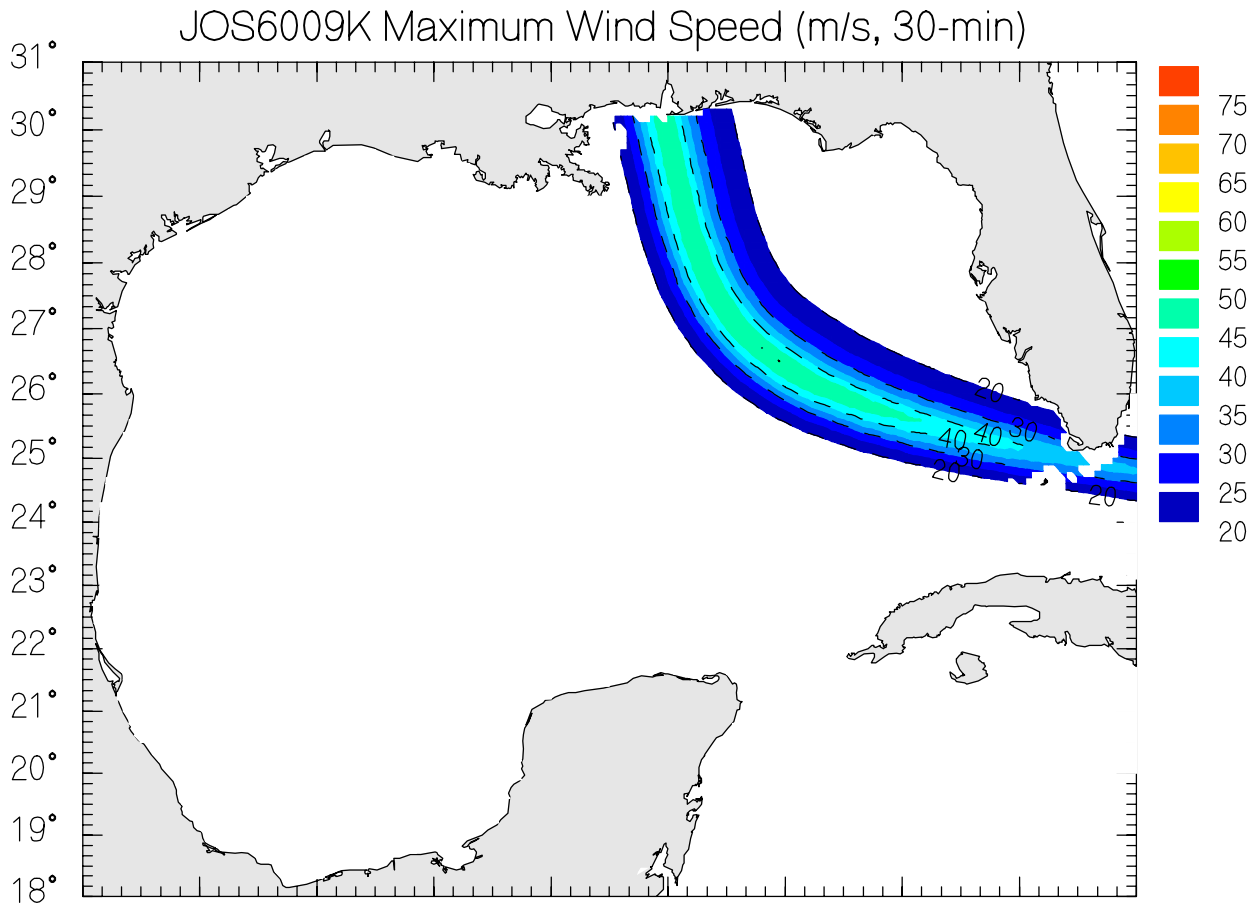
JOS6009K Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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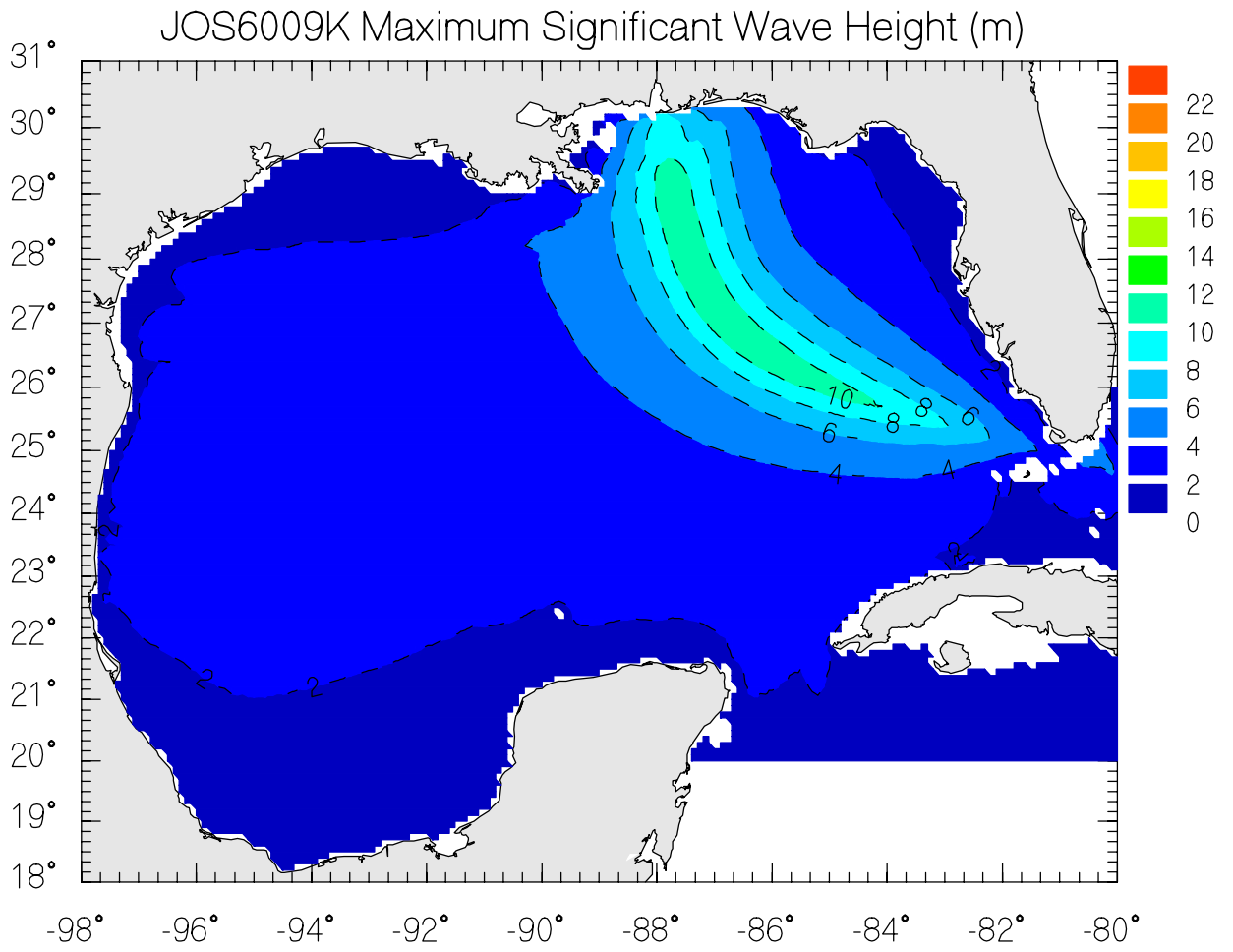
20
20


JOS6009K Maximum Significant Wave Height (m)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
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4
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0
10
8
8
6
6
4
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-88°
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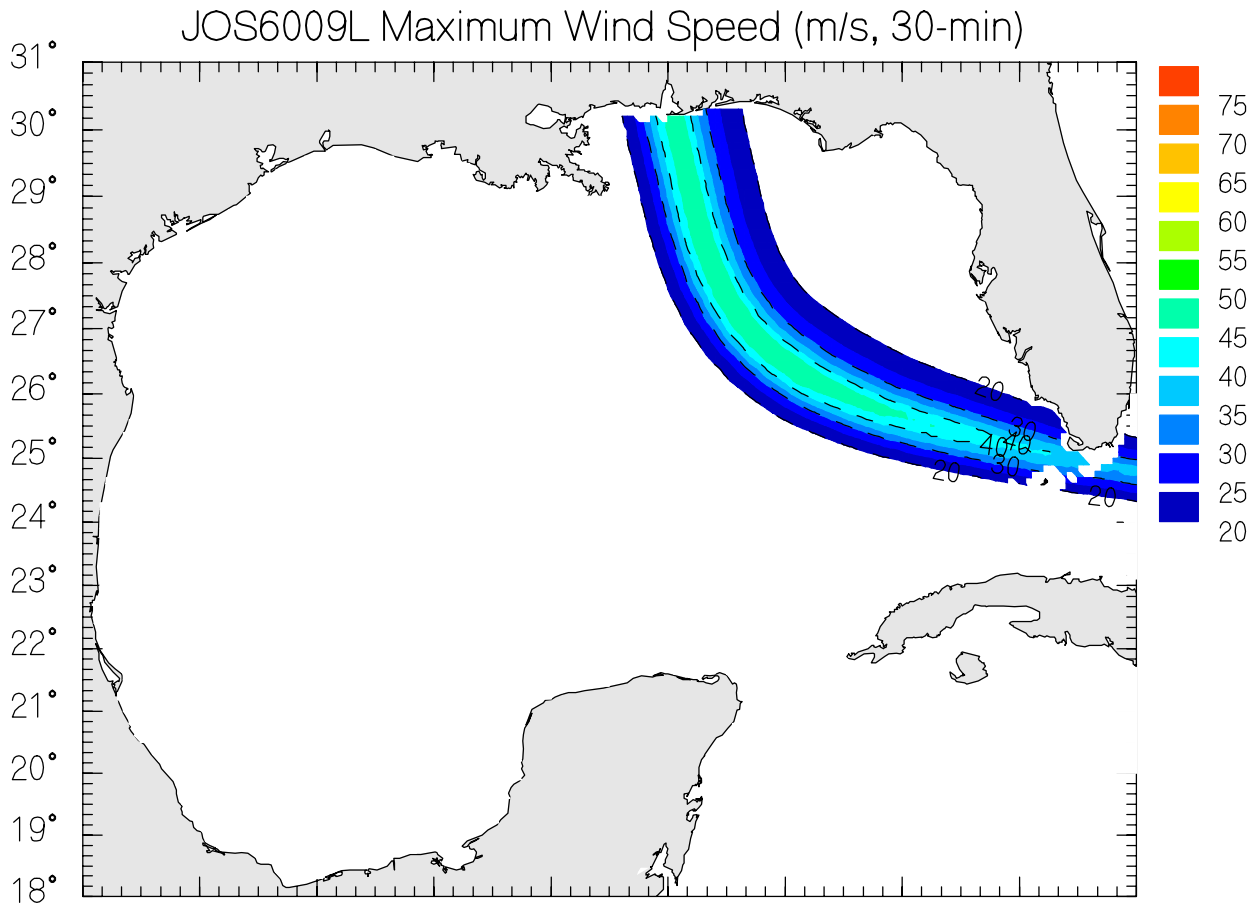
-80°


JOS6009L Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
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20°
19°
18°
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55
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40
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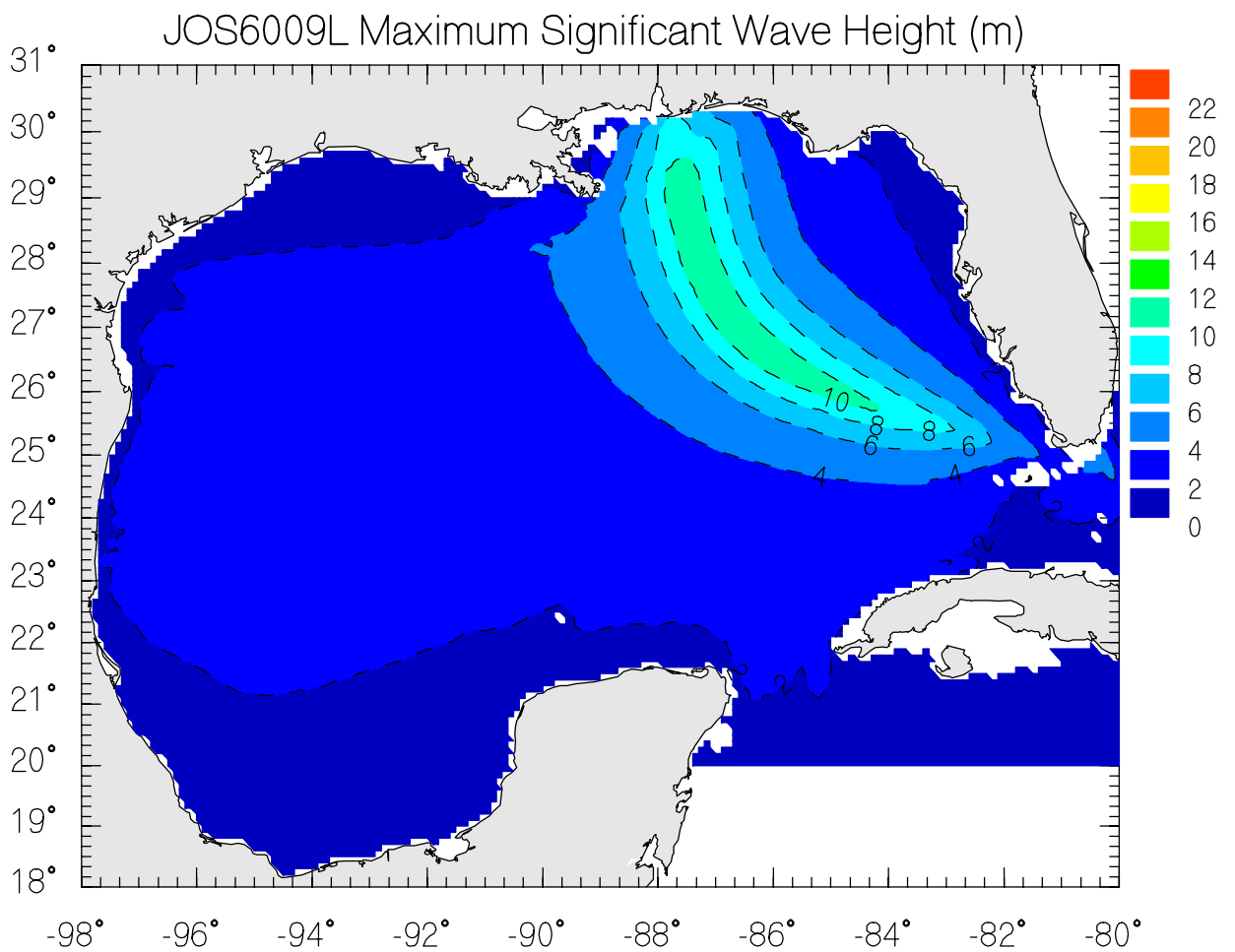
25
20


JOS6009L Maximum Significant Wave Height (m)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
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8
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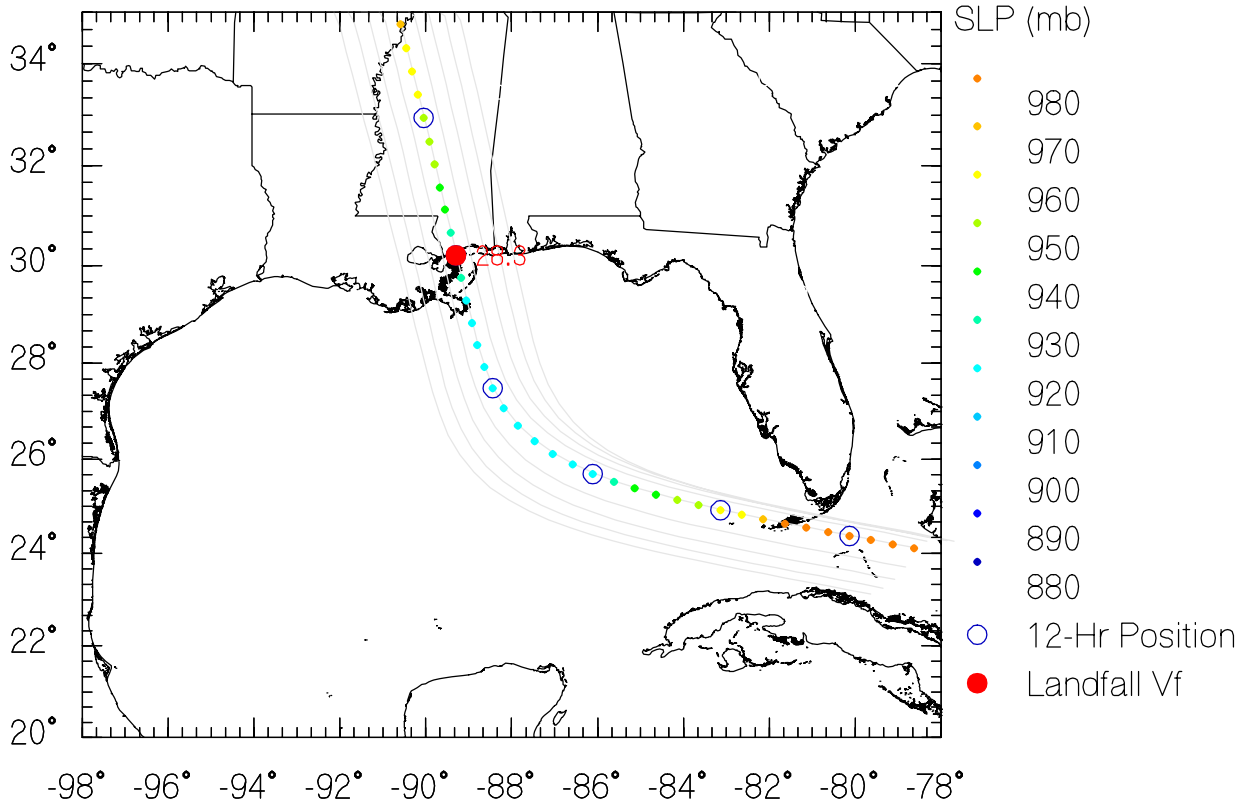
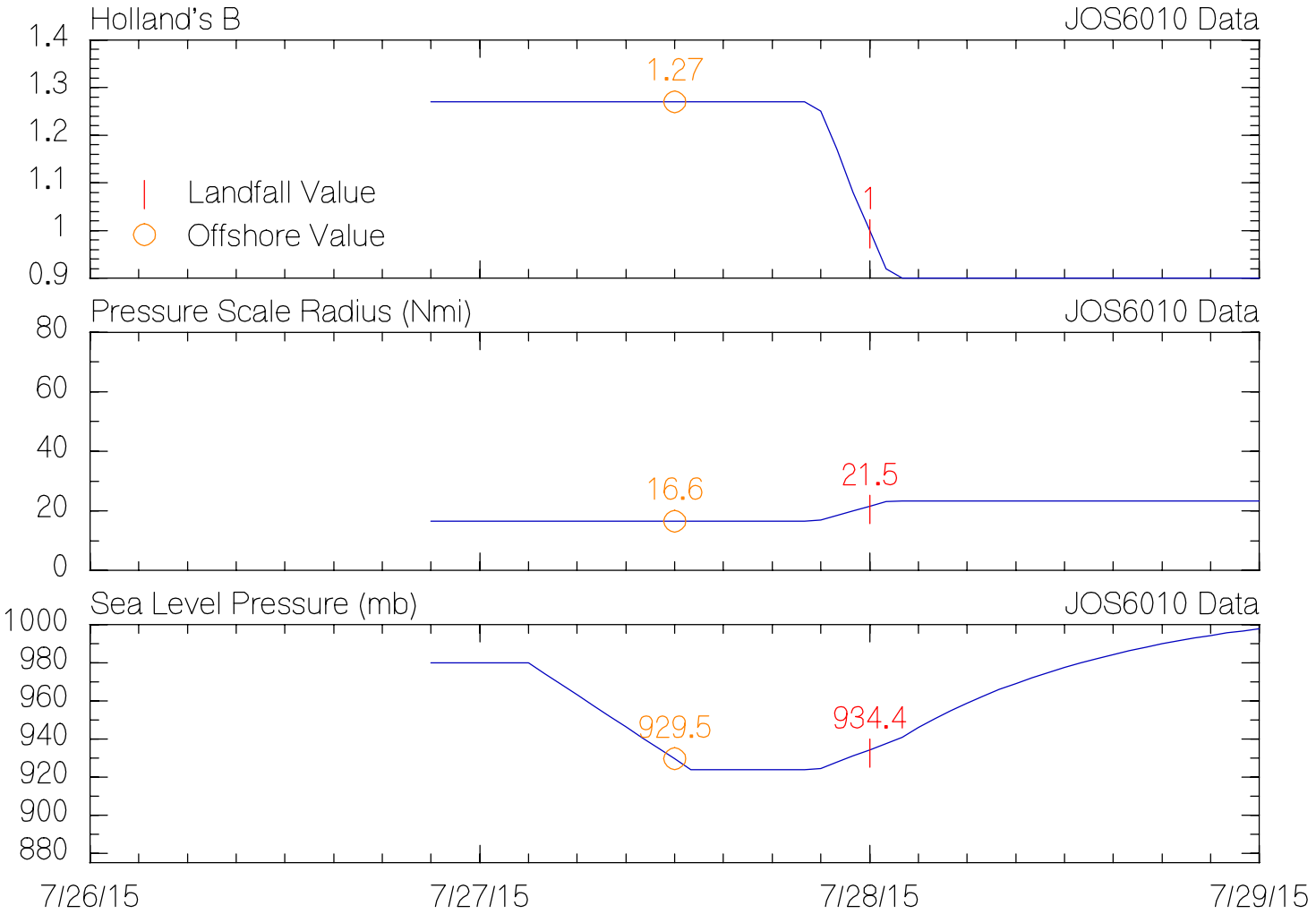
JOS6010 Data



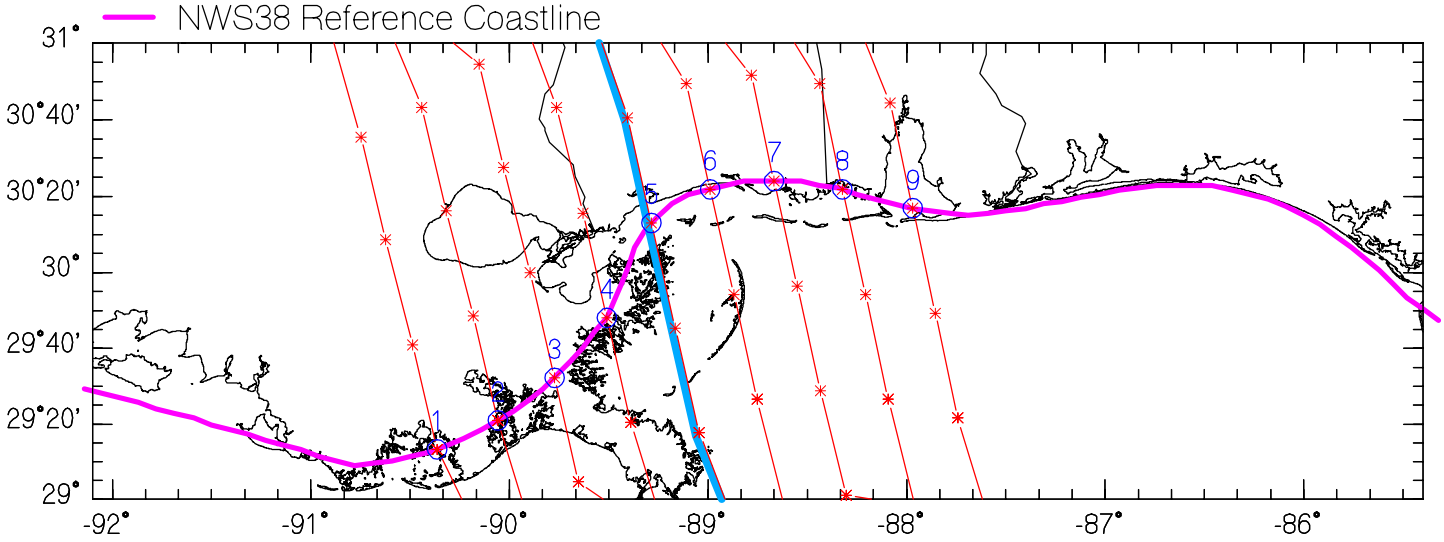


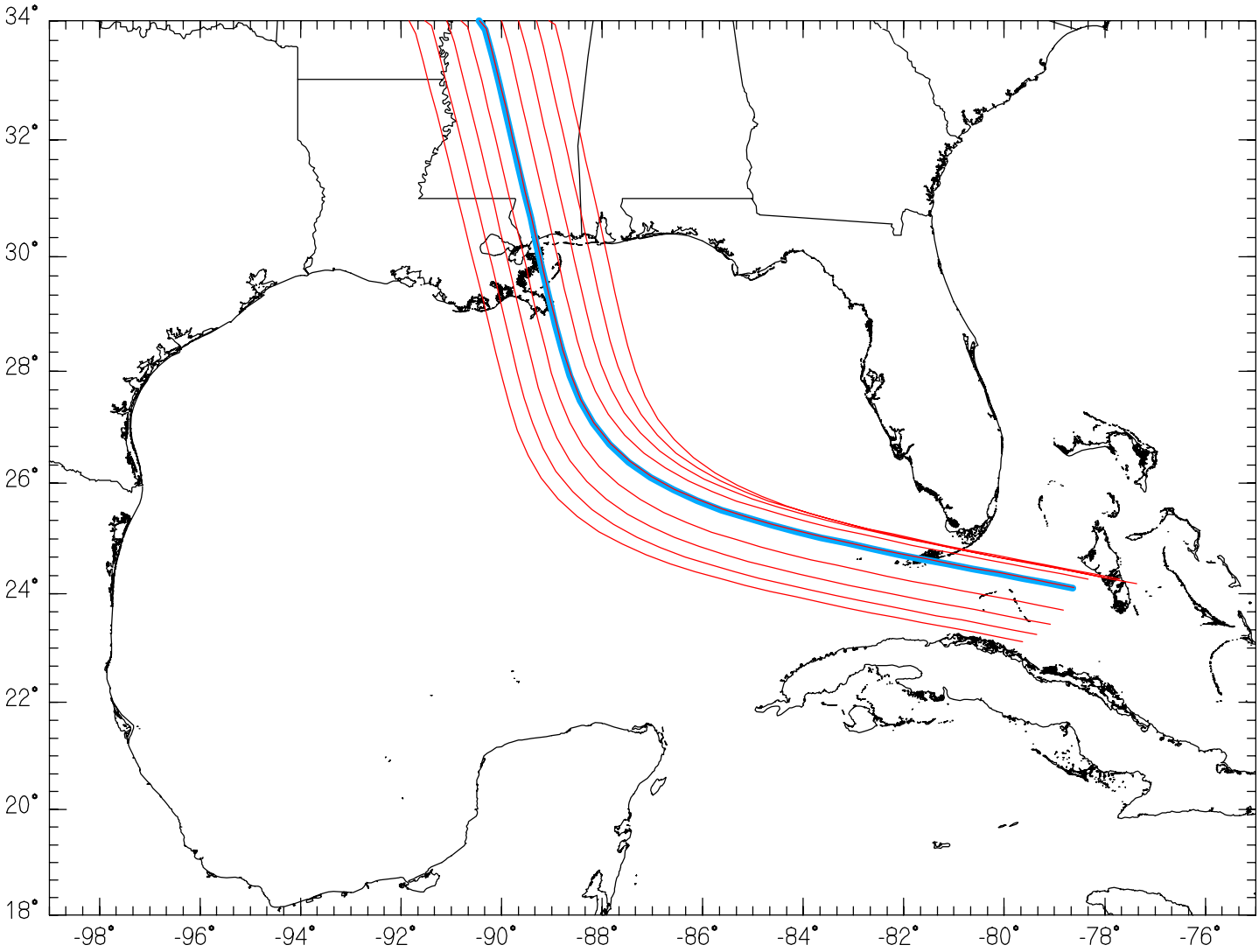
URS JPM-OS6 Production Tracks

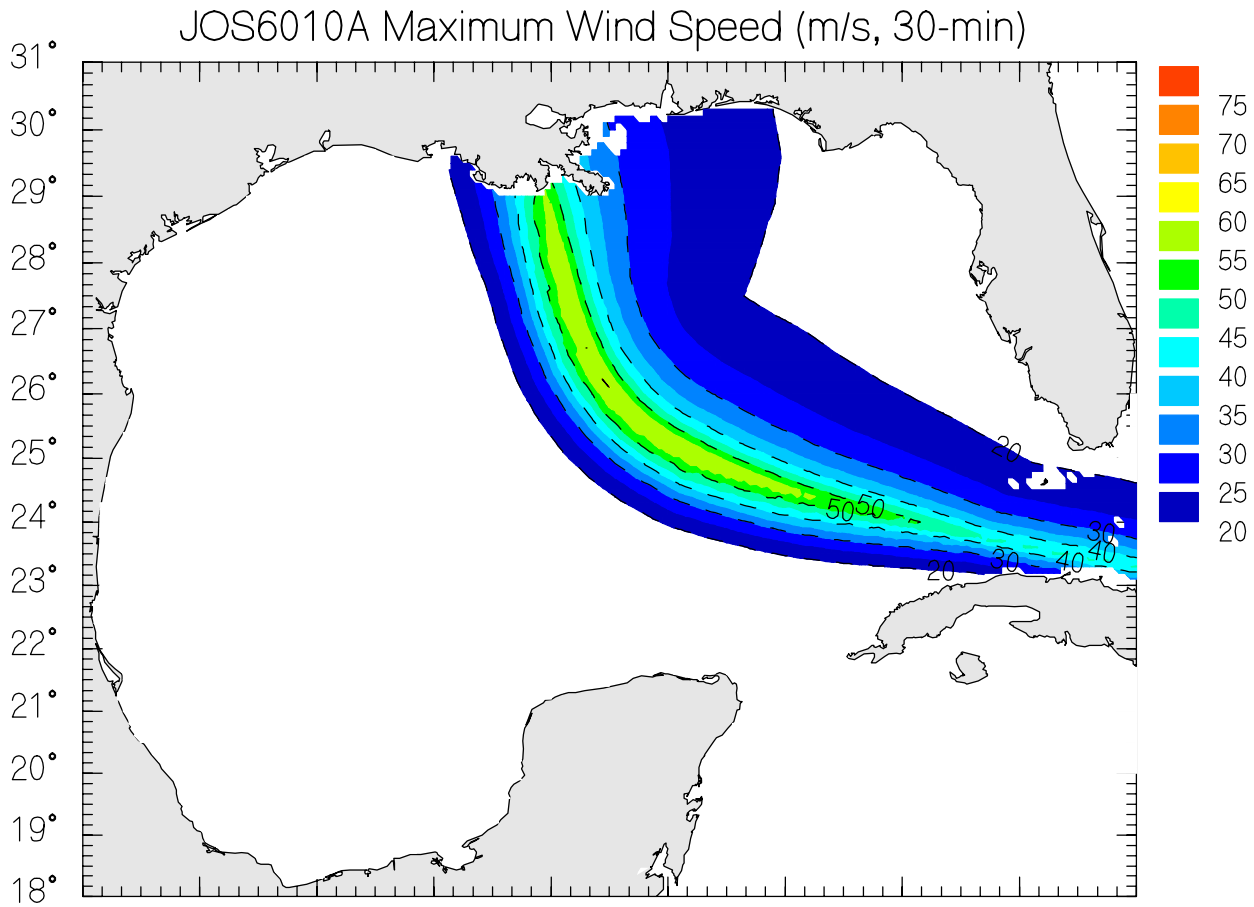
JOS6010 Data

Reference Track — Production Tracks — Production Track Landfall

NWS38 Reference Coastline






JOS6010A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
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20
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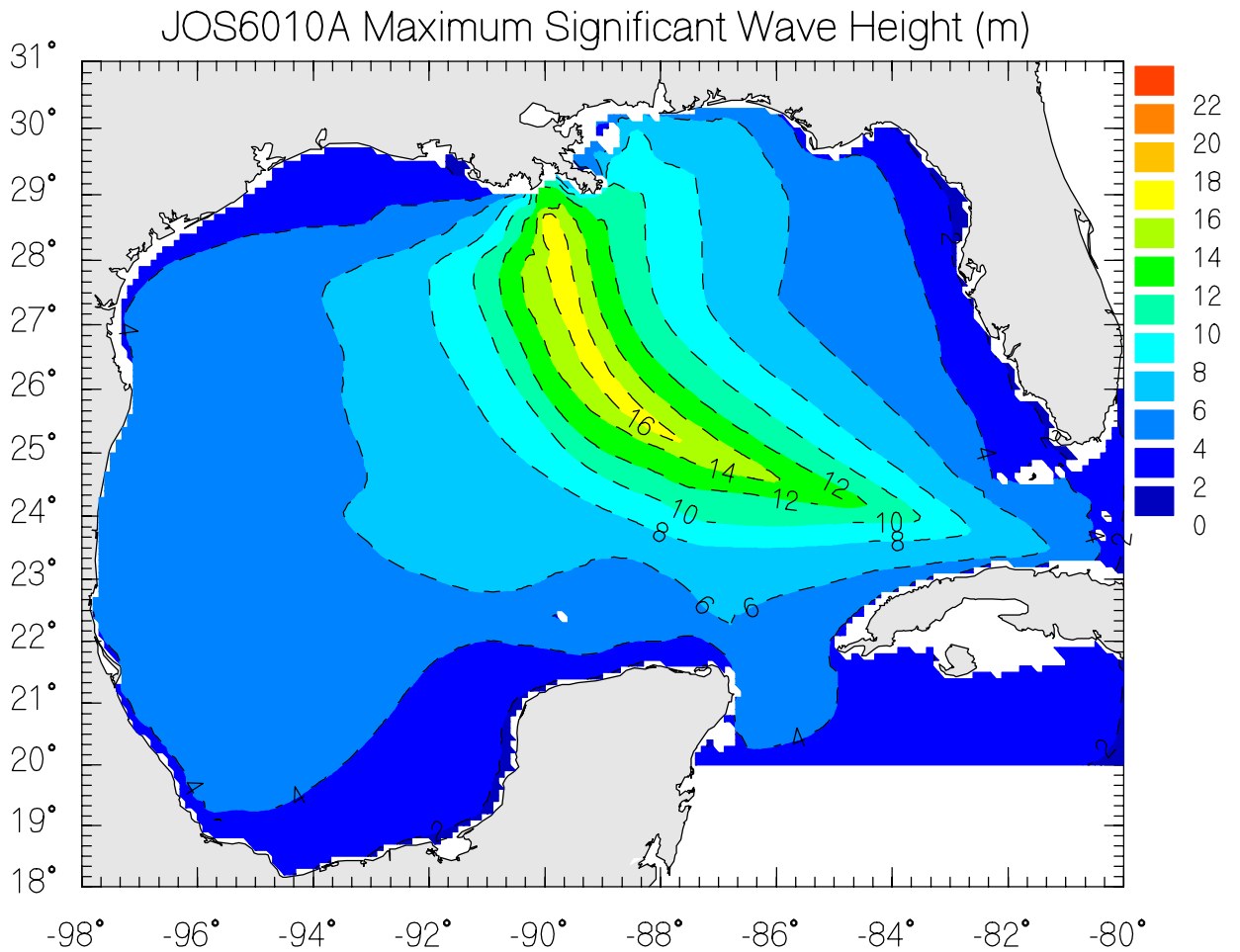
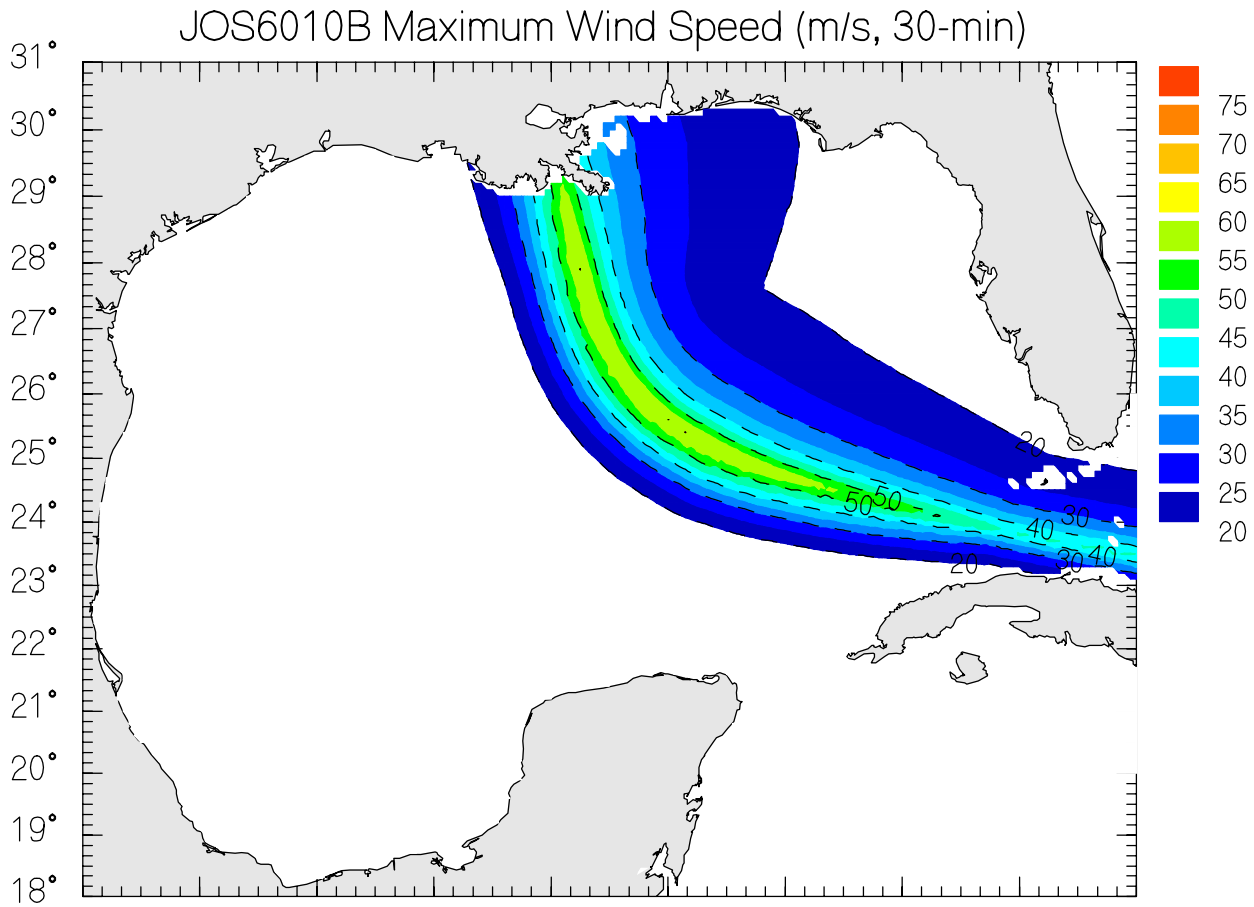
30
40
40
20
30


JOS6010A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
16
14
12
12
10
10
8
8
6
6
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6010B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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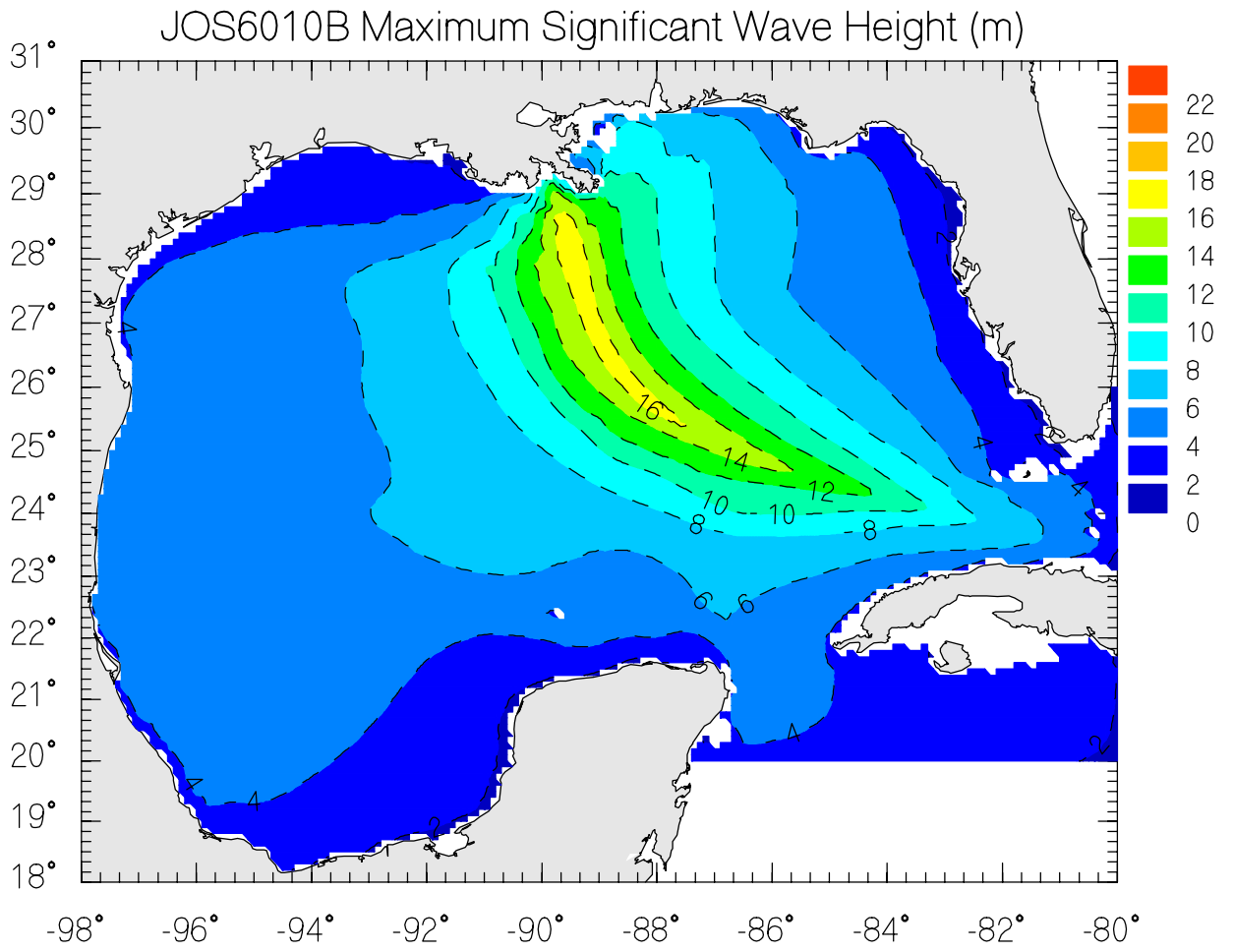
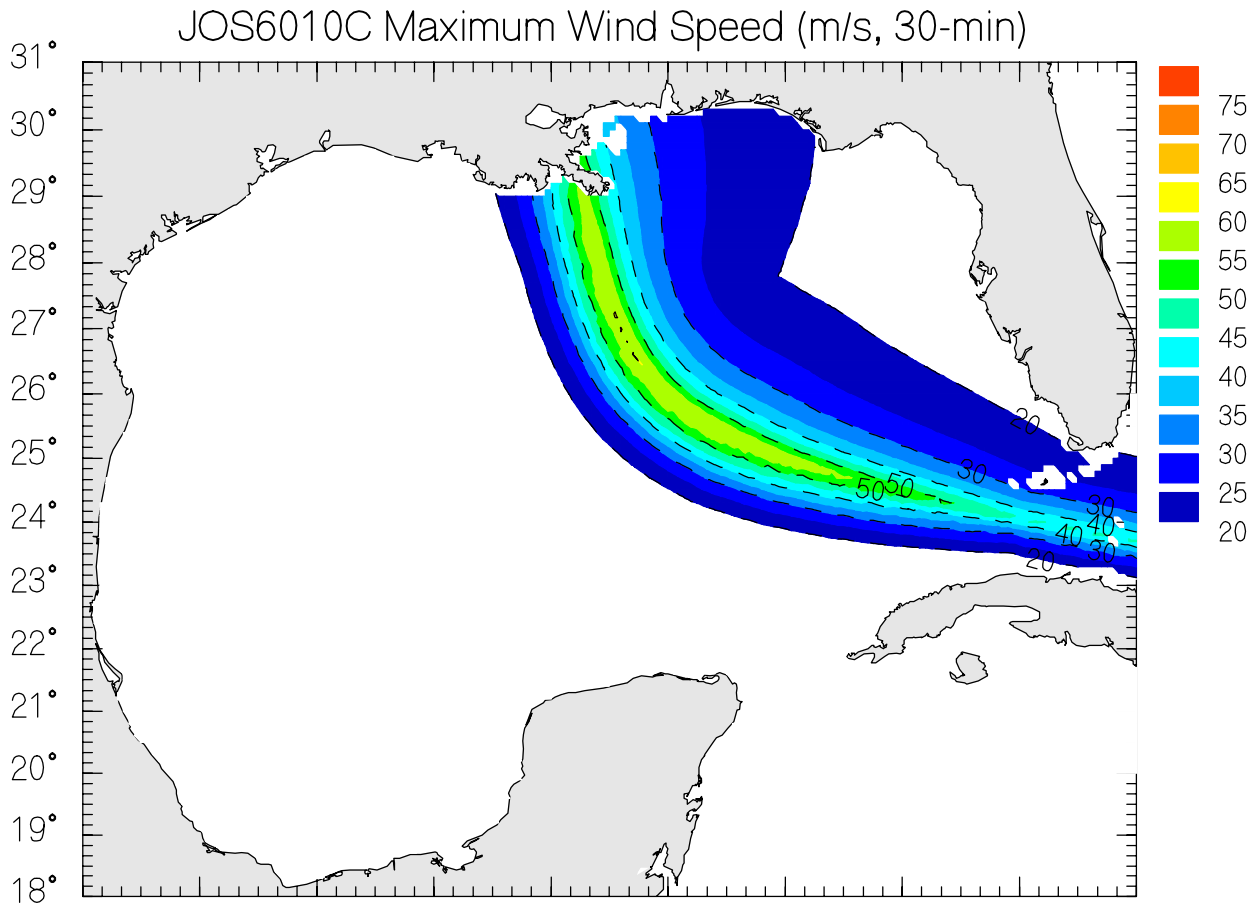
50
40
30
20
30
40


JOS6010B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
16
14
12
10
10
8
8
6
6
4
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6010C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
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50
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35
30
25
20
20
30
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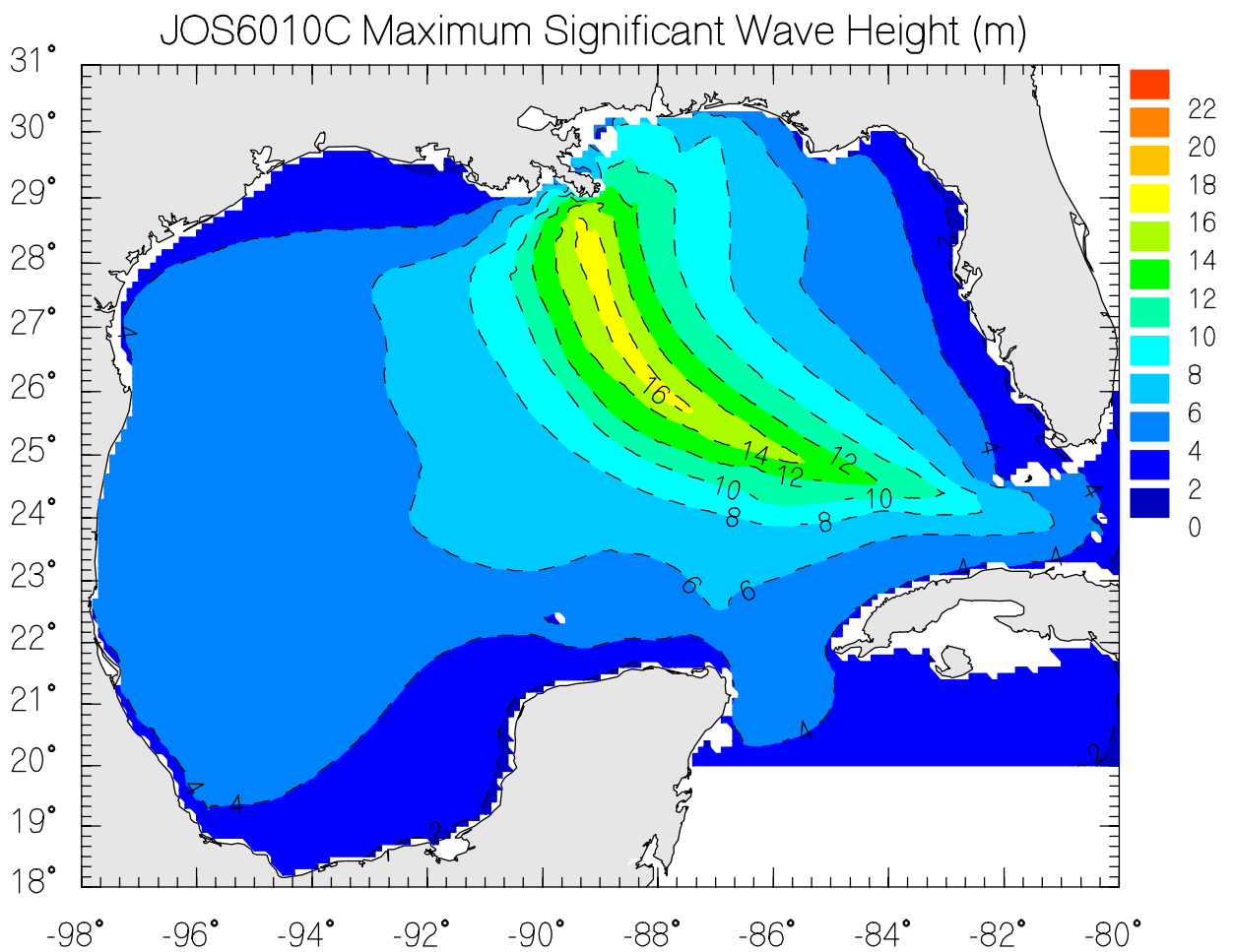
50
30
40
40
30
20


JOS6010C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
16
14
12
12
10
10
8
8
6
6
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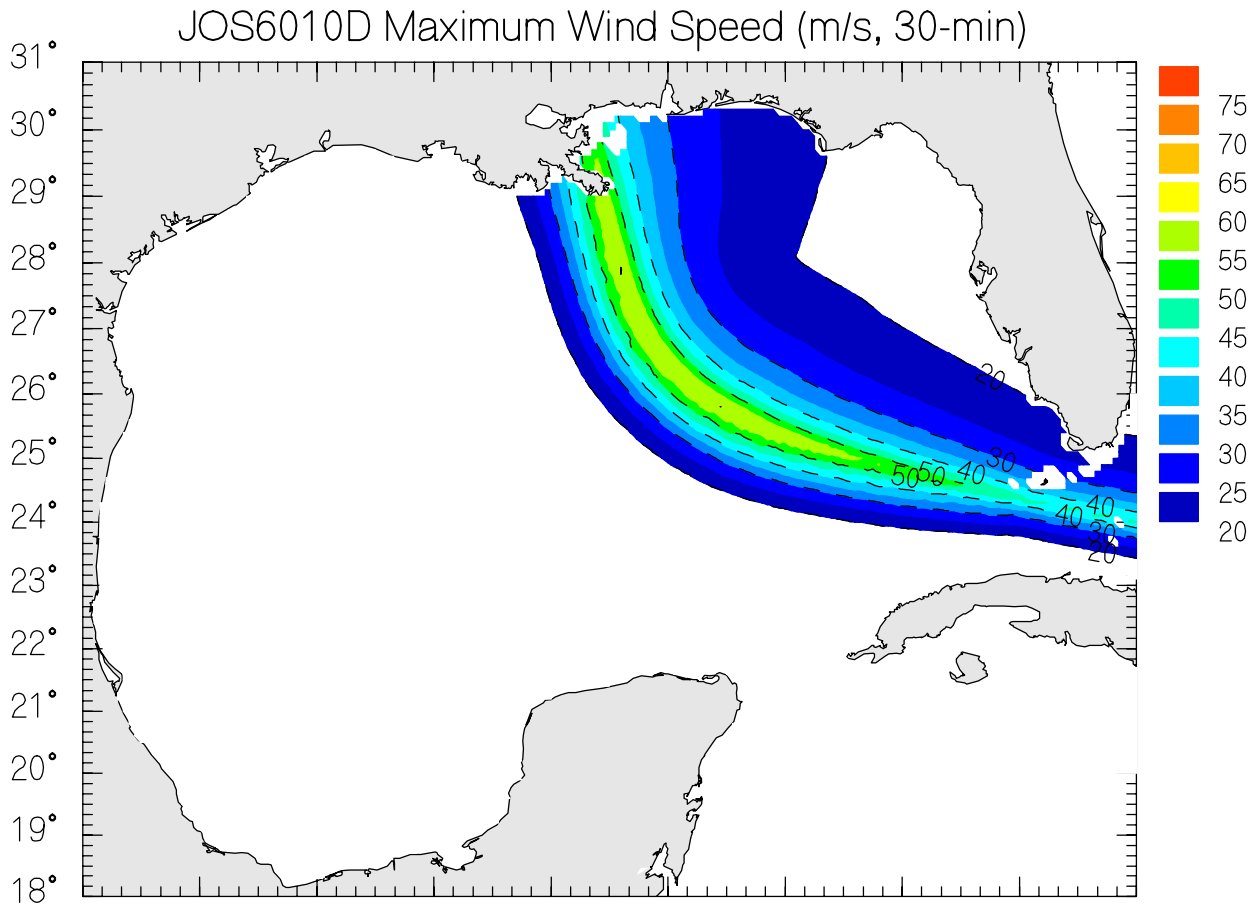
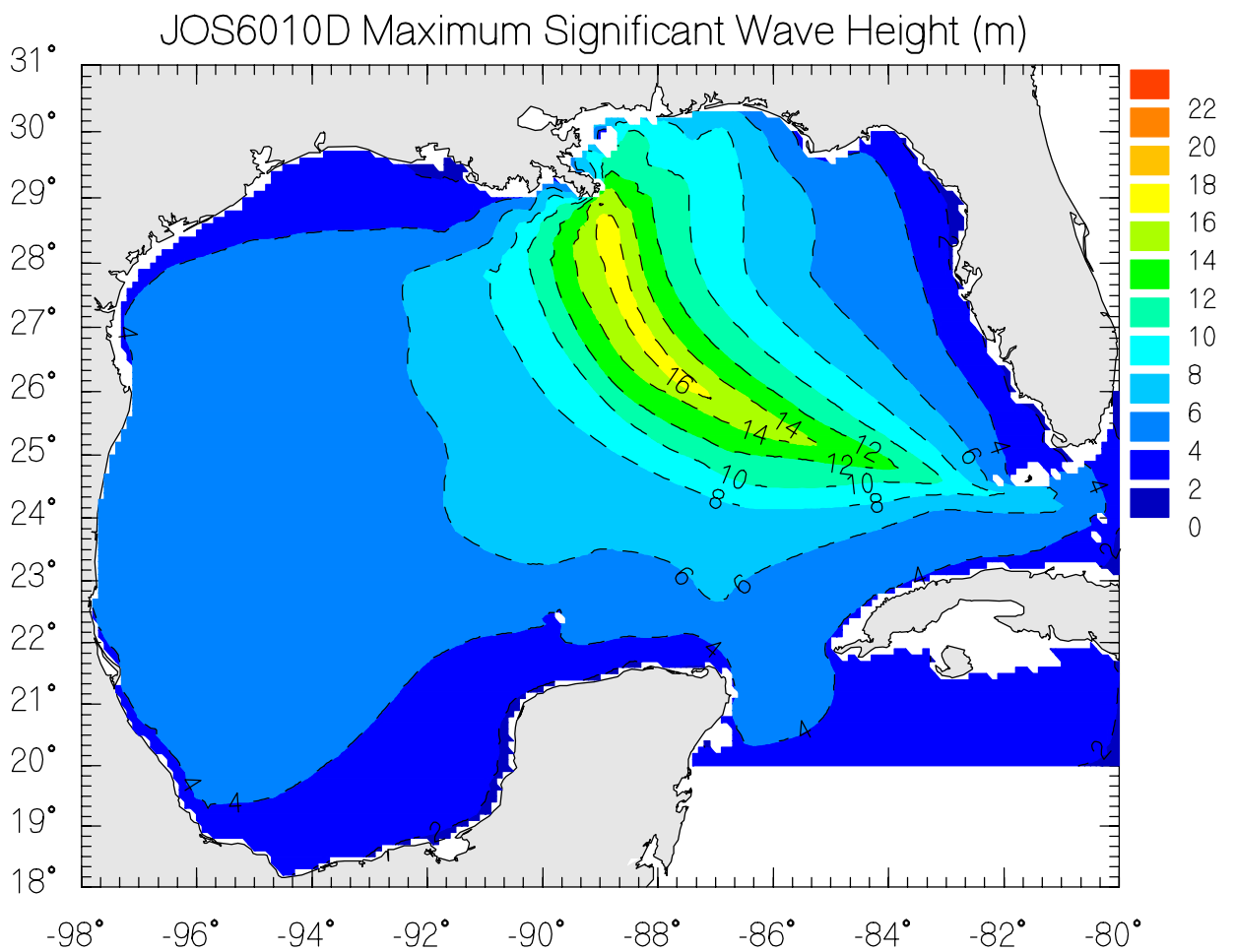
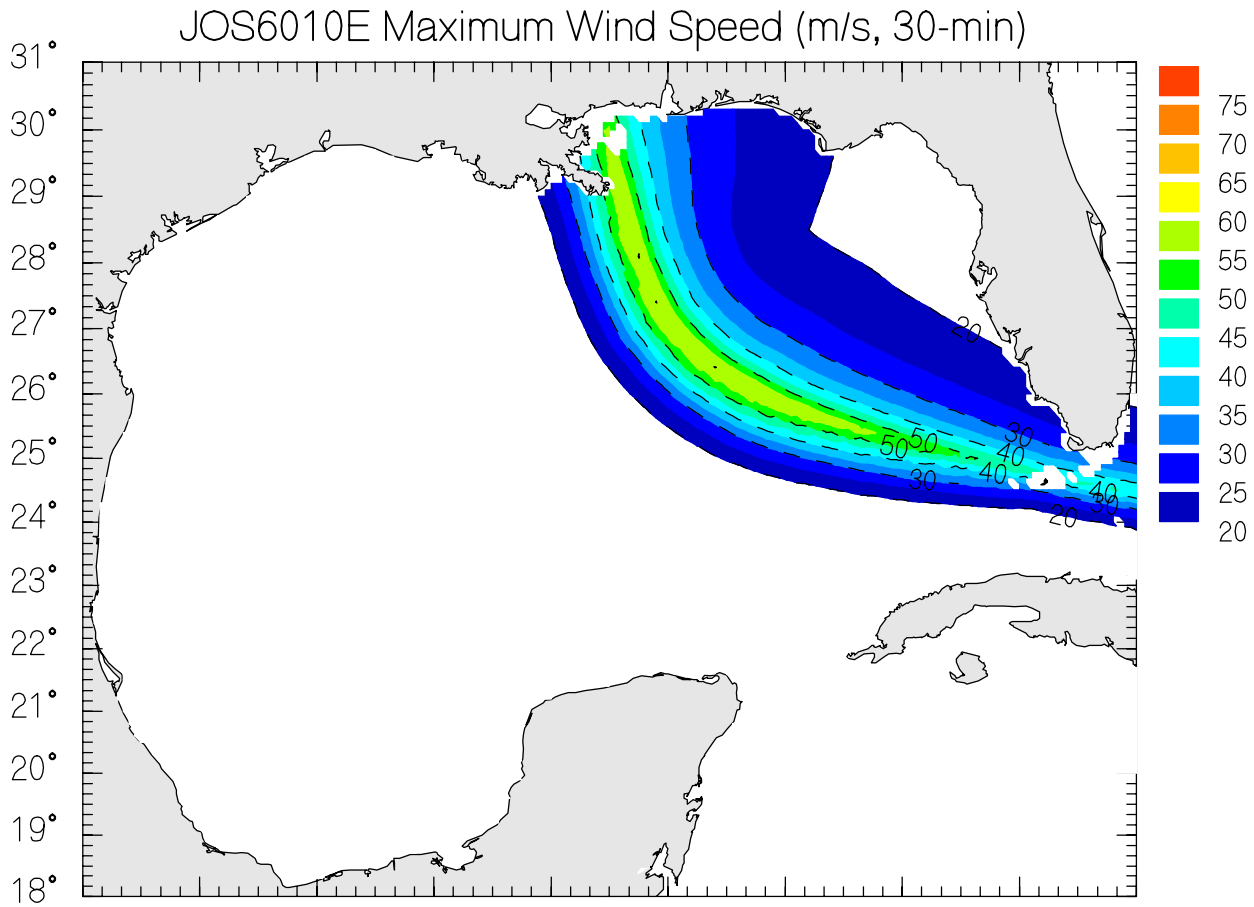
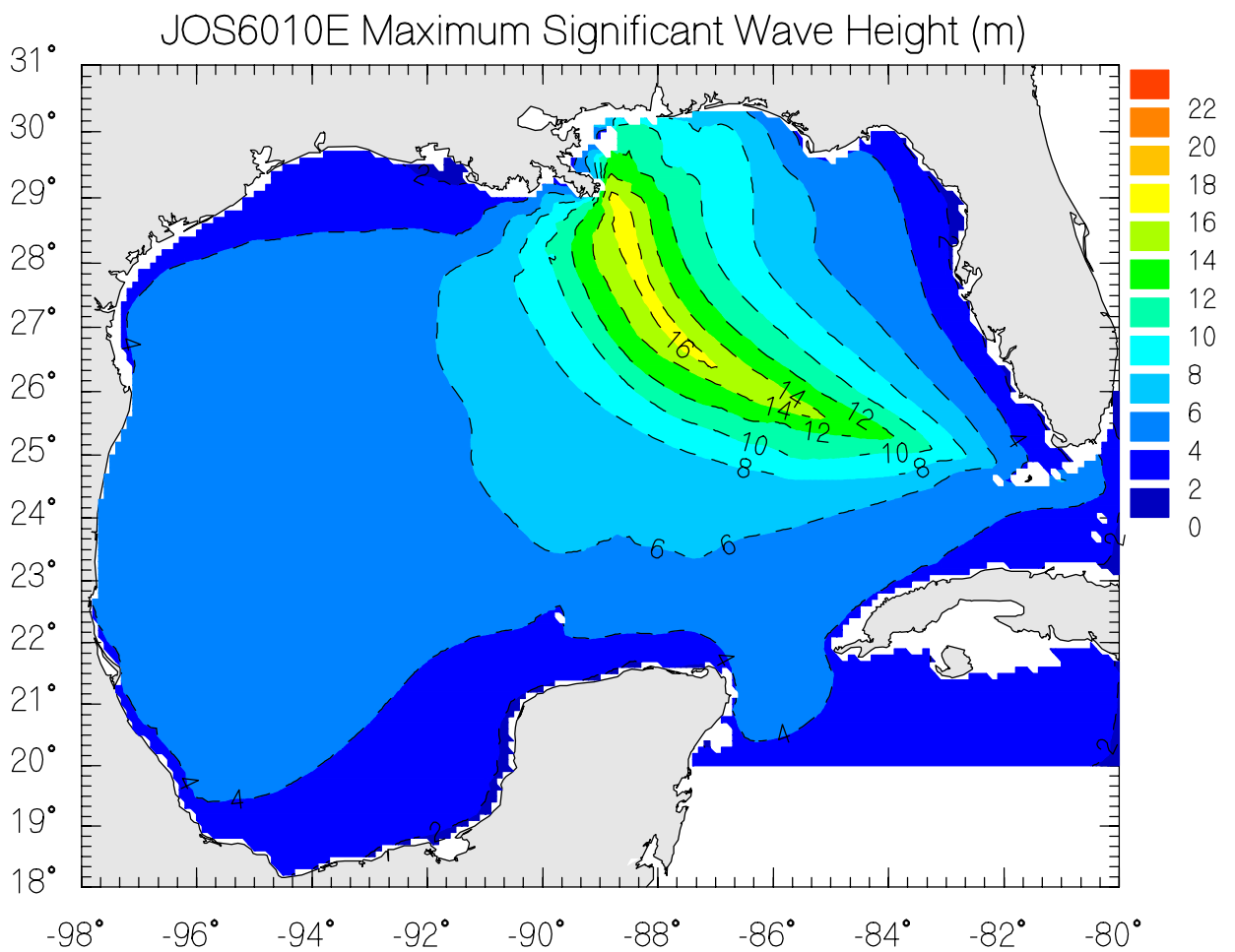
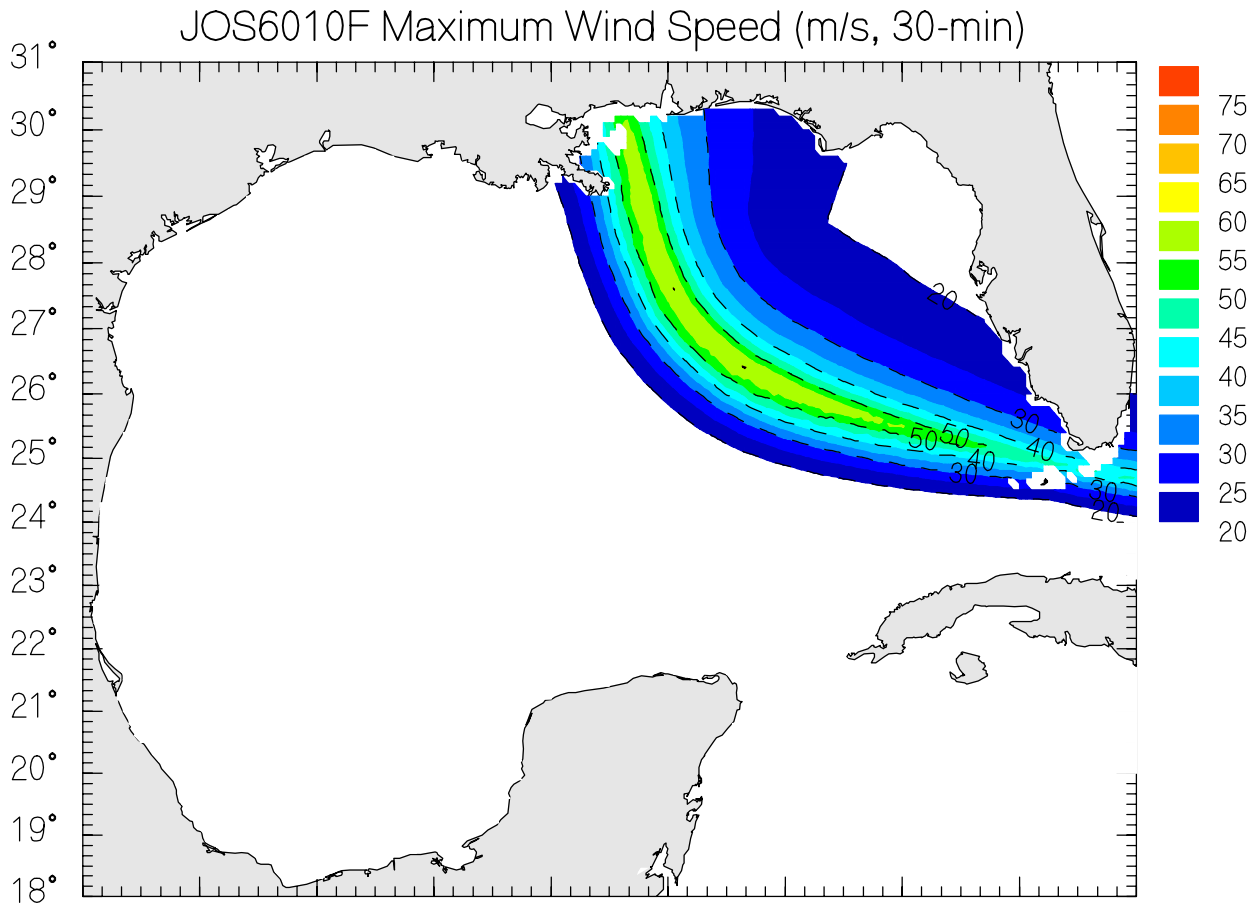
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°

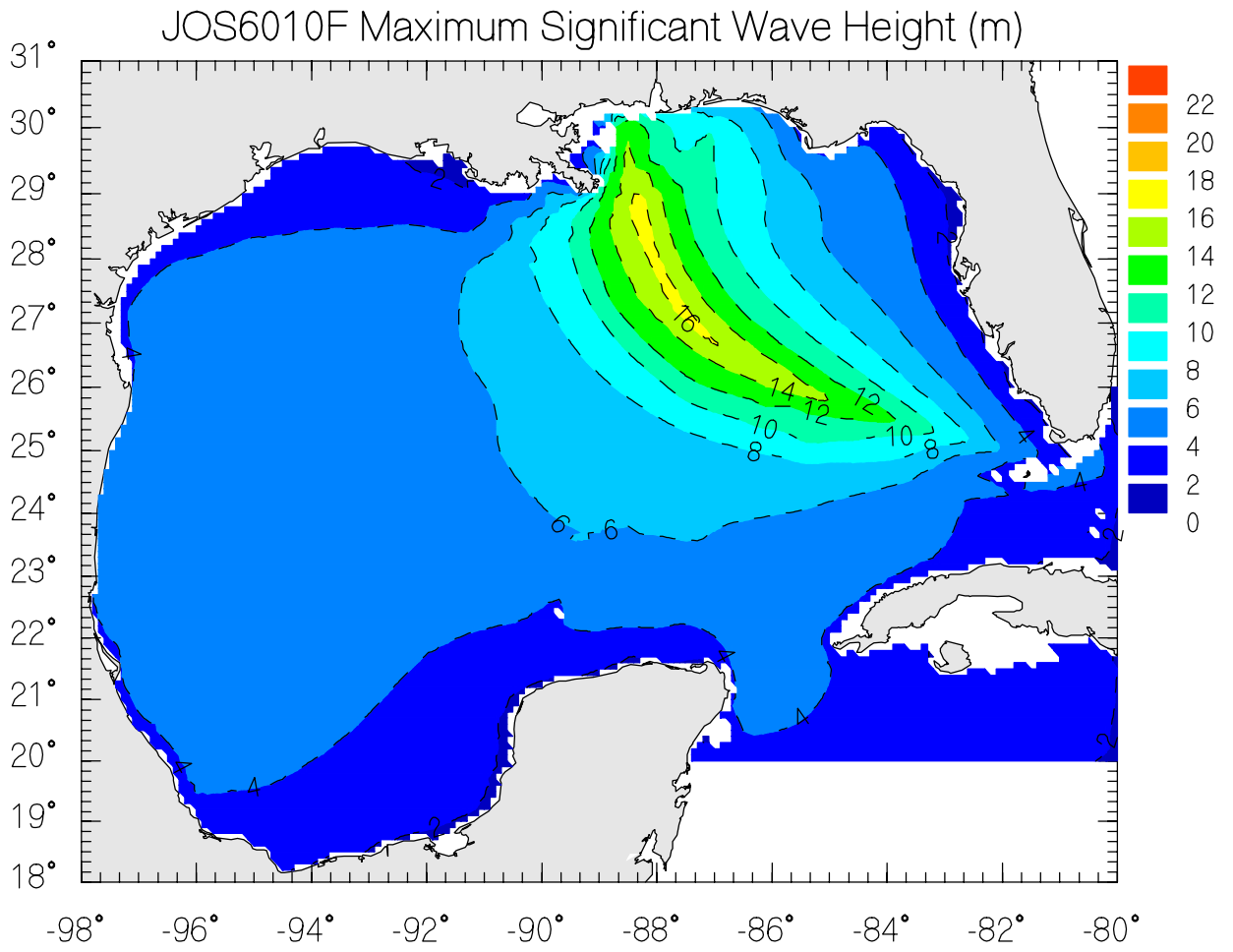

JOS6010D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20

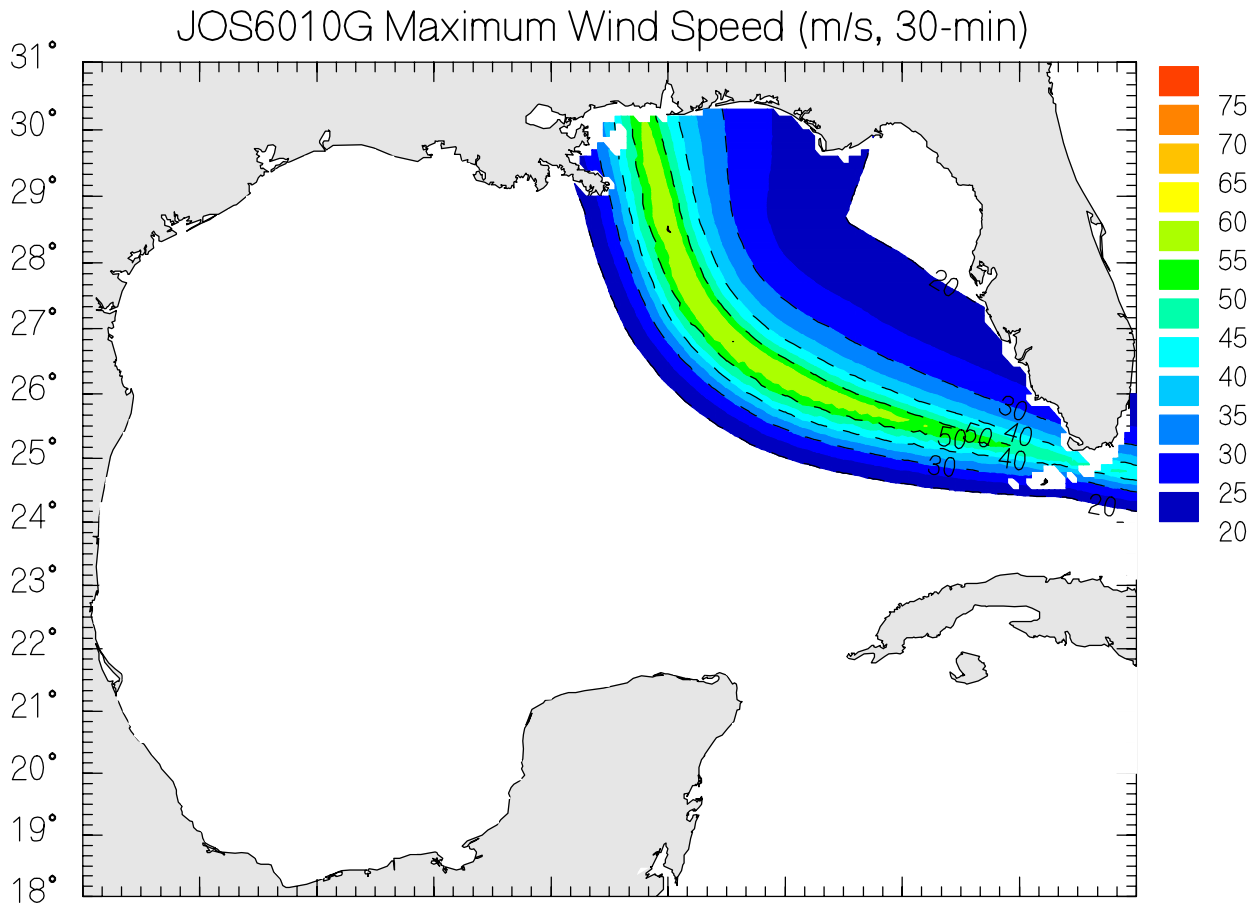

JOS6010D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0

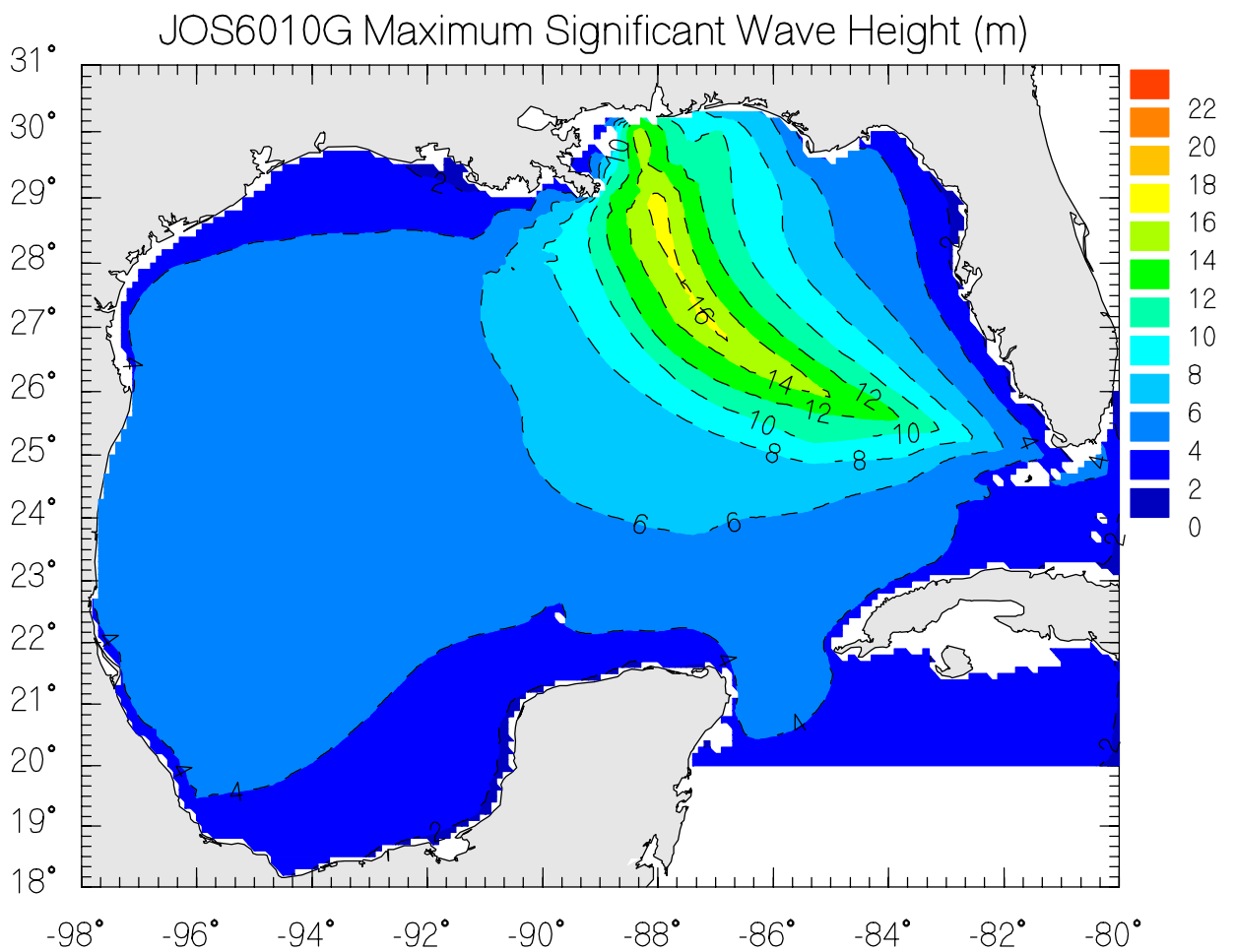

JOS6010E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6010E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0


JOS6010F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6010F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0


JOS6010G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6010G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
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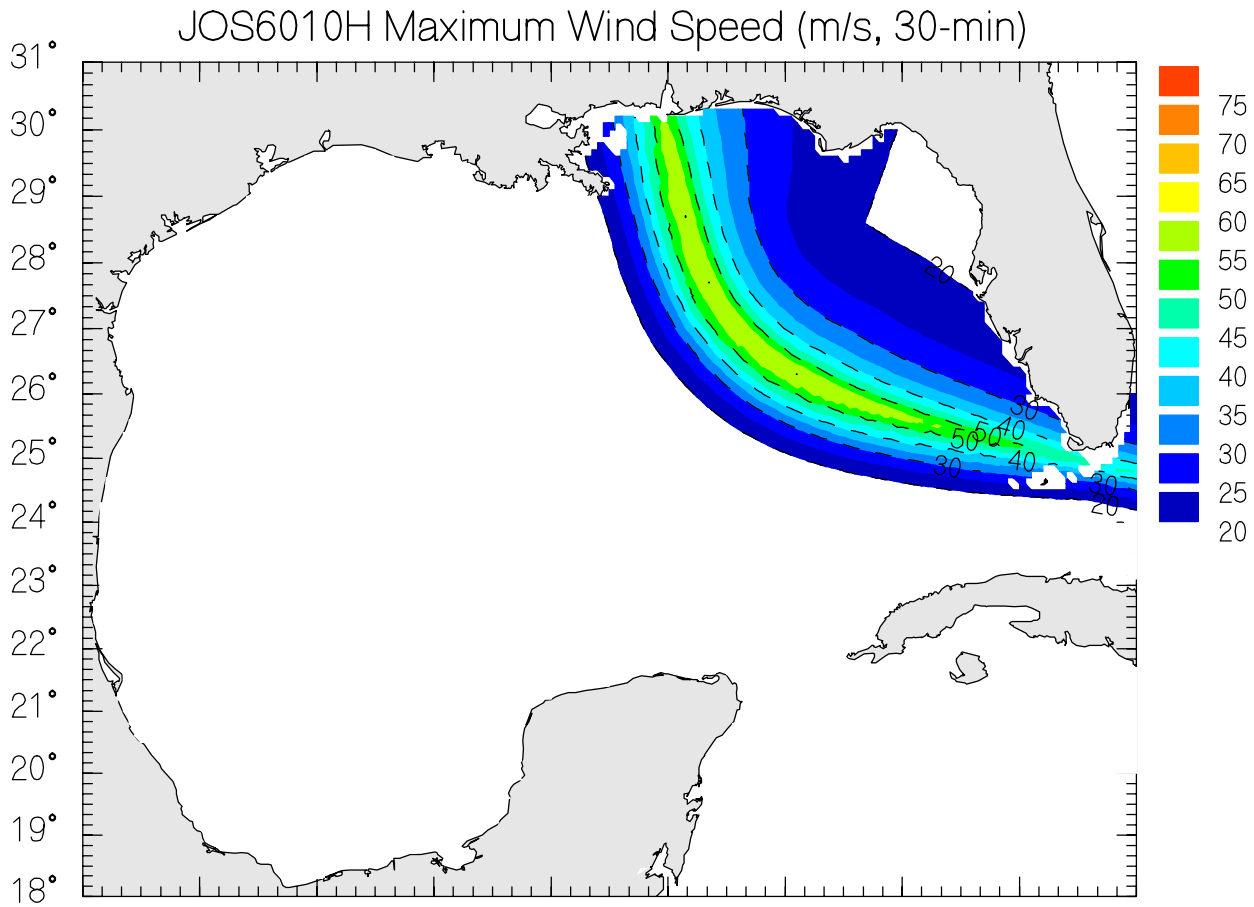
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0


JOS6010H Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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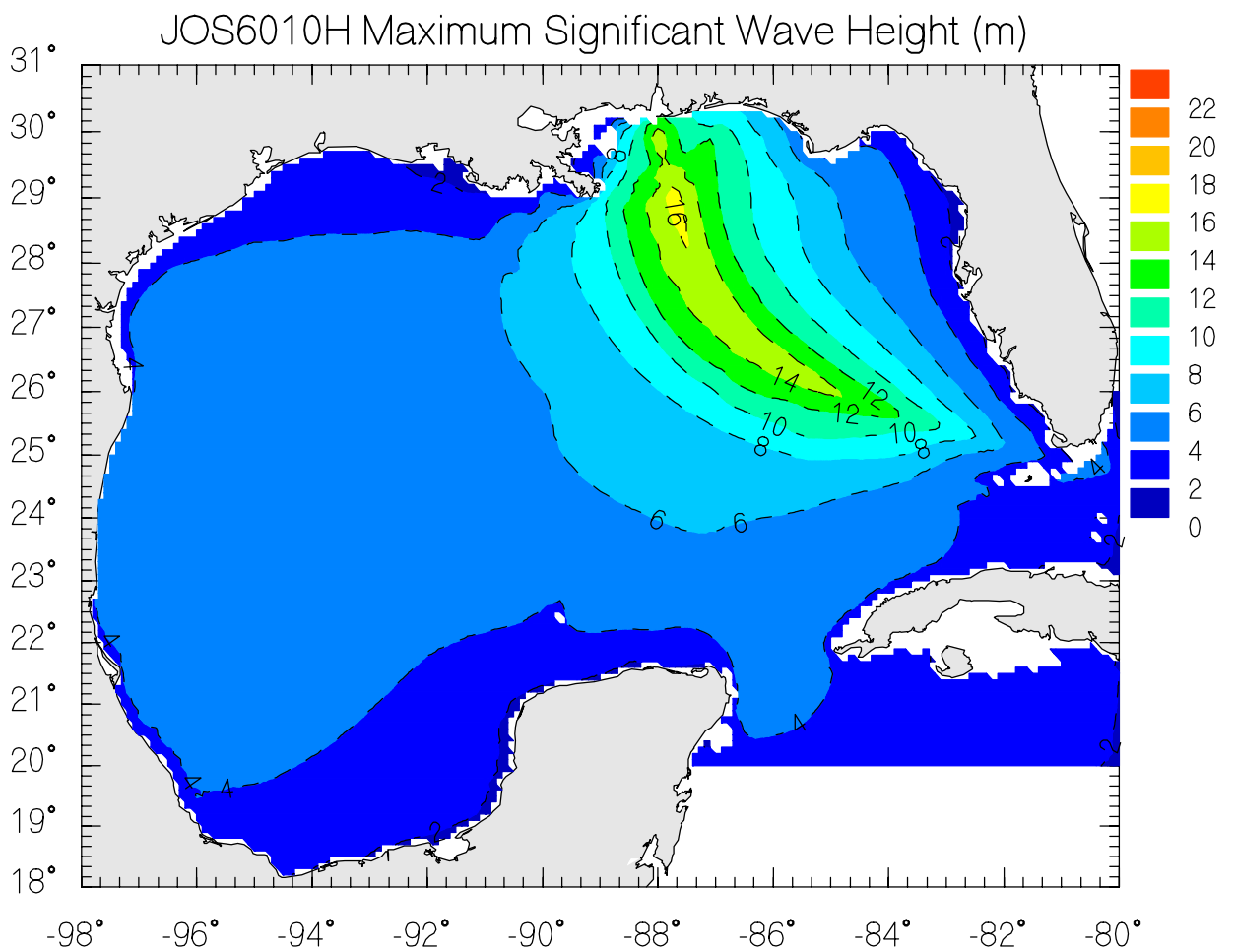
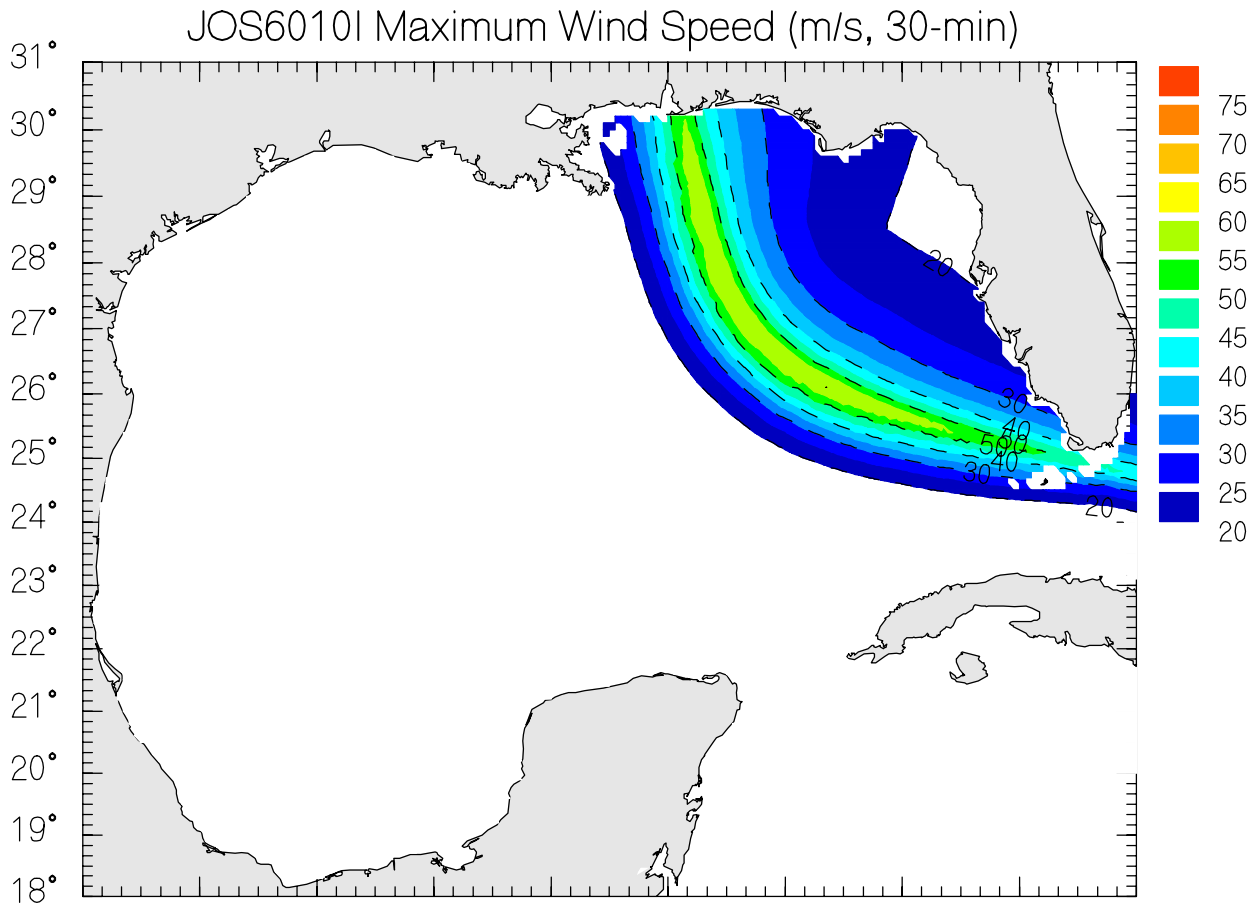
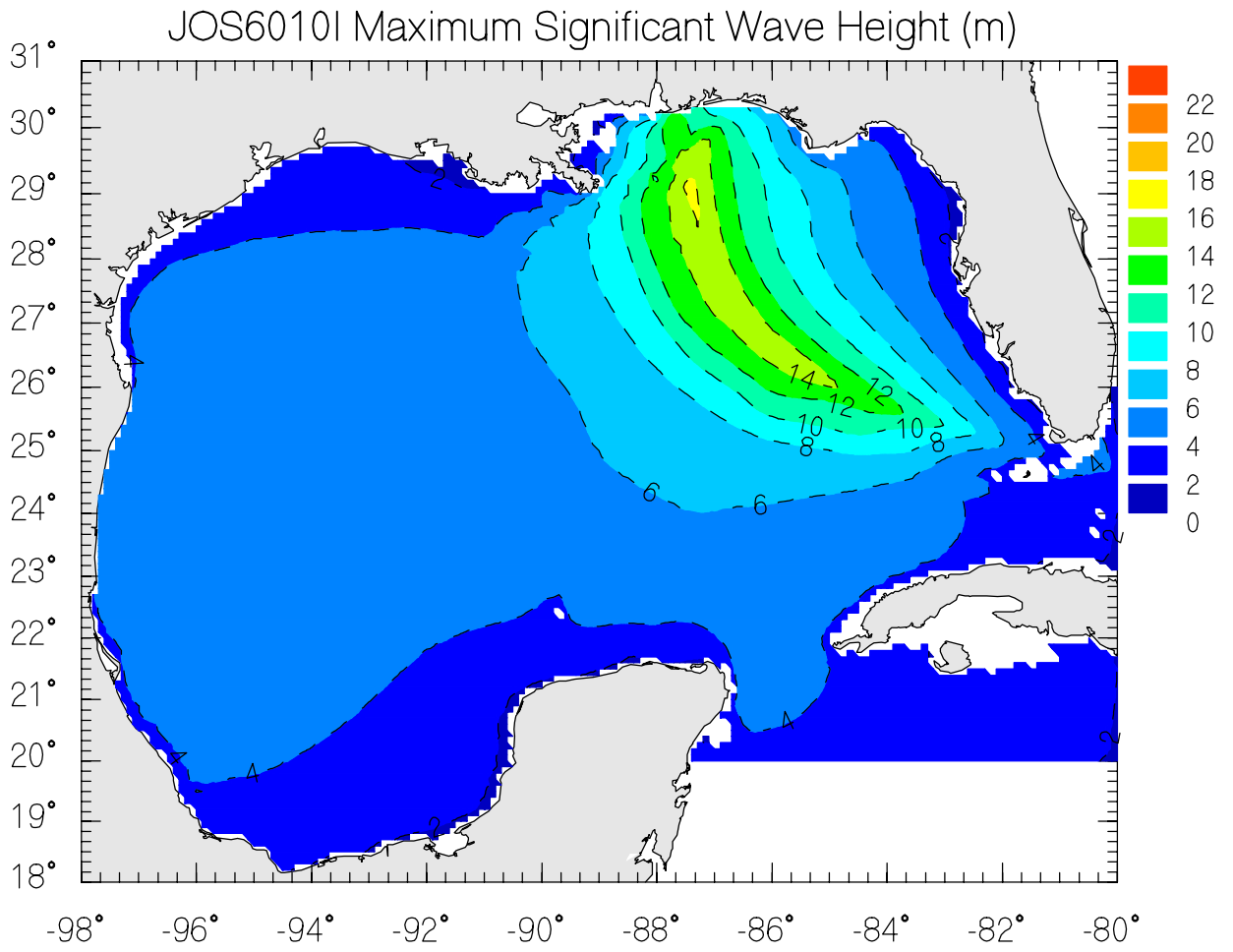
60
55
50
45
40
35
30
25
20


JOS6010H Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0


JOS6010I Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6010I Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
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-80°
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8
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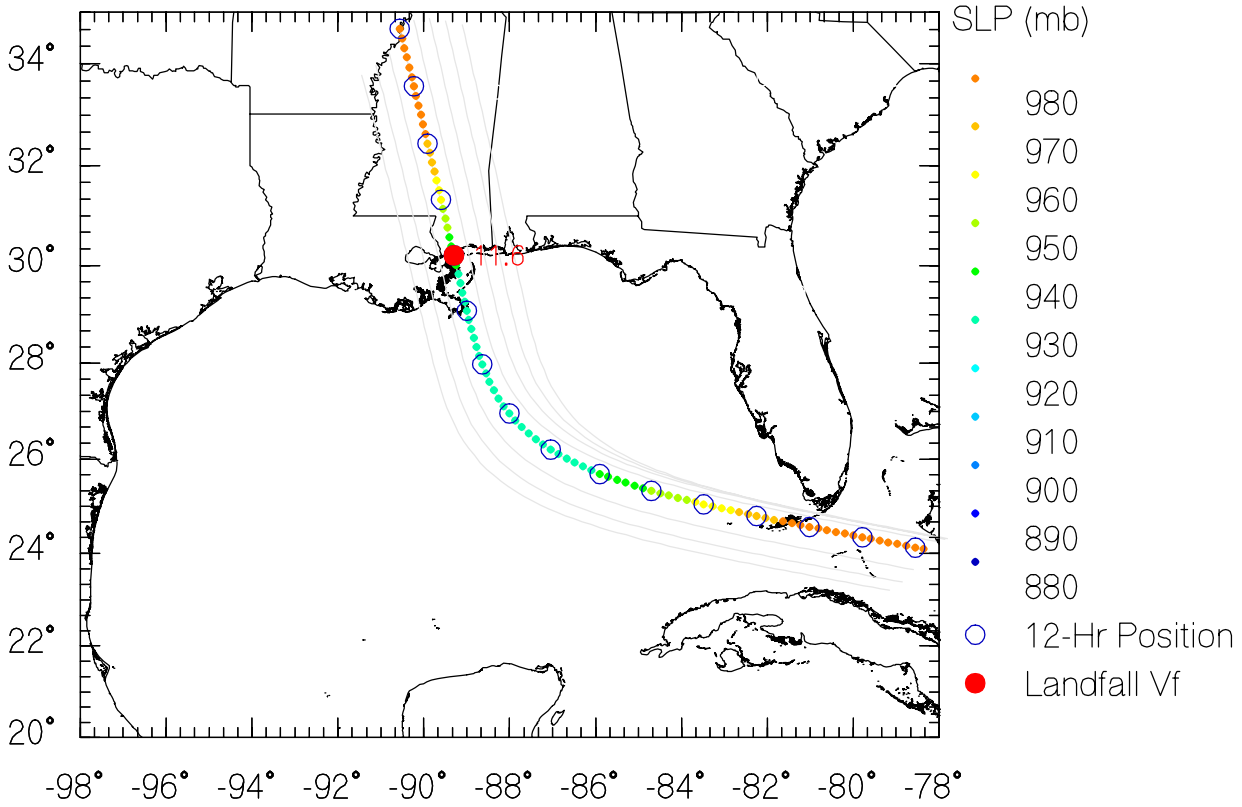
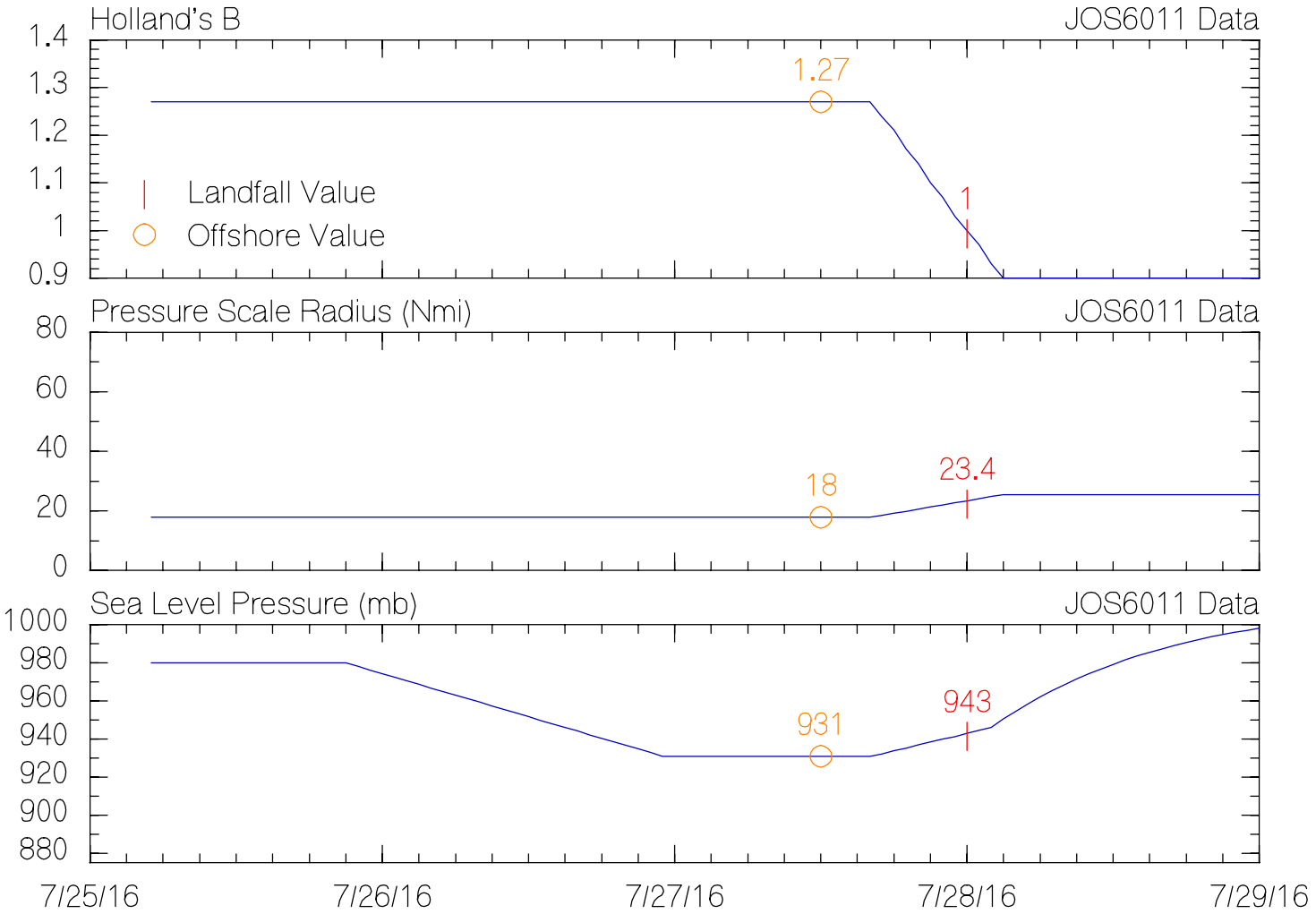
2
0

JOS6011 Data

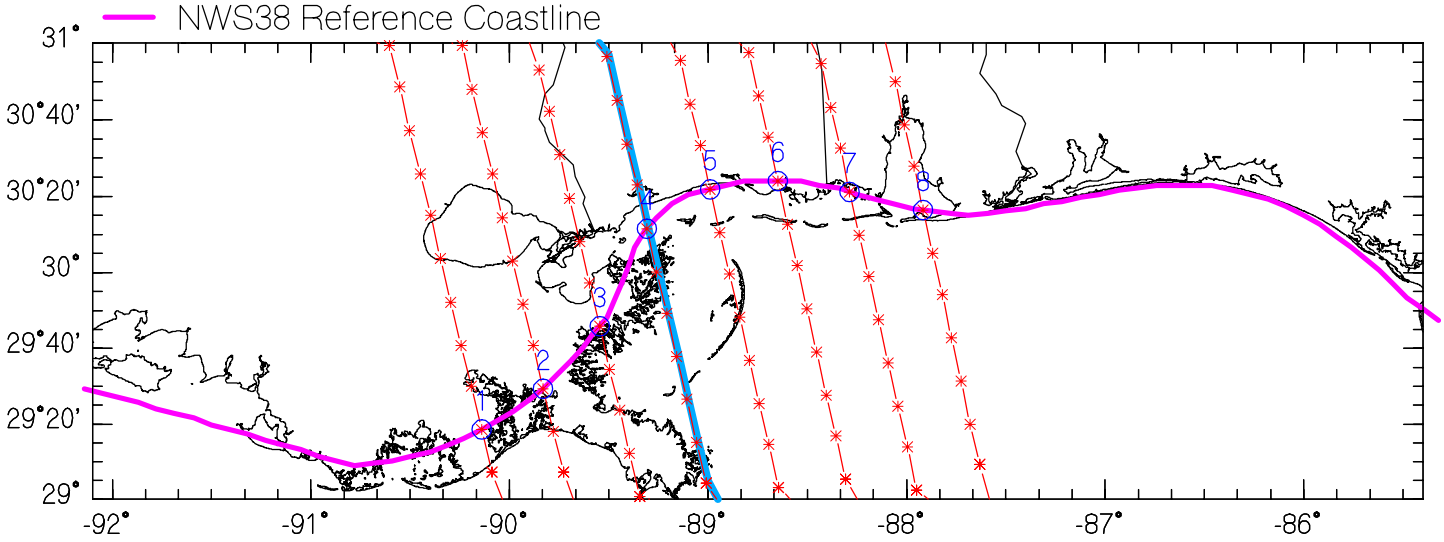


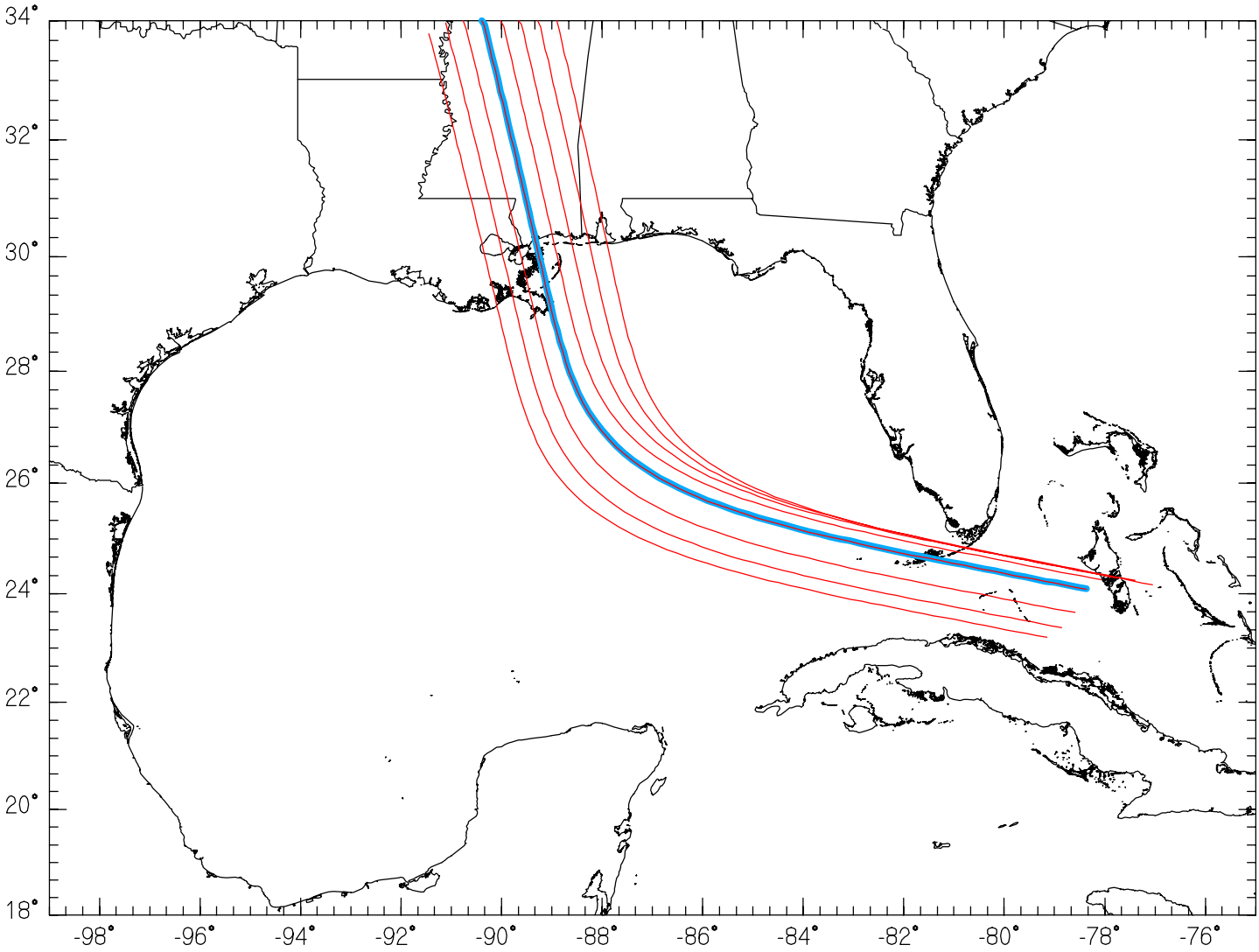


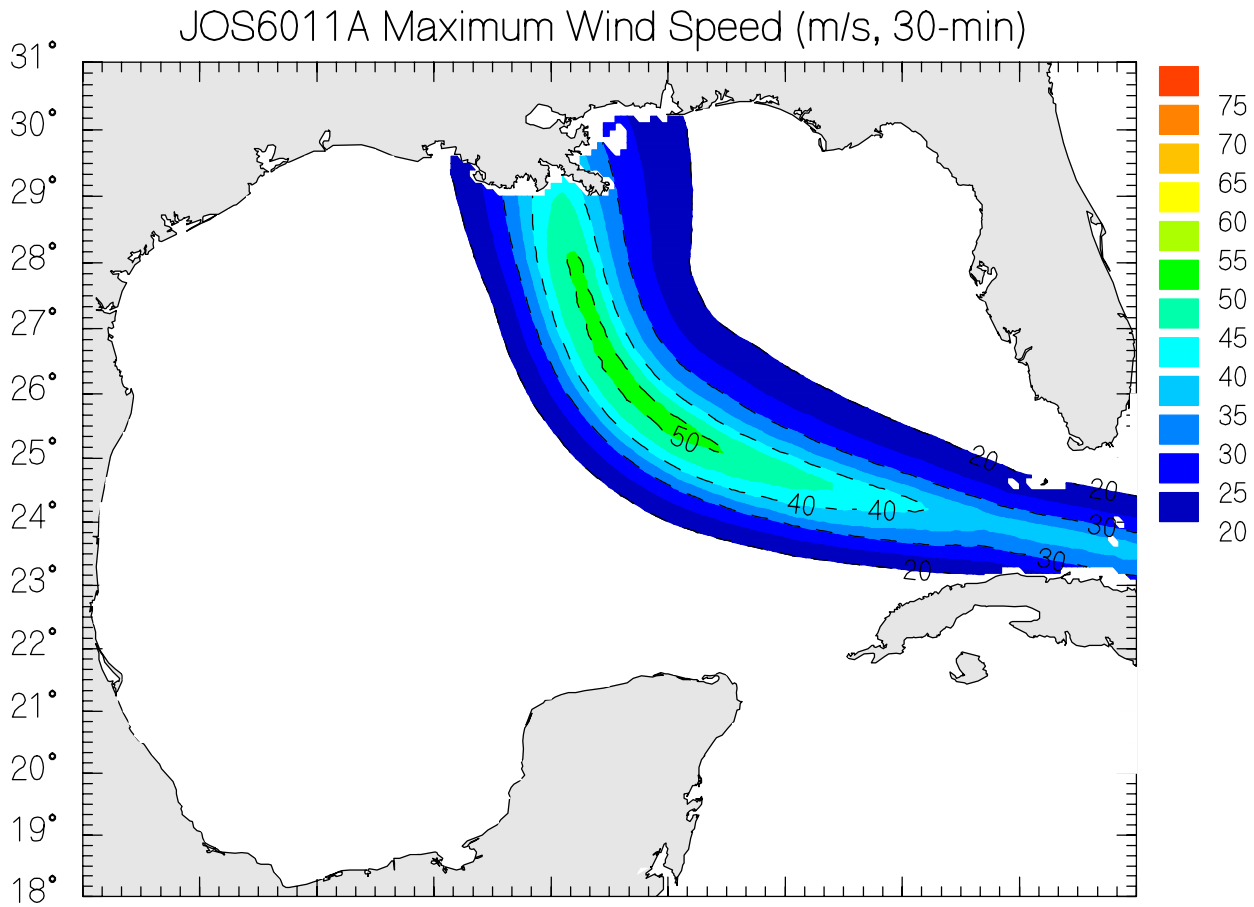
URS JPM-OS6 Production Tracks

JOS6011 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6011A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
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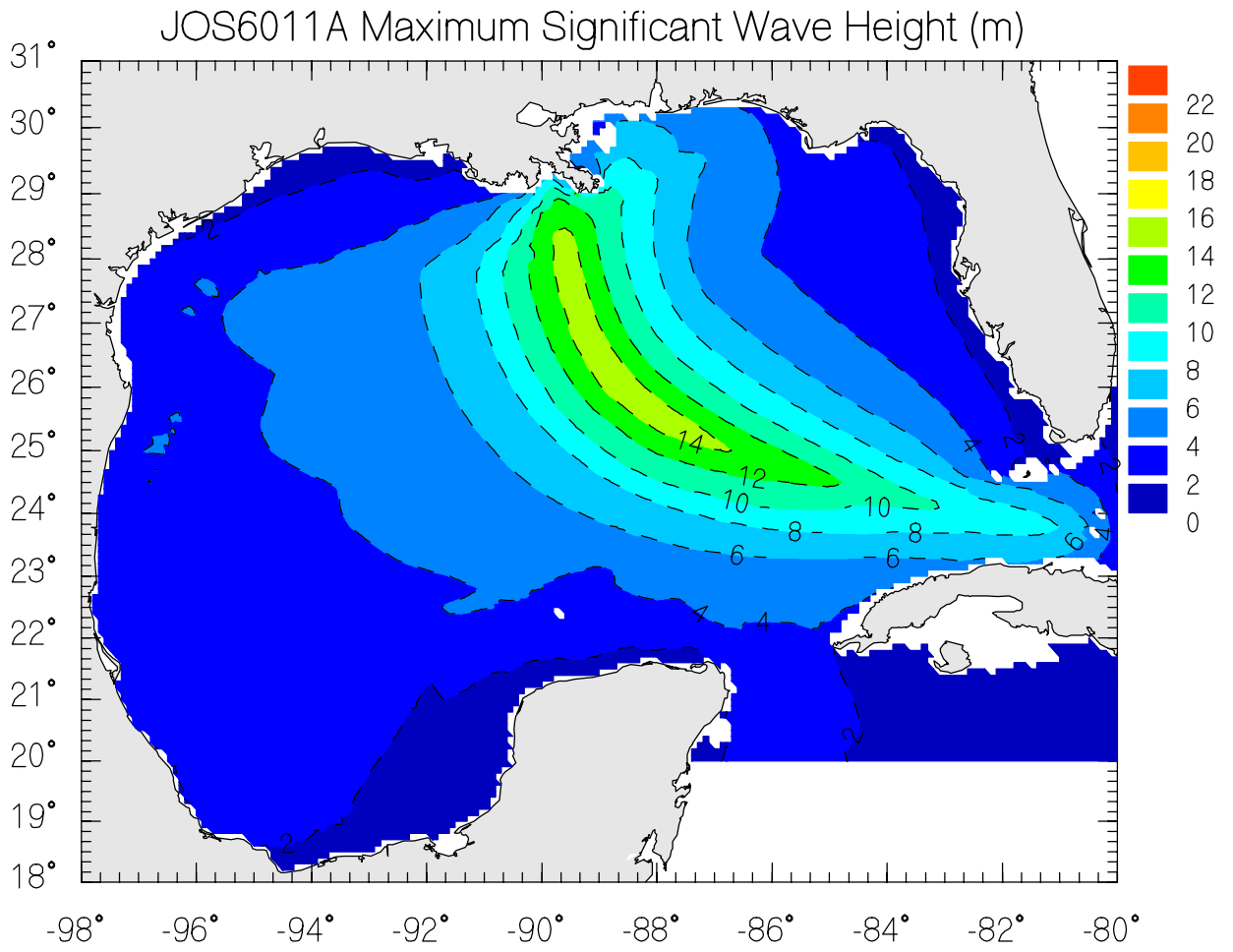
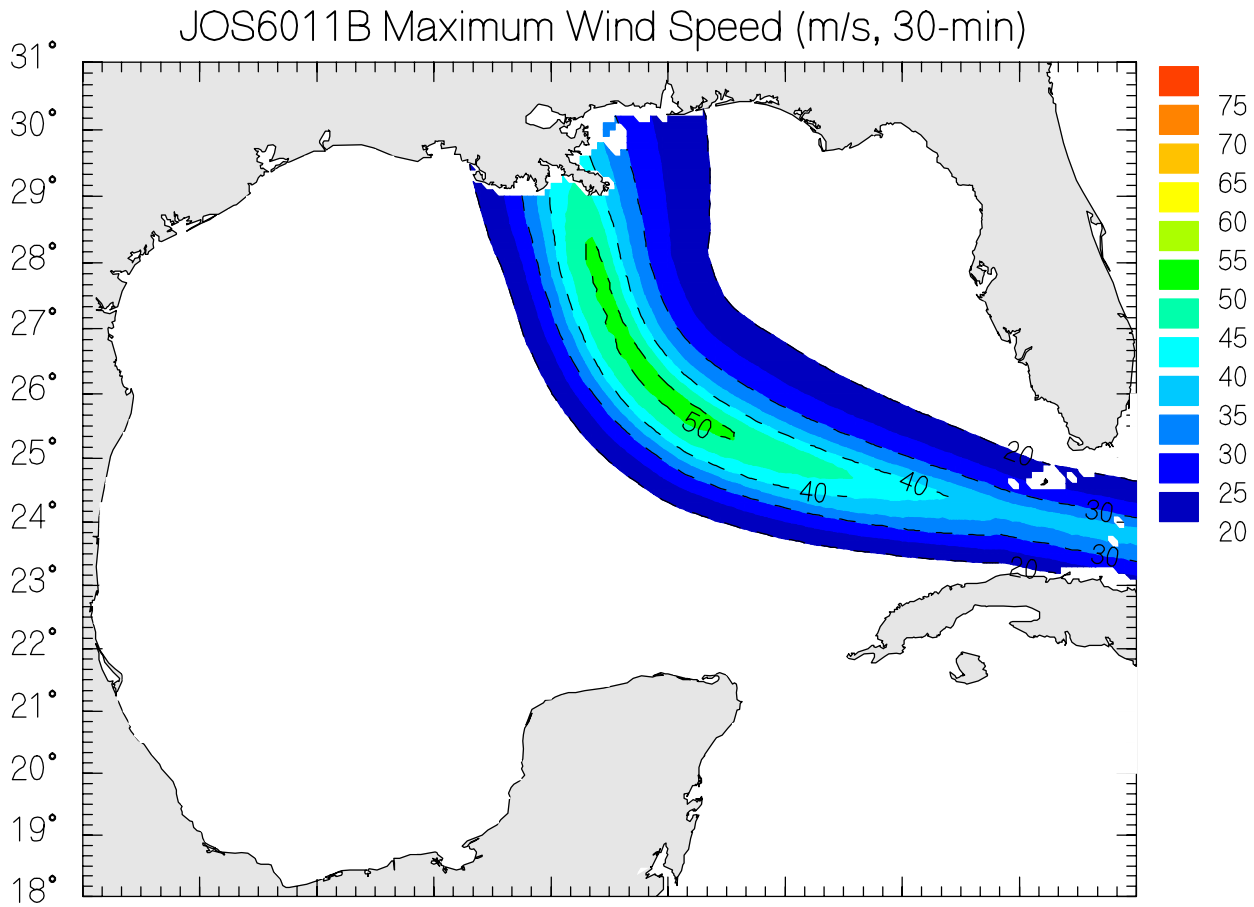
20


JOS6011A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
10
8
8
6
6
4
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6011B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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40
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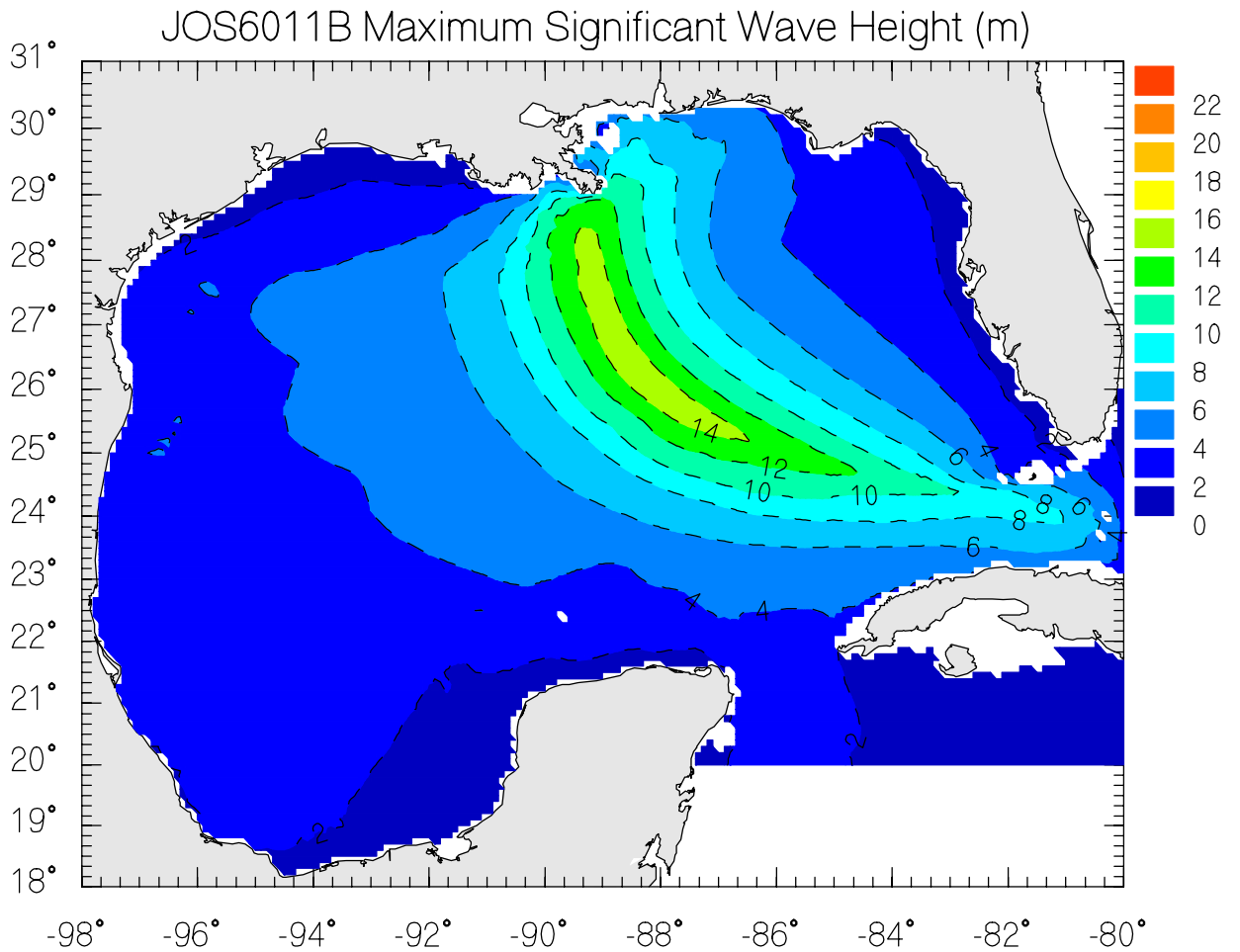
20
20


JOS6011B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
10
8
8
6
6
6
4
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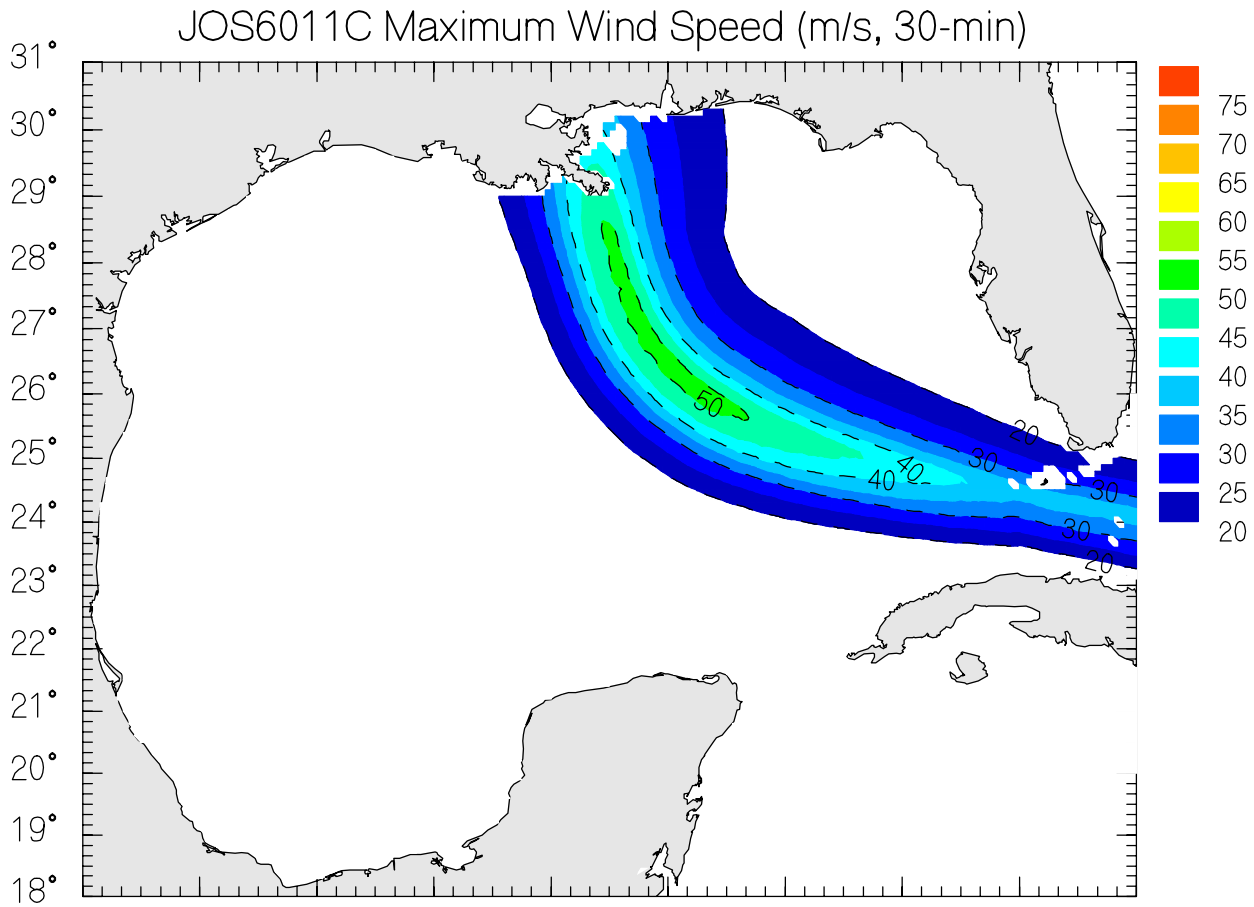
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6011C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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35
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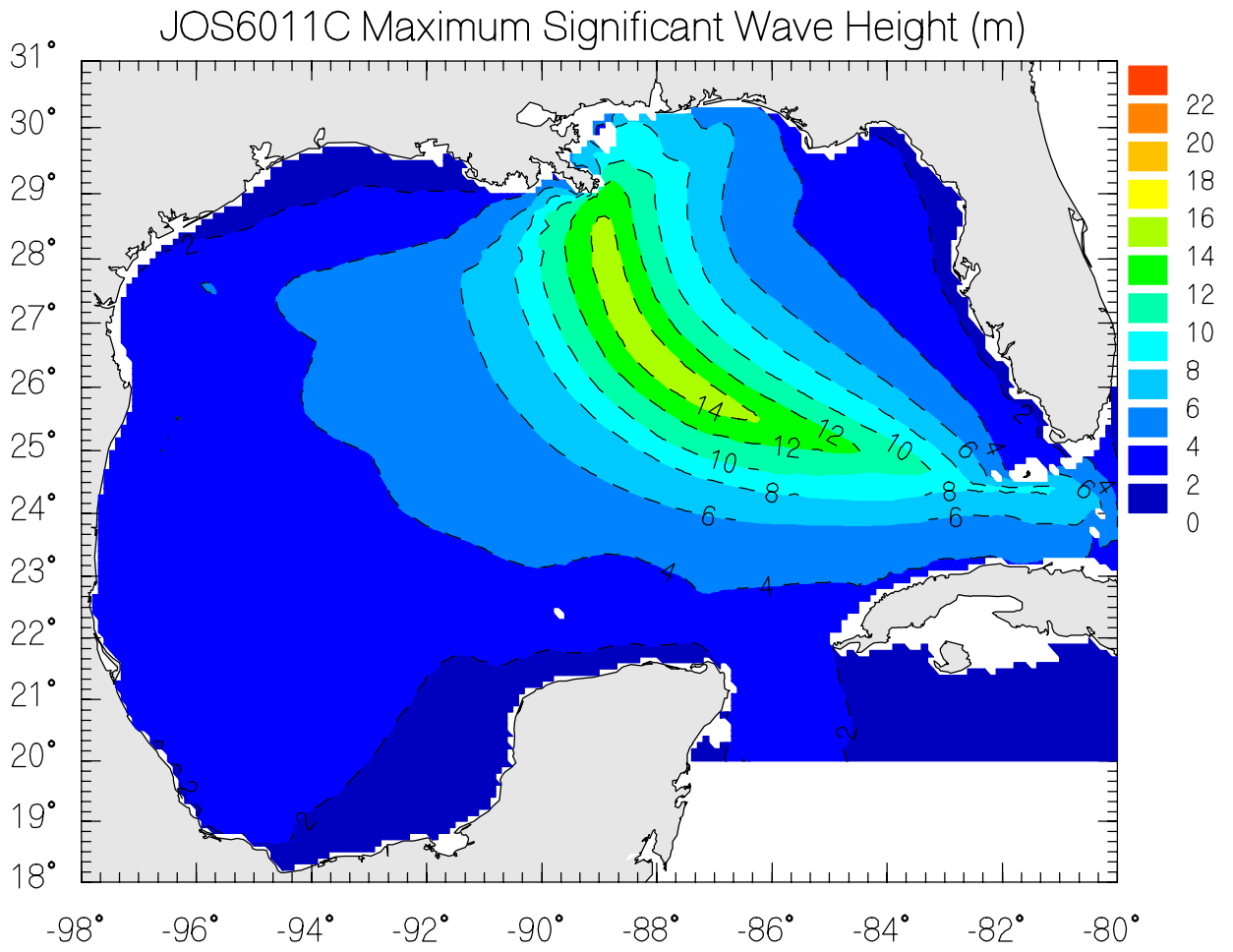
25
20
50
40
30
20


JOS6011C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
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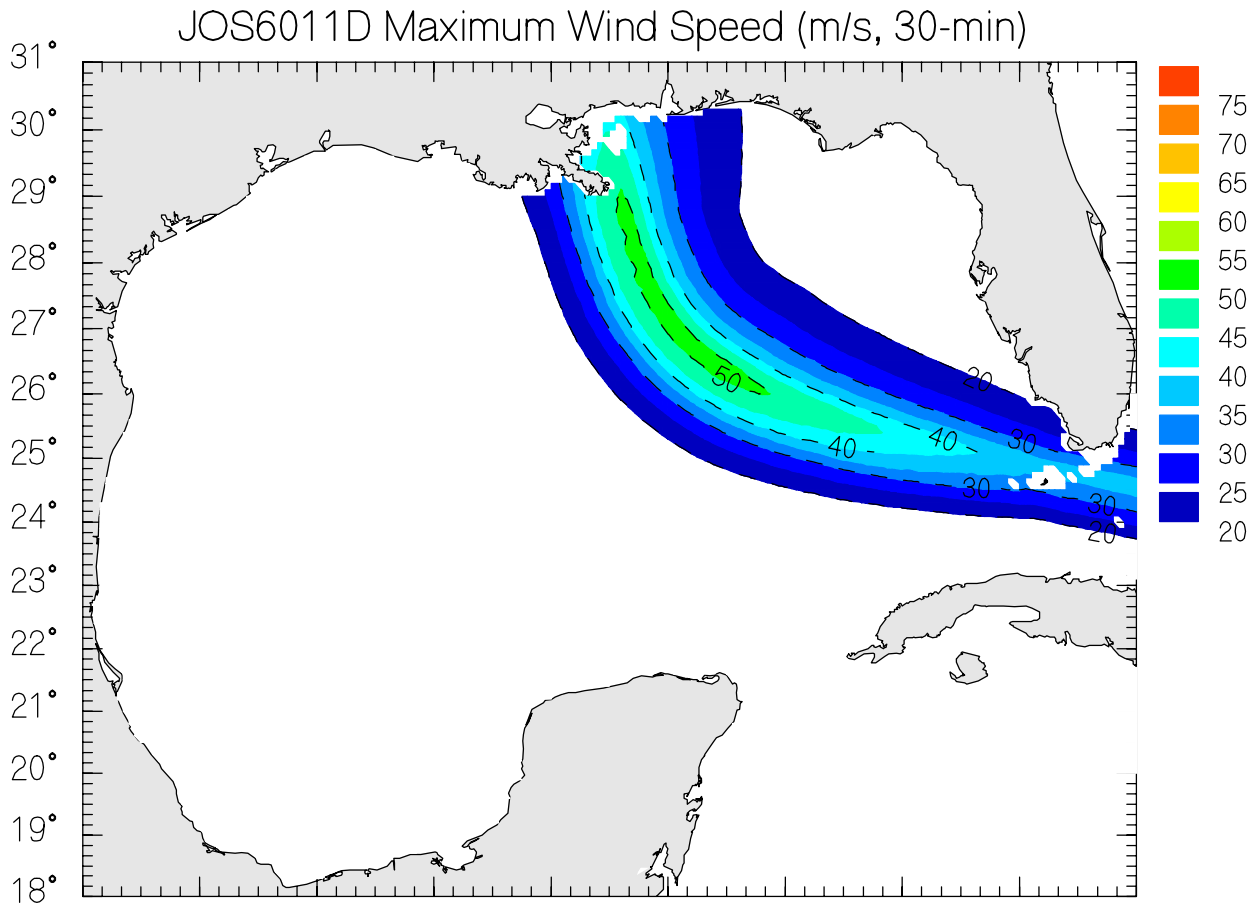
-86°
-84°
-82°
-80°


JOS6011D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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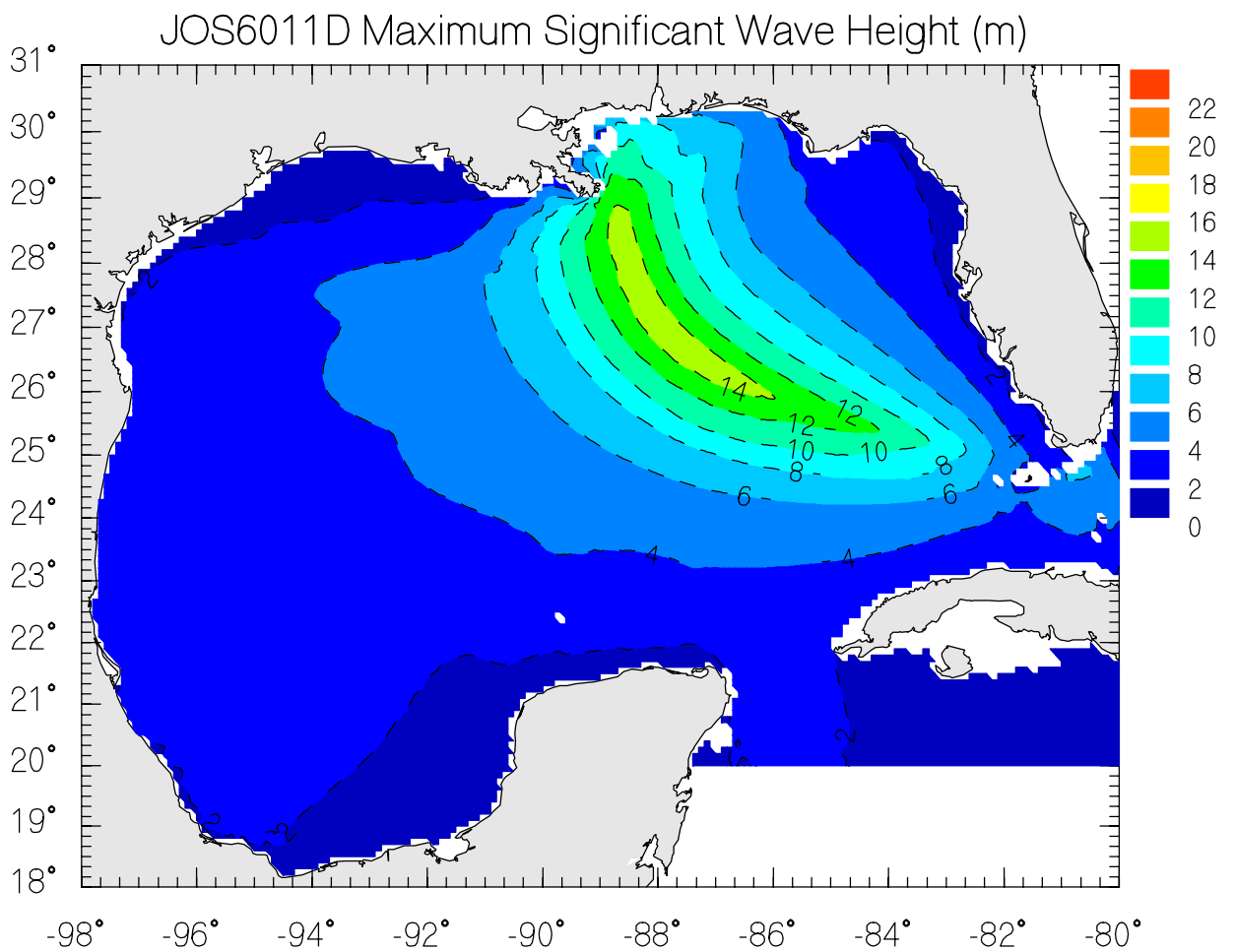
20
20


JOS6011D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
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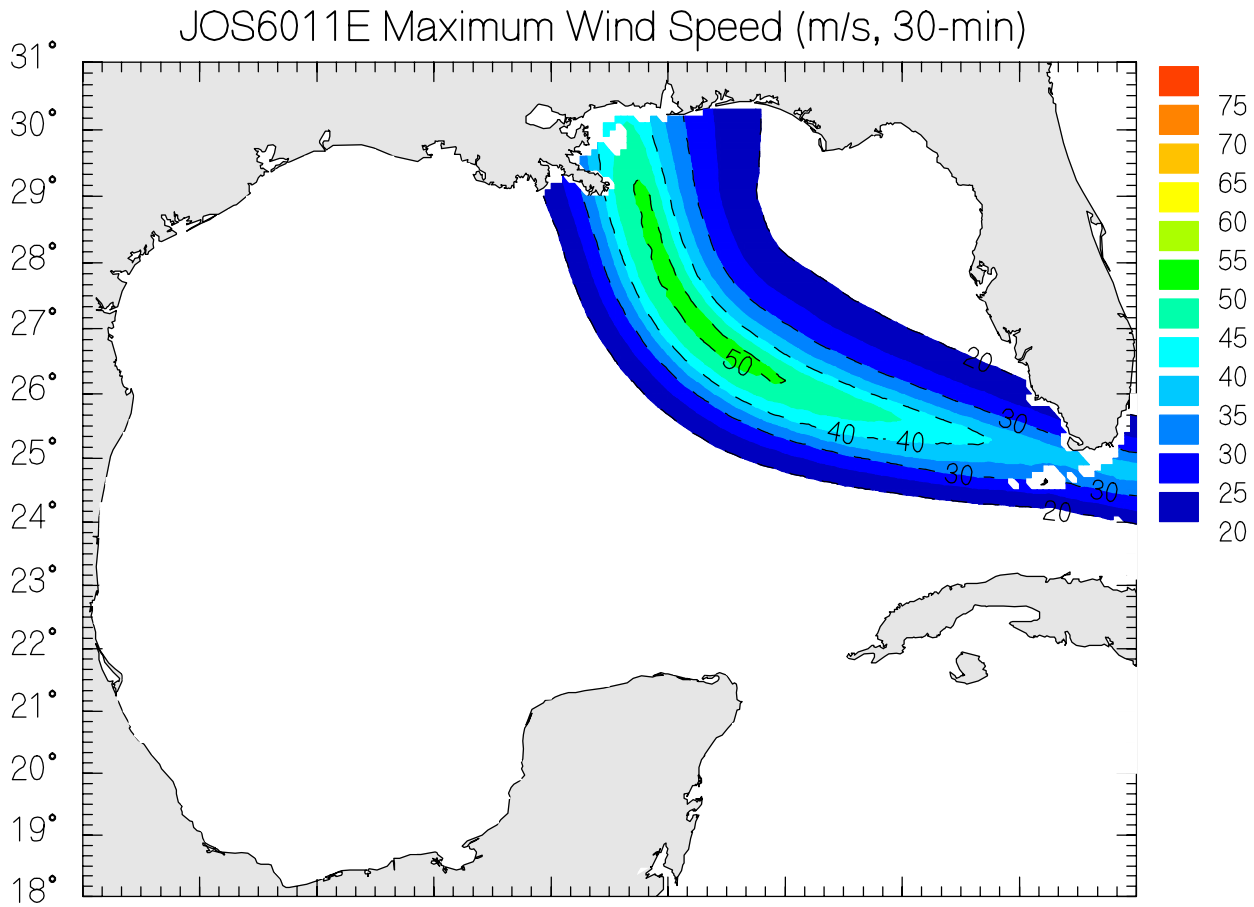
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6011E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
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21°
20°
19°
18°
75
70
65
60
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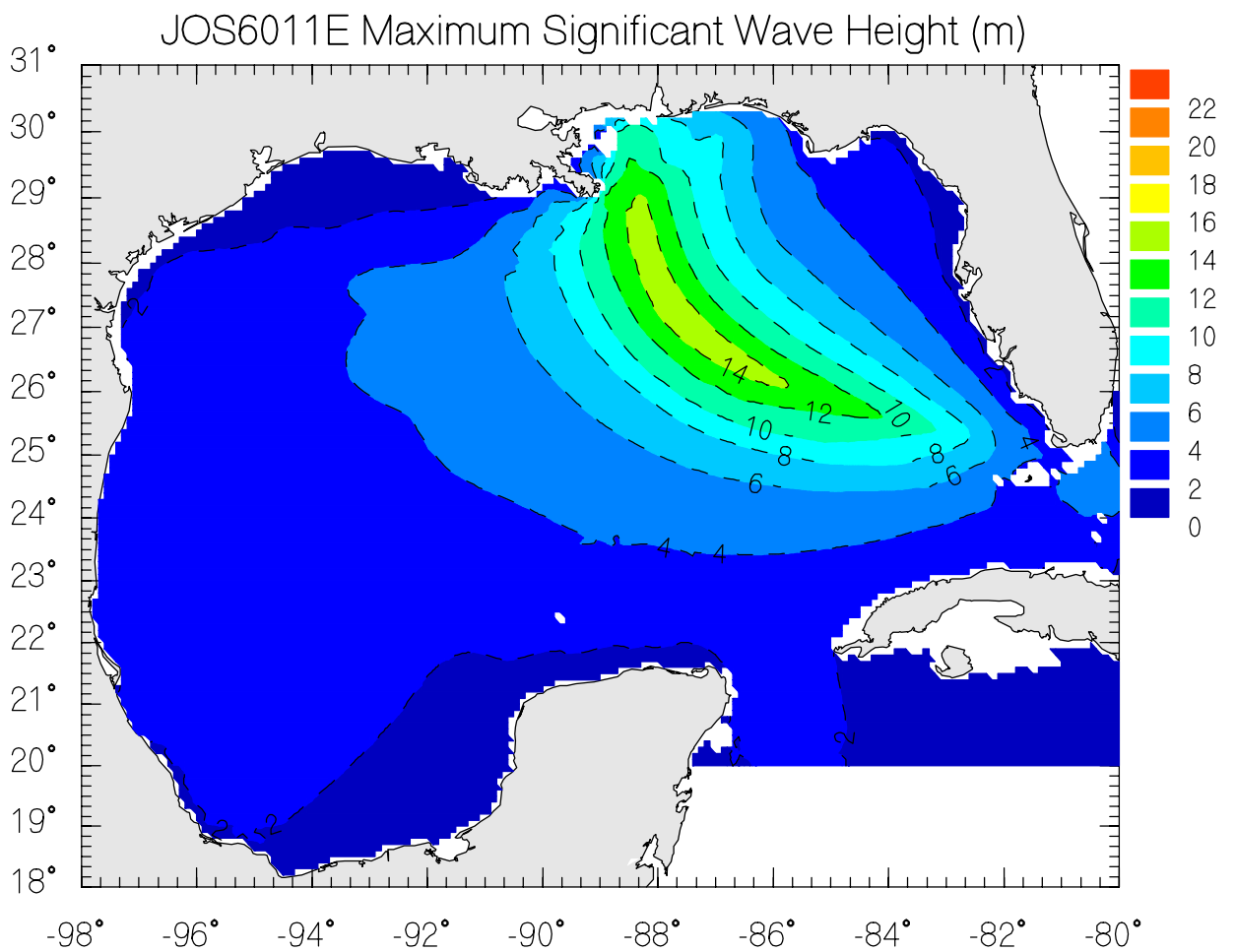
JOS6011E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
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12
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8
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6
6
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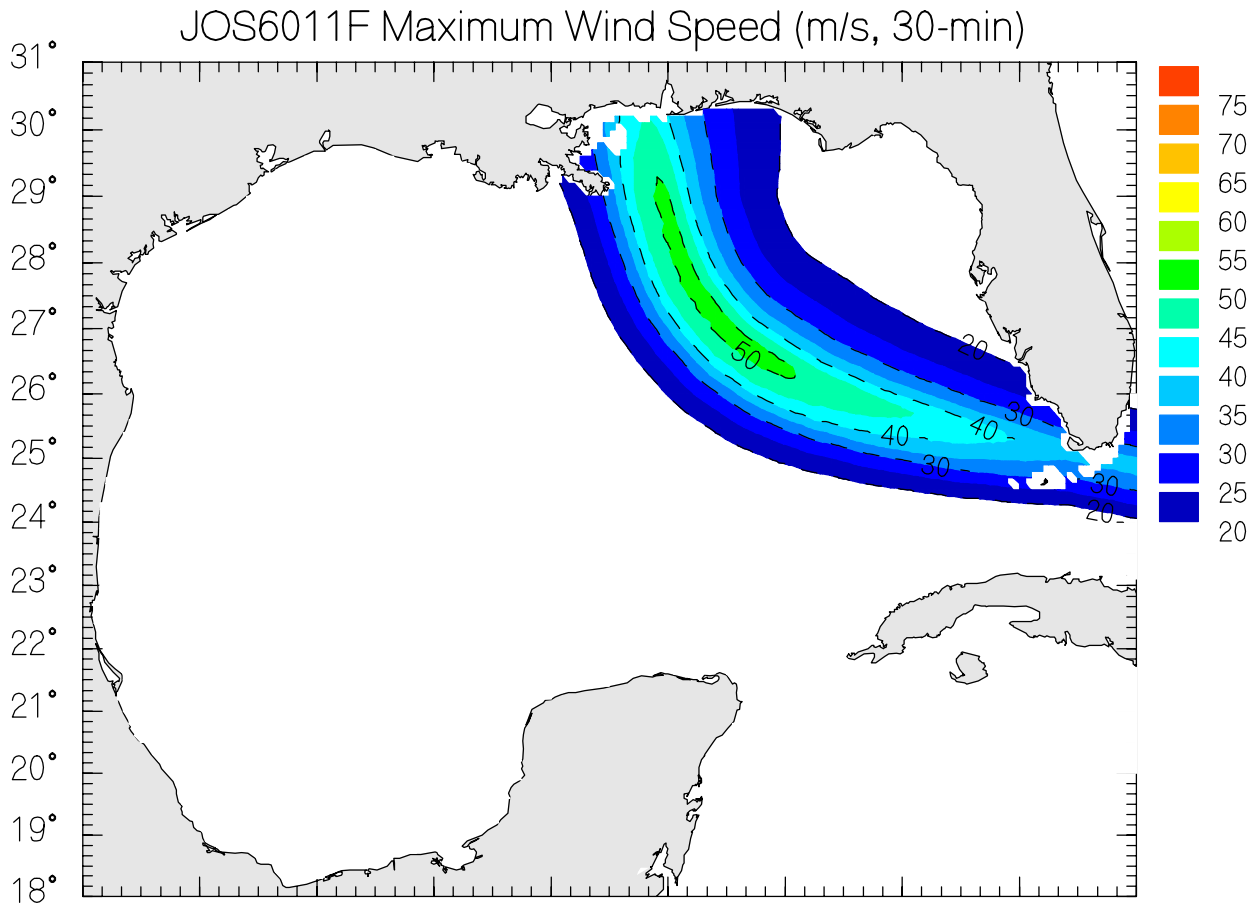
-88°
-86°
-84°
-82°
-80°


JOS6011F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
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25
20
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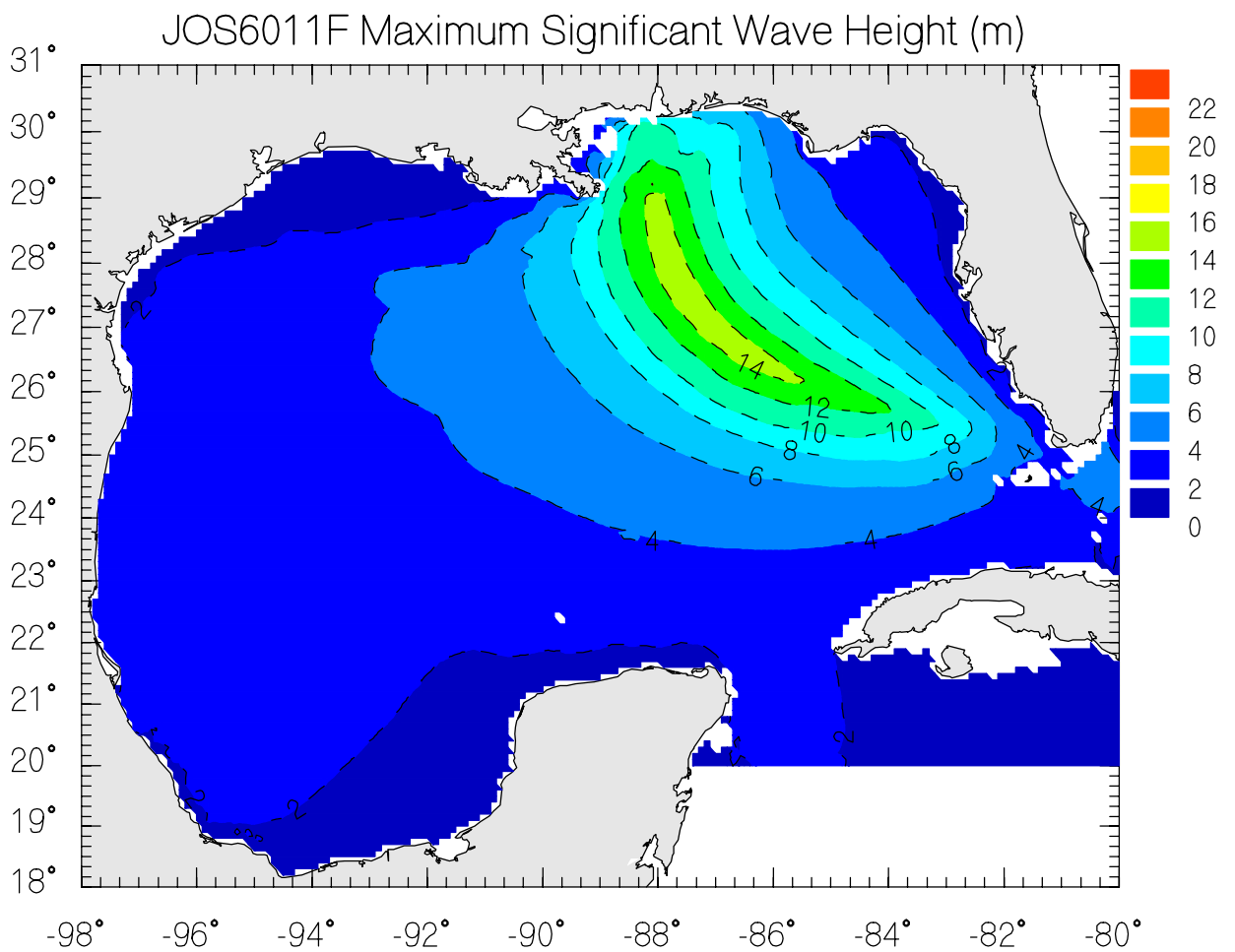
40
30
20


JOS6011F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
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8
6
4
2
0
14
12
10
8
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4
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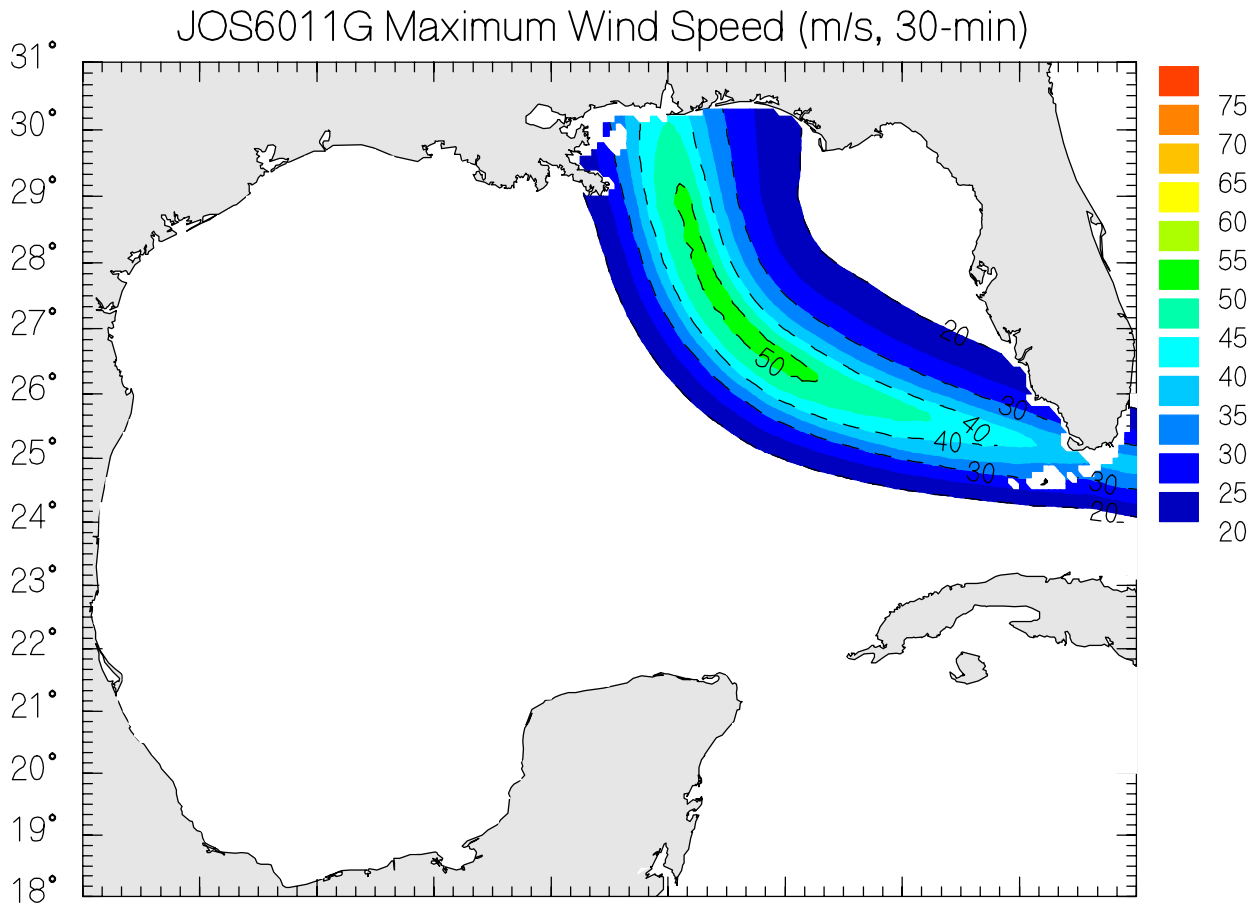
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6011G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
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30
25
20
50
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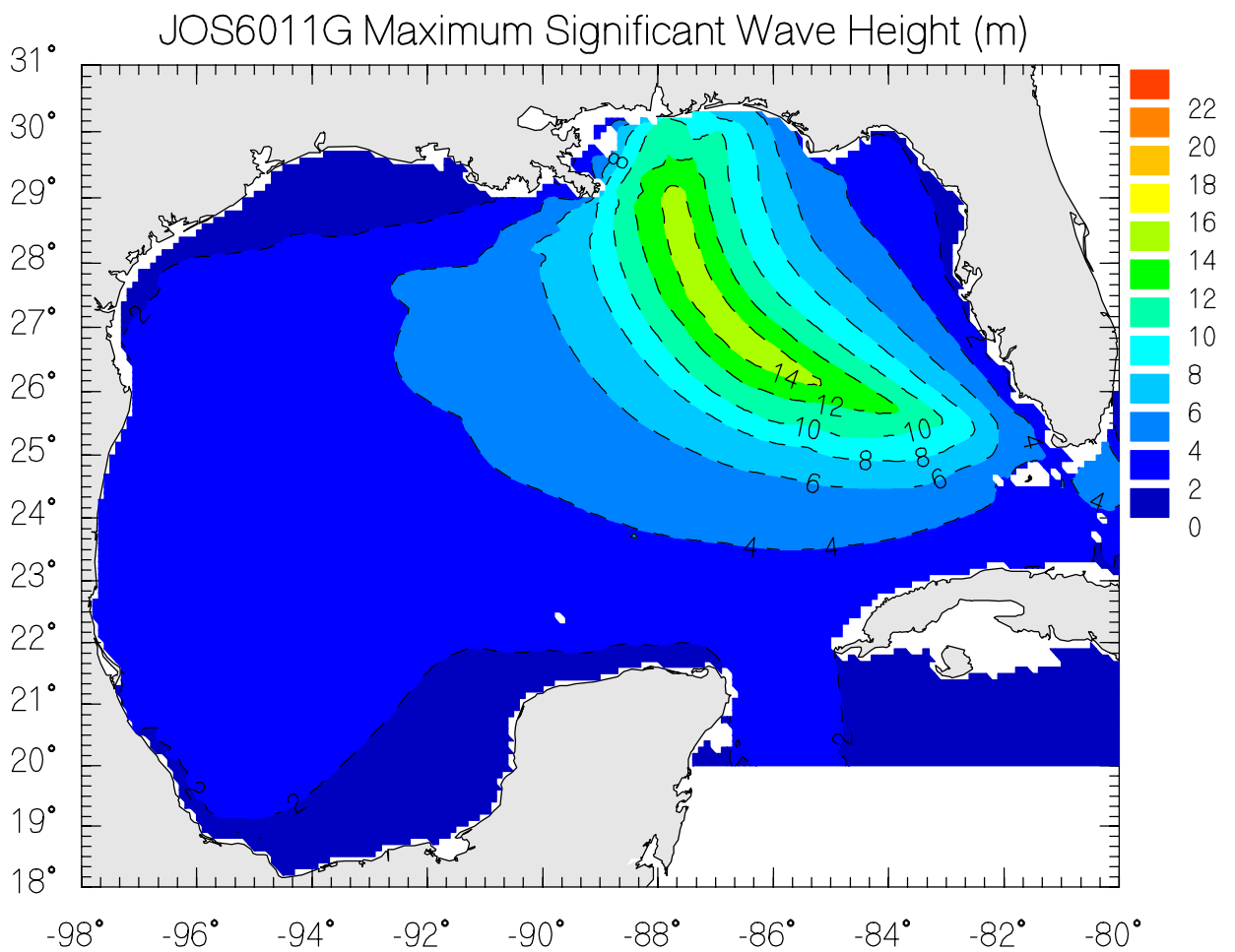
30
20


JOS6011G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
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12
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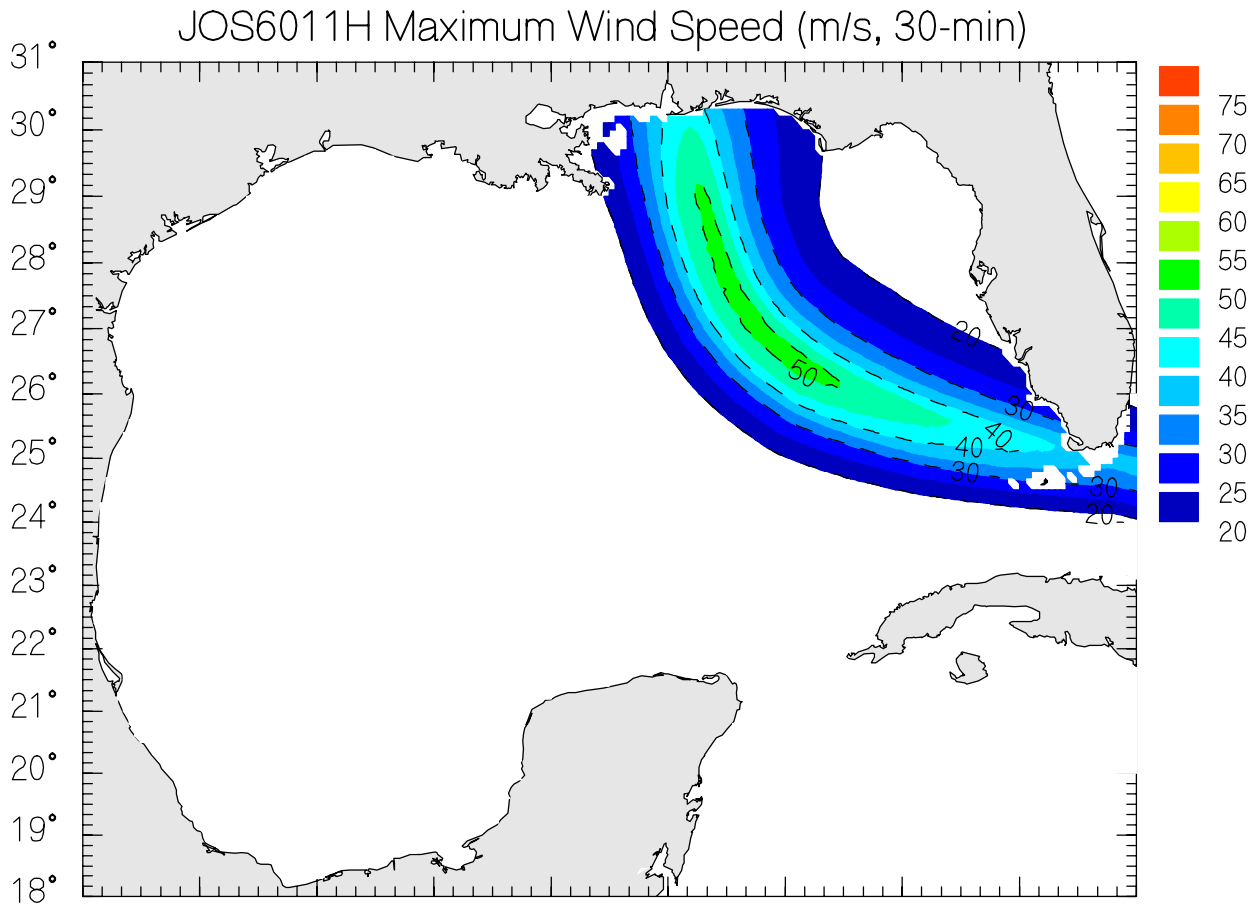
JOS6011H Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
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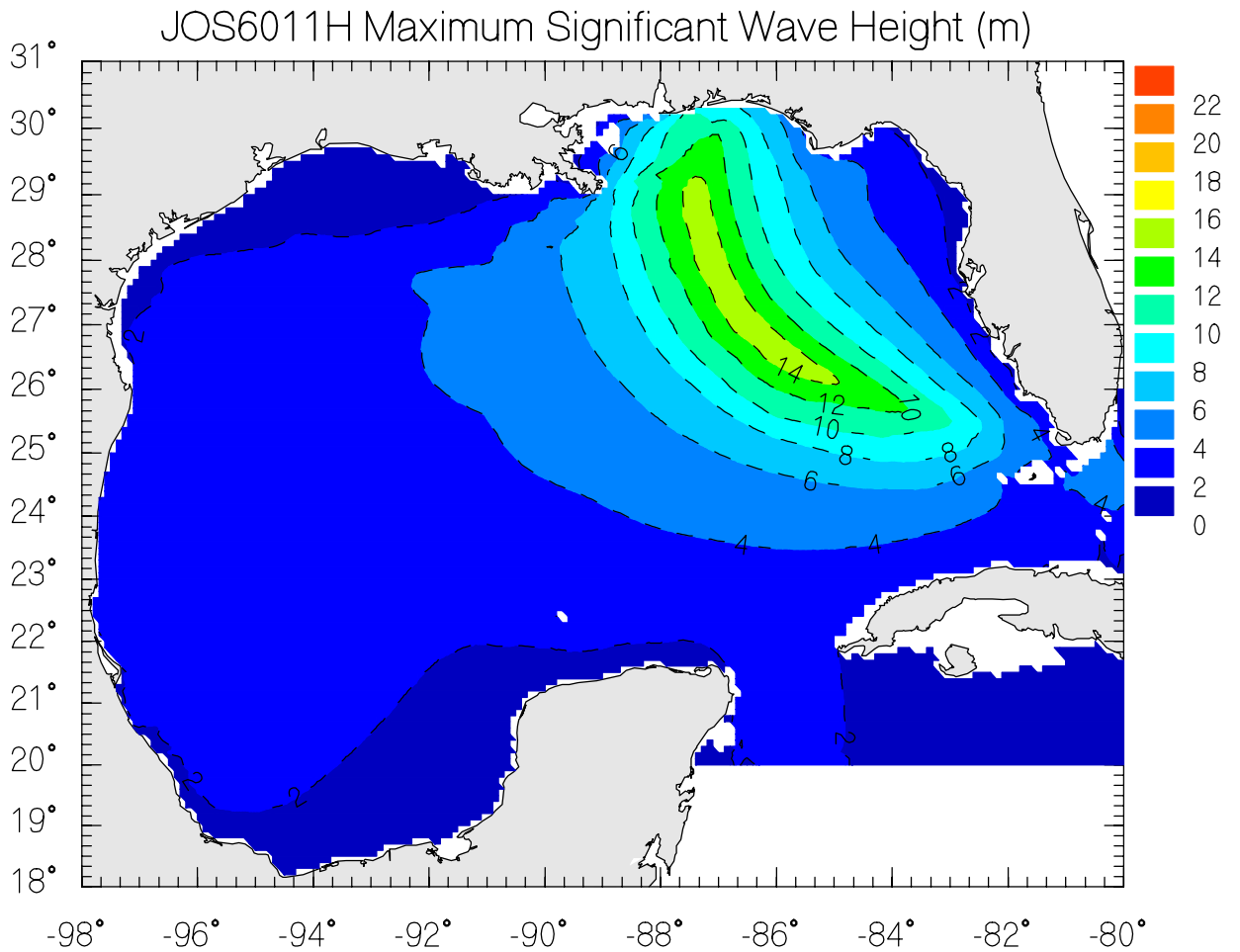
25
20
50
40
30
20


JOS6011H Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
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-98°
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-92°
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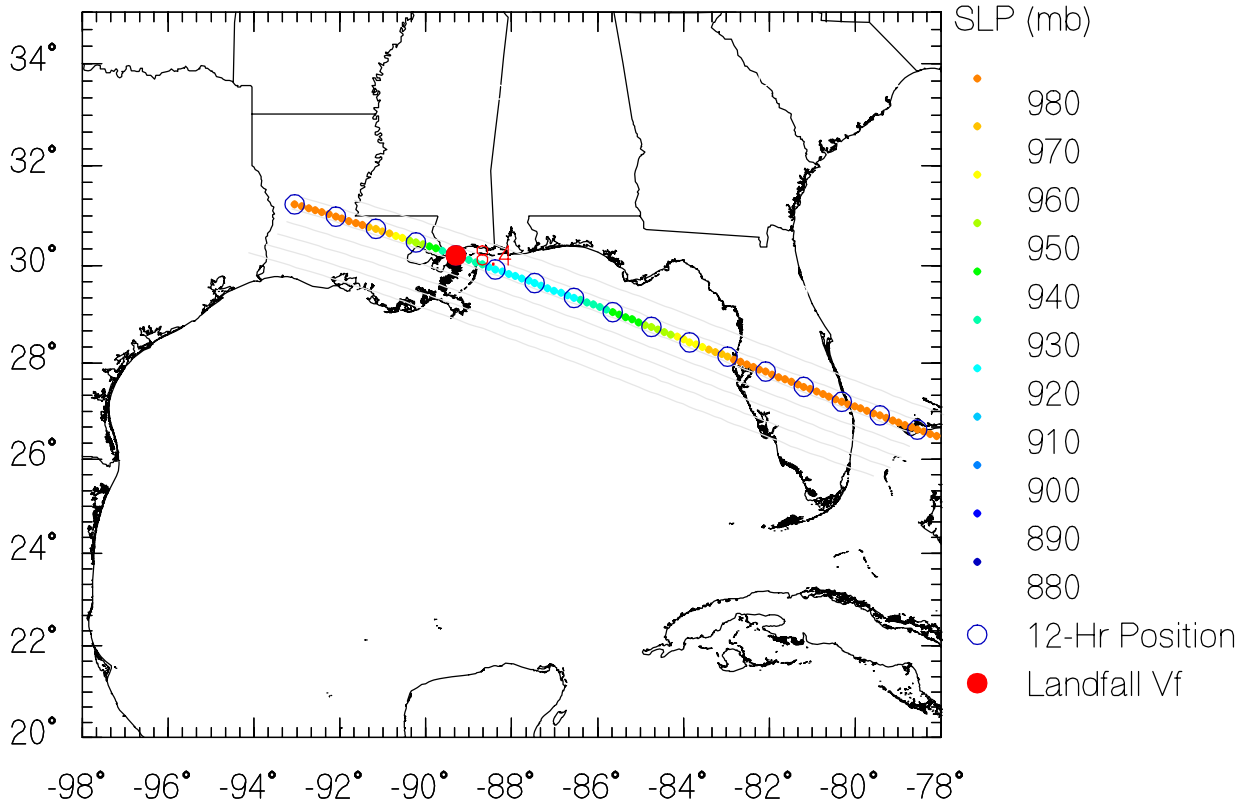
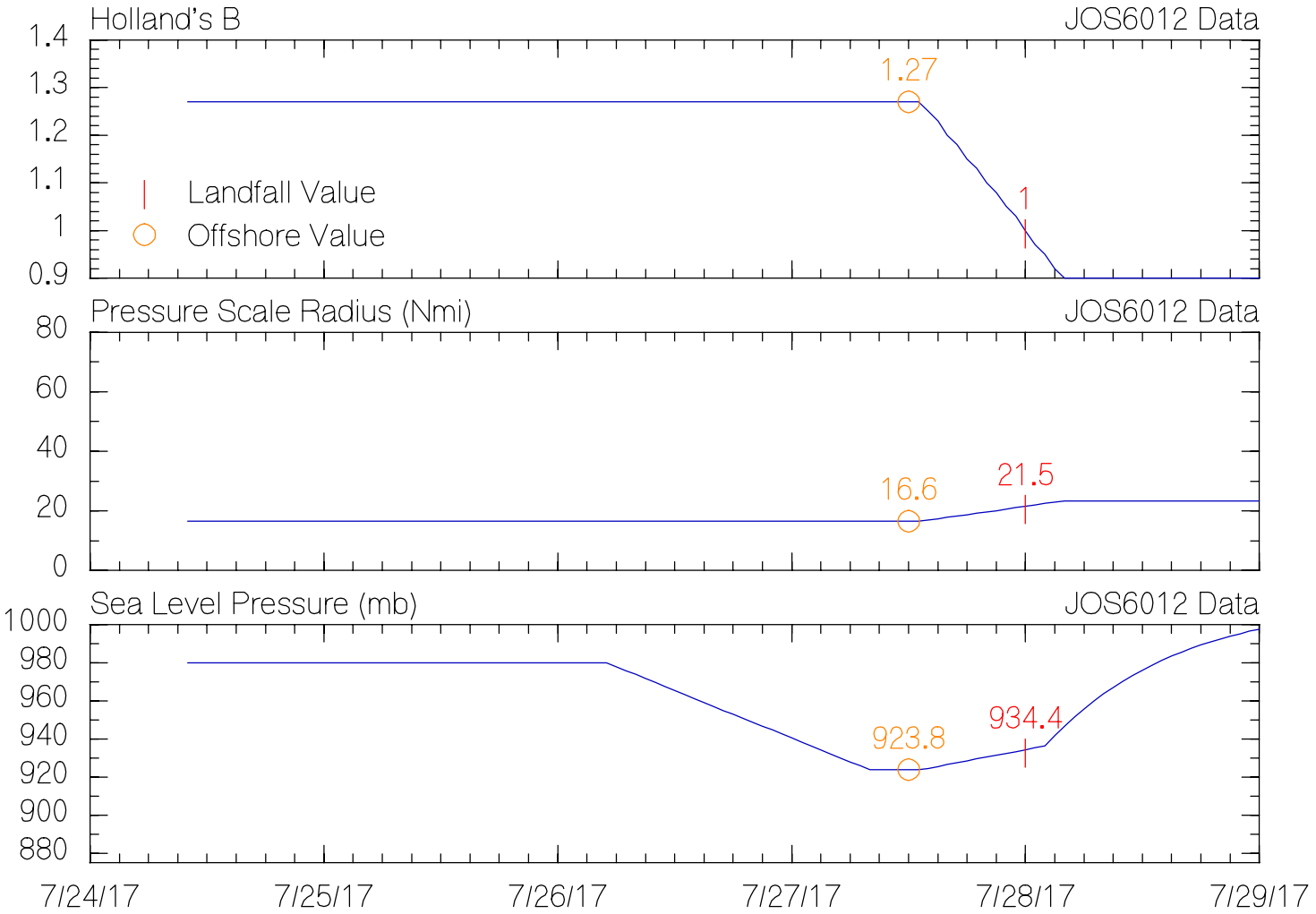
-88°
-86°
-84°
-82°
-80°

JOS6012 Data

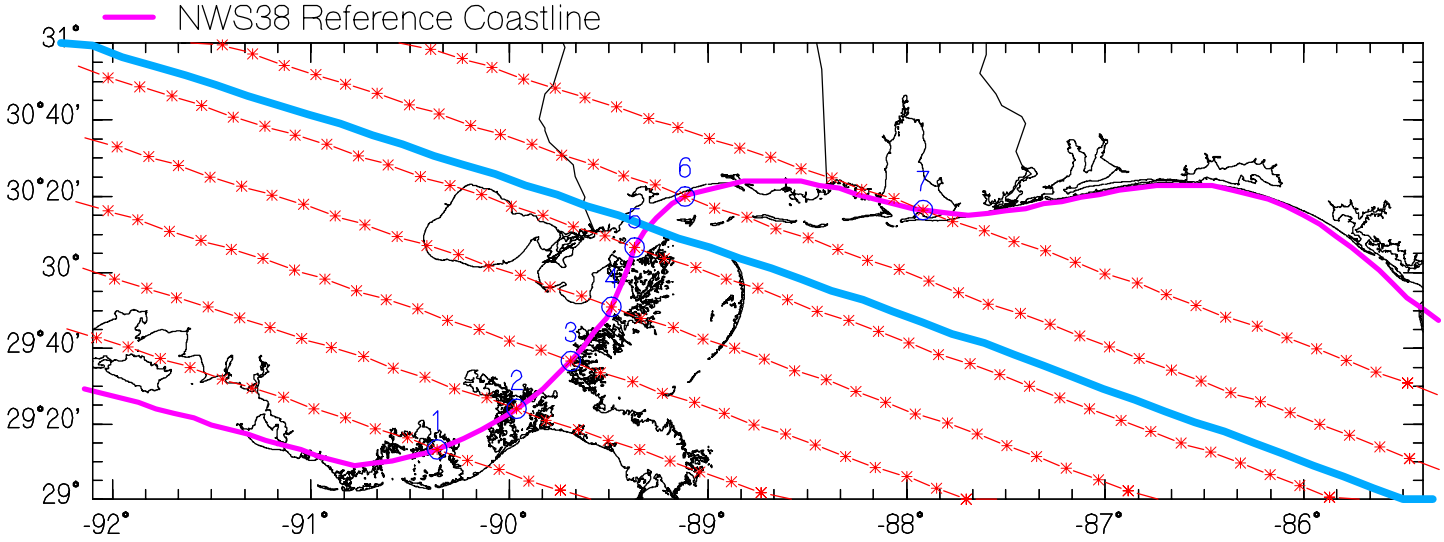


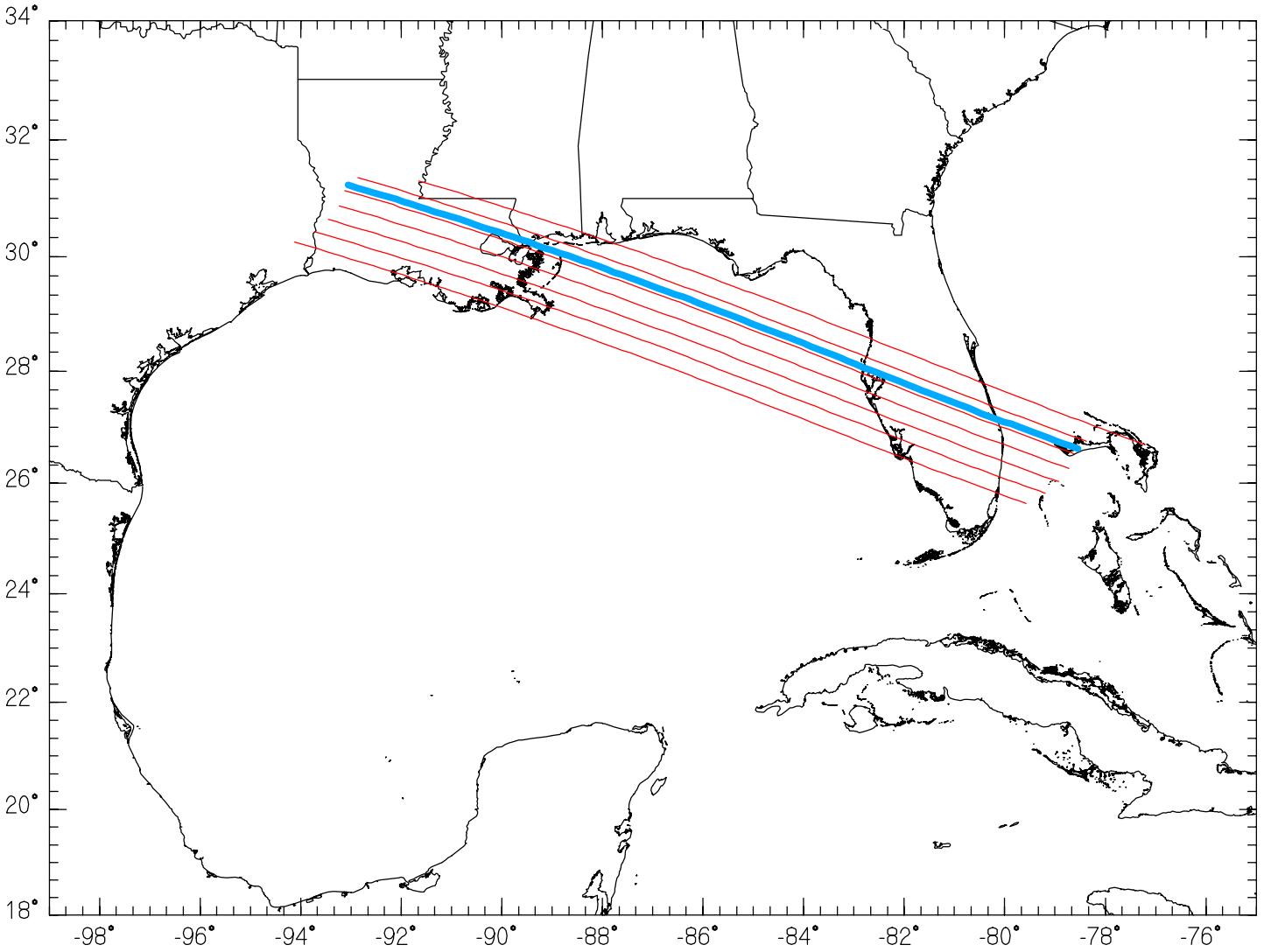


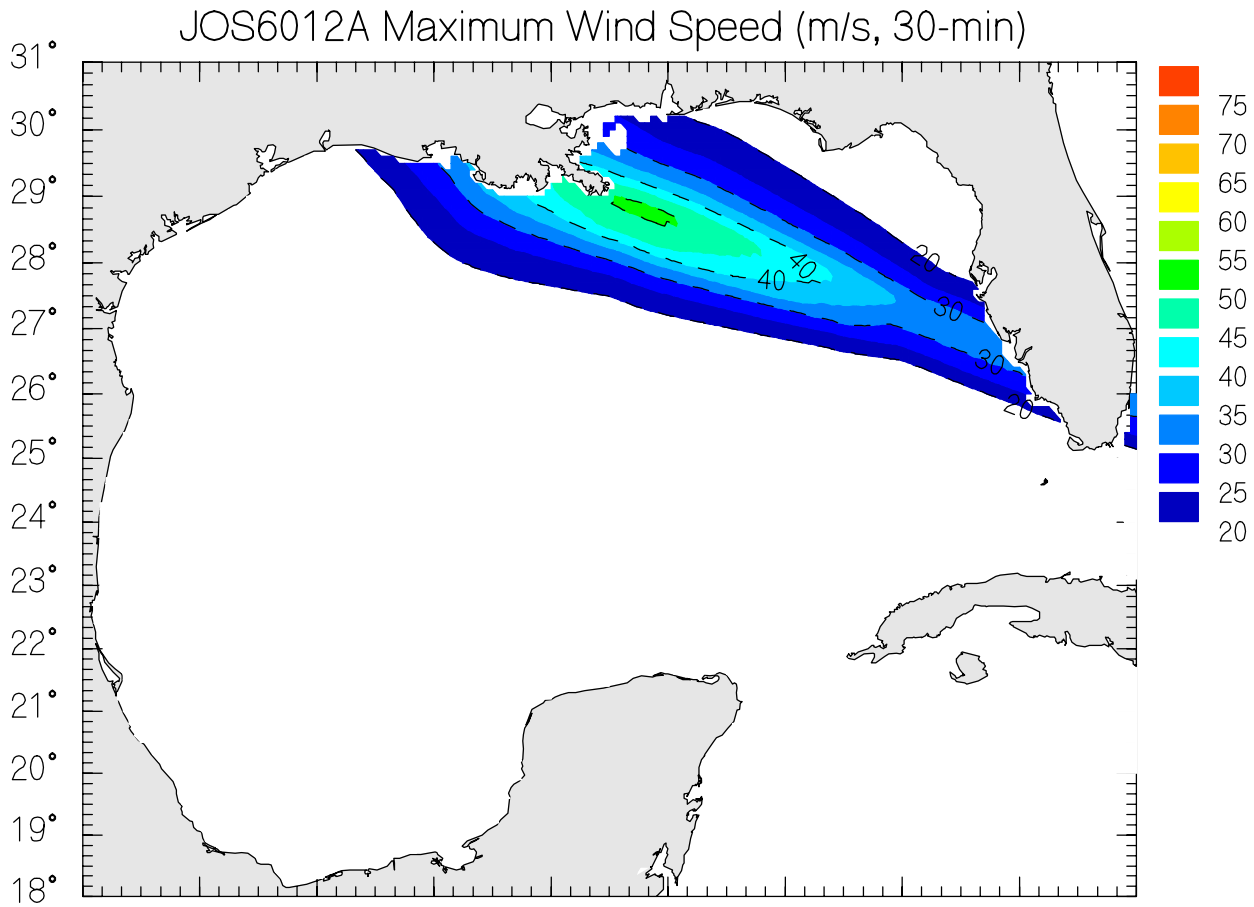
URS JPM-OS6 Production Tracks

JOS6012 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6012A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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35
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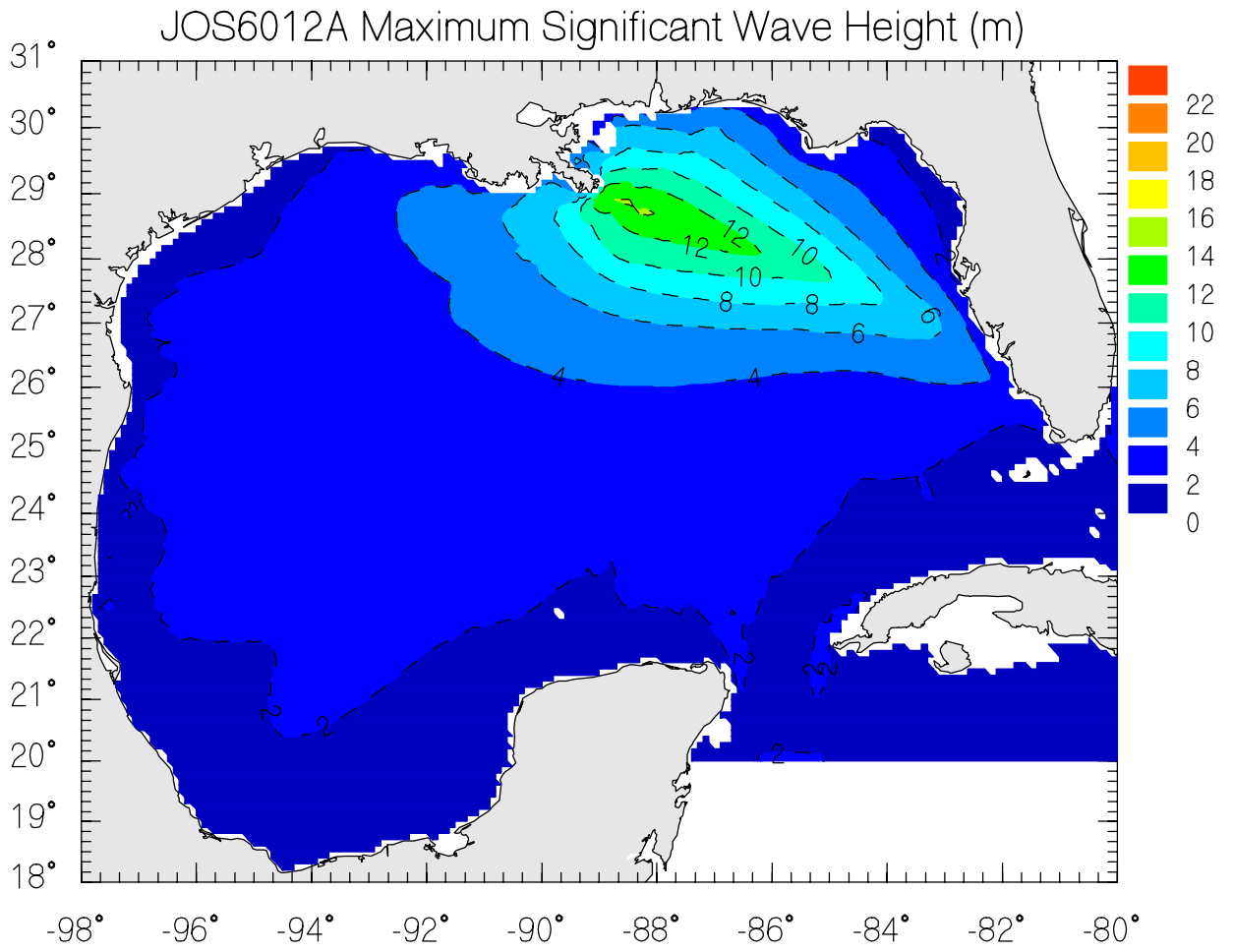
25
20


JOS6012A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
12
12
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10
8
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6
4
4
2
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22
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18
16
14
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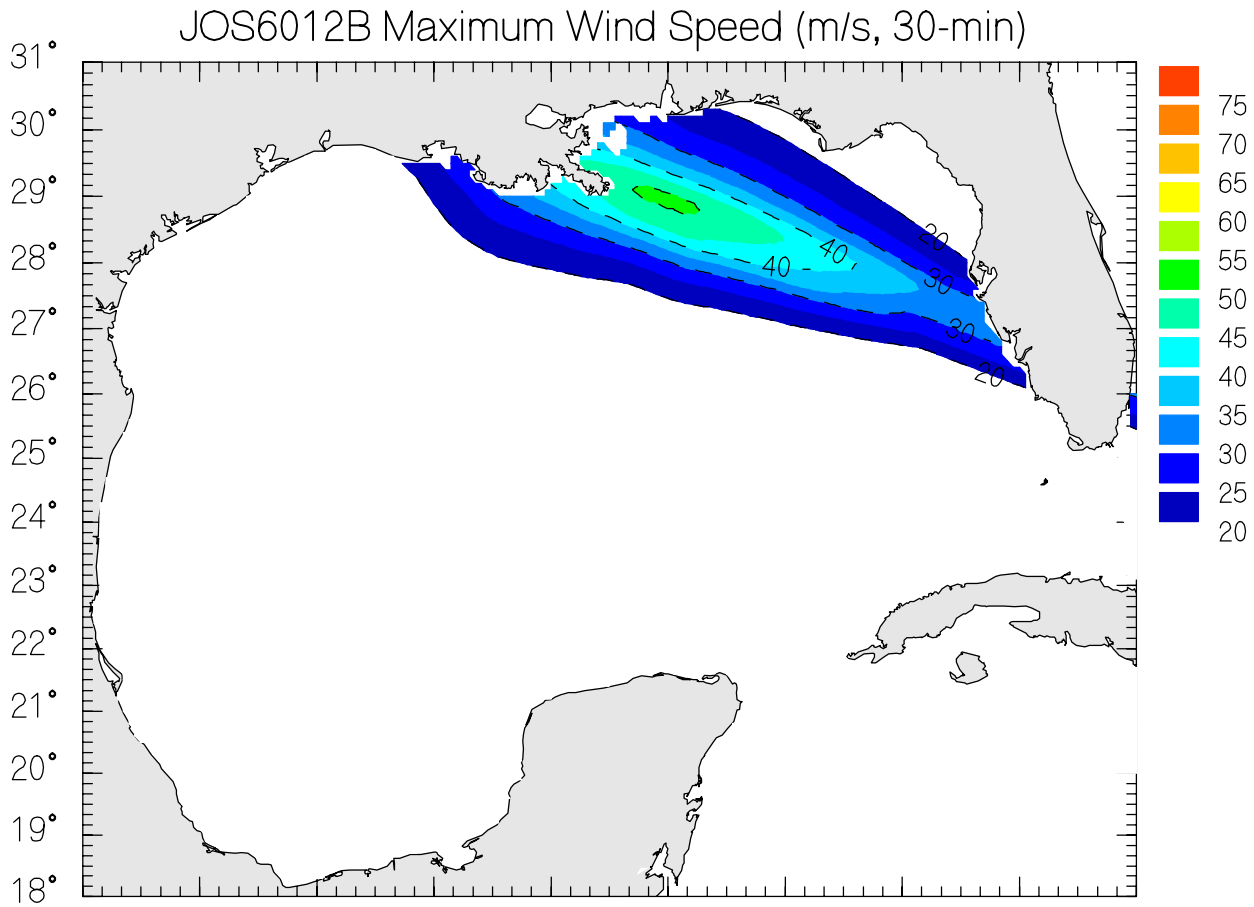
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6012B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
40
40
30
30
20
20
75
70
65
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55
50
45
40
35
30
25
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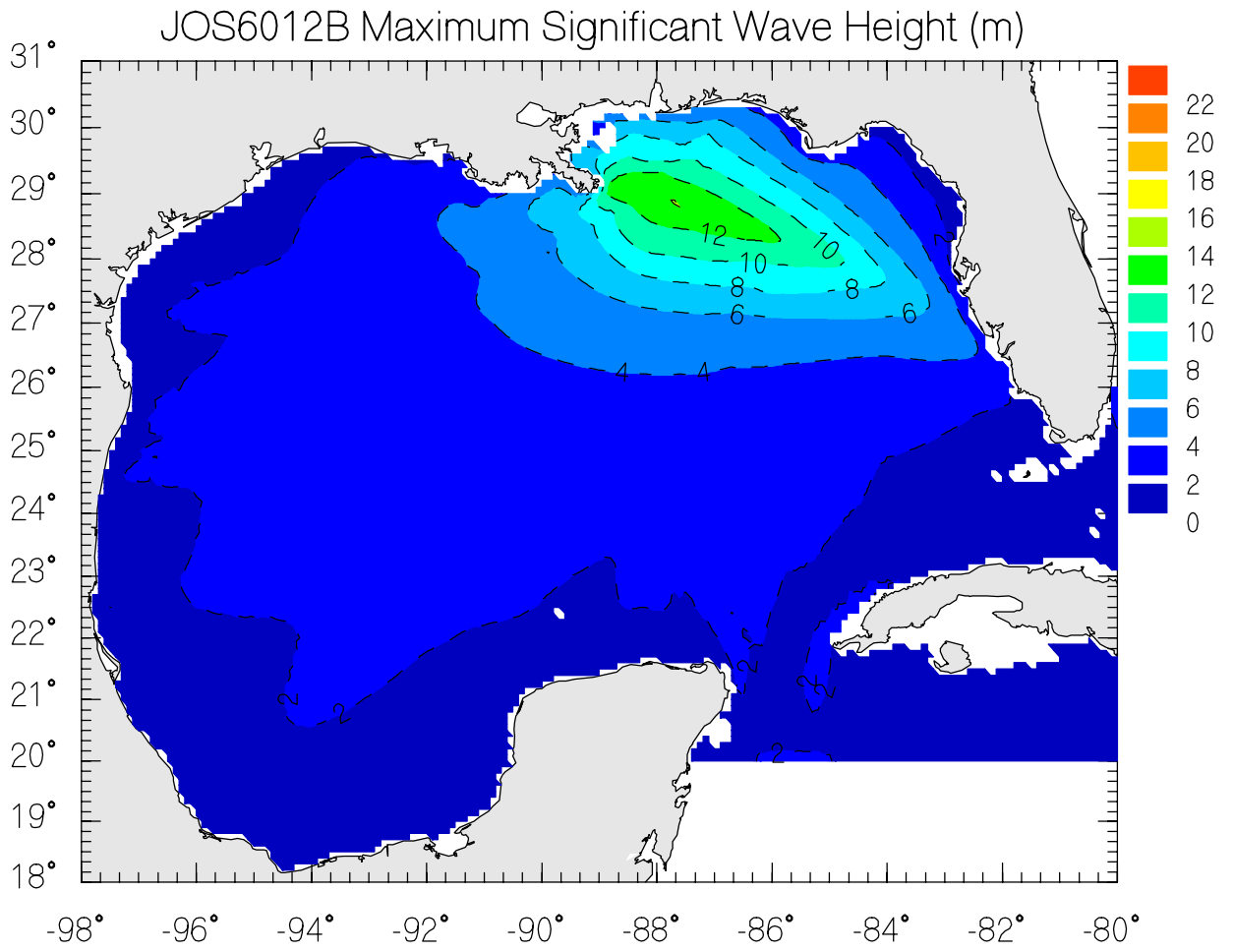
JOS6012B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
12
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10
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6
4
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2
2
2
22
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18
16
14
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-98°
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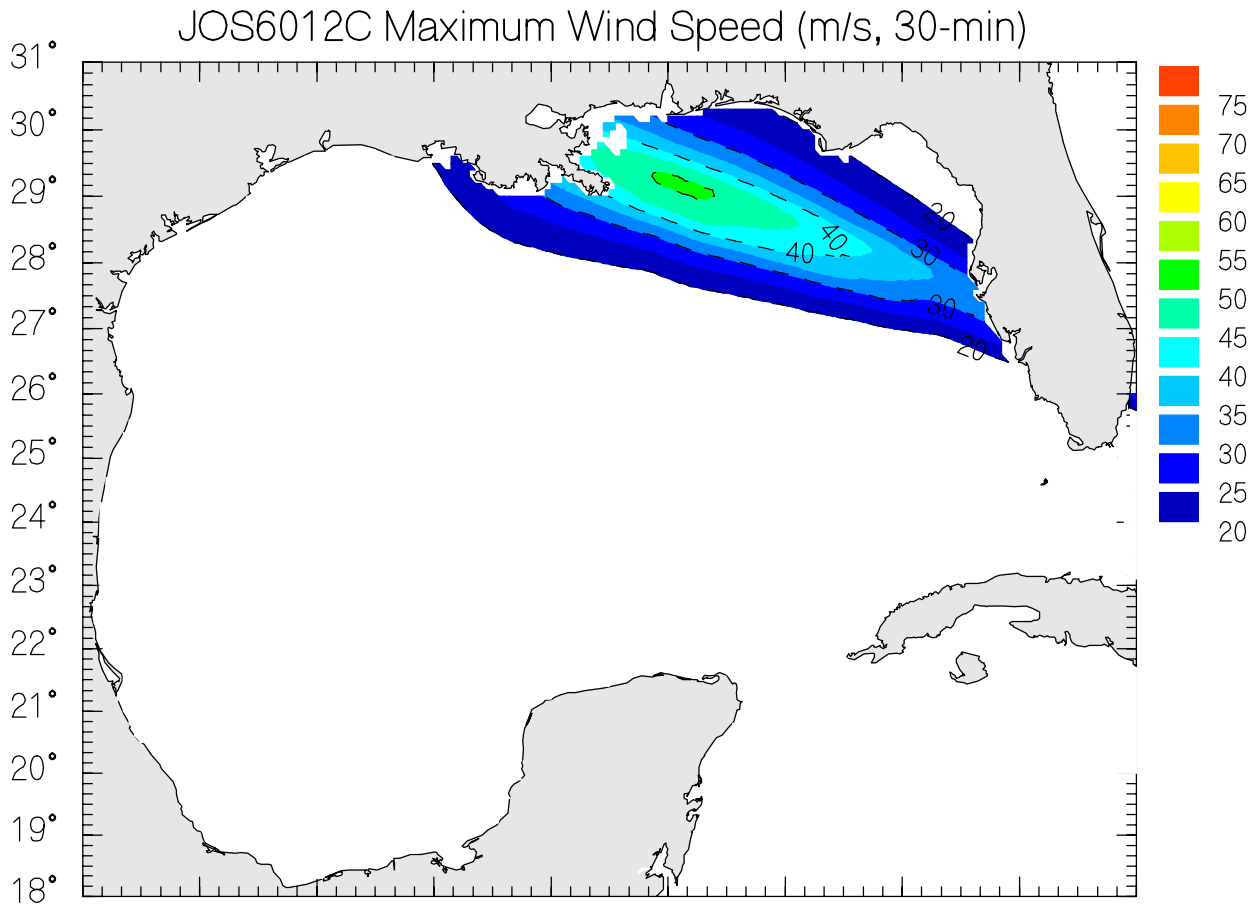
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6012C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
40
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30
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75
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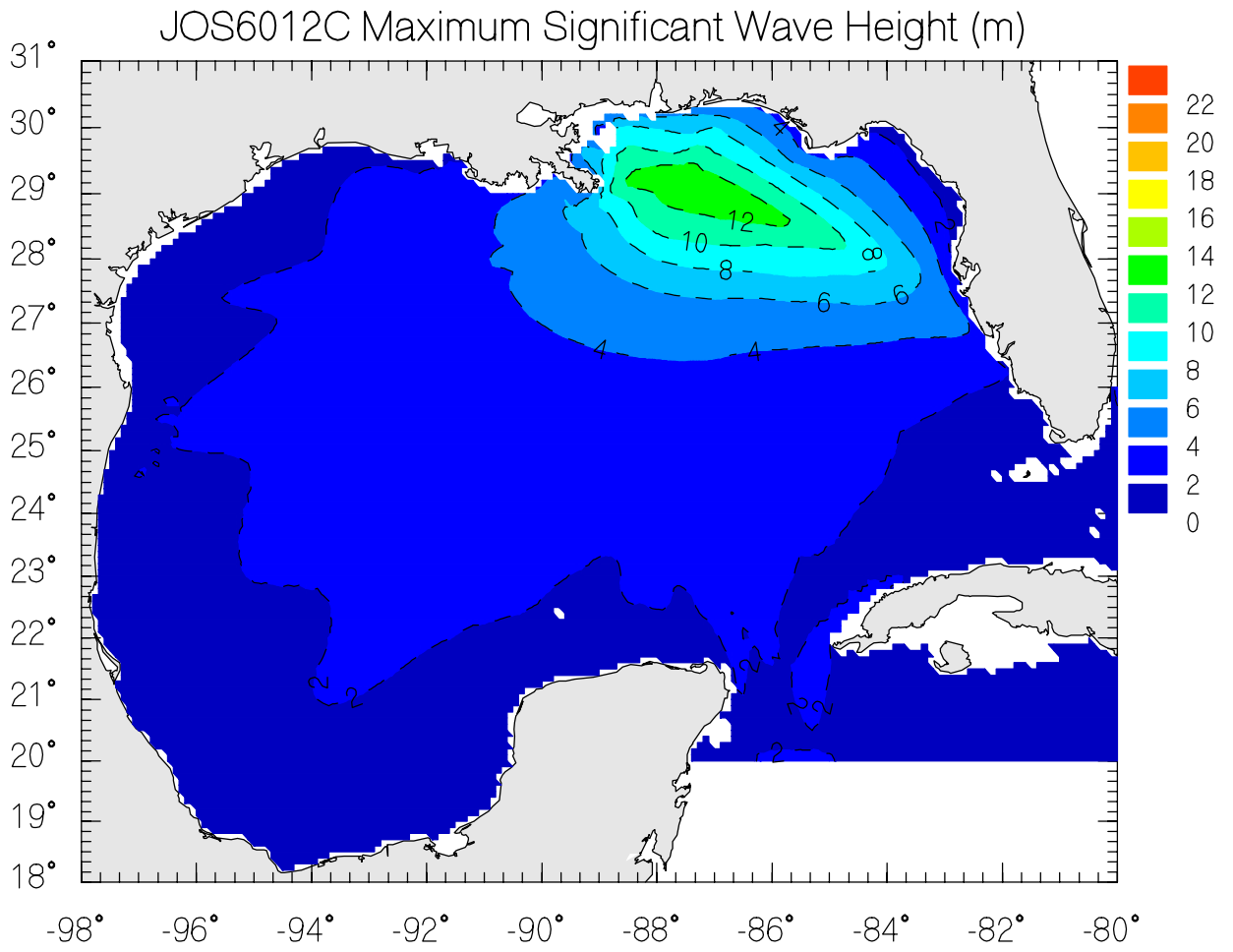
JOS6012C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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8
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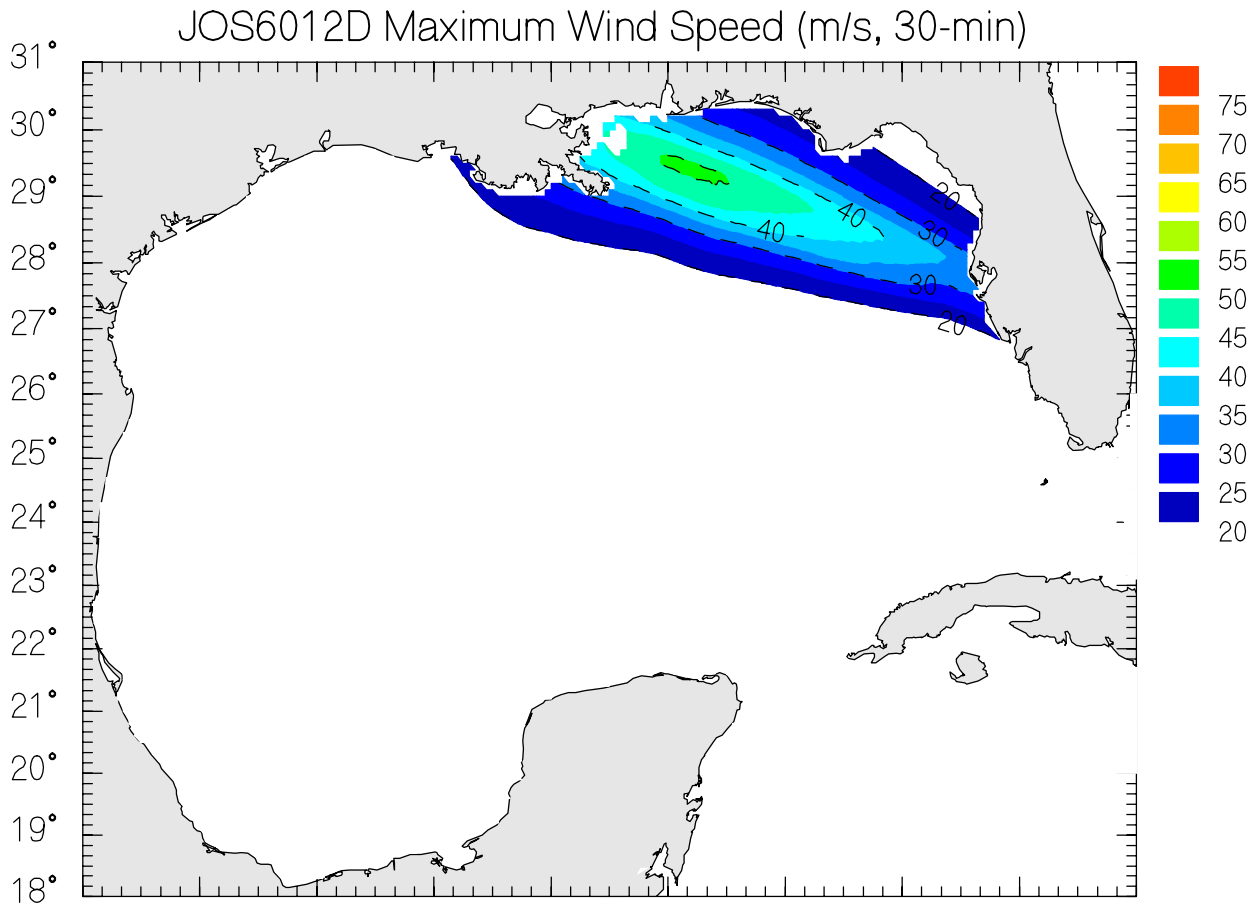
JOS6012D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
40
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75
70
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50
45
40
35
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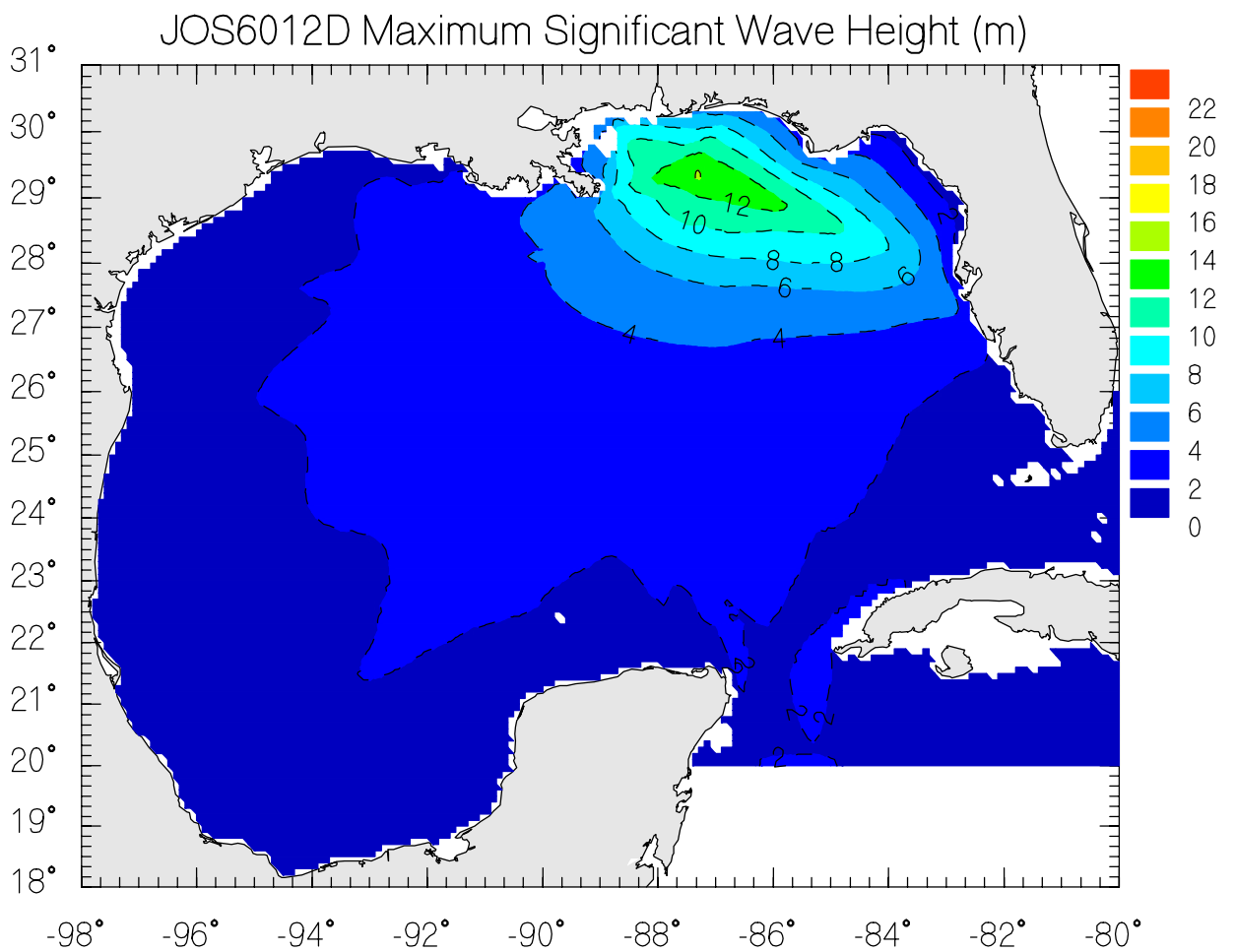
JOS6012D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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18
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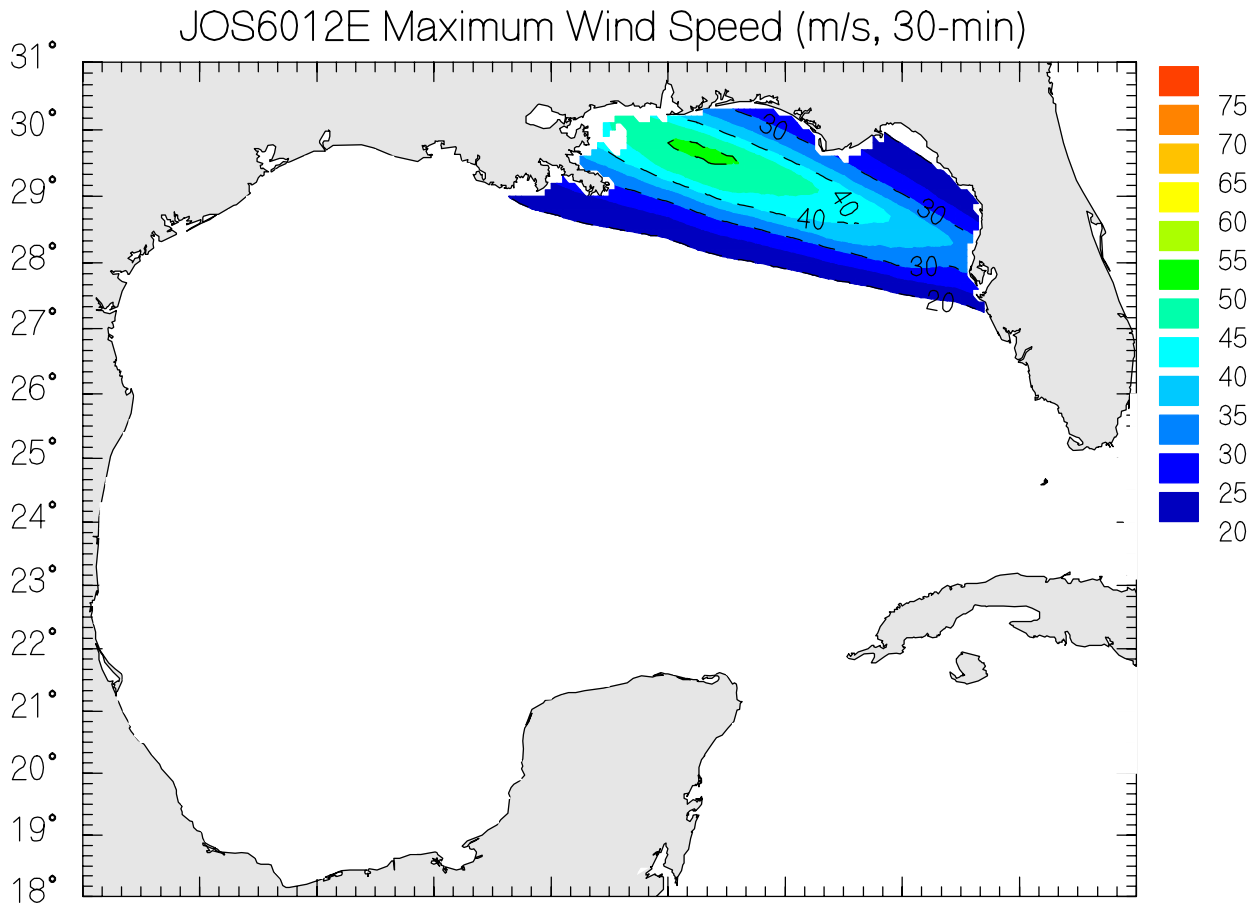
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6012E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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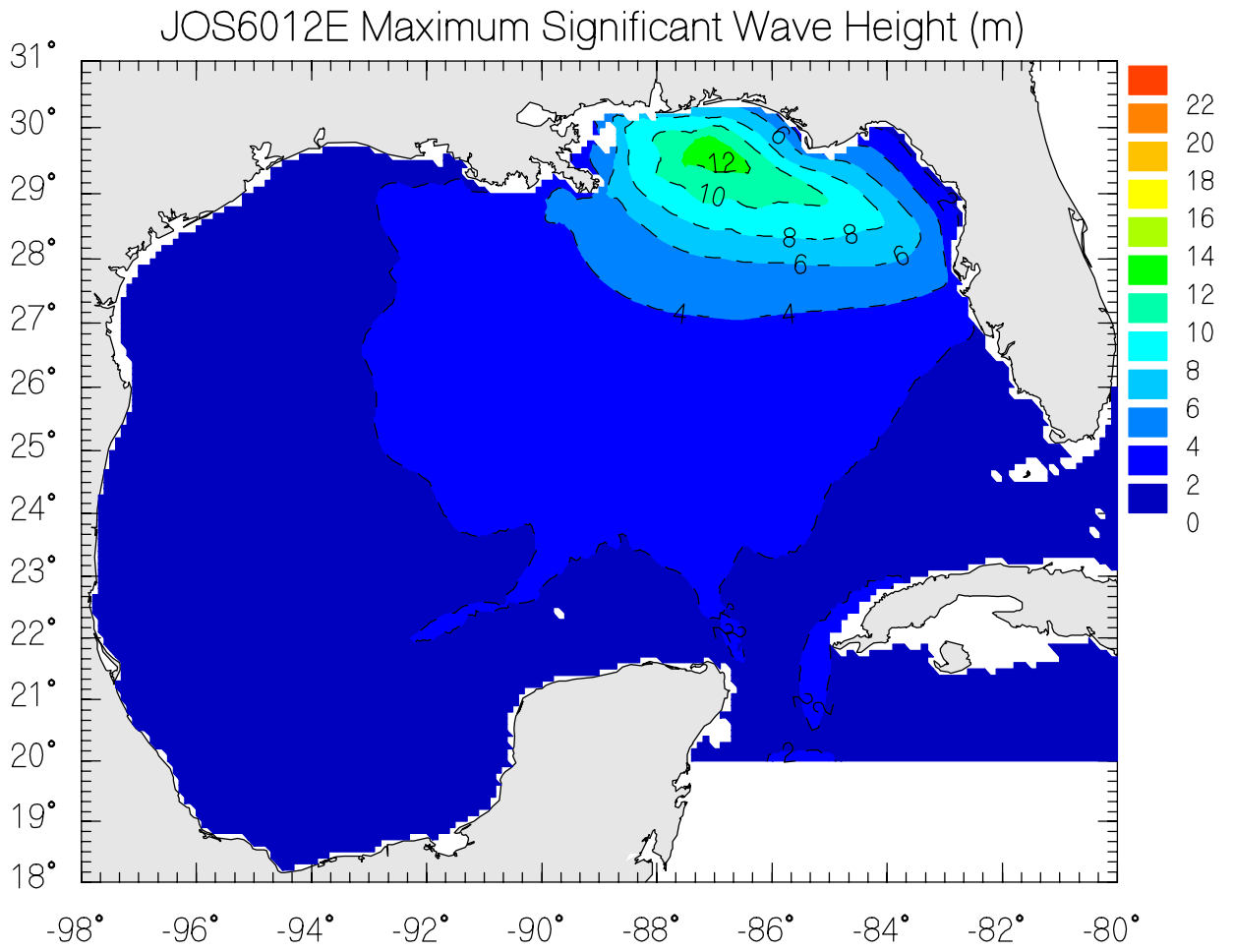
JOS6012E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
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25°
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23°
22°
21°
20°
19°
18°
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18
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-92°
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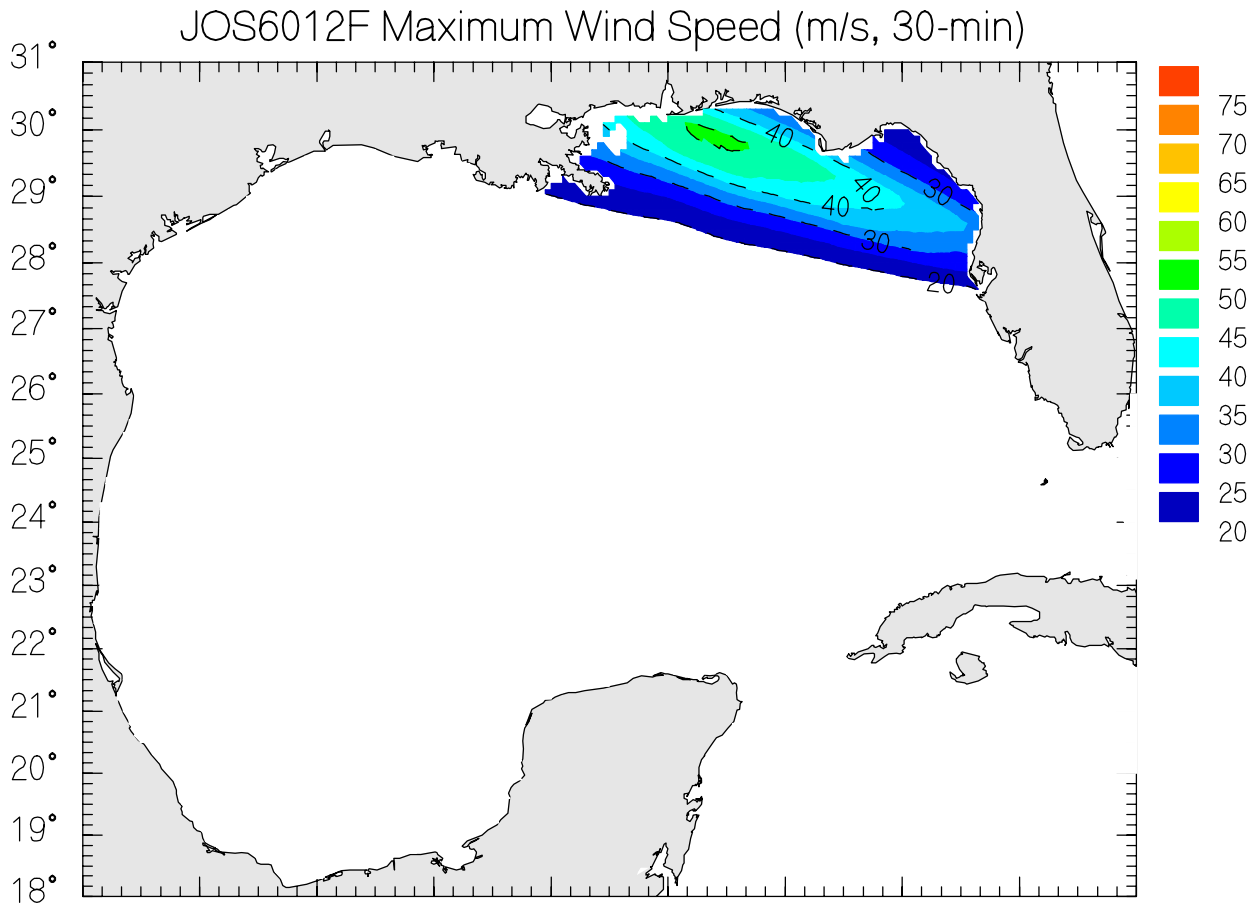
-88°
-86°
-84°
-82°
-80°


JOS6012F Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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30
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35
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25
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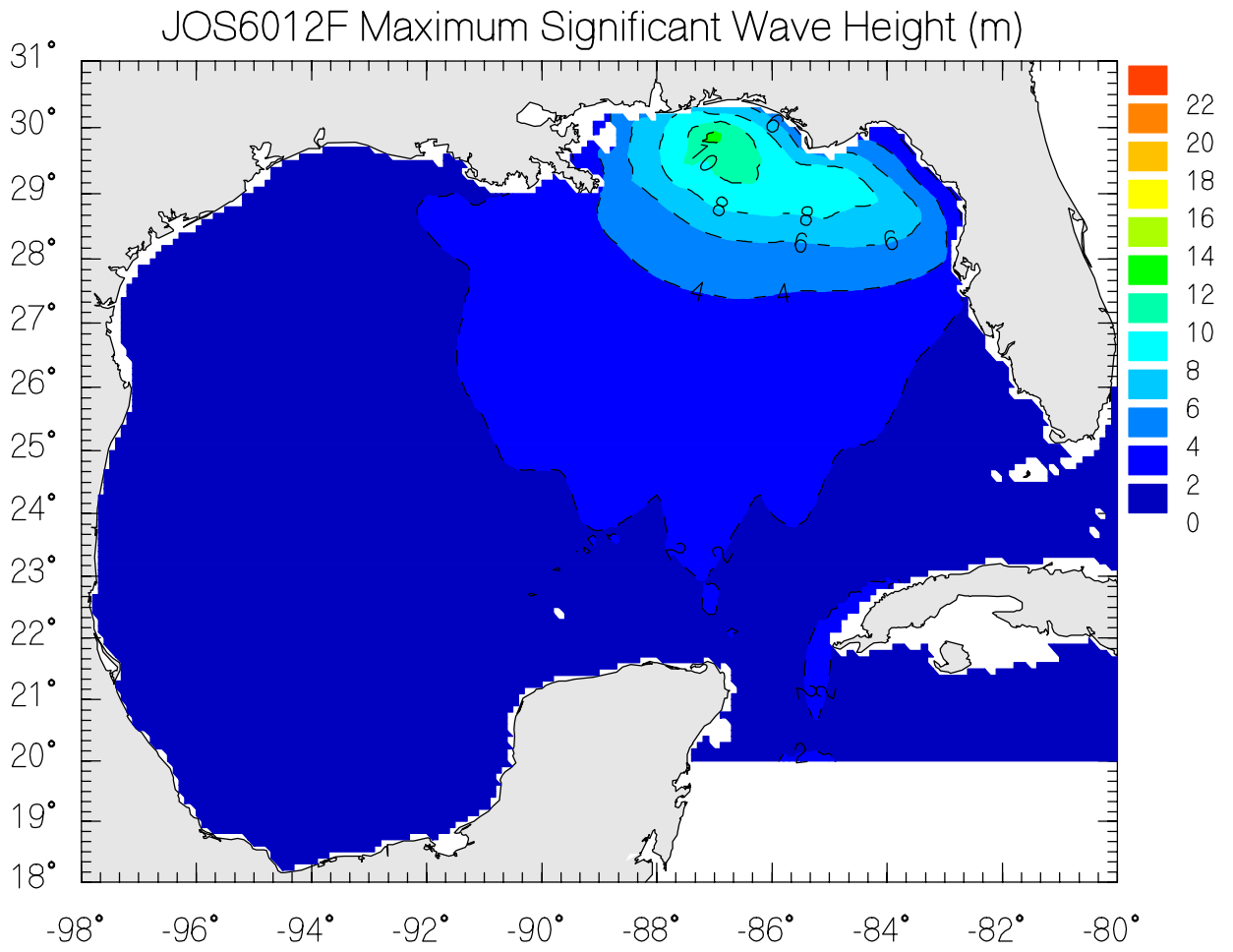
JOS6012F Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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18
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-92°
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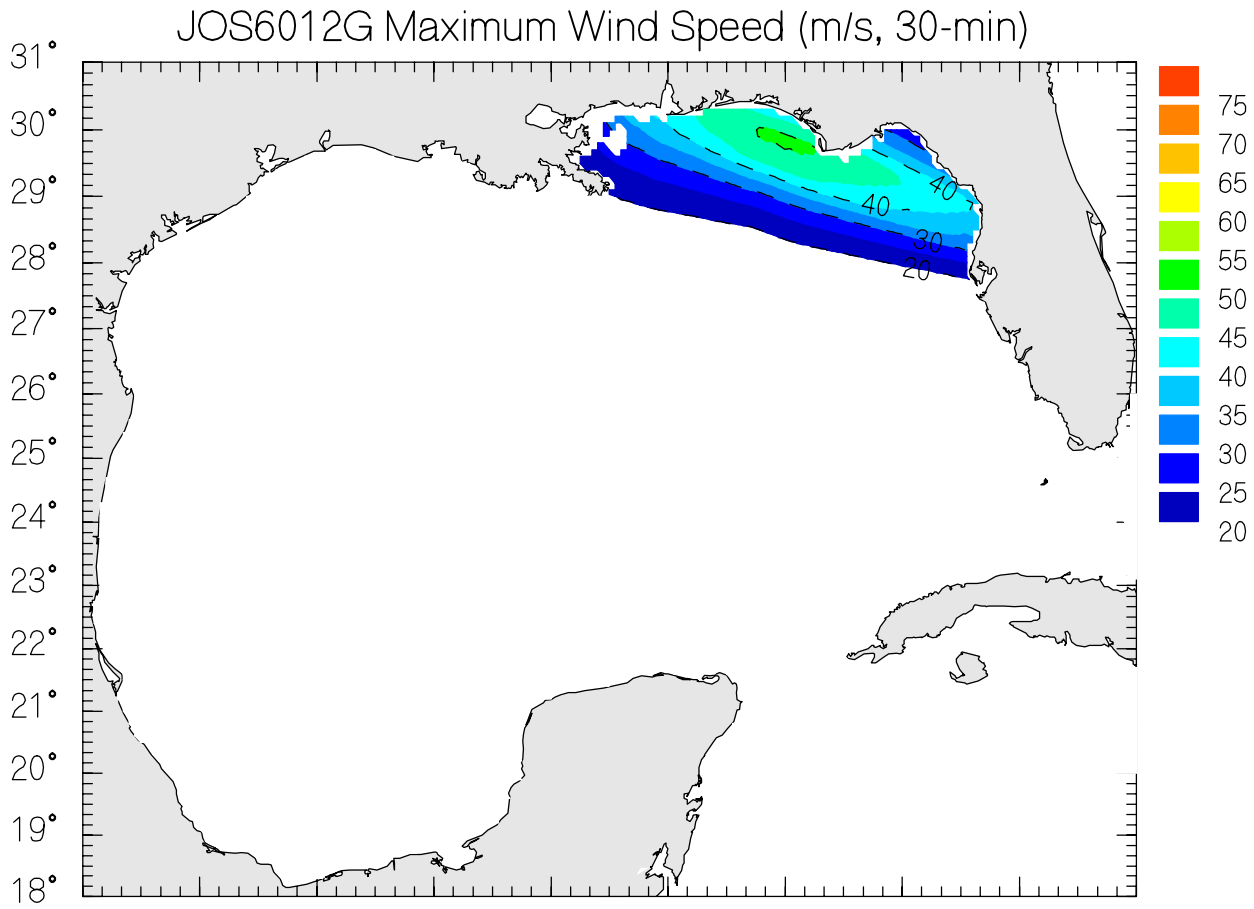
-88°
-86°
-84°
-82°
-80°


JOS6012G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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25
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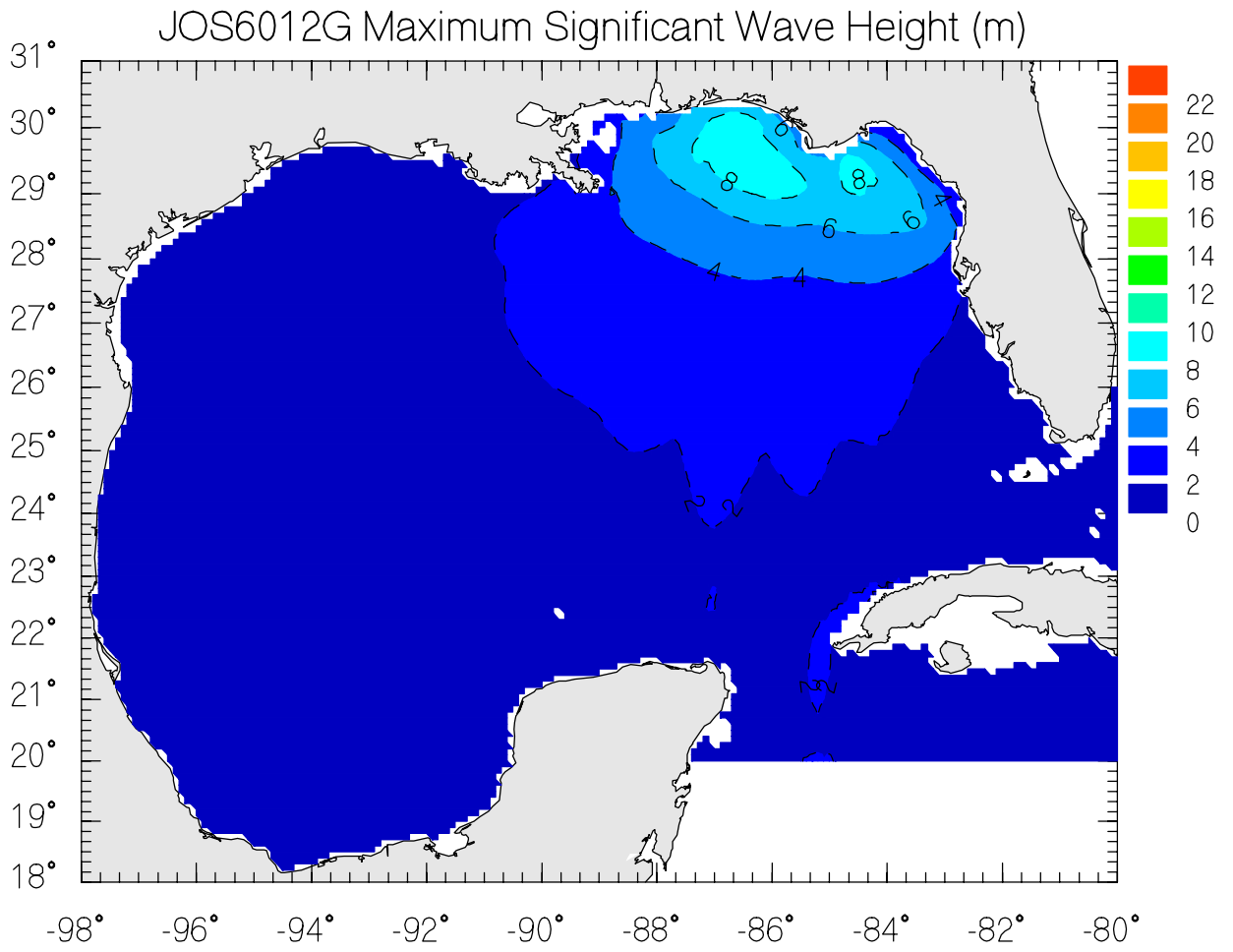
JOS6012G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
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-84°
-82°
-80°
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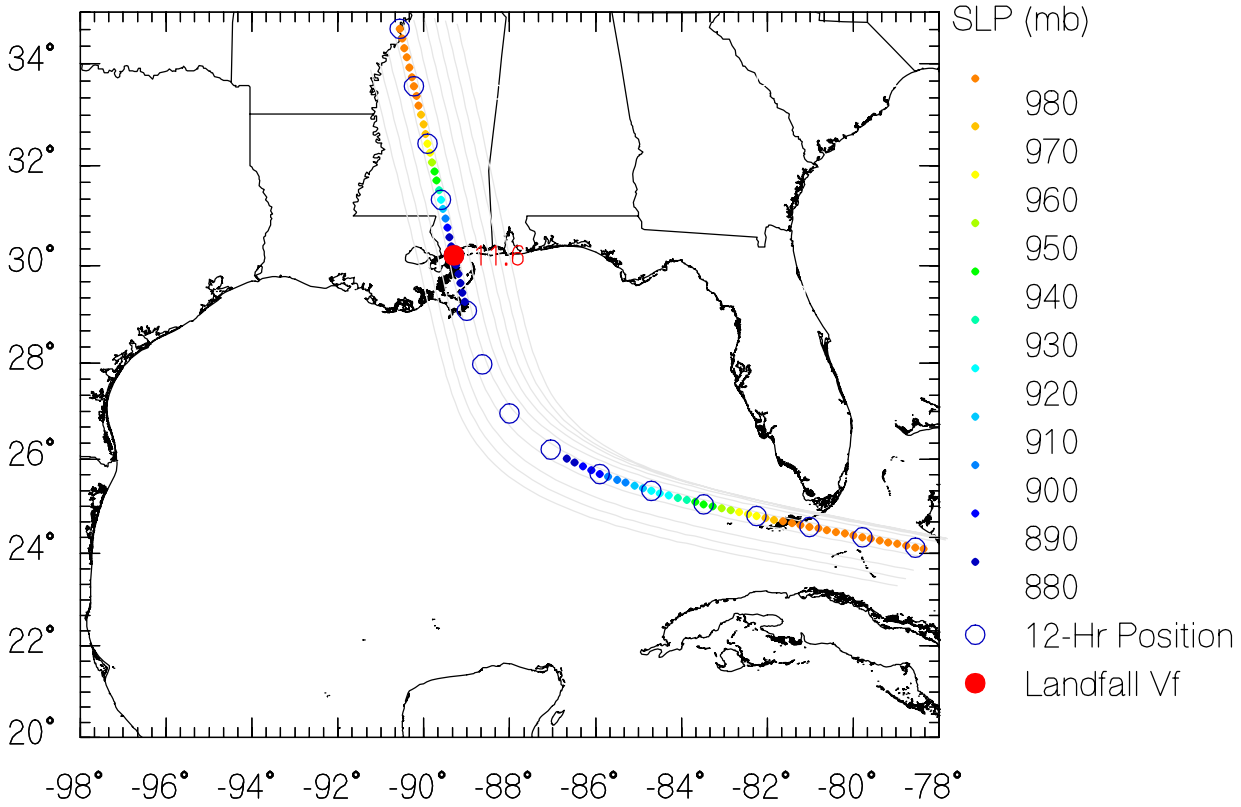
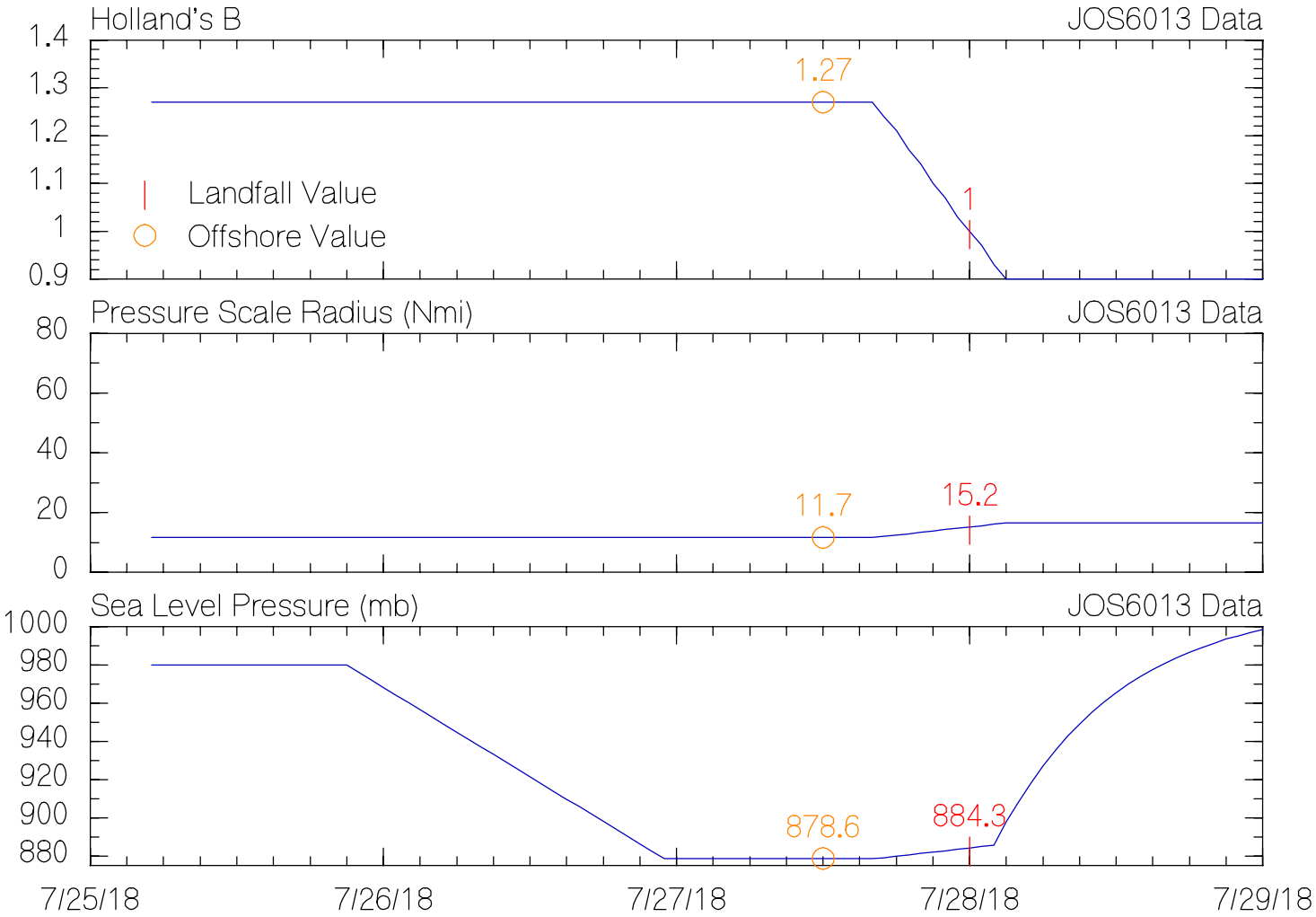
2
0

JOS6013 Data

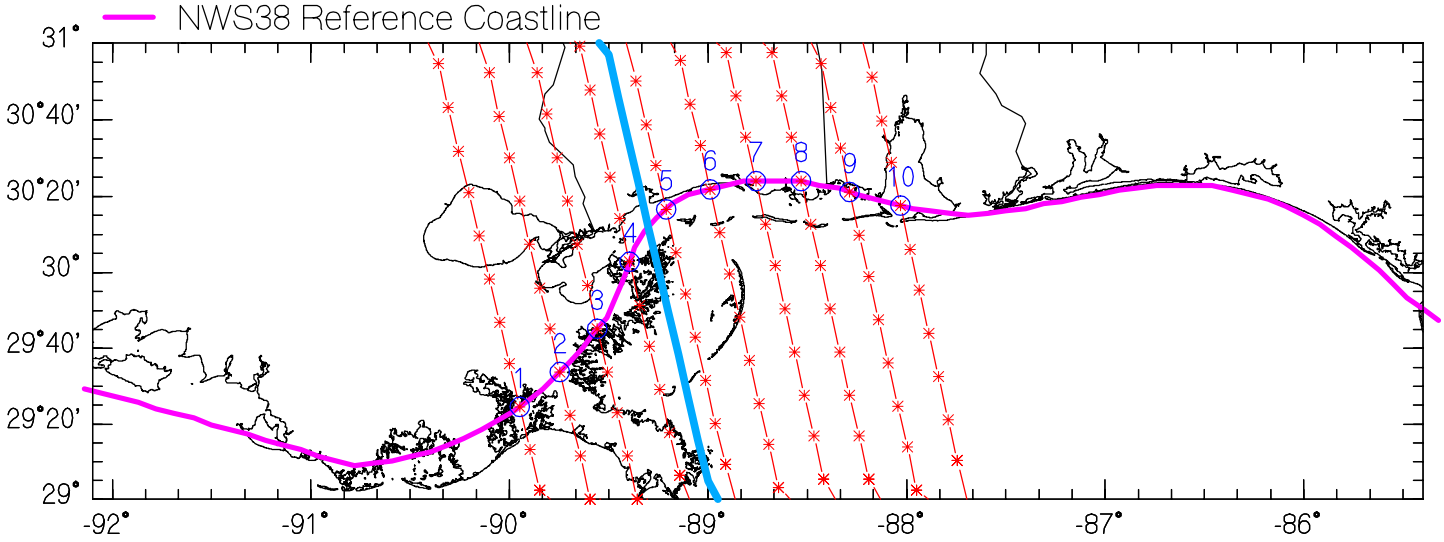


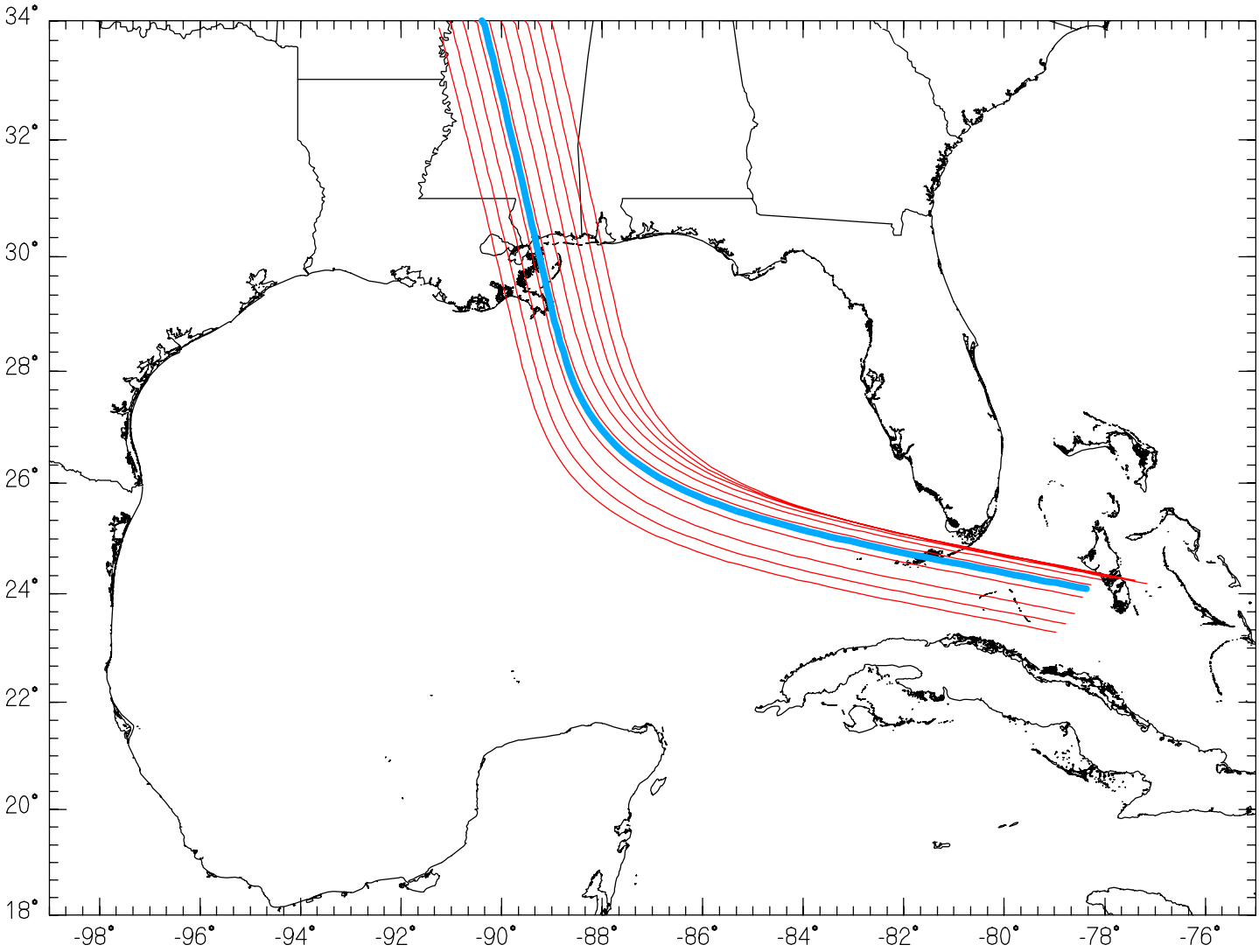


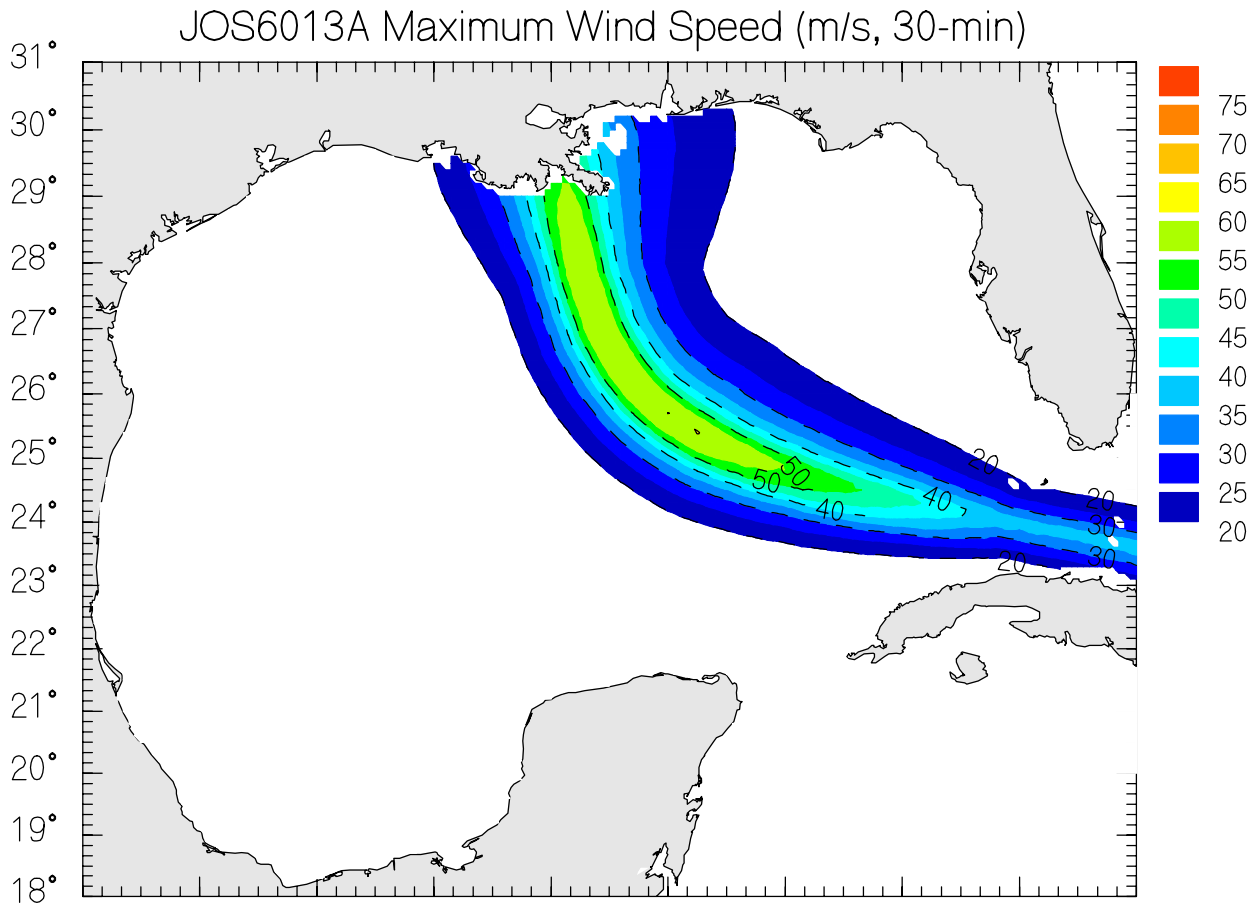
URS JPM-OS6 Production Tracks

JOS6013 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6013A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
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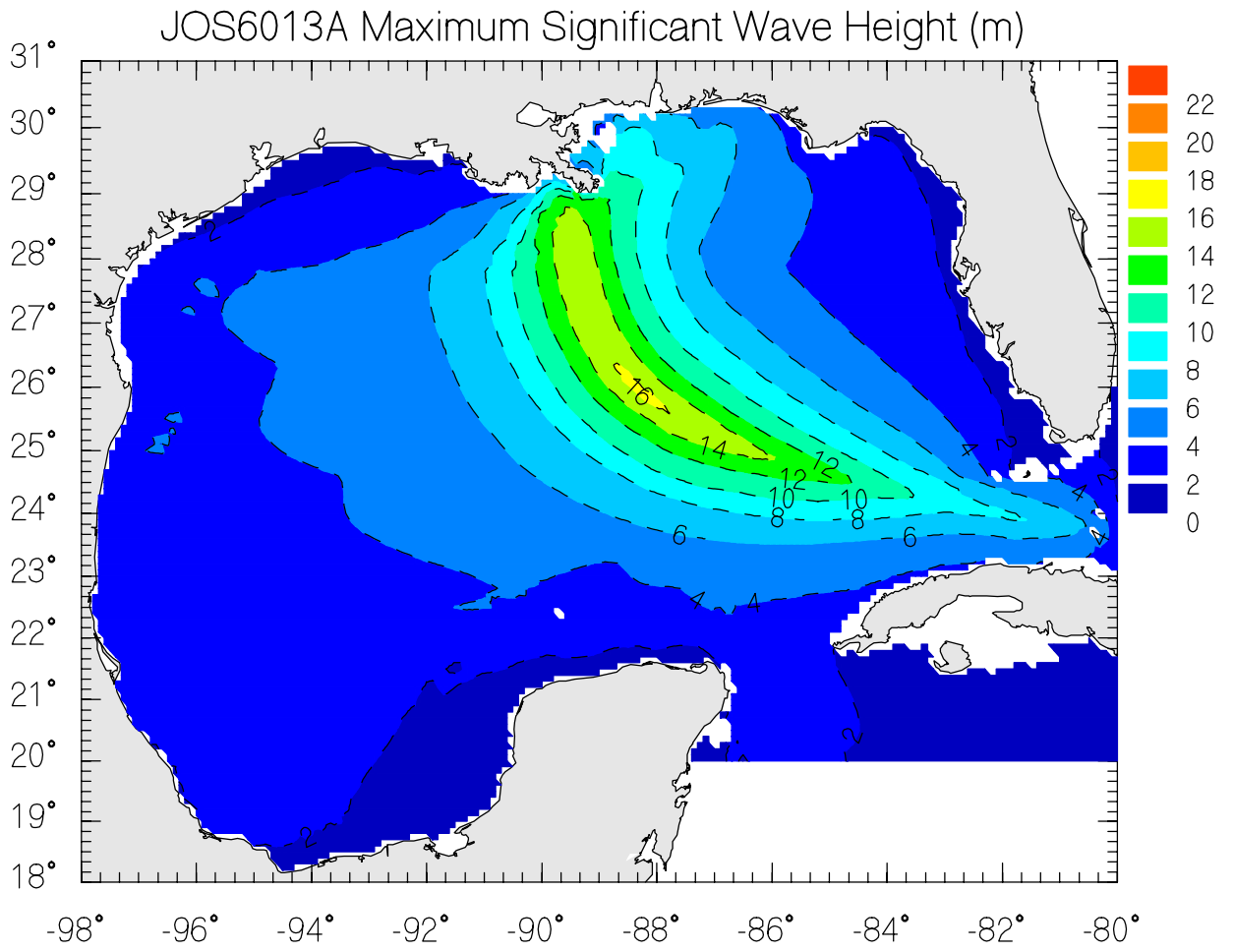
25
20


JOS6013A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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18
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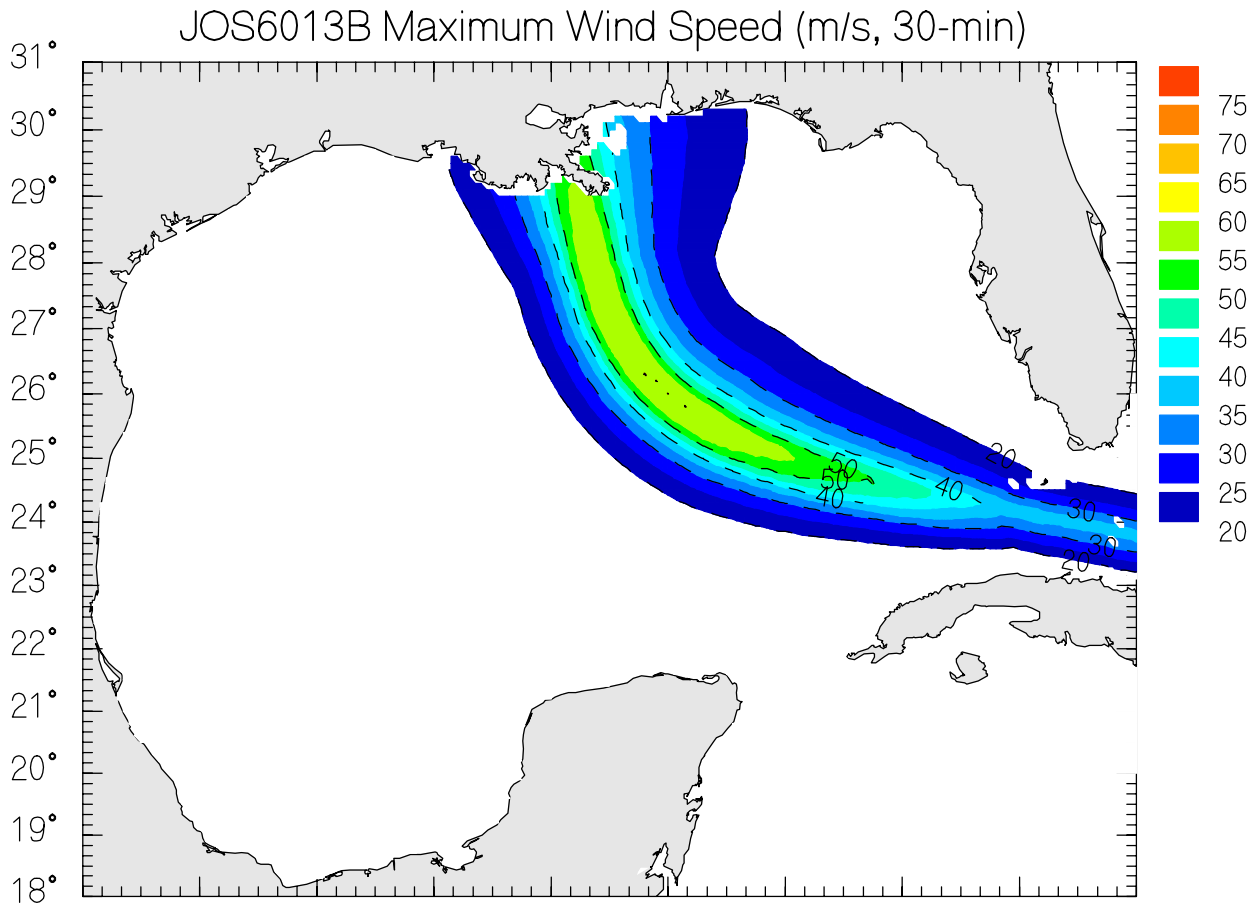
8
6
4
2
0


JOS6013B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
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35
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25
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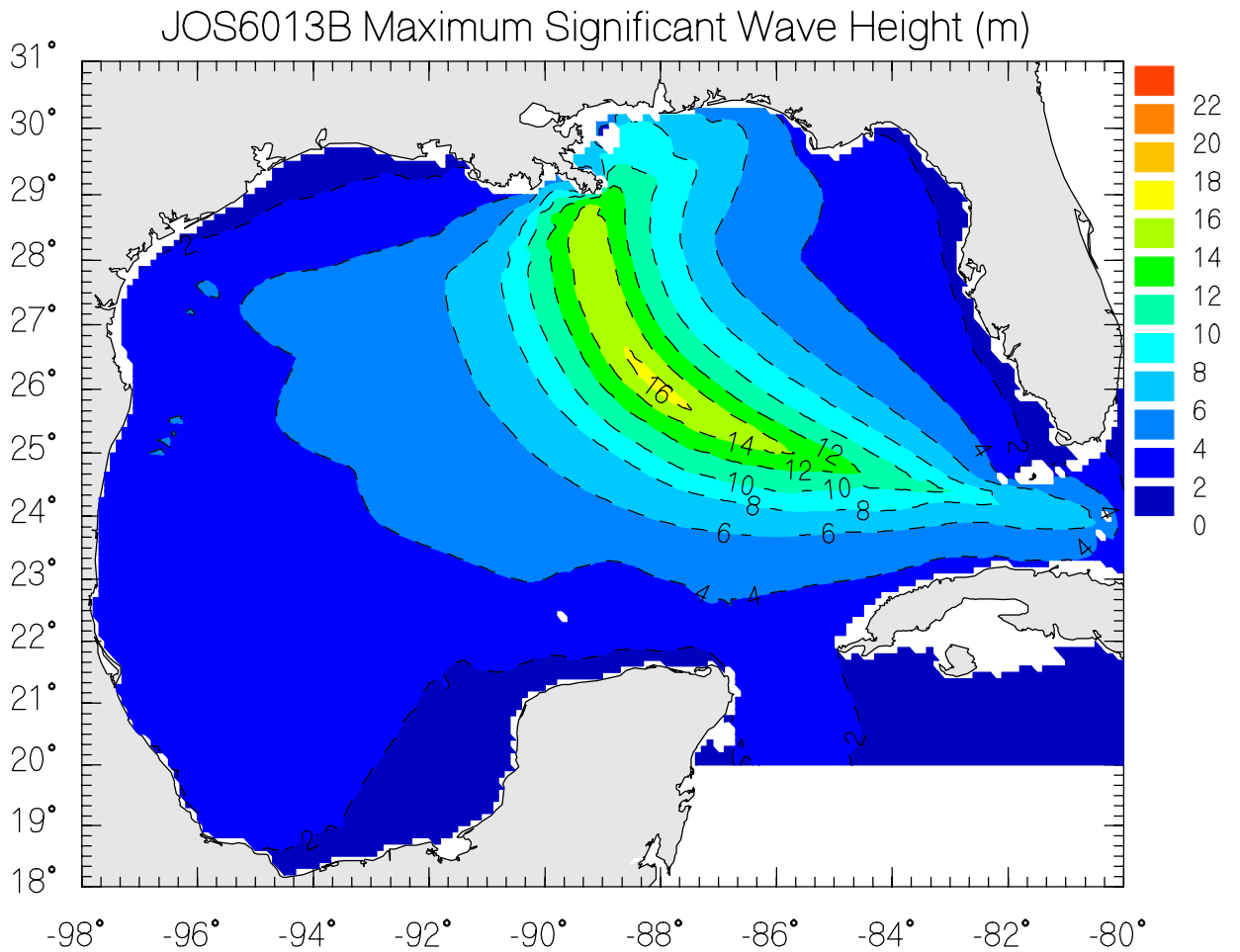
JOS6013B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
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-82°
-80°
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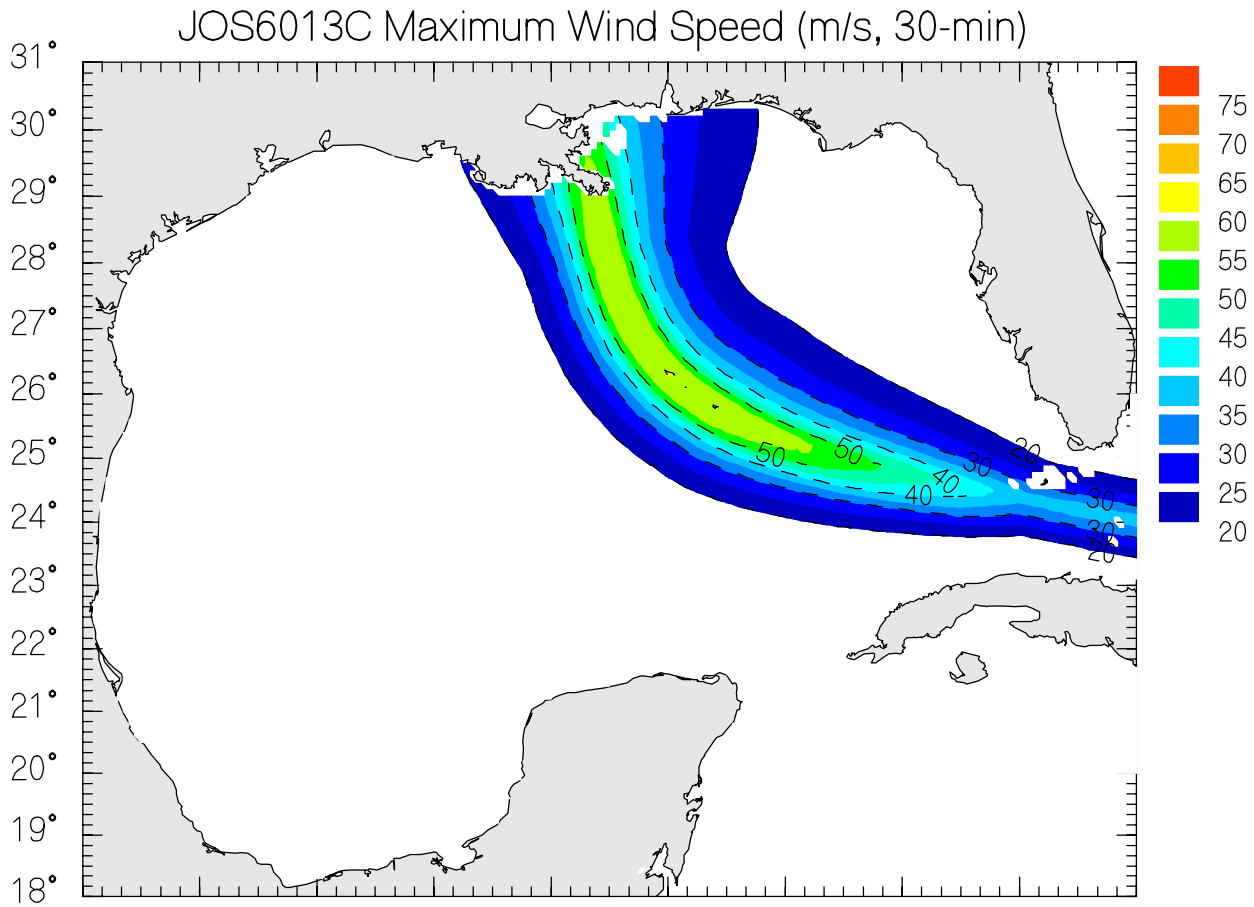
JOS6013C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
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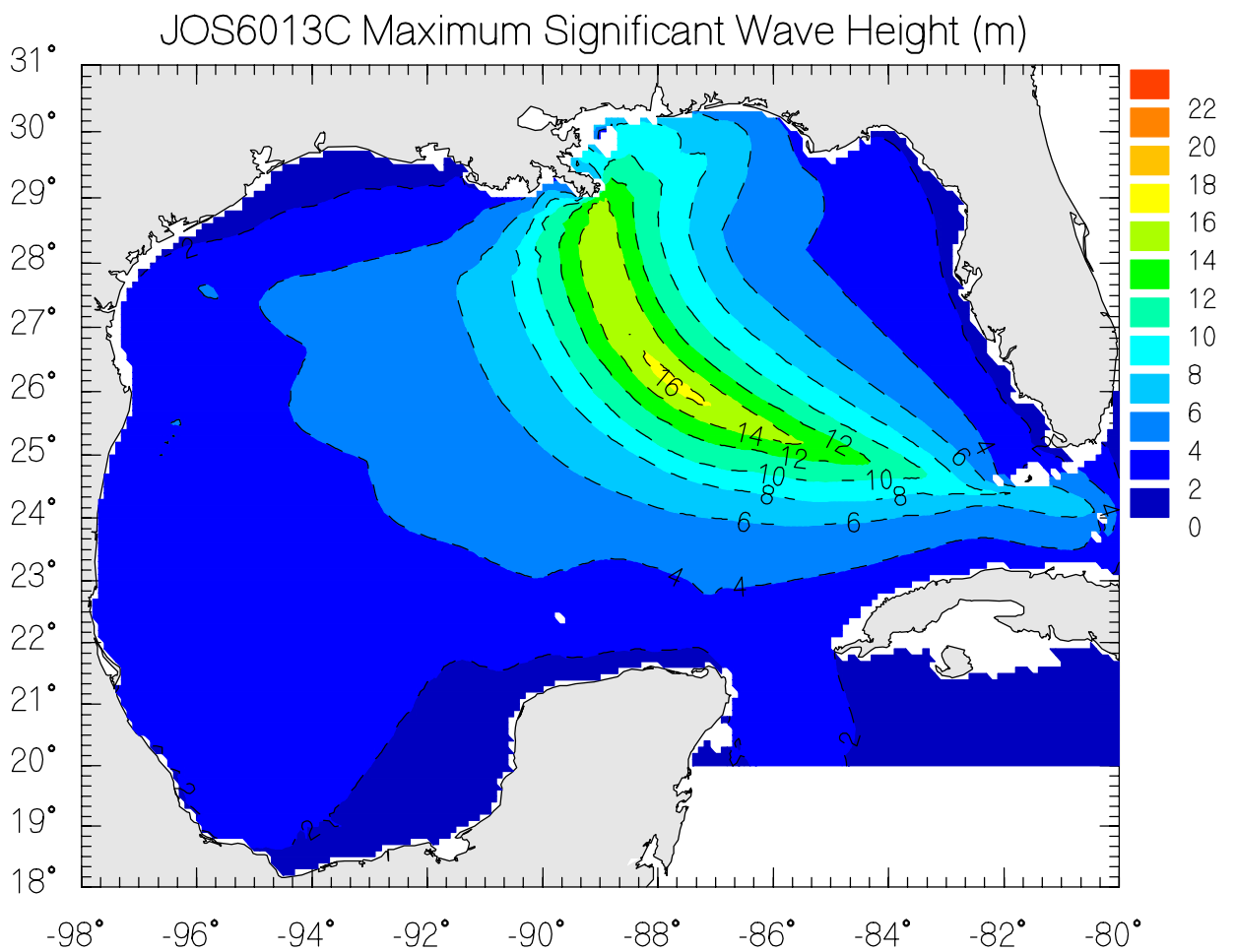
45
40
35
30
25
20


JOS6013C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
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-82°
-80°
22
20
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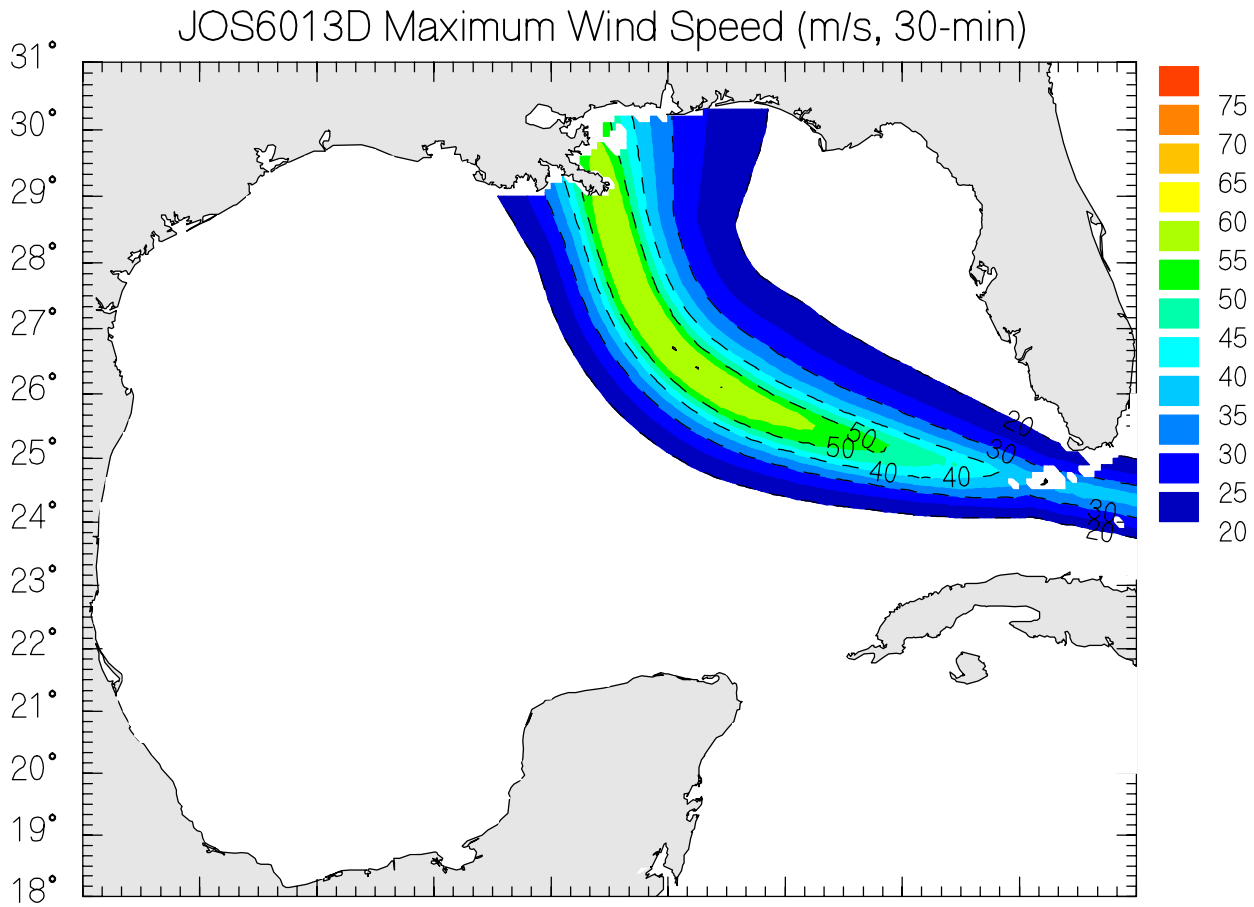
JOS6013D Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
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21°
20°
19°
18°
75
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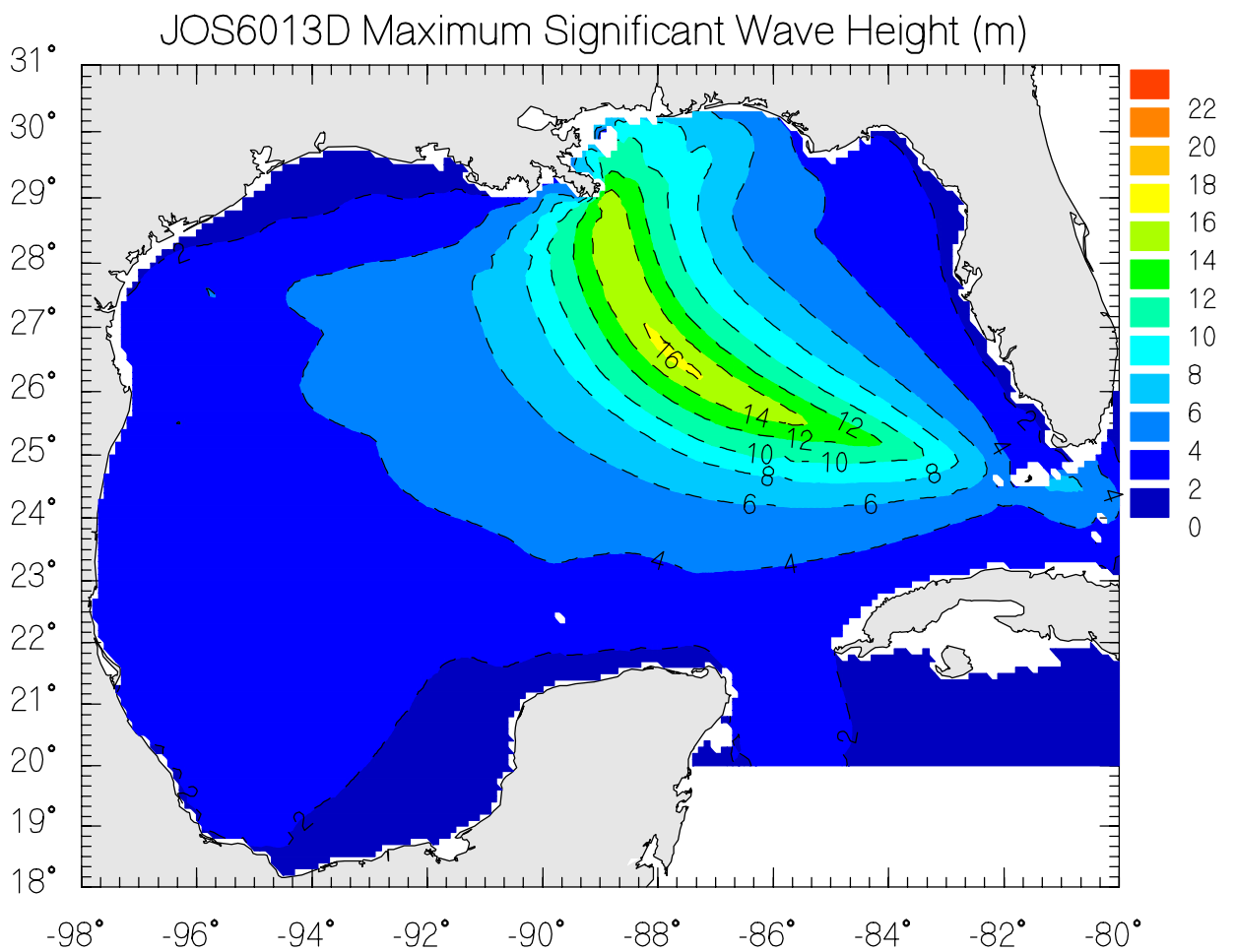
25
20


JOS6013D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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18
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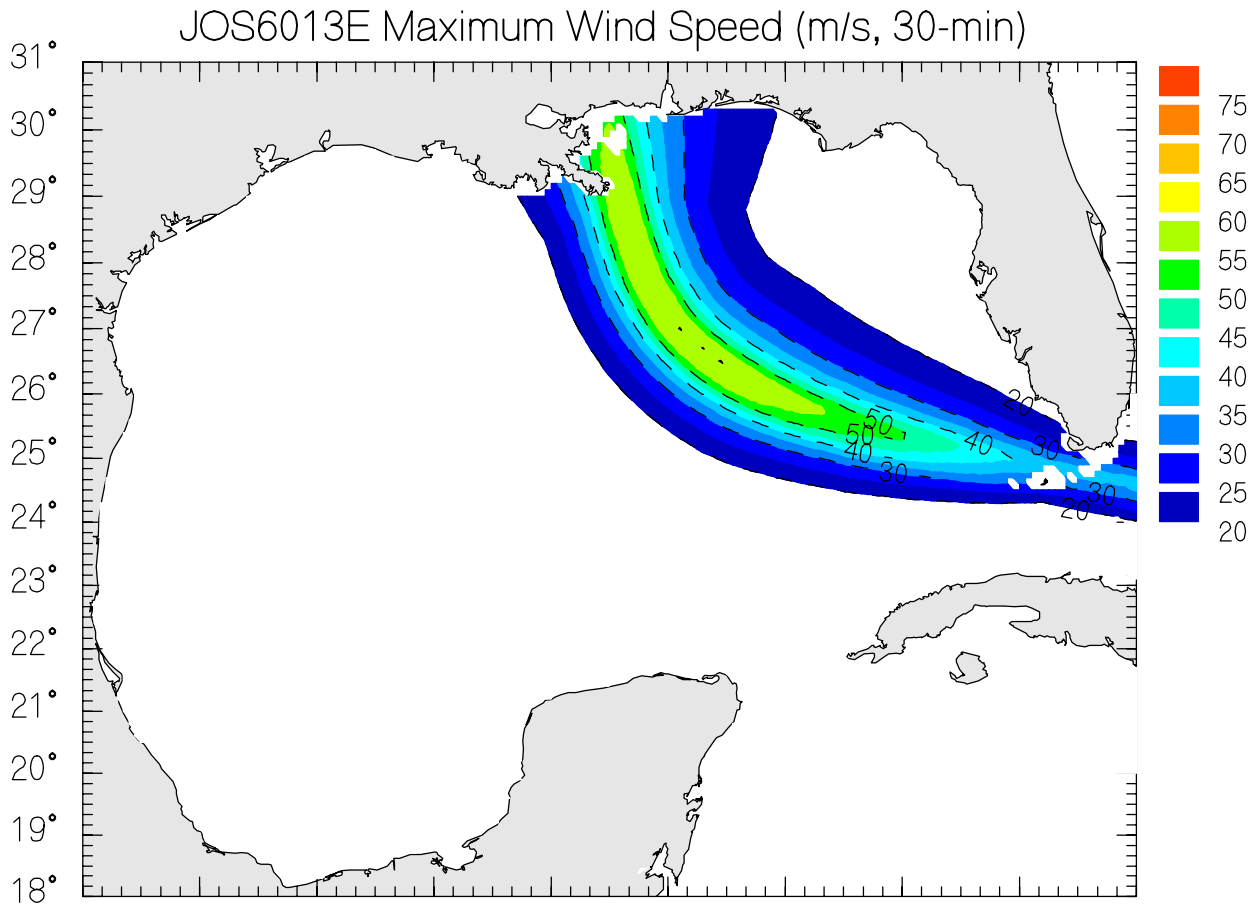
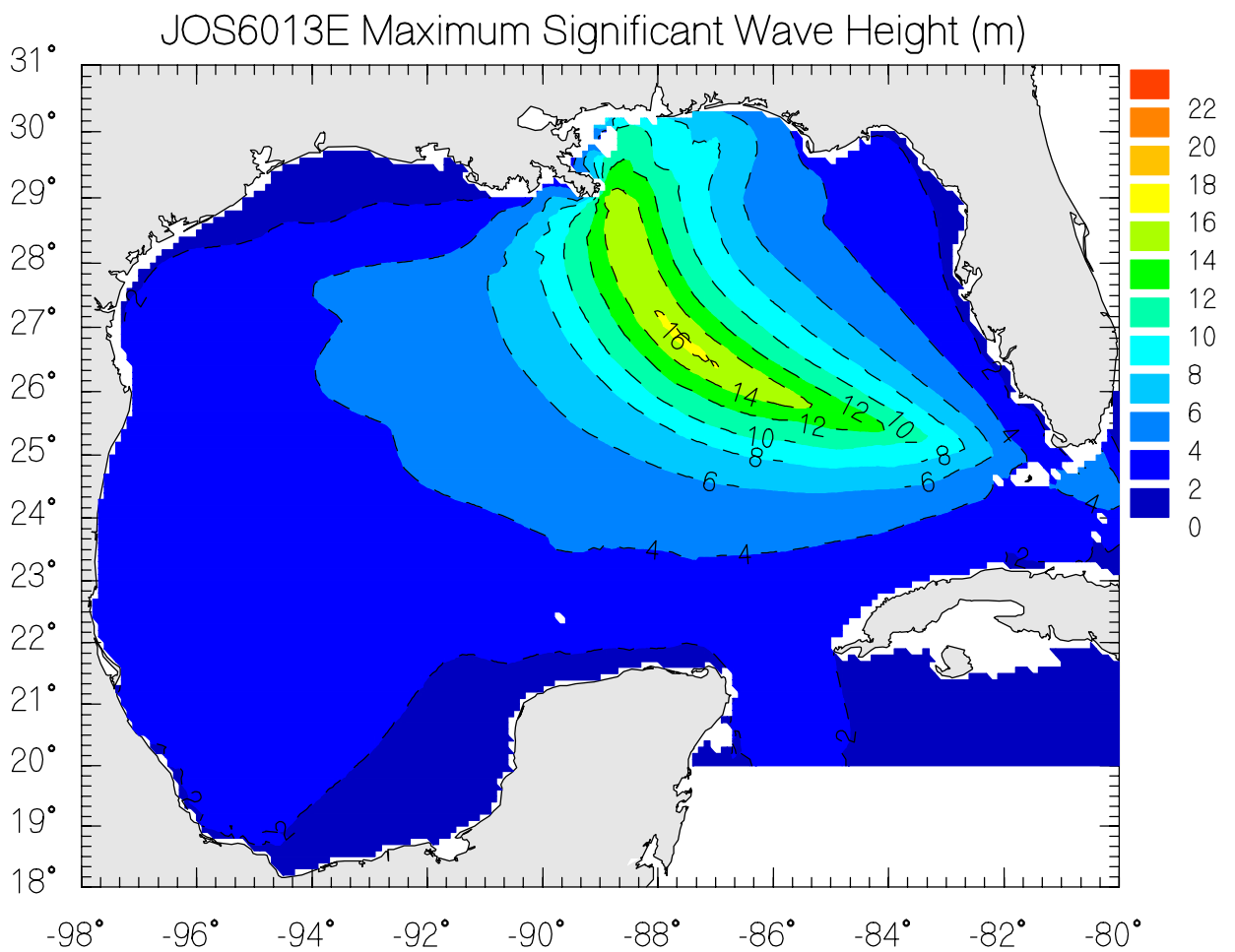

JOS6013E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6013E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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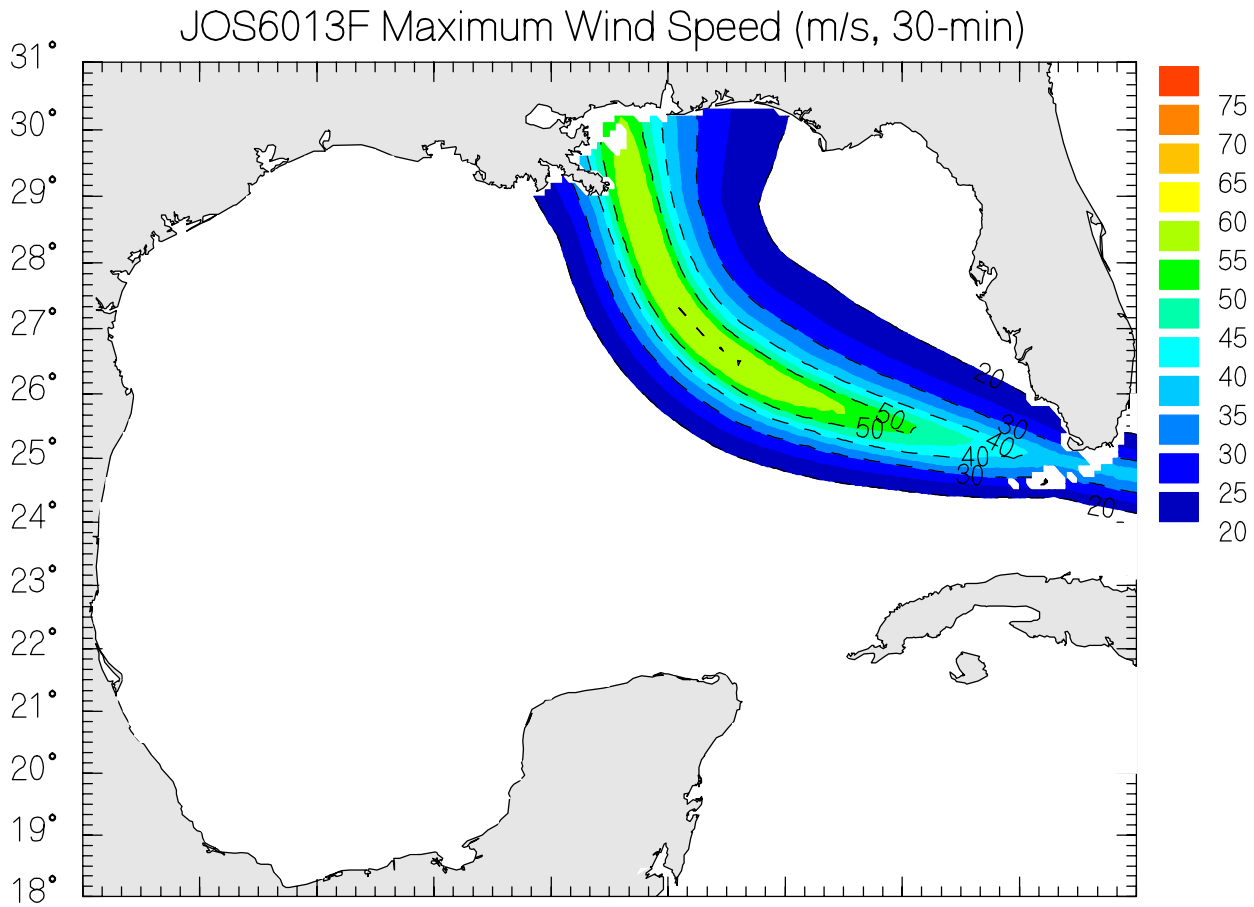
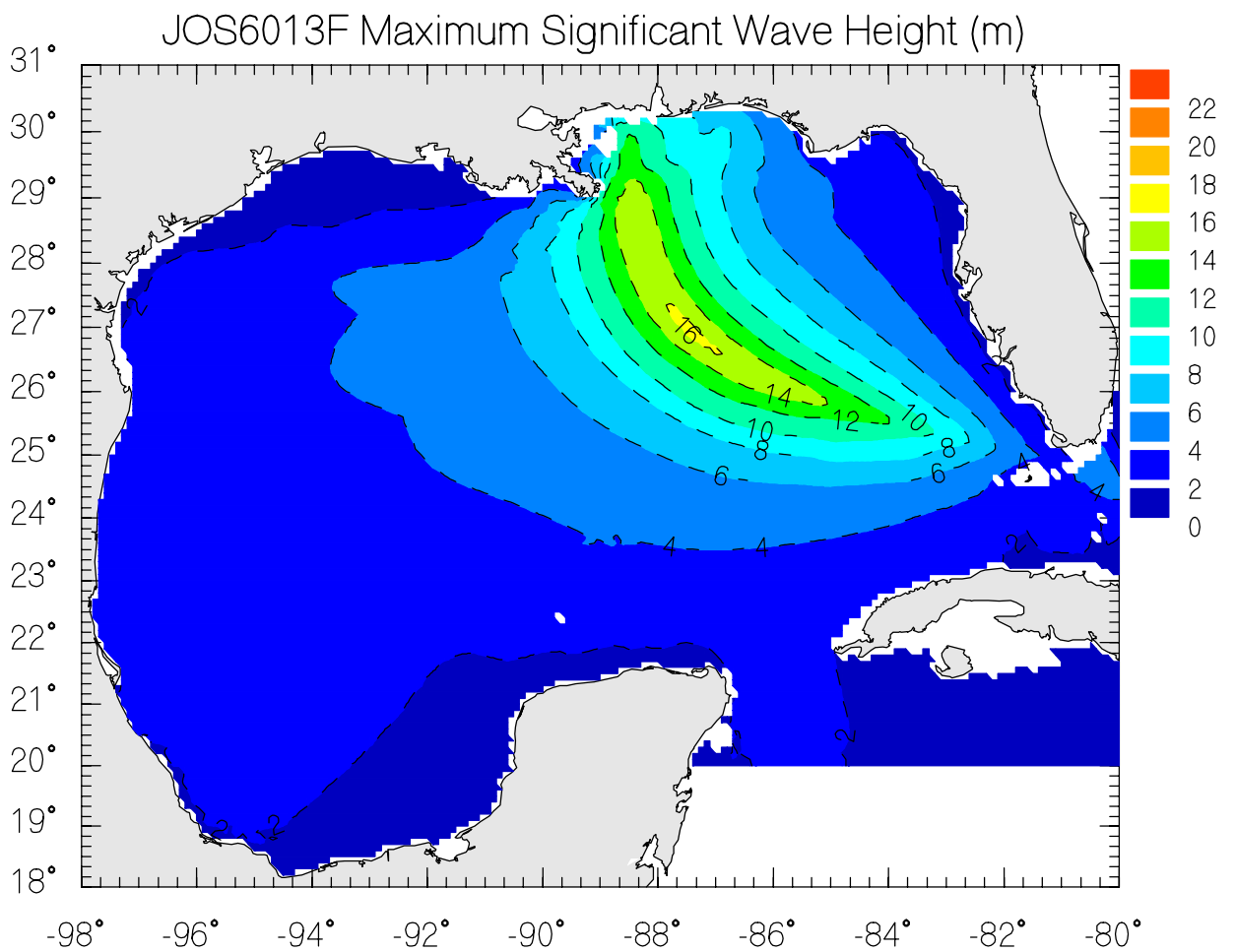

JOS6013F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6013F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
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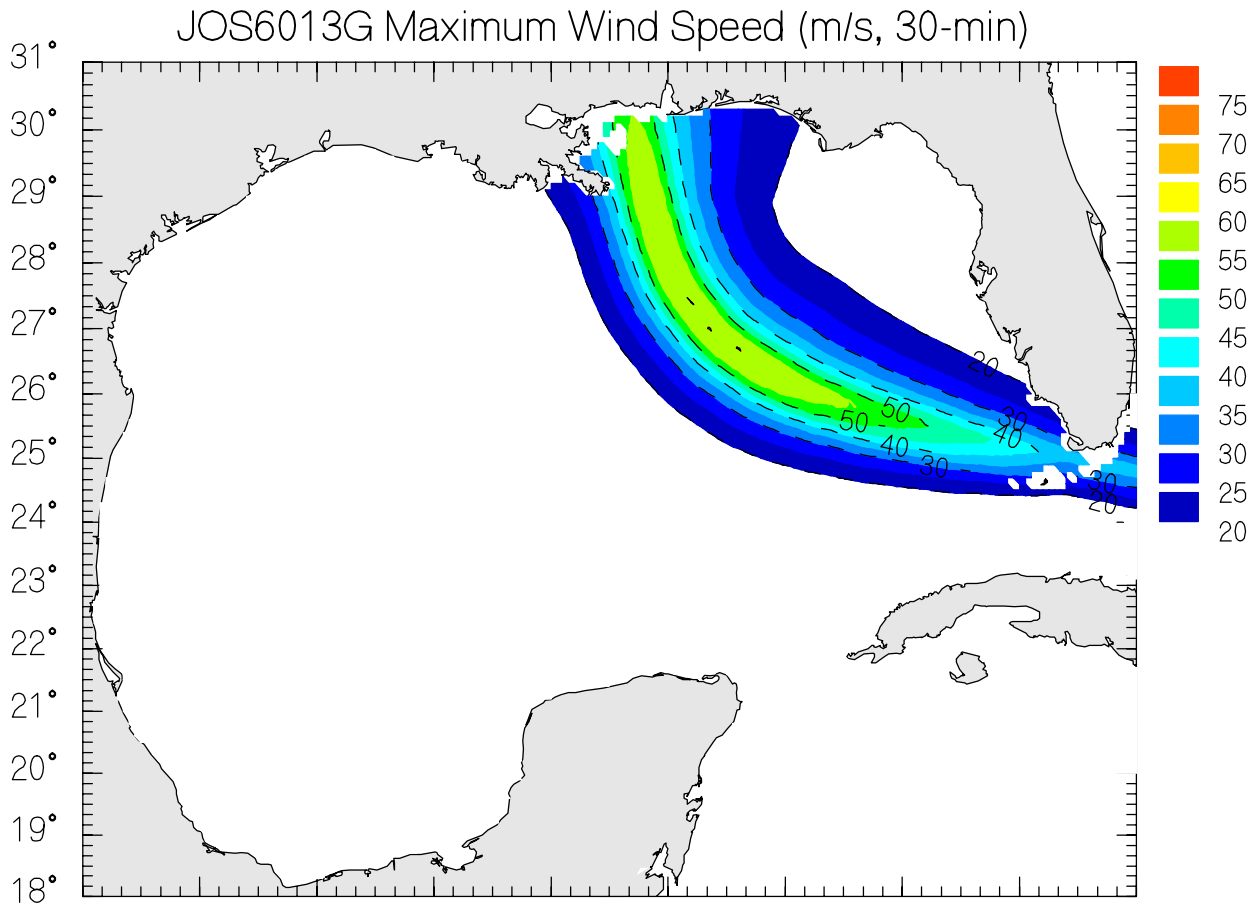
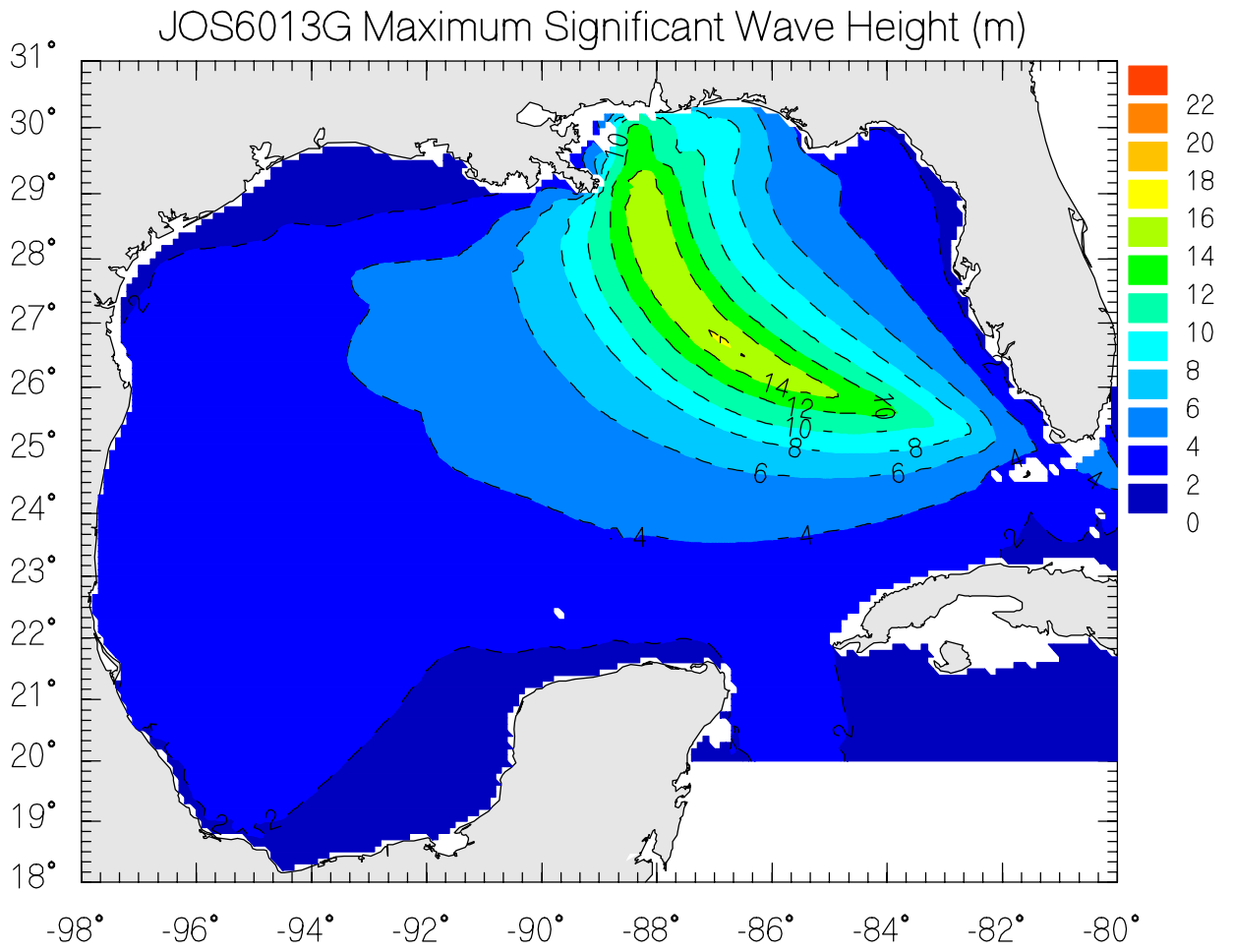
14
12
10
8
6
4
2
0


JOS6013G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6013G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
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12
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8
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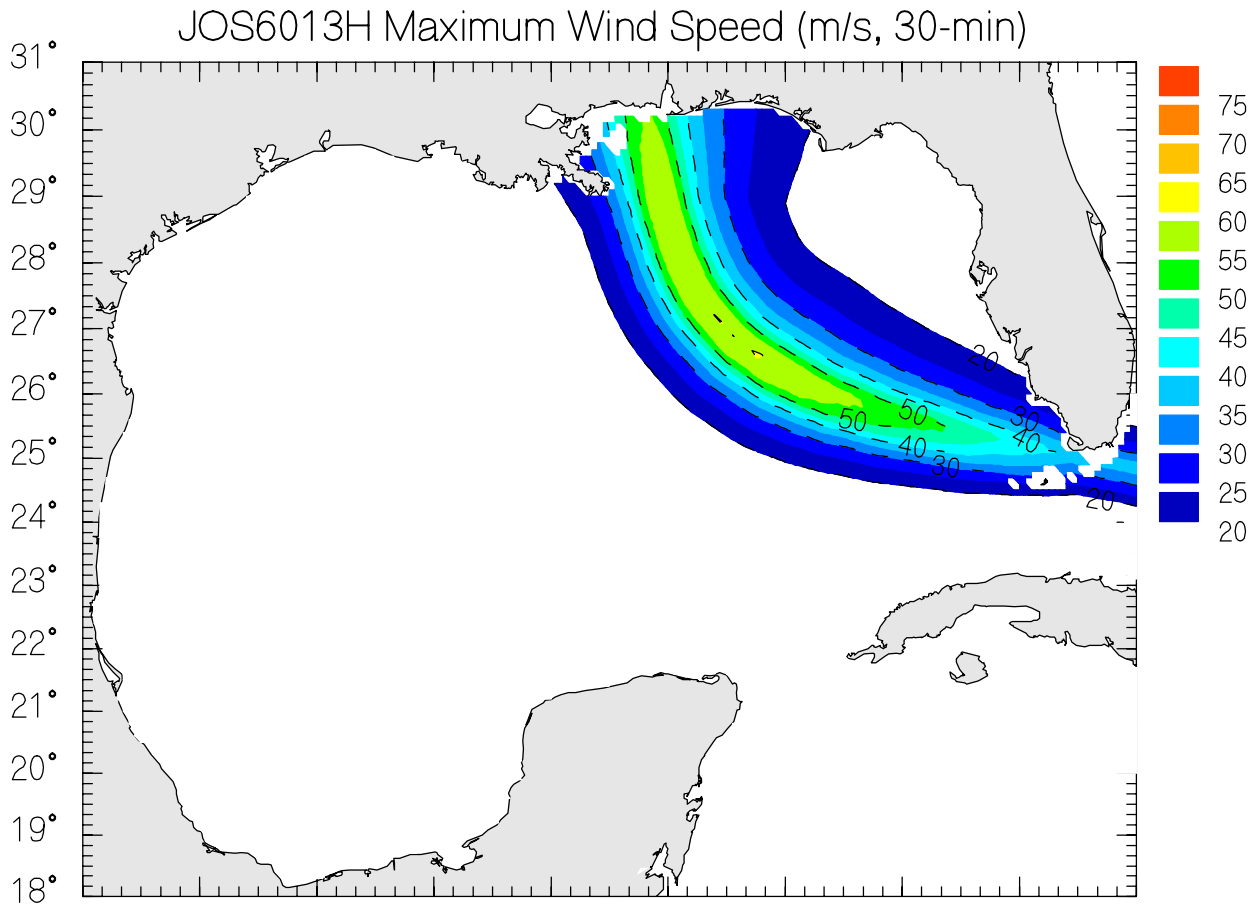
4
2
0


JOS6013H Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
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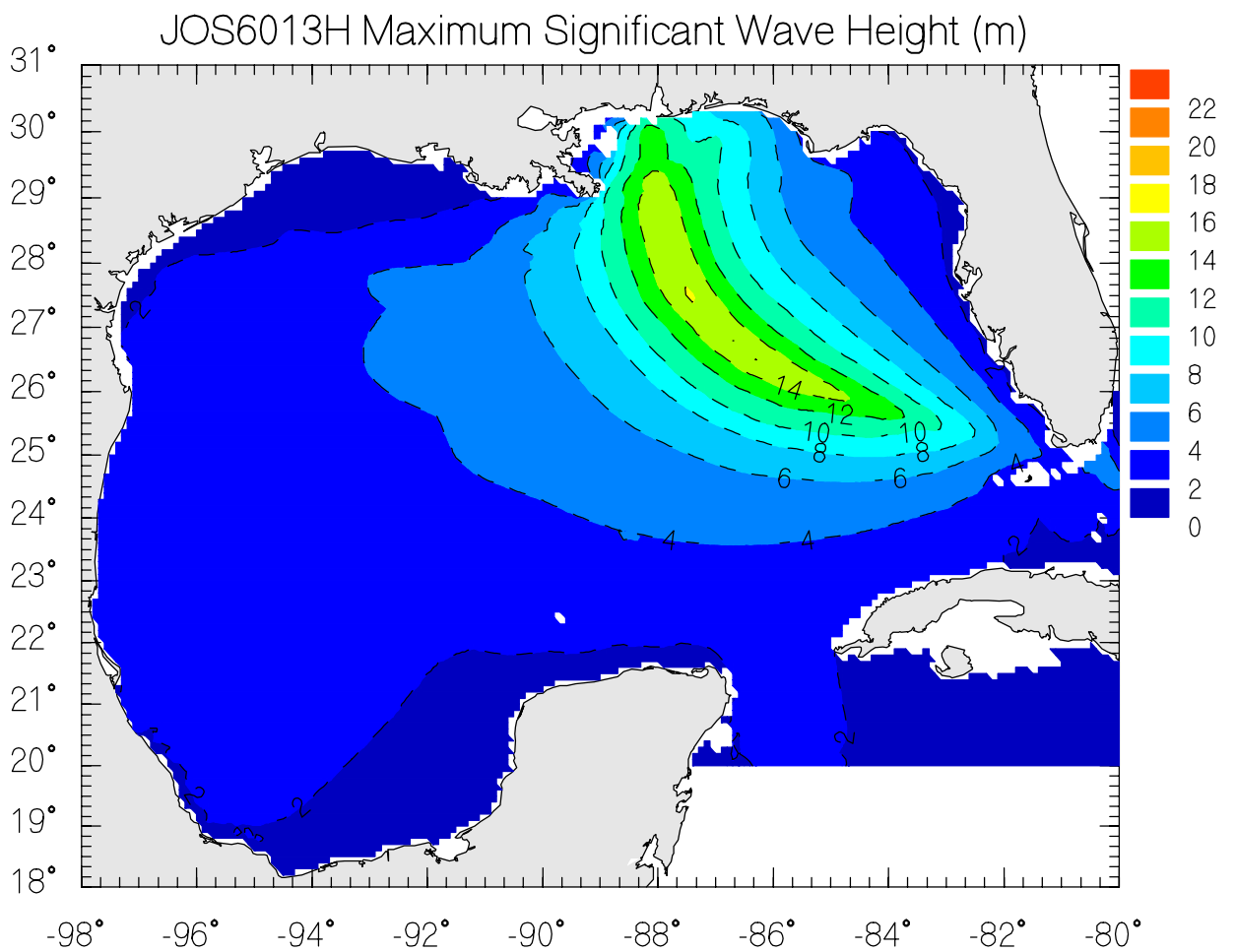
40
35
30
25
20


JOS6013H Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
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-82°
-80°
22
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8
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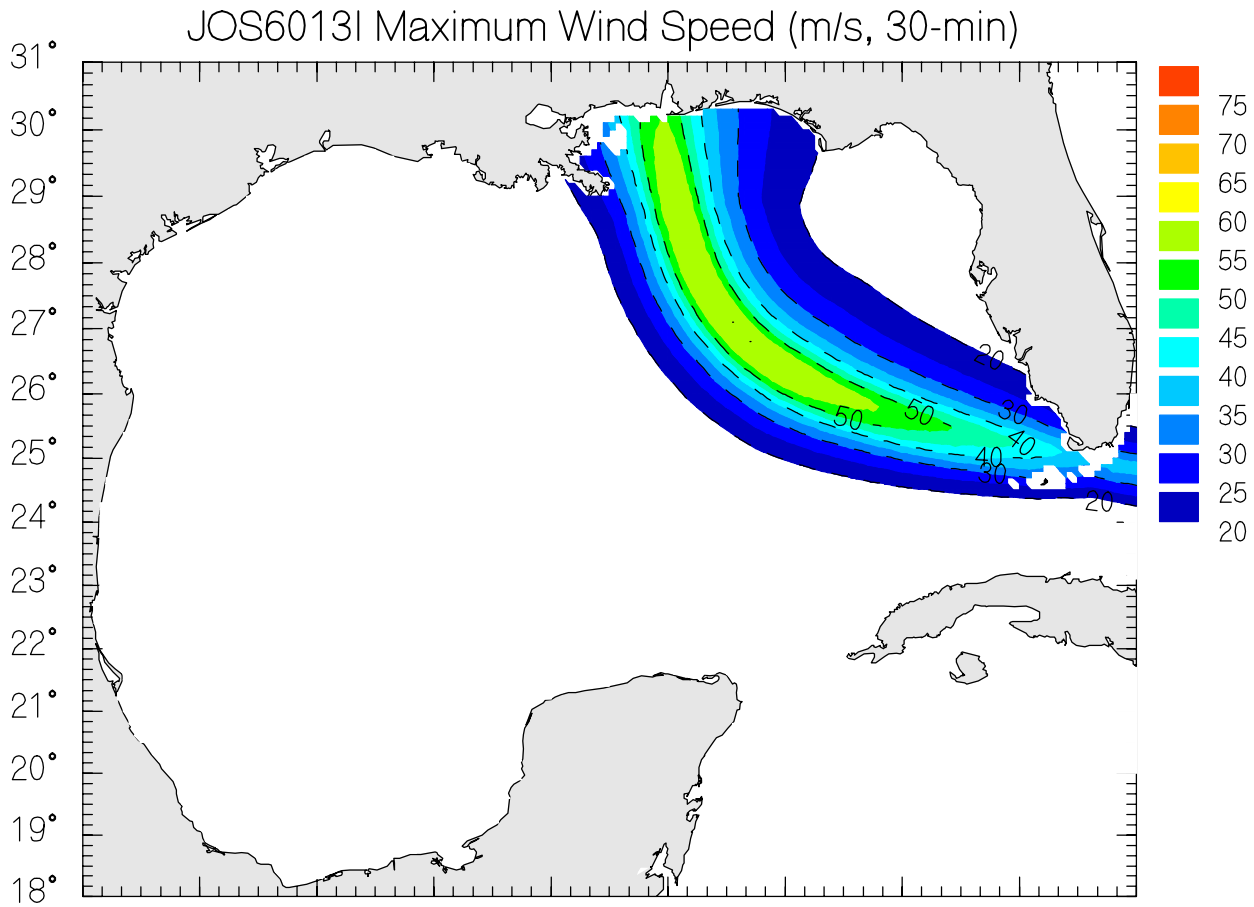
JOS6013I Maximum Wind Speed (m/s, 30-min)
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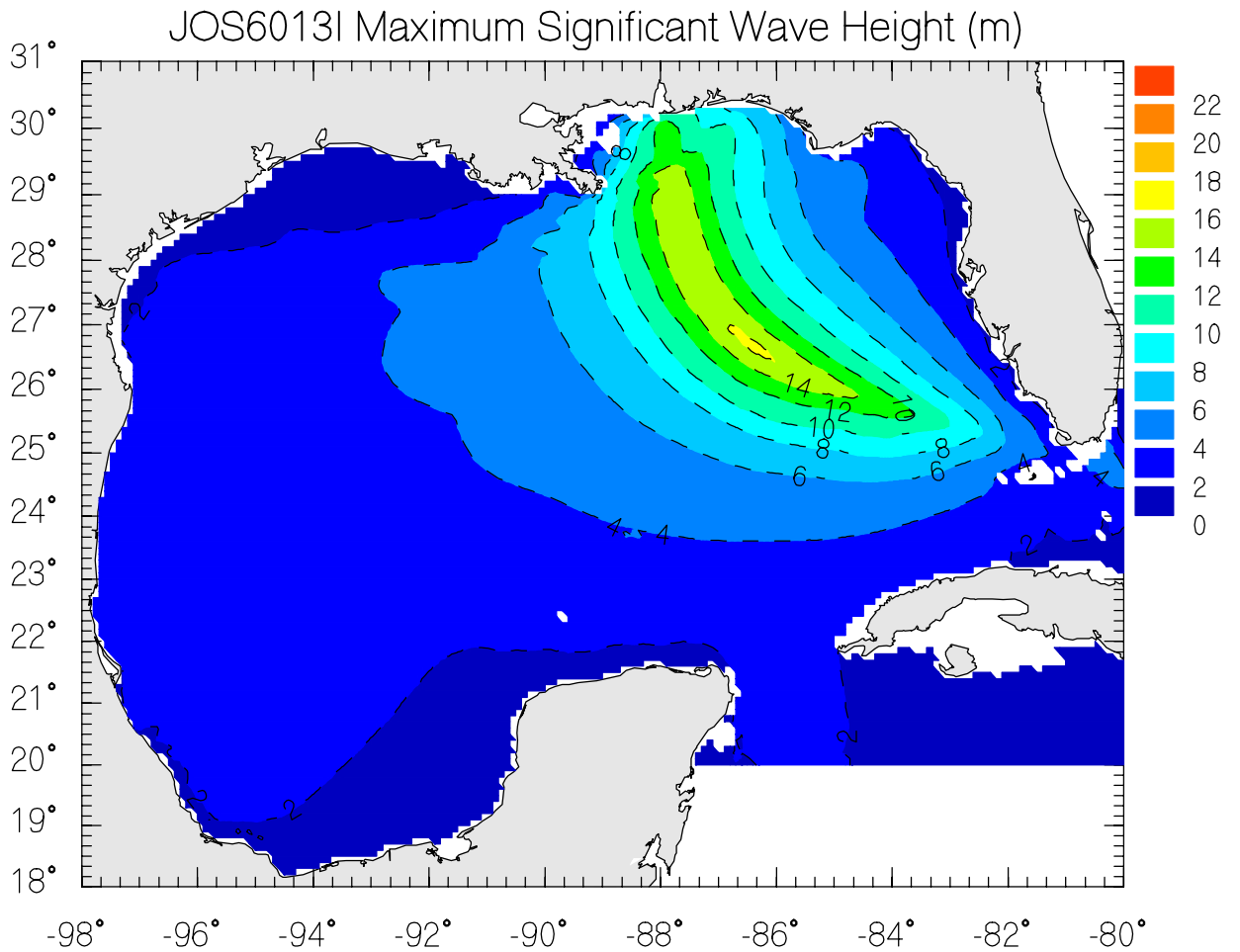
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6013I Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
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-80°
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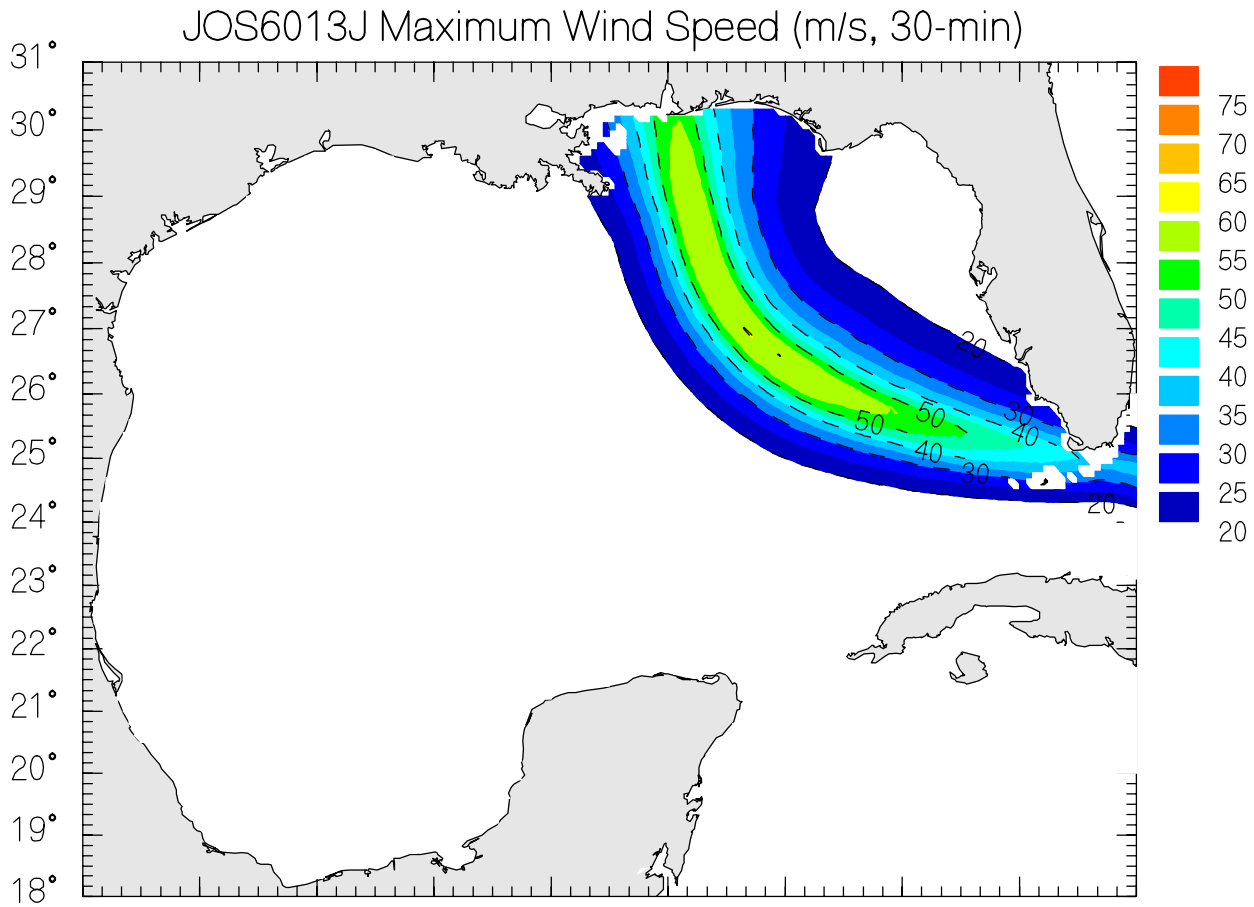
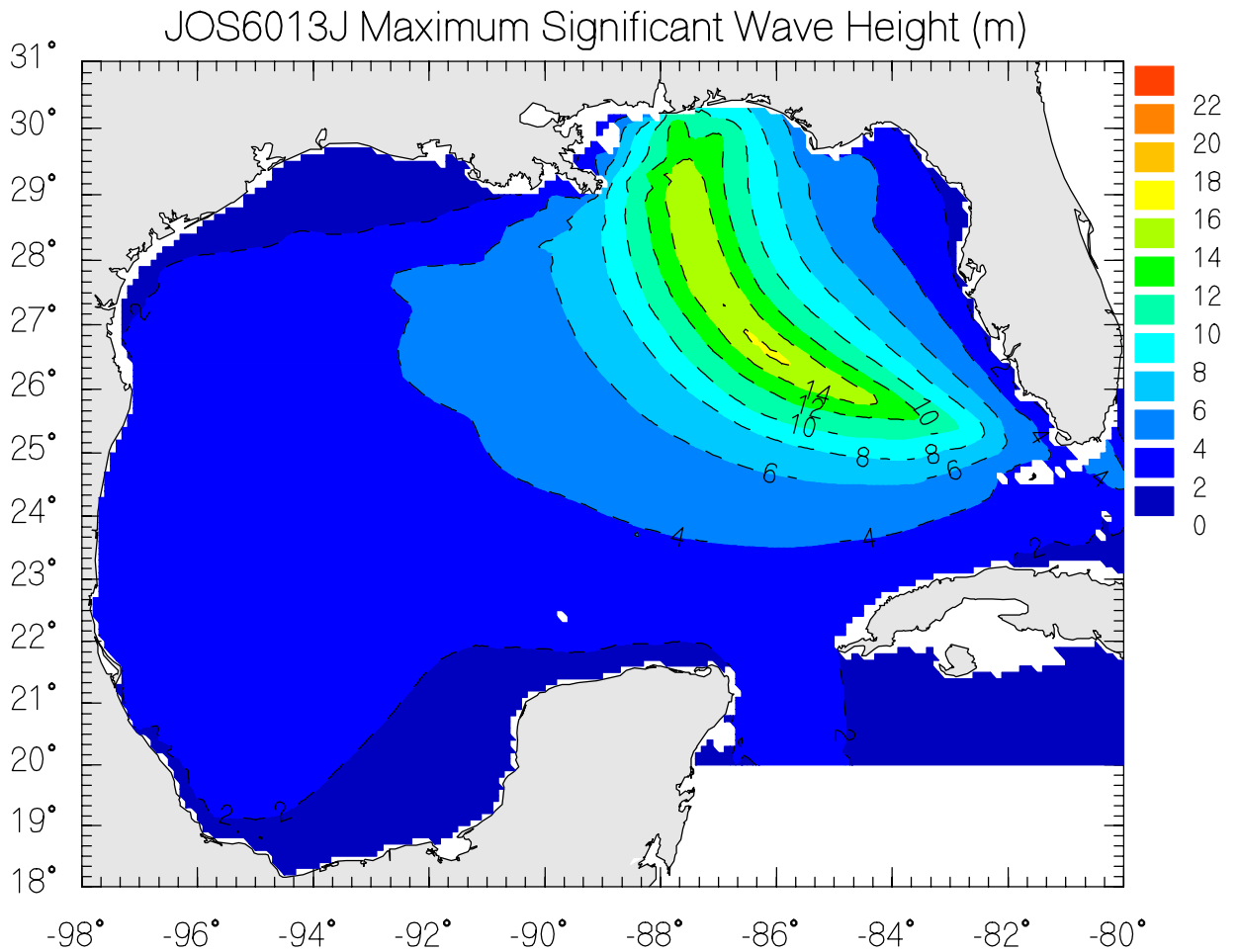

JOS6013J Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6013J Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
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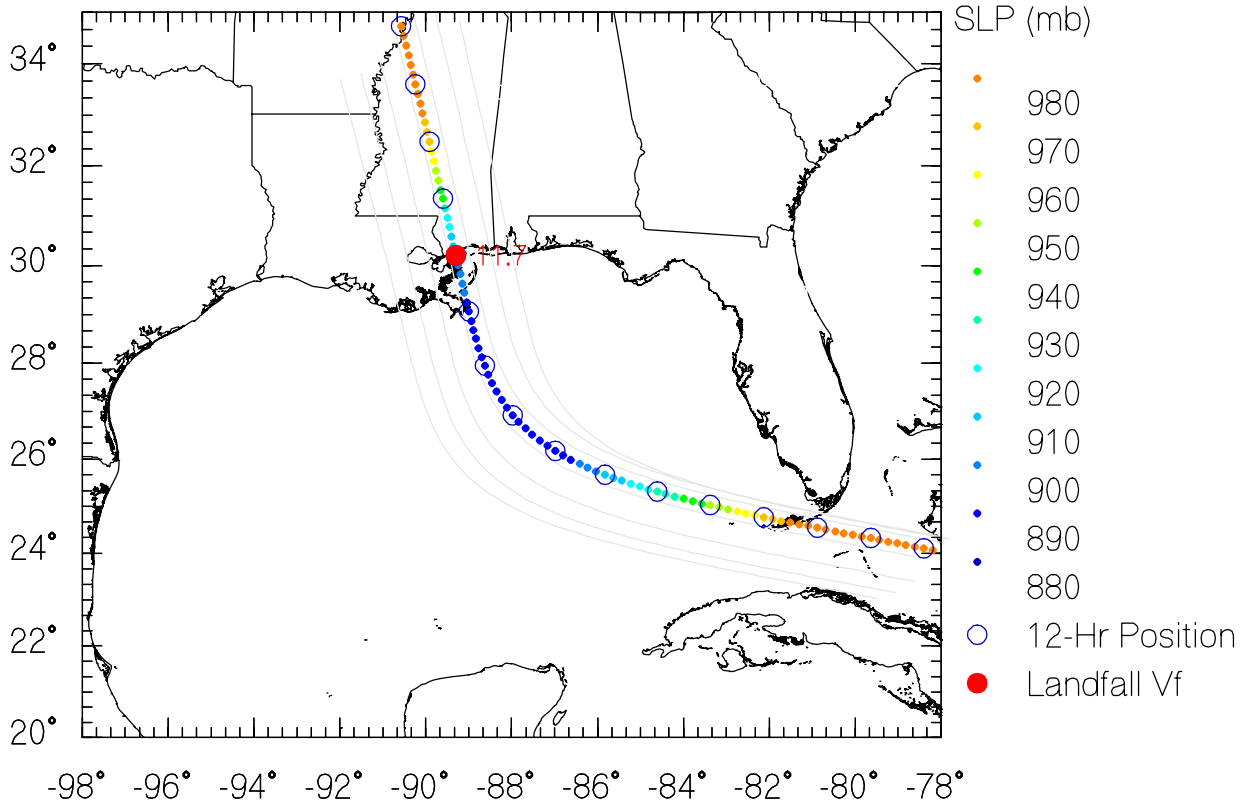
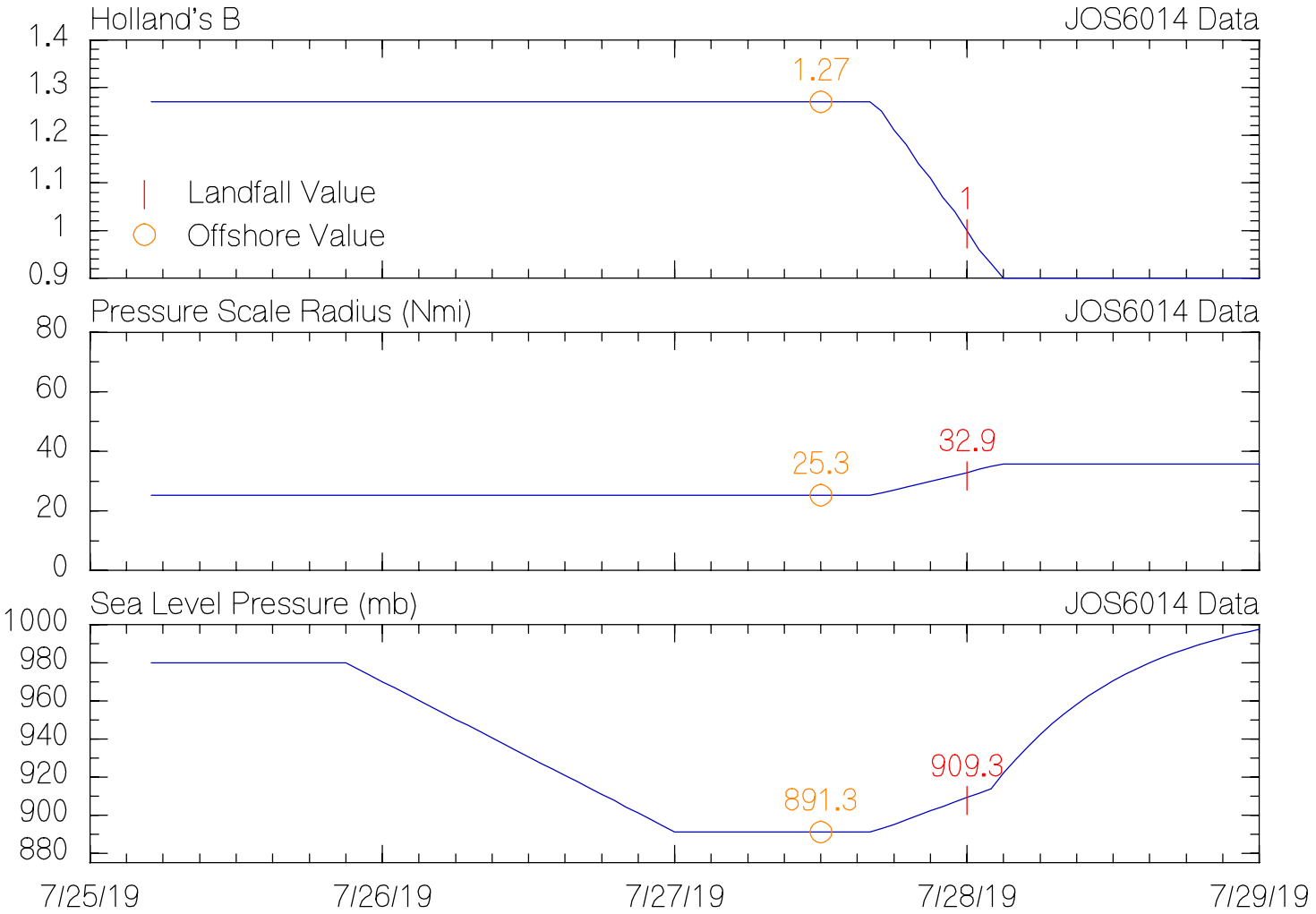
JOS6014 Data

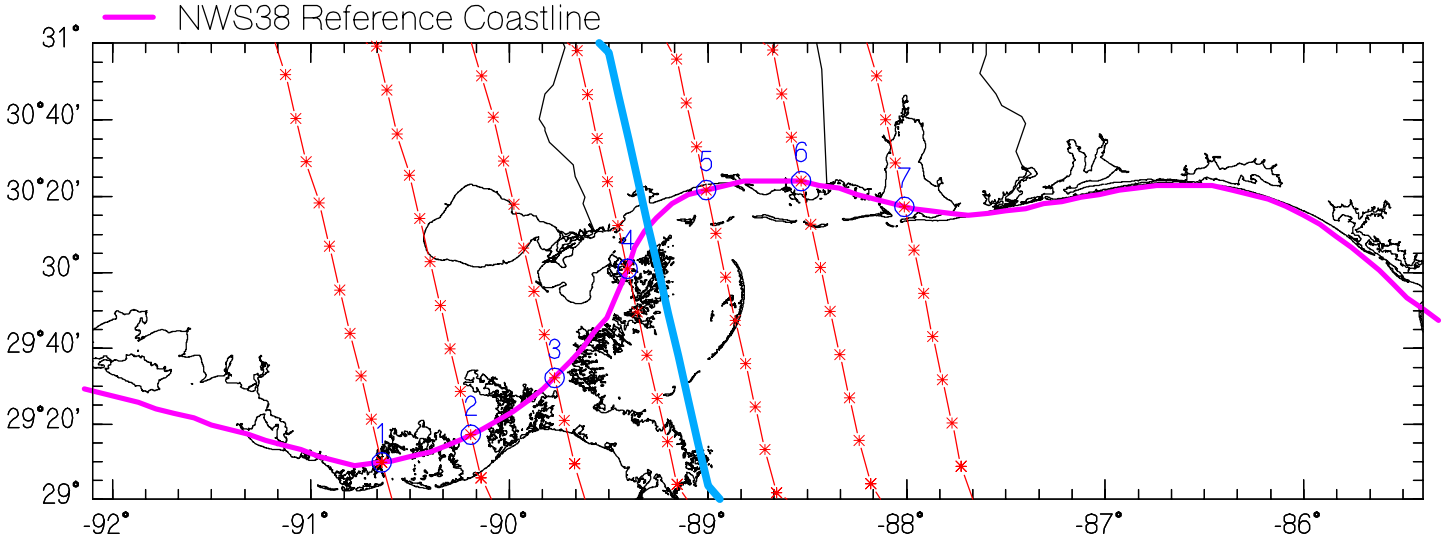


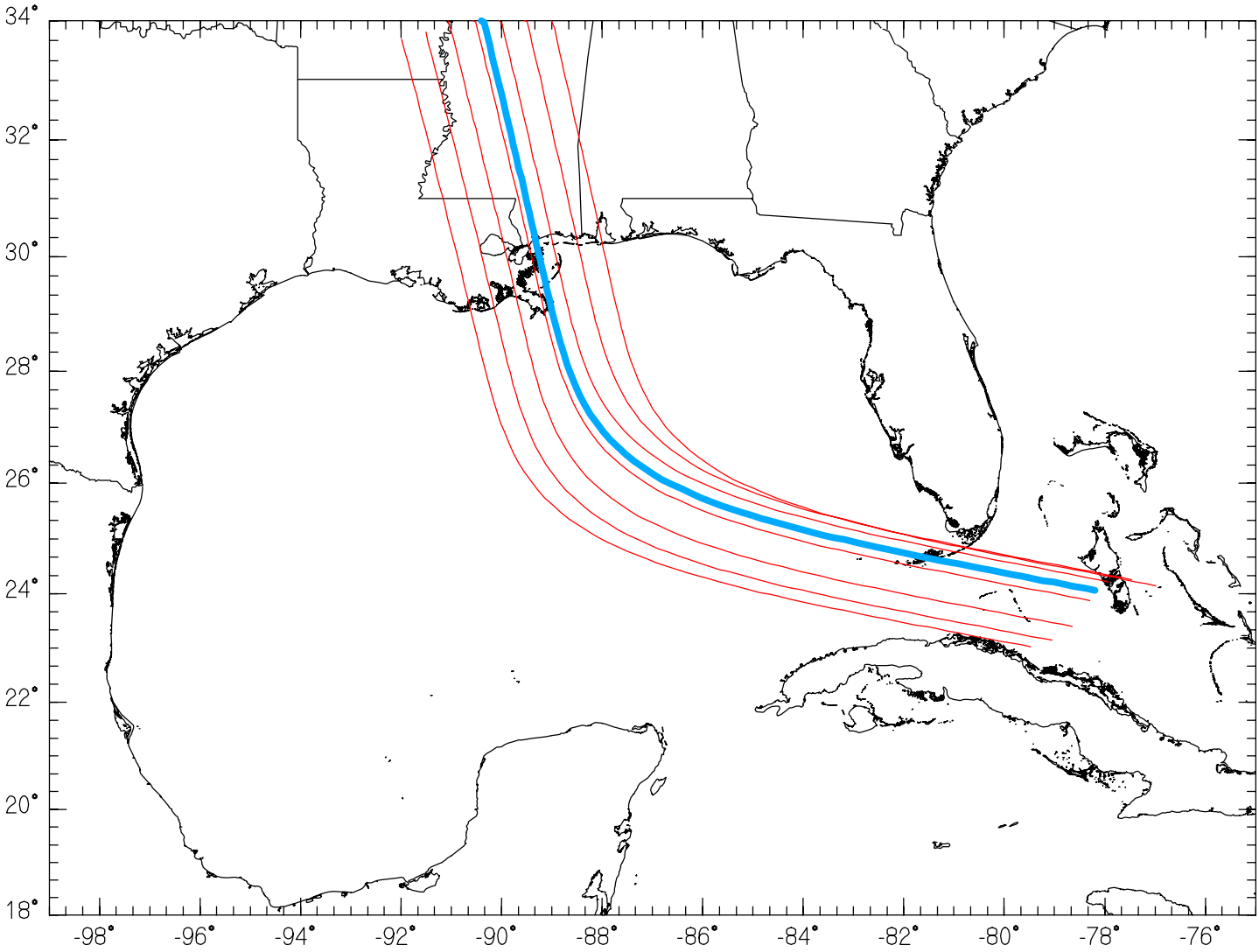


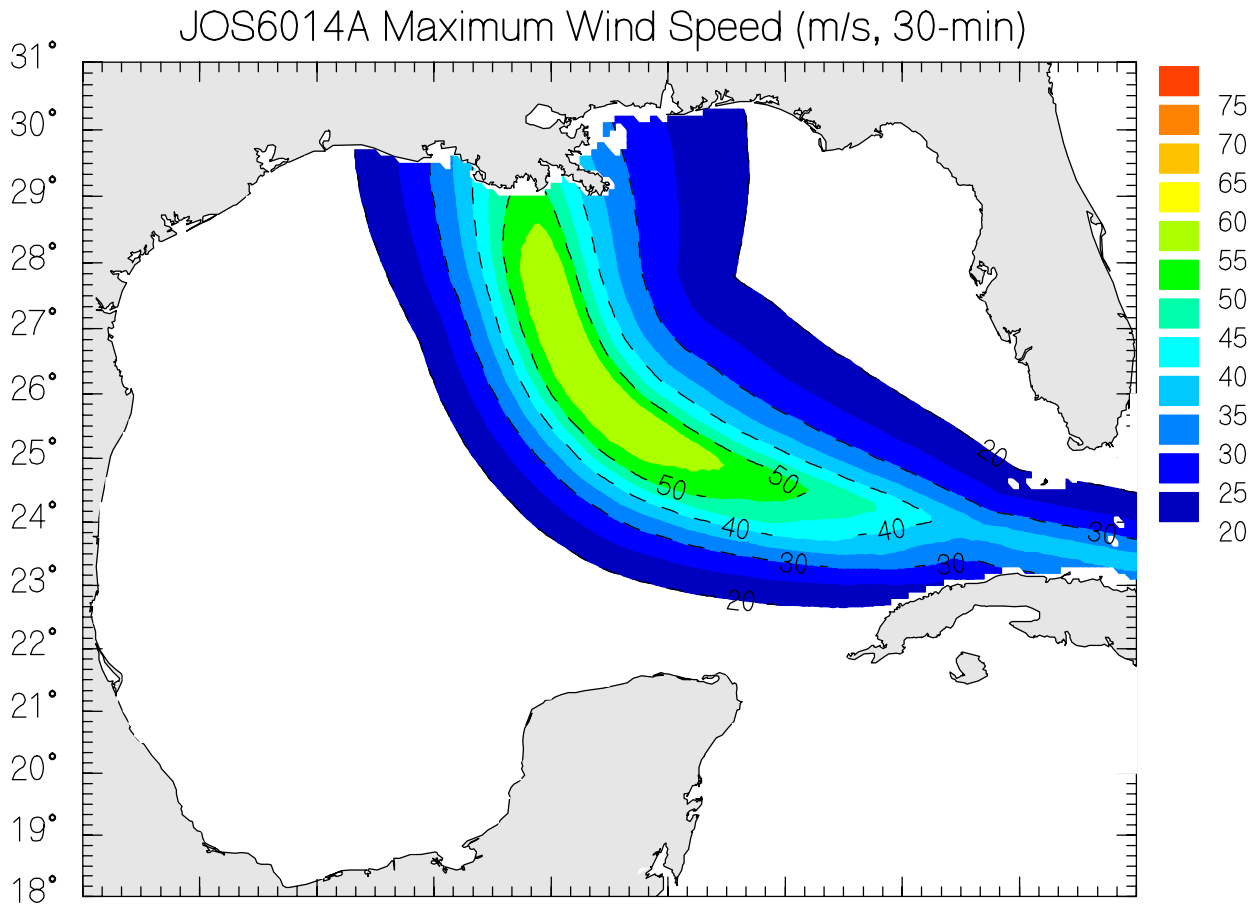
URS JPM-OS6 Production Tracks

JOS6014 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6014A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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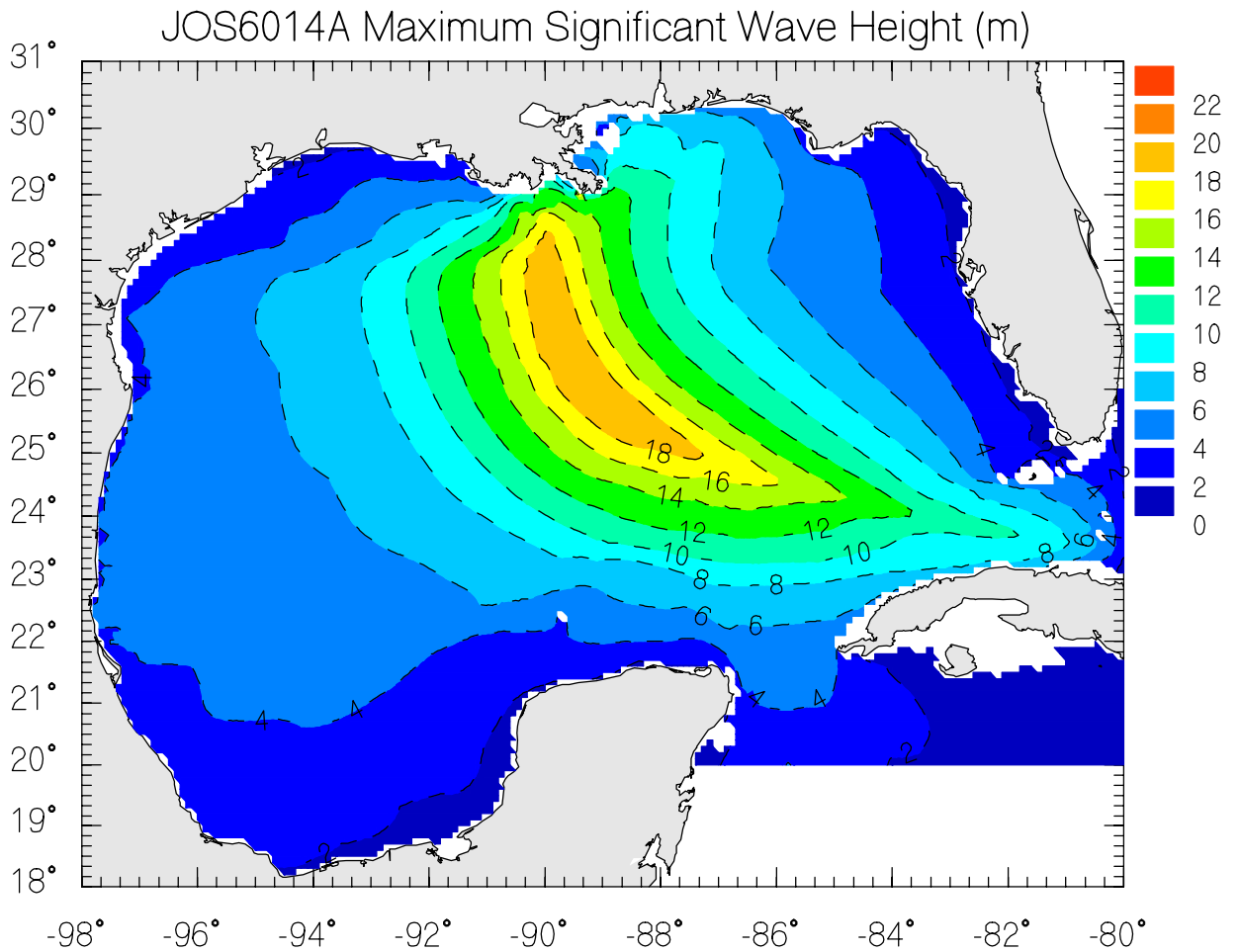
25
20
50
40
30
20


JOS6014A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
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-88°
-86°
-84°
-82°
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16
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8
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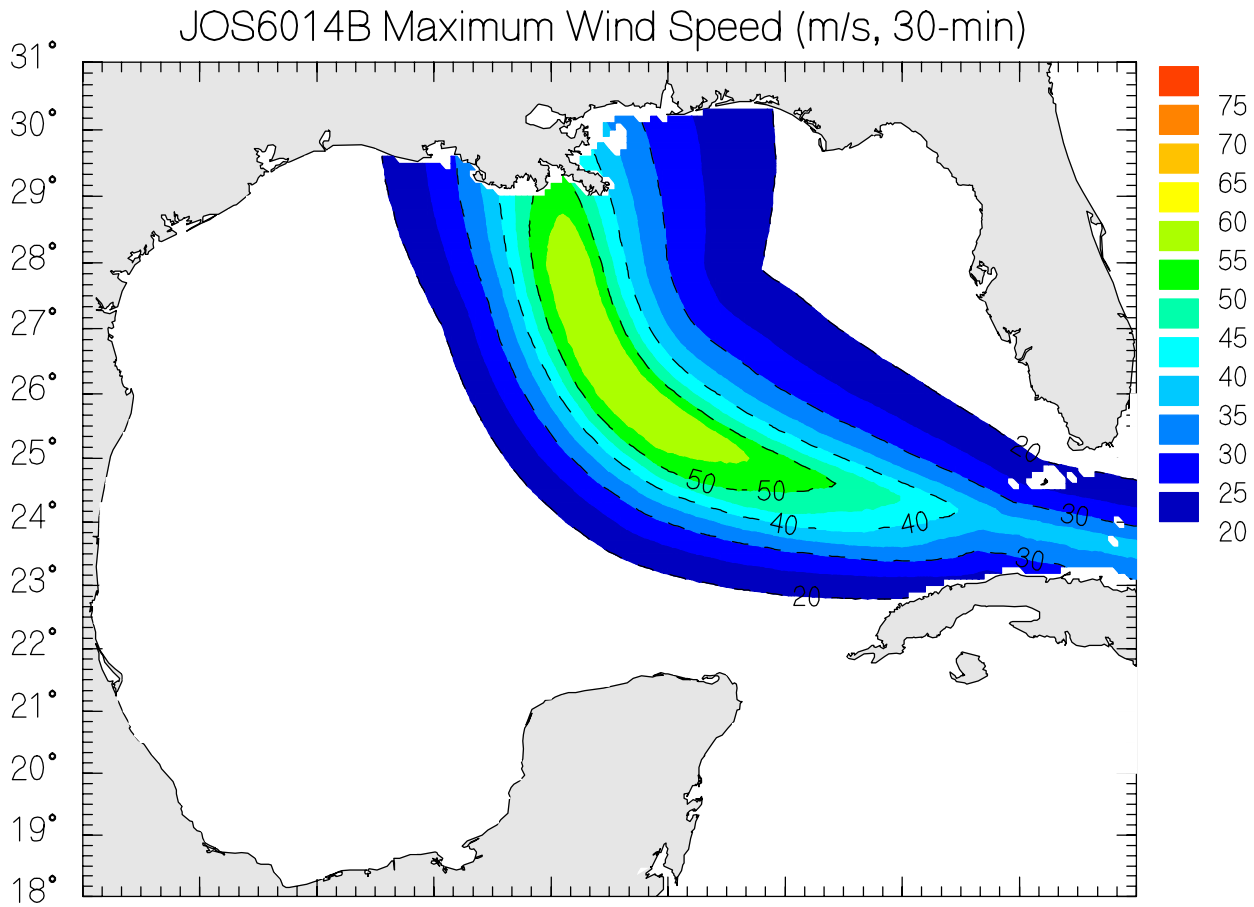
8
6


JOS6014B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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70
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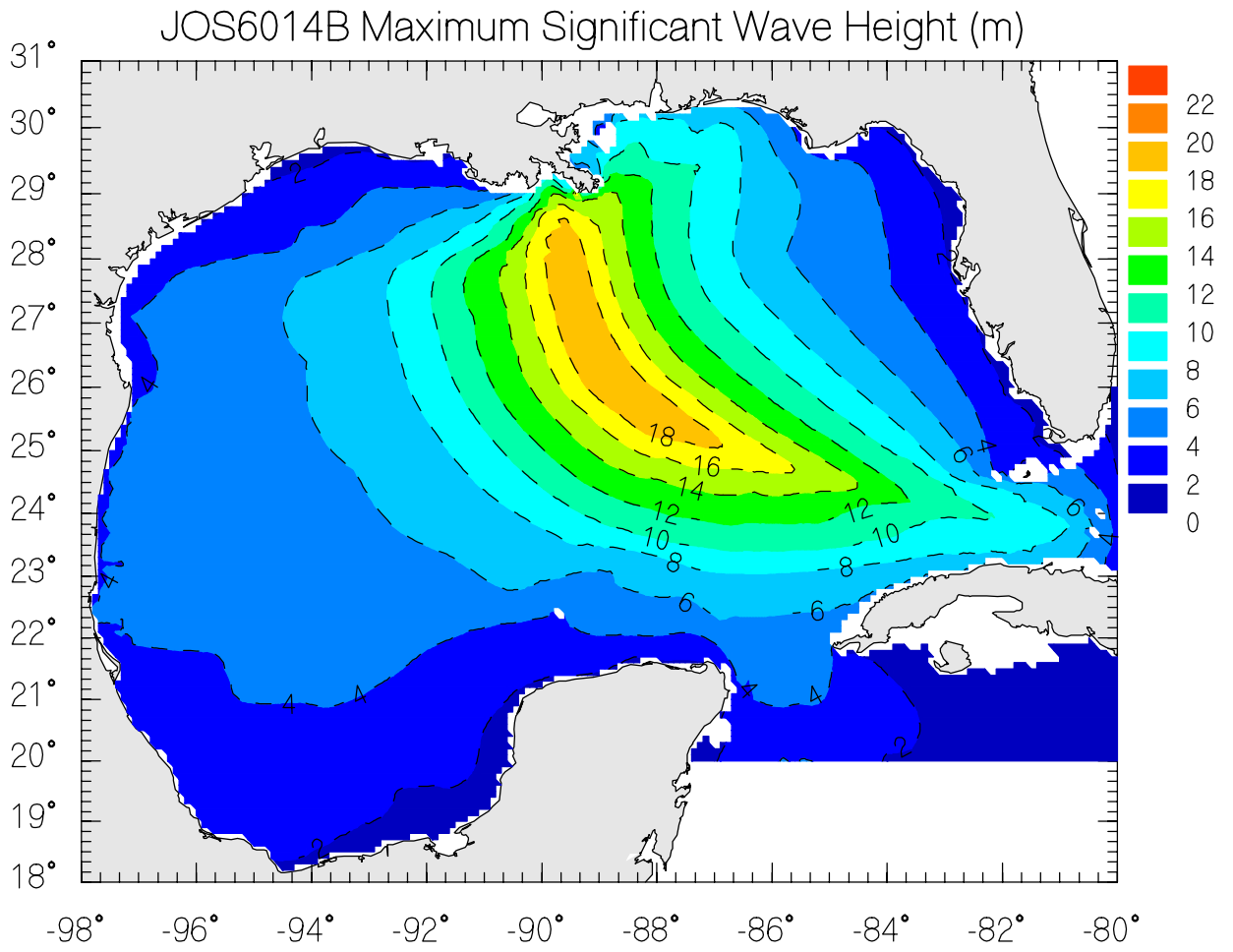
20


JOS6014B Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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-84°
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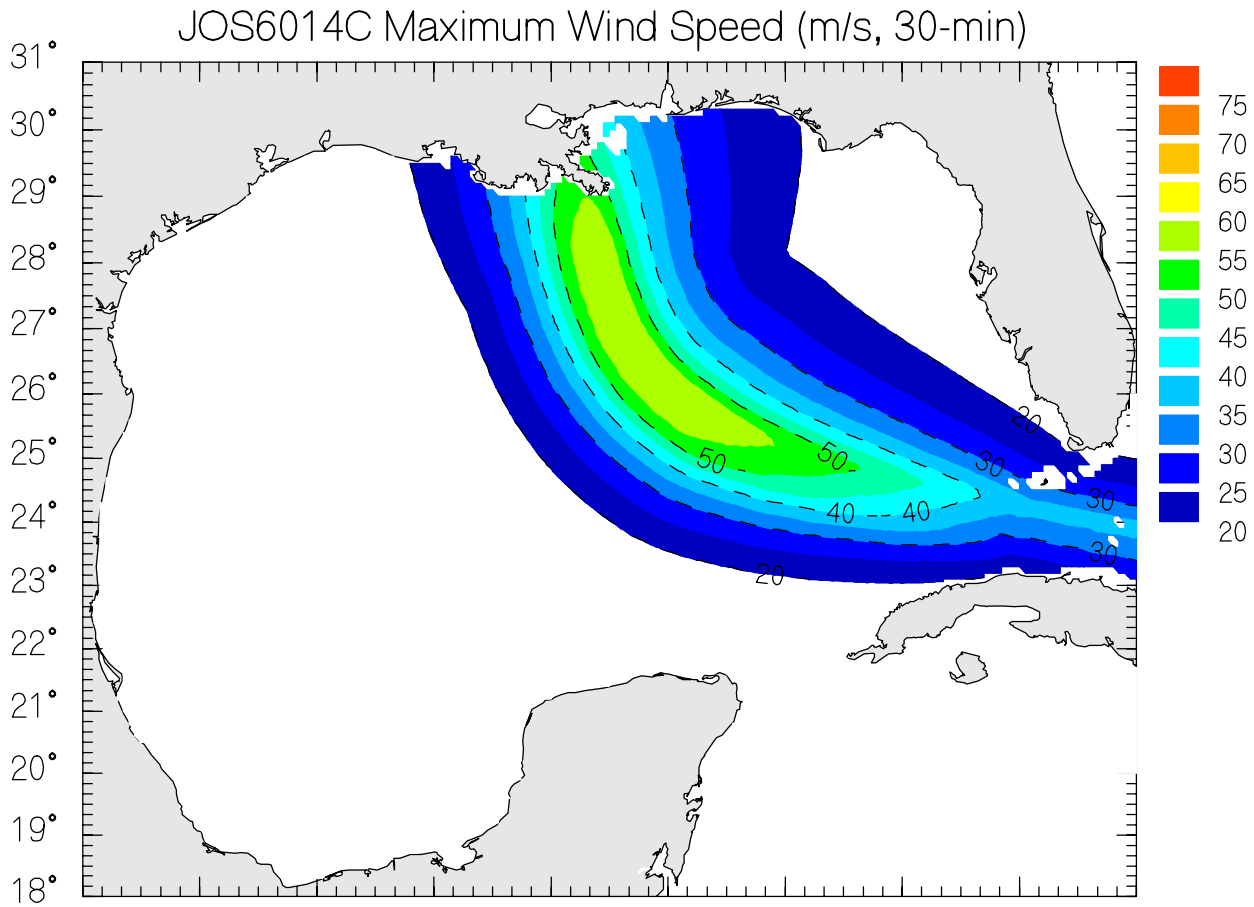
-80°


JOS6014C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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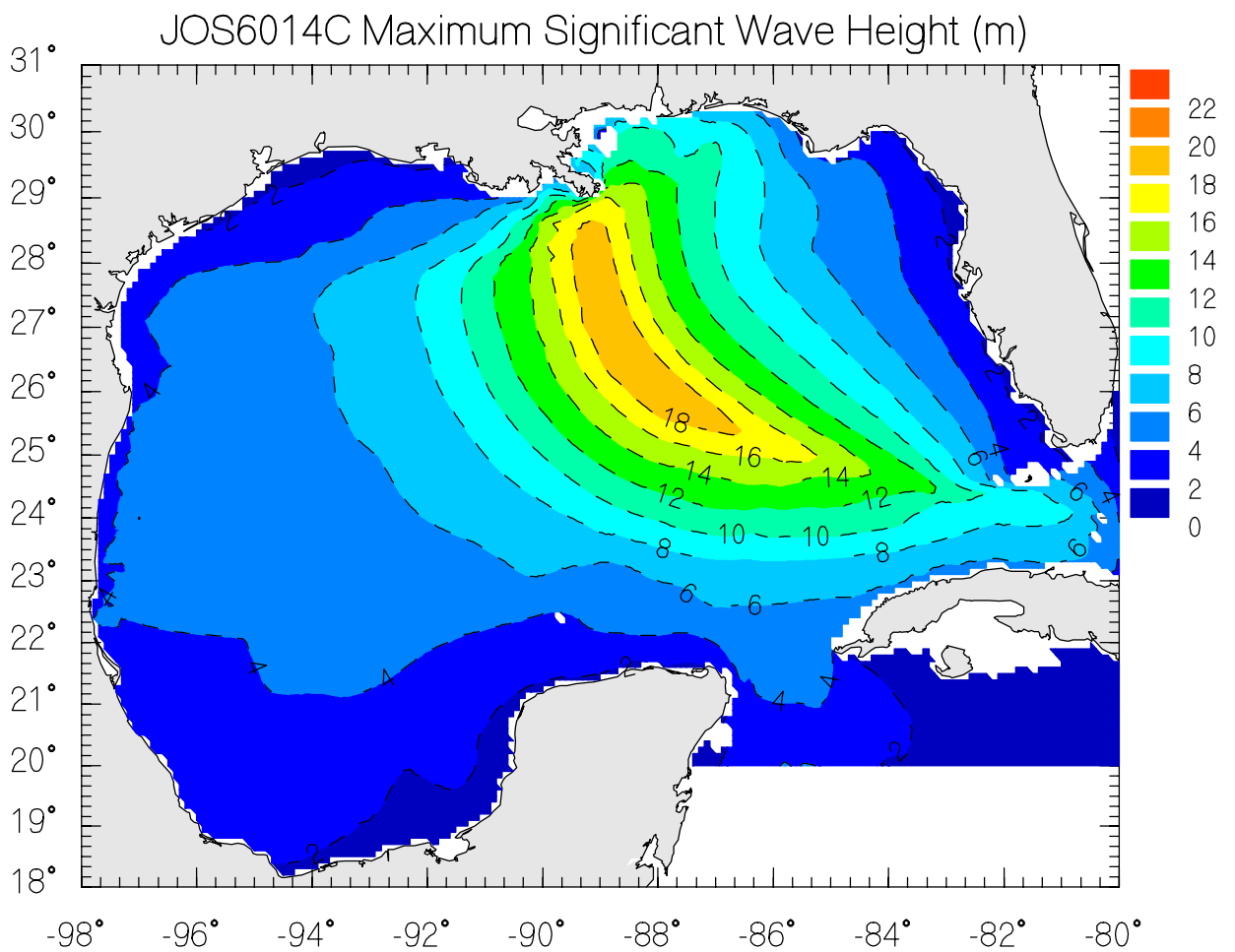
30
20


JOS6014C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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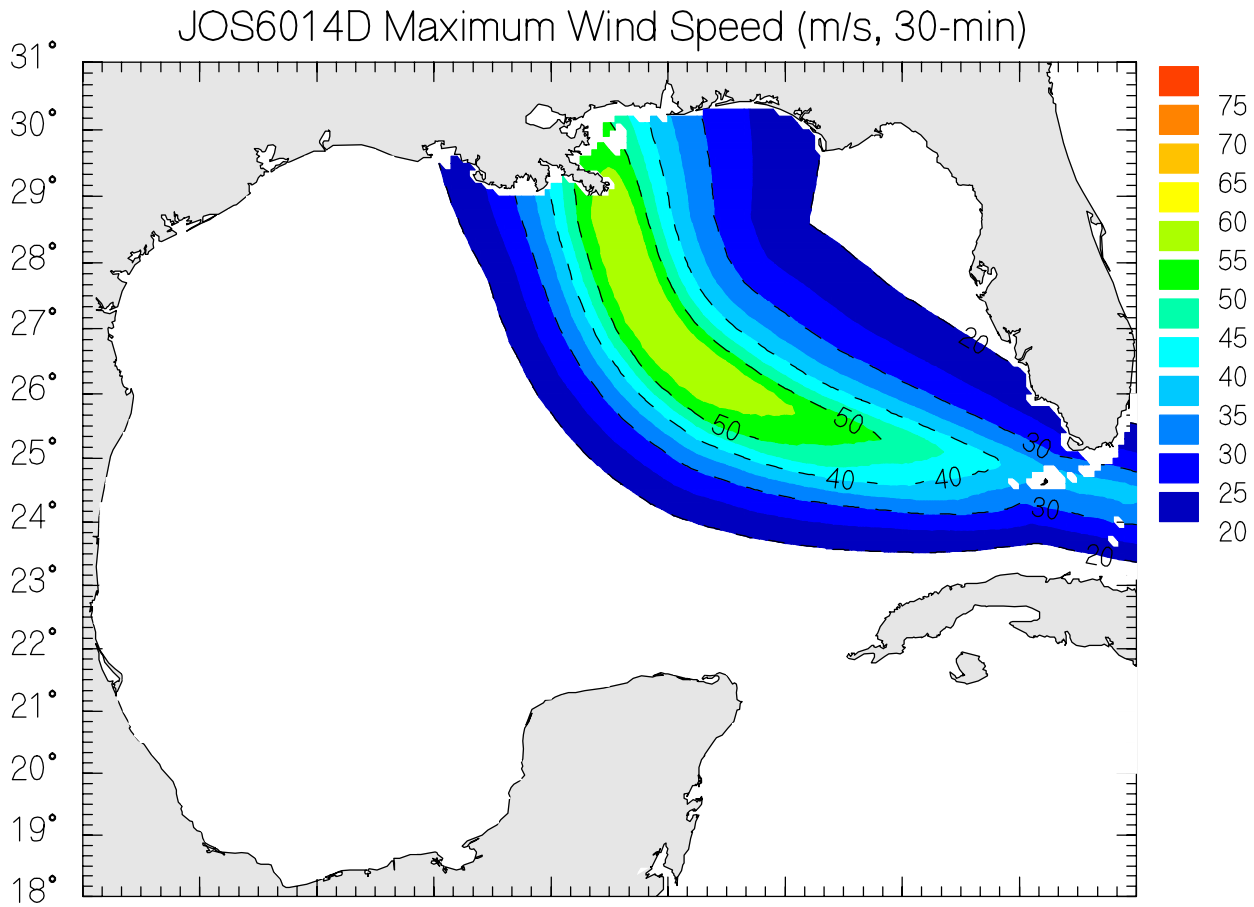
2
0


JOS6014D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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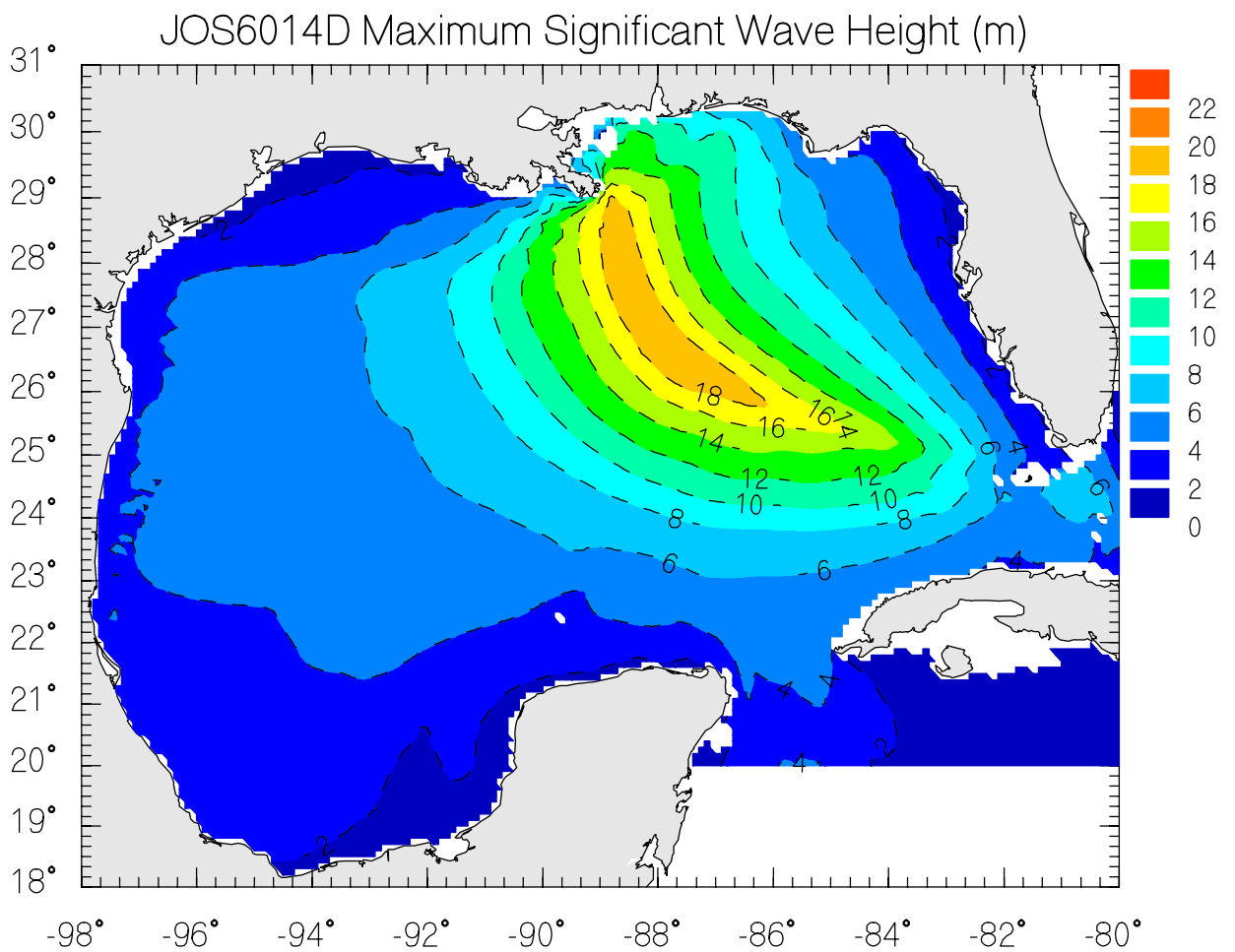
20


JOS6014D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
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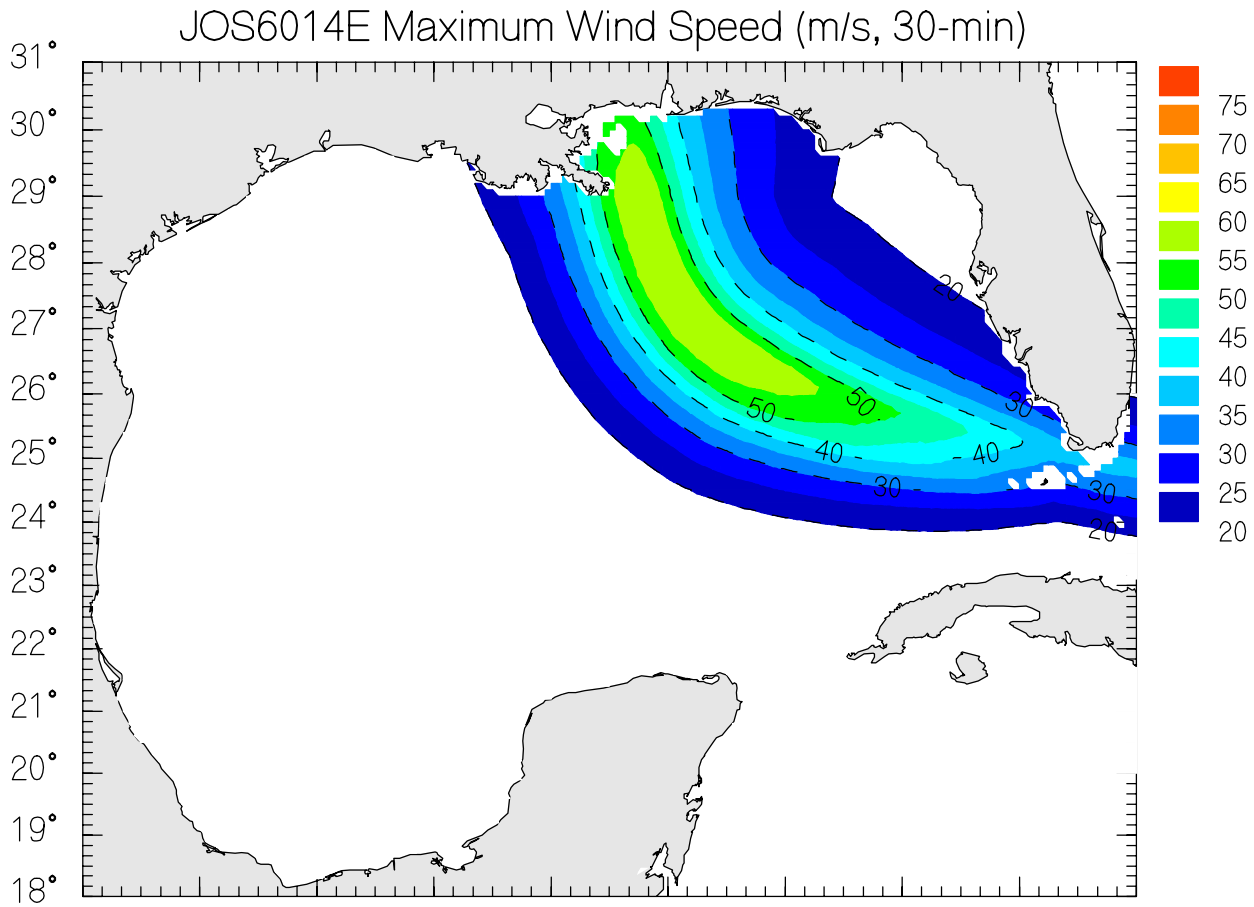
JOS6014E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
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20°
19°
18°
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25
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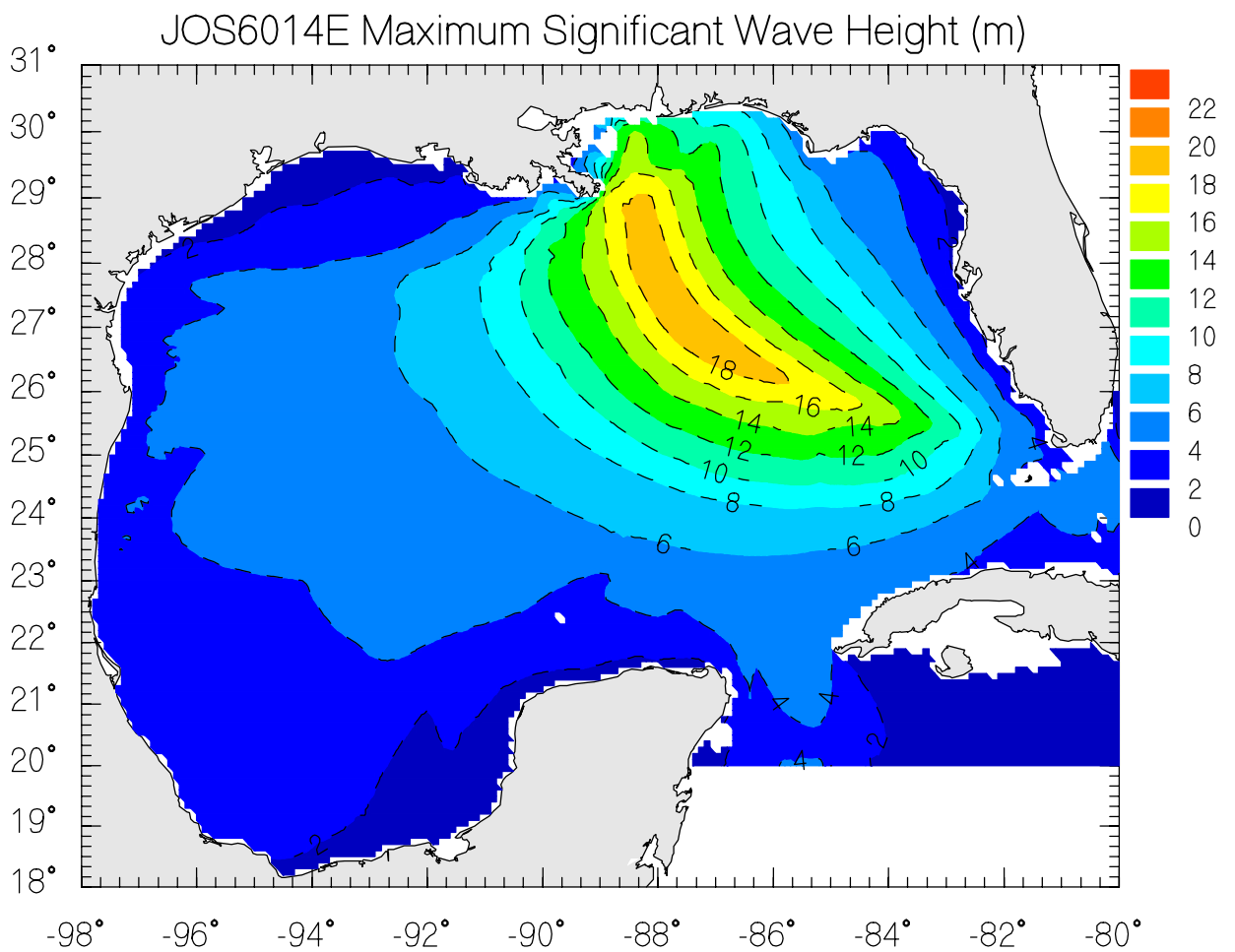
JOS6014E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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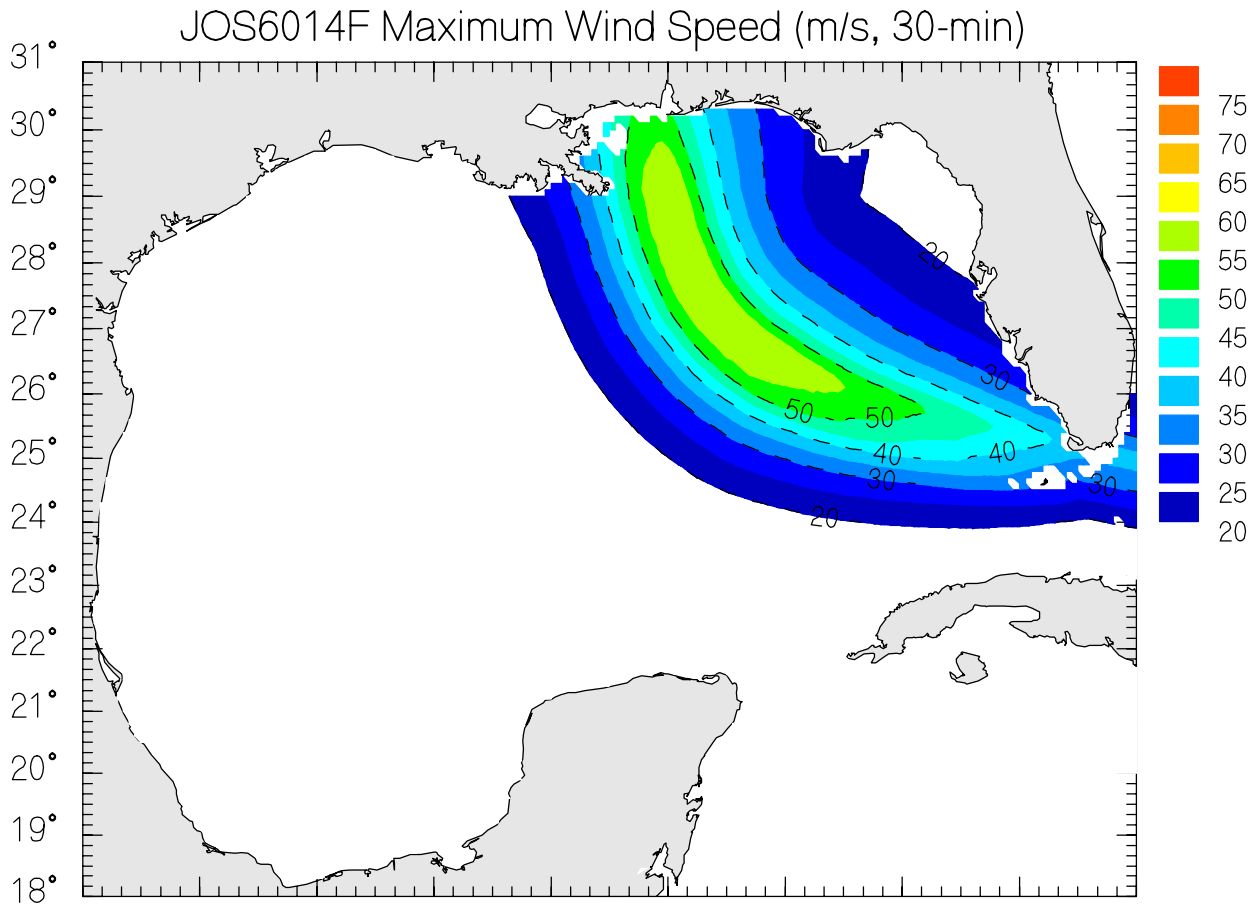
JOS6014F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
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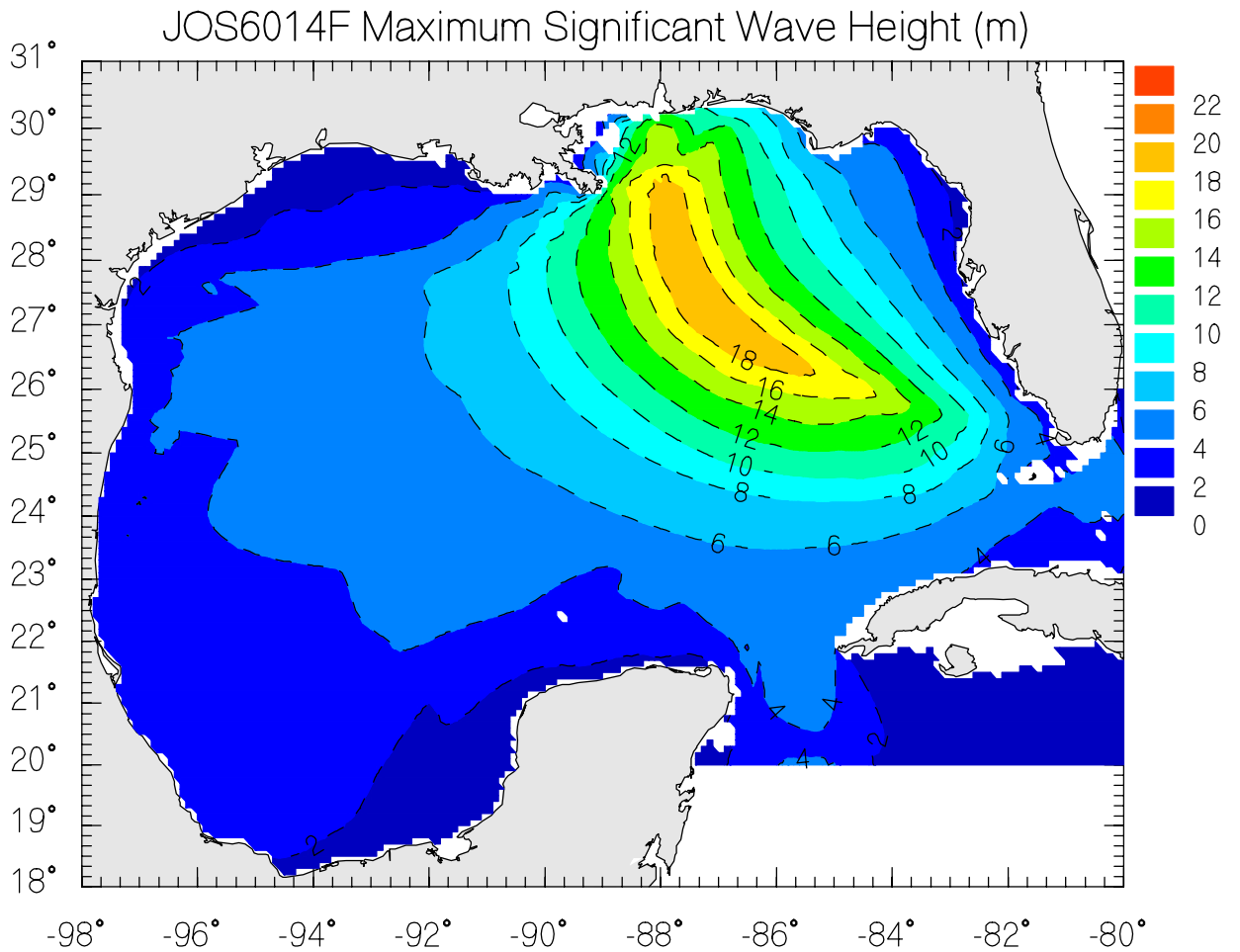
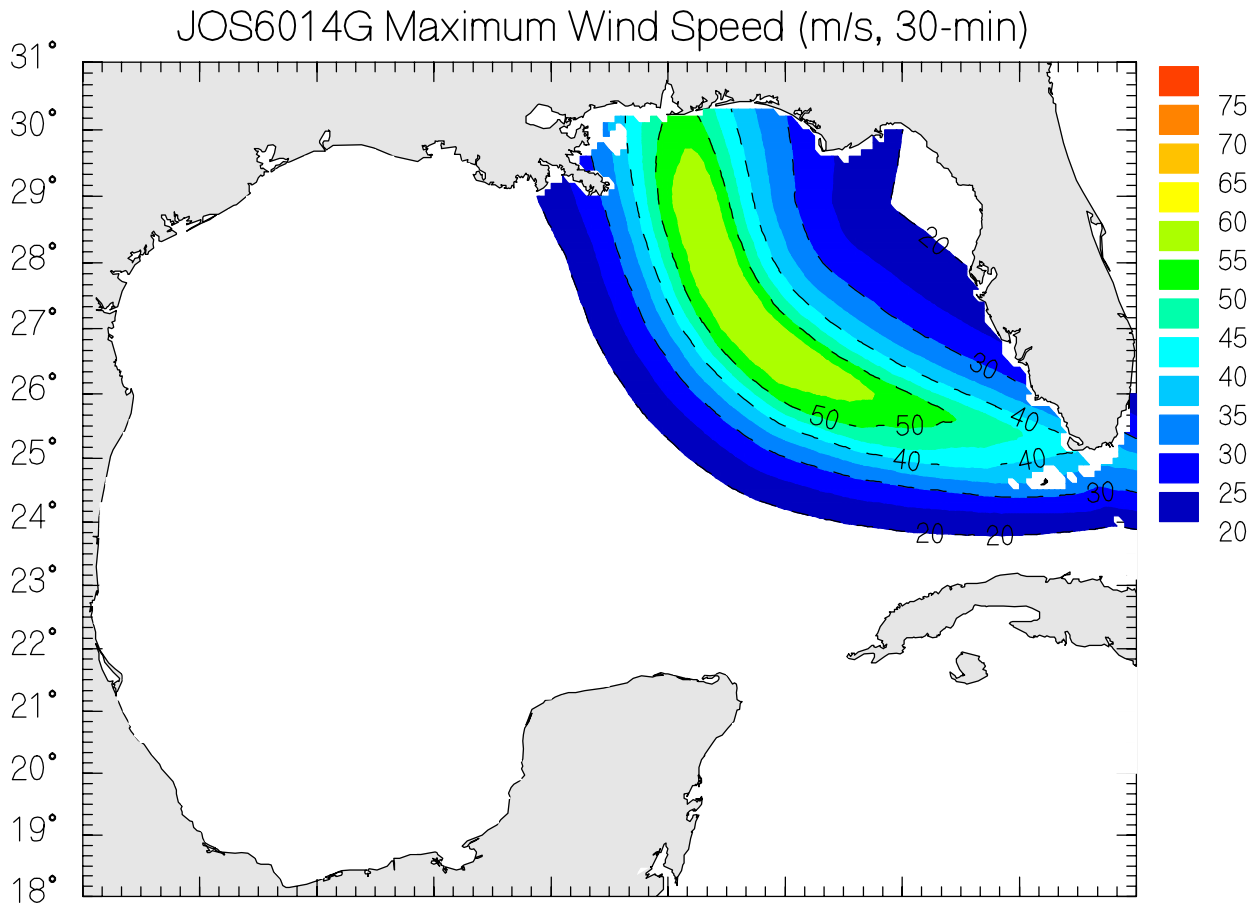
30
20


JOS6014F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
18
16
14
12
10
8
6
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6014G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
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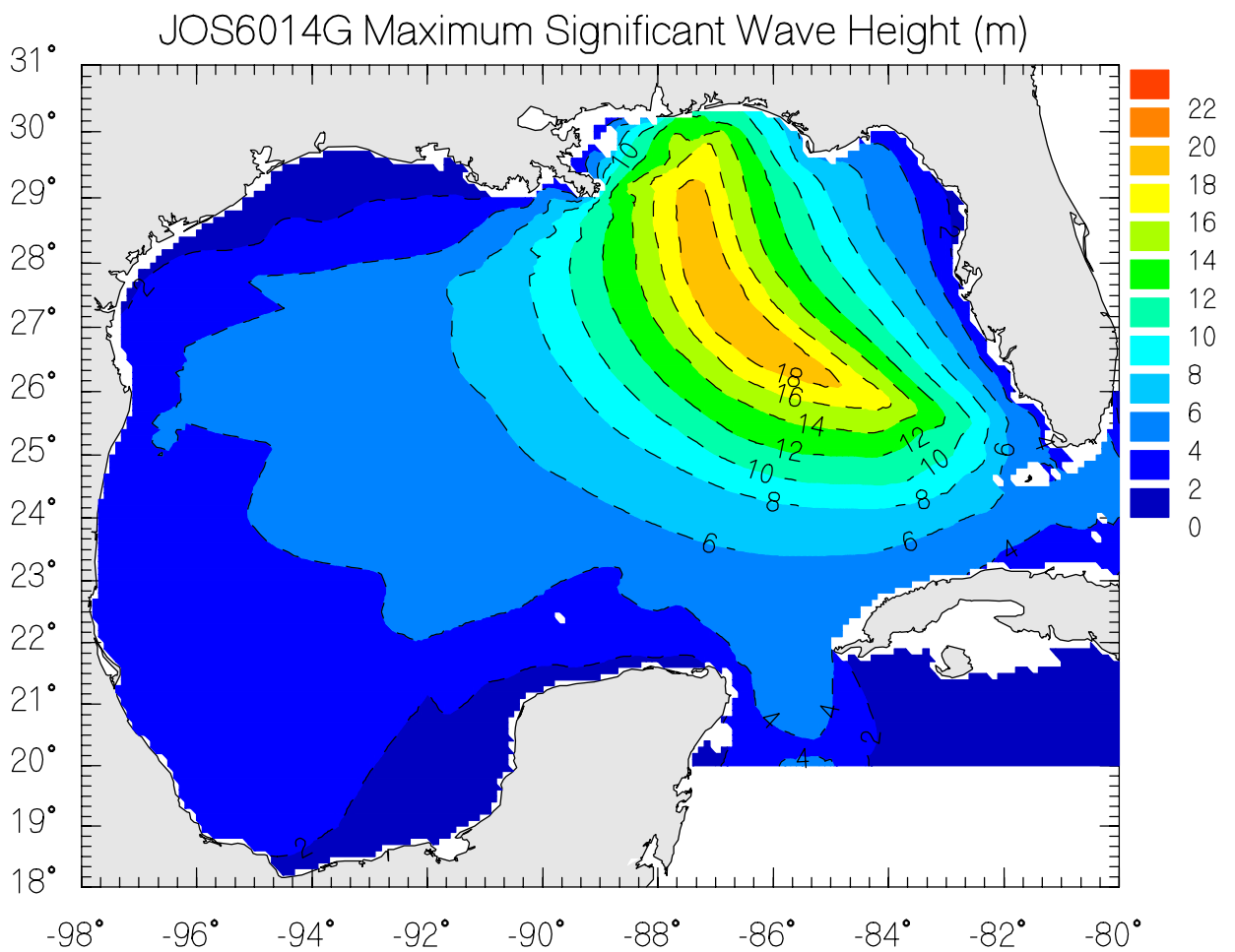
55
50
45
40
35
30
25
20


JOS6014G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
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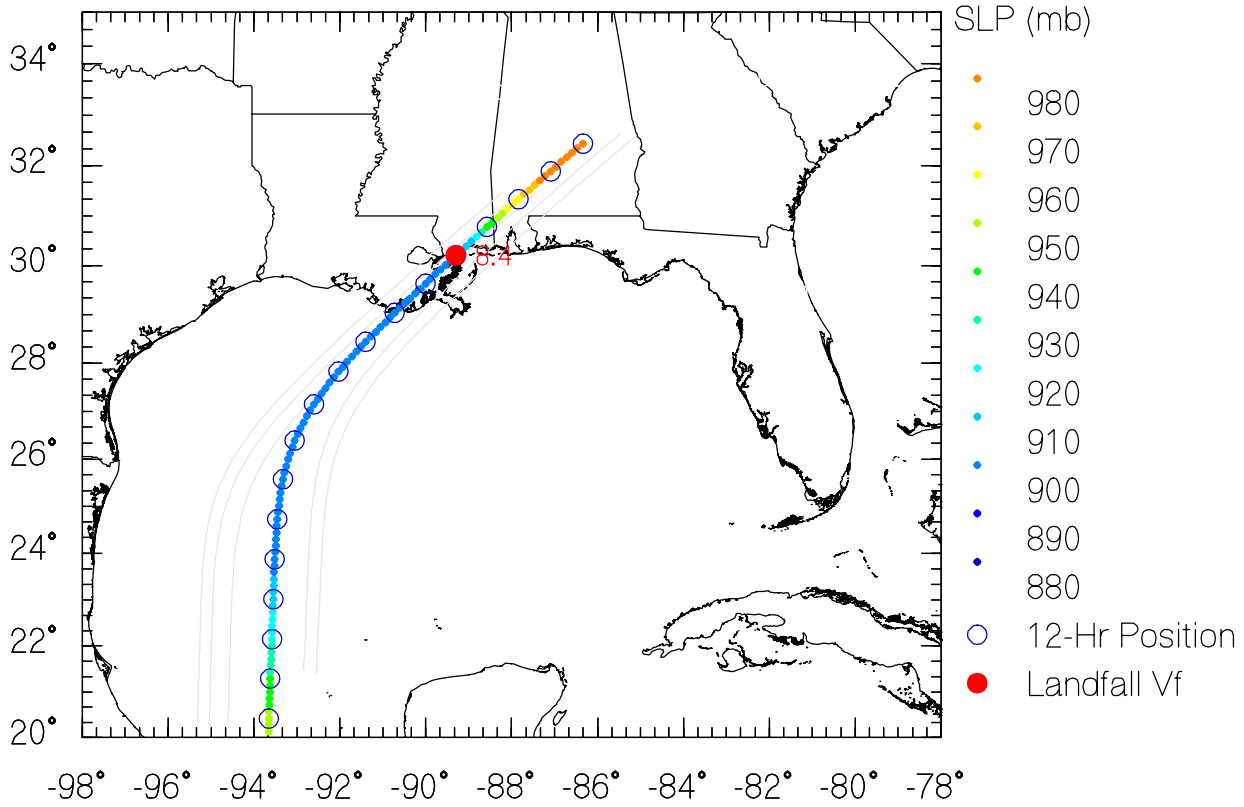
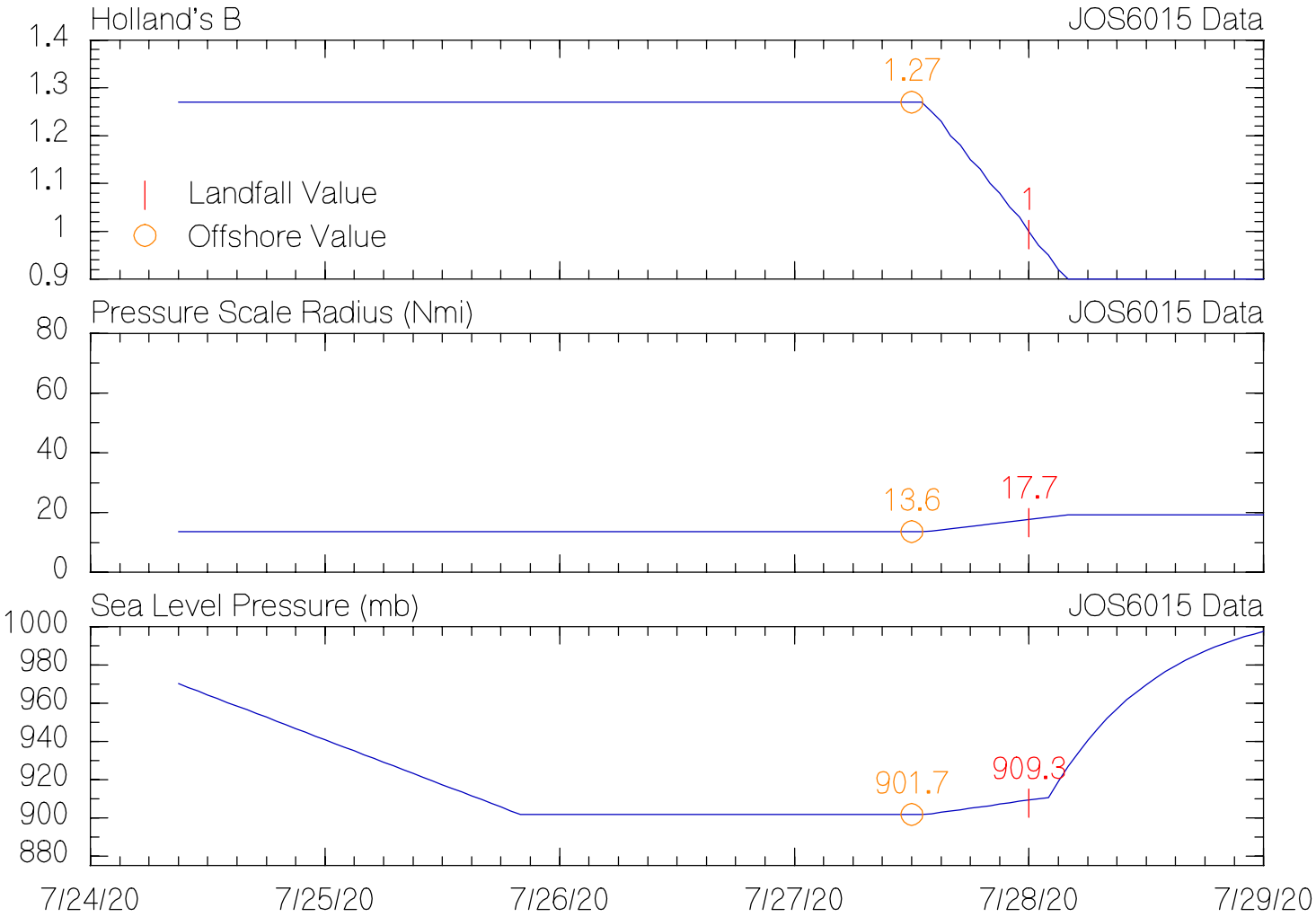
14
12
10
8
6
4
2
0

JOS6015 Data

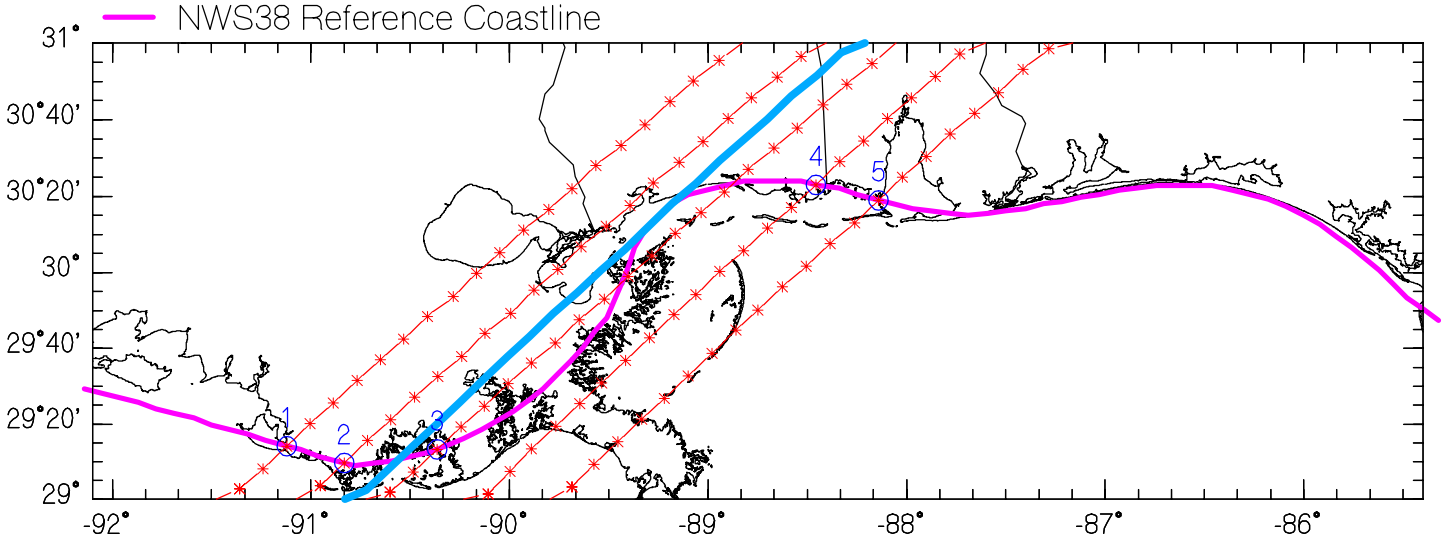


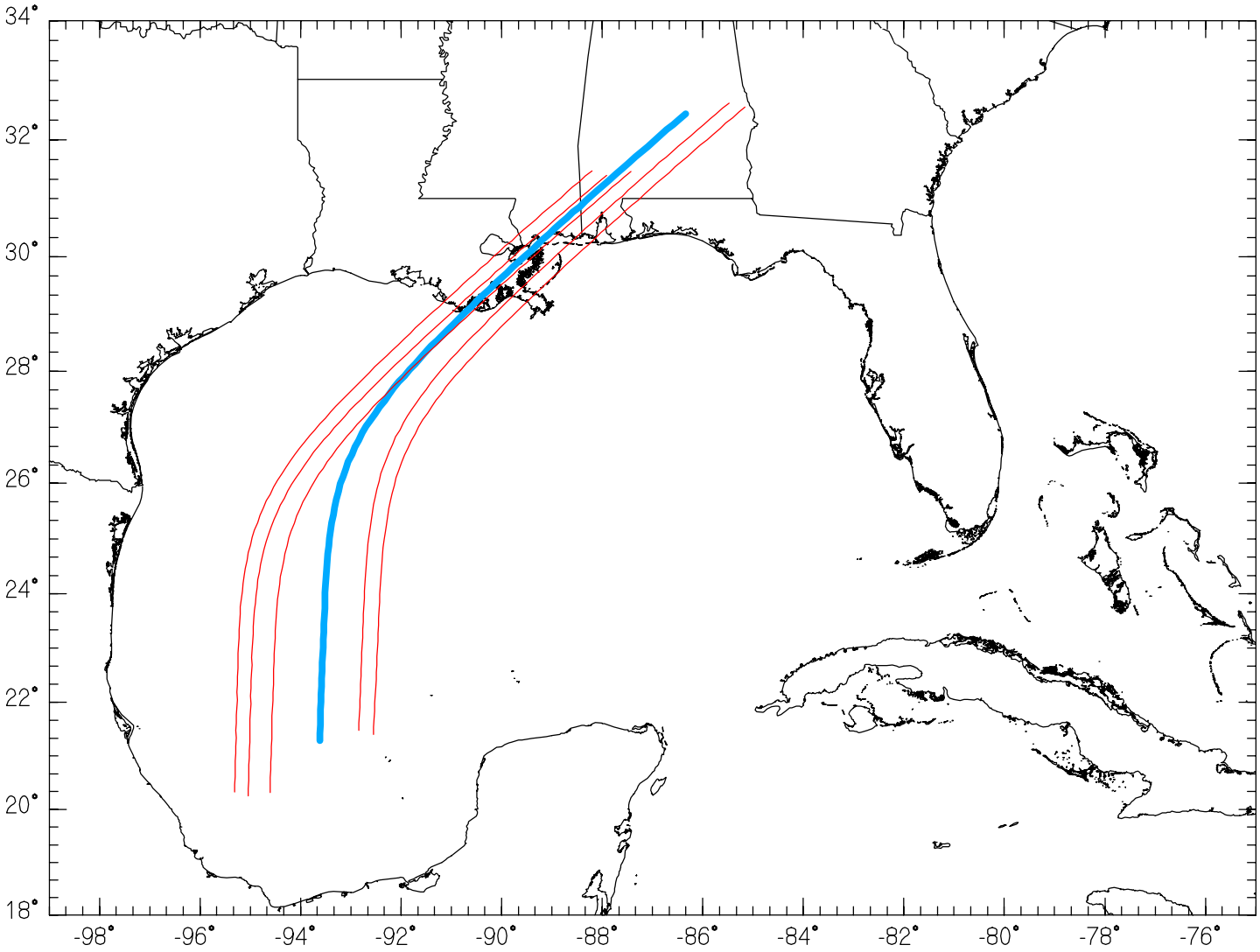


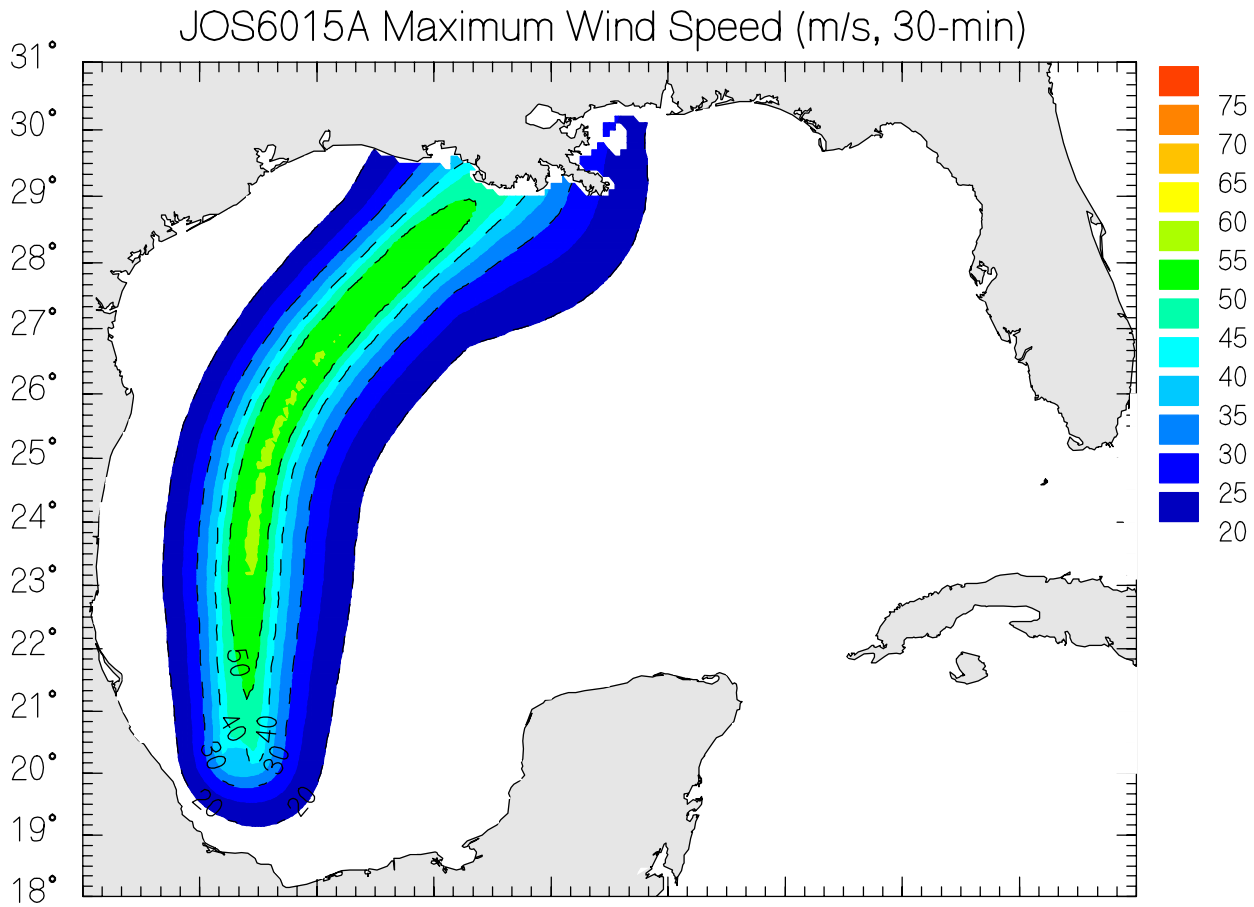
URS JPM-OS6 Production Tracks

JOS6015 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6015A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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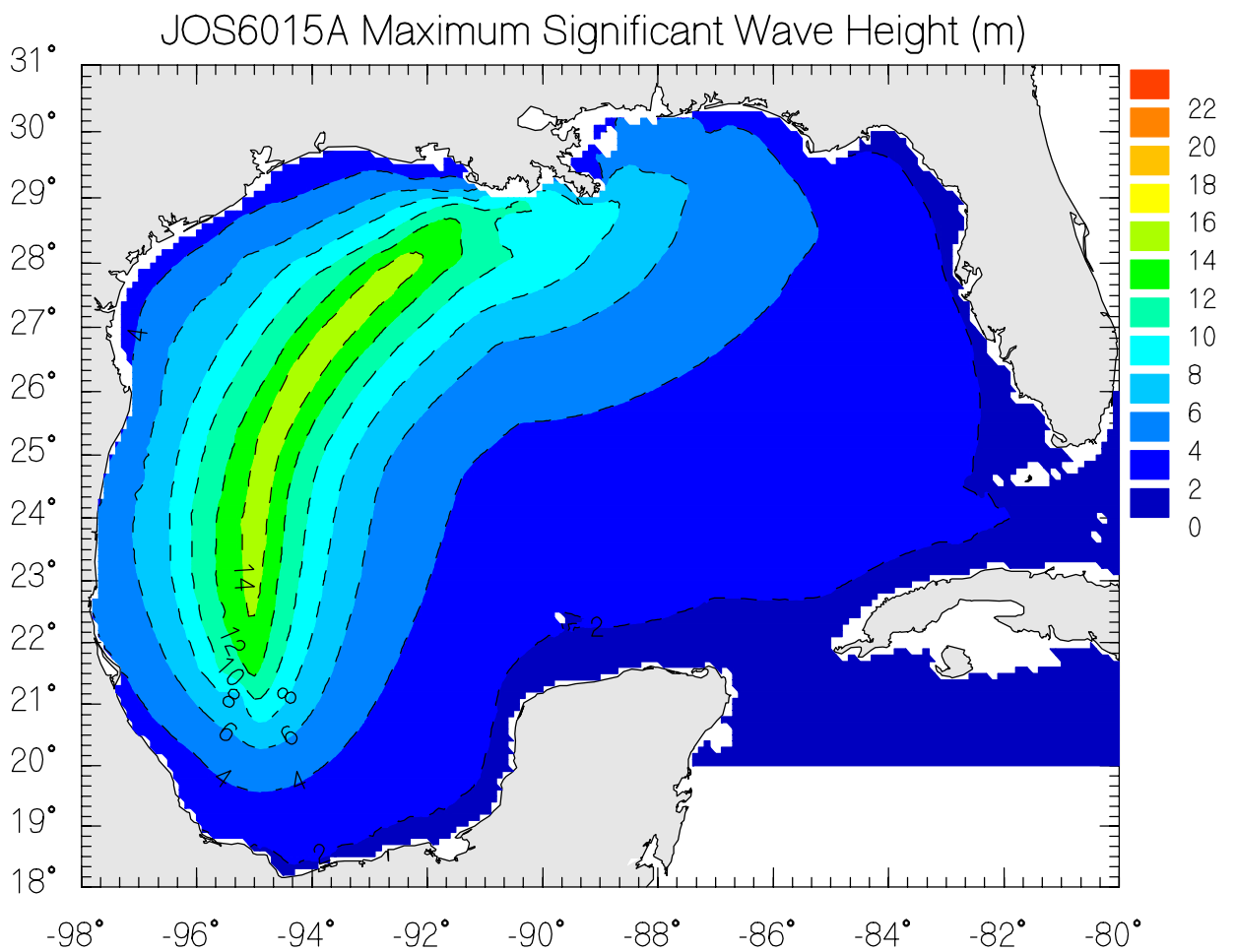
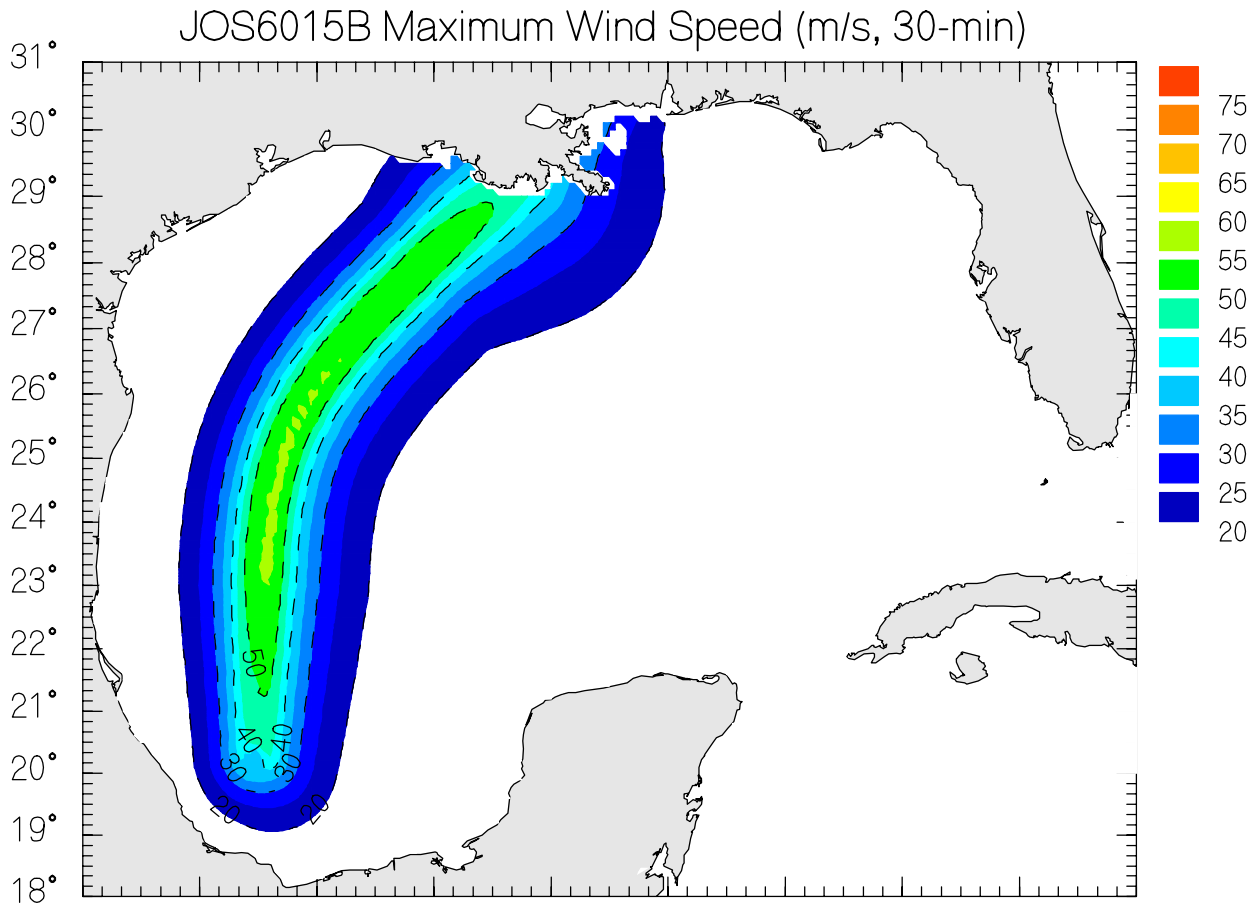
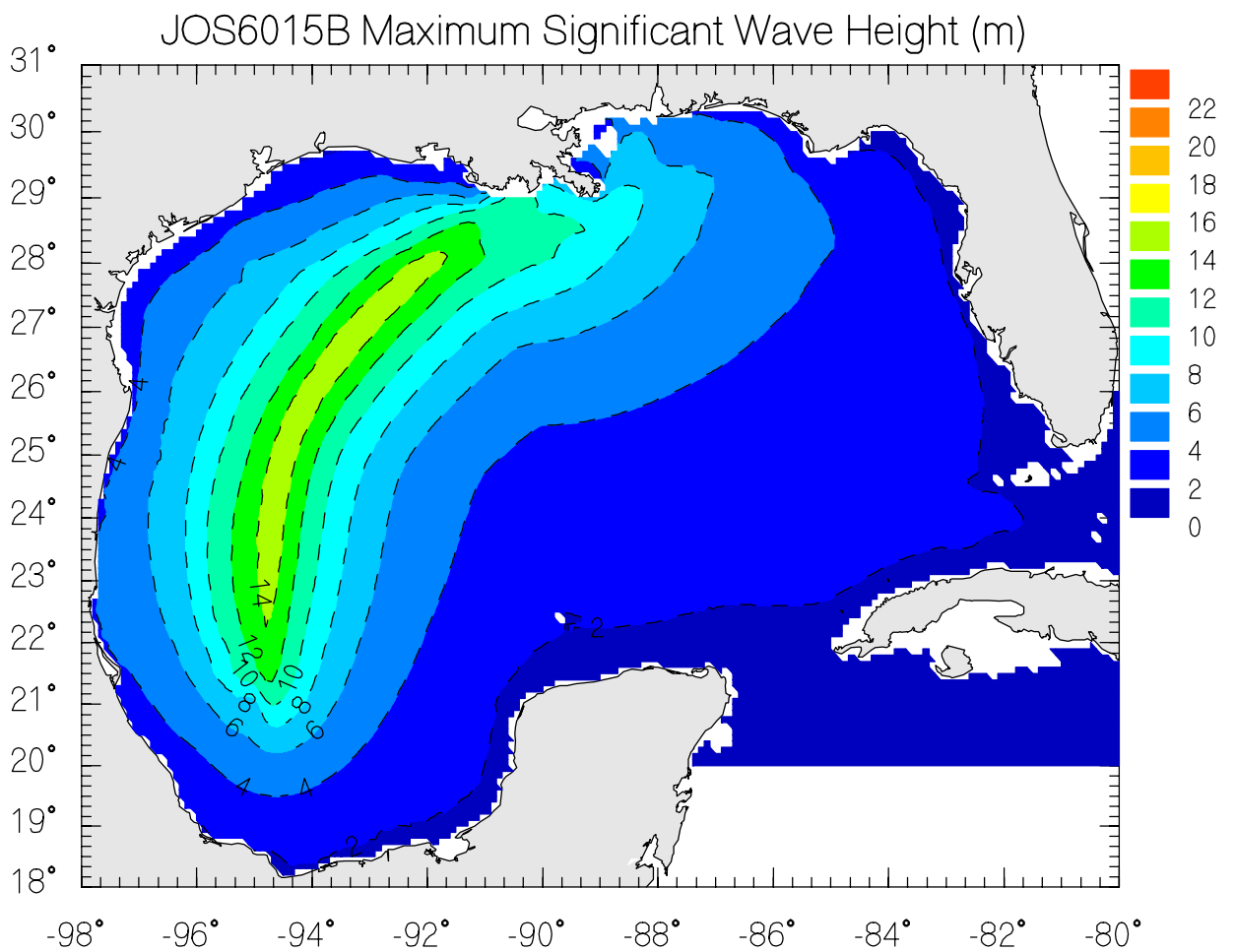
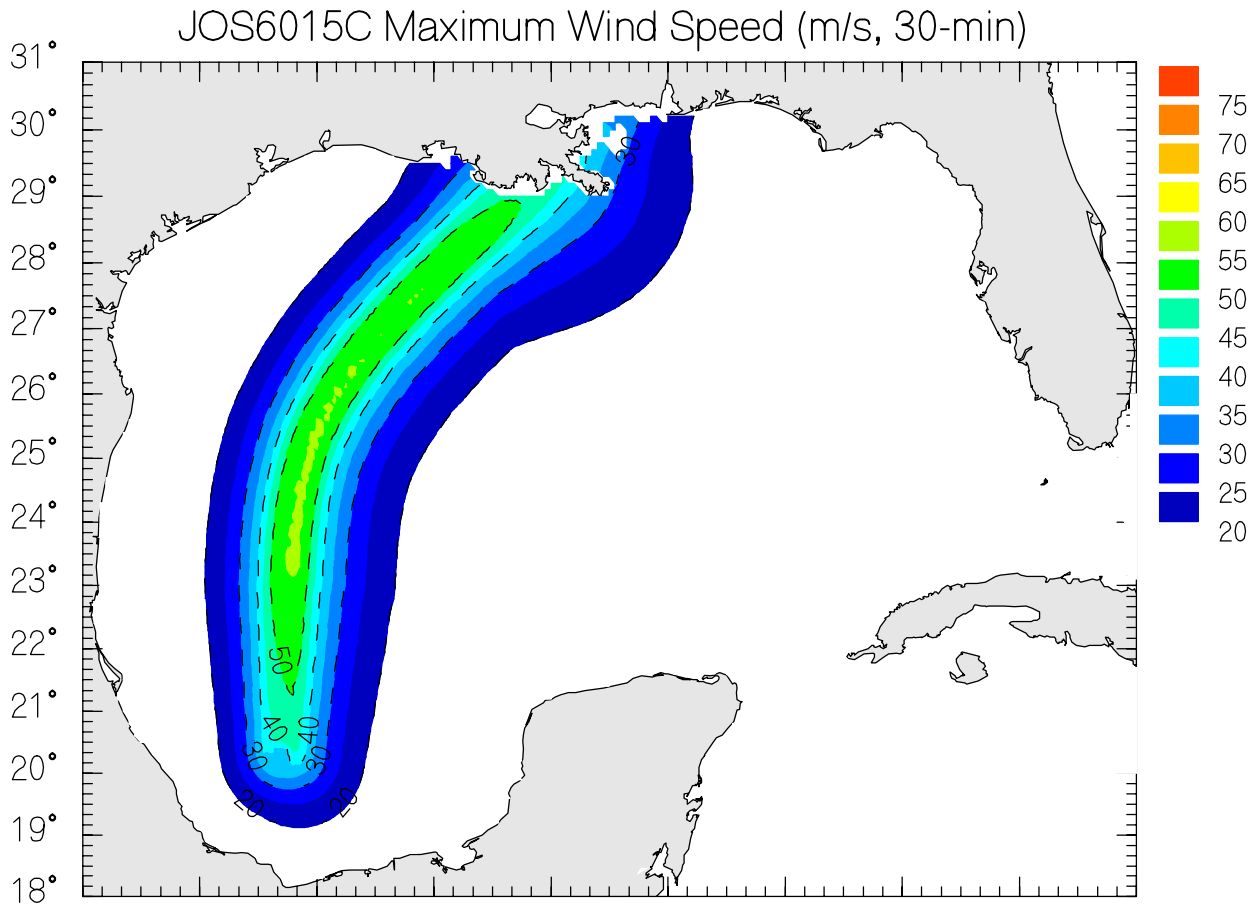
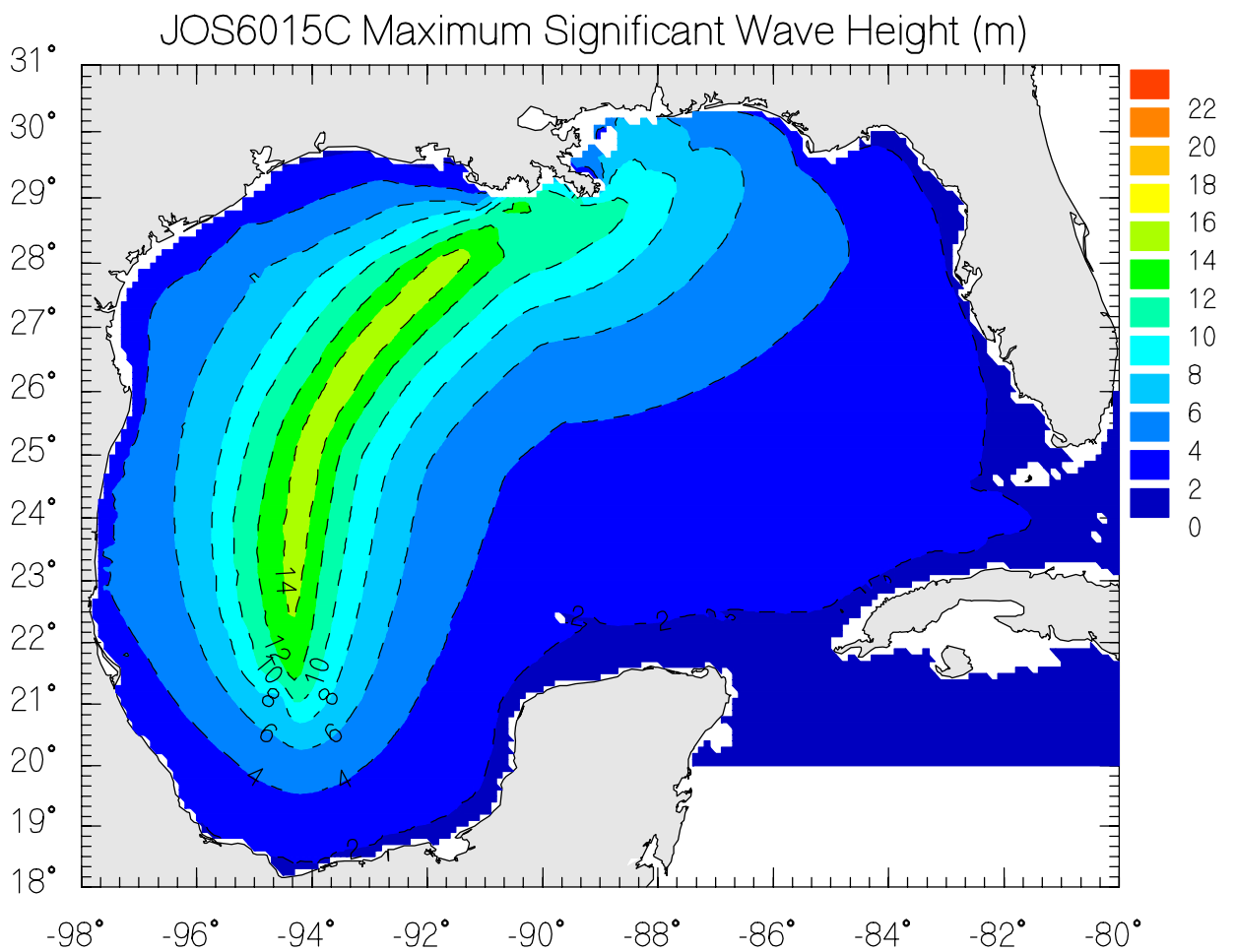
25
20
50
40
30
20


JOS6015A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
8
6
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6015B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
50
40
30
20


JOS6015B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
14
12
10
8
6
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6015C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6015C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
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12
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8
6
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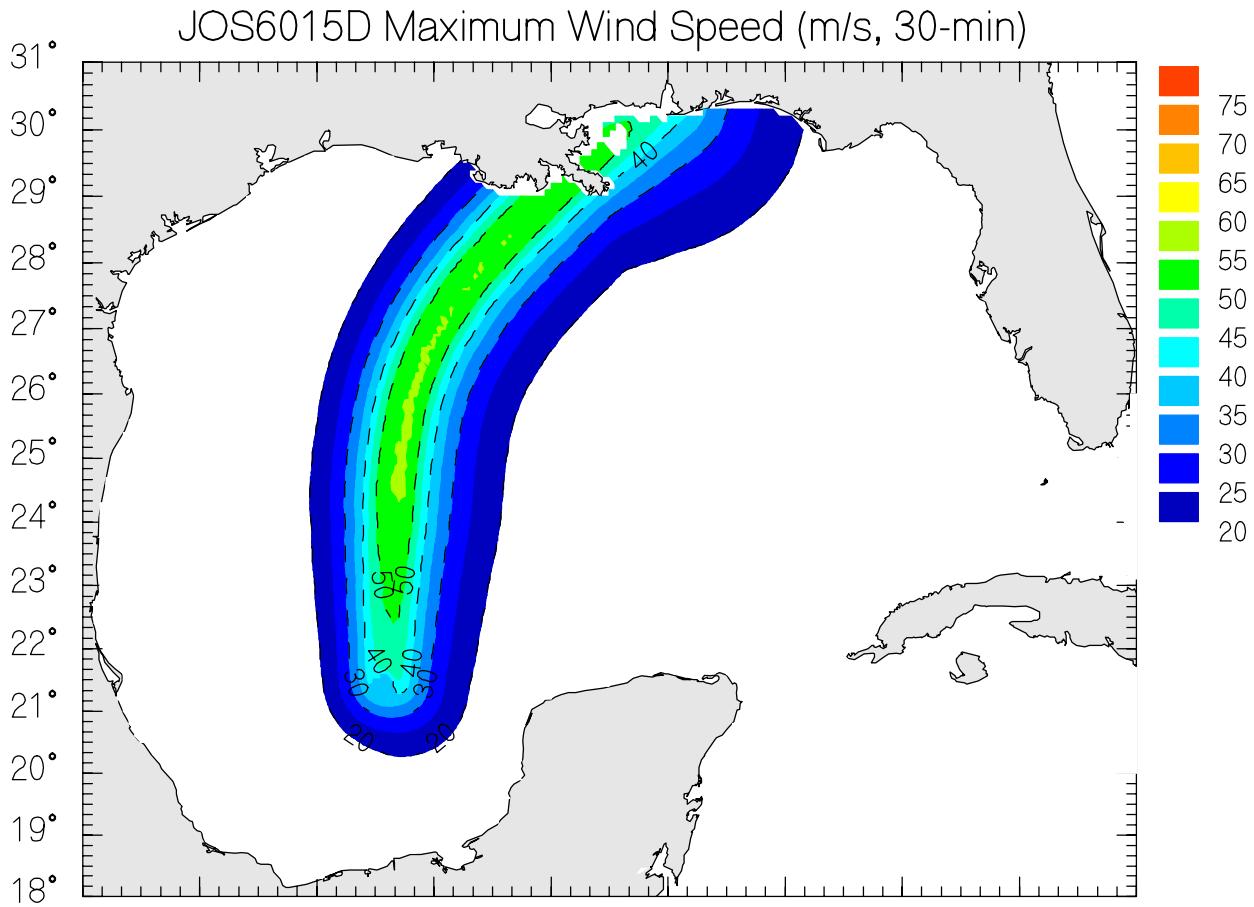
JOS6015D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
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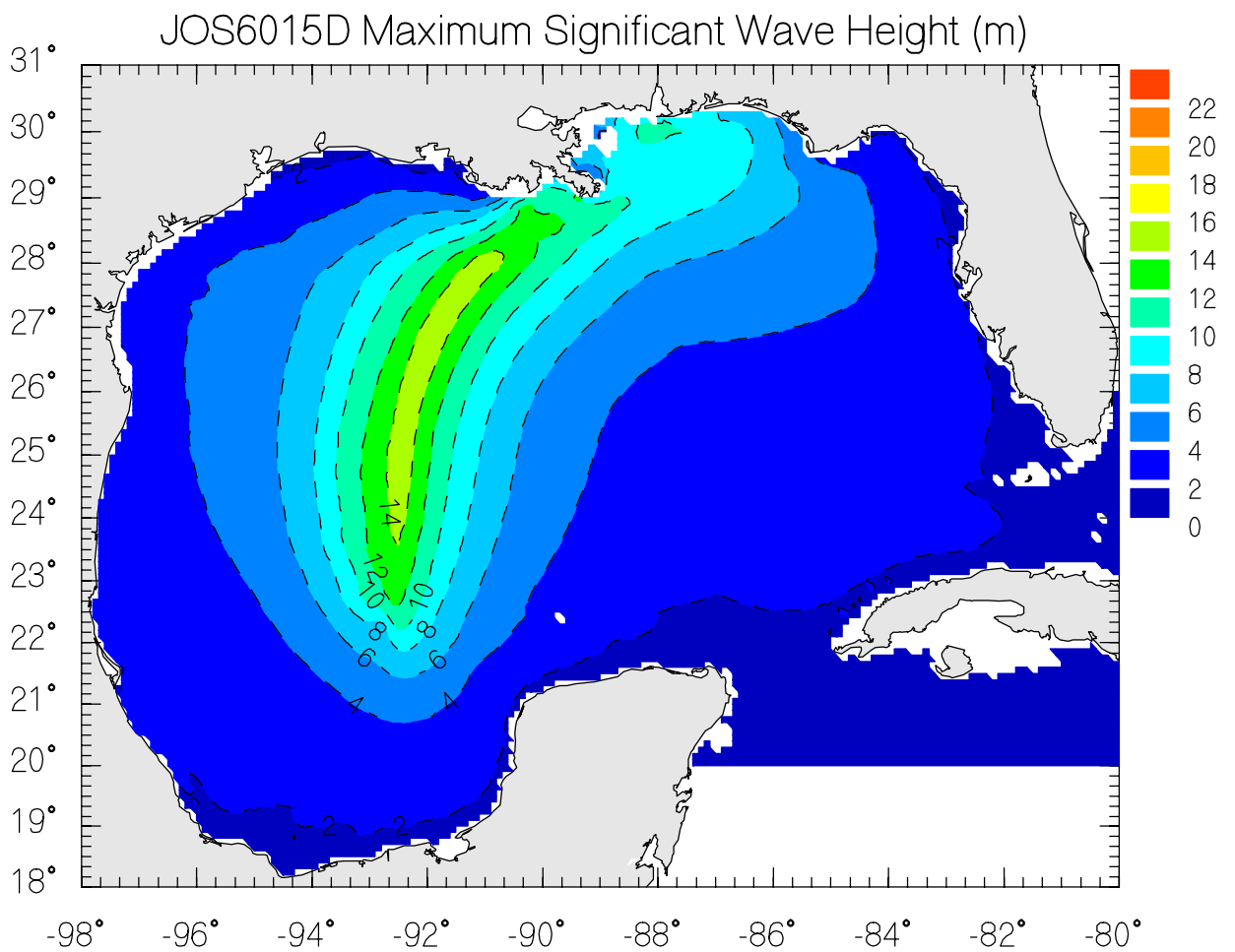
40
35
30
25
20


JOS6015D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
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-82°
-80°
22
20
18
16
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8
6
4
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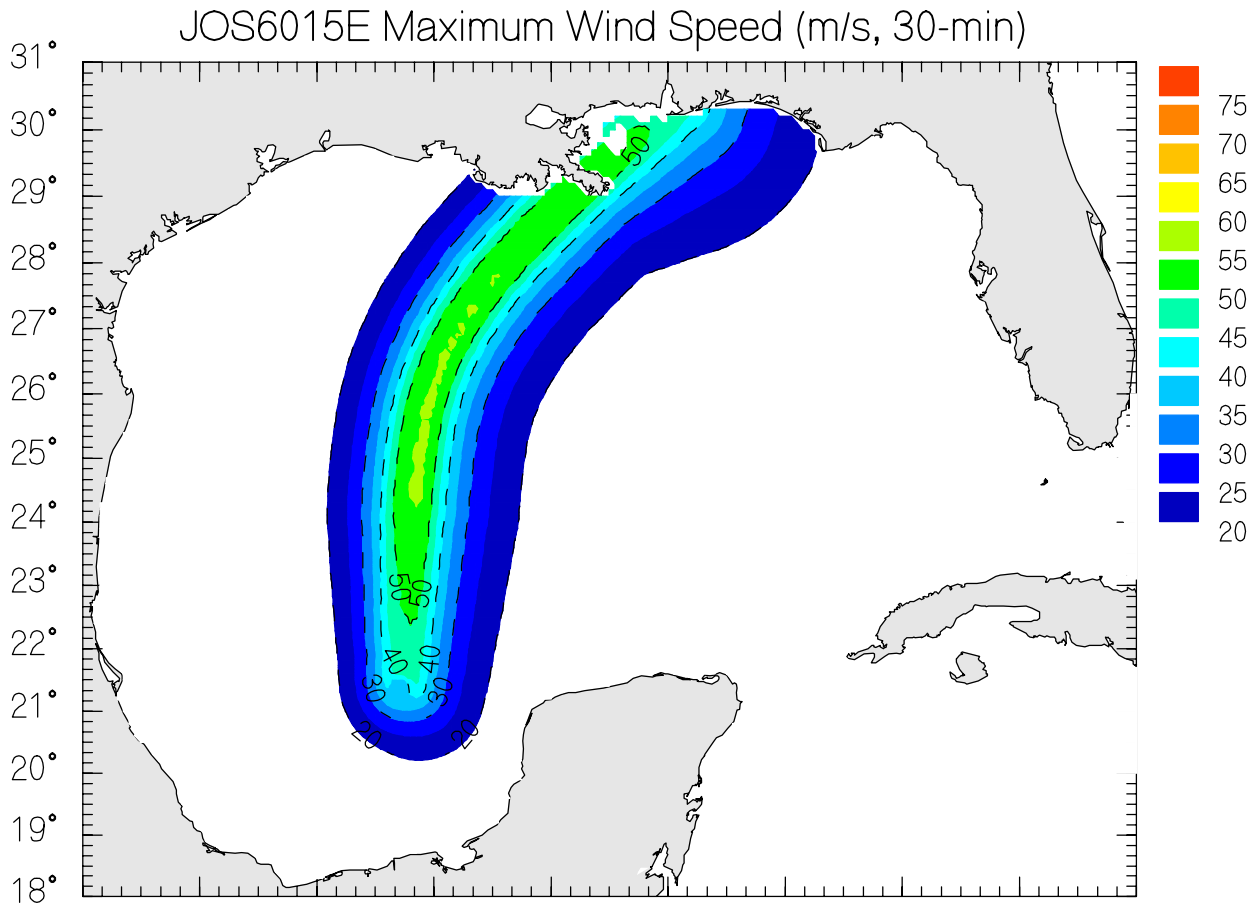
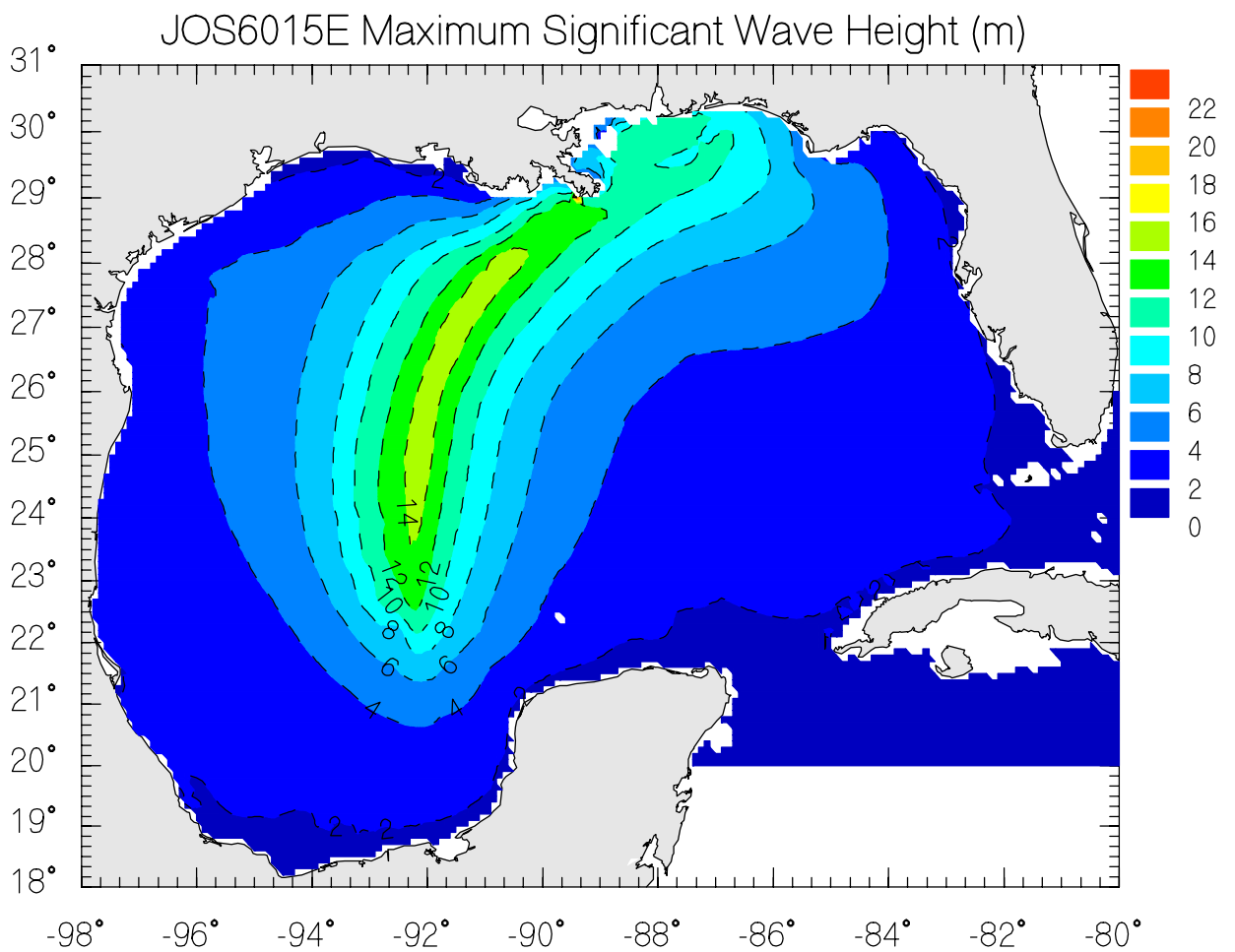

JOS6015E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6015E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
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-80°
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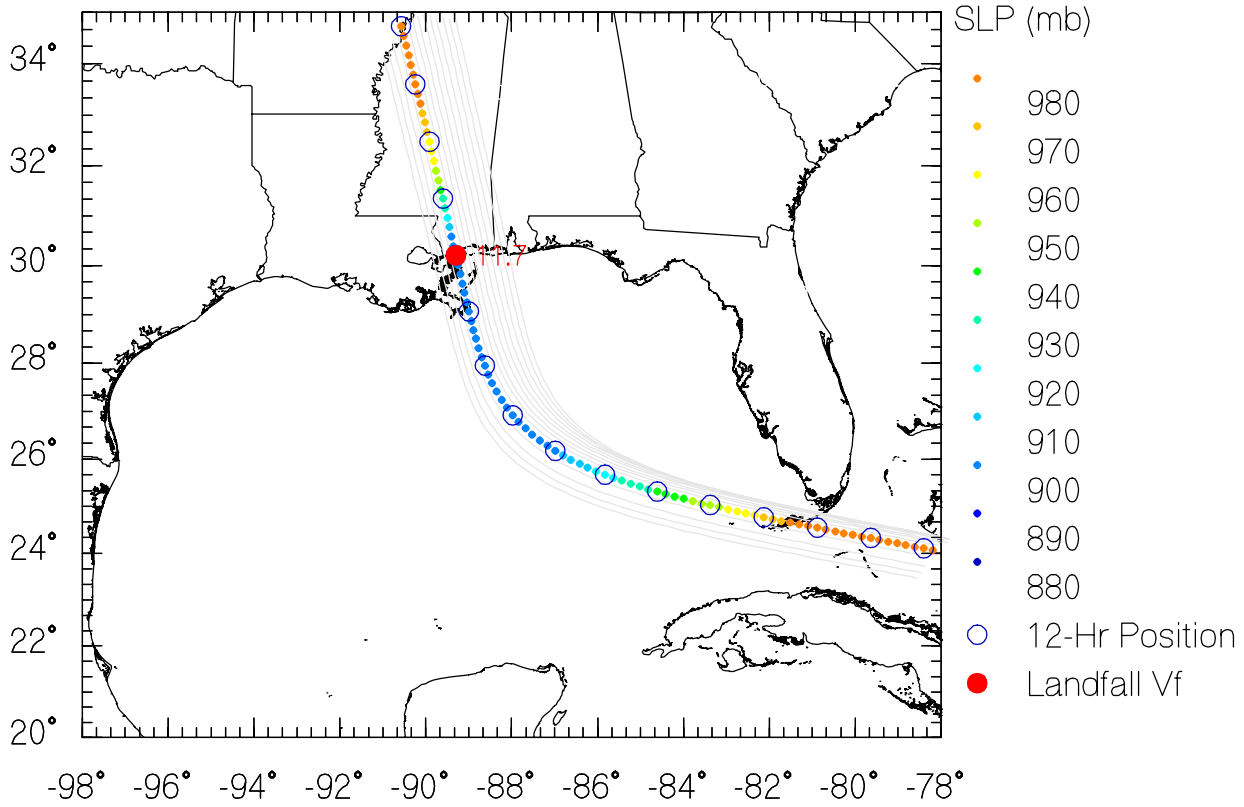
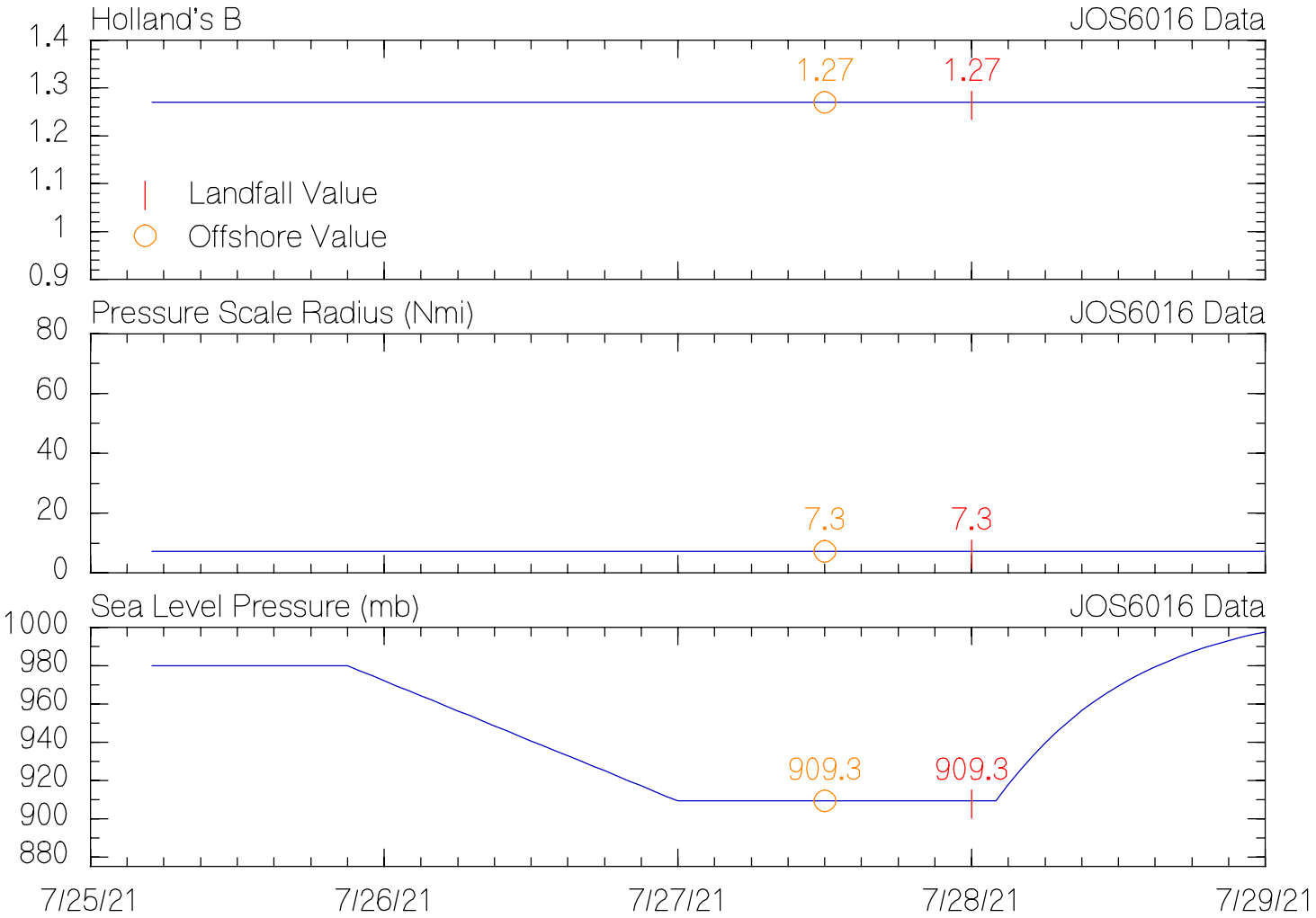
6
4
2
0

JOS6016 Data

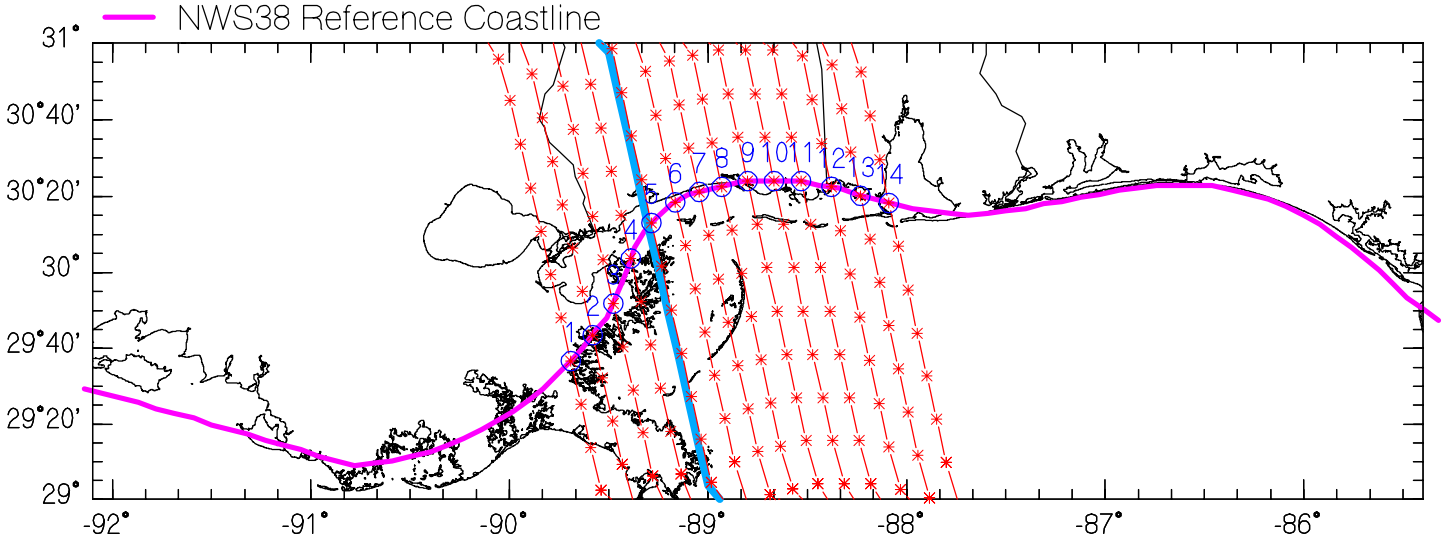


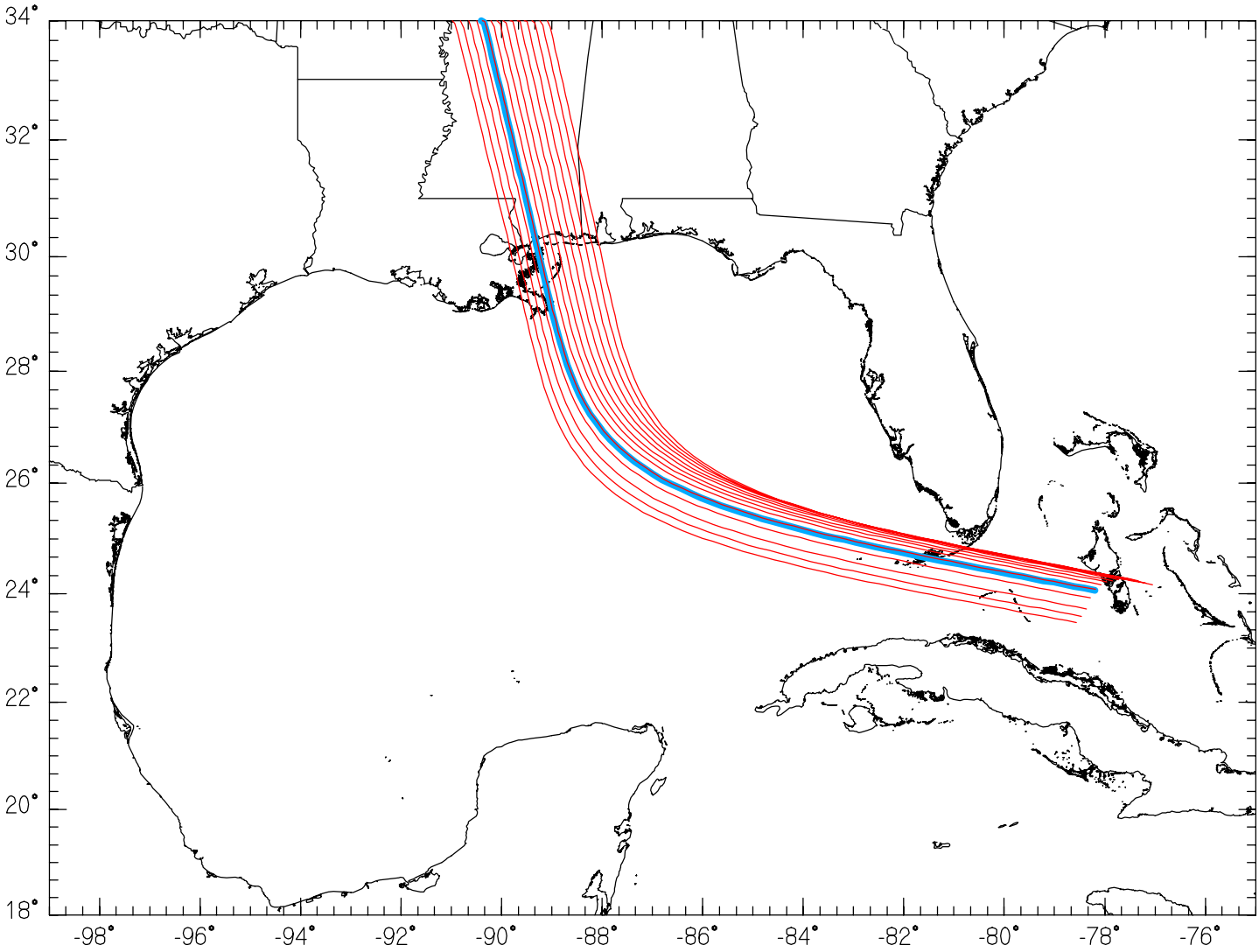


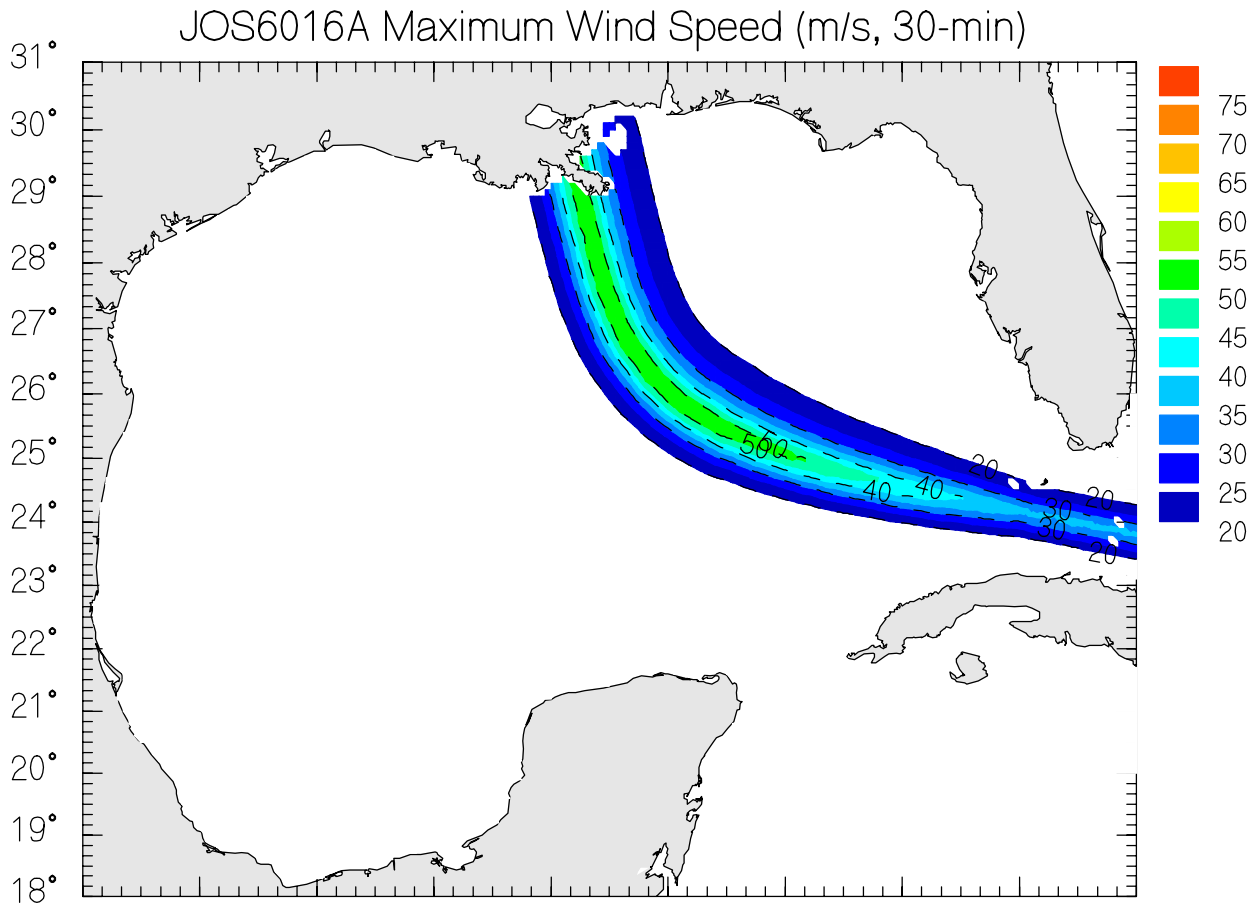
URS JPM-OS6 Production Tracks

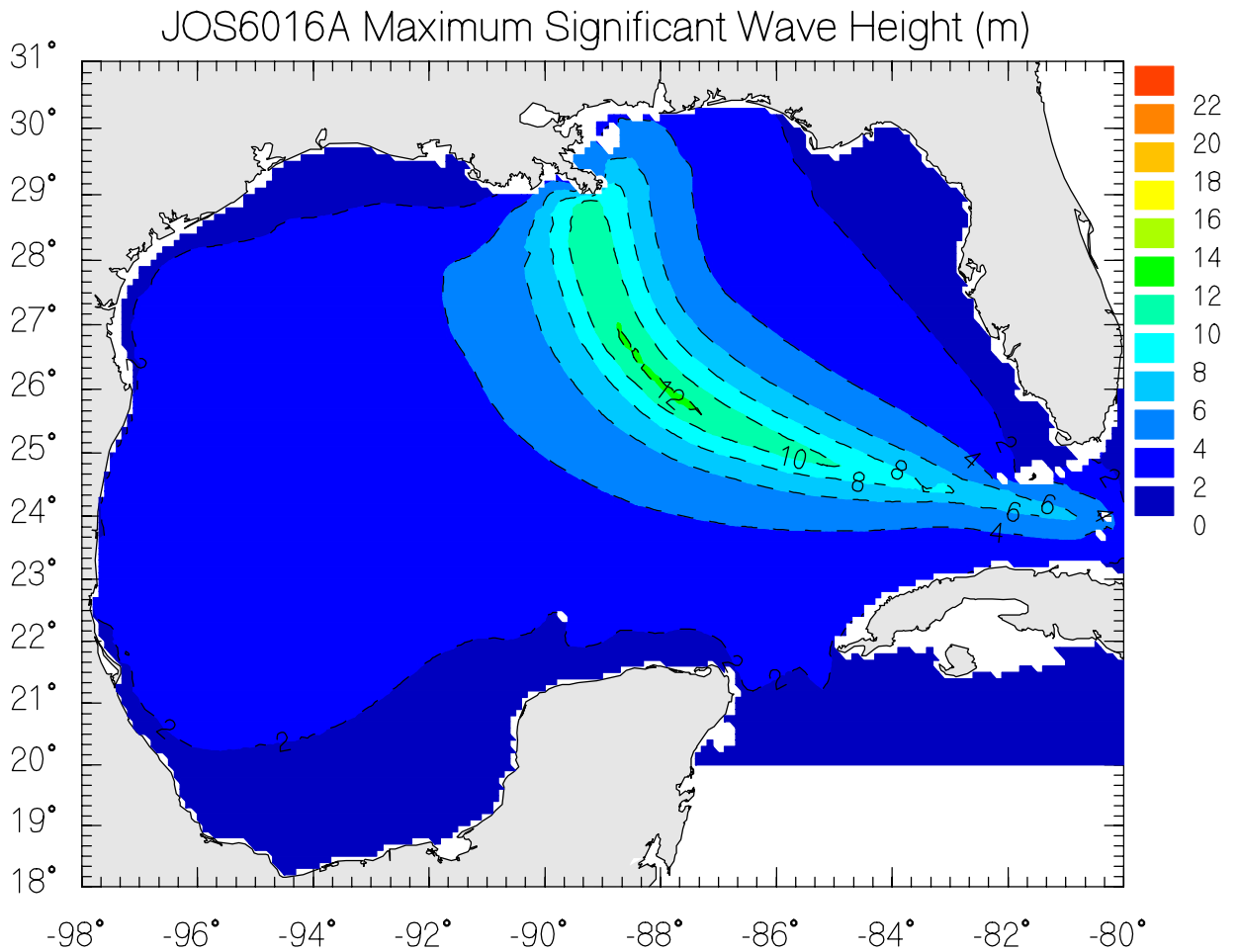
JOS6016 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6016A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
50
40
30
20


JOS6016A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
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12
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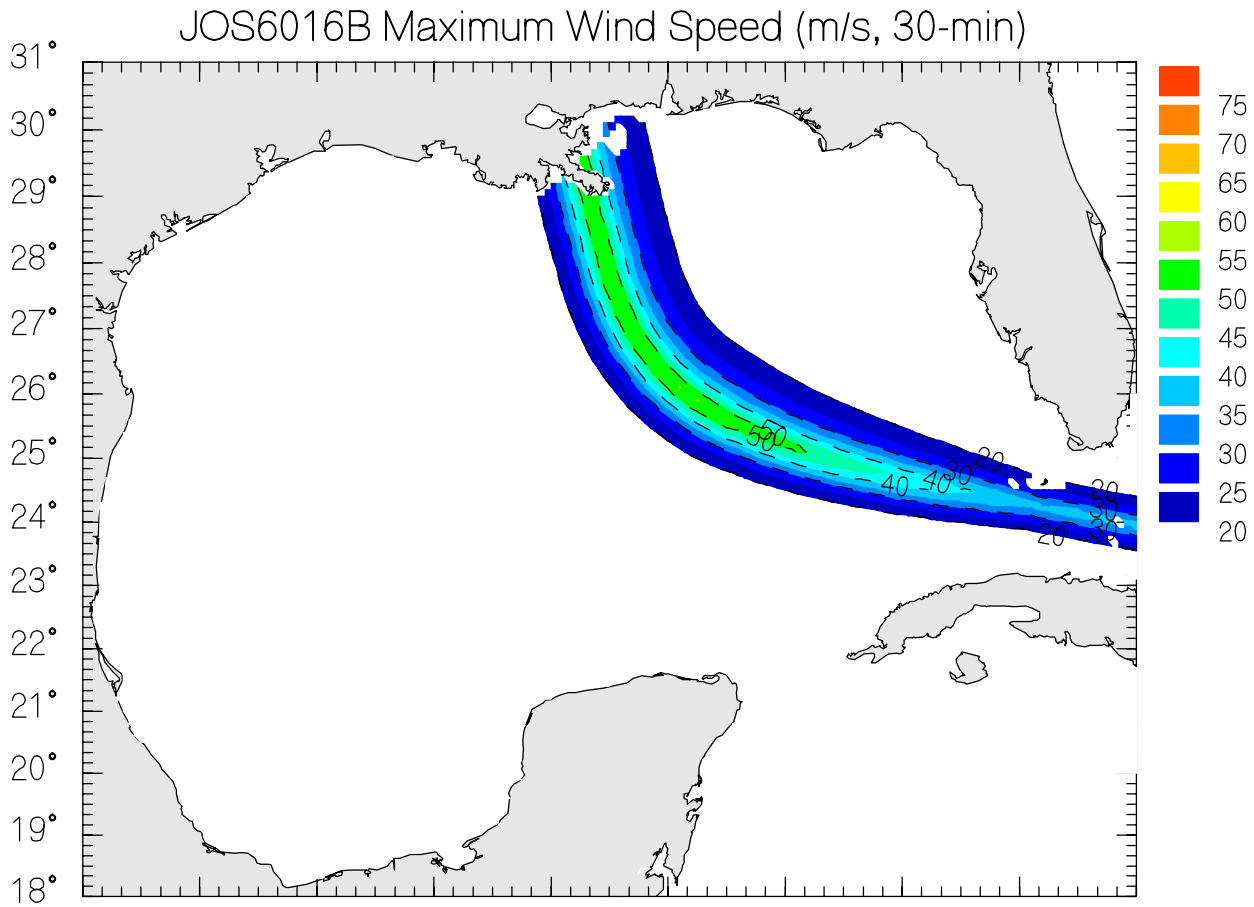
8
6
4
2


JOS6016B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
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20°
19°
18°
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70
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55
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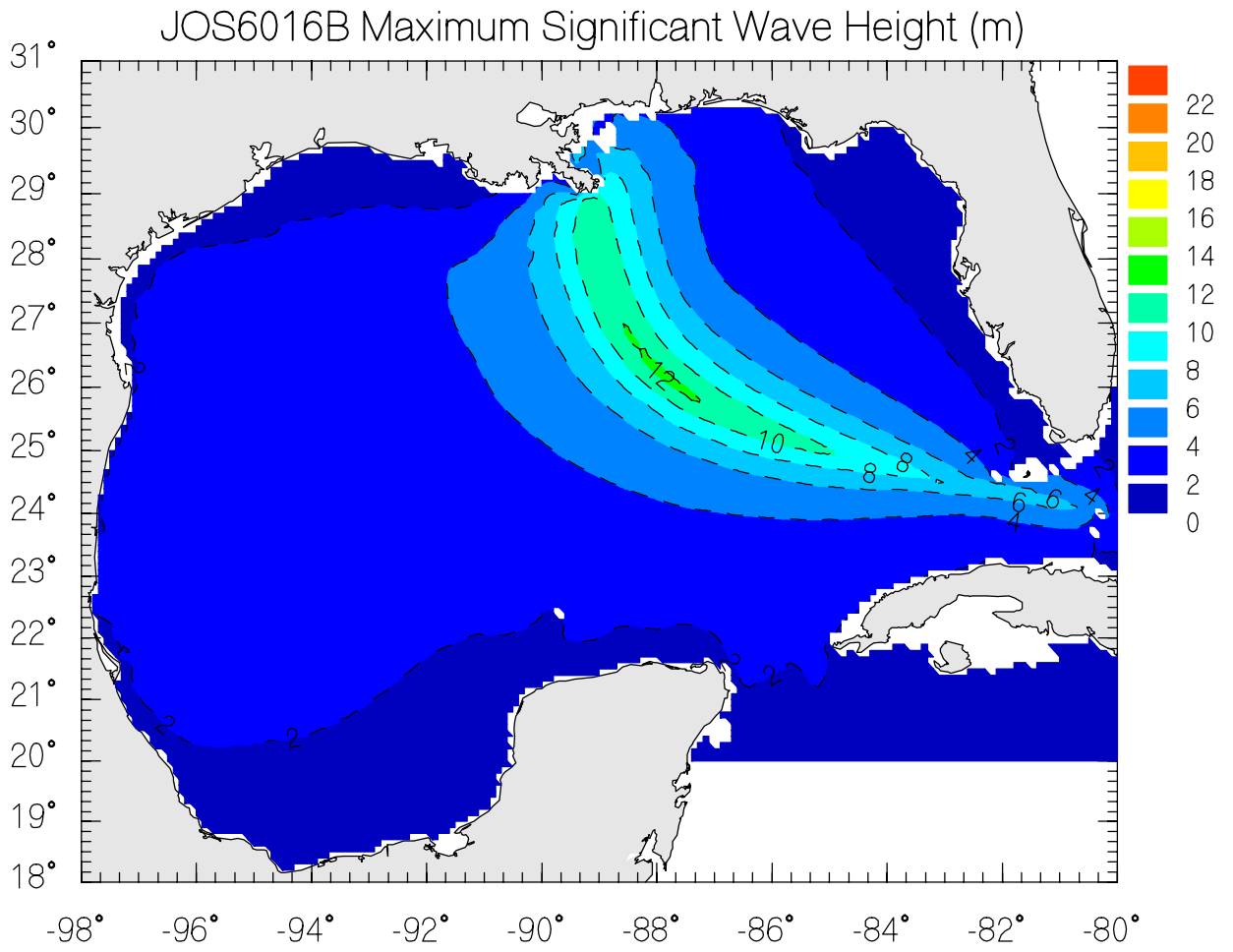
45
40
35
30
25
20


JOS6016B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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-80°
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12
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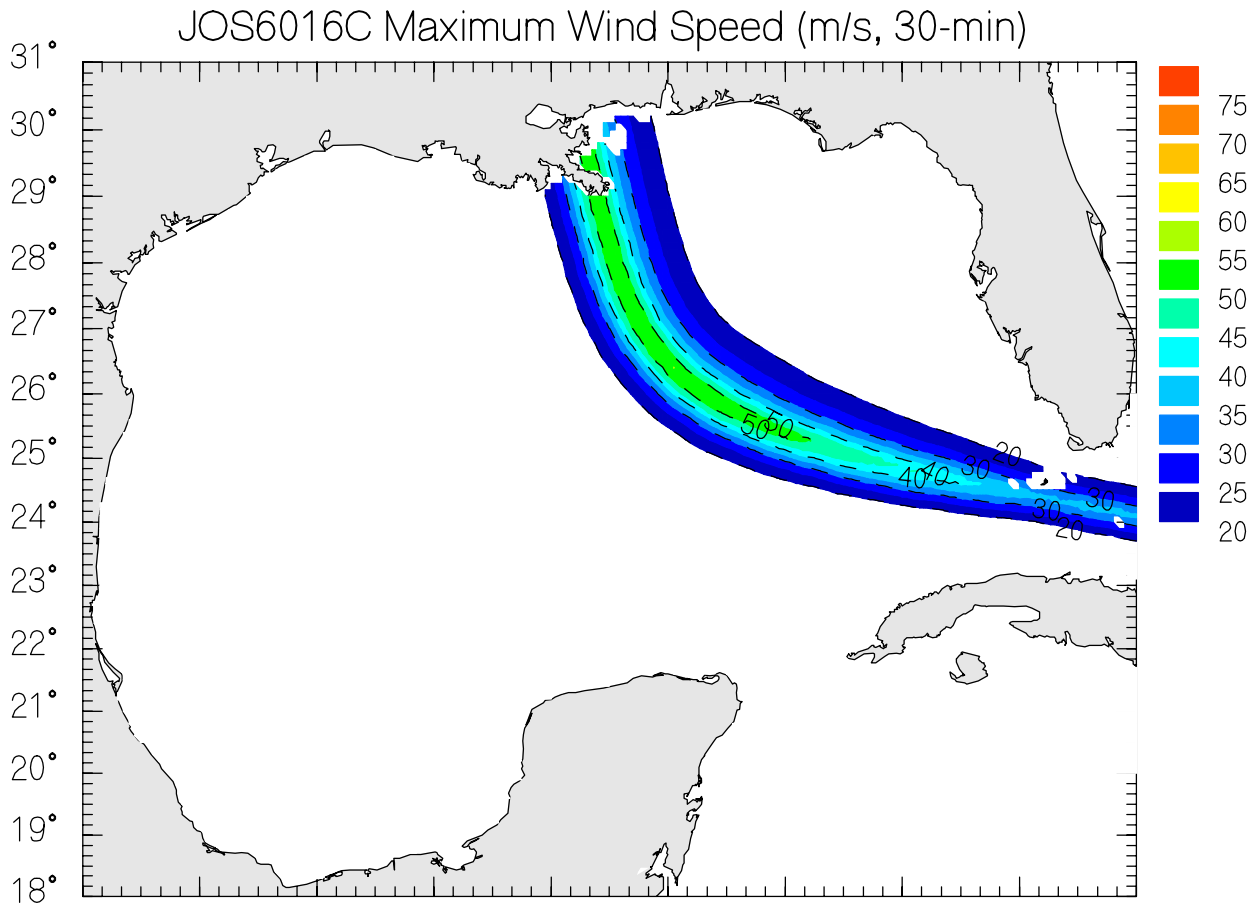
8
6
4
2
0


JOS6016C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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60
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35
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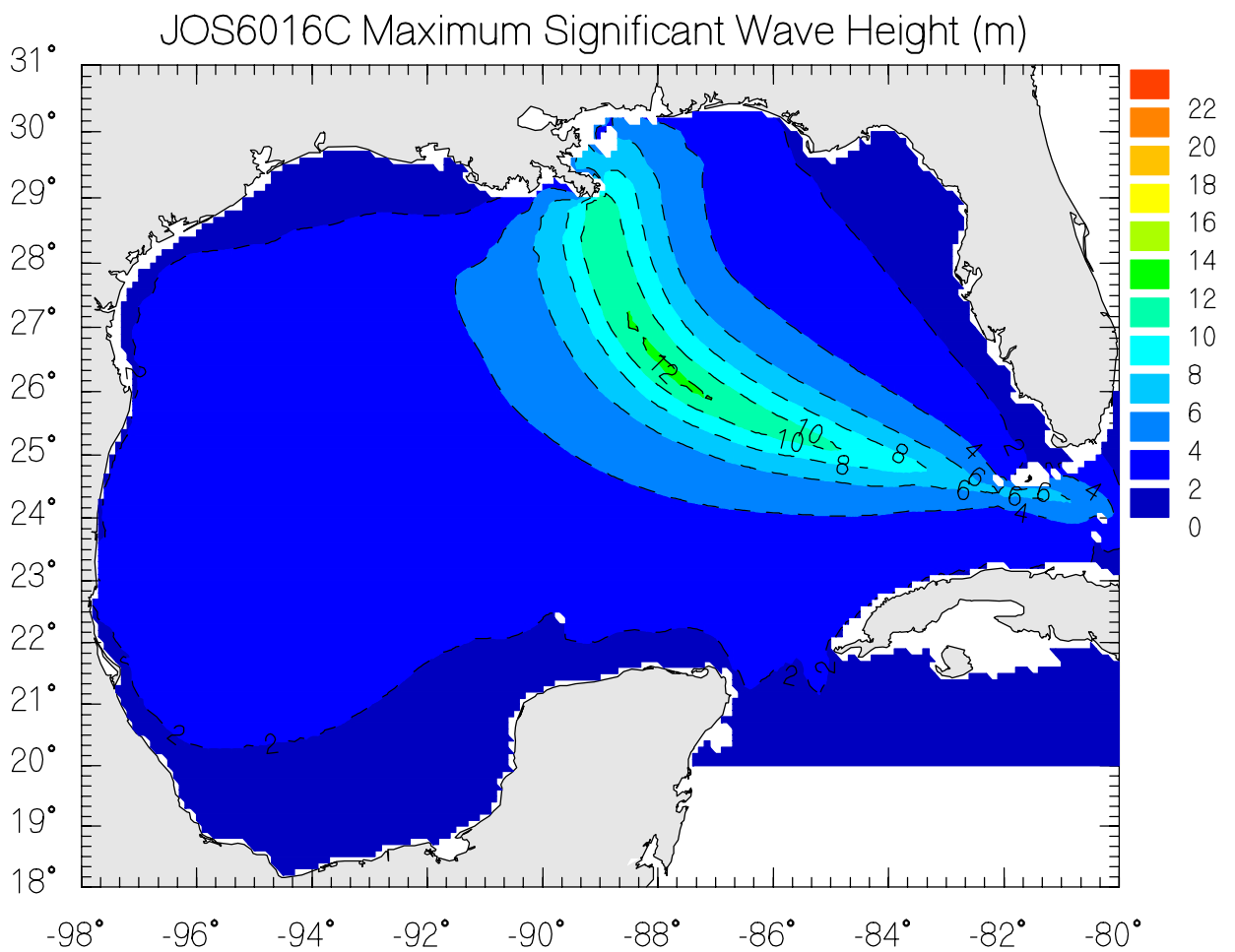
25
20


JOS6016C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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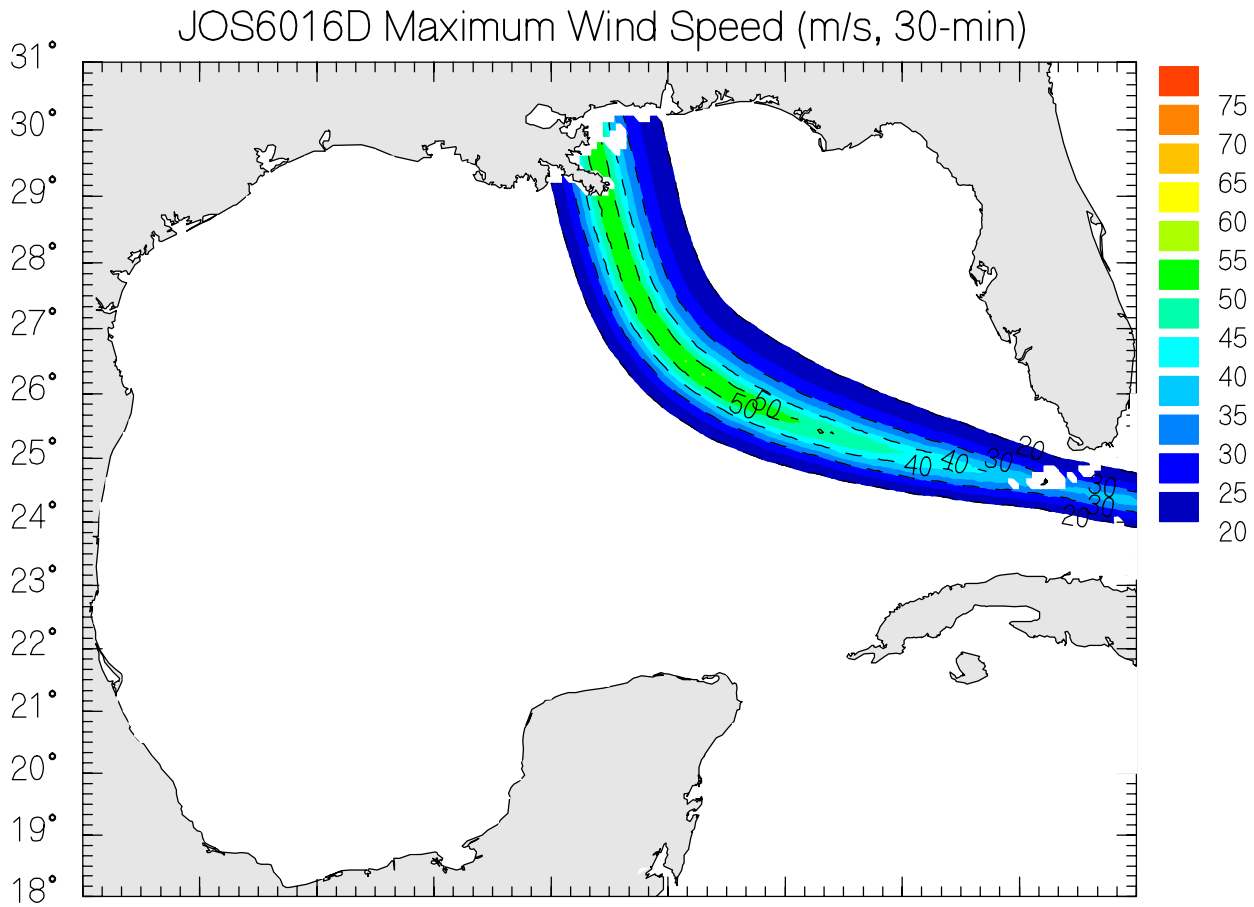
10
8
6
4
2
0


JOS6016D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
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40
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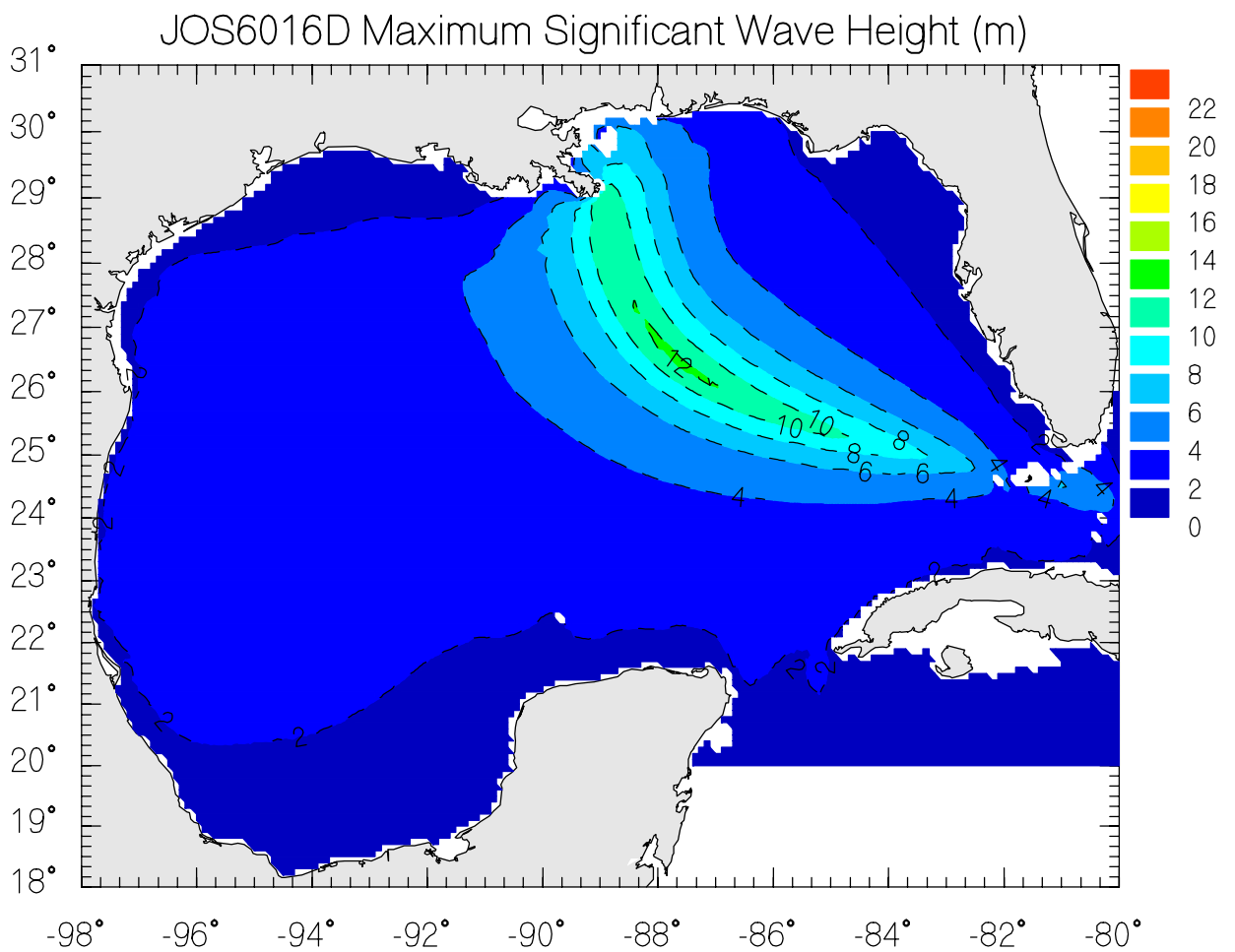
25
20


JOS6016D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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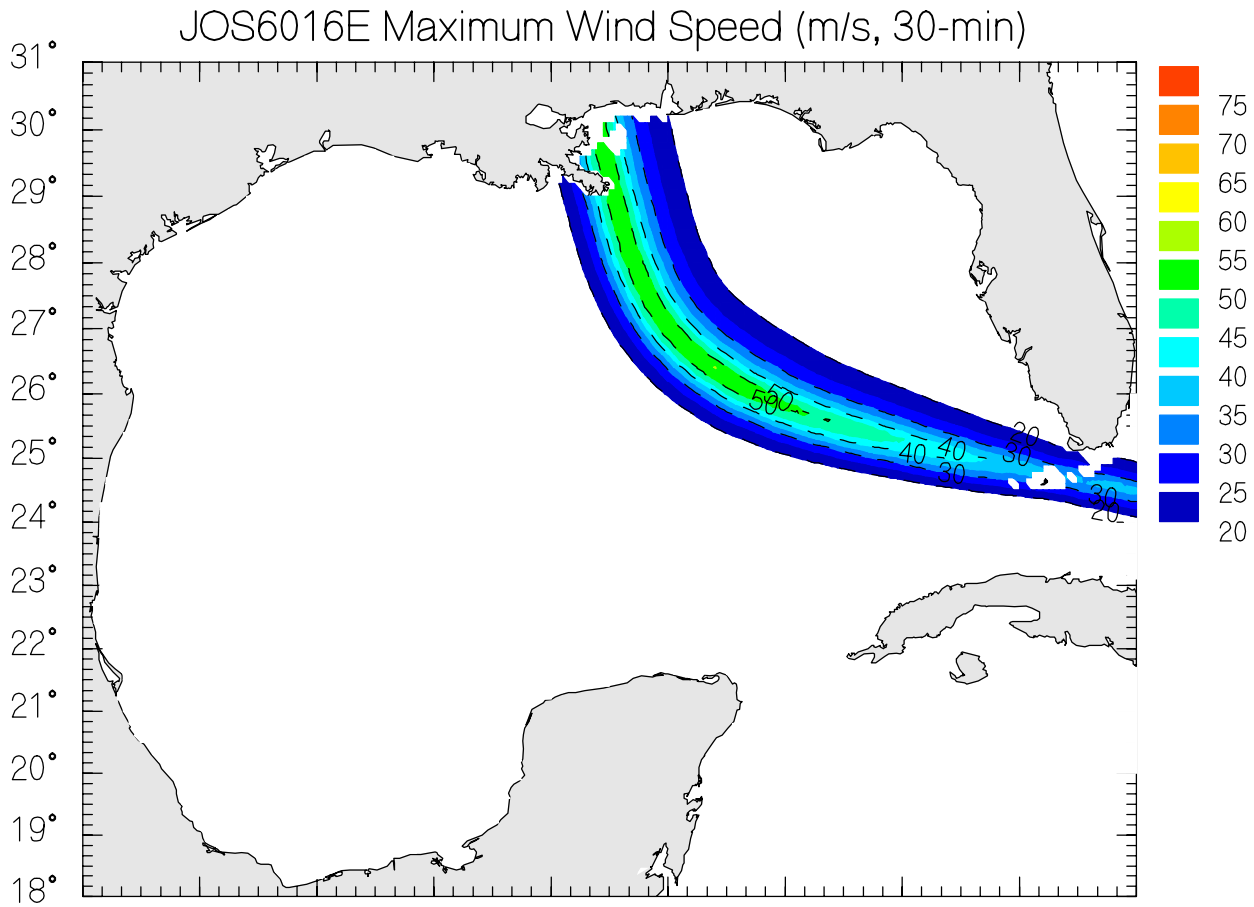
2
0


JOS6016E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
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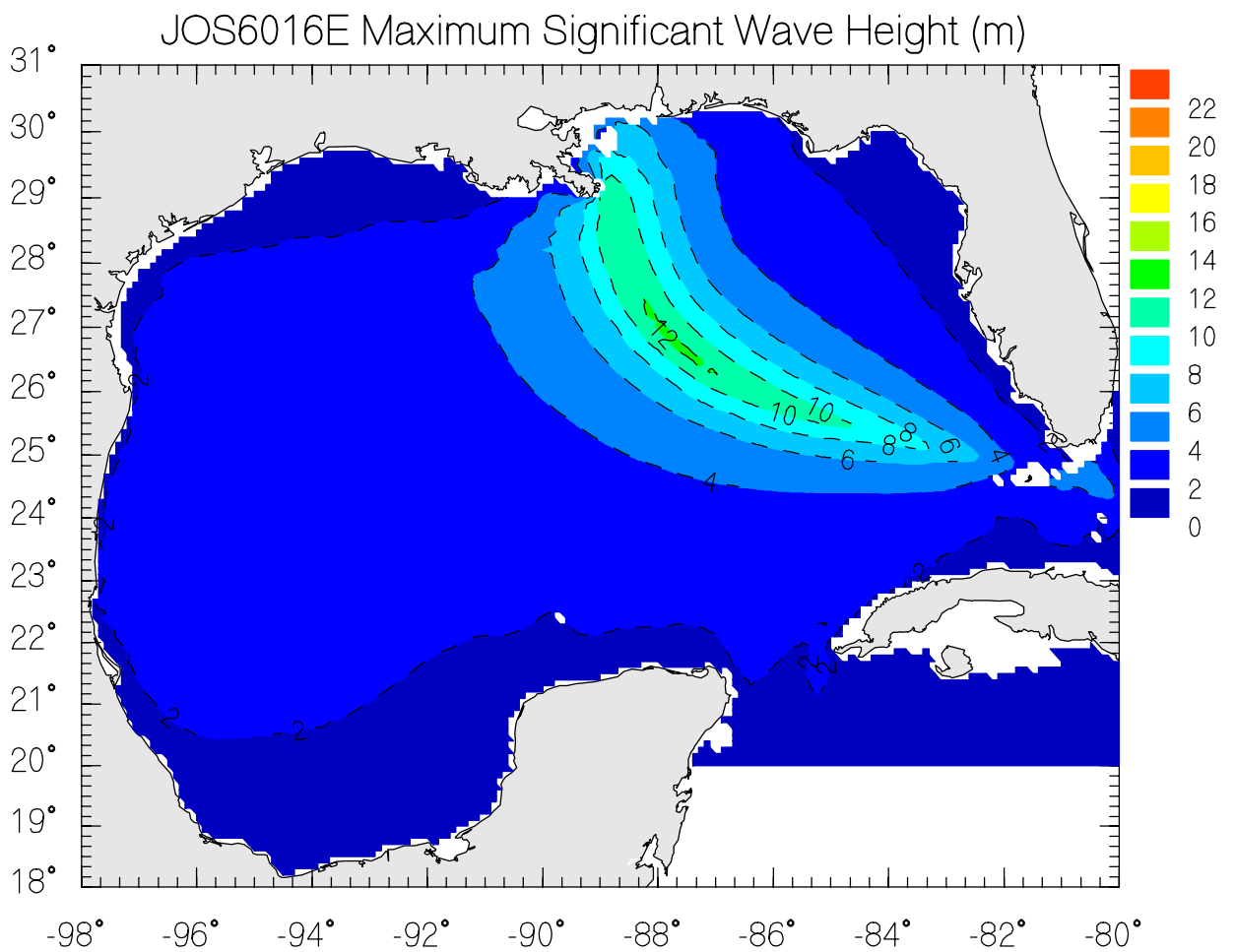
45
40
35
30
25
20


JOS6016E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
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-88°
-86°
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-80°
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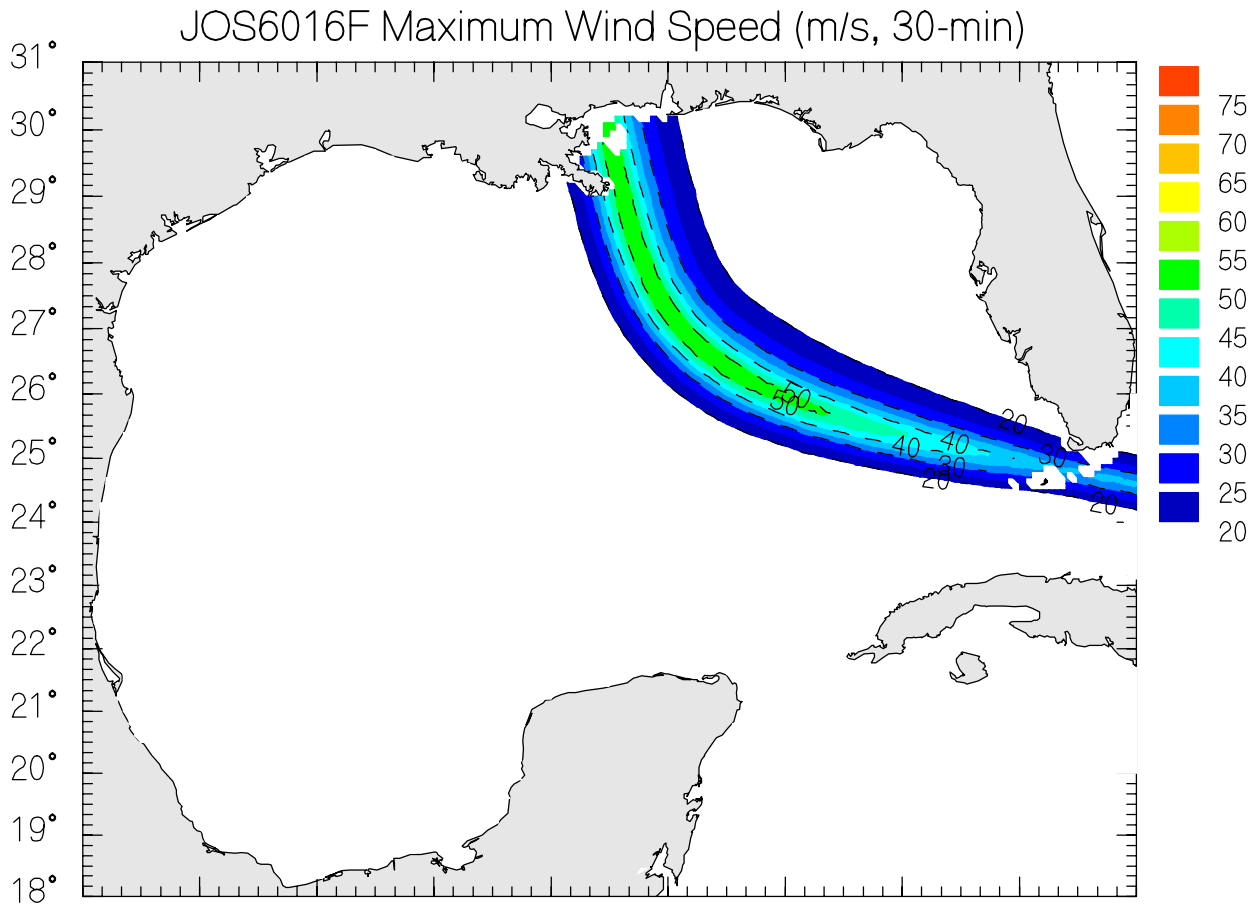
6
4
2
0


JOS6016F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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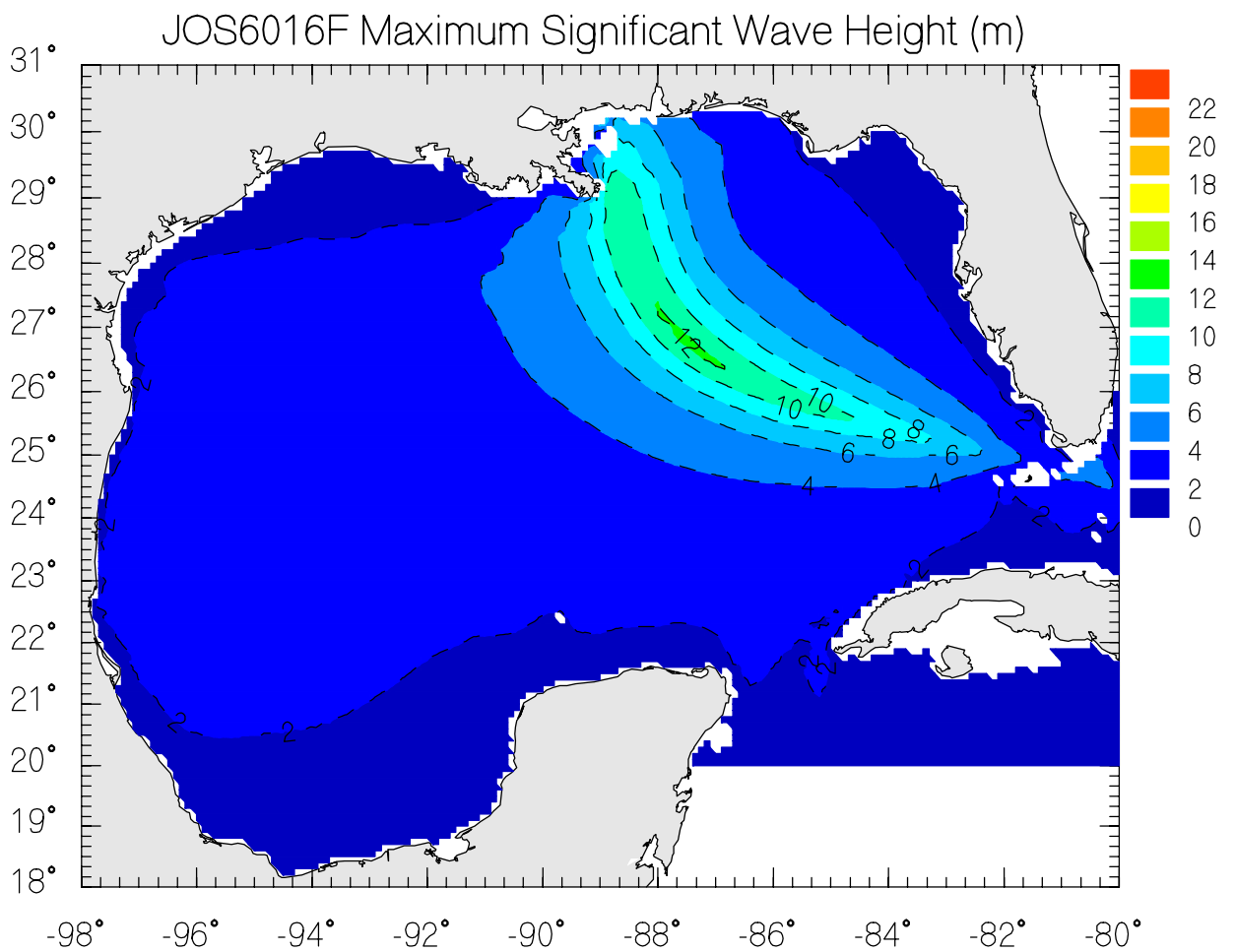
25
20


JOS6016F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
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20°
19°
18°
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-80°
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4
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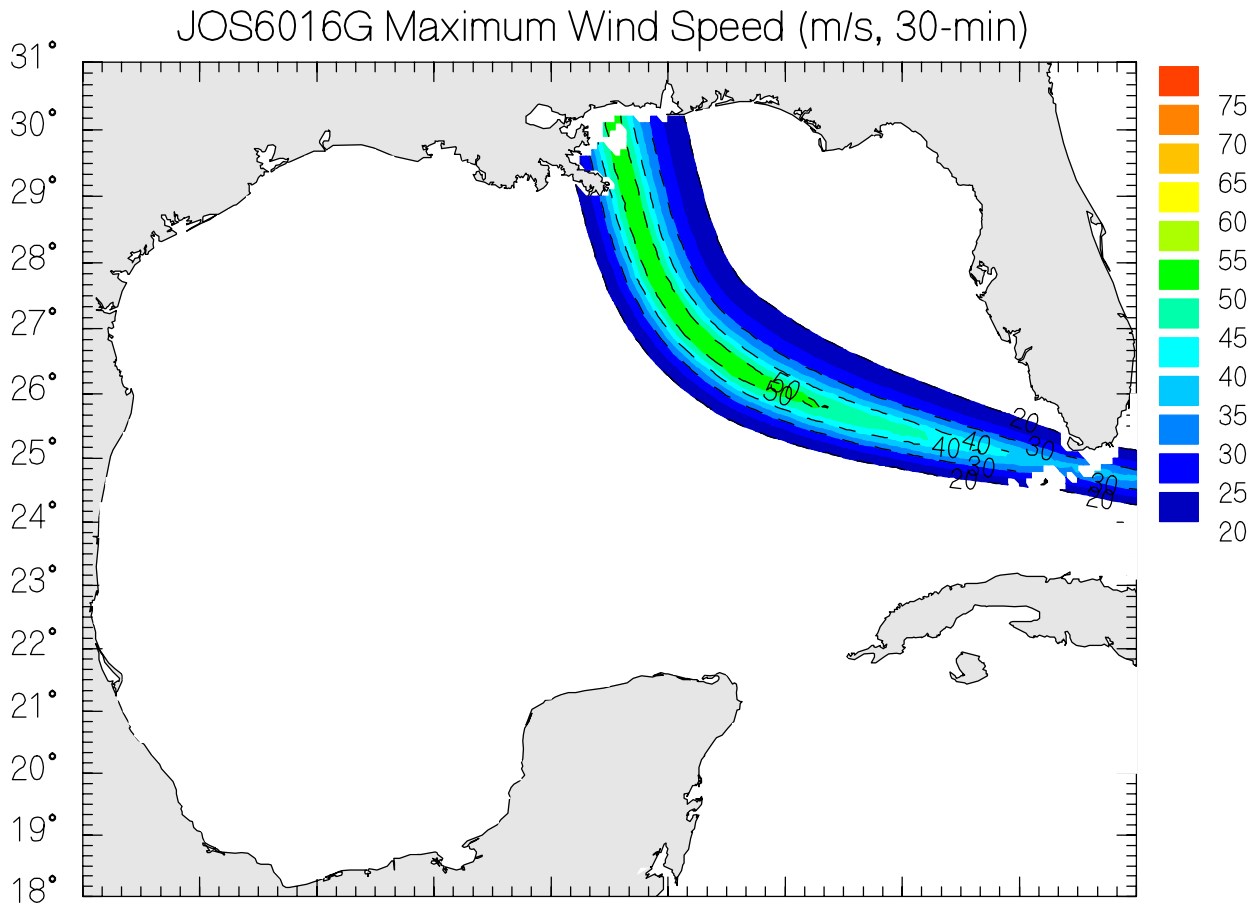
JOS6016G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
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23°
22°
21°
20°
19°
18°
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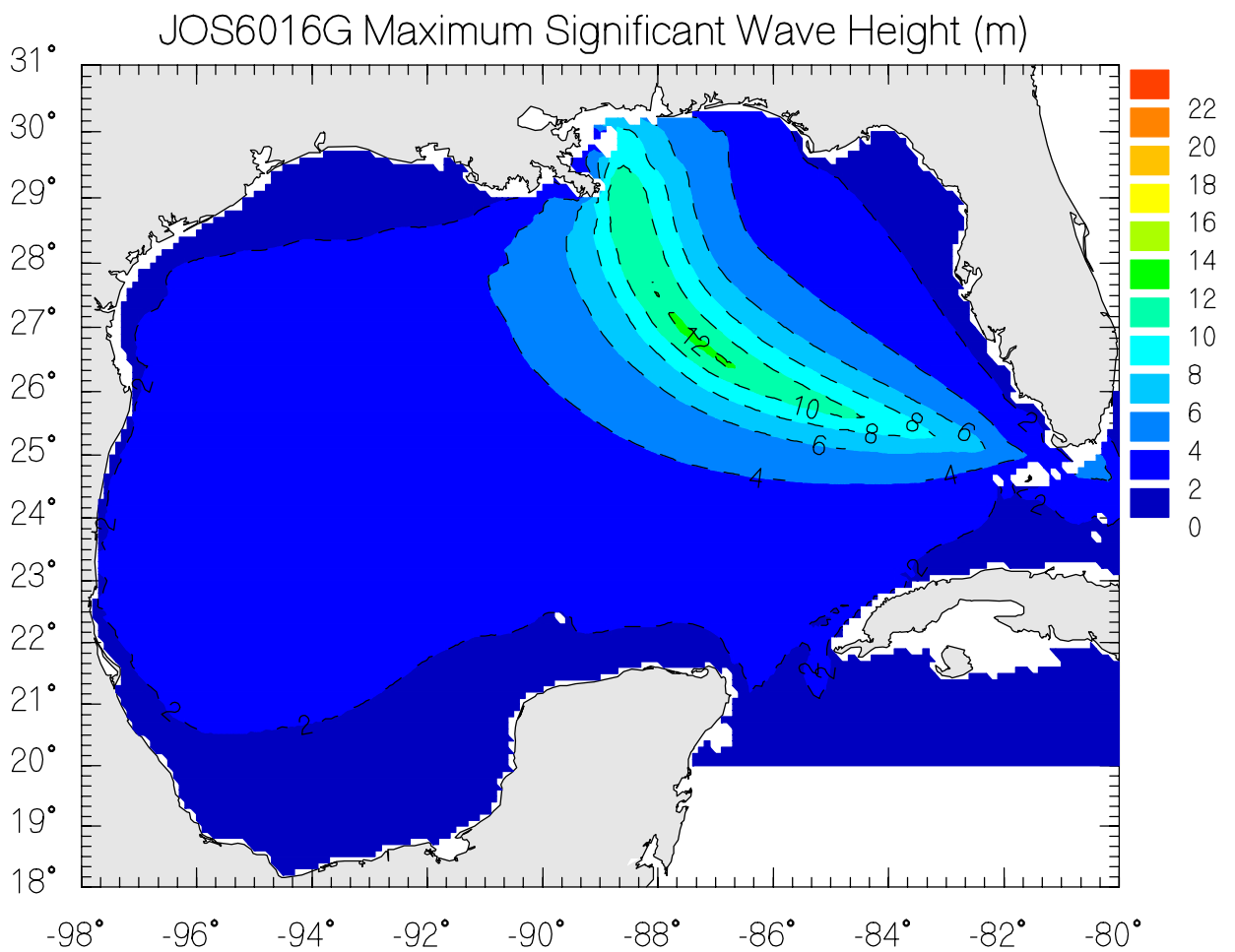
25
20


JOS6016G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
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-82°
-80°
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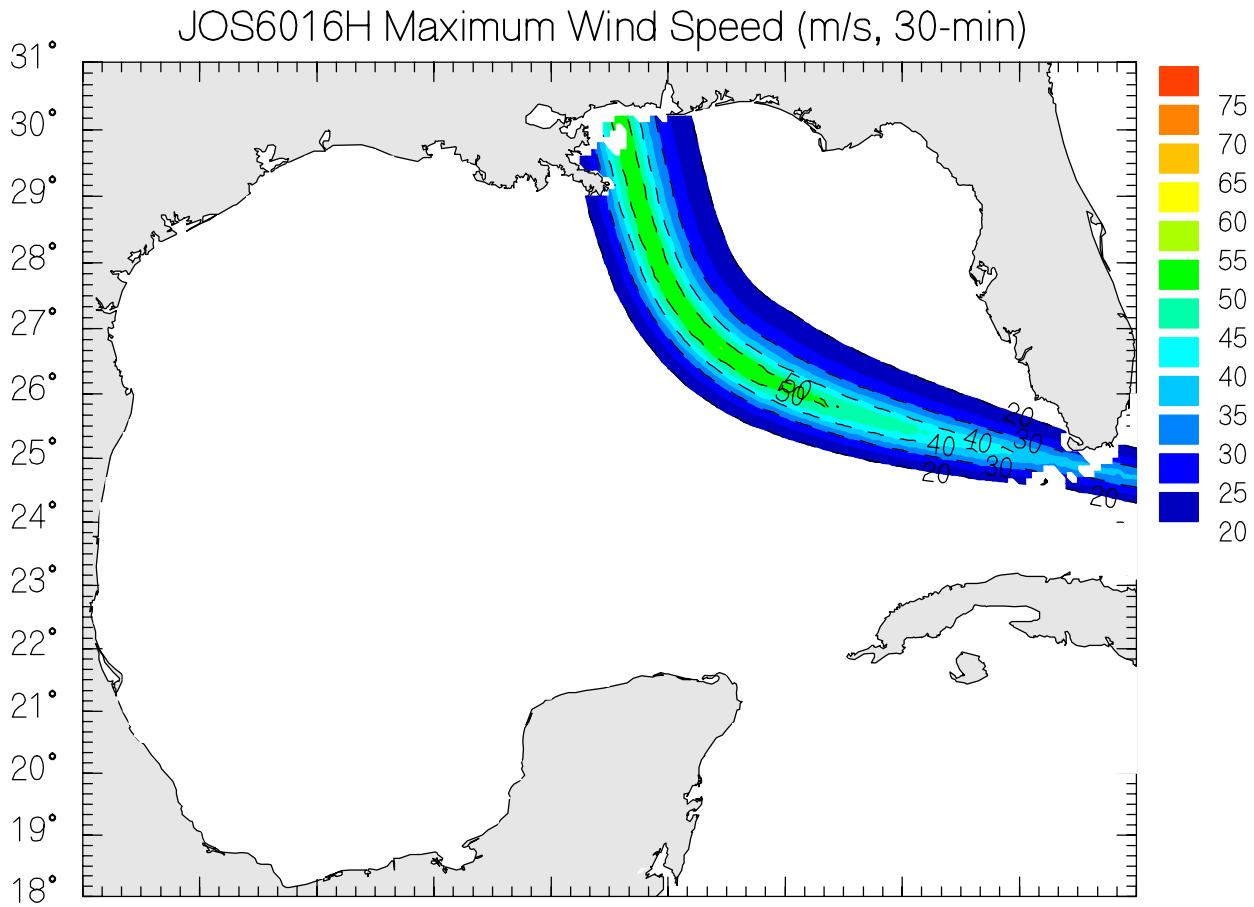
JOS6016H Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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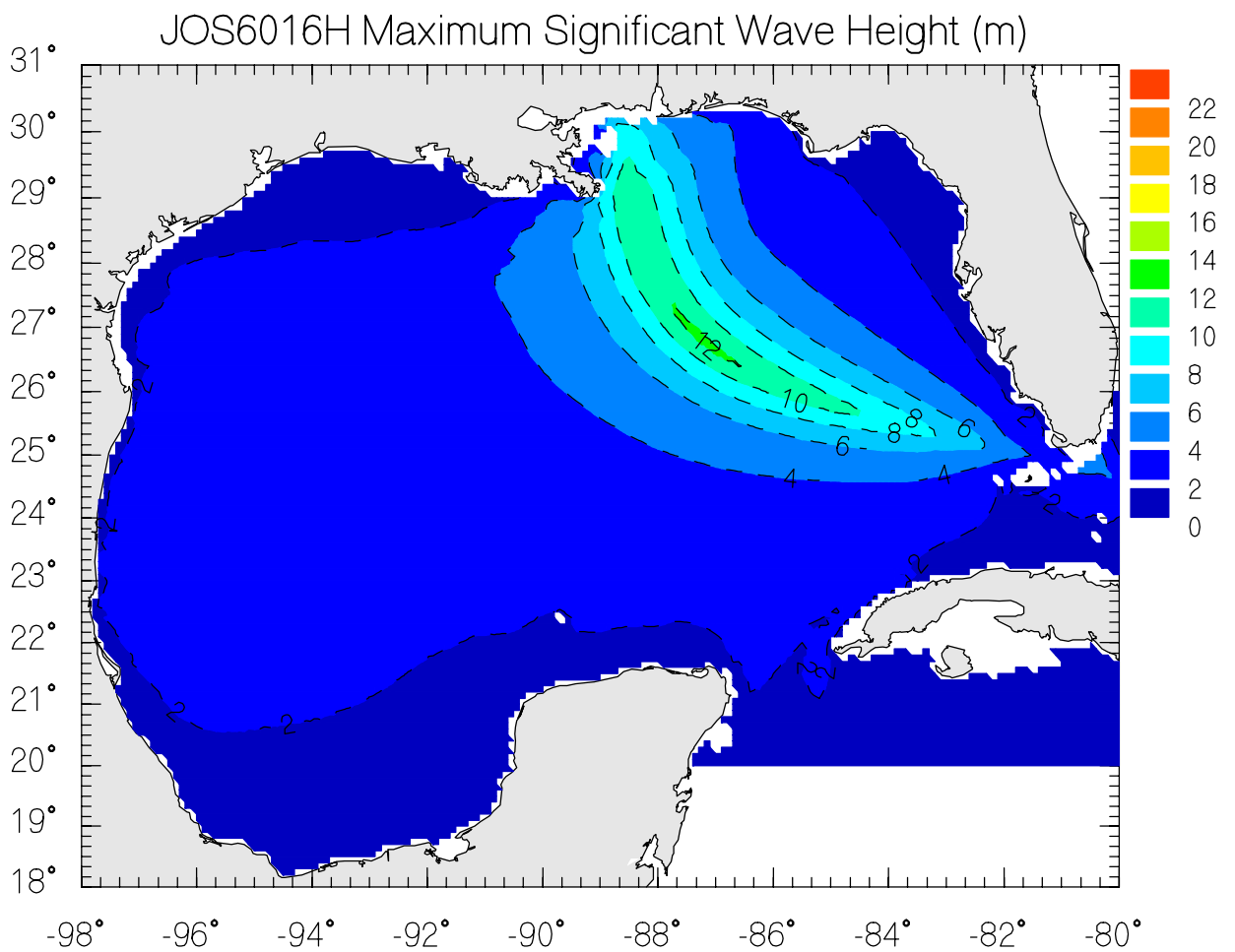
JOS6016H Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
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21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
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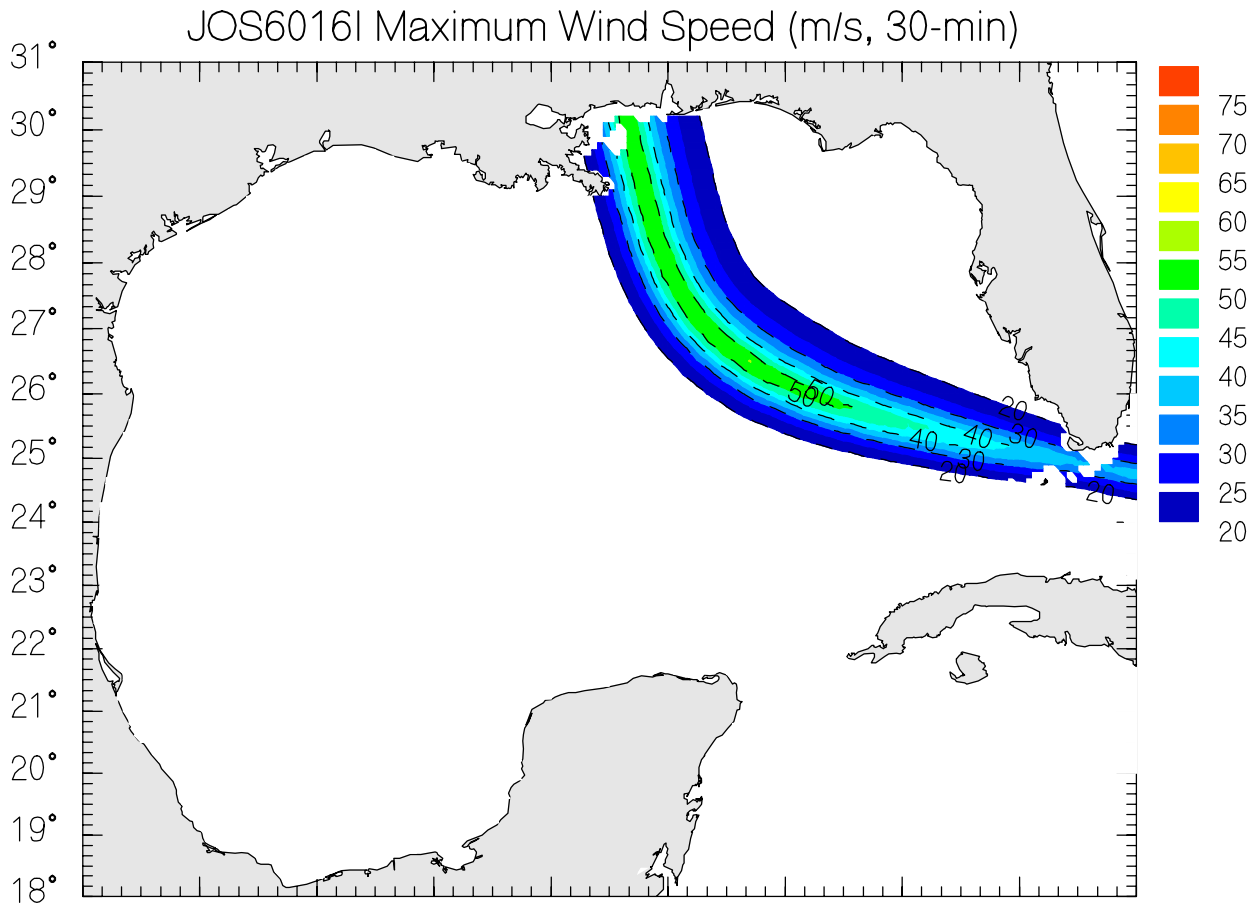
JOS6016I Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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30
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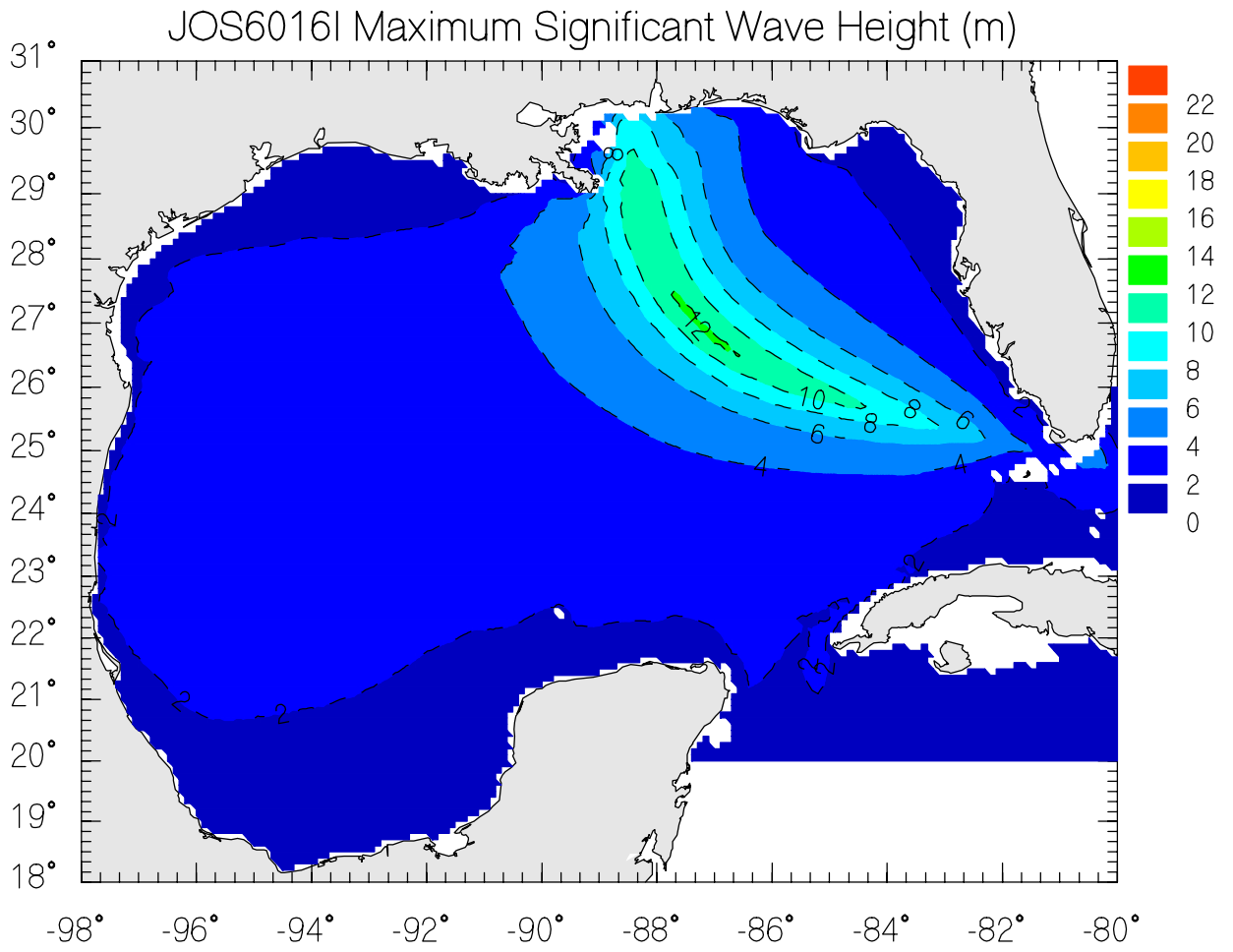
JOS6016I Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
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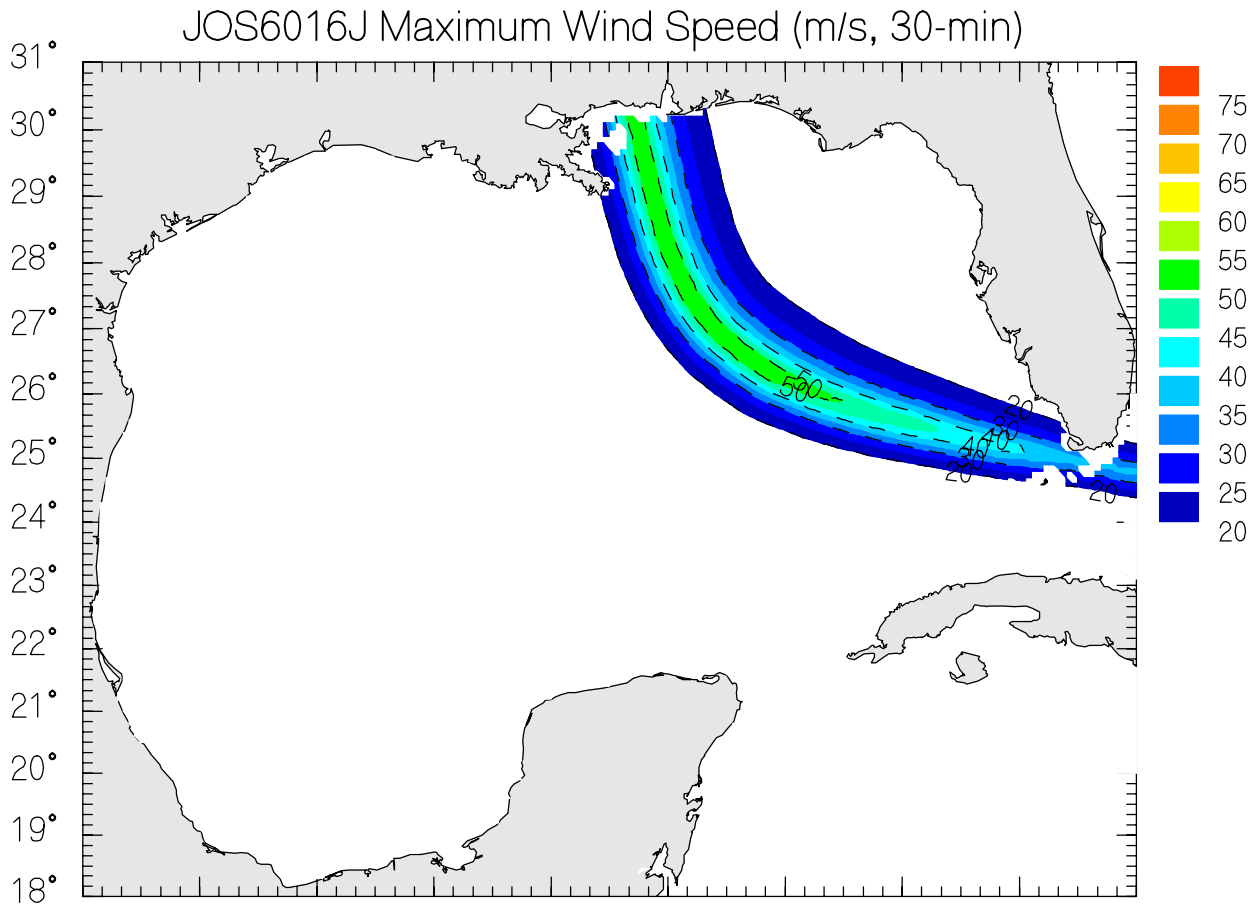
JOS6016J Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
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21°
20°
19°
18°
75
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55
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25
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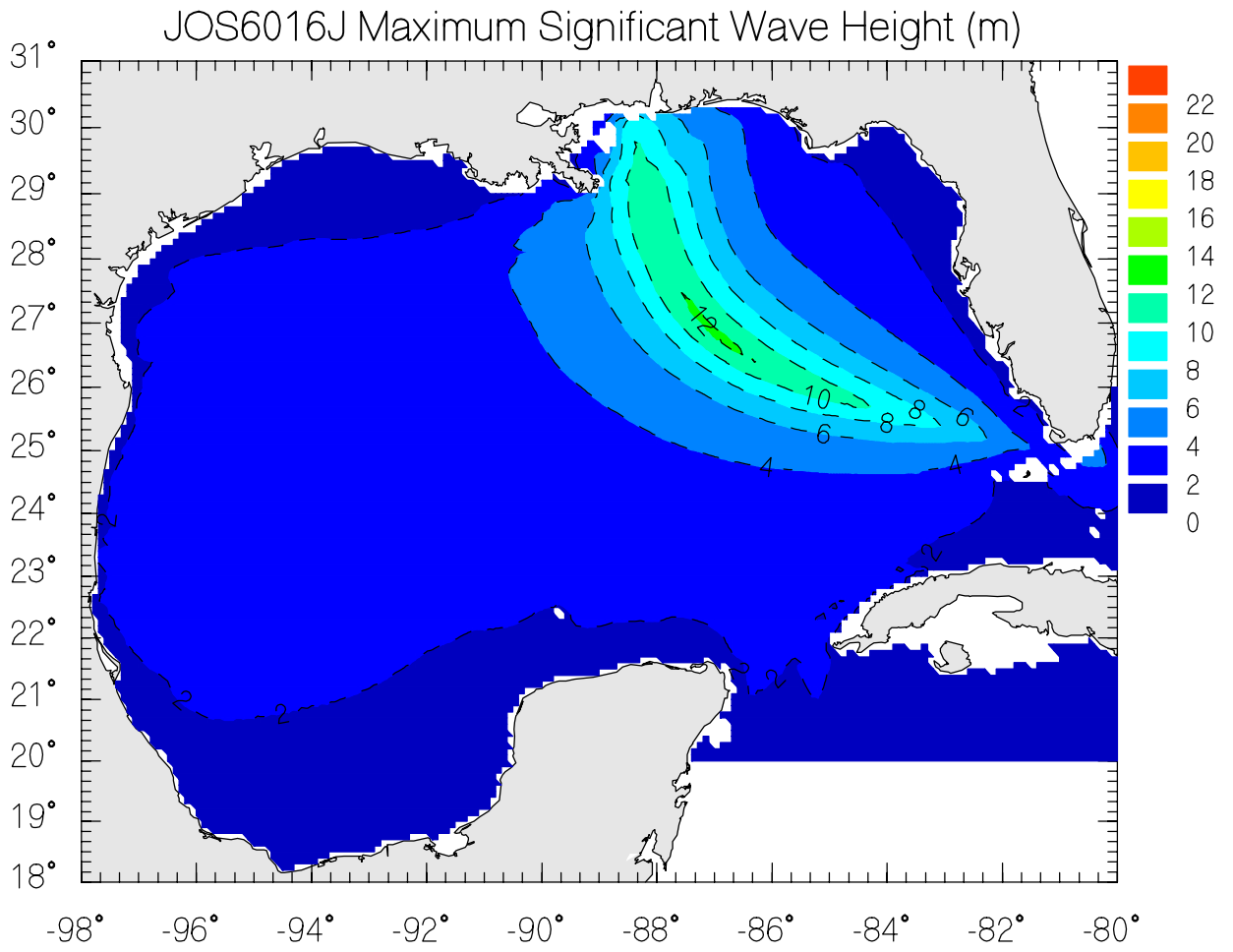
JOS6016J Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
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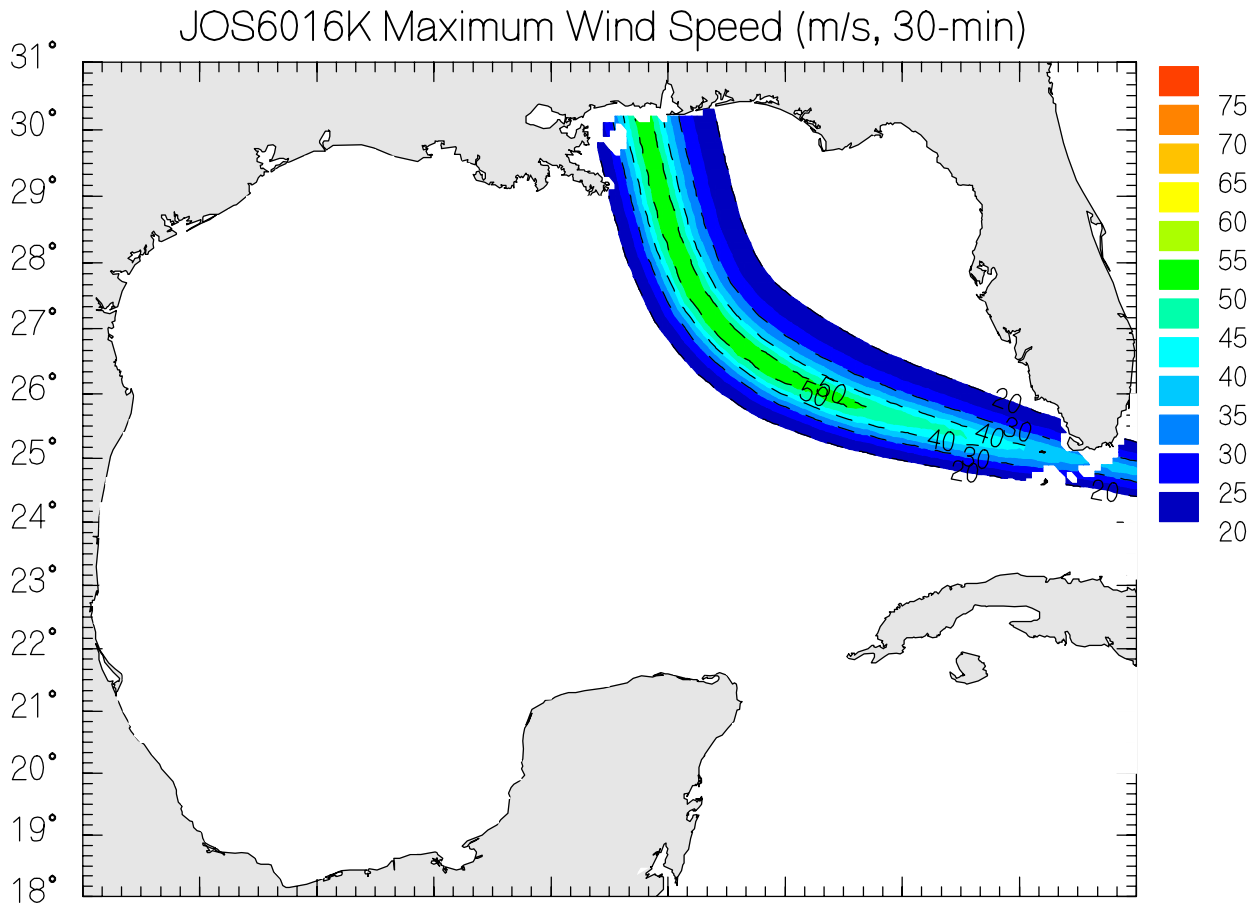
JOS6016K Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
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21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
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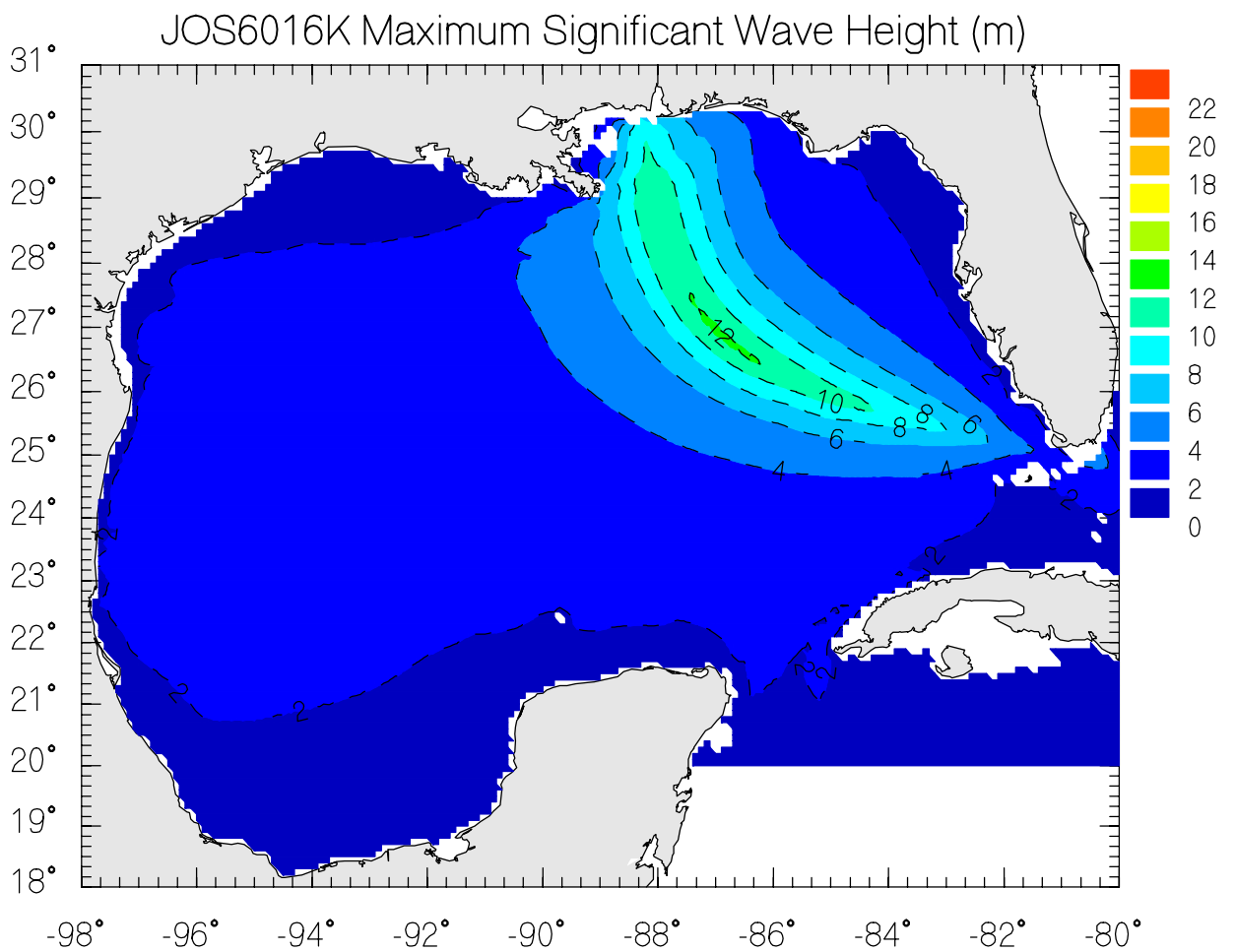
25
20


JOS6016K Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
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-82°
-80°
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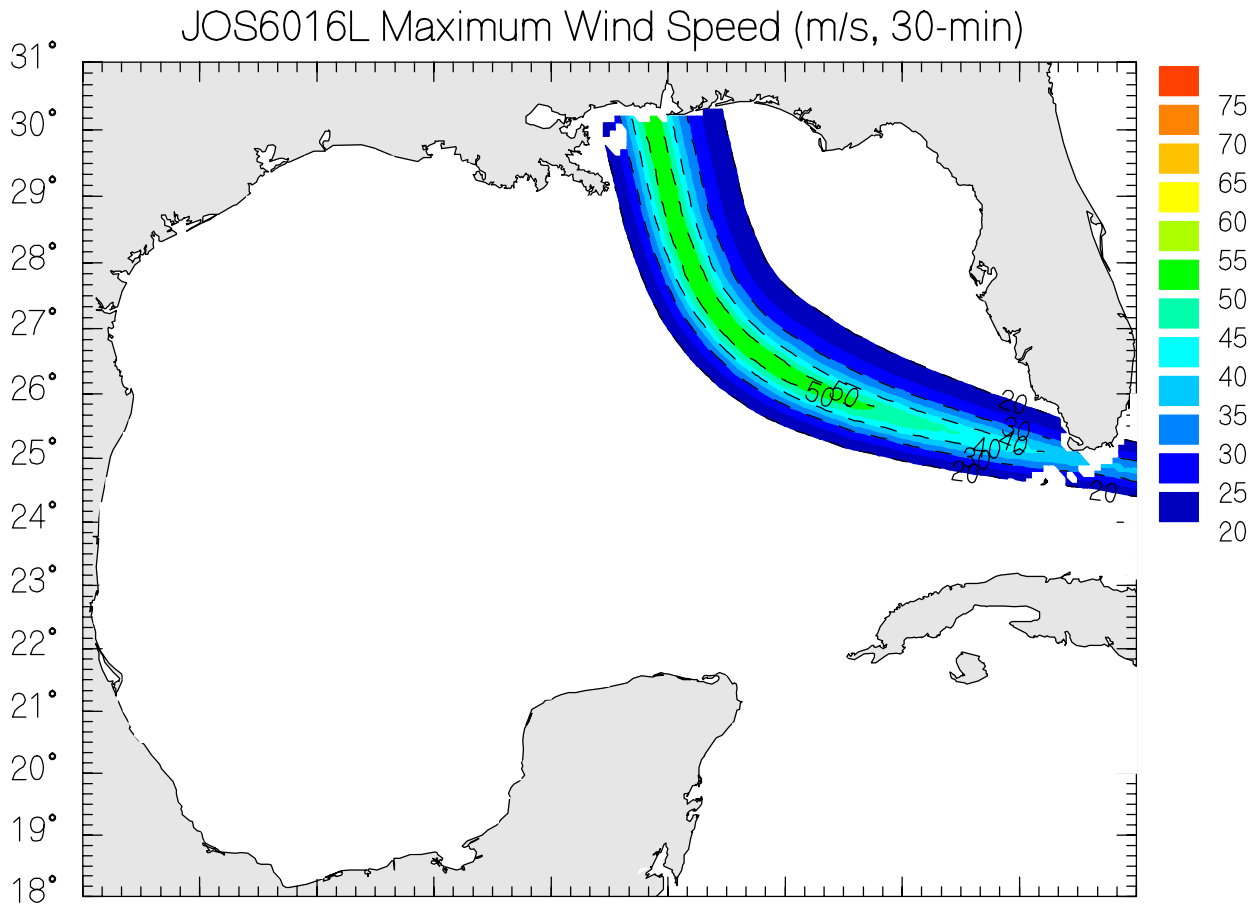
JOS6016L Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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55
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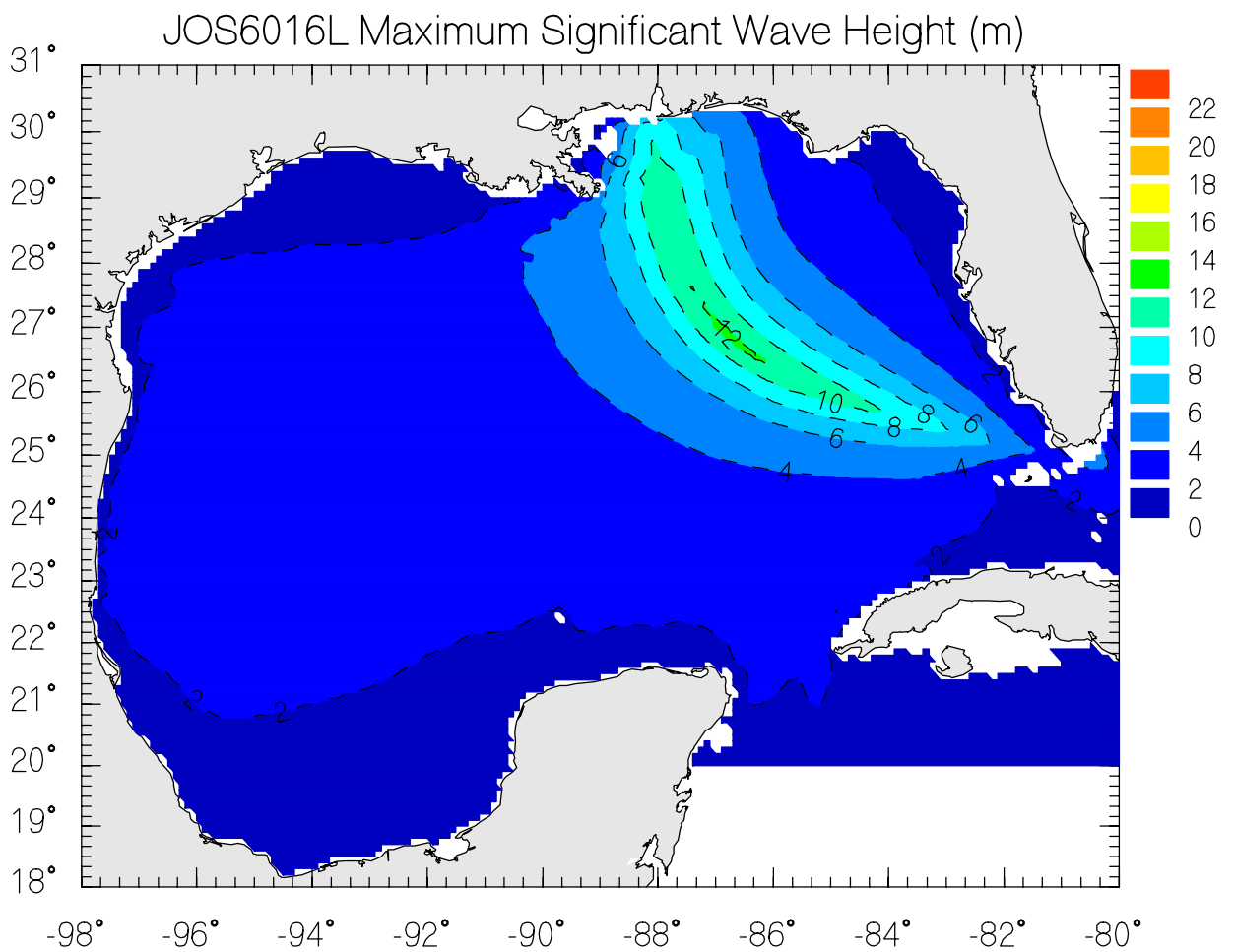
45
40
35
30
25
20


JOS6016L Maximum Significant Wave Height (m)
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28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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22
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4
2
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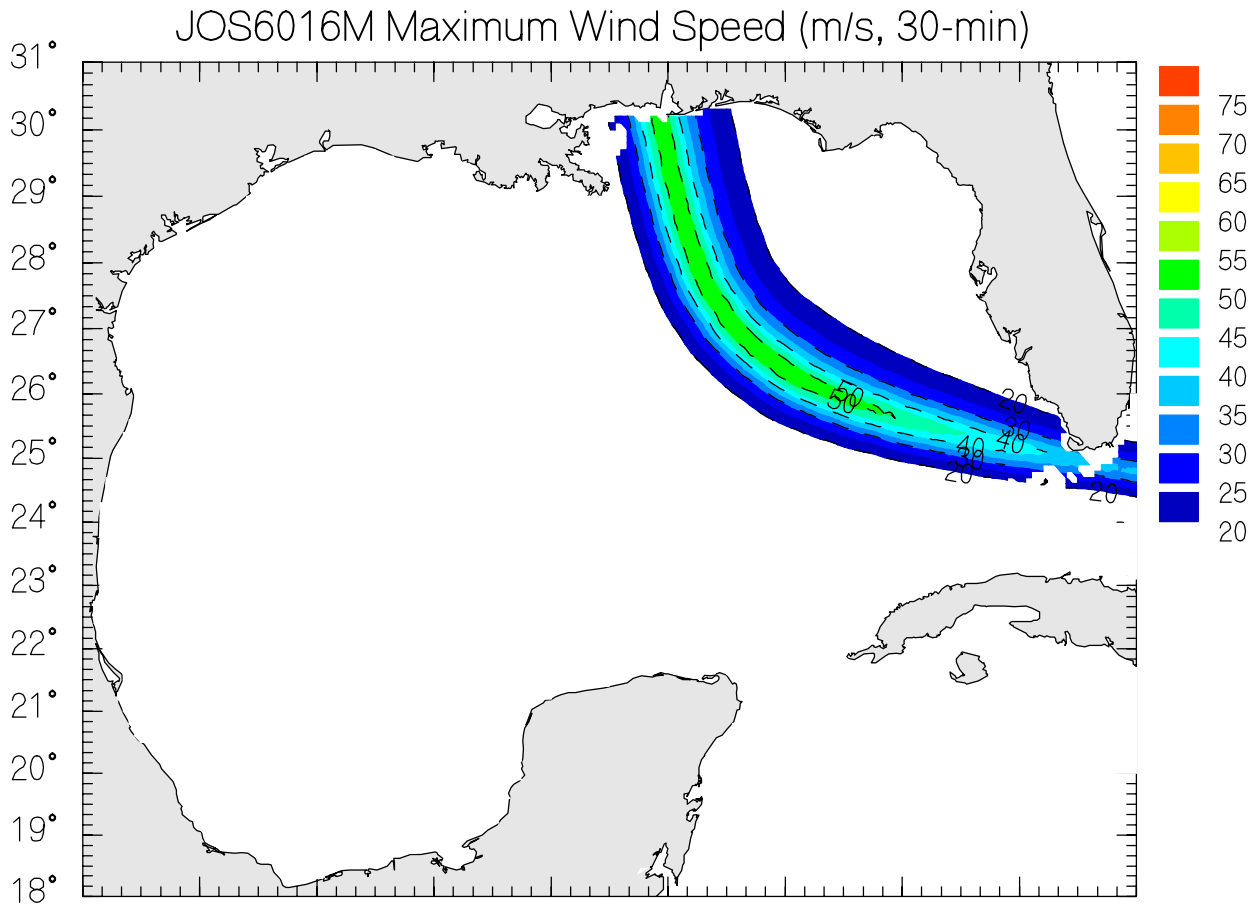
JOS6016M Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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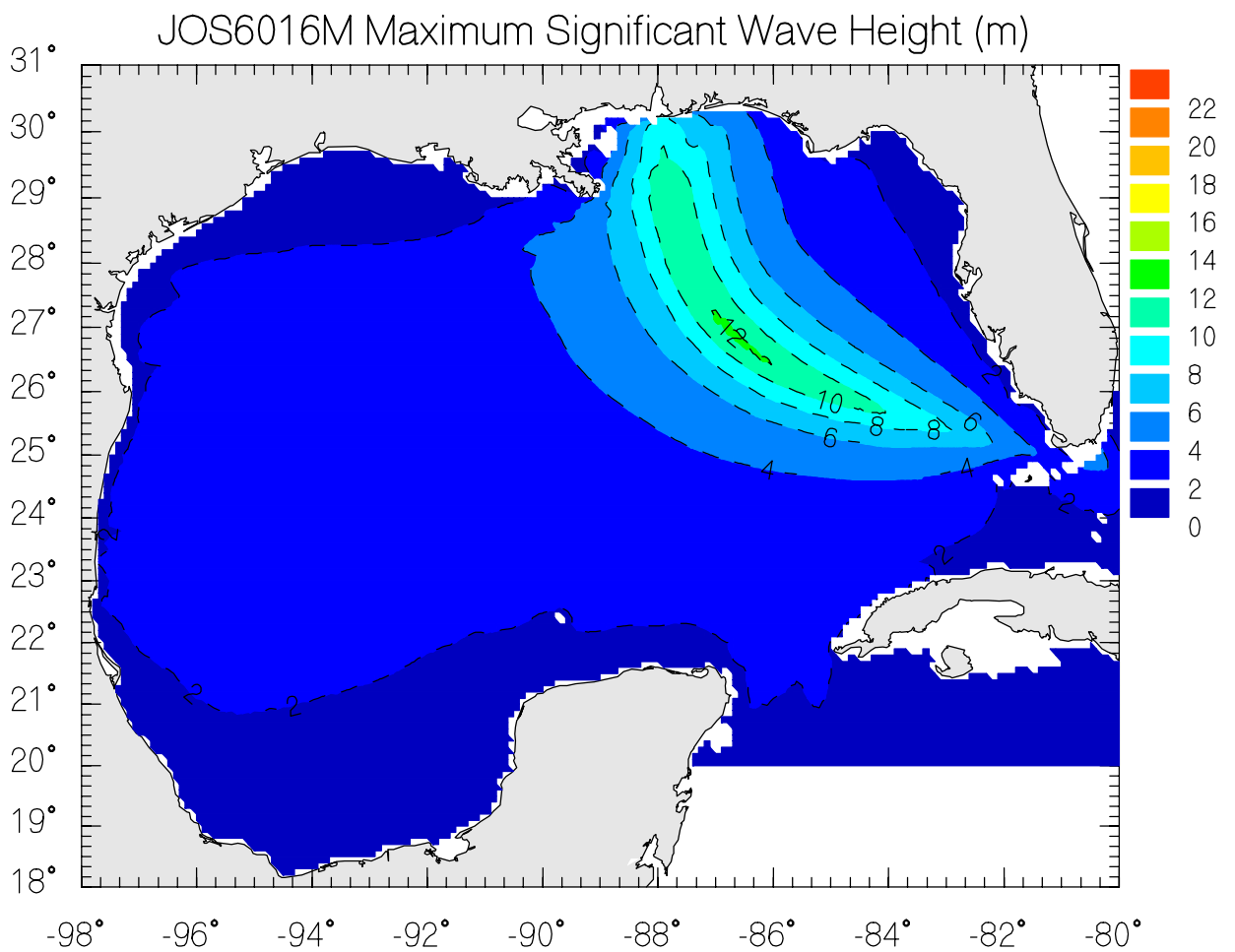
60
55
50
45
40
35
30
25
20


JOS6016M Maximum Significant Wave Height (m)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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-82°
-80°
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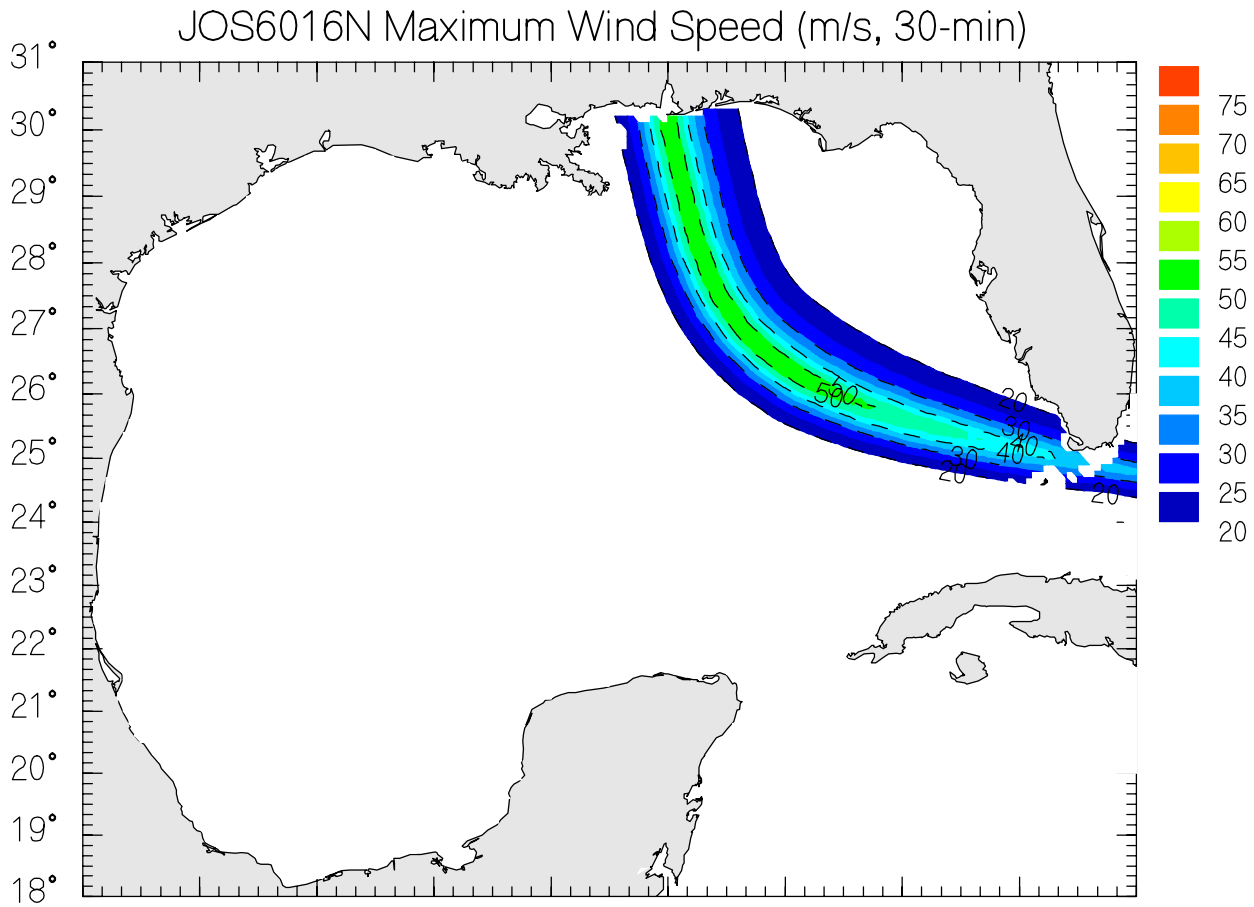
JOS6016N Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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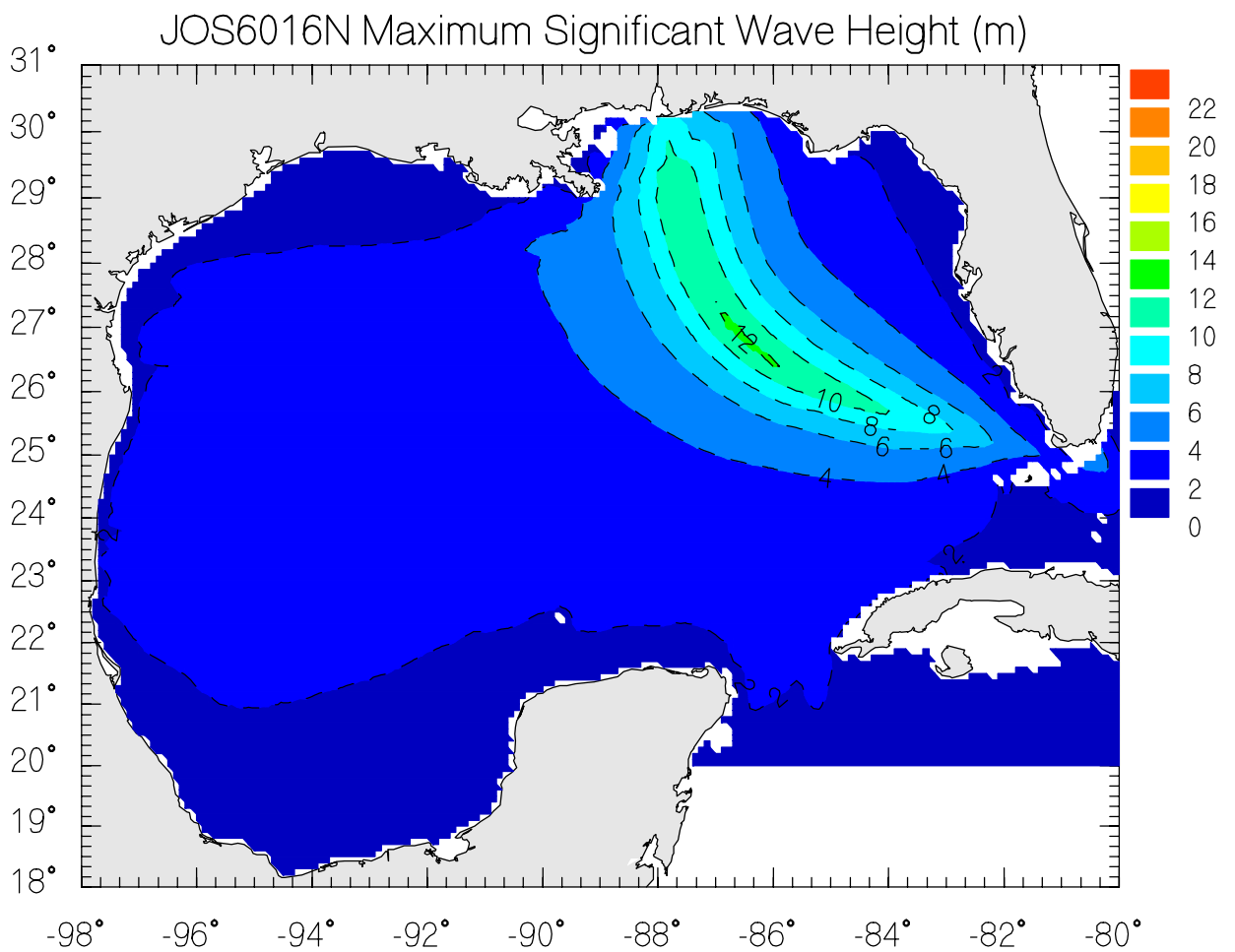
20
20


JOS6016N Maximum Significant Wave Height (m)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
12
10
8
8
6
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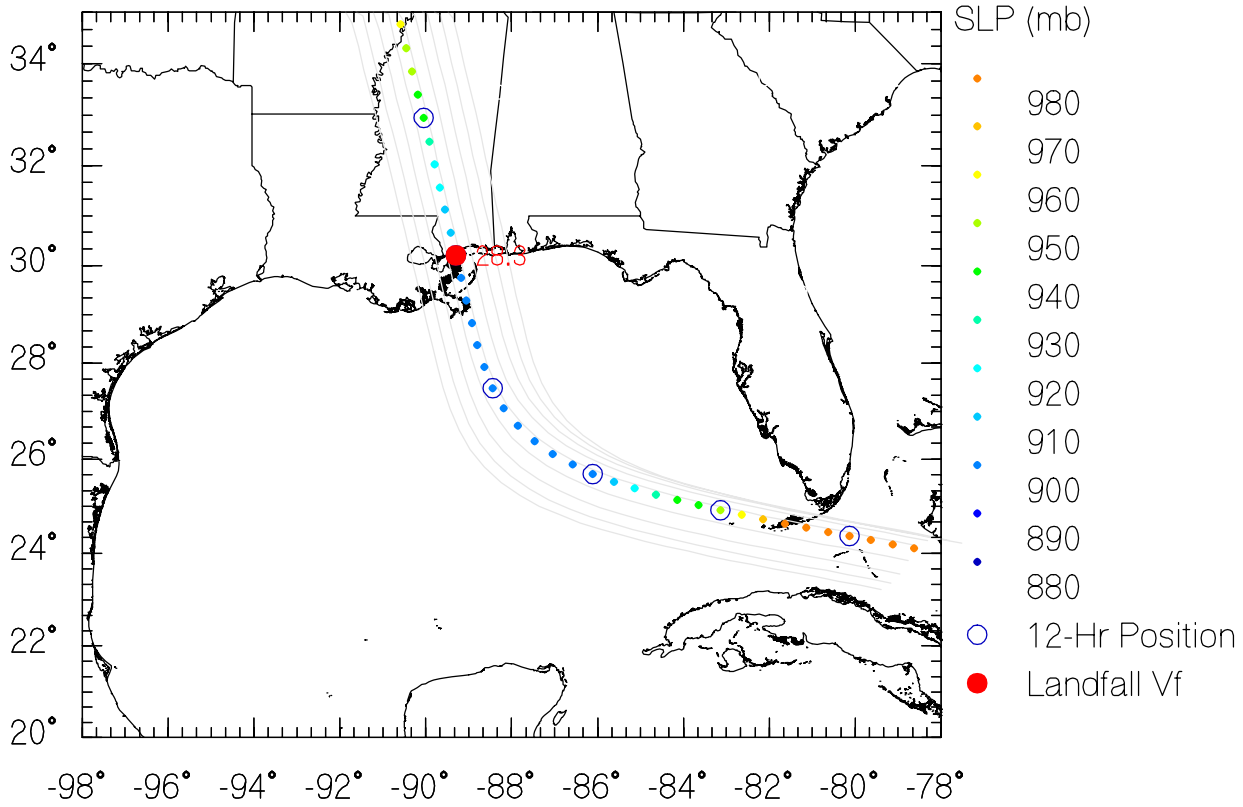
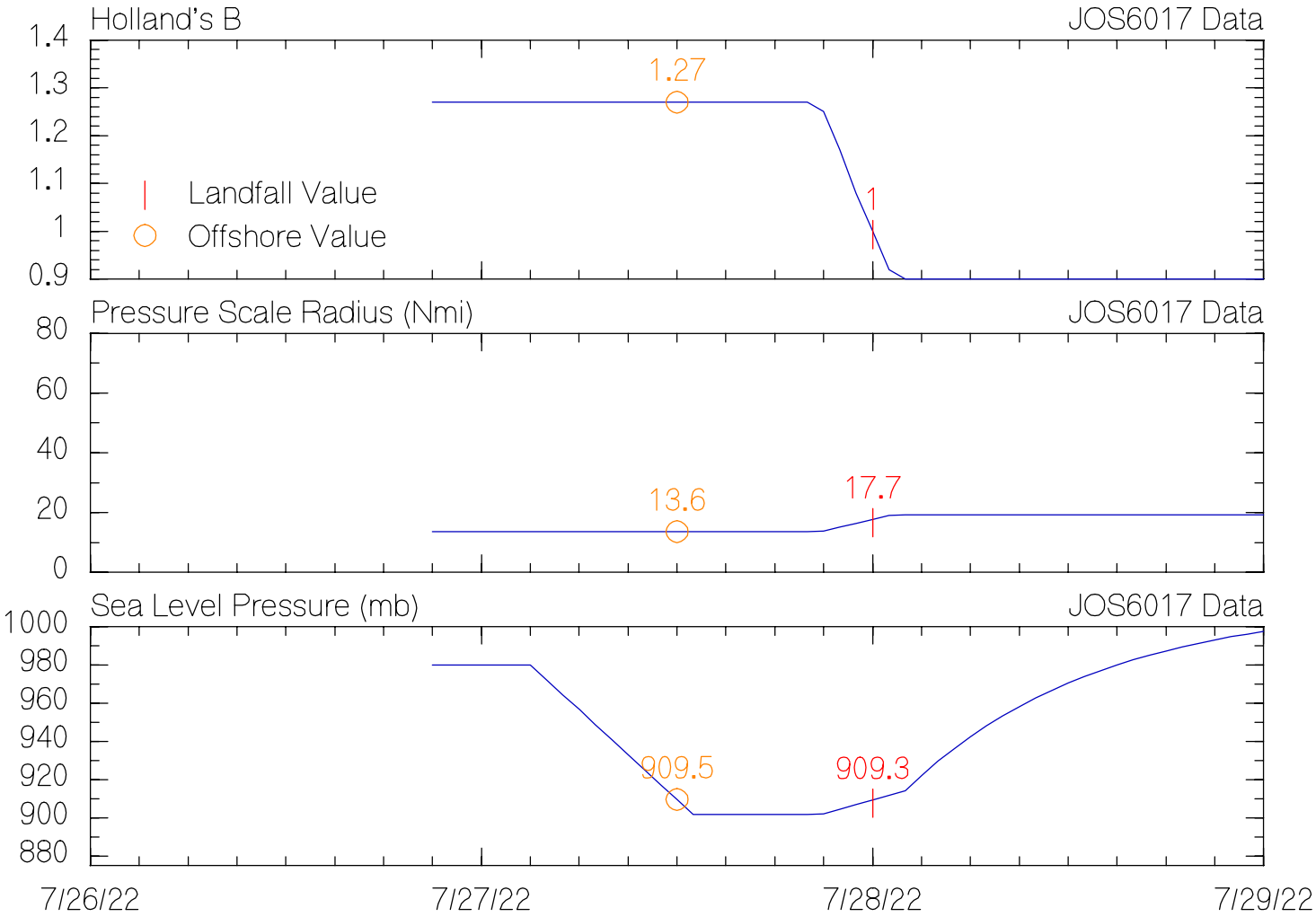
-84°
-82°
-80°

JOS6017 Data



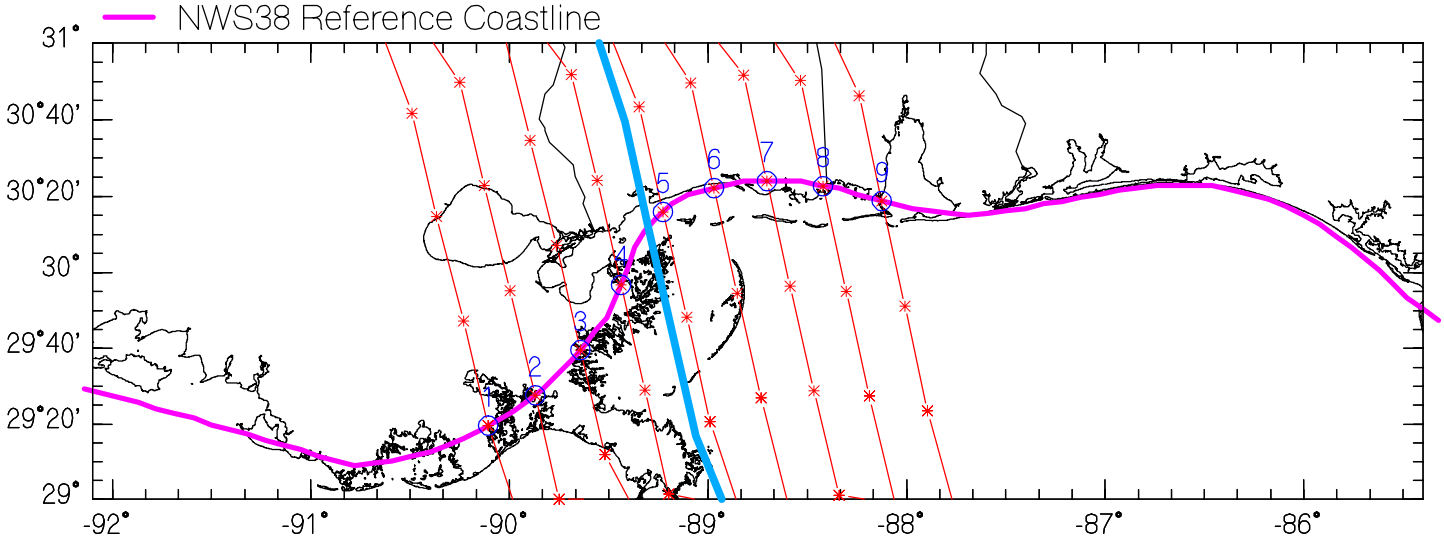


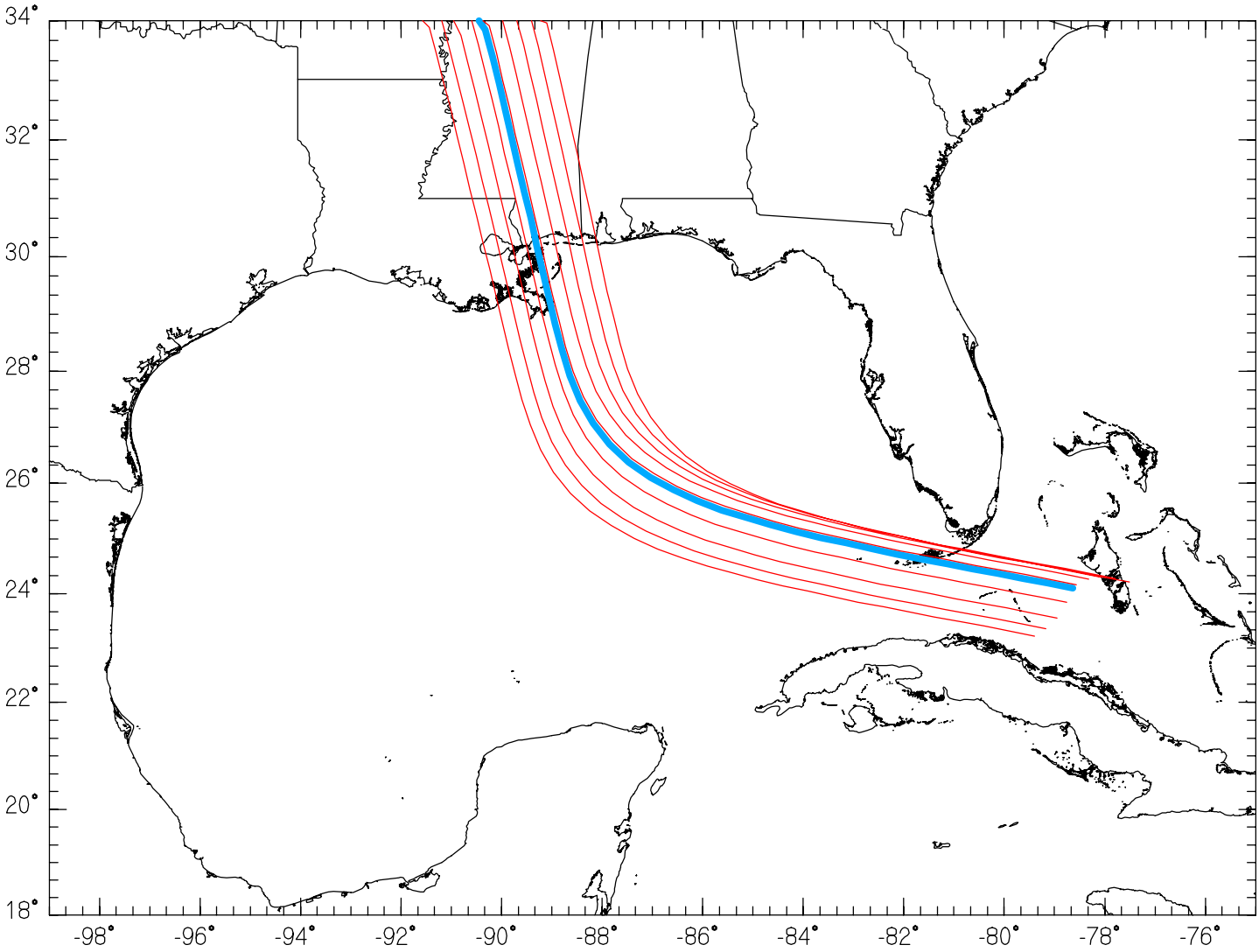
URS JPM-OS6 Production Tracks

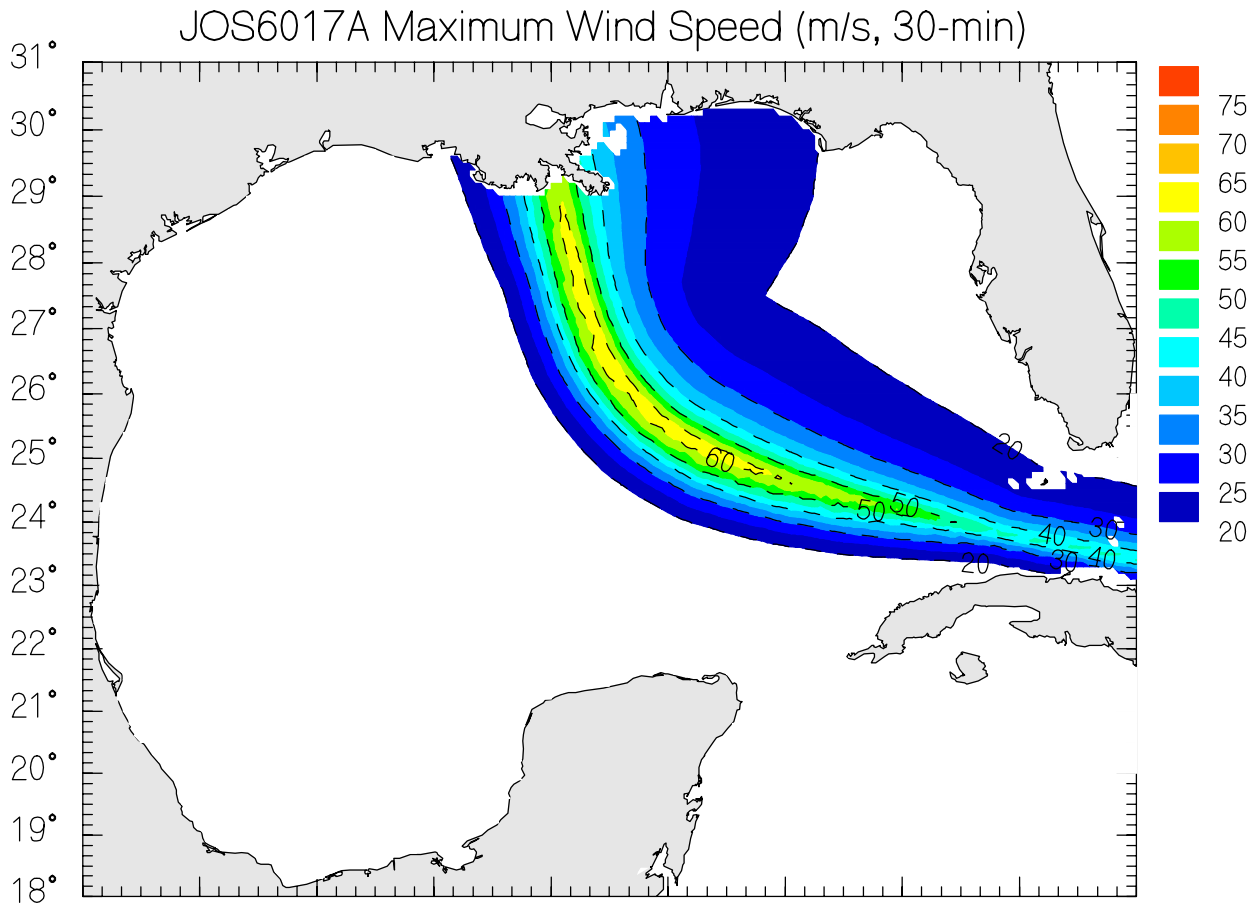
JOS6017 Data

Reference Track — Production Tracks — Production Track Landfall

NWS38 Reference Coastline






JOS6017A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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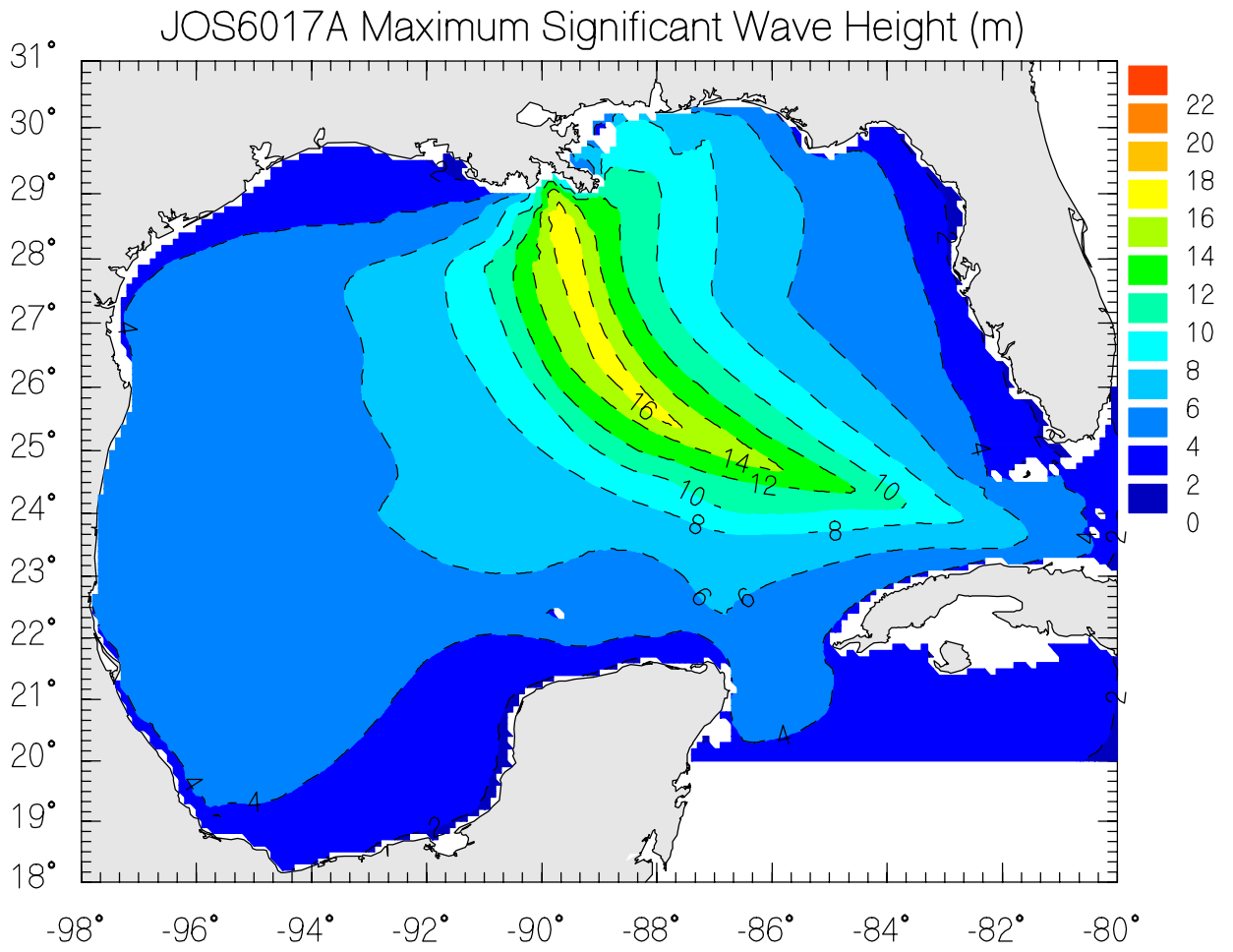
30
20


JOS6017A Maximum Significant Wave Height (m)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
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18°
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-96°
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8
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4
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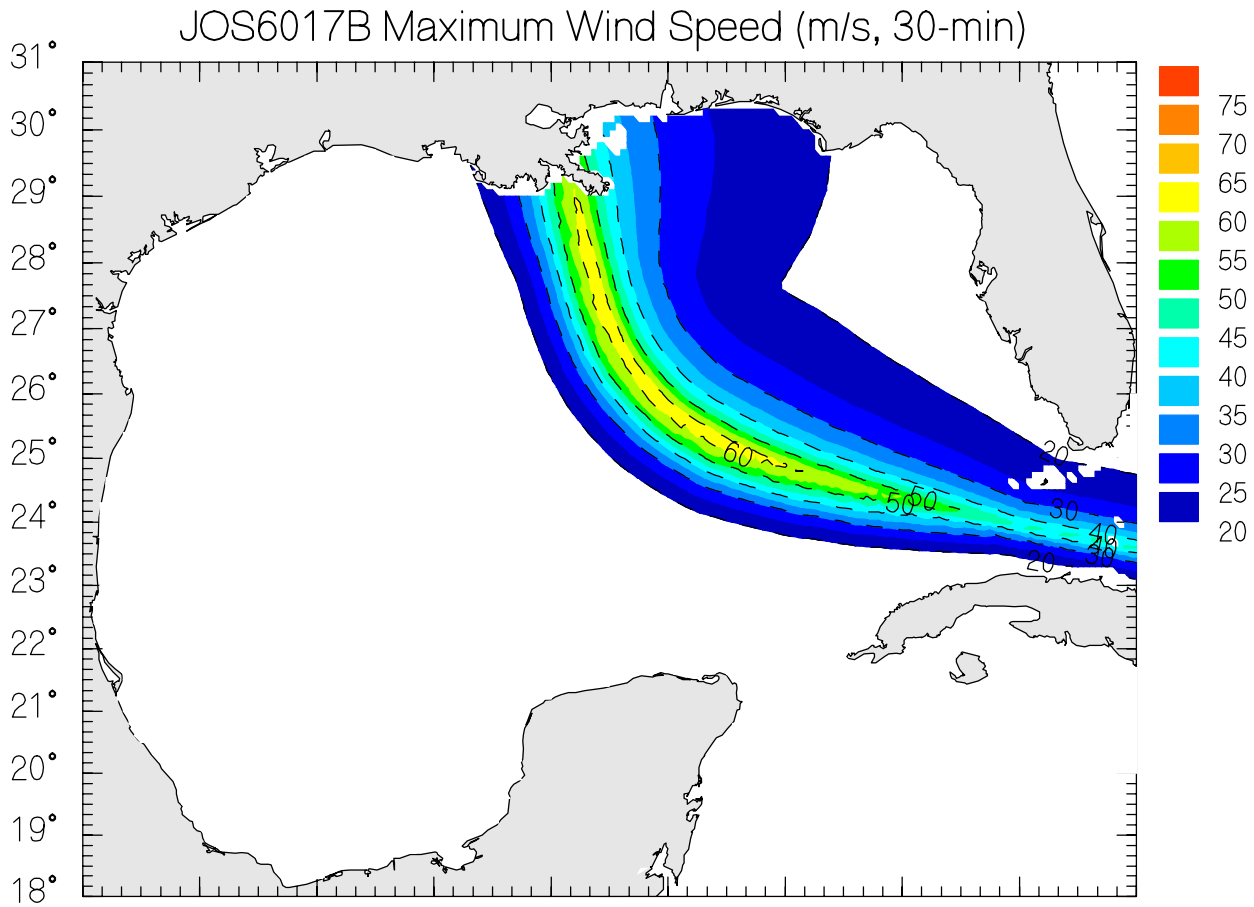
JOS6017B Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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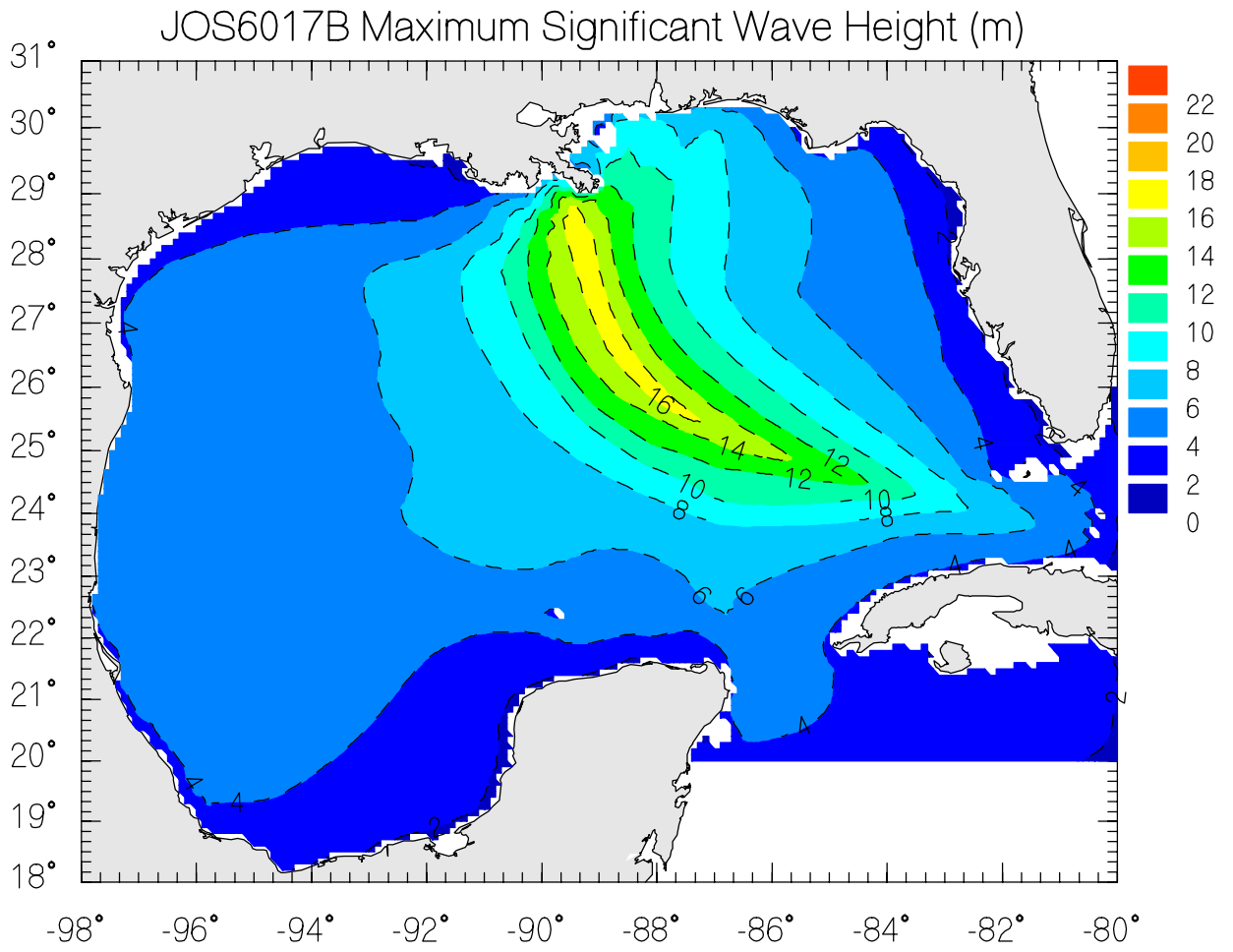
20


JOS6017B Maximum Significant Wave Height (m)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
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8
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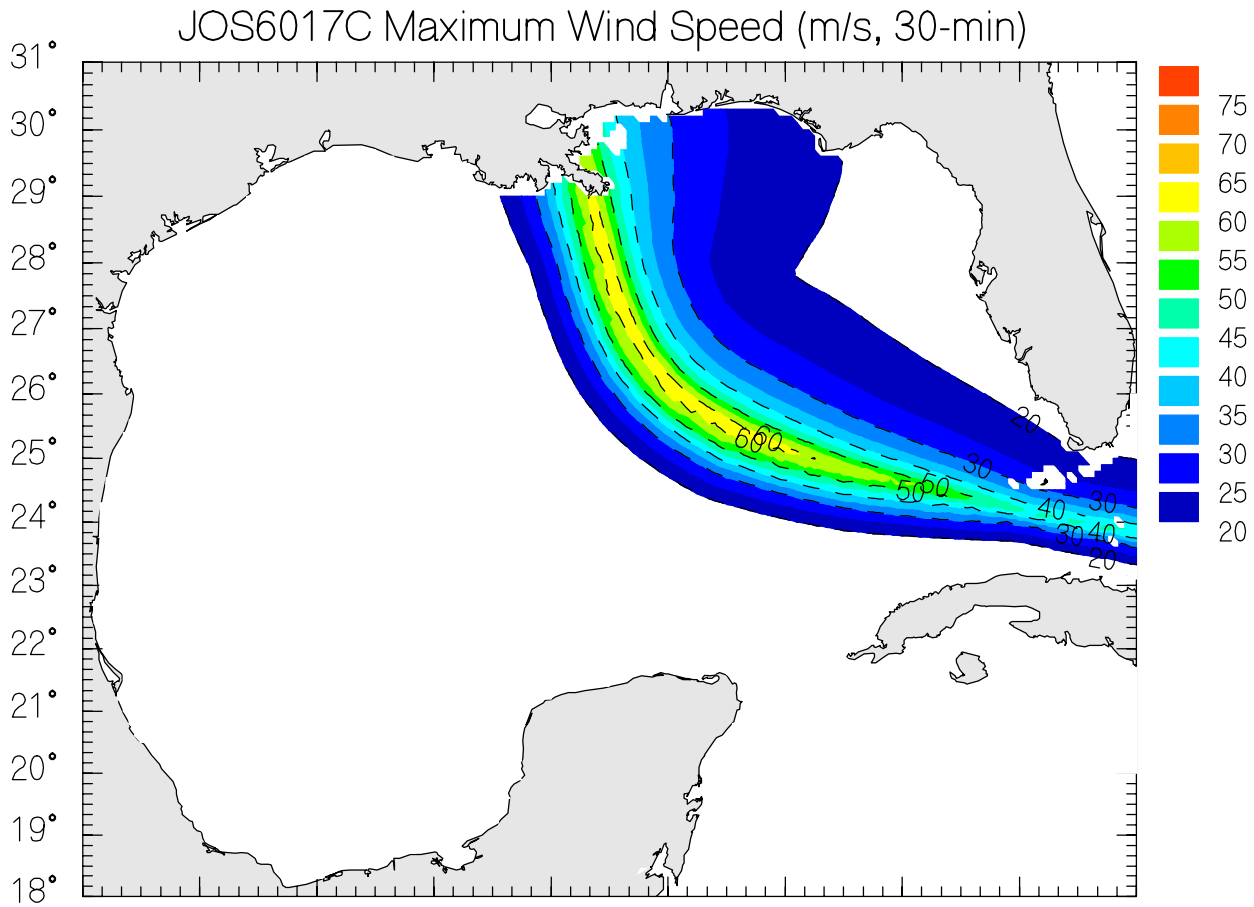
4
2


JOS6017C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
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19°
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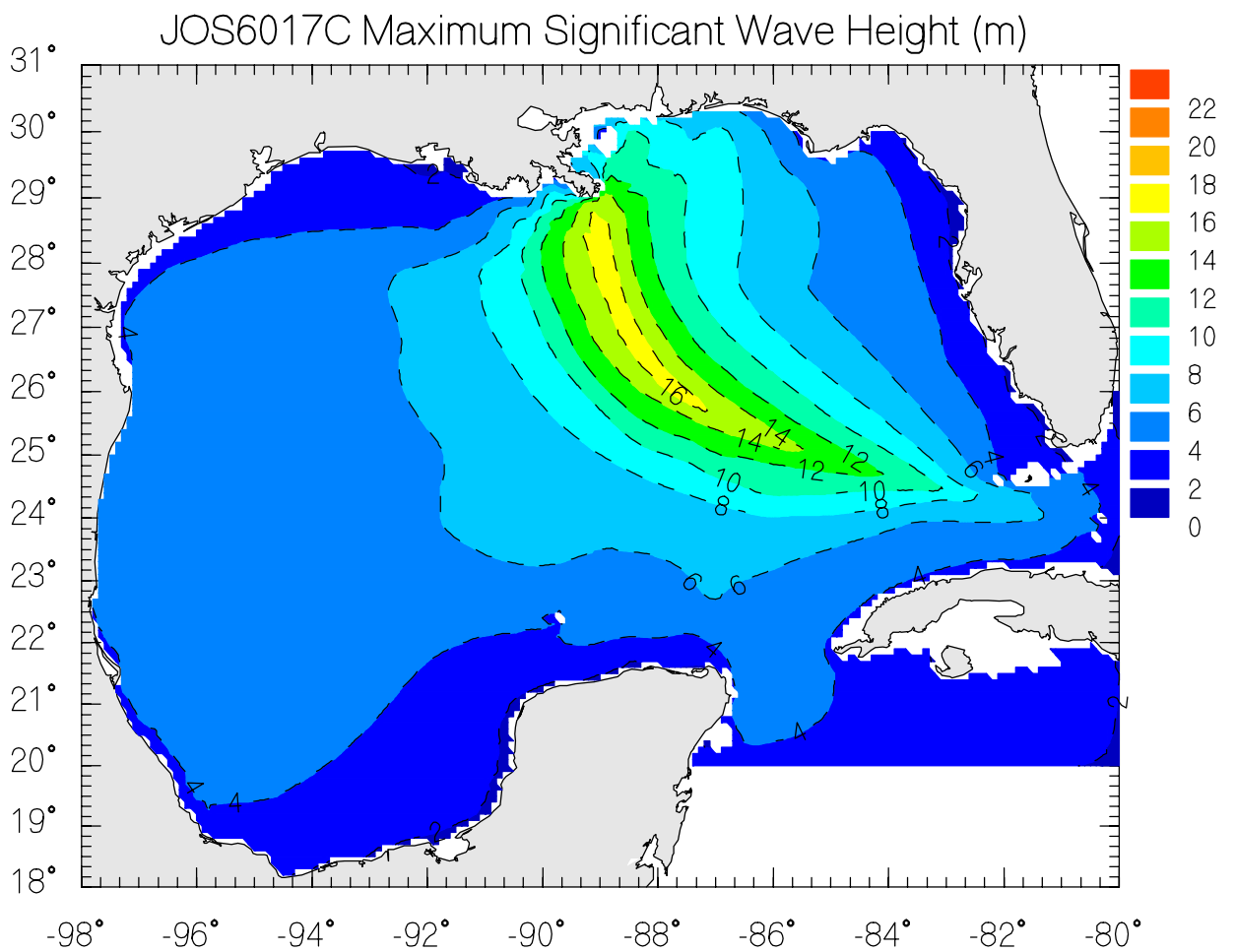
25
20


JOS6017C Maximum Significant Wave Height (m)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
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22
20
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14
12
10
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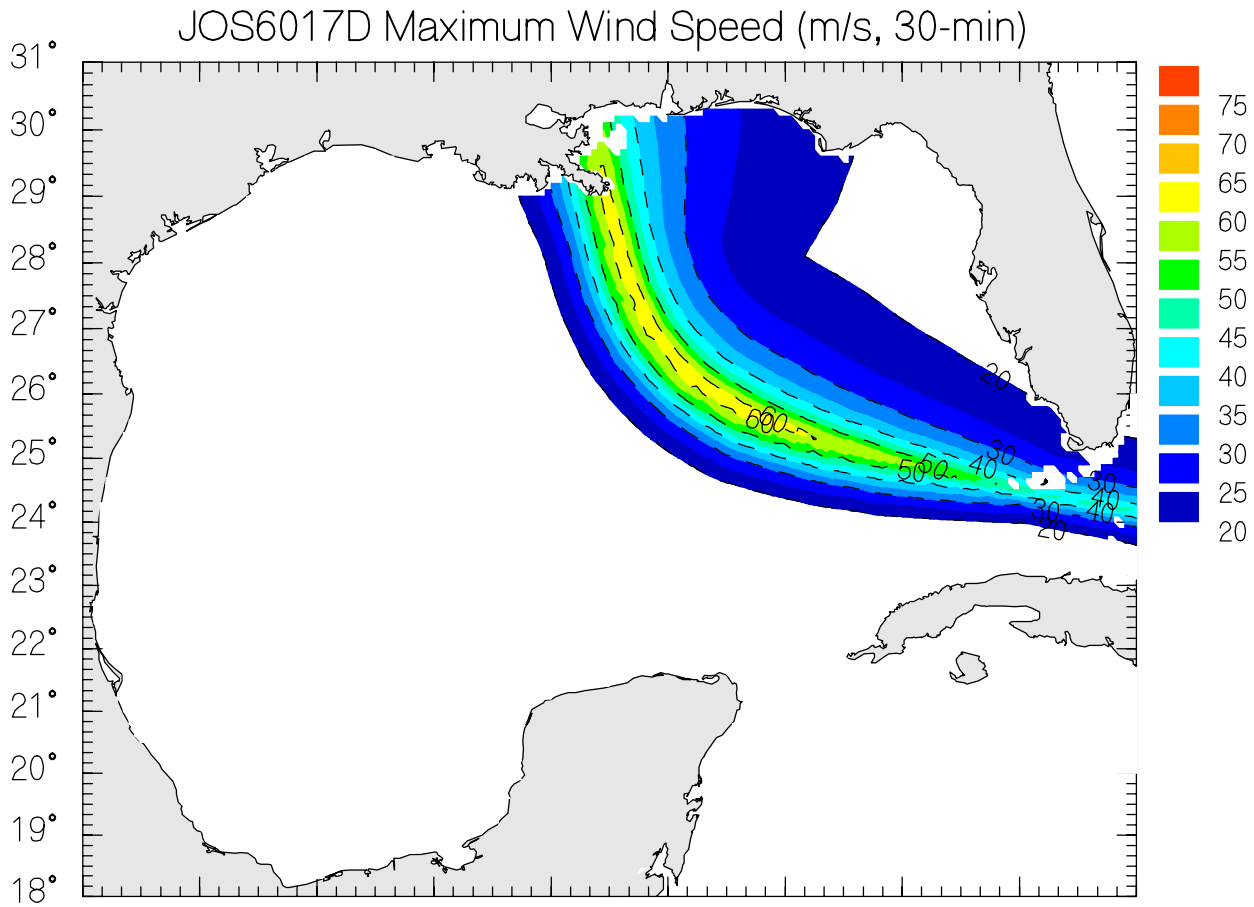
4
2
0


JOS6017D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
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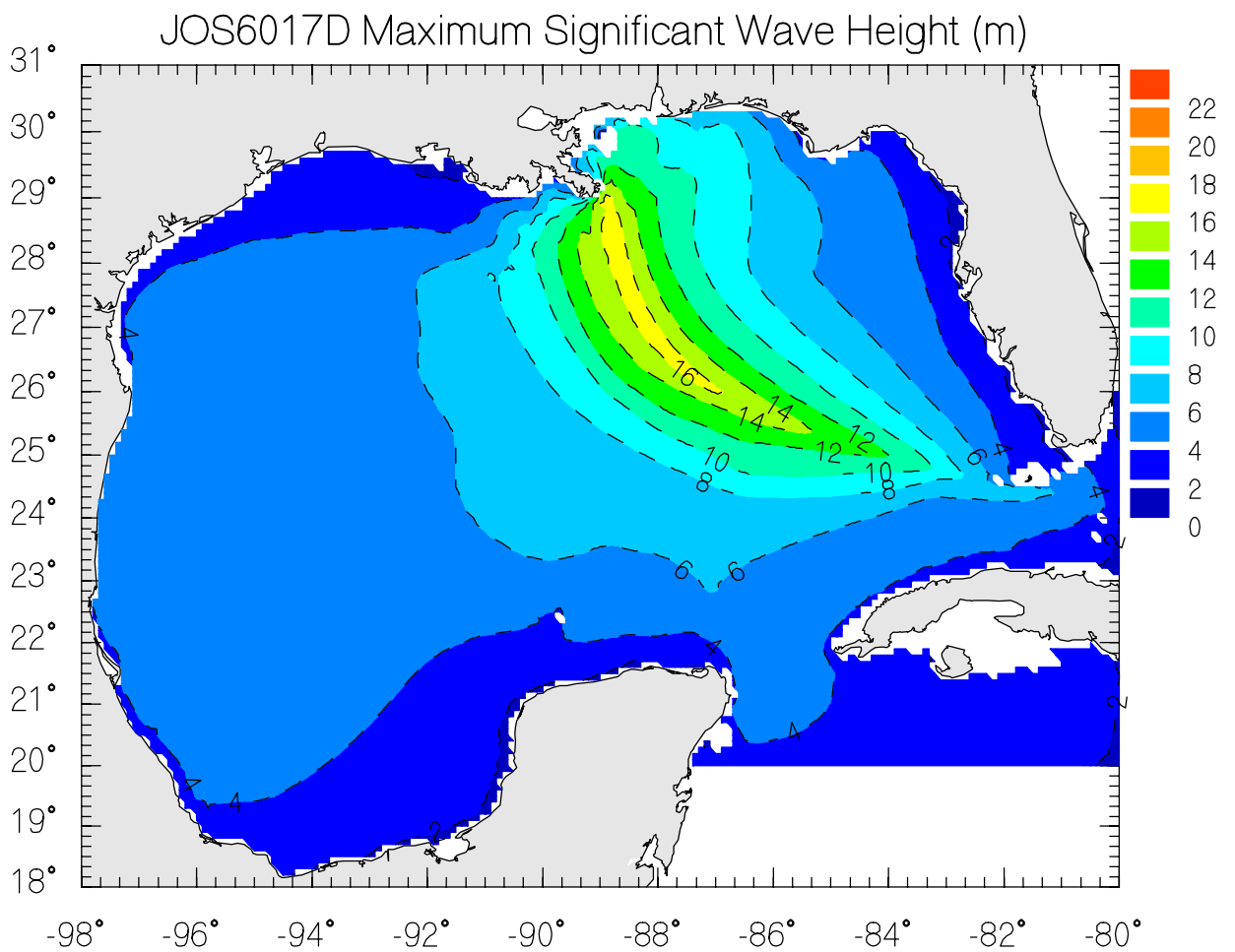
20


JOS6017D Maximum Significant Wave Height (m)
31°
30°
29°
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27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
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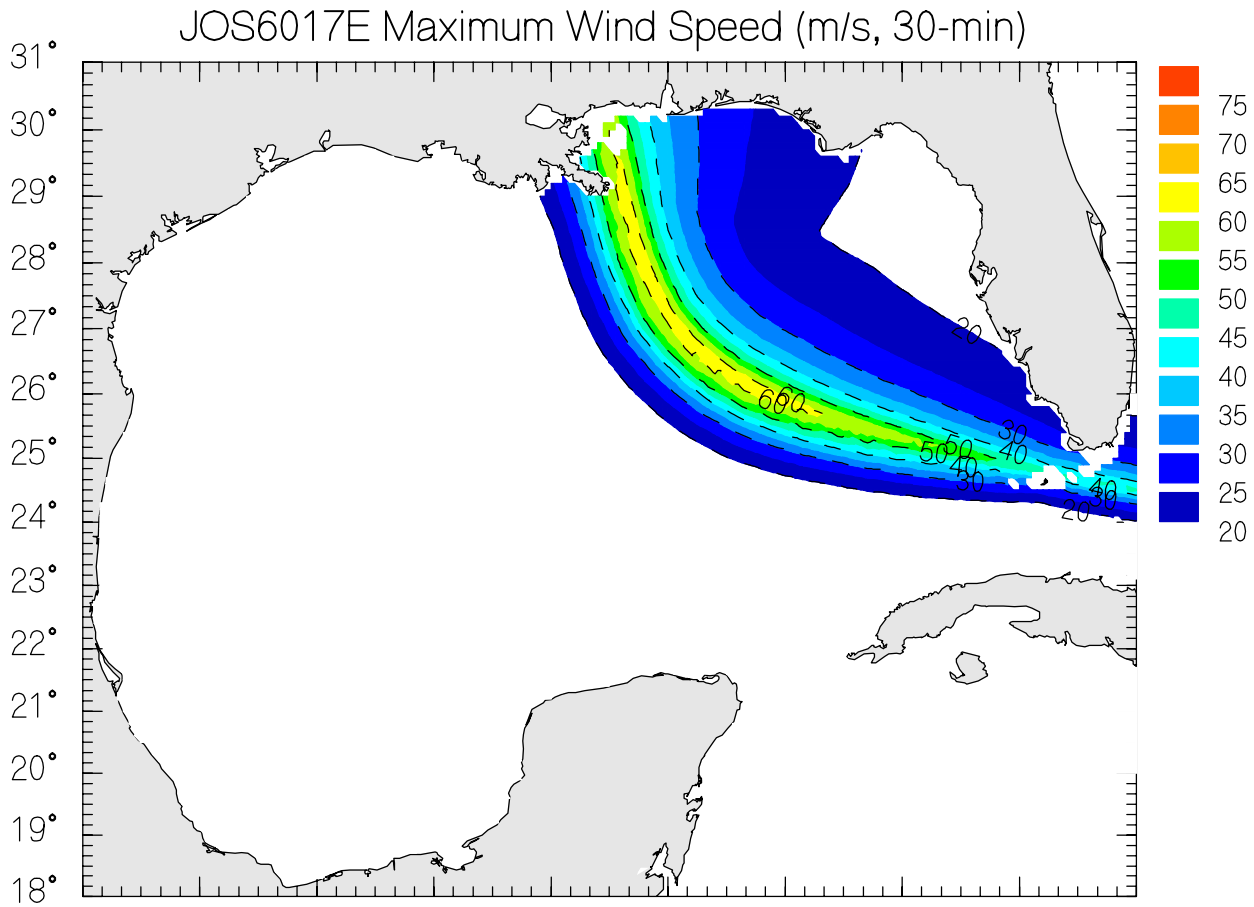
JOS6017E Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
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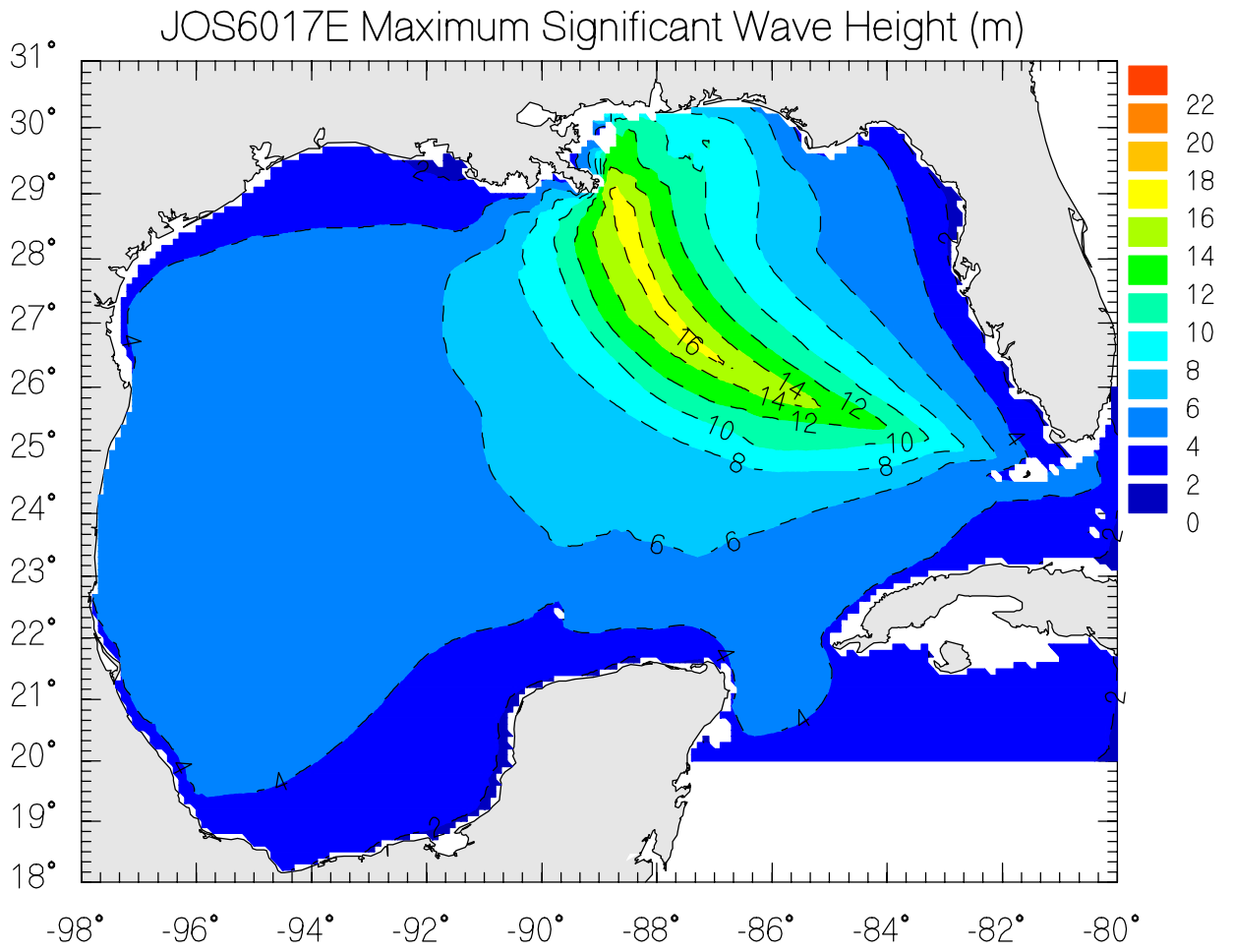
20


JOS6017E Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
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23°
22°
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19°
18°
-98°
-96°
-94°
-92°
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2
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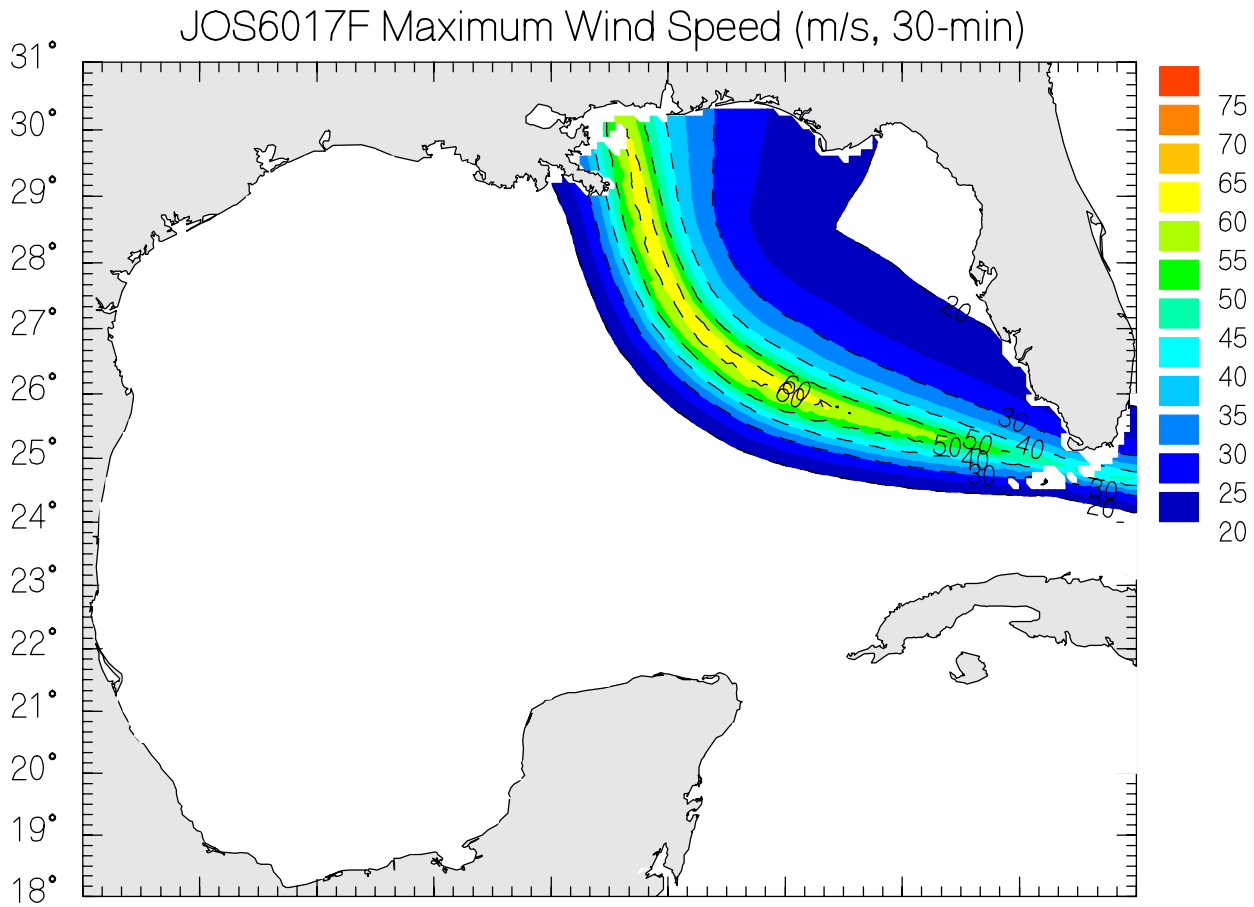
JOS6017F Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
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19°
18°
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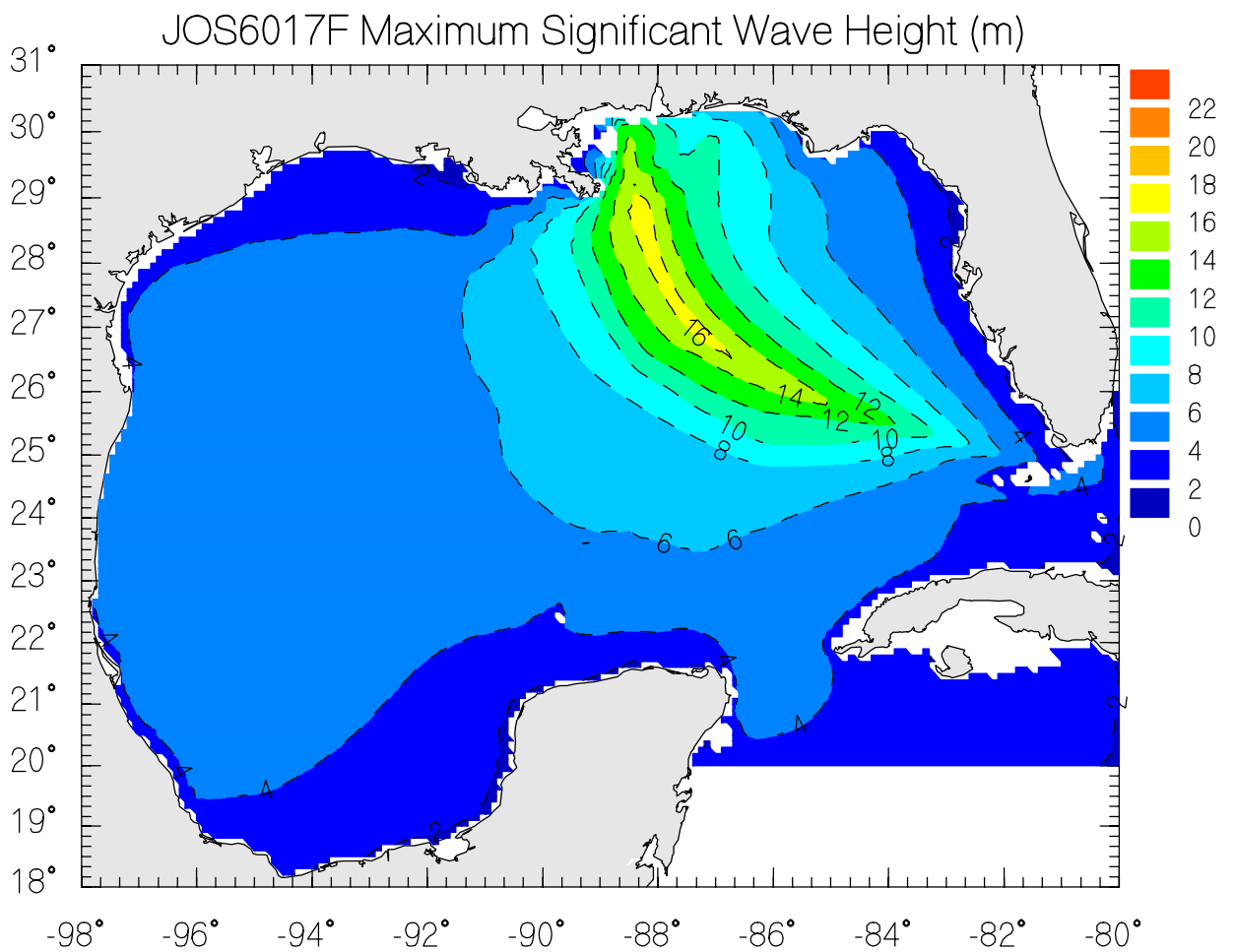
25
20


JOS6017F Maximum Significant Wave Height (m)
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26°
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19°
18°
-98°
-96°
-94°
-92°
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2
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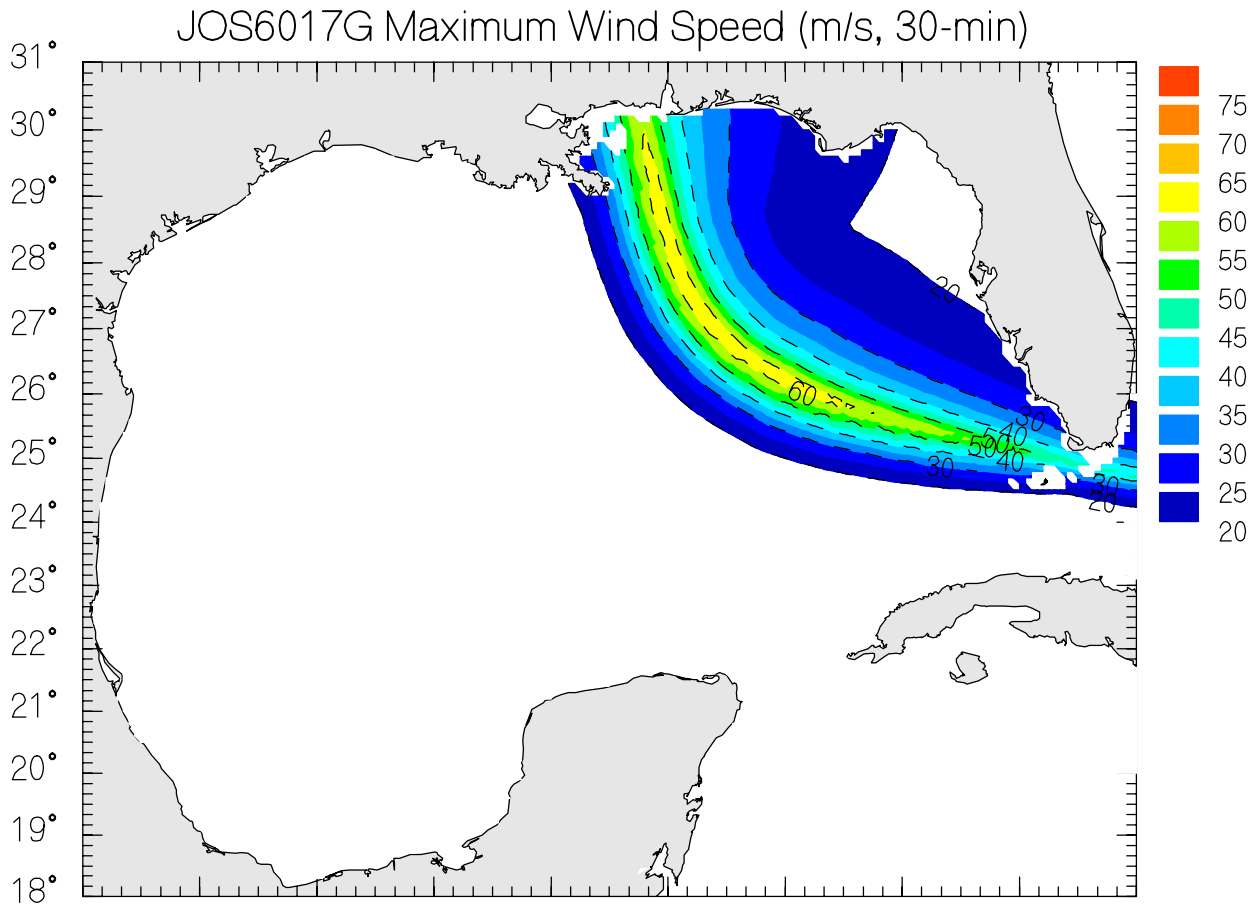
JOS6017G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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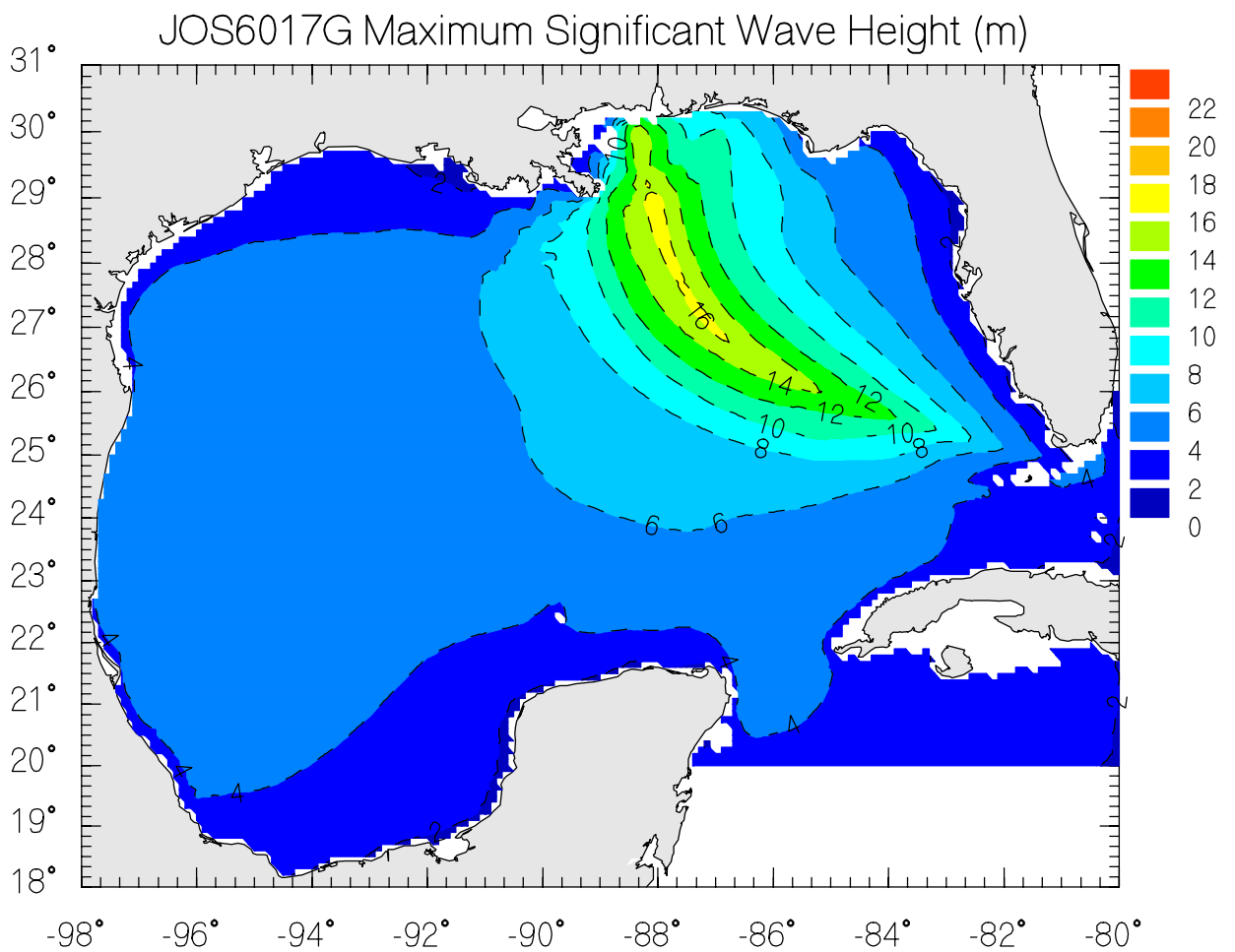
JOS6017G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
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23°
22°
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20°
19°
18°
-98°
-96°
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-92°
-90°
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-82°
-80°
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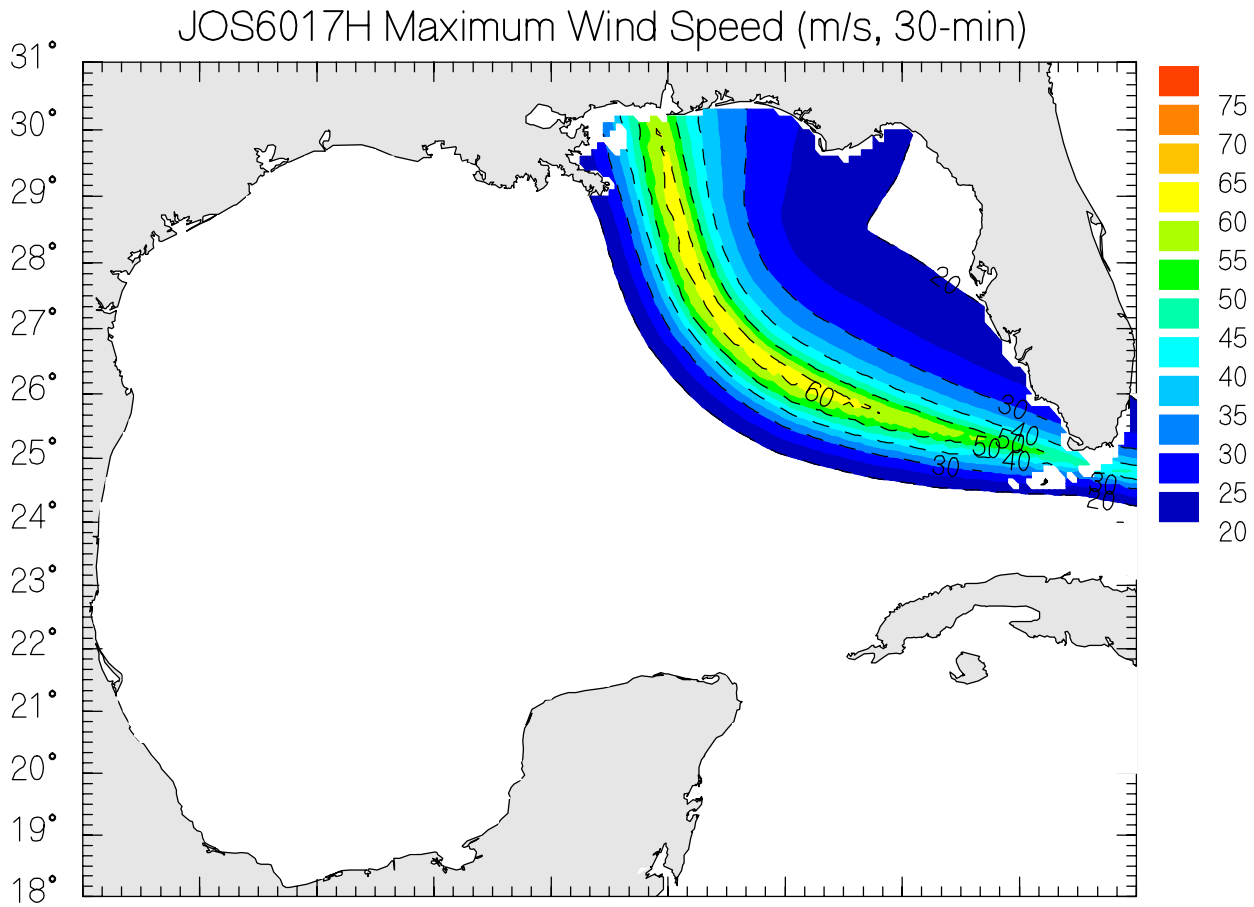
JOS6017H Maximum Wind Speed (m/s, 30-min)
31°
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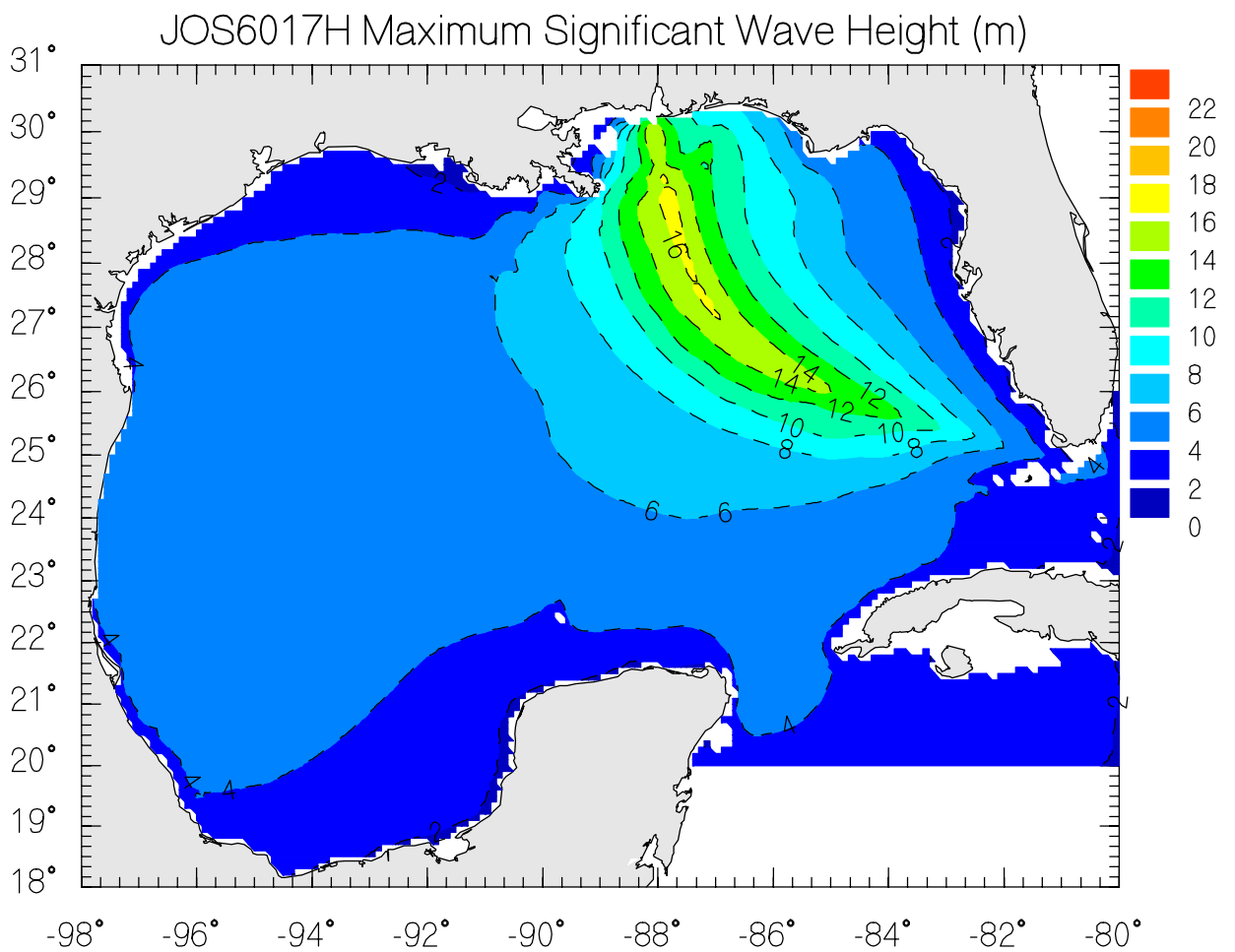
JOS6017H Maximum Significant Wave Height (m)
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30°
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28°
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-98°
-96°
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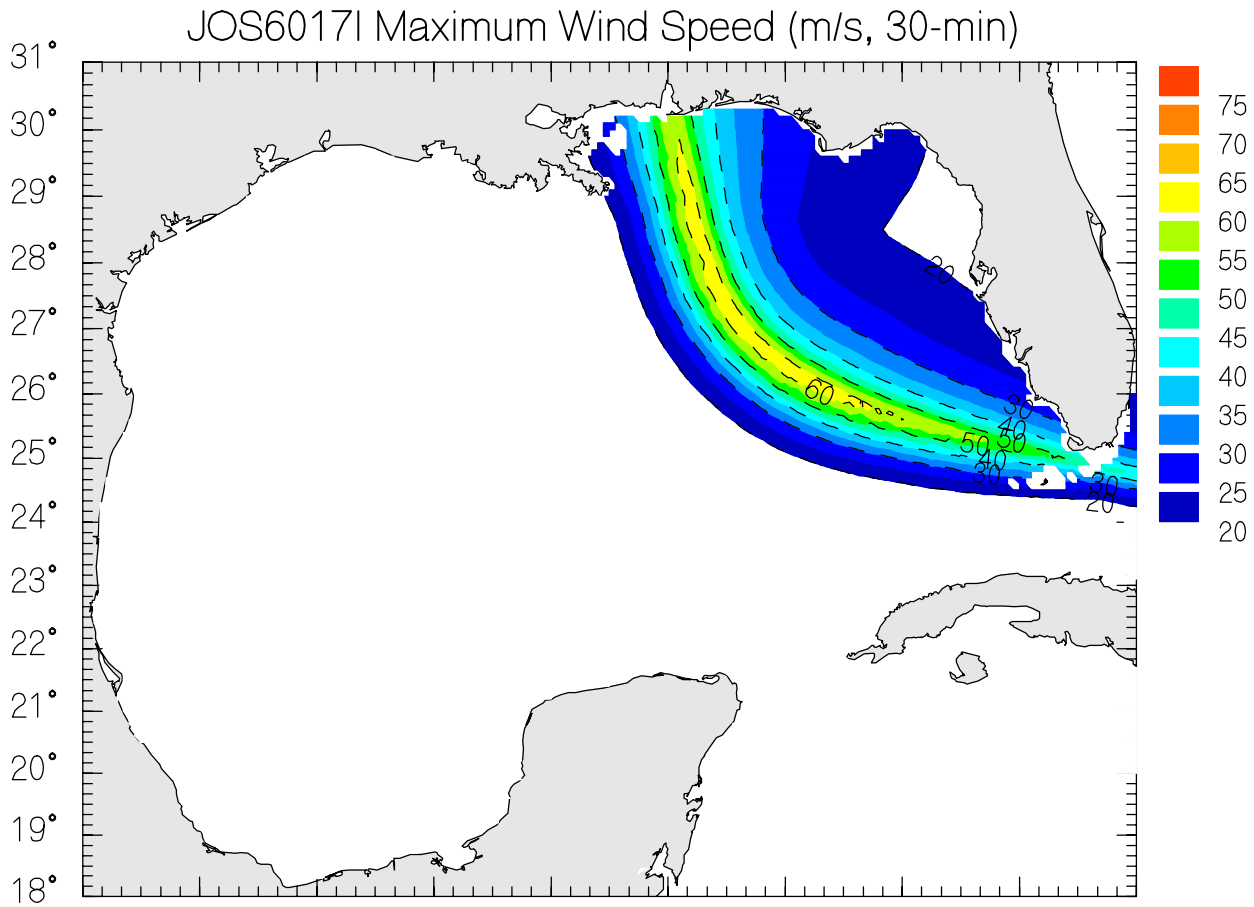
JOS6017I Maximum Wind Speed (m/s, 30-min)
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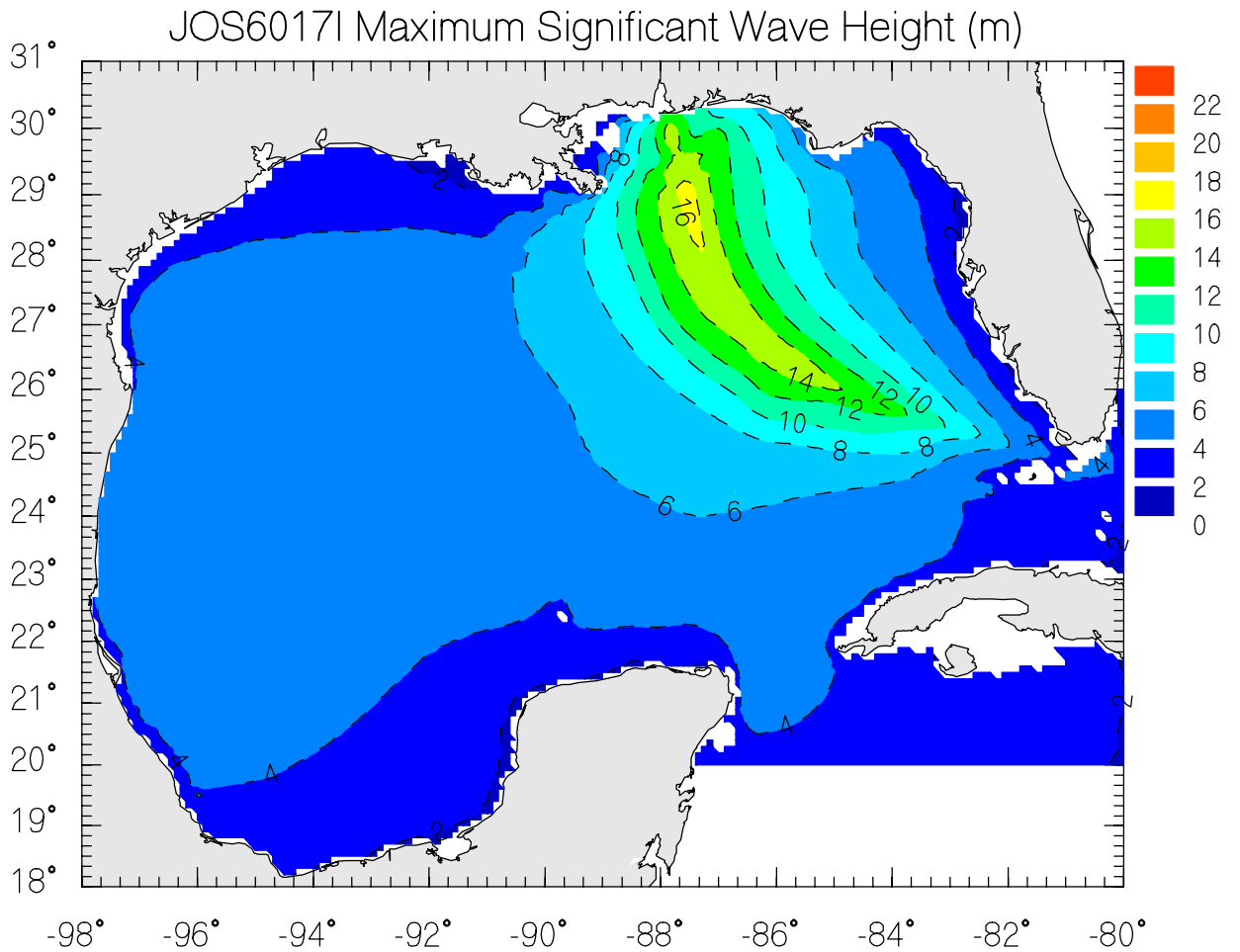
JOS6017I Maximum Significant Wave Height (m)
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28°
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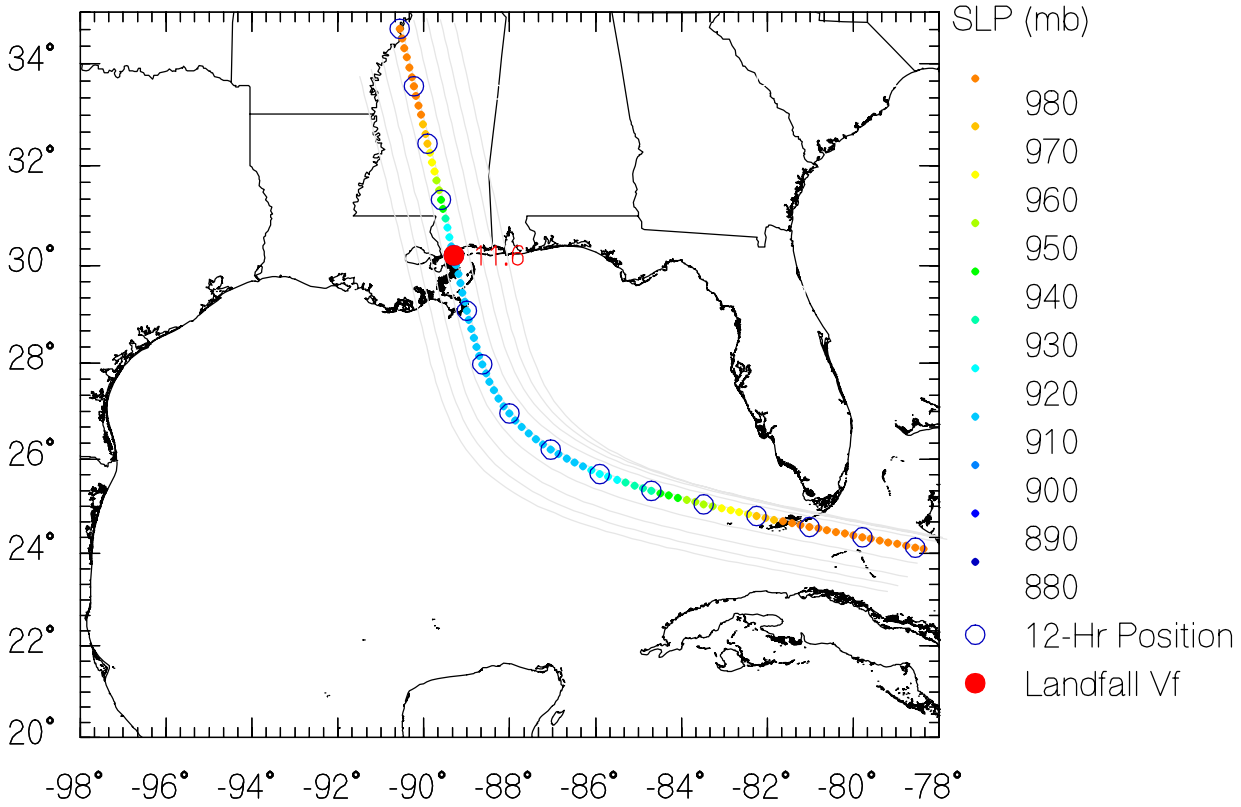
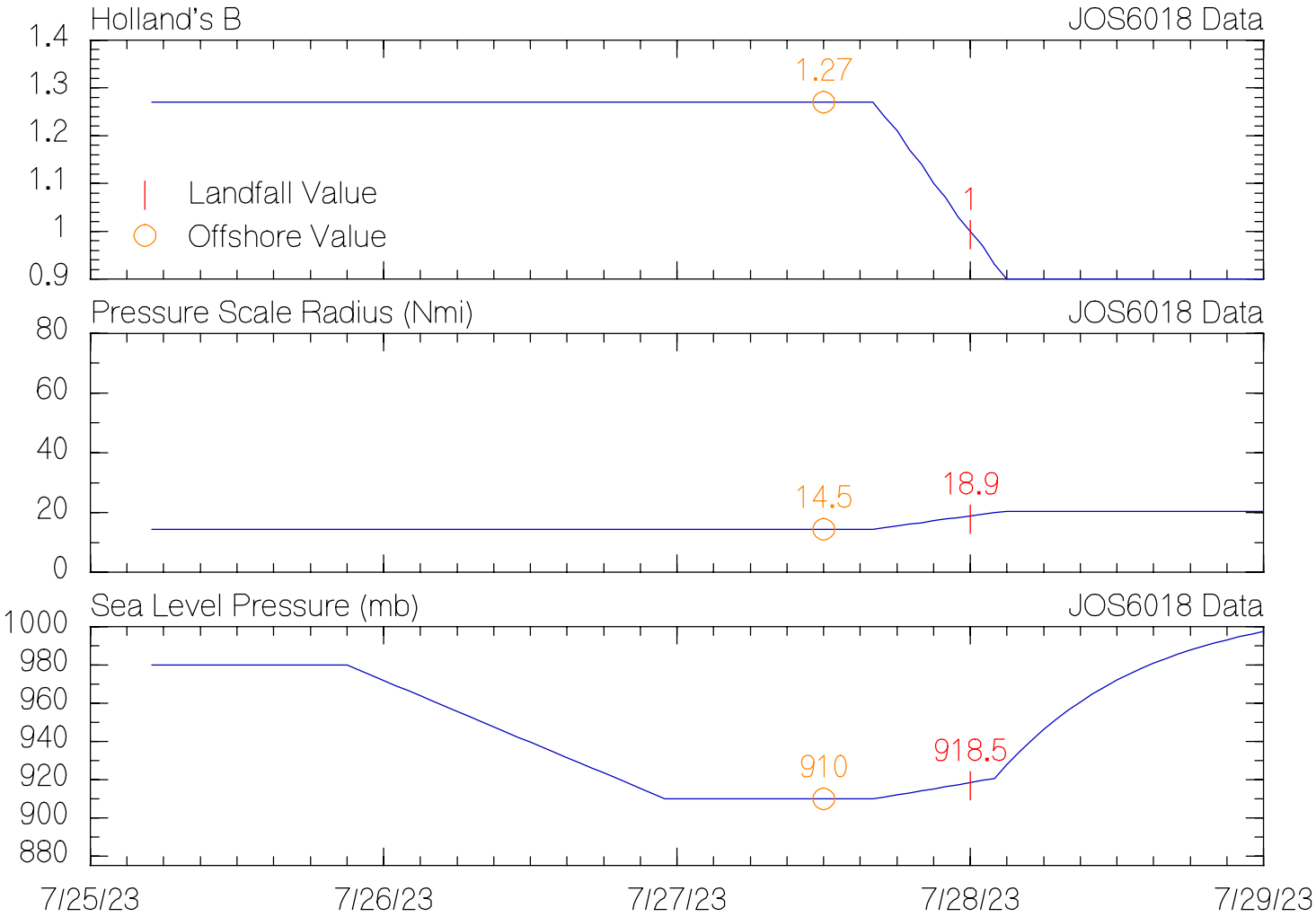
JOS6018 Data



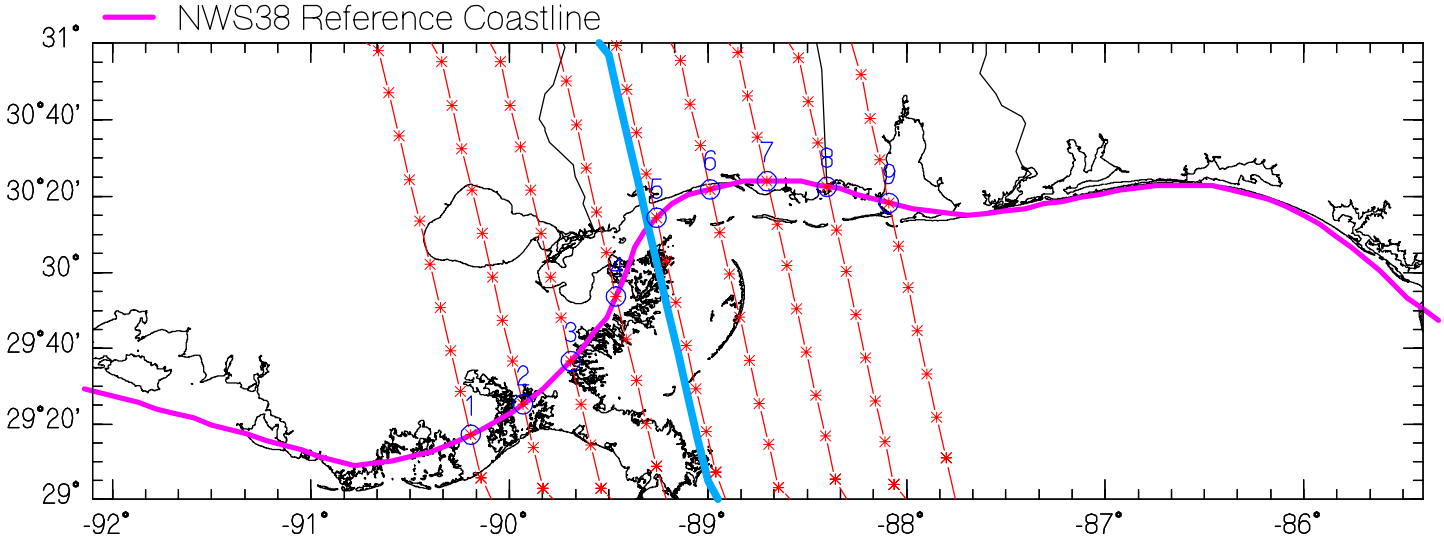


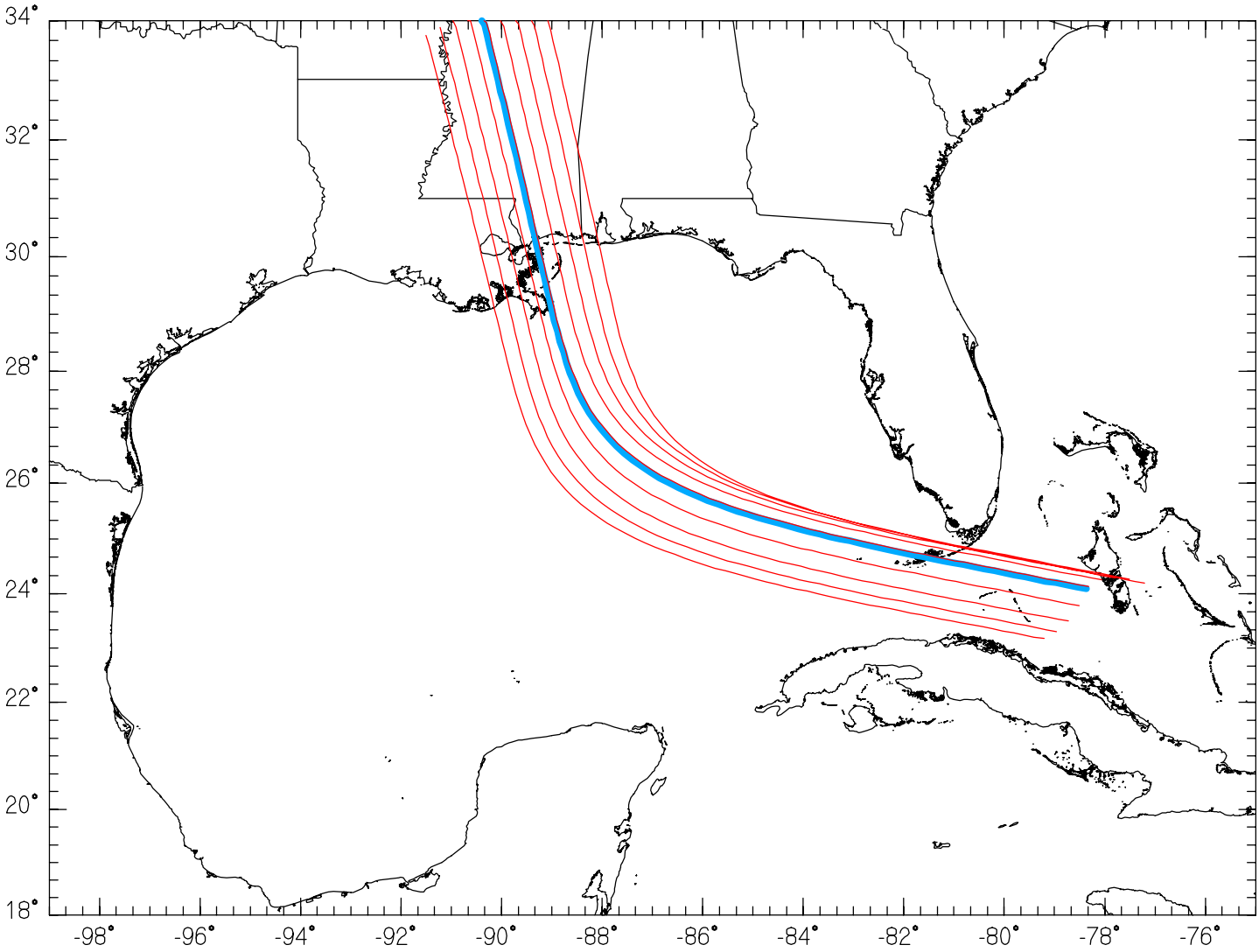
URS JPM-OS6 Production Tracks

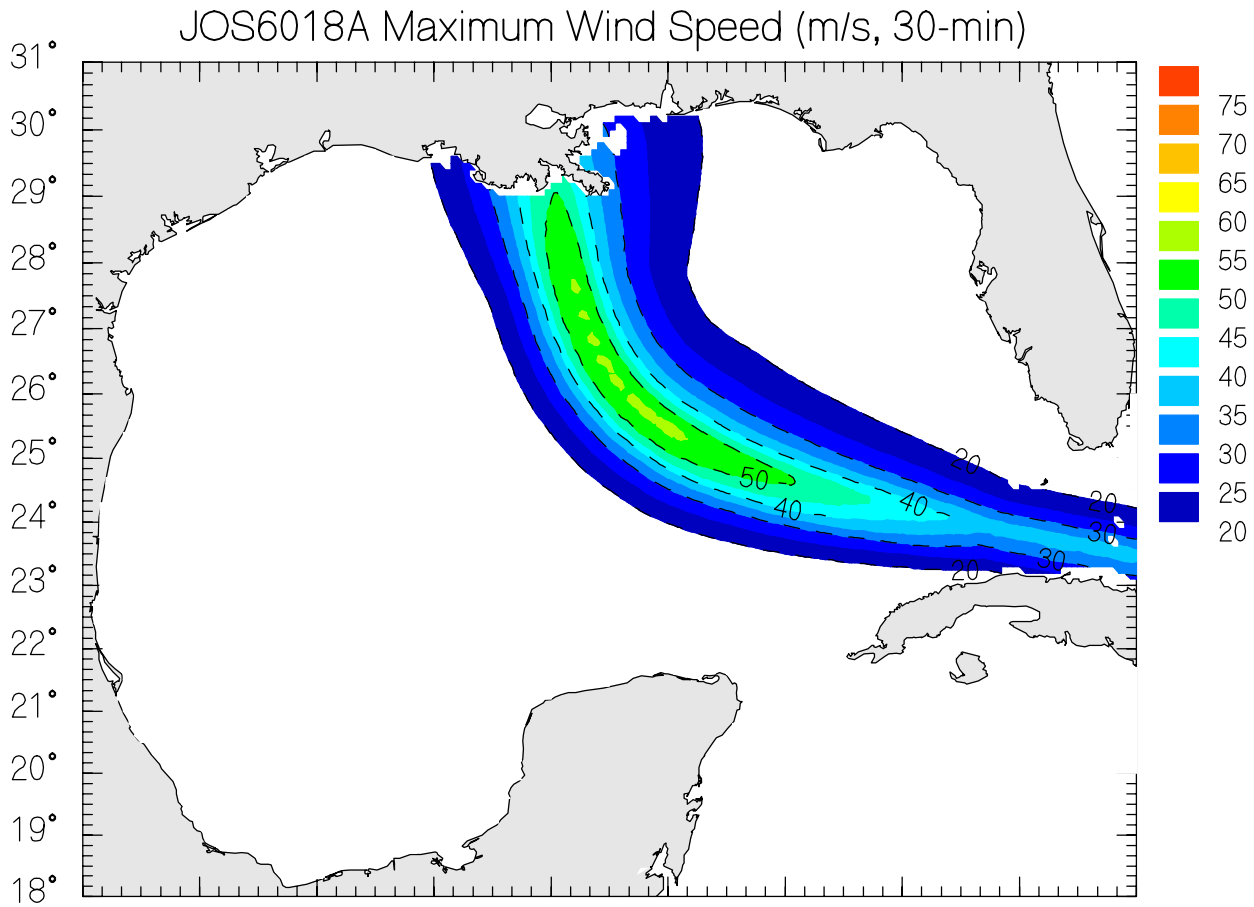
JOS6018 Data

Reference Track — Production Tracks — Production Track Landfall

NWS38 Reference Coastline






JOS6018A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
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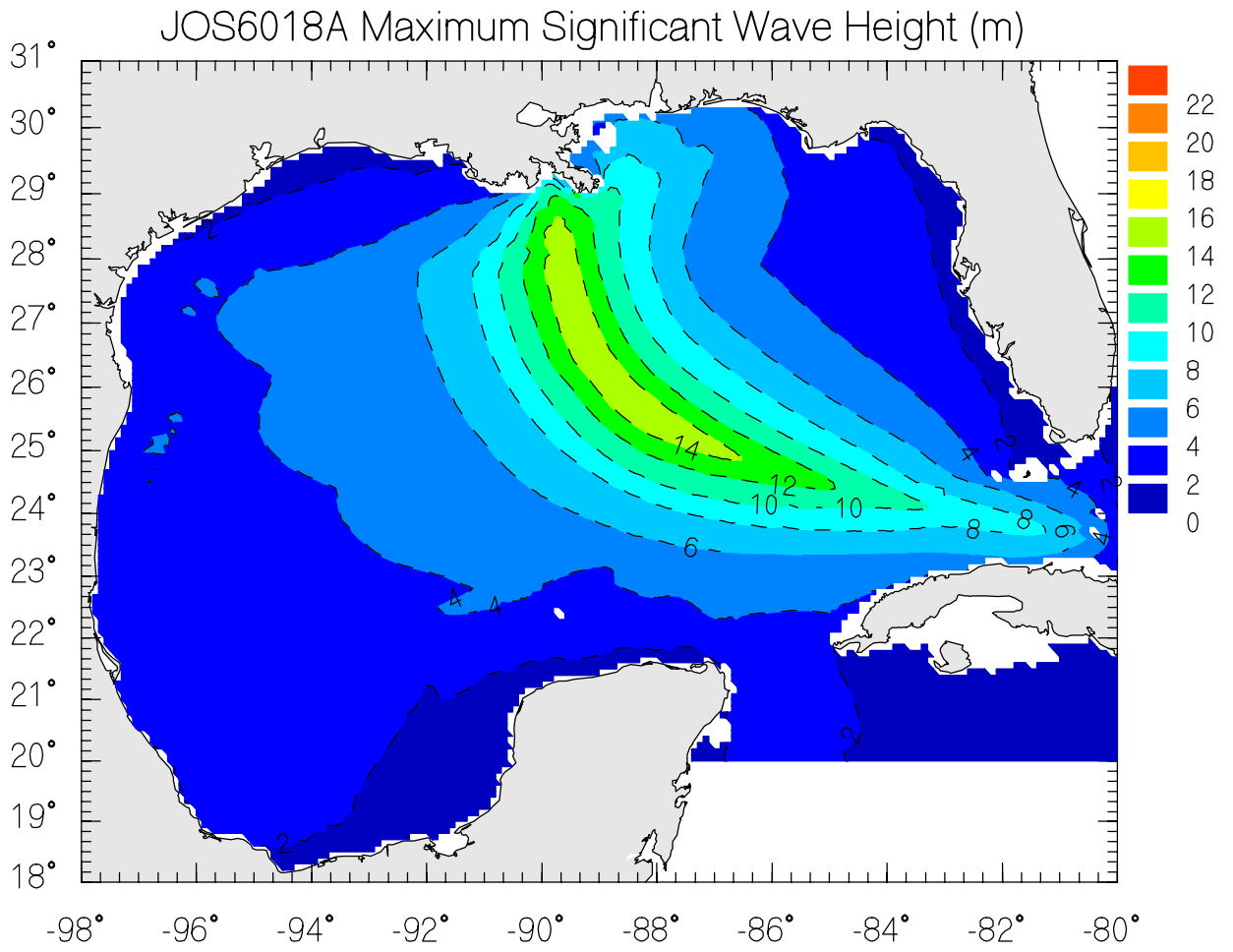
JOS6018A Maximum Significant Wave Height (m)
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29°
28°
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25°
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-98°
-96°
-94°
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-90°
-88°
-86°
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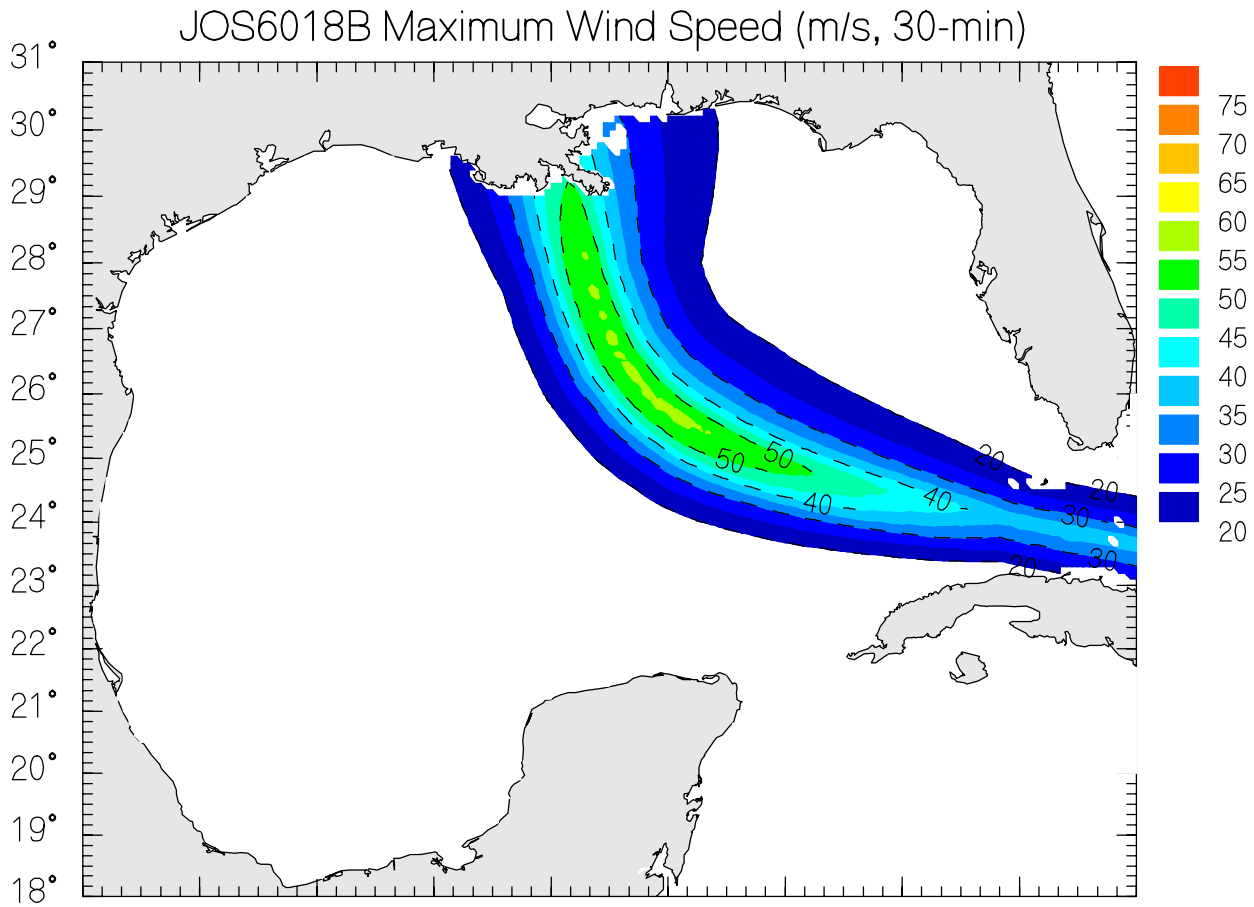
-80°


JOS6018B Maximum Wind Speed (m/s, 30-min)
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30°
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27°
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23°
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21°
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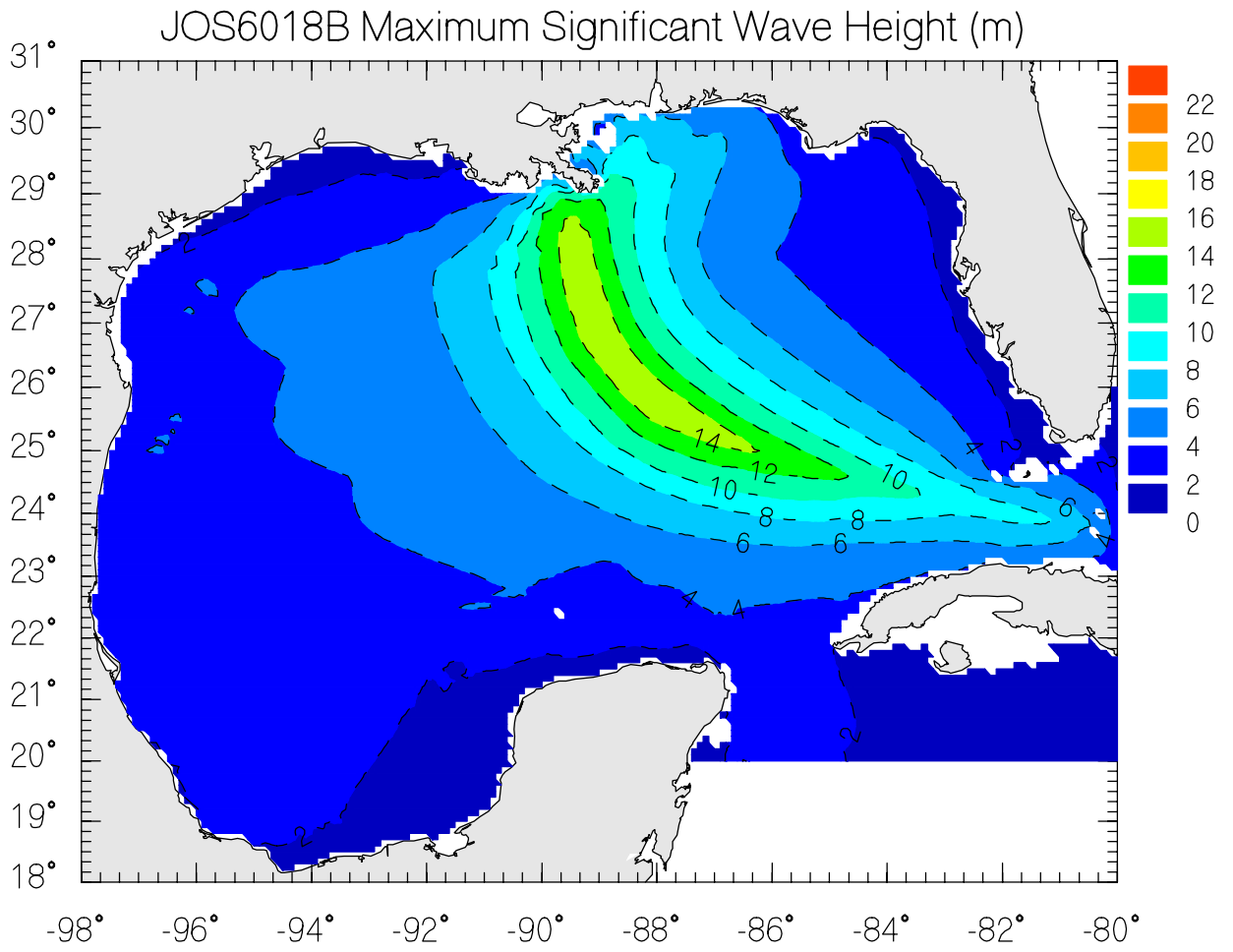
JOS6018B Maximum Significant Wave Height (m)
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27°
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25°
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20°
19°
18°
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-96°
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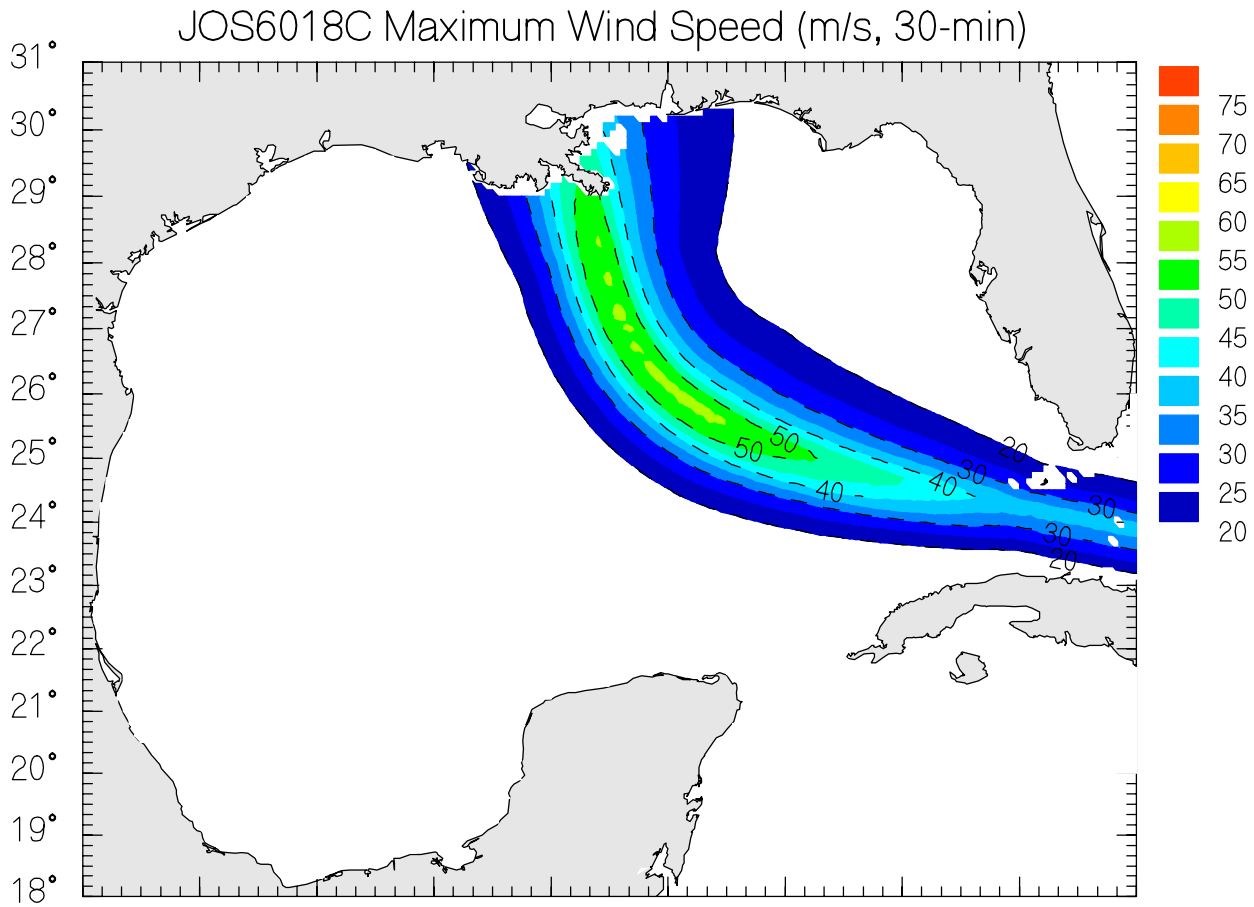
JOS6018C Maximum Wind Speed (m/s, 30-min)
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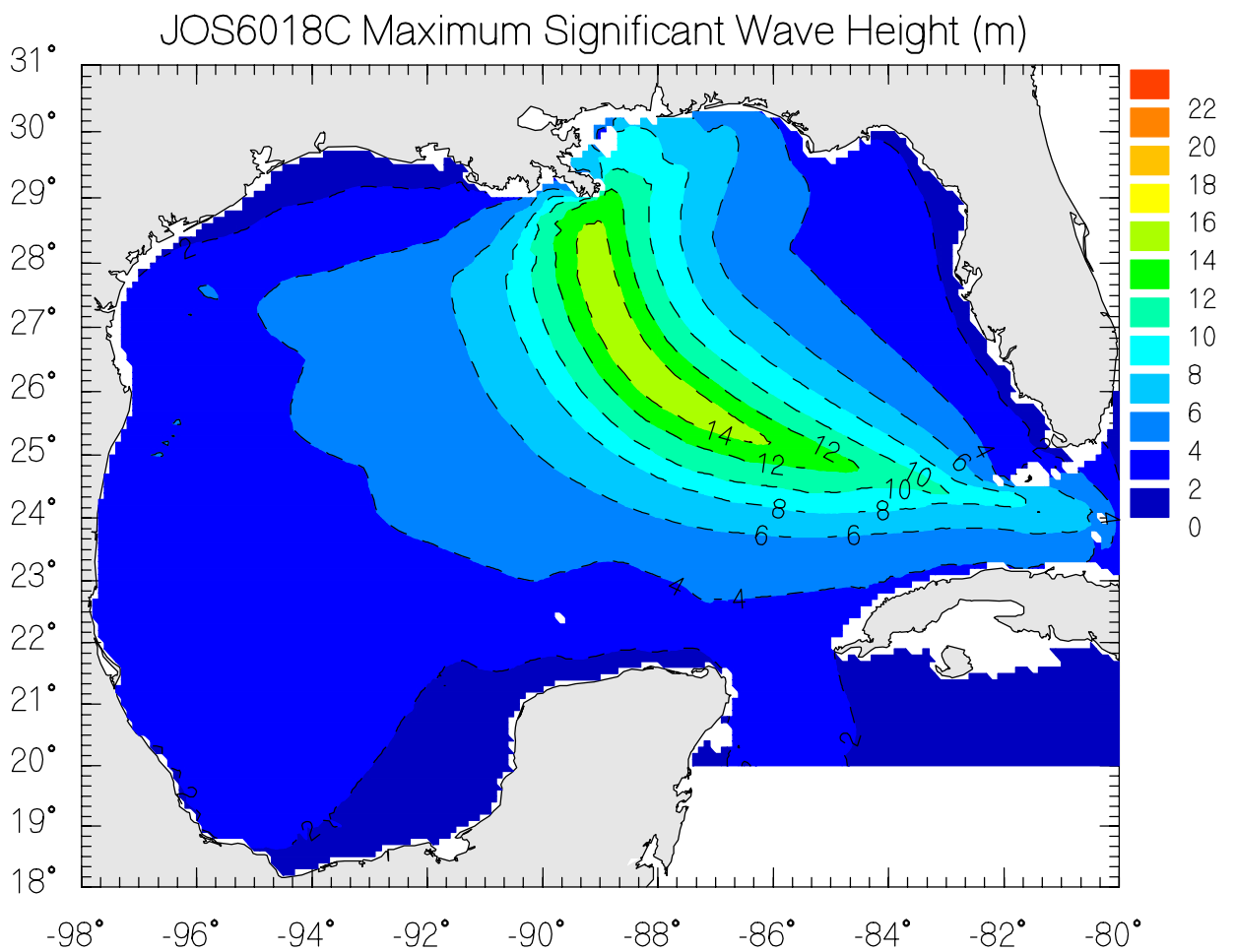
JOS6018C Maximum Significant Wave Height (m)
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19°
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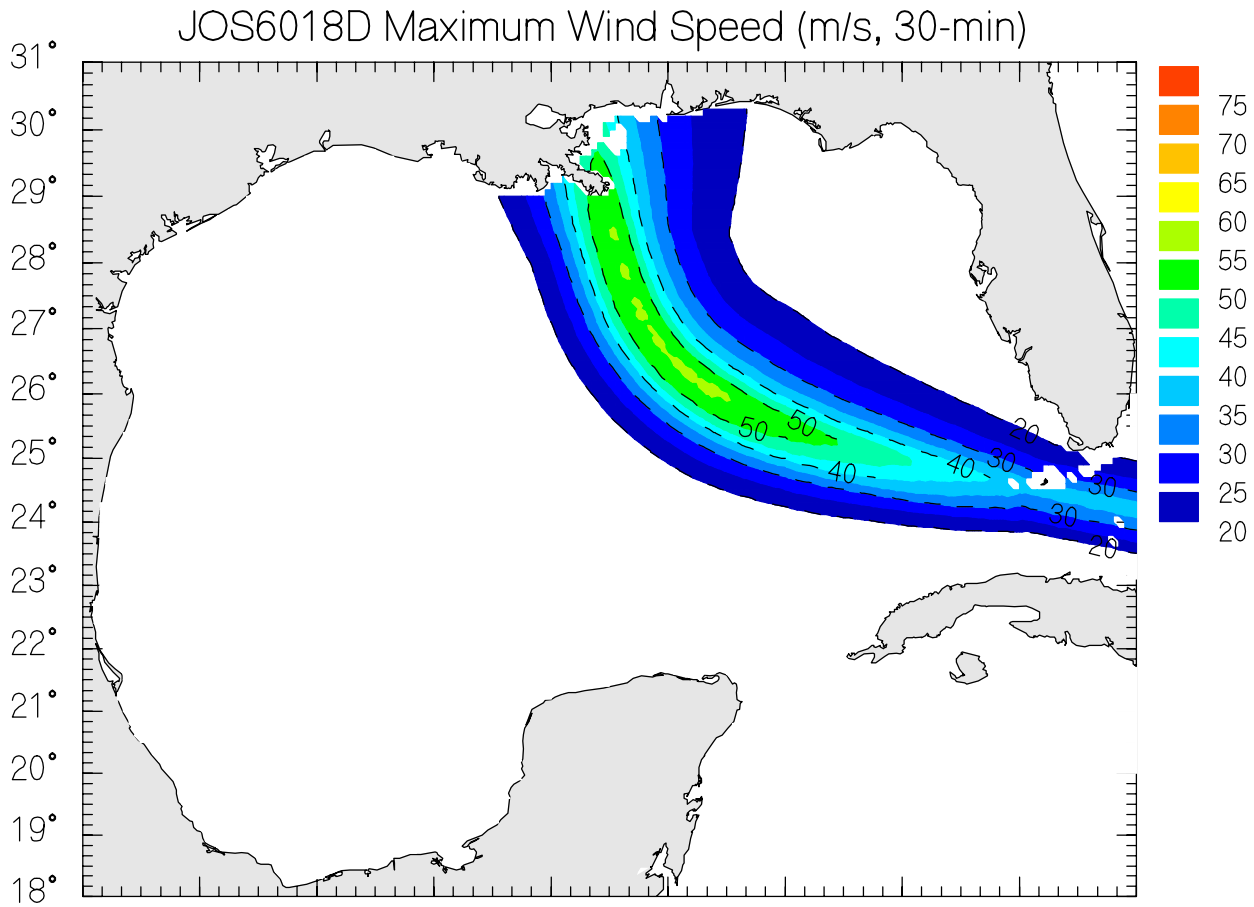
JOS6018D Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
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25°
24°
23°
22°
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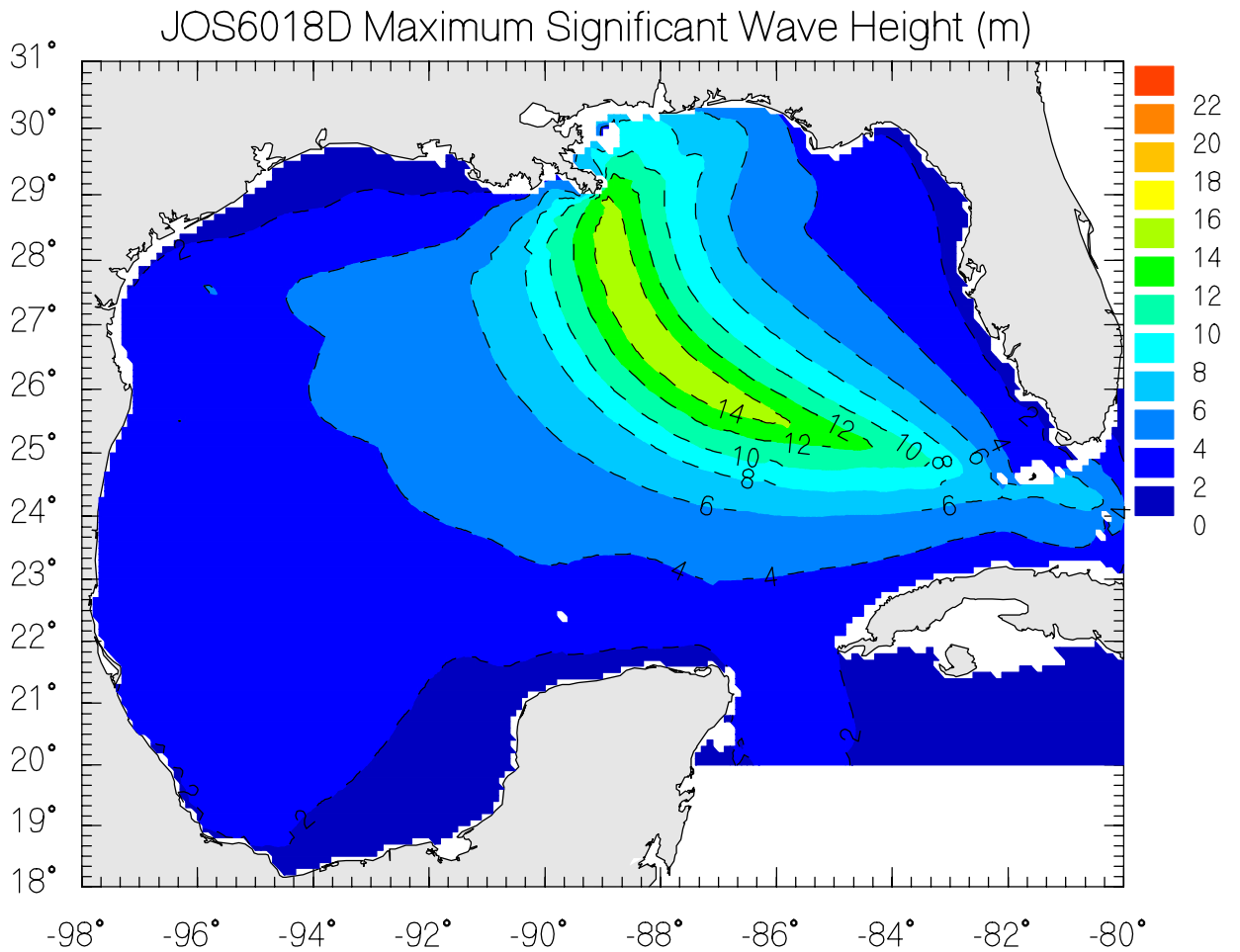
JOS6018D Maximum Significant Wave Height (m)
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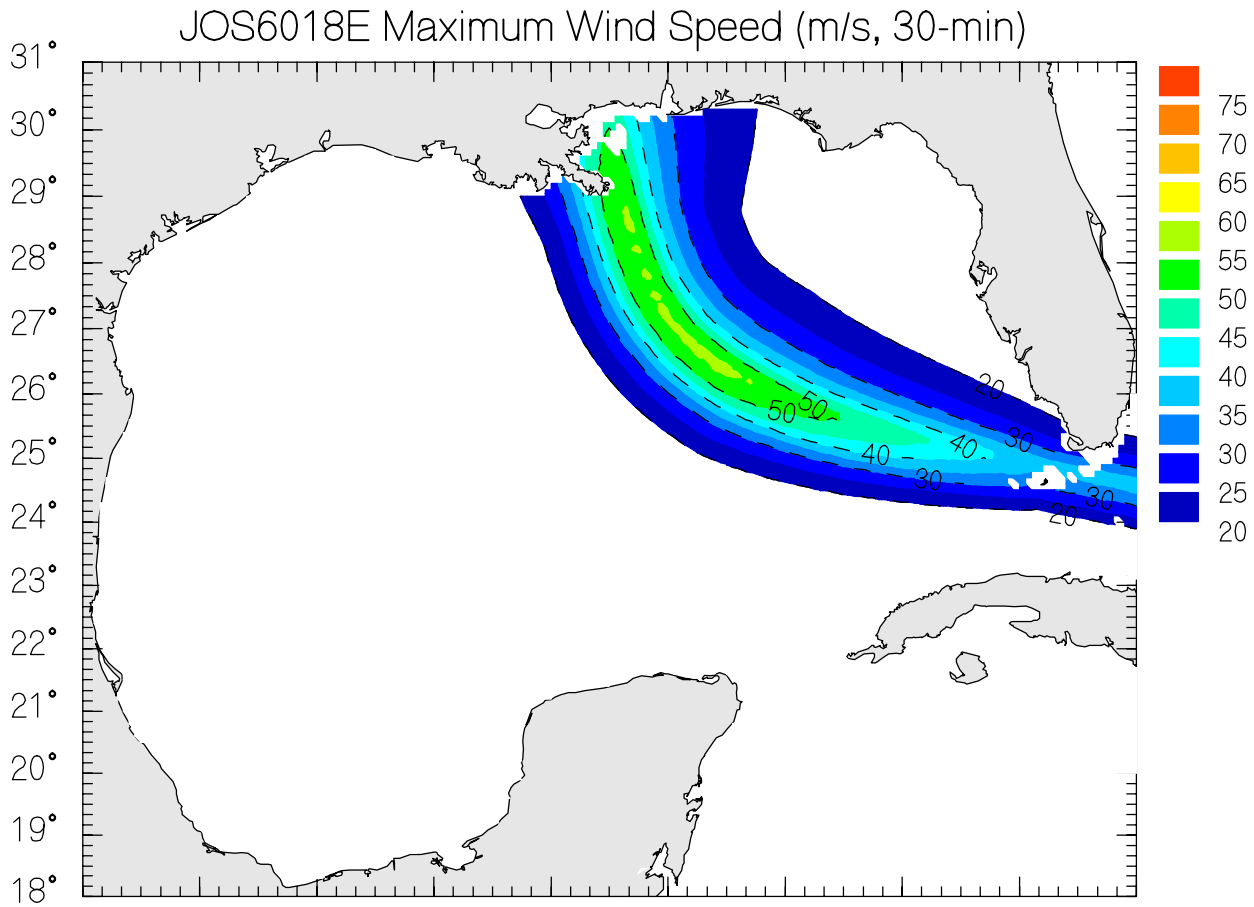
JOS6018E Maximum Wind Speed (m/s, 30-min)
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29°
28°
27°
26°
25°
24°
23°
22°
21°
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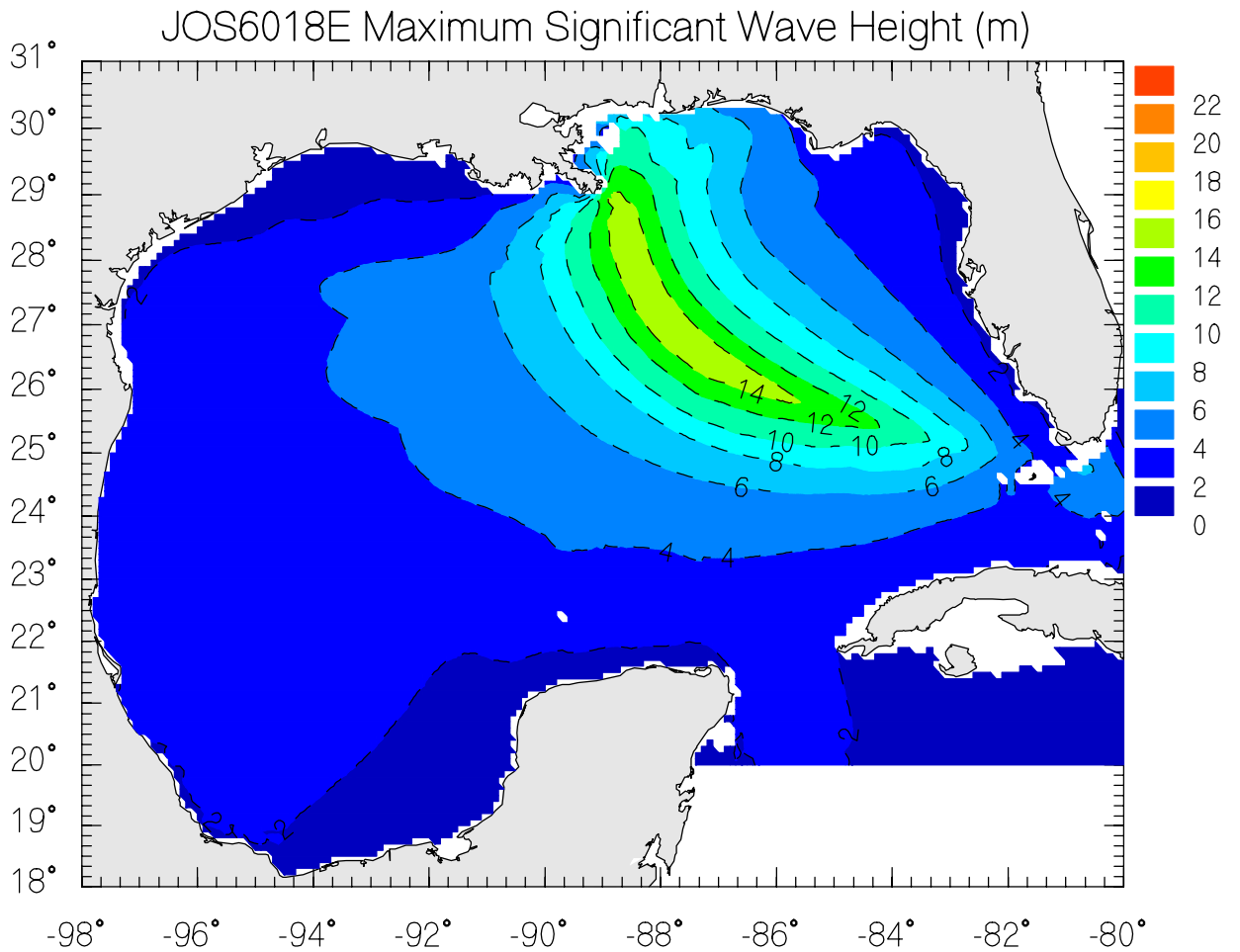
JOS6018E Maximum Significant Wave Height (m)
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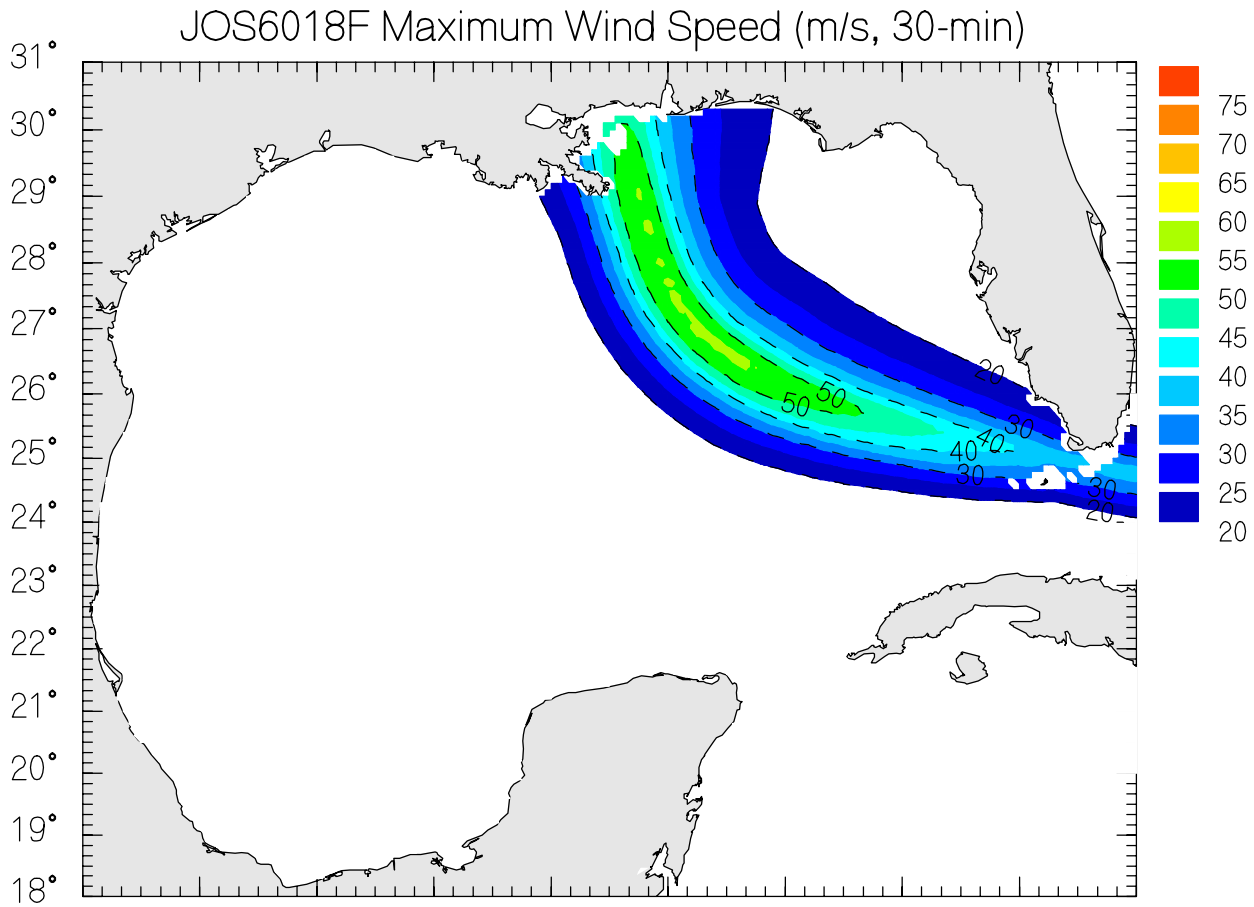
JOS6018F Maximum Wind Speed (m/s, 30-min)
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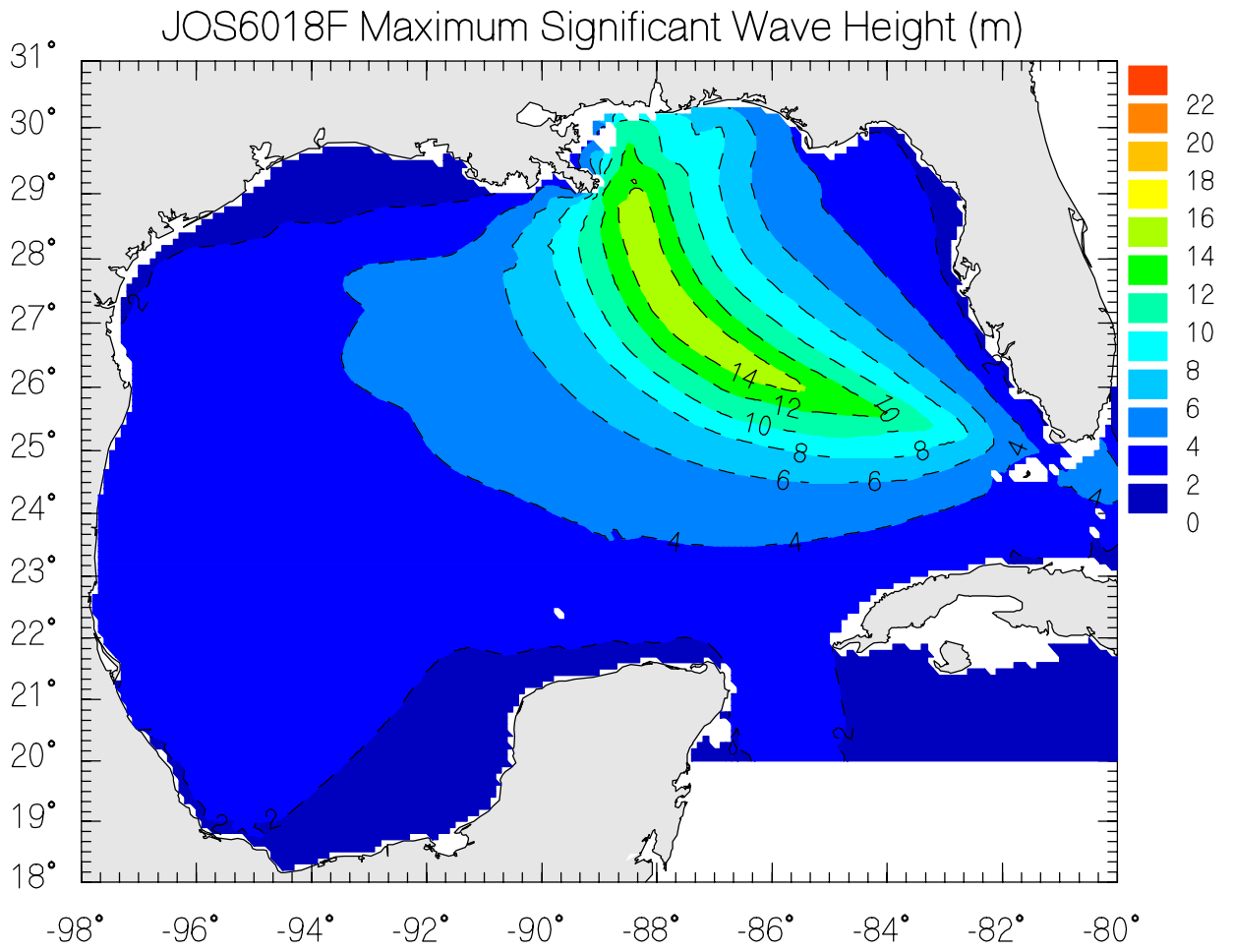
JOS6018F Maximum Significant Wave Height (m)
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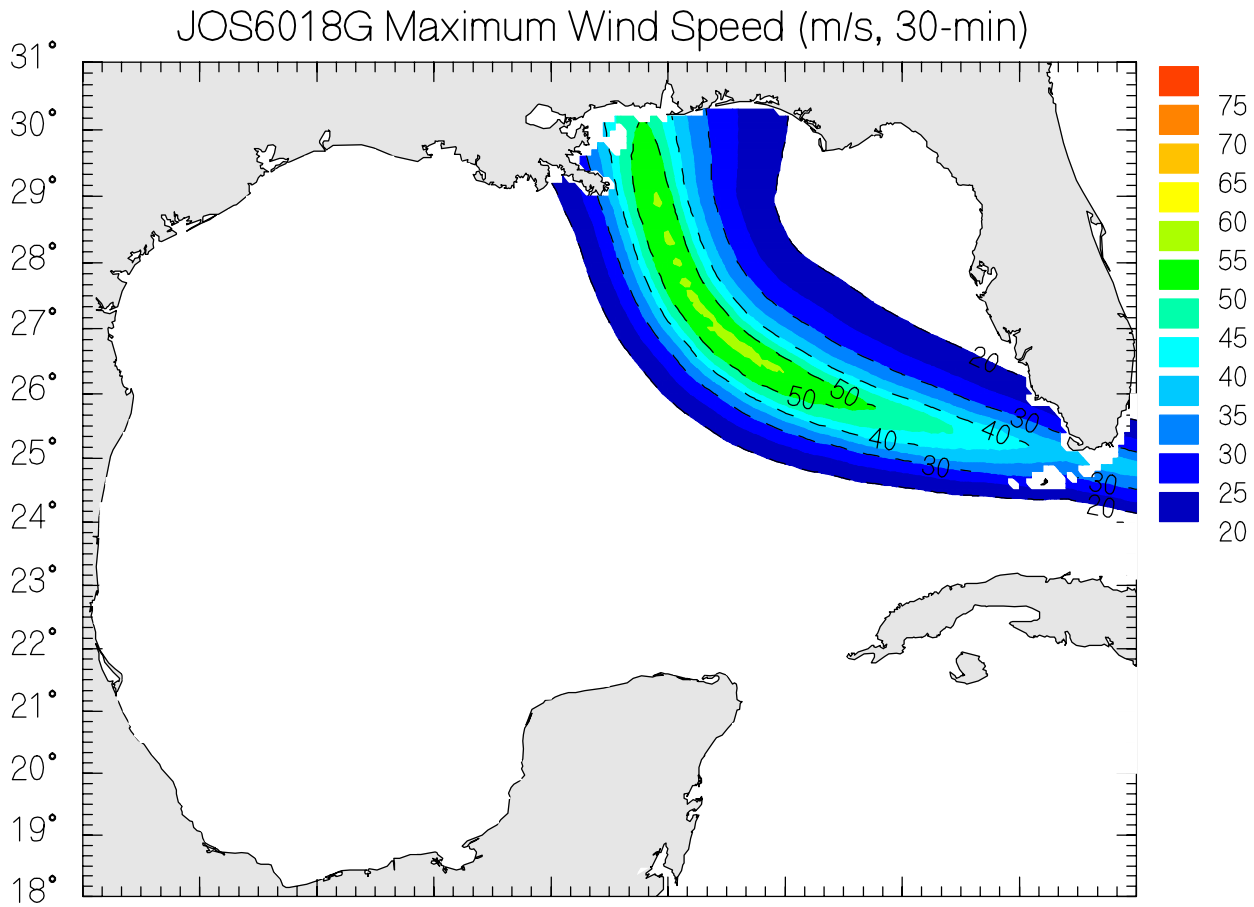
JOS6018G Maximum Wind Speed (m/s, 30-min)
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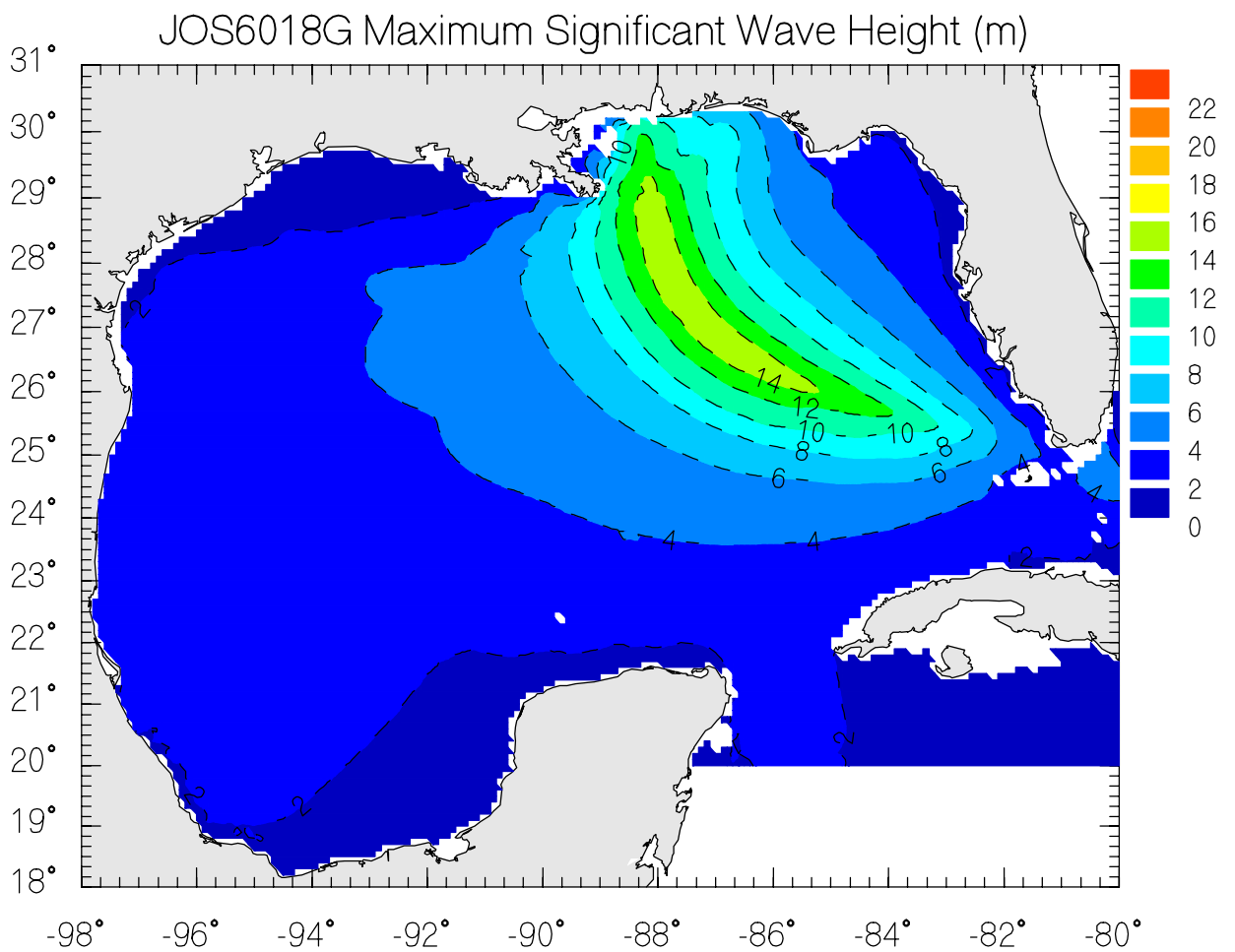
JOS6018G Maximum Significant Wave Height (m)
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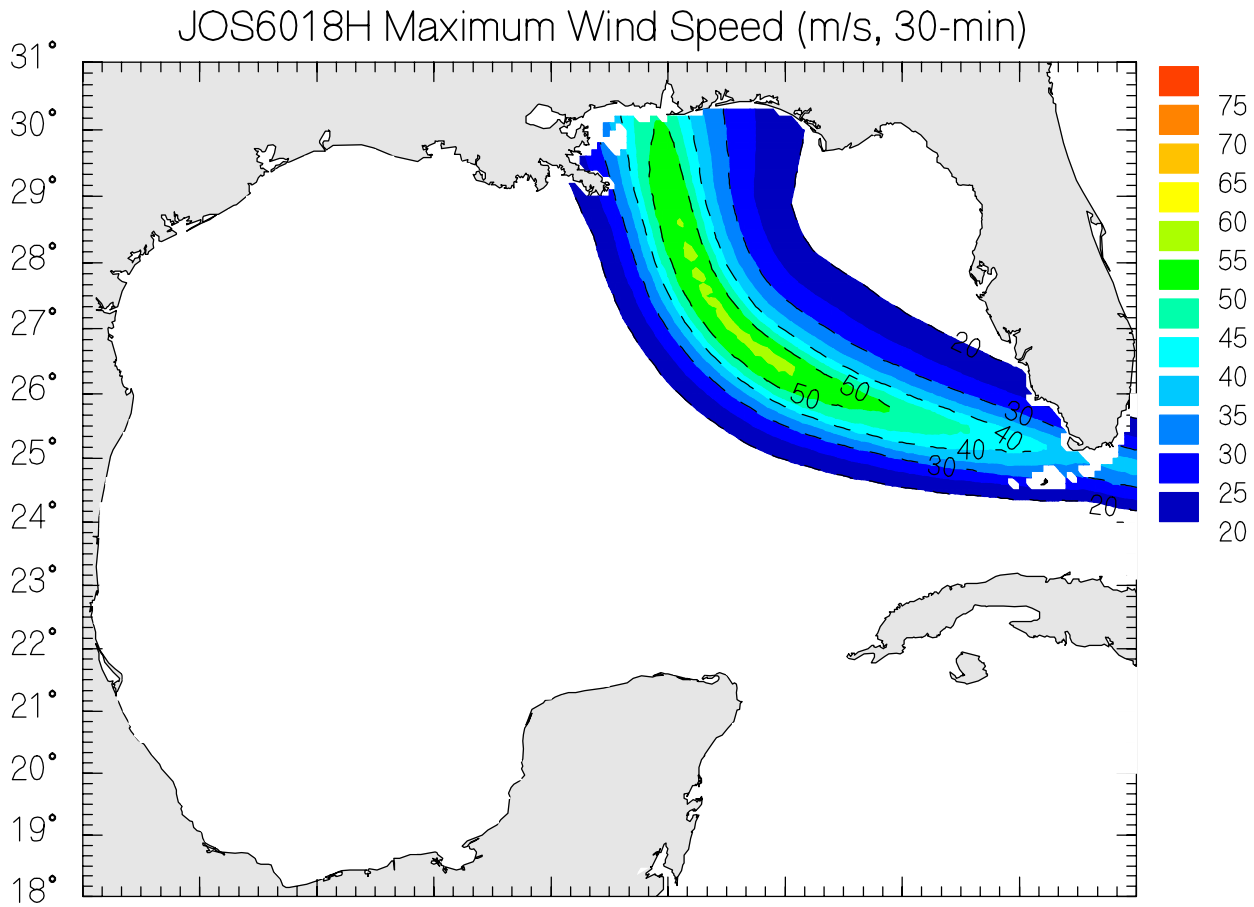
JOS6018H Maximum Wind Speed (m/s, 30-min)
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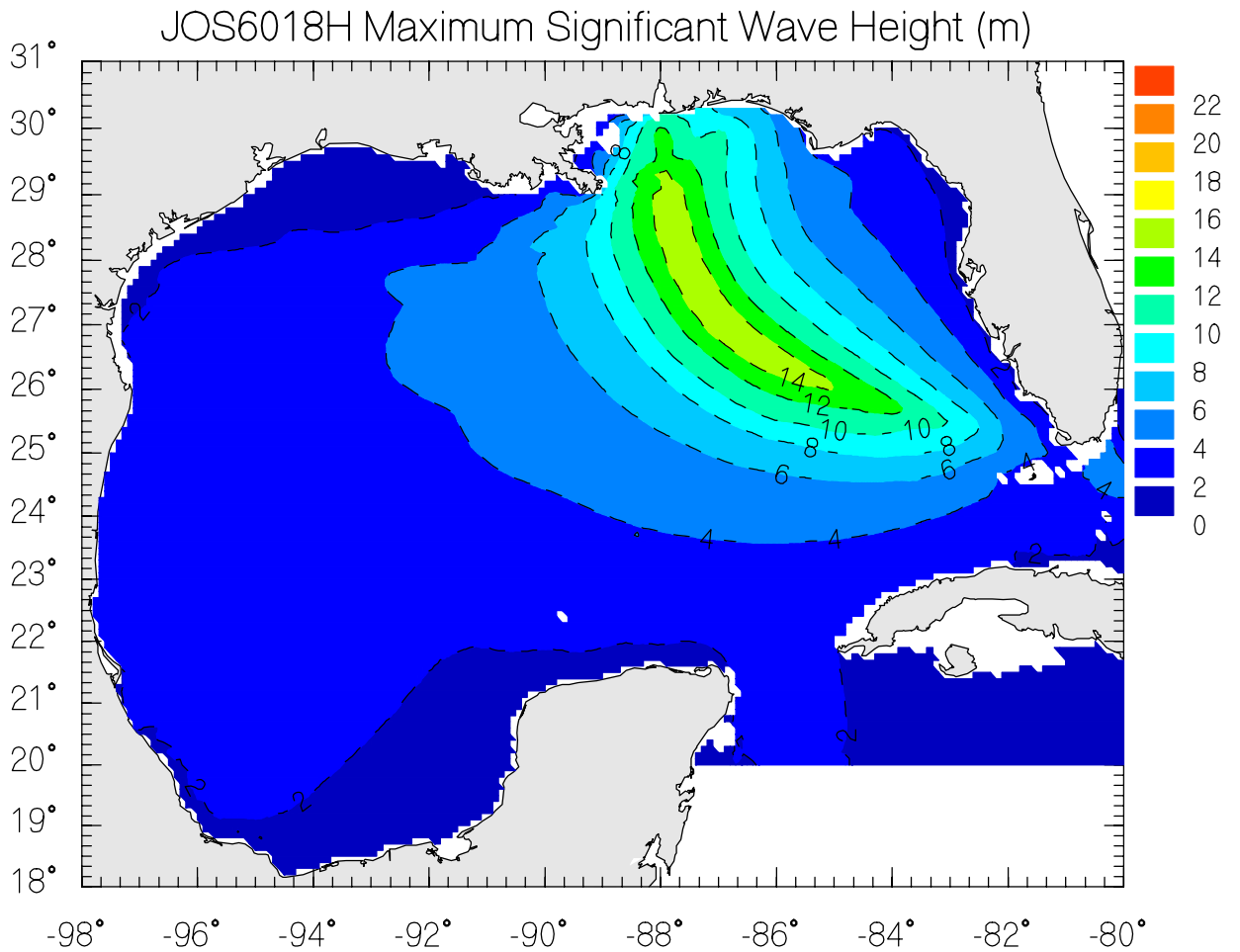
JOS6018H Maximum Significant Wave Height (m)
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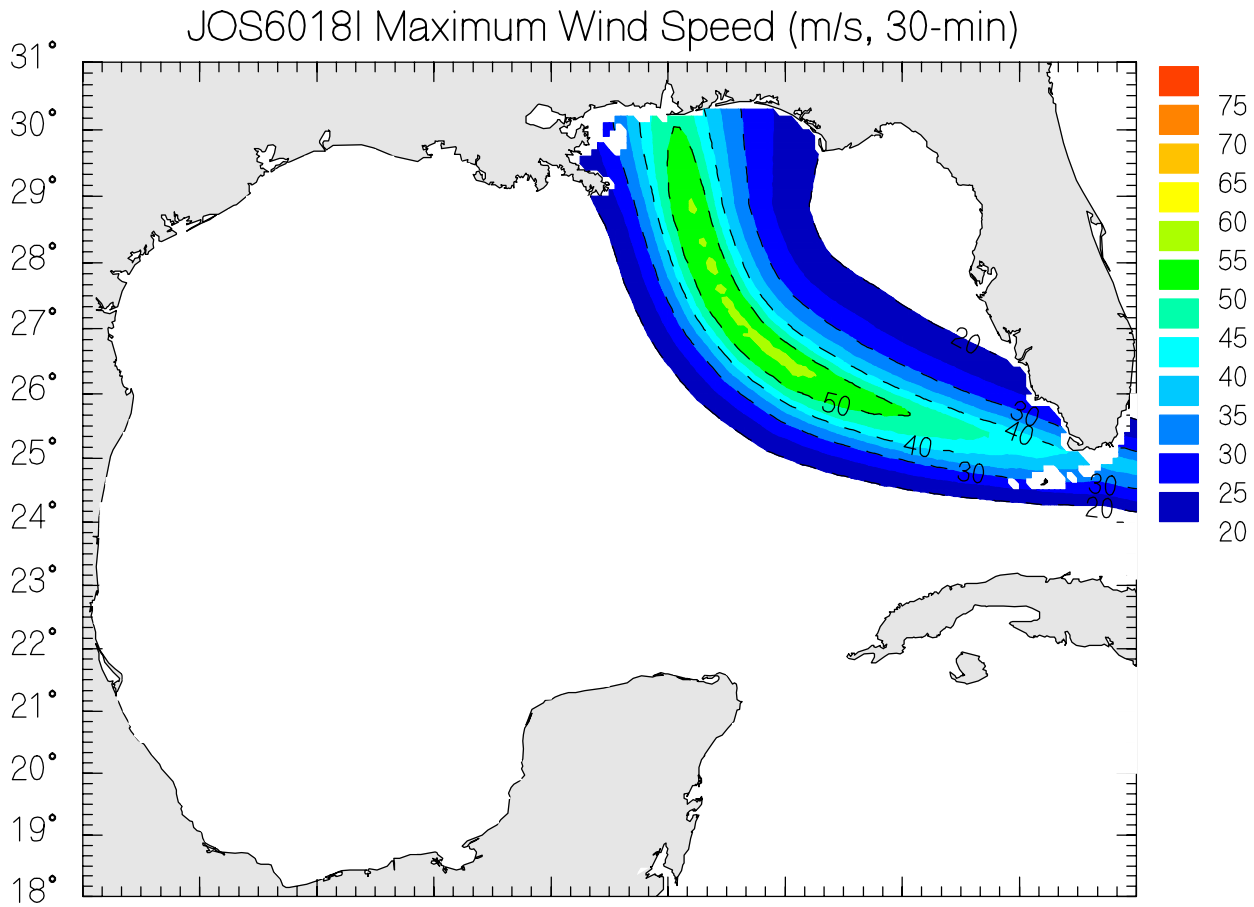
JOS6018I Maximum Wind Speed (m/s, 30-min)
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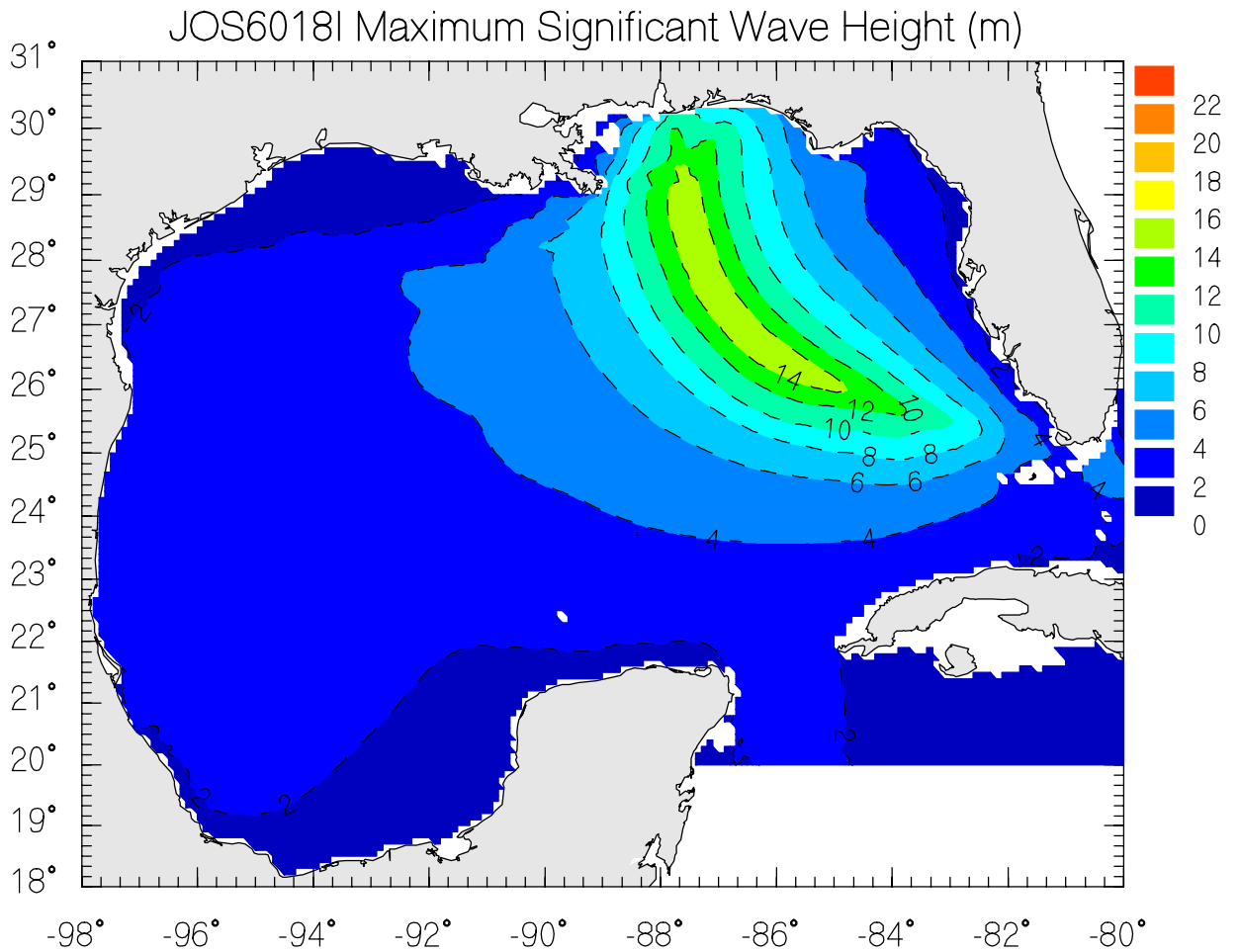
JOS6018I Maximum Significant Wave Height (m)
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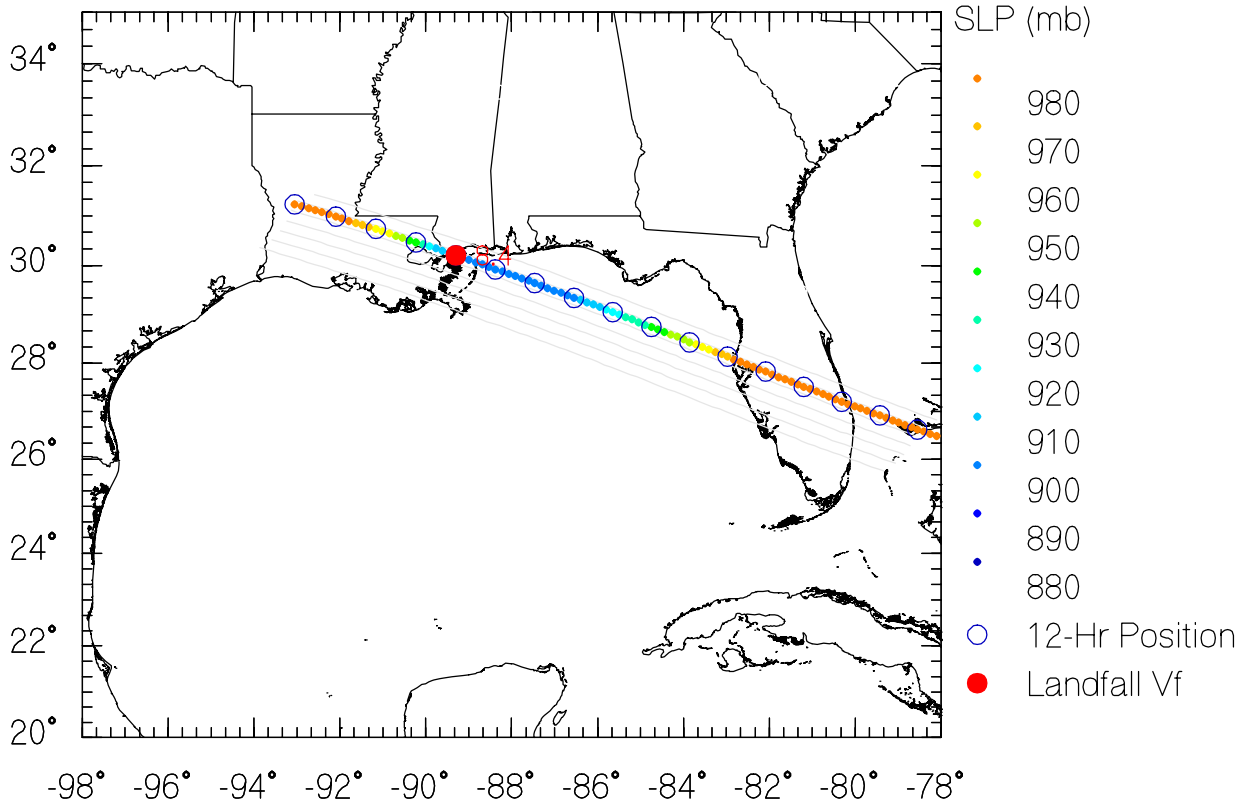
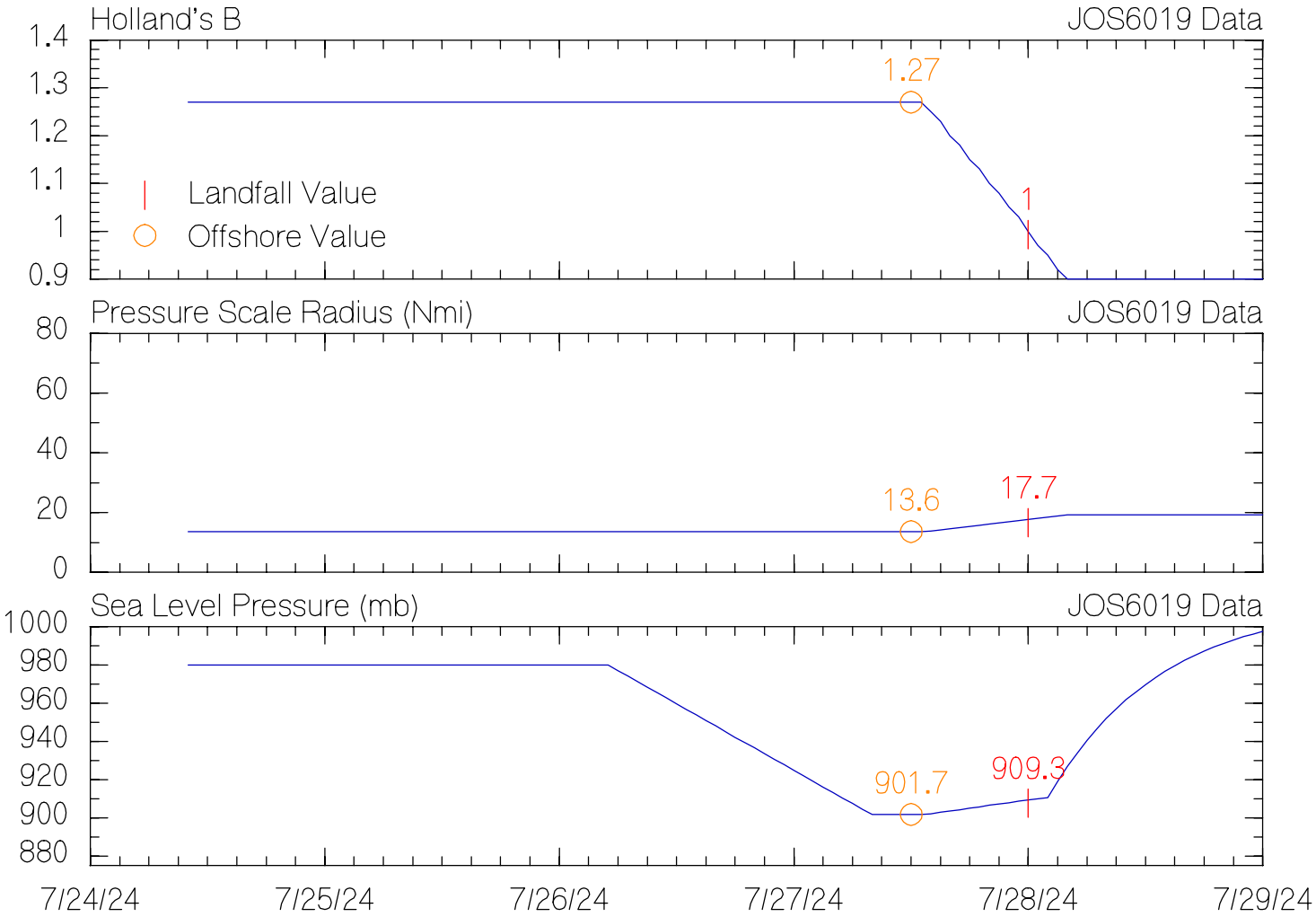
JOS6019 Data

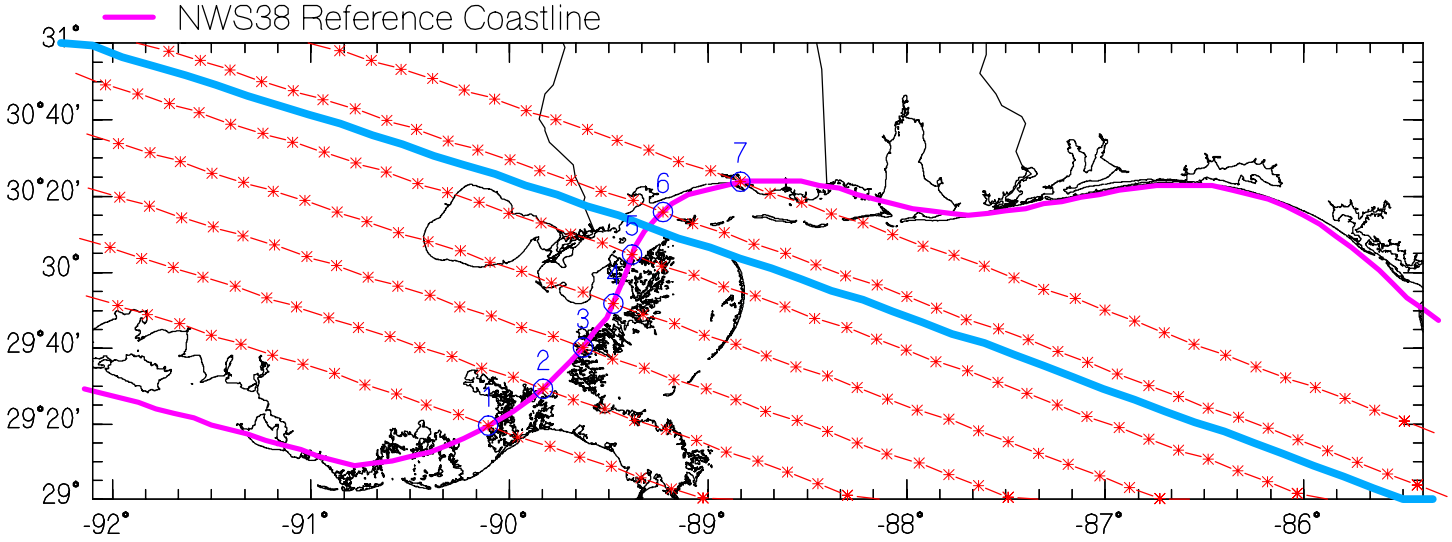


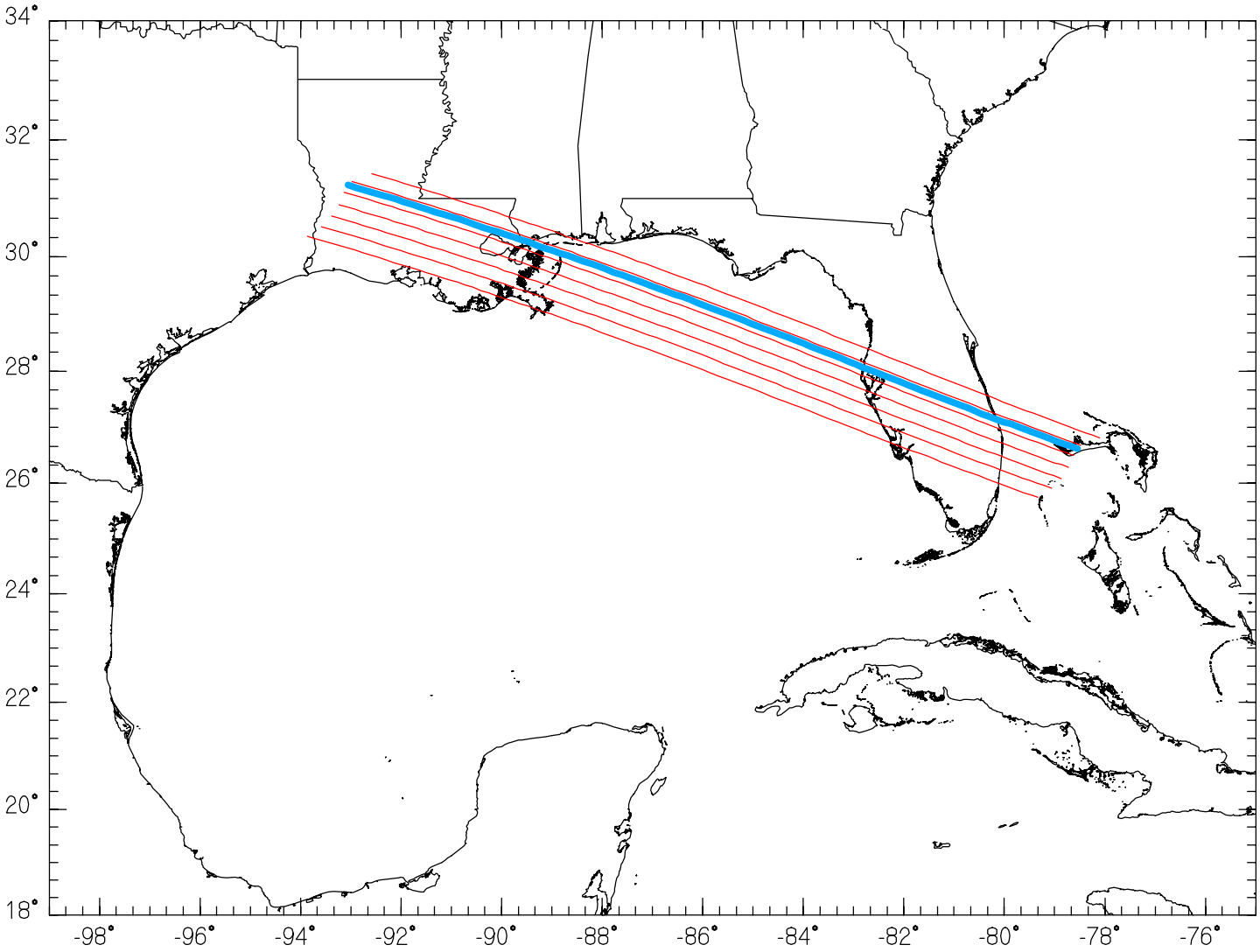


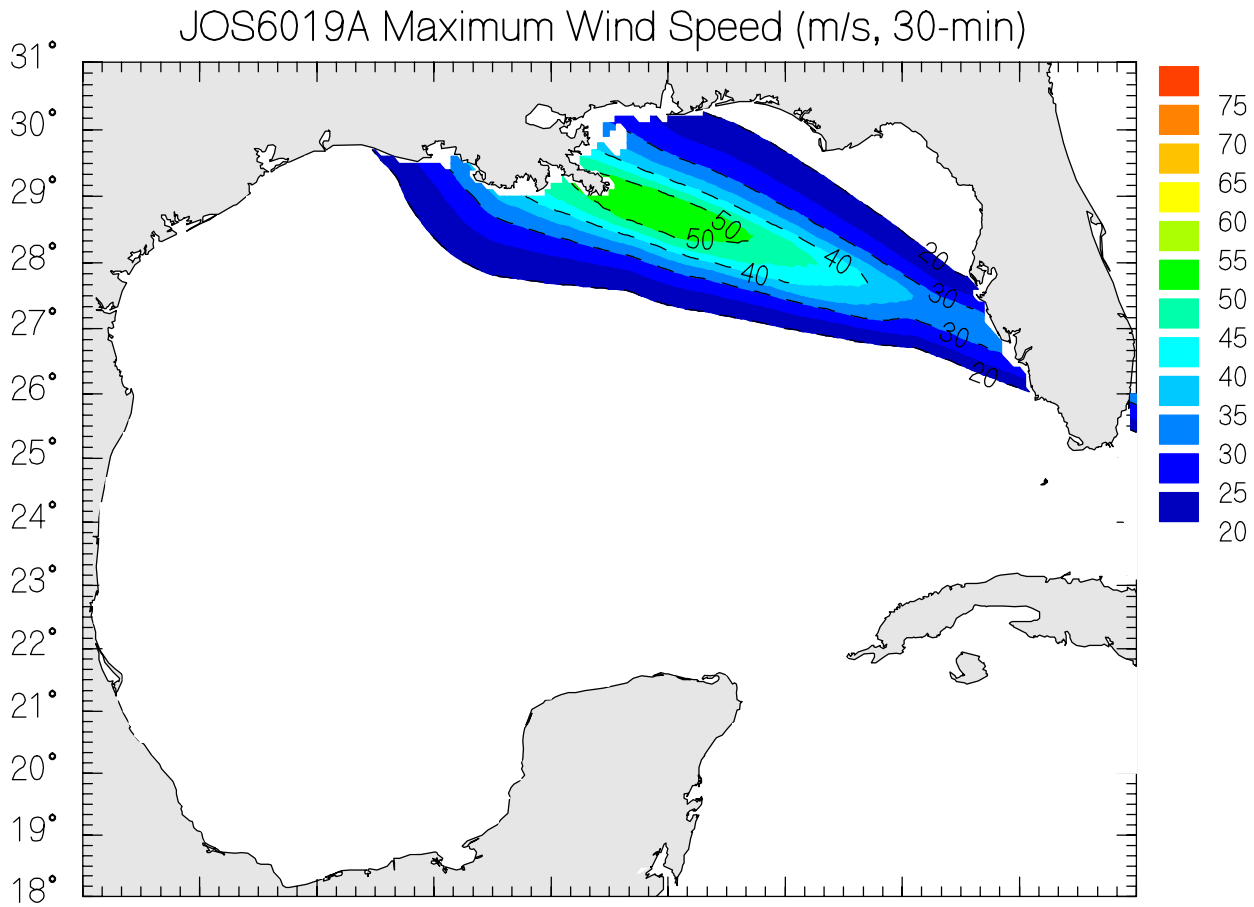
URS JPM-OS6 Production Tracks

JOS6019 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






JOS6019A Maximum Wind Speed (m/s, 30-min)
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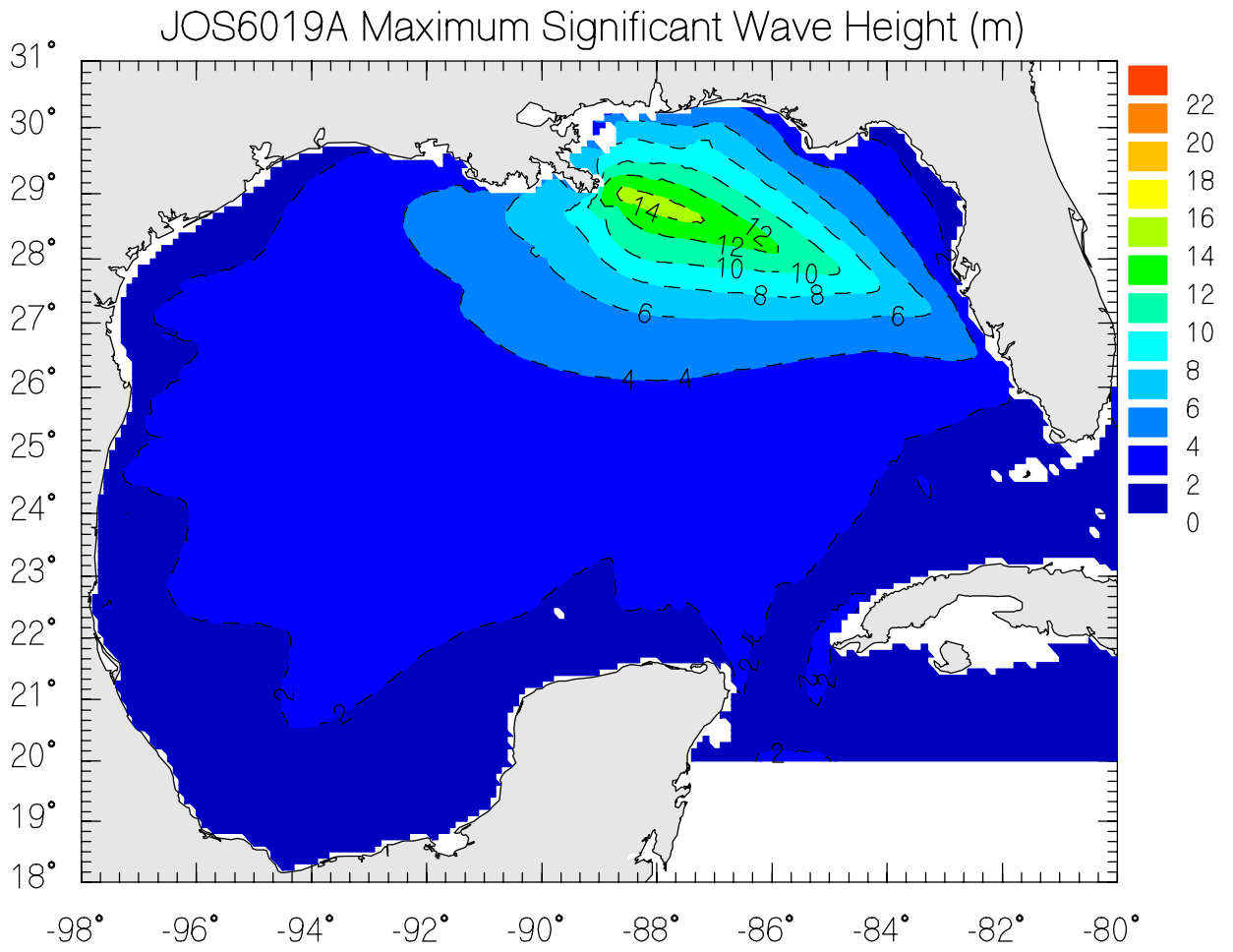
JOS6019A Maximum Significant Wave Height (m)
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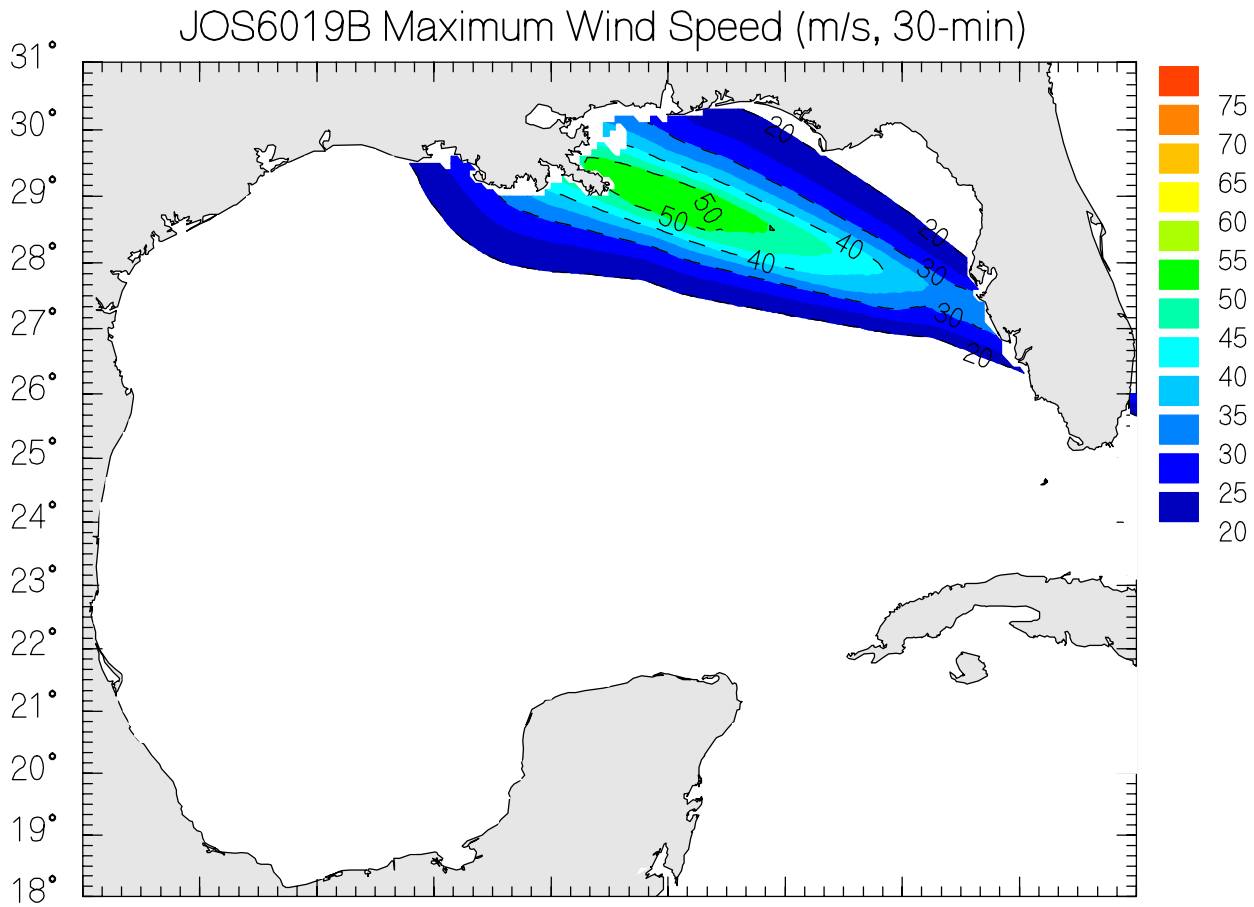
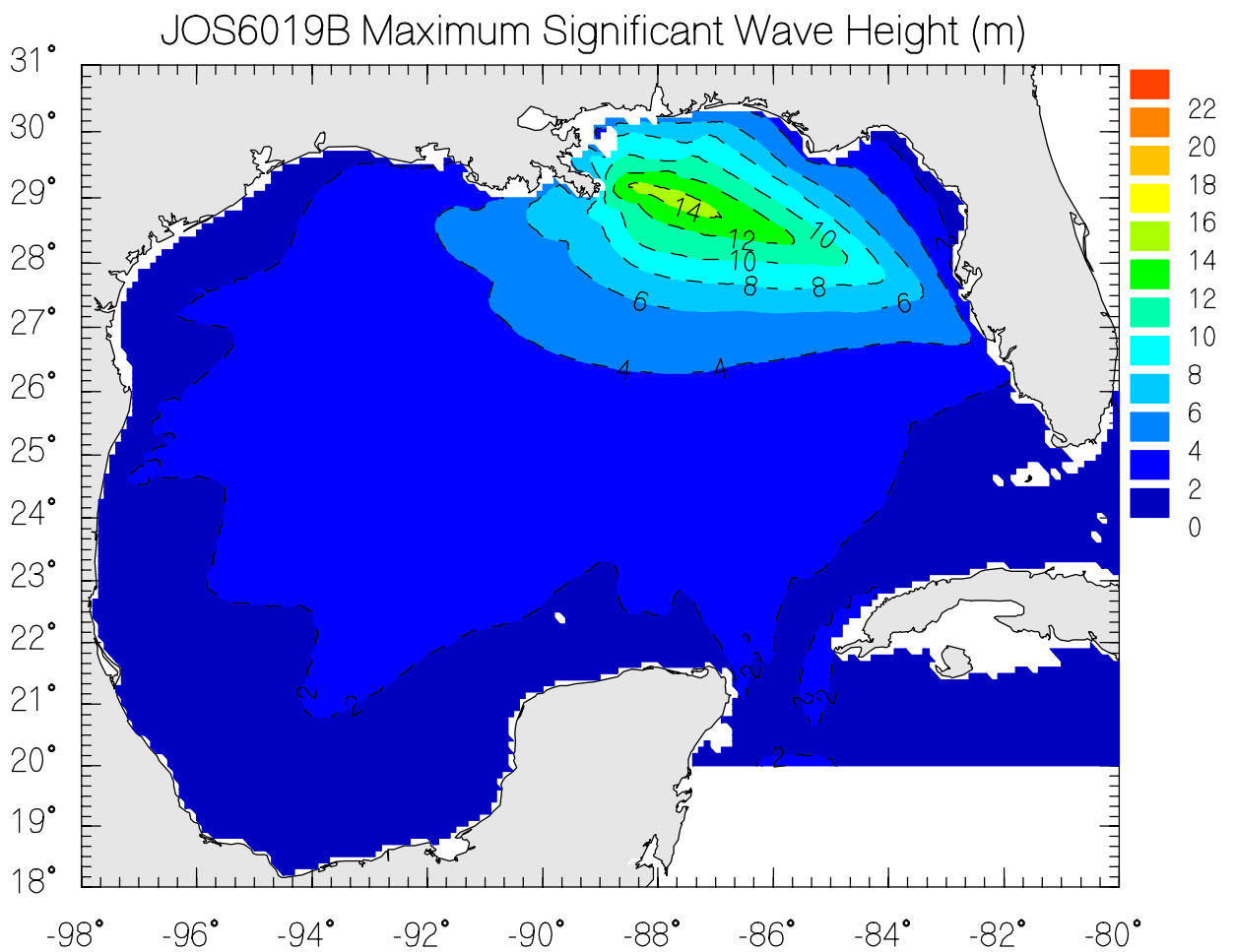
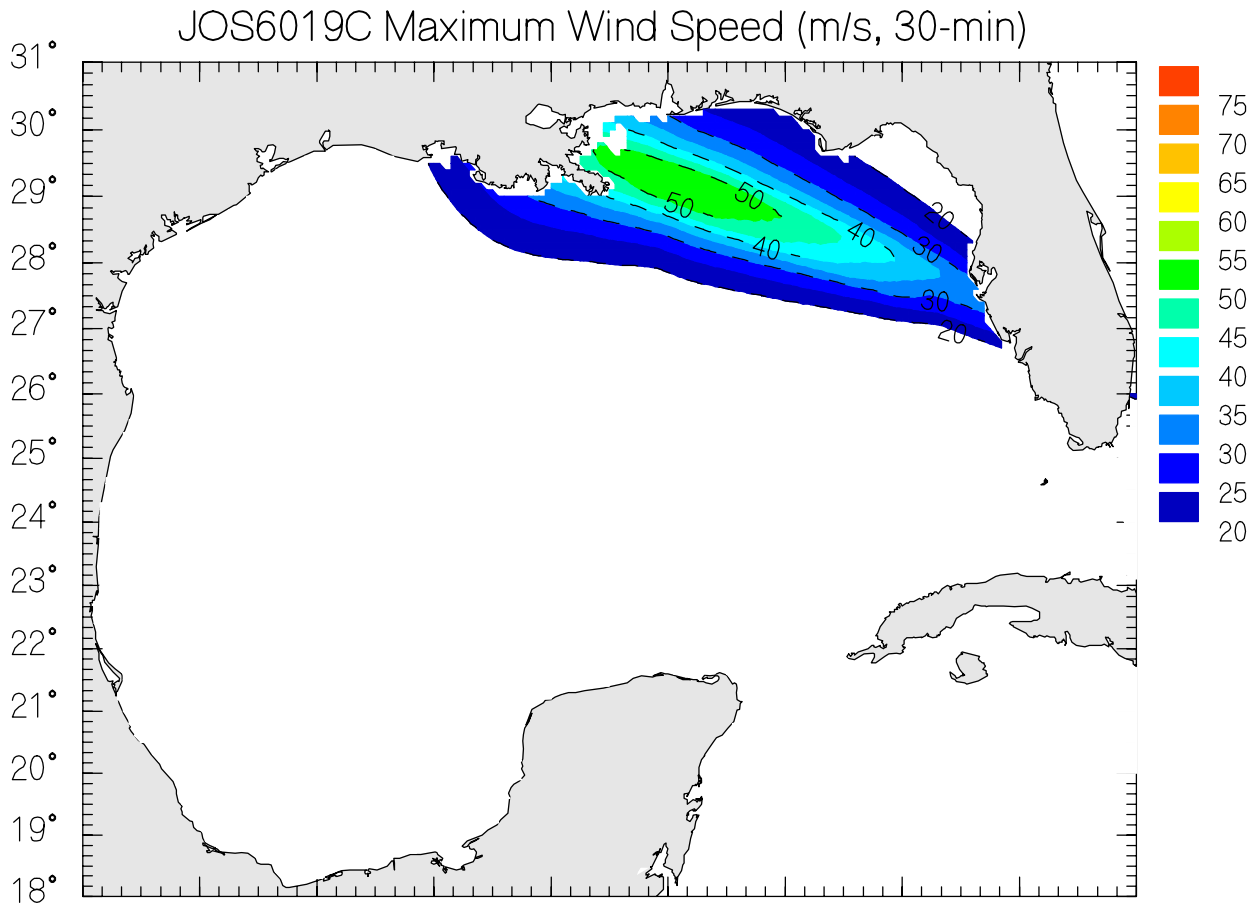

JOS6019B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6019B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0


JOS6019C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
50
50
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30
30
20
20
75
70
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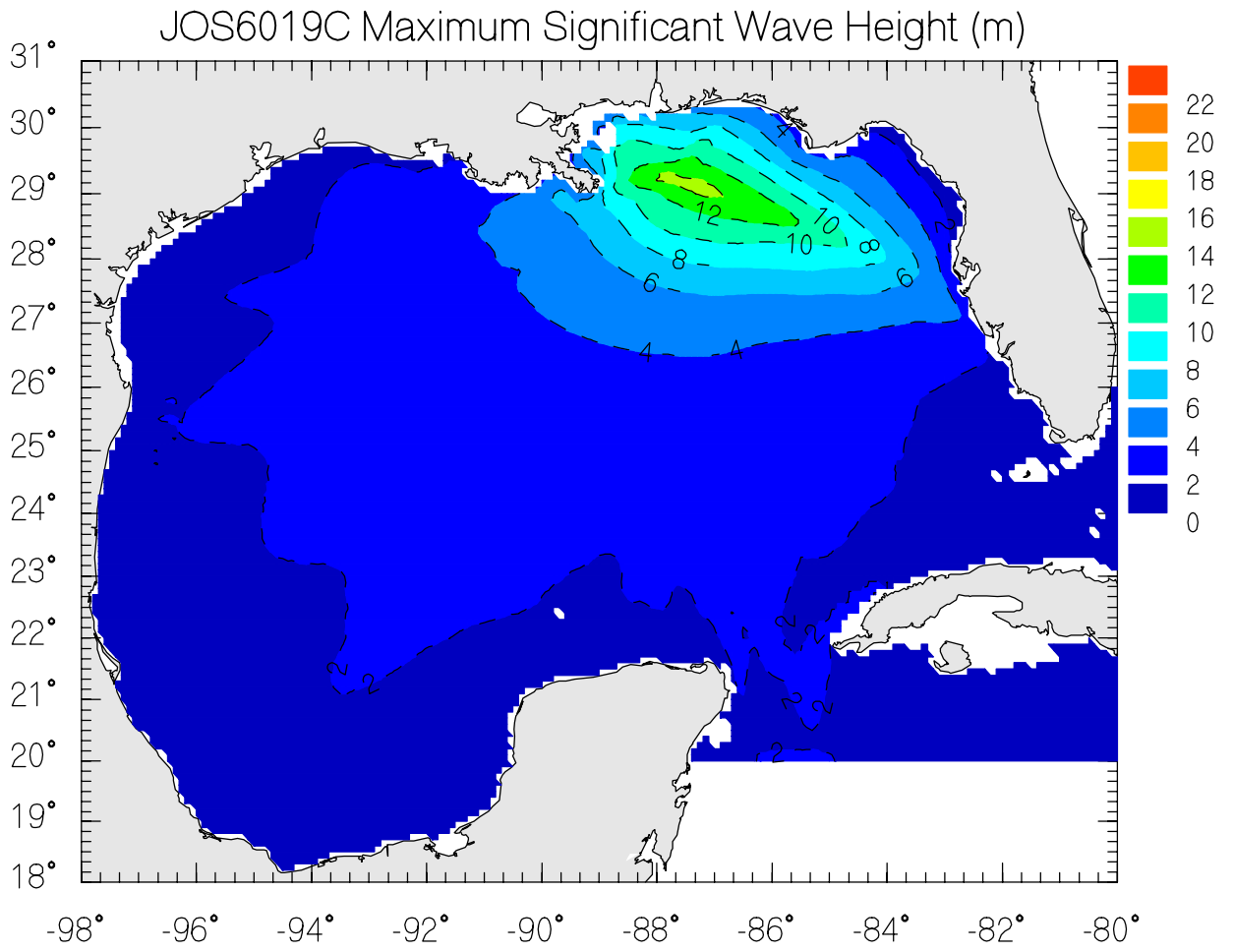
60
55
50
45
40
35
30
25
20


JOS6019C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
12
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8
6
4
2
22
20
18
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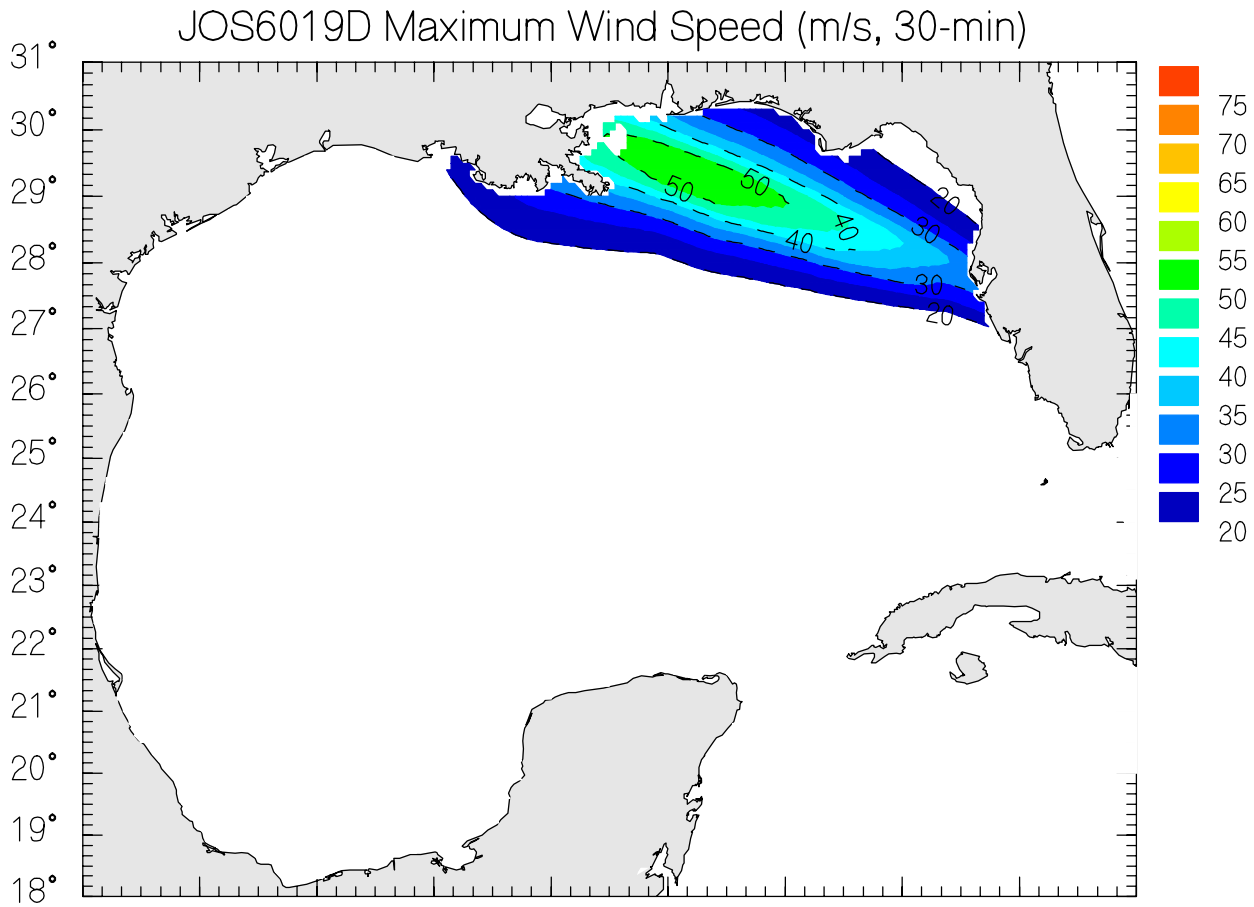
14
12
10
8
6
4
2
0


JOS6019D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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20
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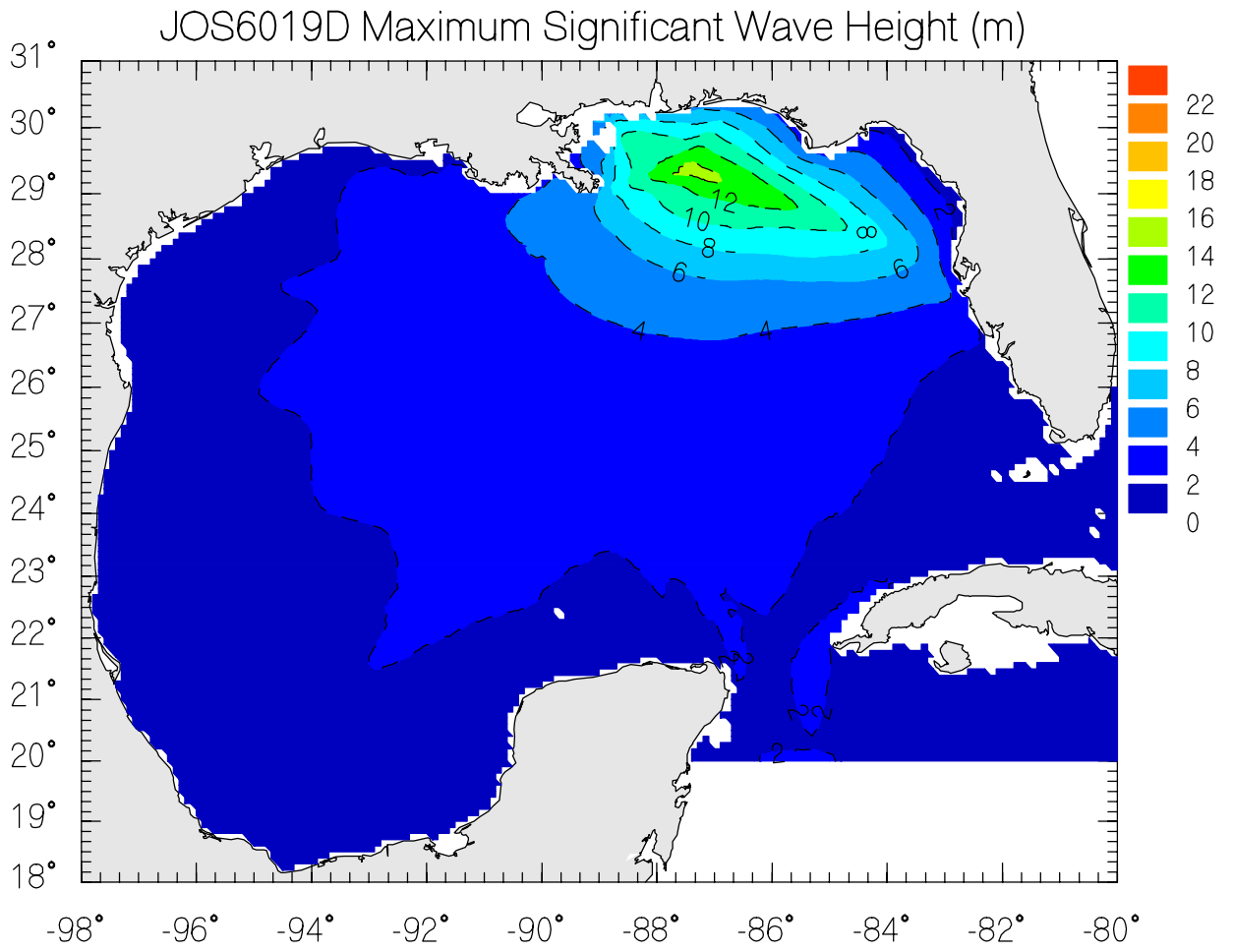
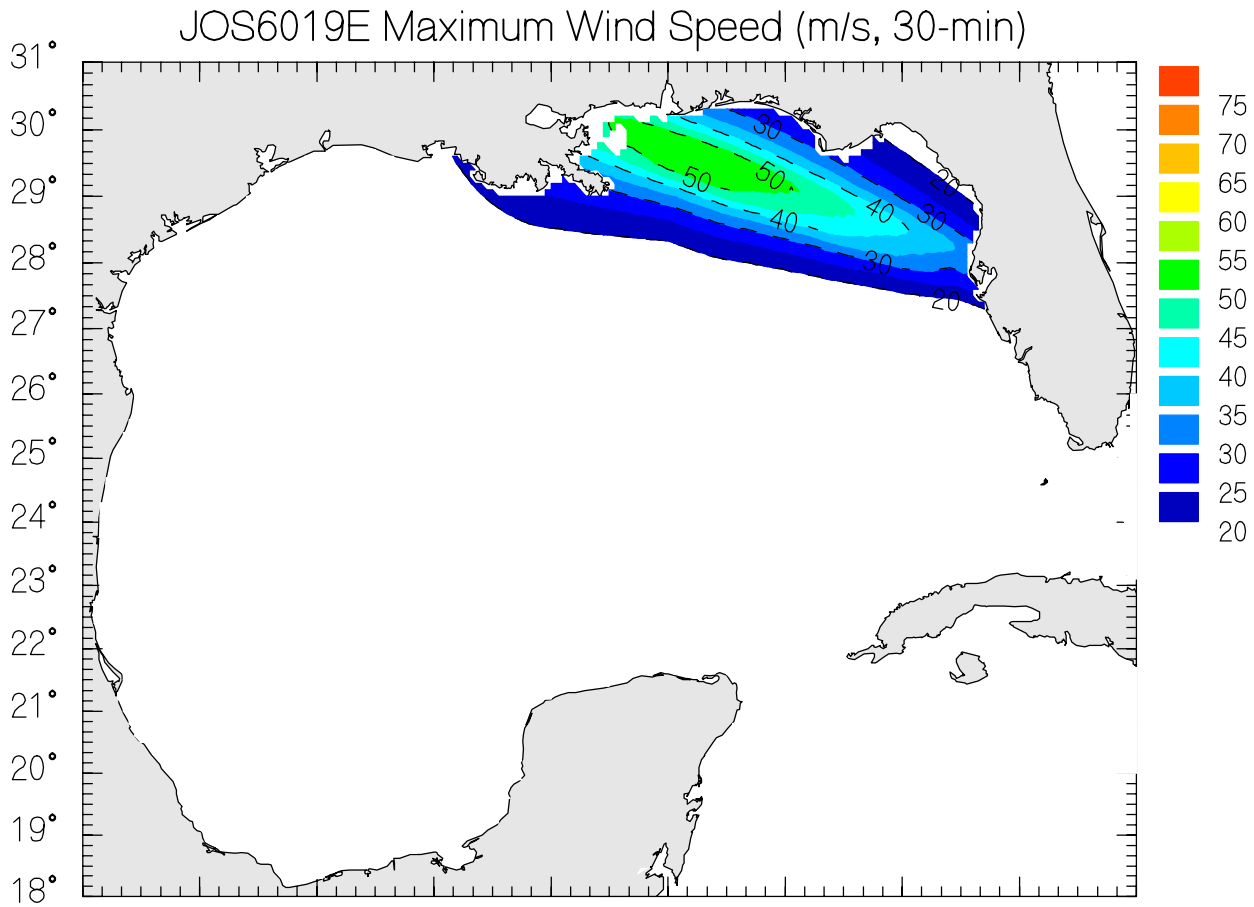
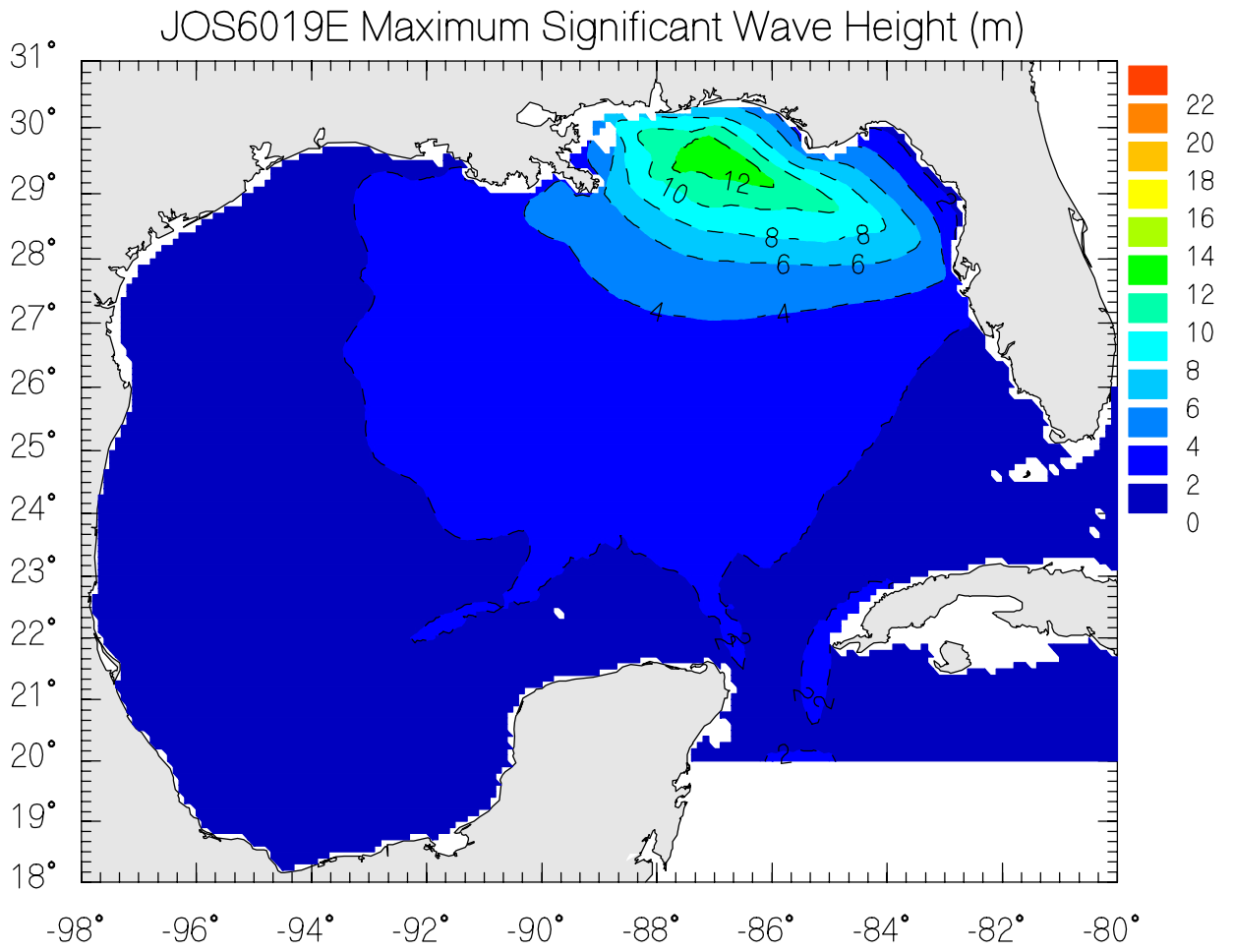
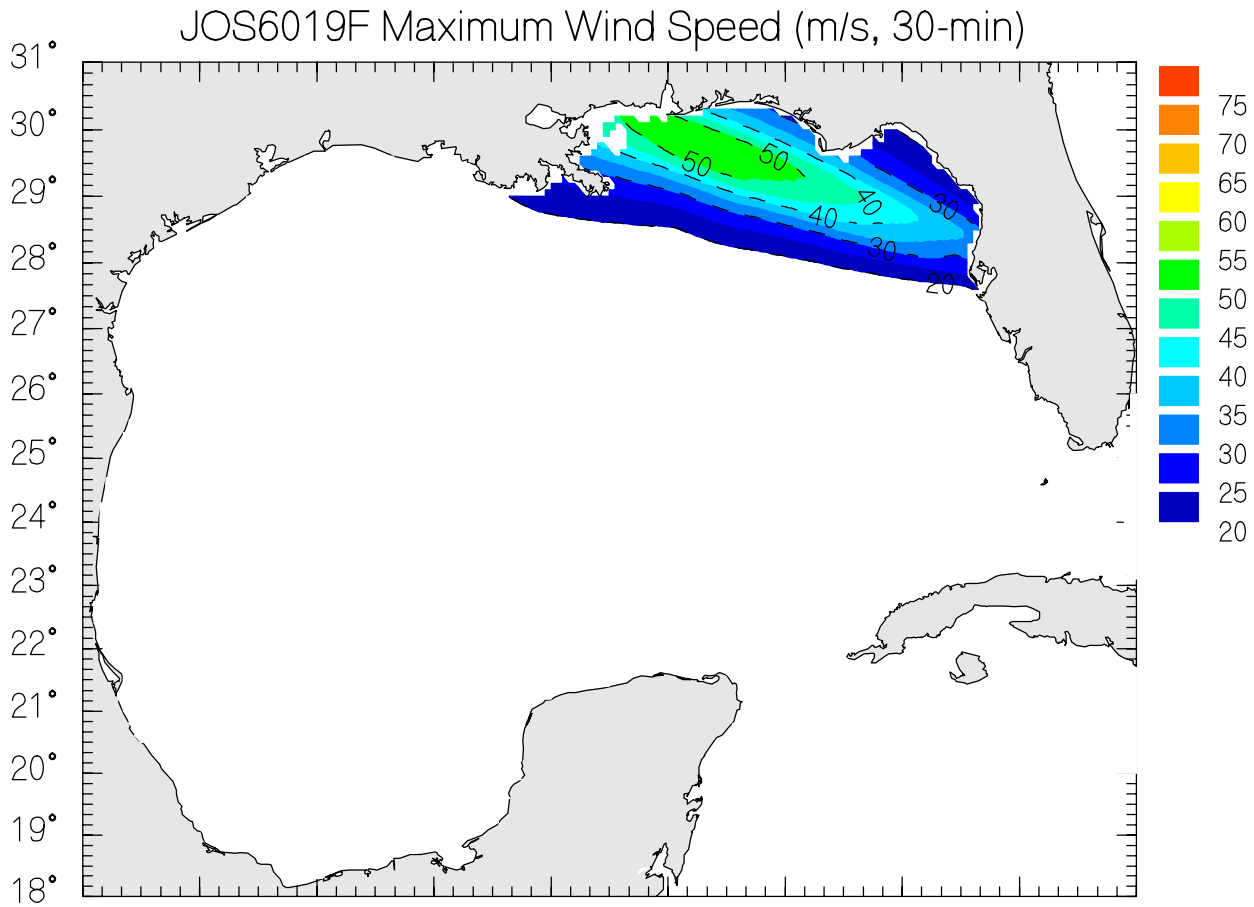
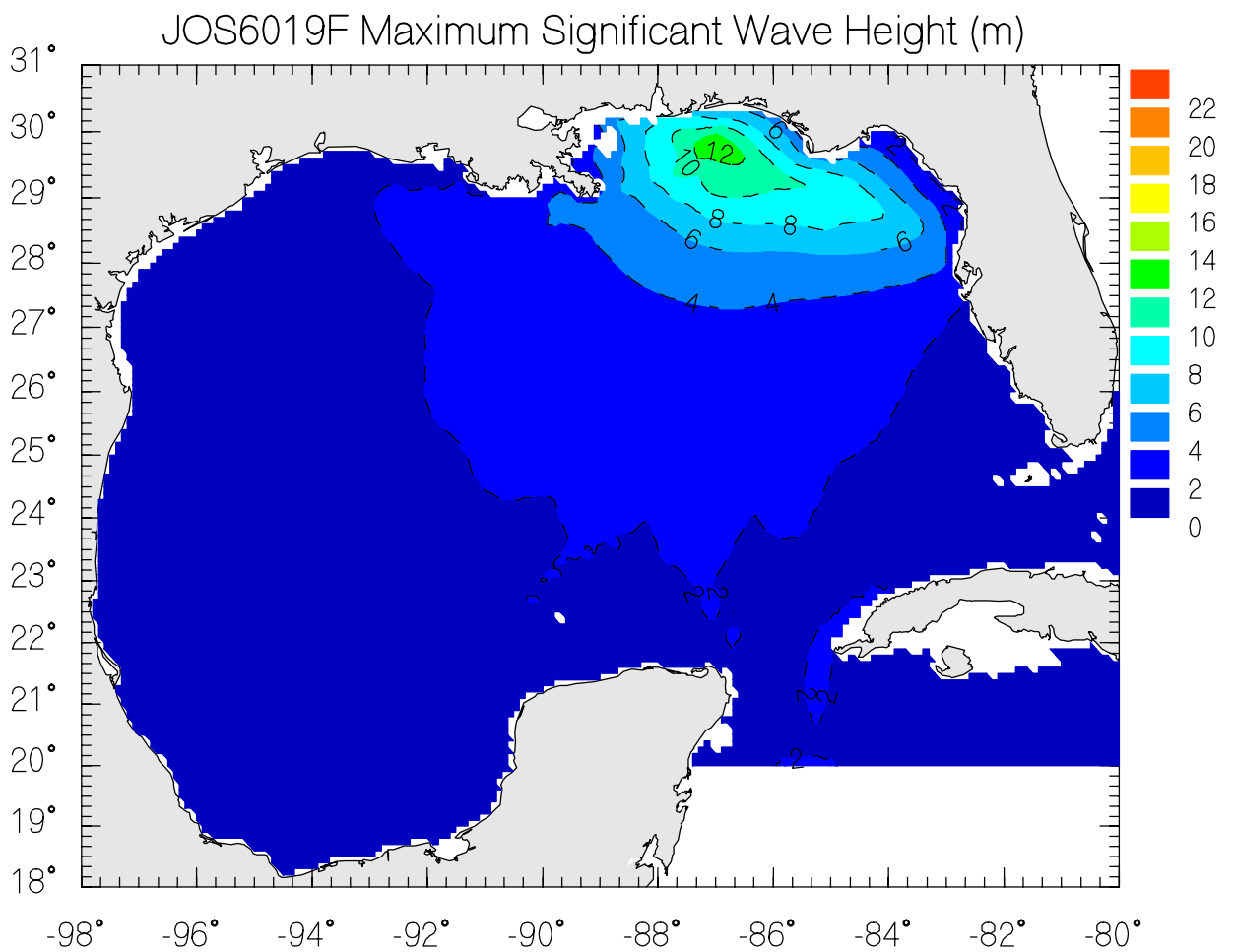
35
30
25
20


JOS6019D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
12
10
8
6
4
2
22
20
18
16
14
12
10
8
6
4
2
0
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


JOS6019E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20


JOS6019E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0


JOS6019F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
50
50
40
40
30
30
20
75
70
65
60
55
50
45
40
35
30
25
20


JOS6019F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
12
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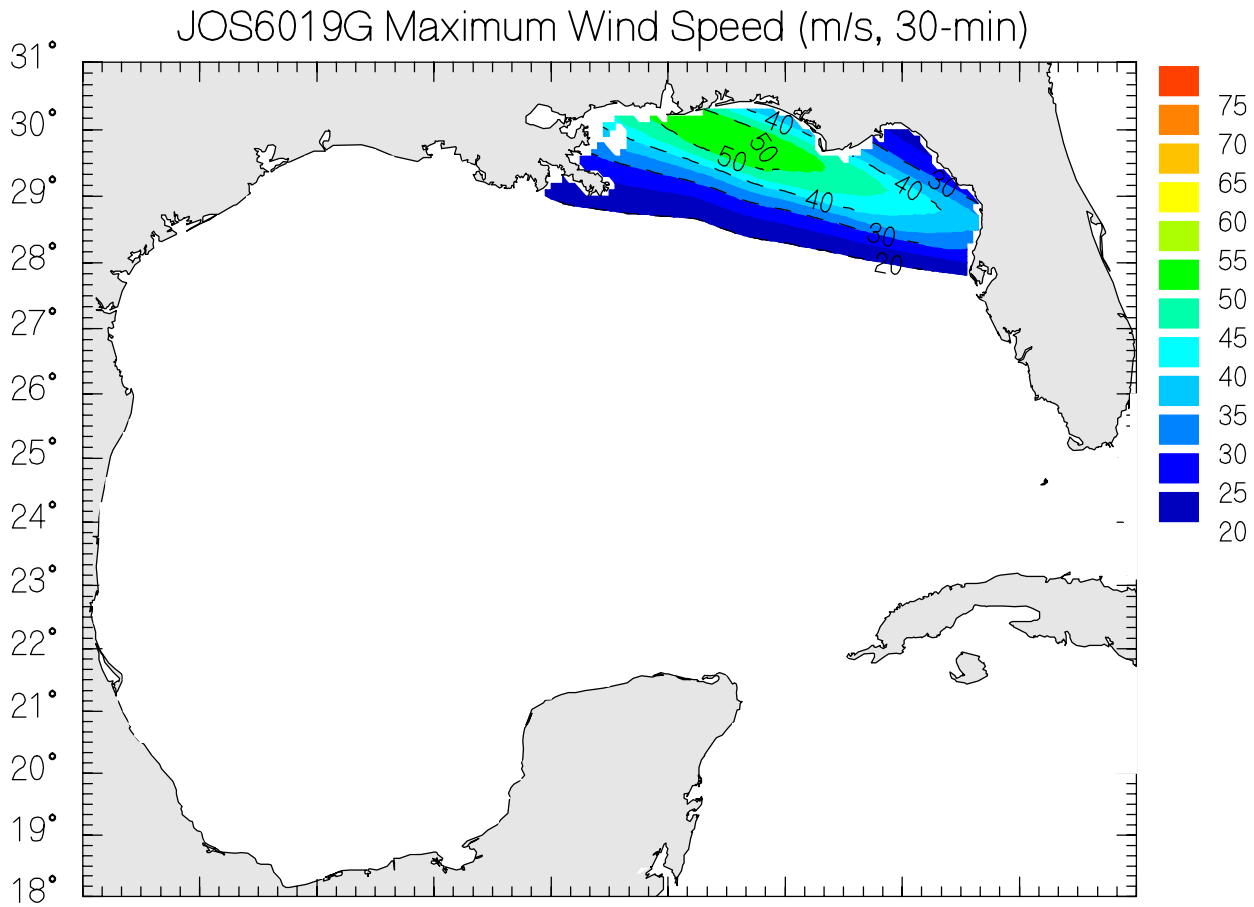
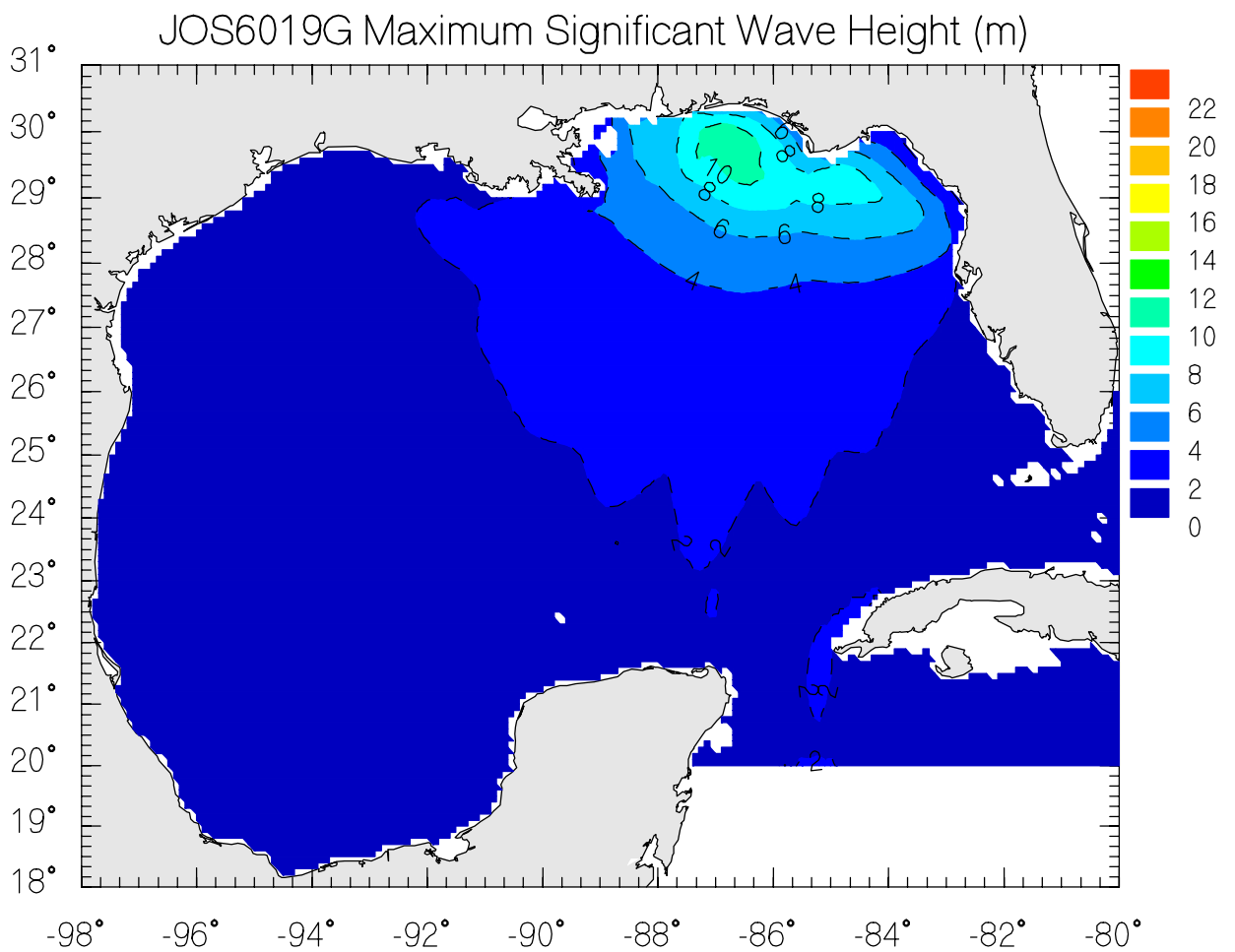
10
8
6
4
2
0

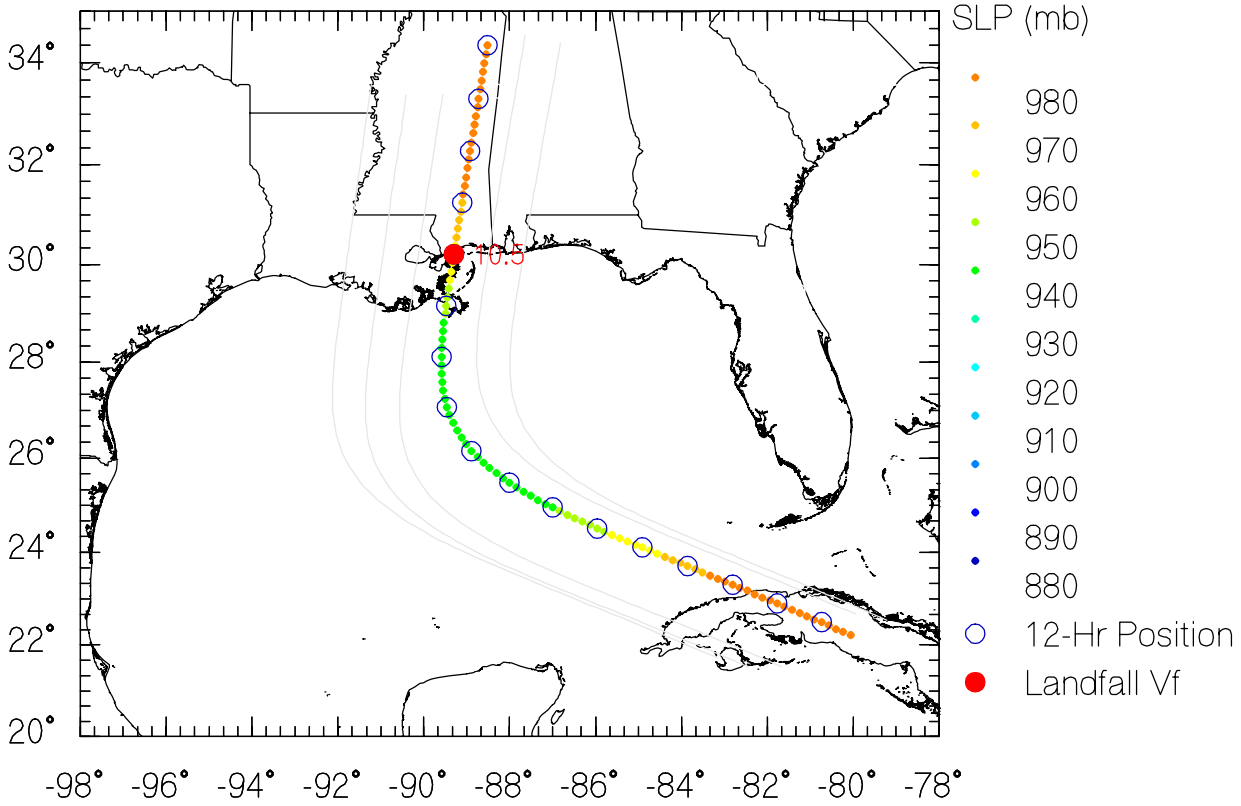

JOS6019G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20

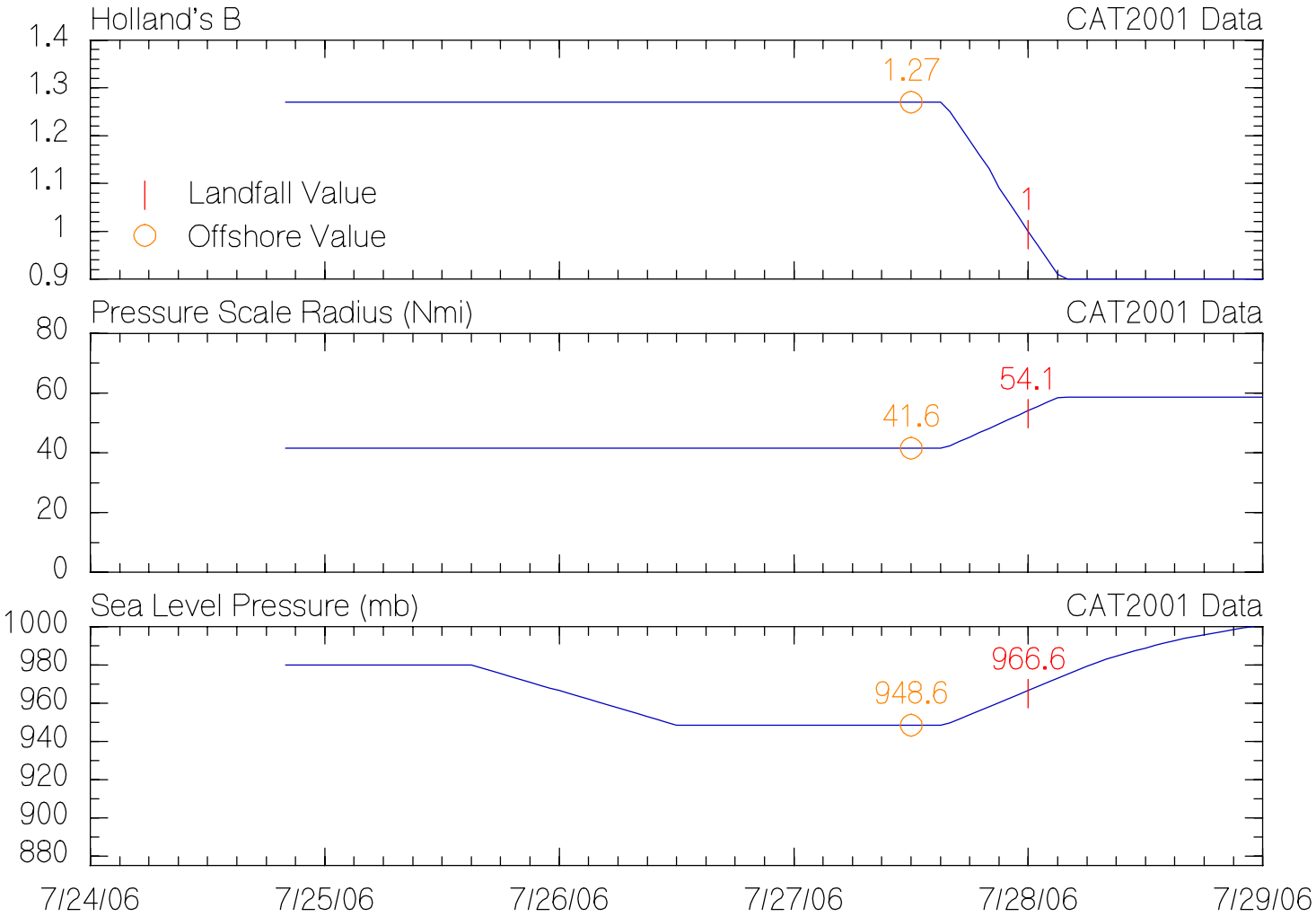

JOS6019G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0

Appendix B

Storm parameters, track and output for CAT2 Storm Set

CAT2001 Data



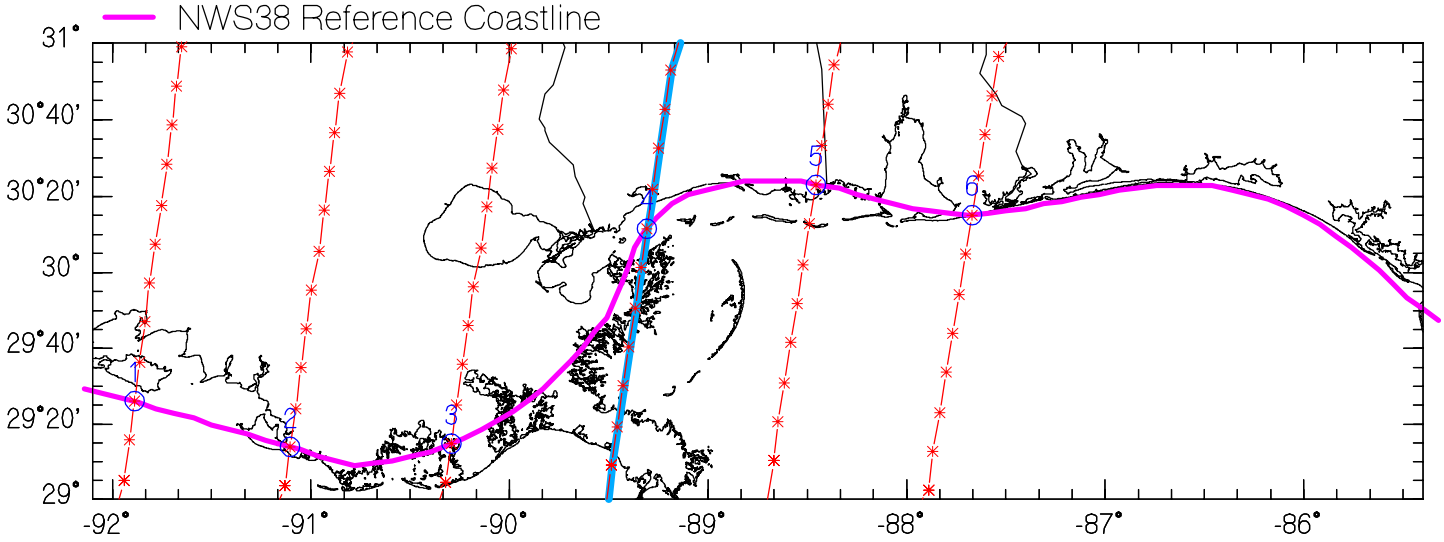


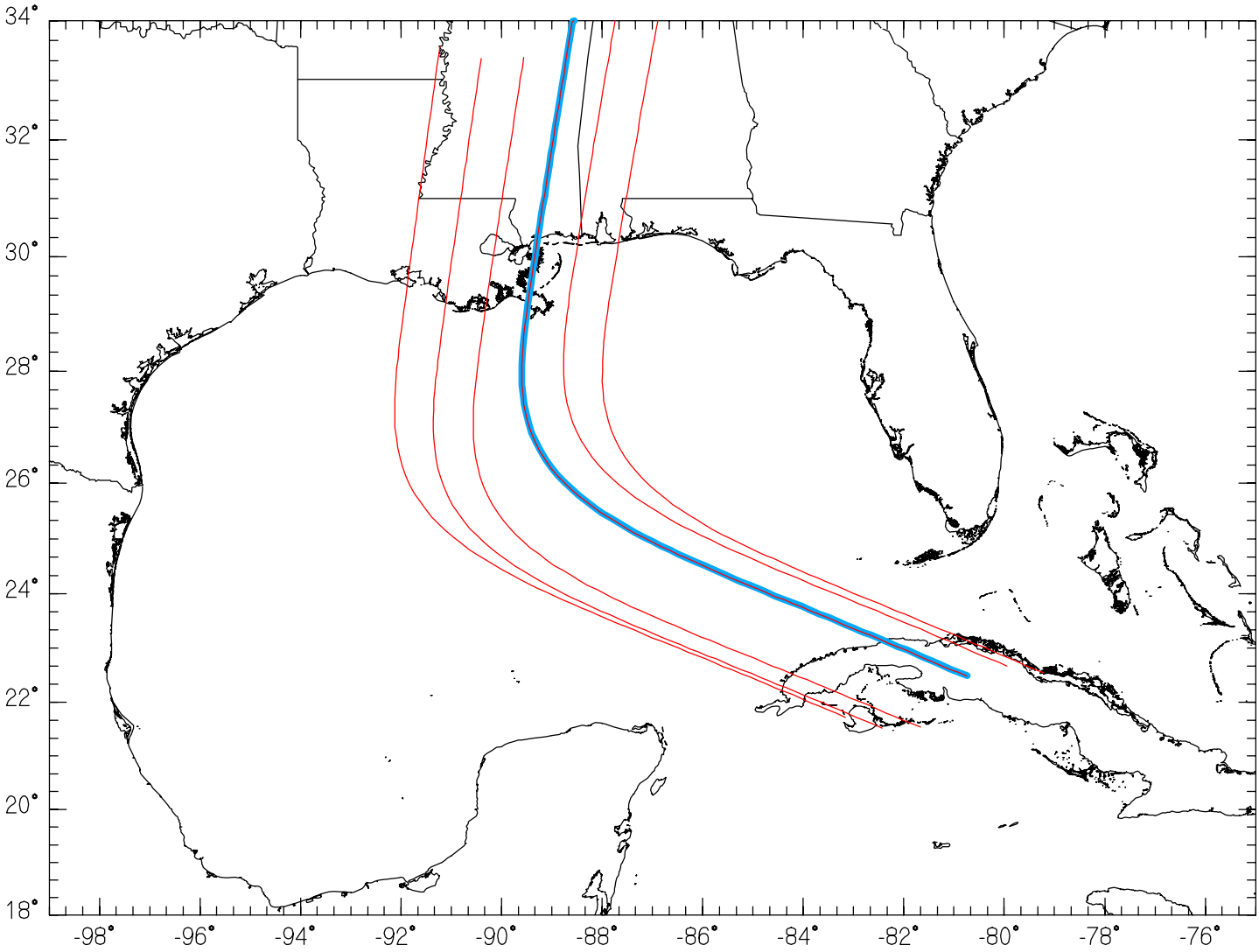
oceanweather inc.

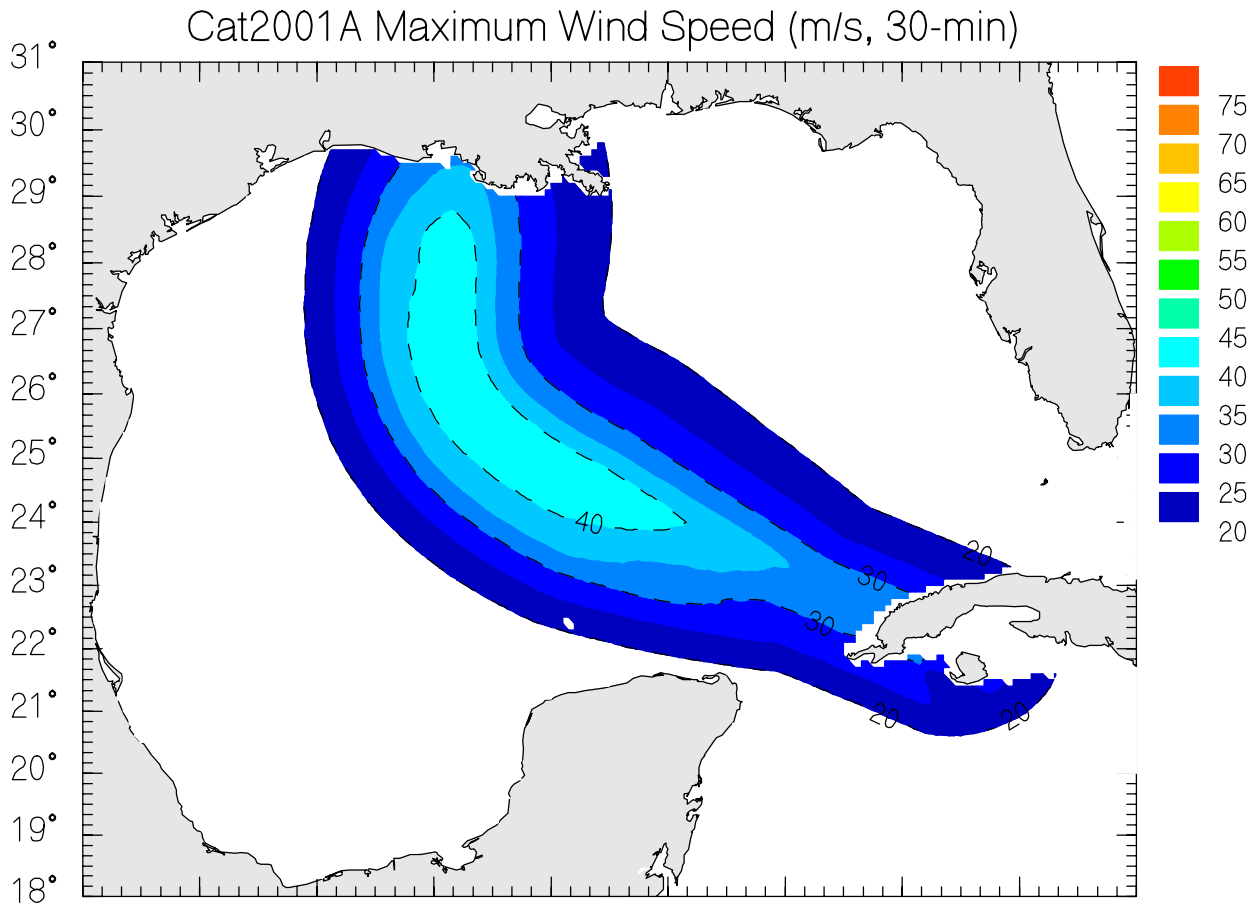
URS JPM-OS6 Production Tracks

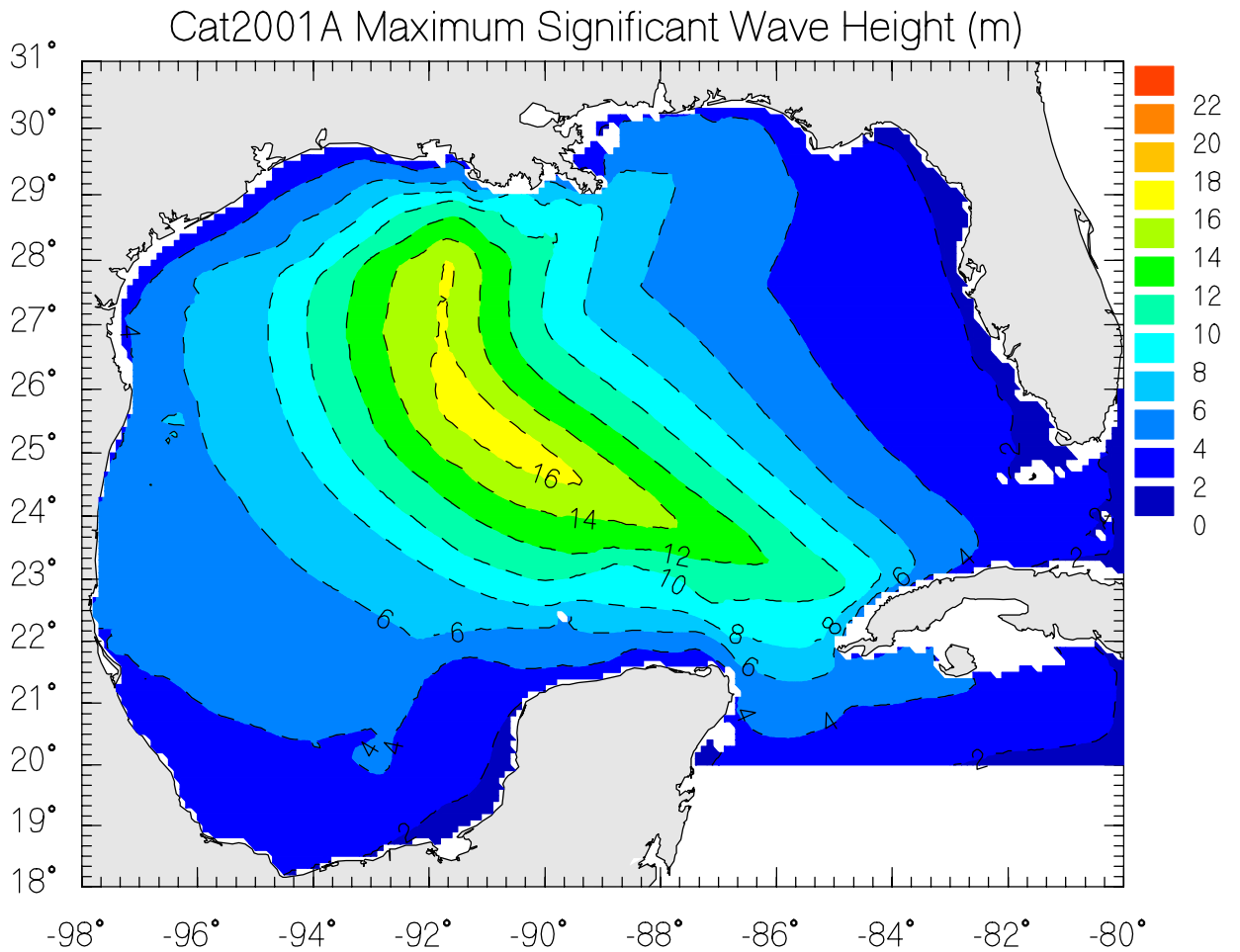
CAT2001 Data

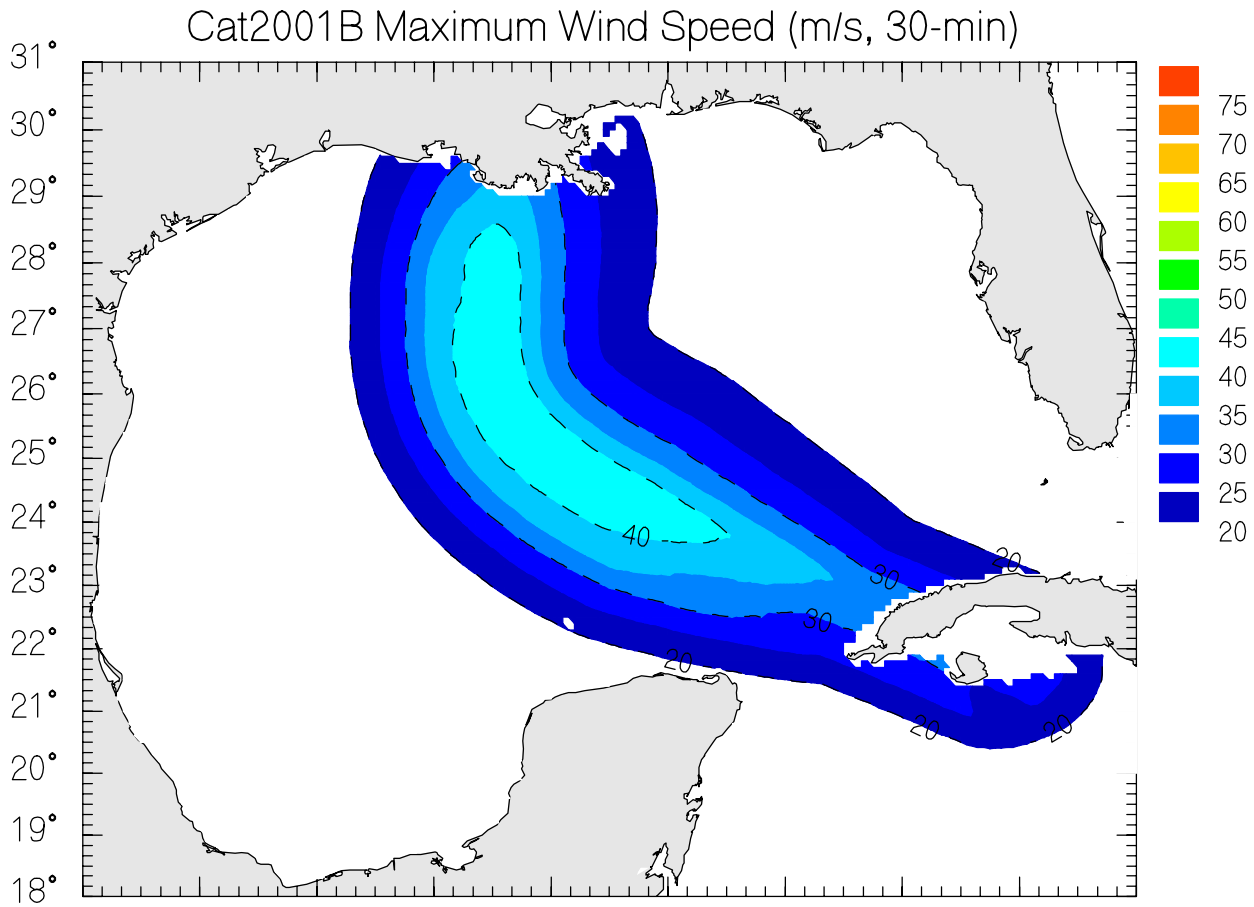
Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline

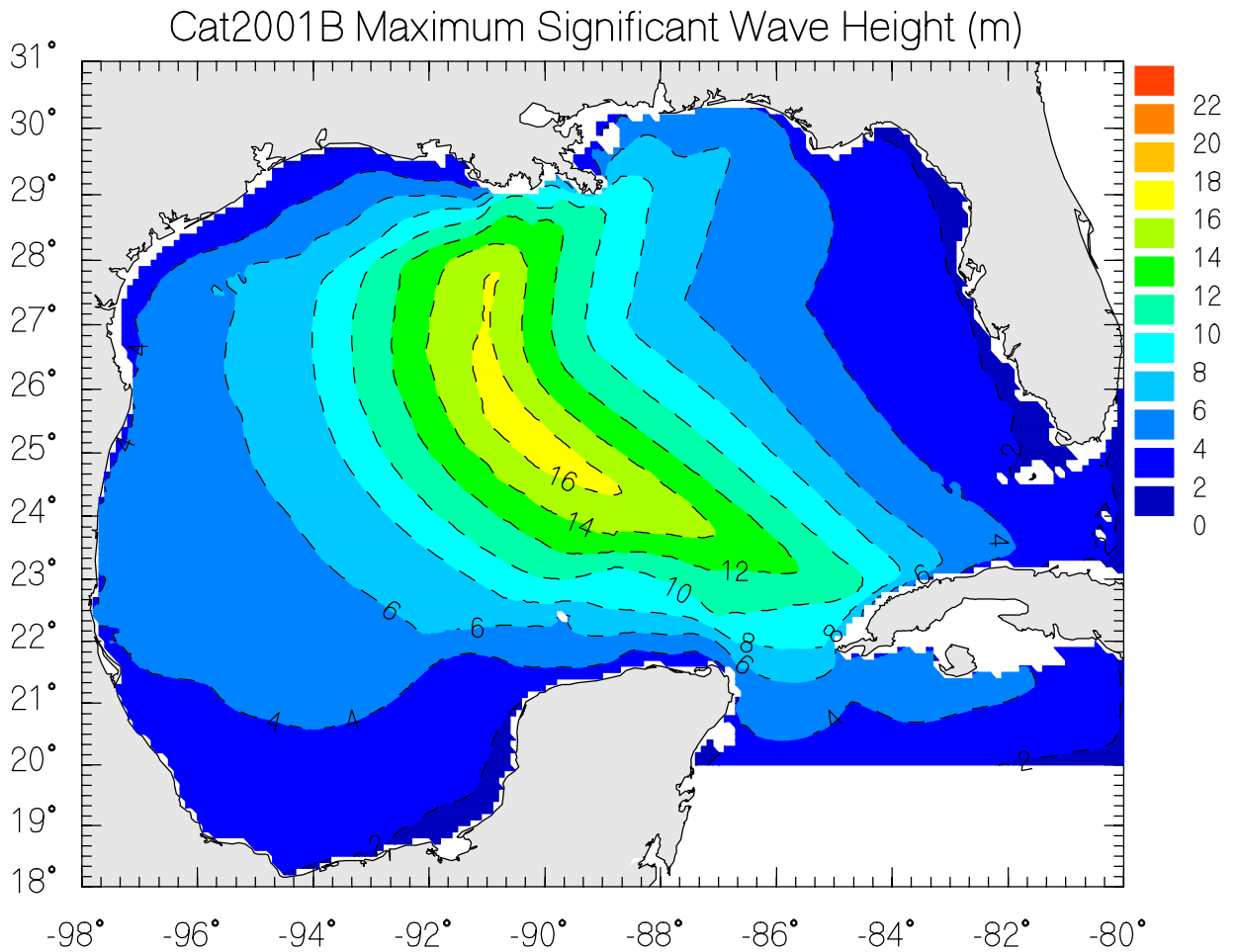


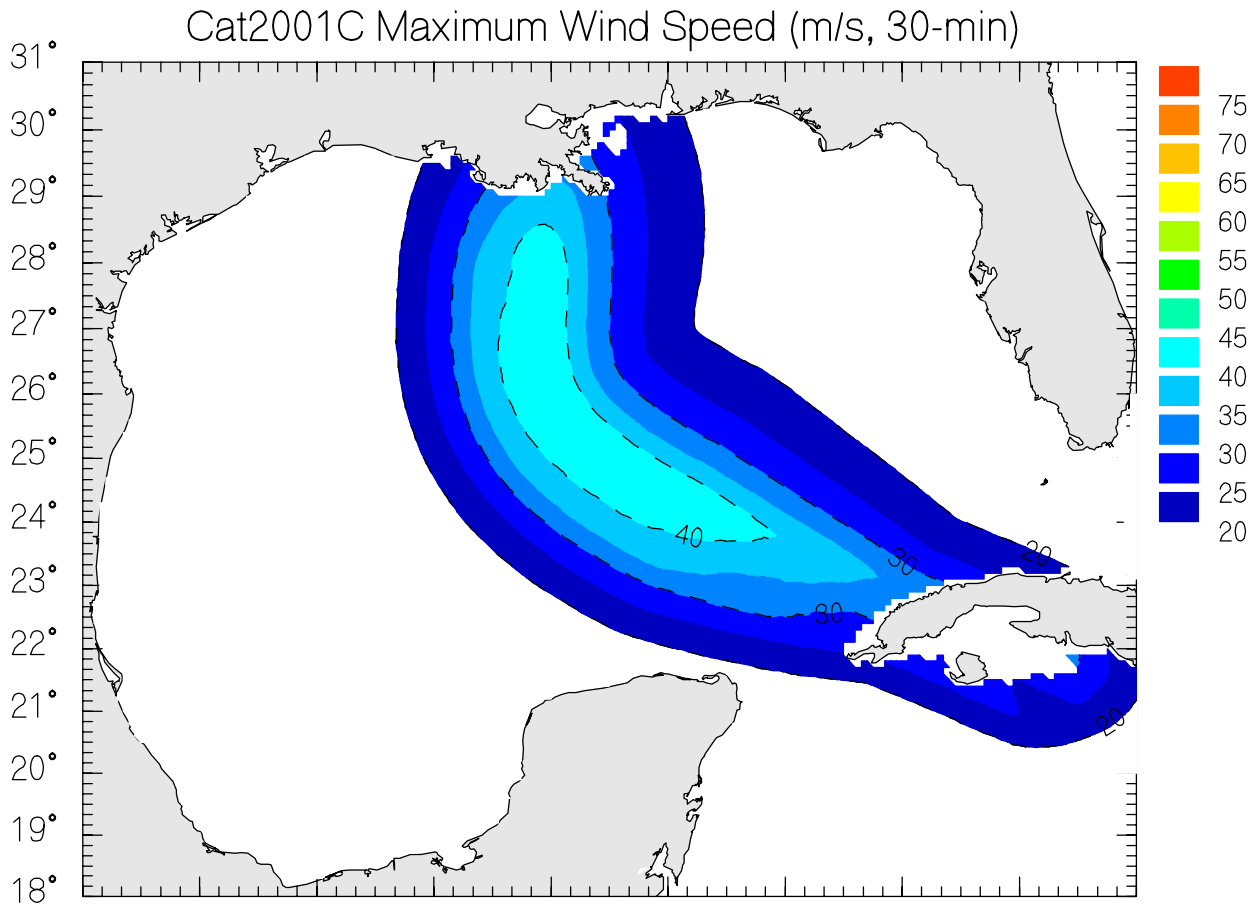



Cat2001A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
40
30
30
20
20
20


Cat2001A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
16
14
12
10
8
6
6
6
8
8
6
2
2
2
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


Cat2001B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
40
30
20


Cat2001B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
18
16
14
12
10
8
6
4
2
0
16
14
12
10
8
6
4
2


Cat2001C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
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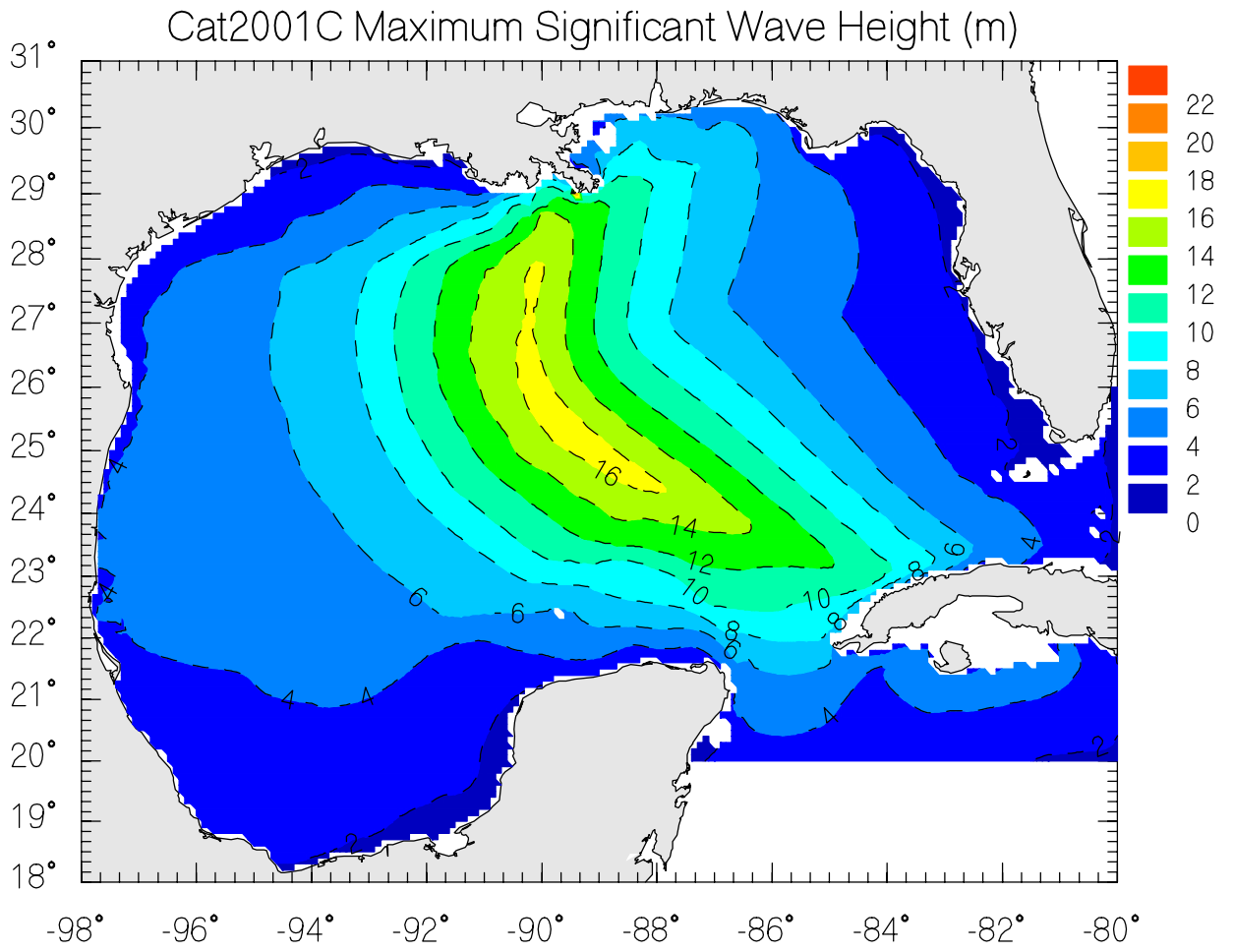
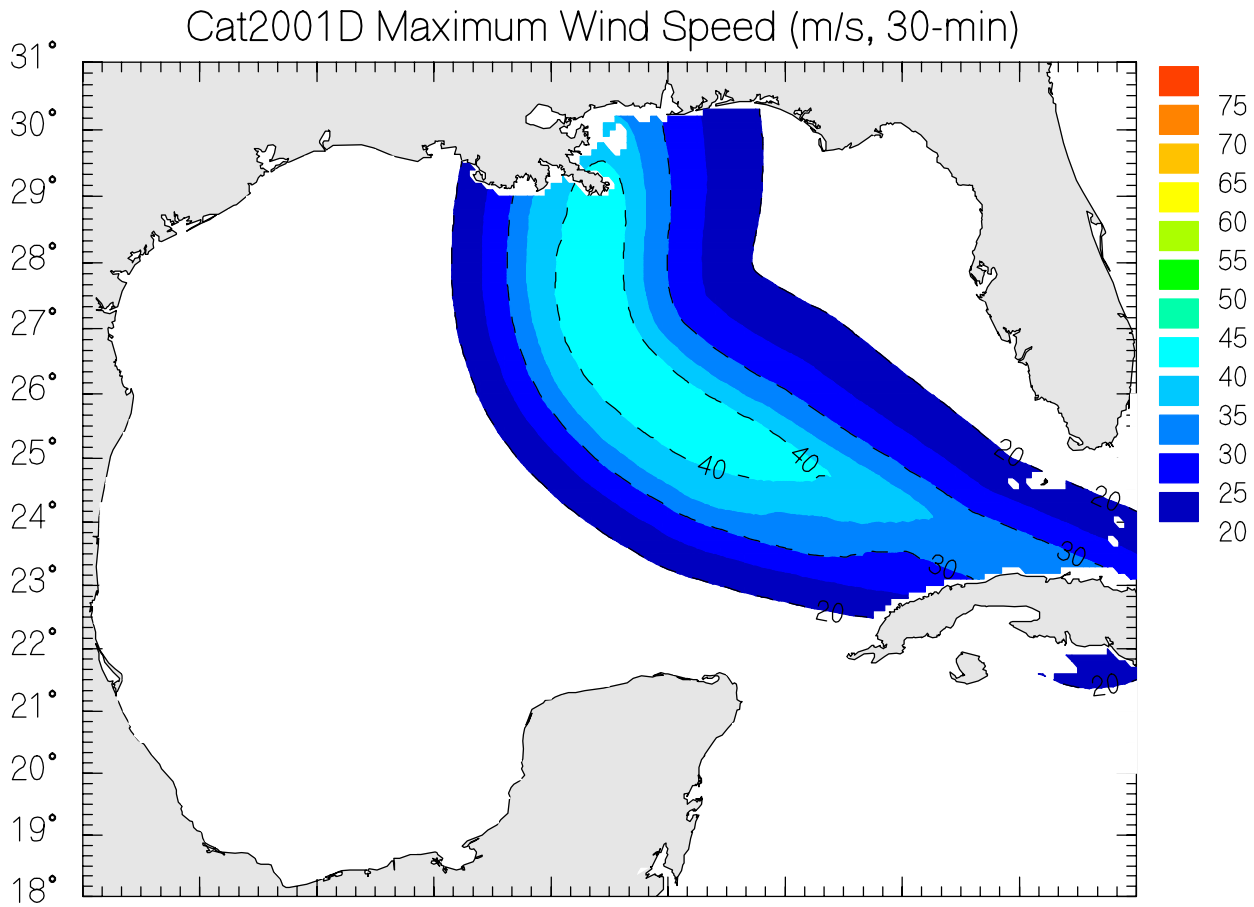
20
40
30
20
80
20


Cat2001C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
16
14
12
10
8
6
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


Cat2001D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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45
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40
40
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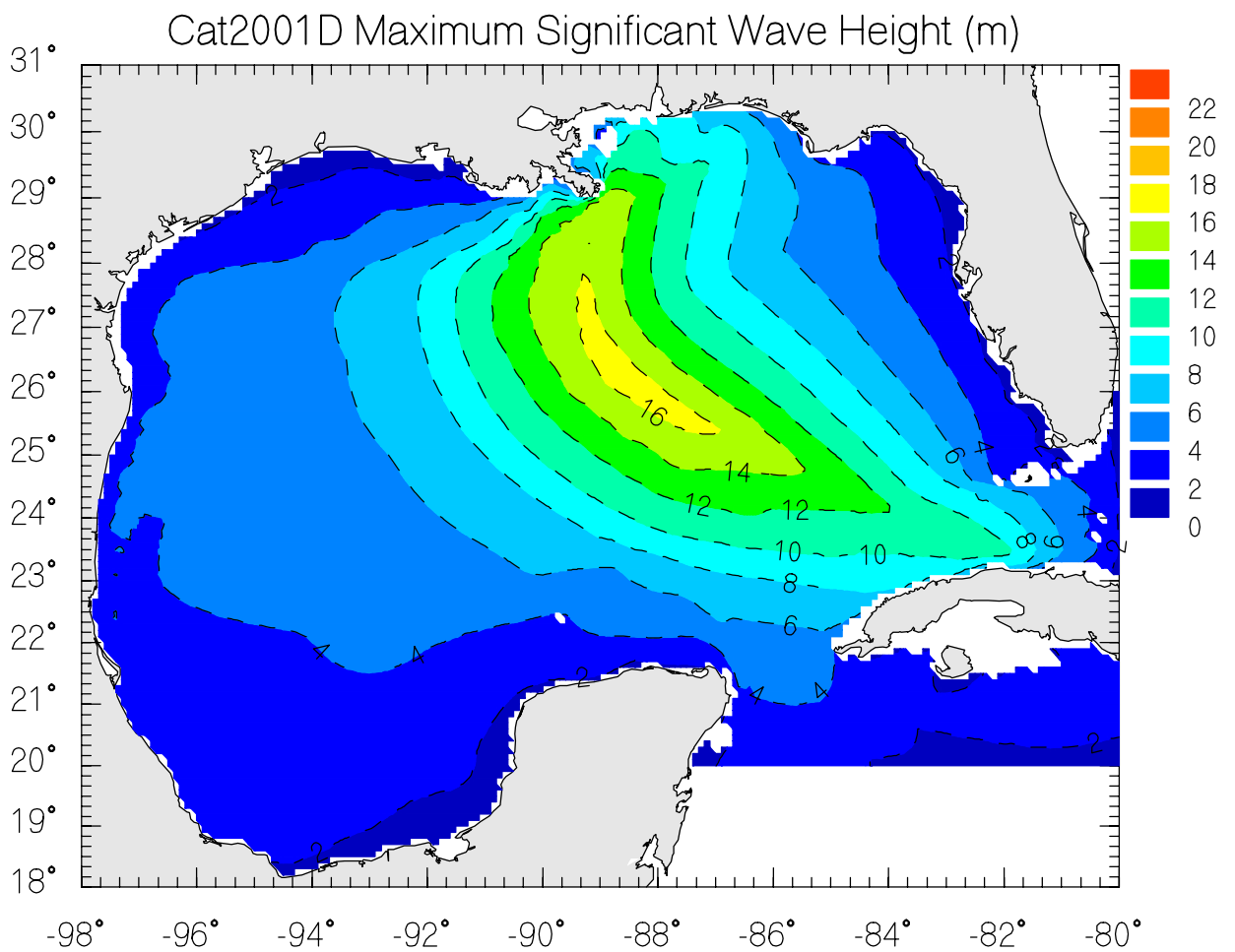
30
20
20
20
20


Cat2001D Maximum Significant Wave Height (m)
31°
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29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
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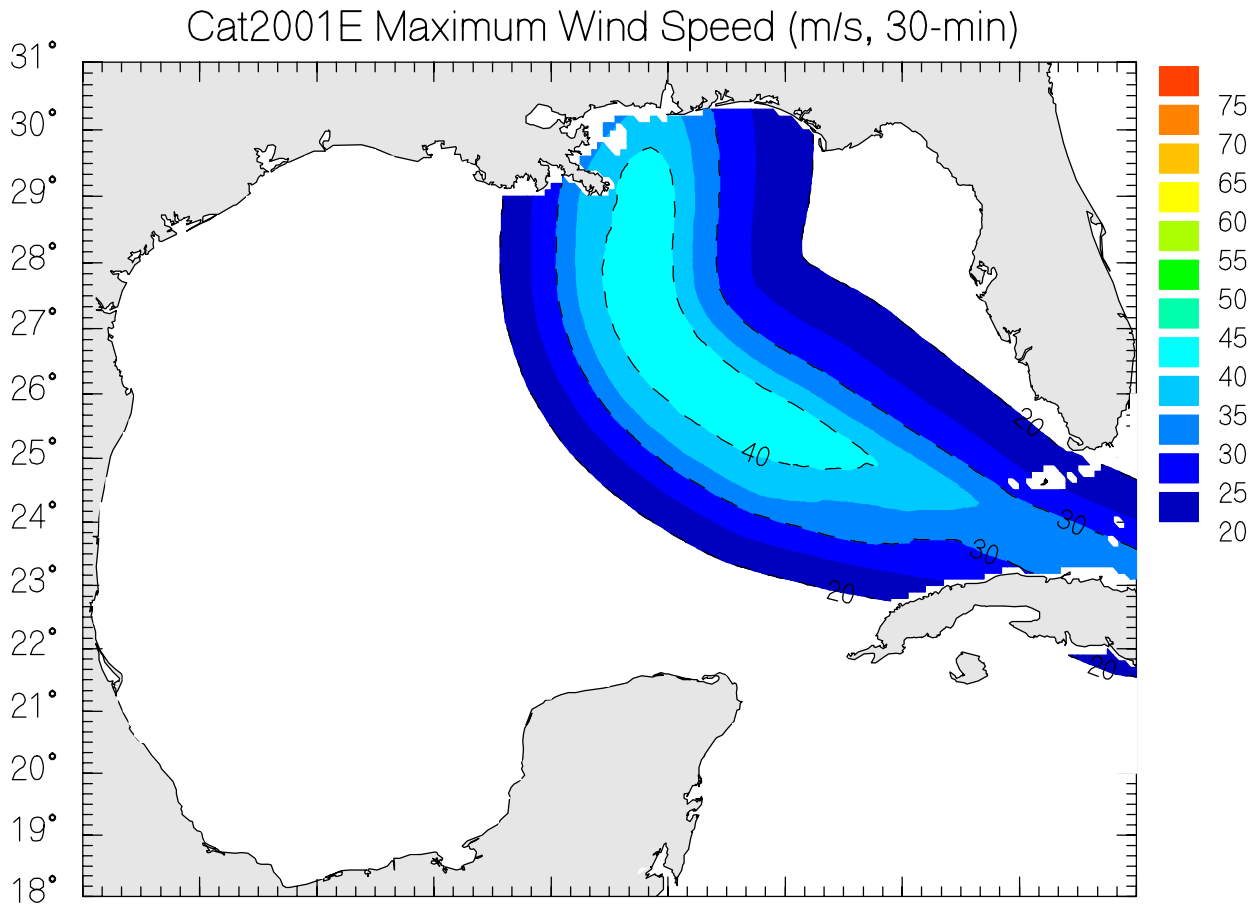
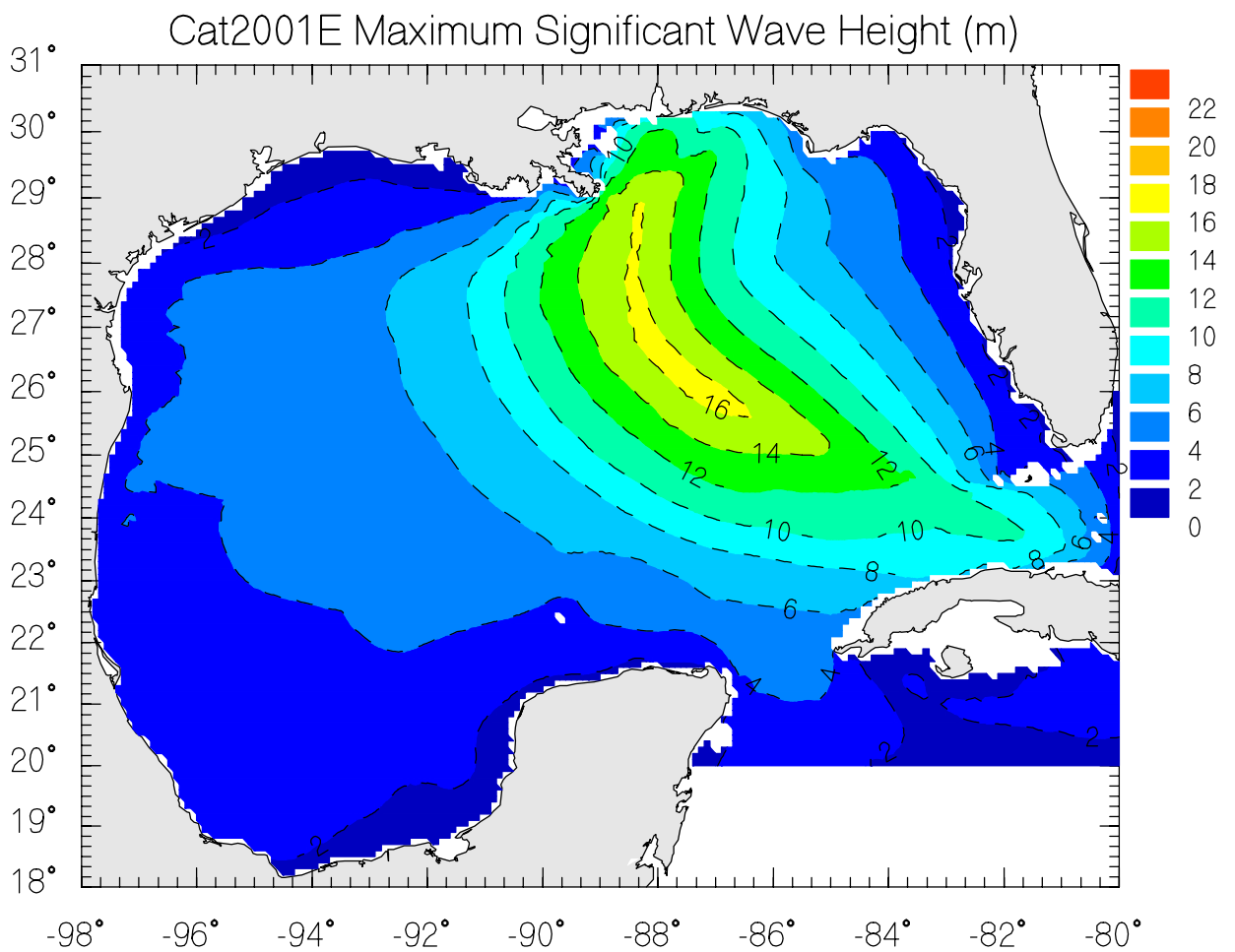
12
12
10
10
8
6


Cat2001E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
40
30
20


Cat2001E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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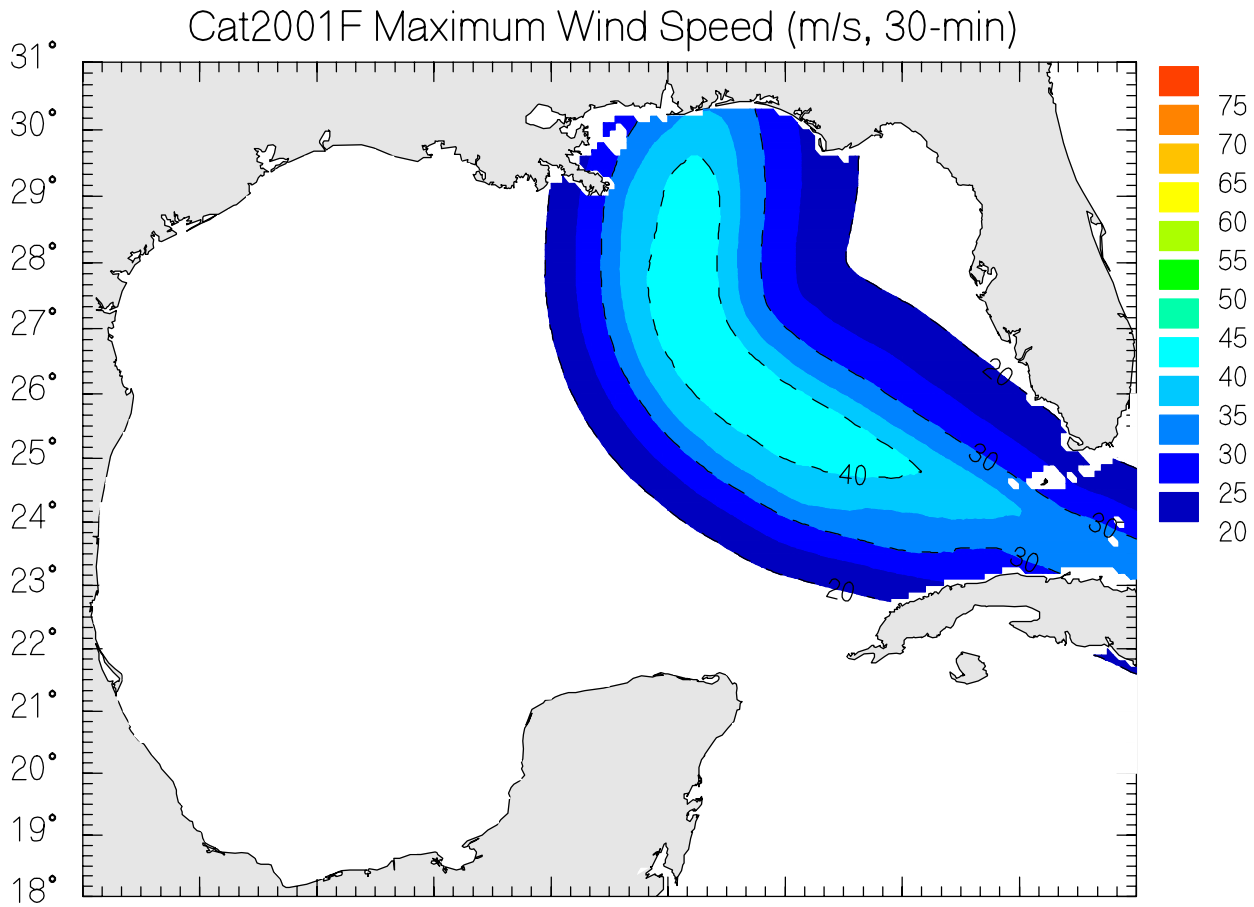
12
10
8
6
4
2


Cat2001F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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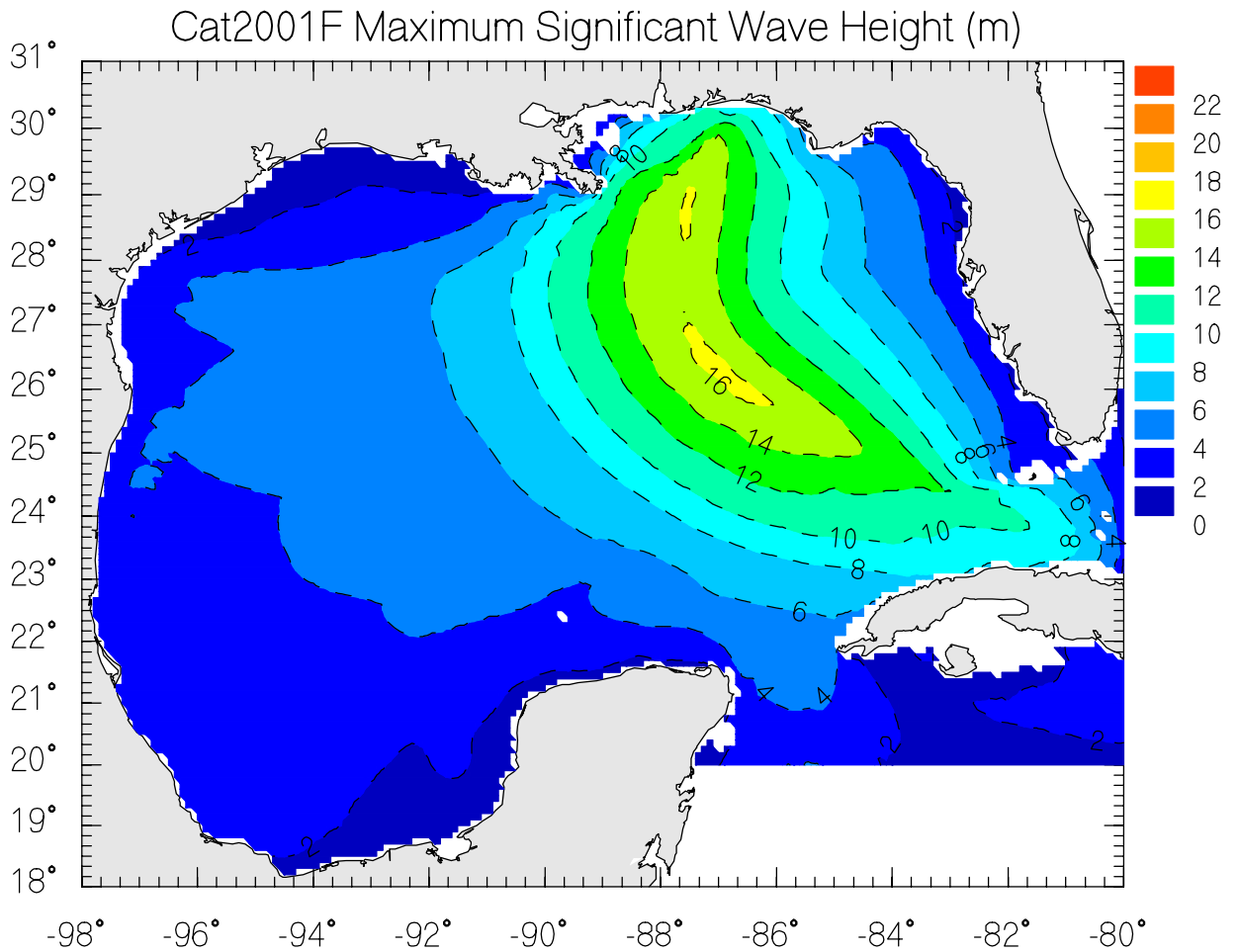
40
30
20


Cat2001F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
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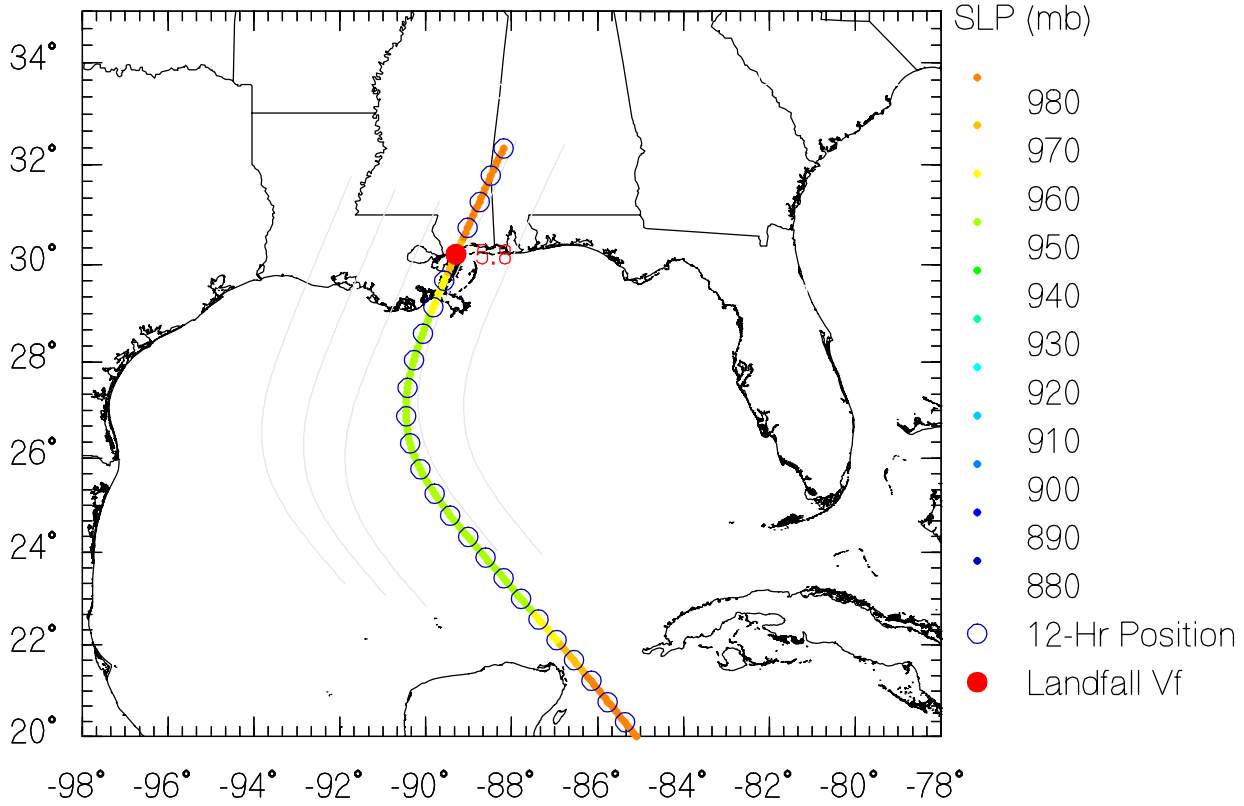
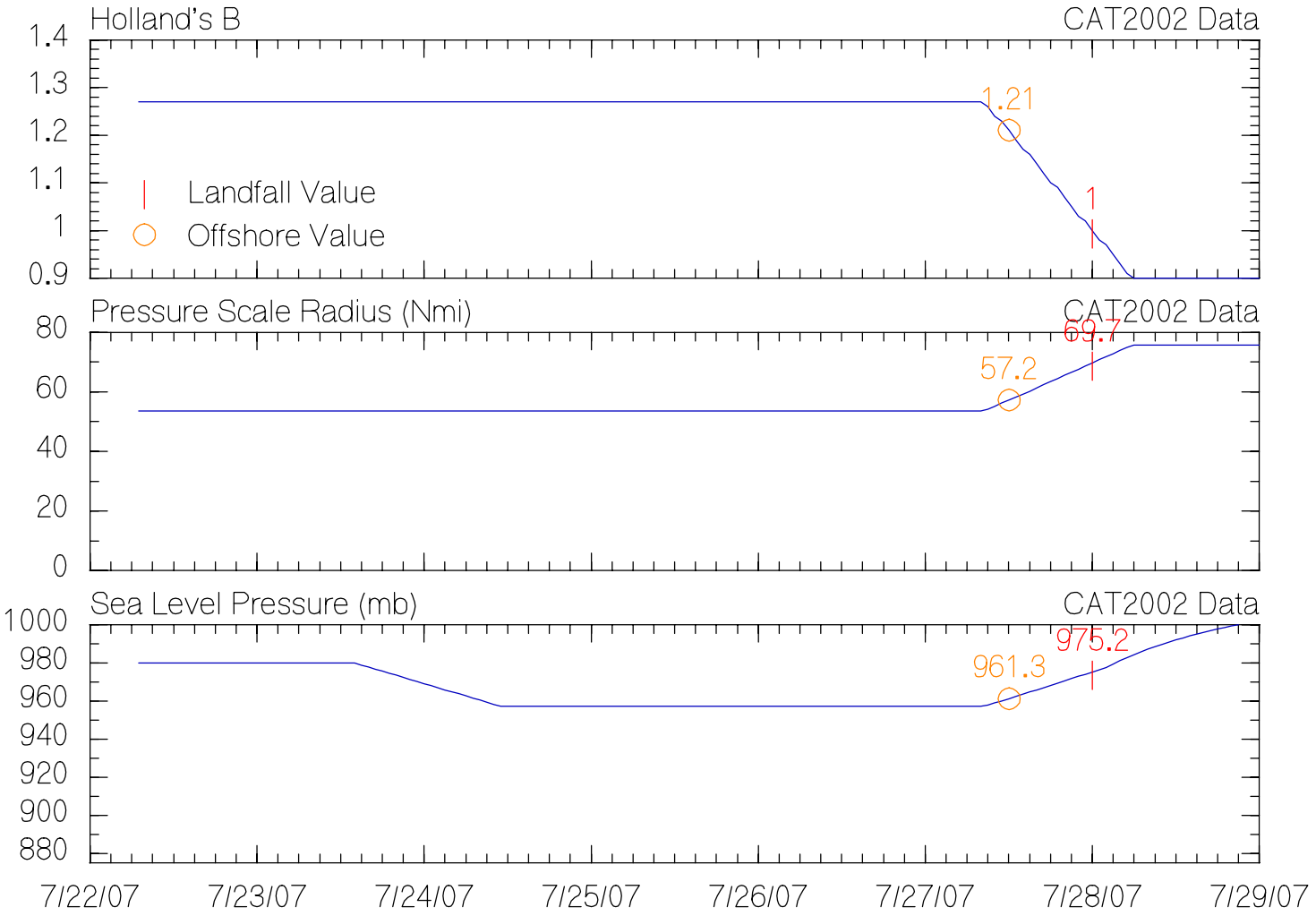
16
14
12
10
8
6
4
2
0
16
14
12
10
8
6

CAT2002 Data

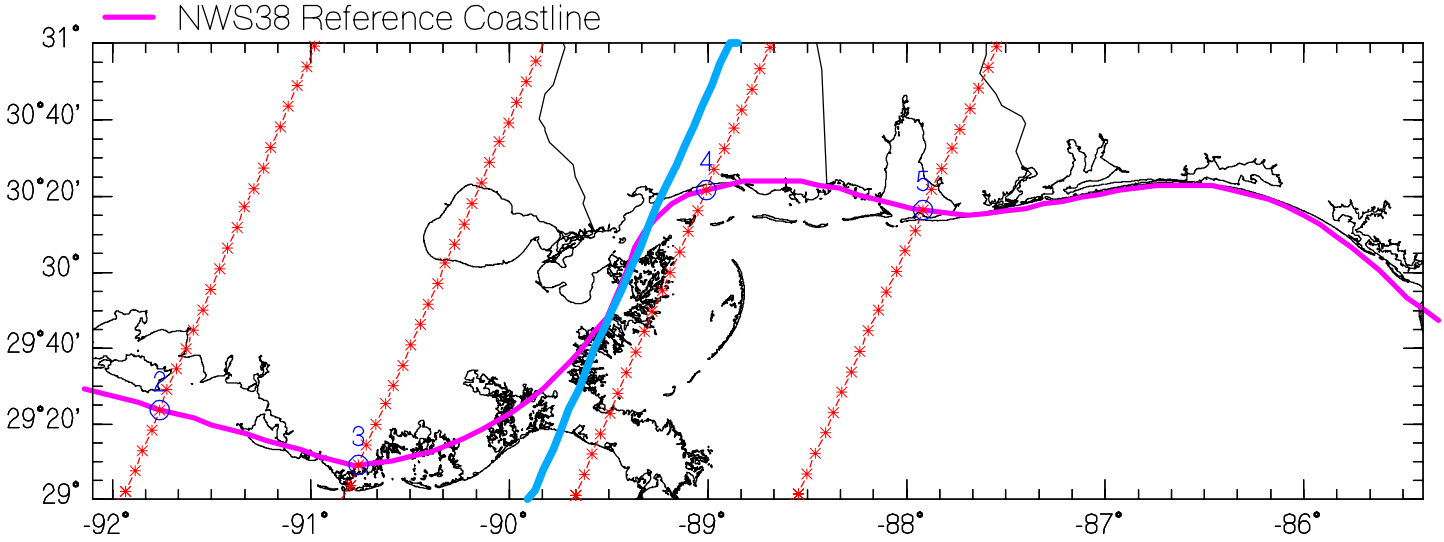


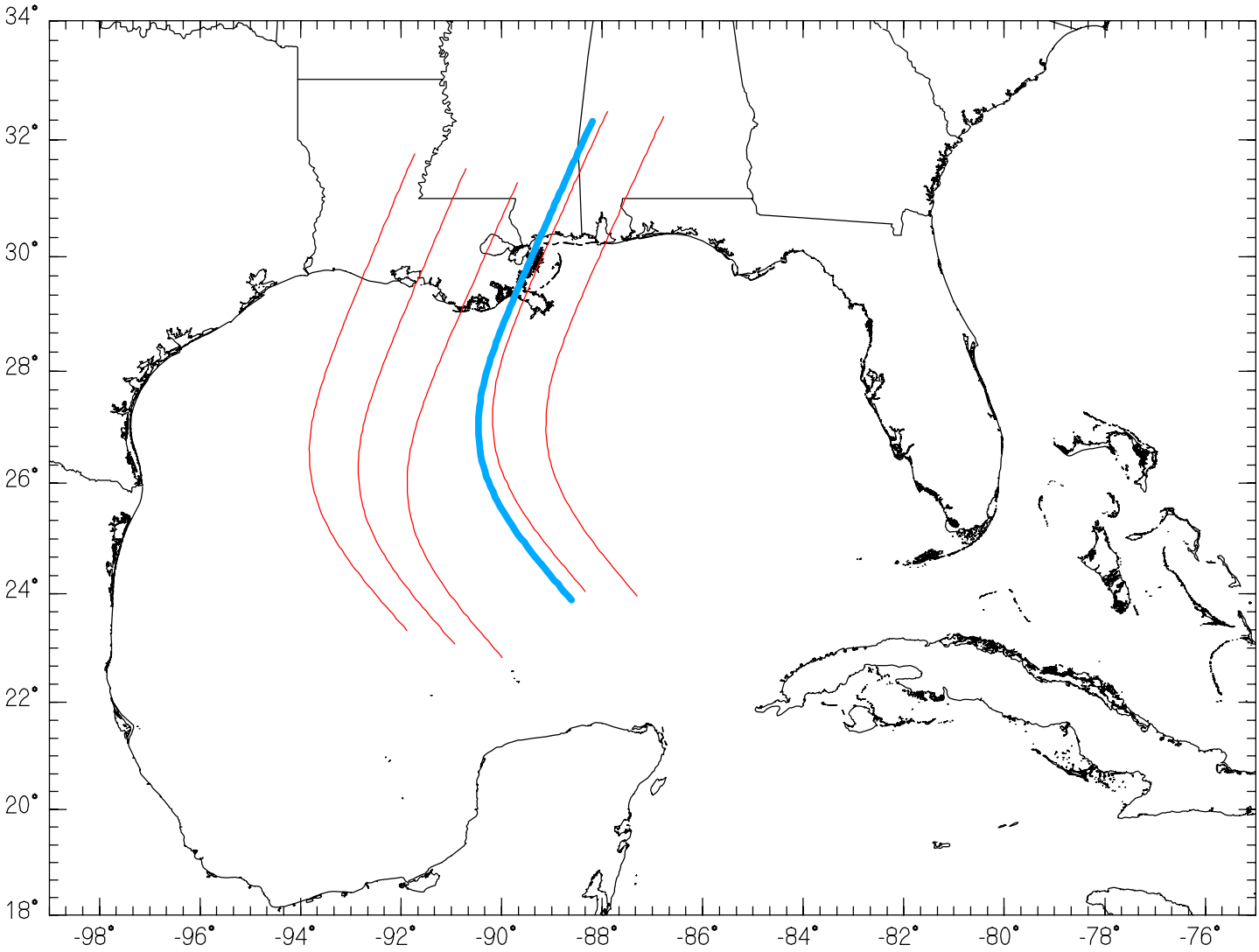


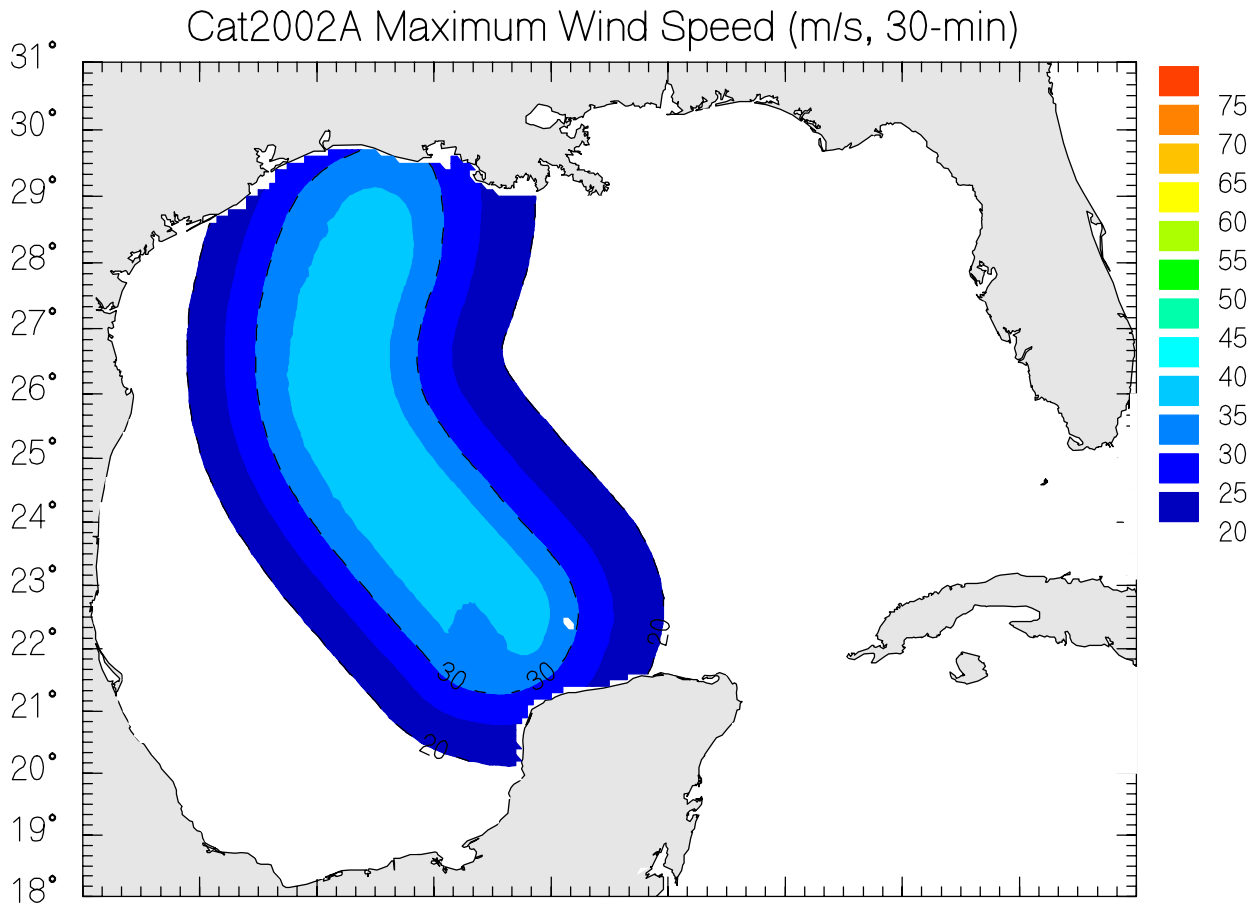
URS JPM-OS6 Production Tracks

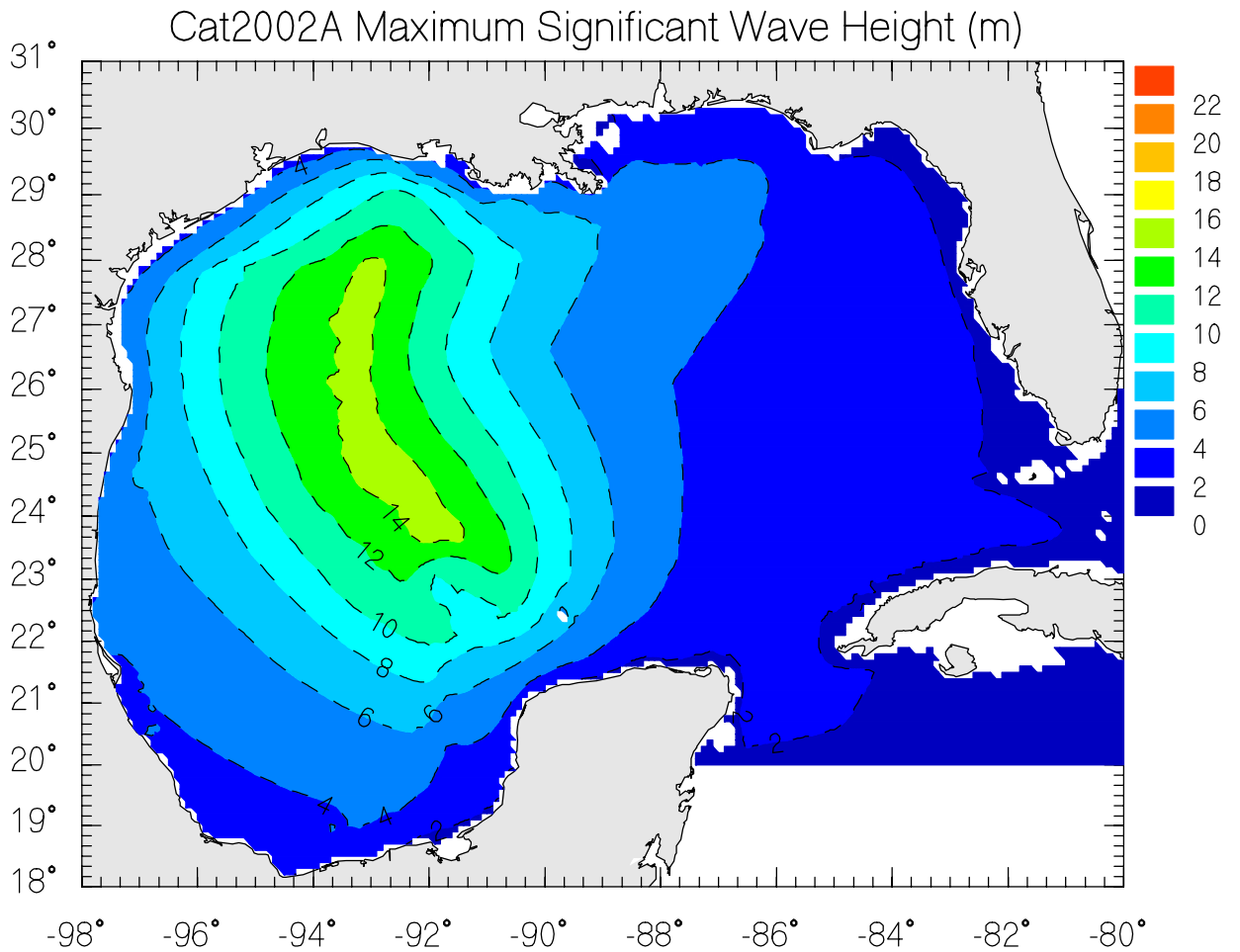
CAT2002 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






Cat2002A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
55
50
45
40
35
30
25
20
30
30
20
20


Cat2002A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
20
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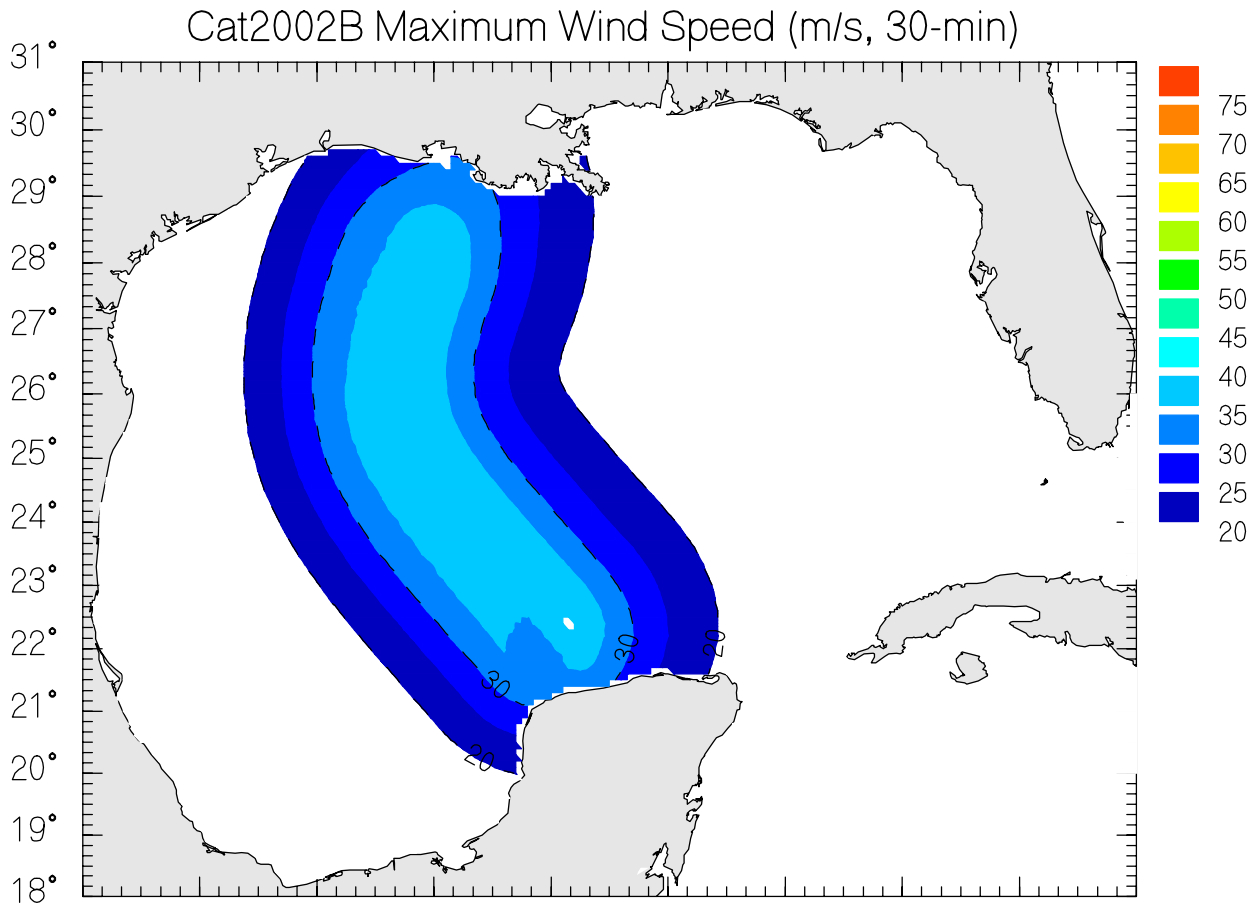
Cat2002B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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65
60
55
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45
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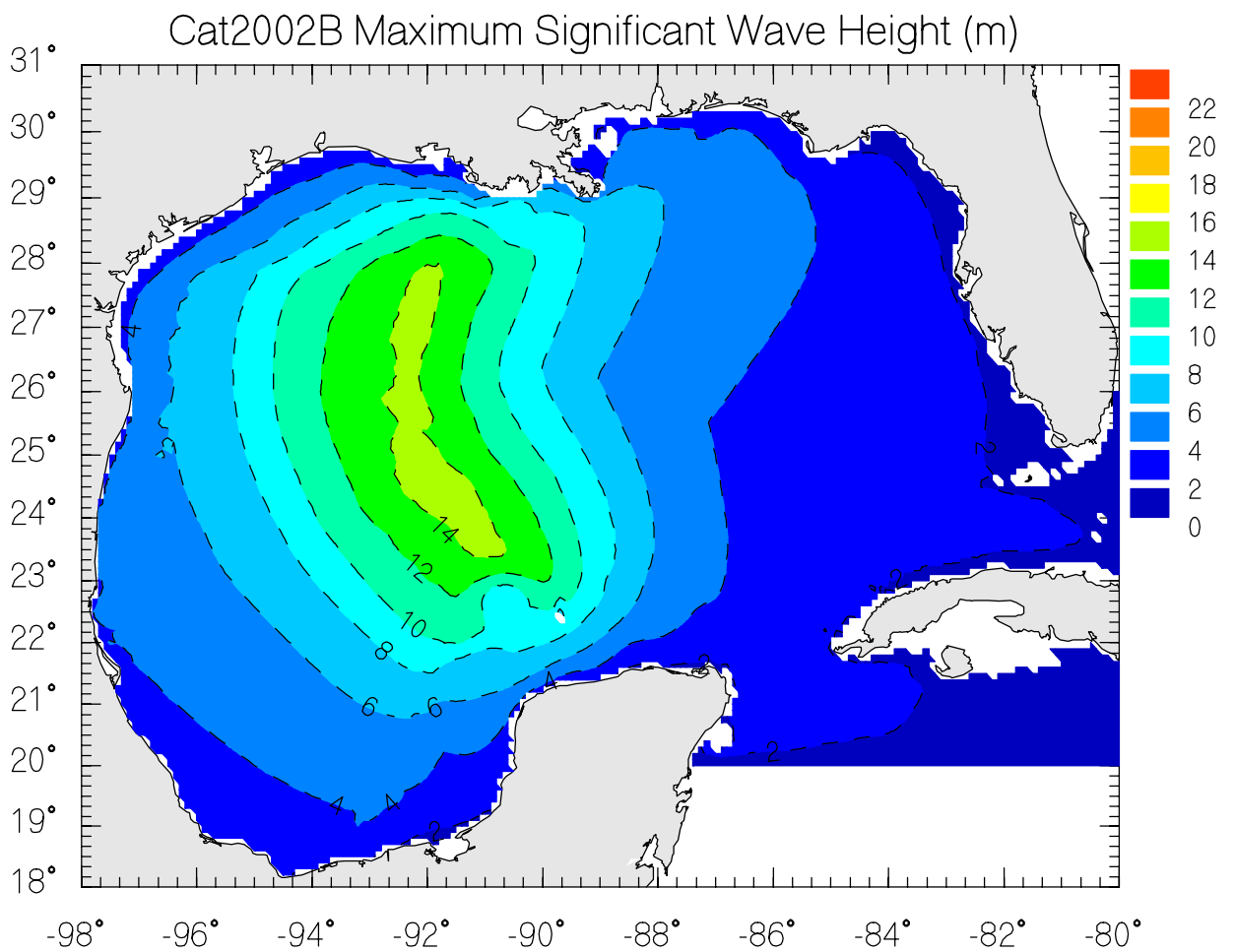
25
20
30
20


Cat2002B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
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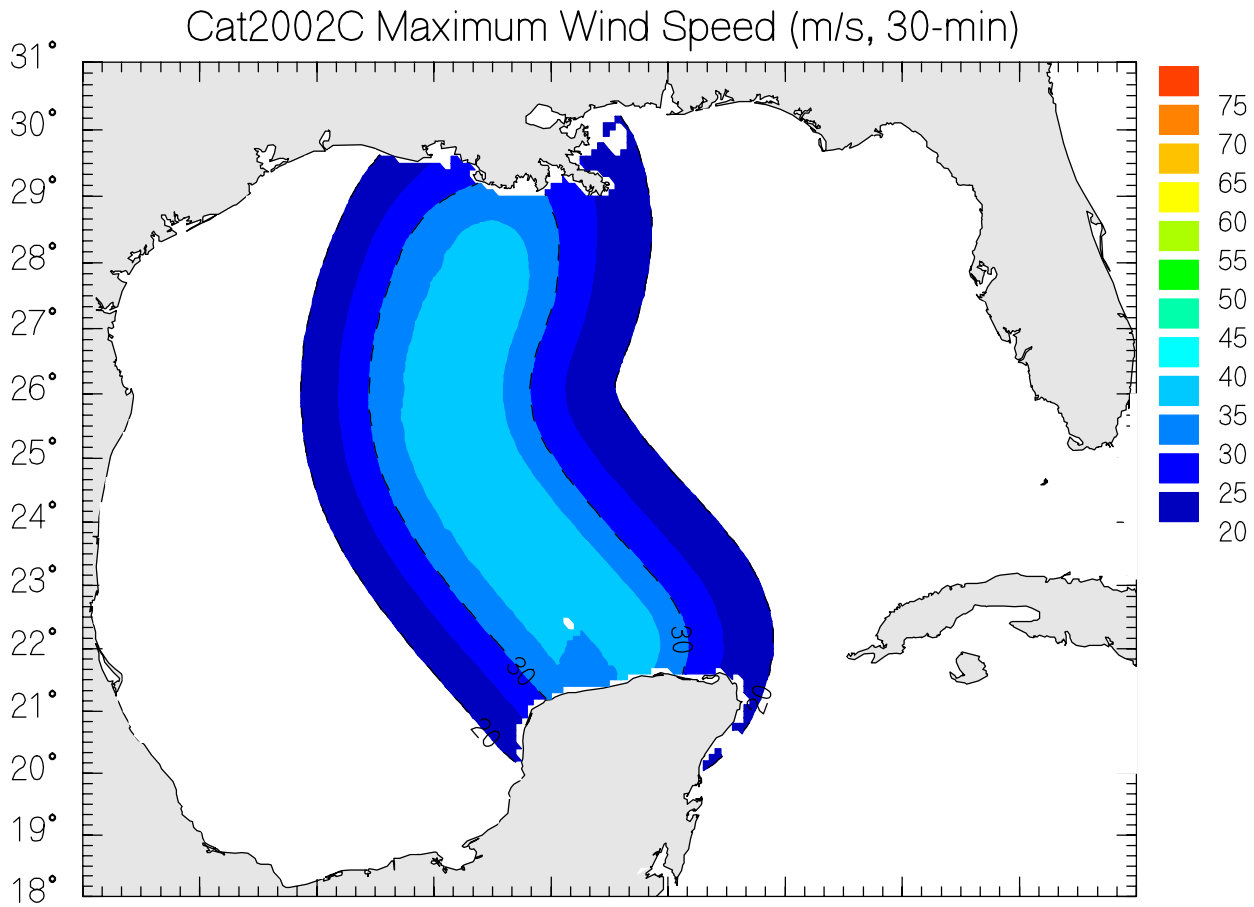
Cat2002C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
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35
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20
30
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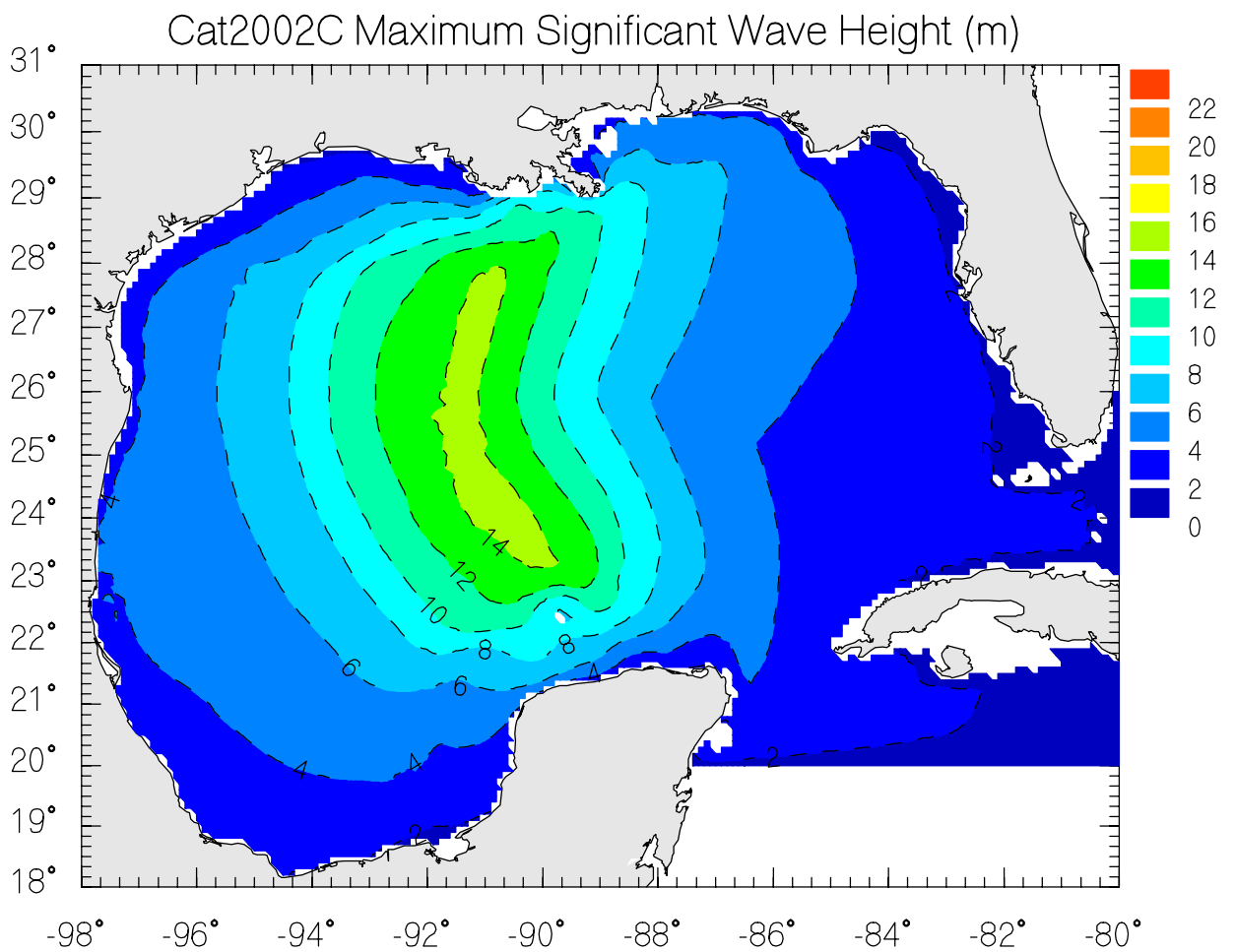
30
30


Cat2002C Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
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23°
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21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
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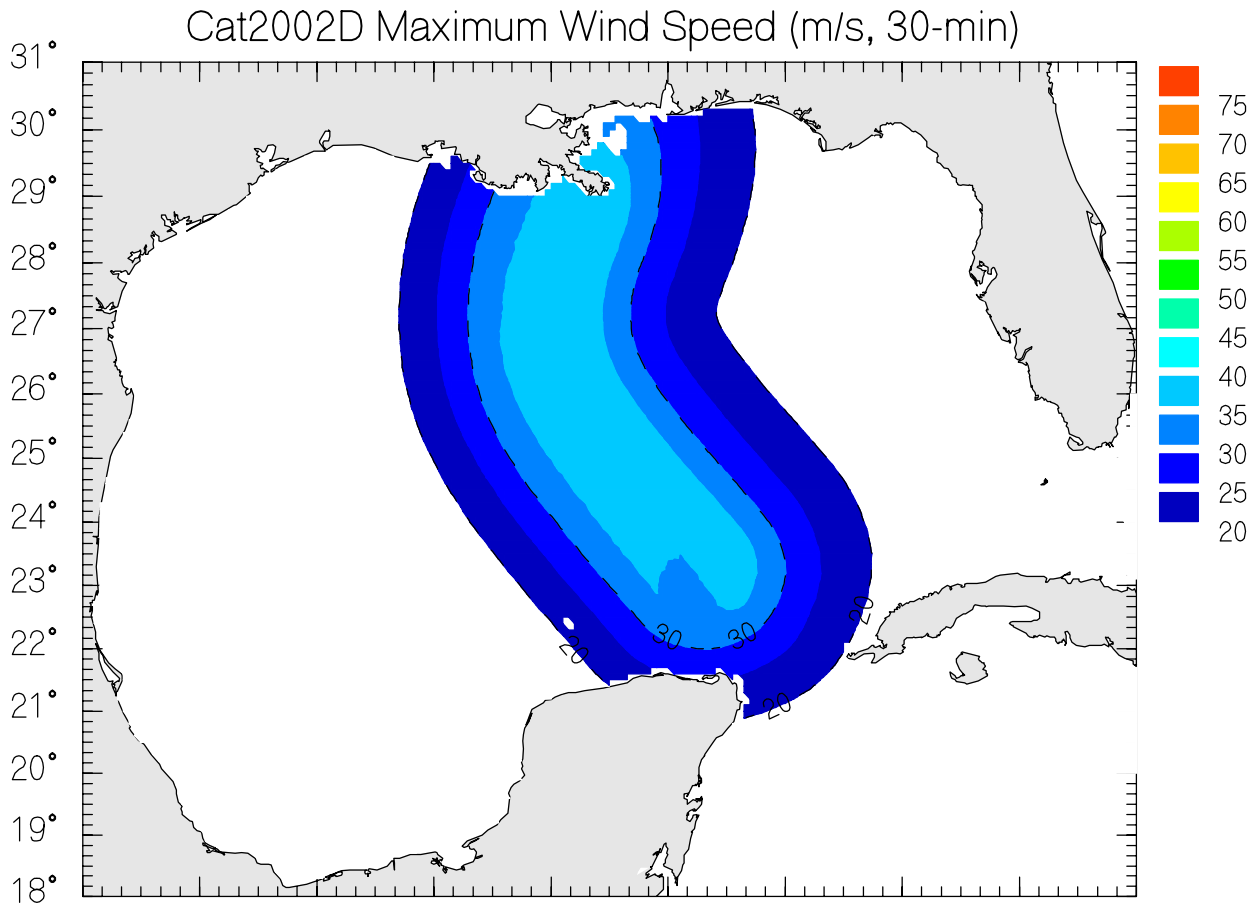
Cat2002D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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20
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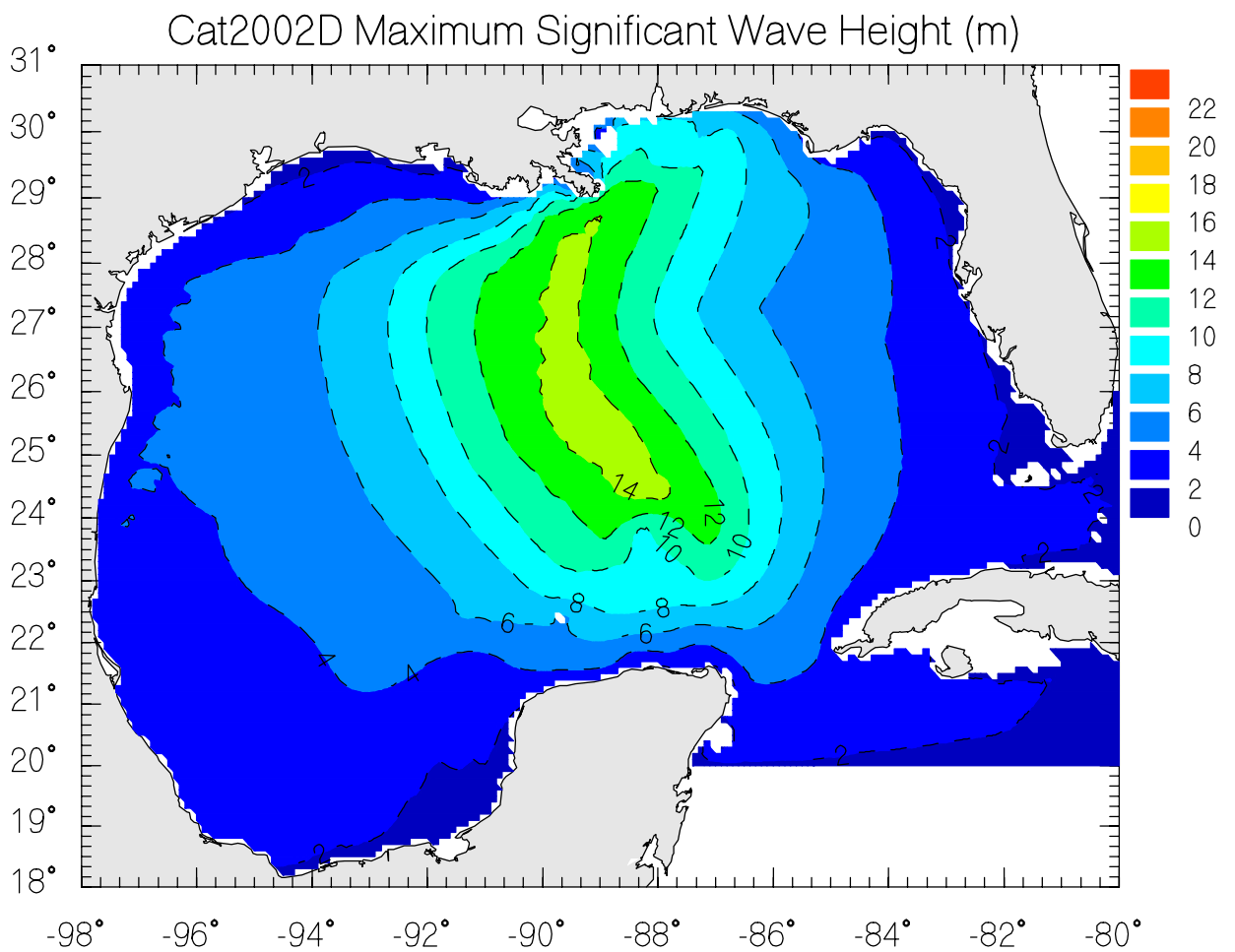
Cat2002D Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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18°
-98°
-96°
-94°
-92°
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-88°
-86°
-84°
-82°
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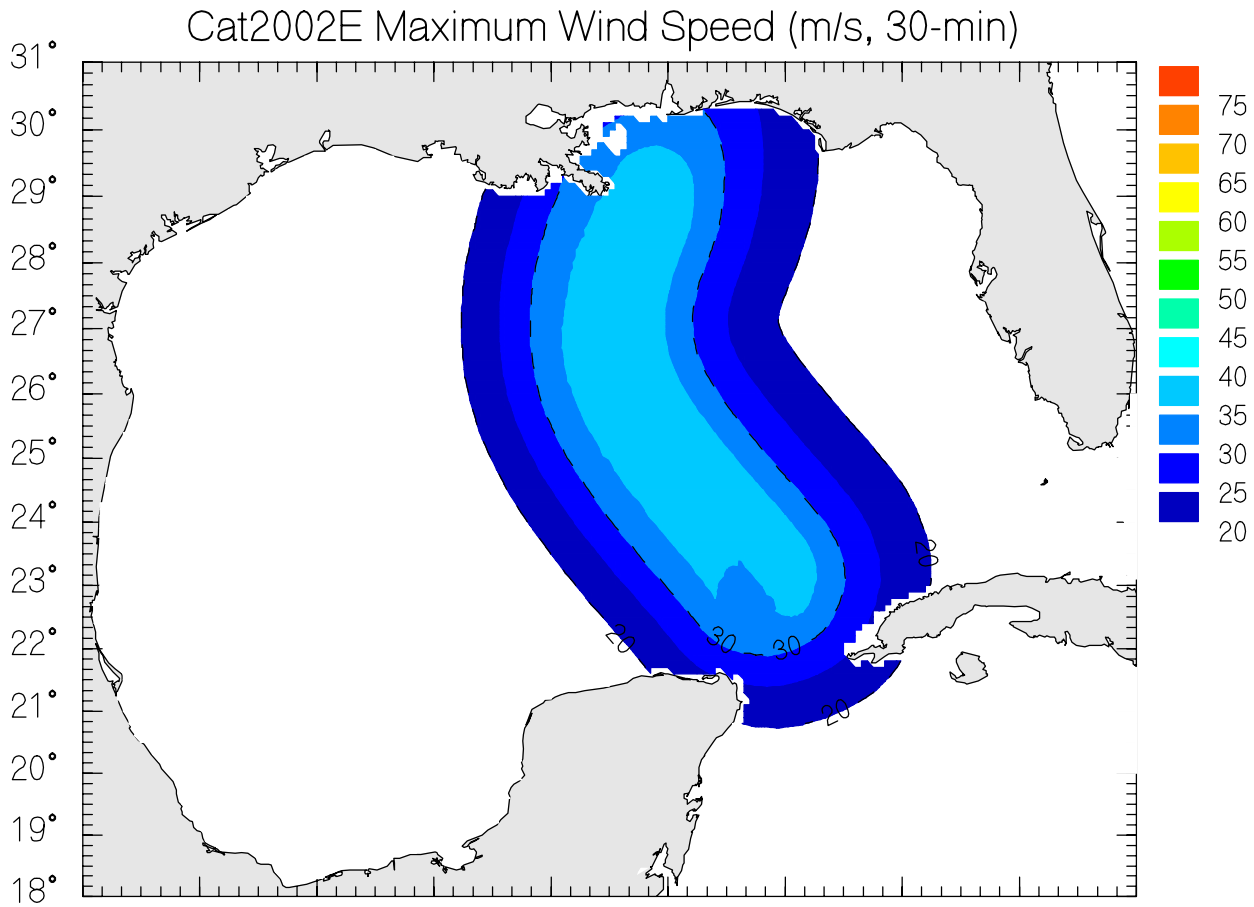
Cat2002E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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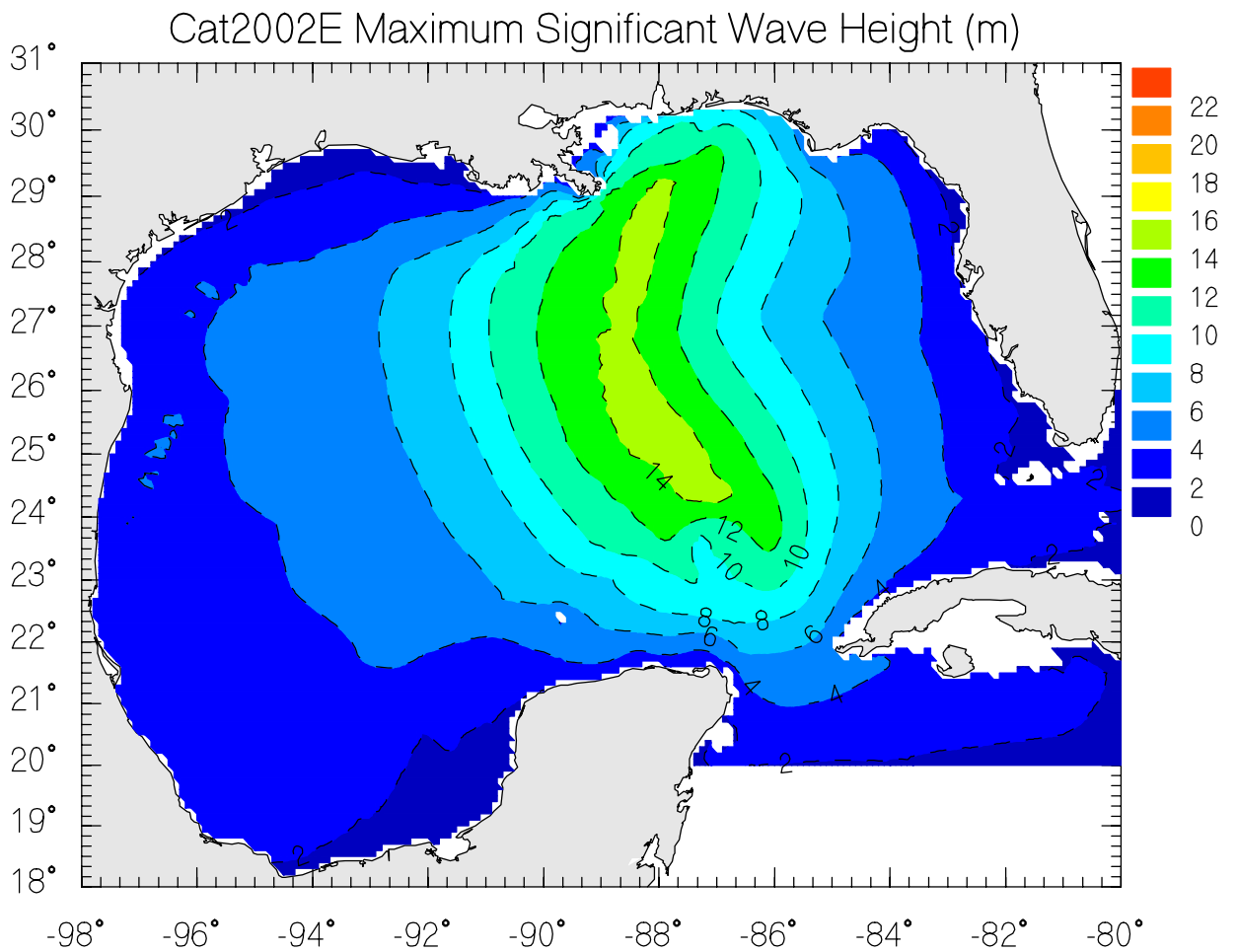
Cat2002E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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18°
-98°
-96°
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-90°
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-86°
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-82°
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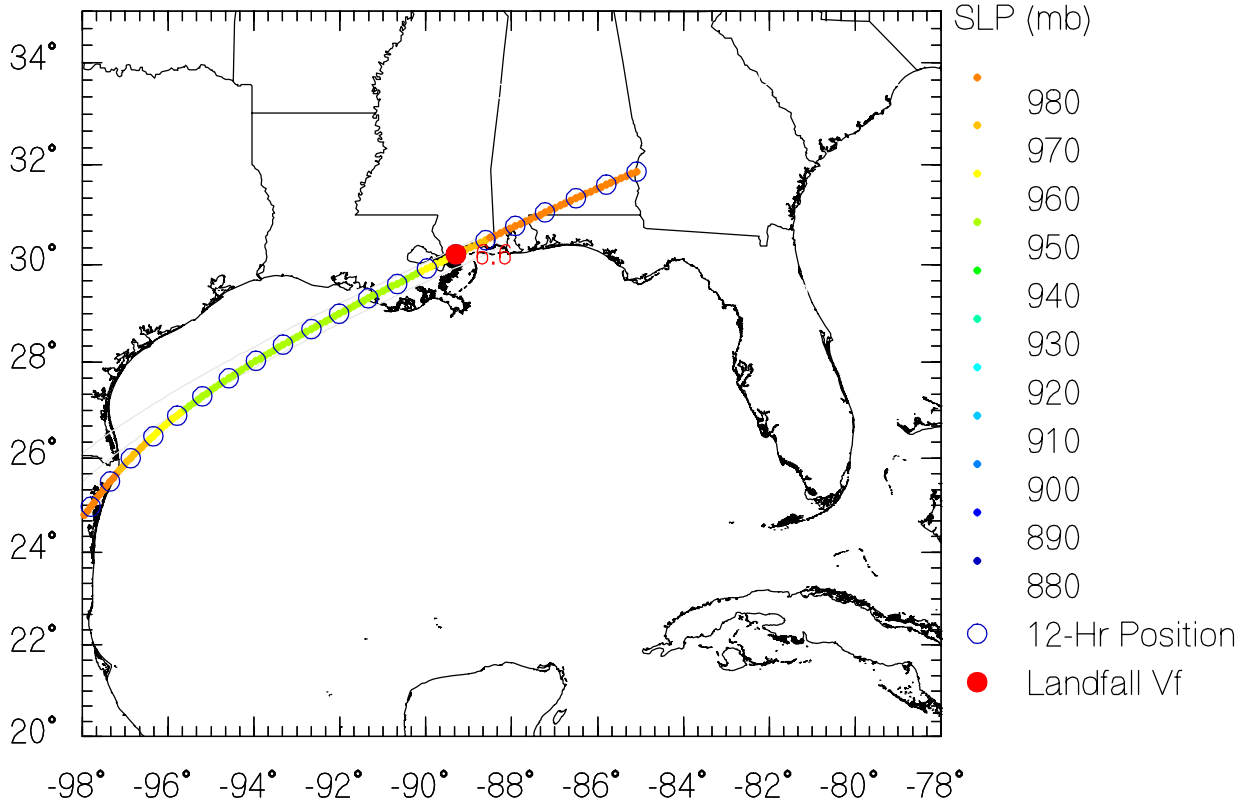
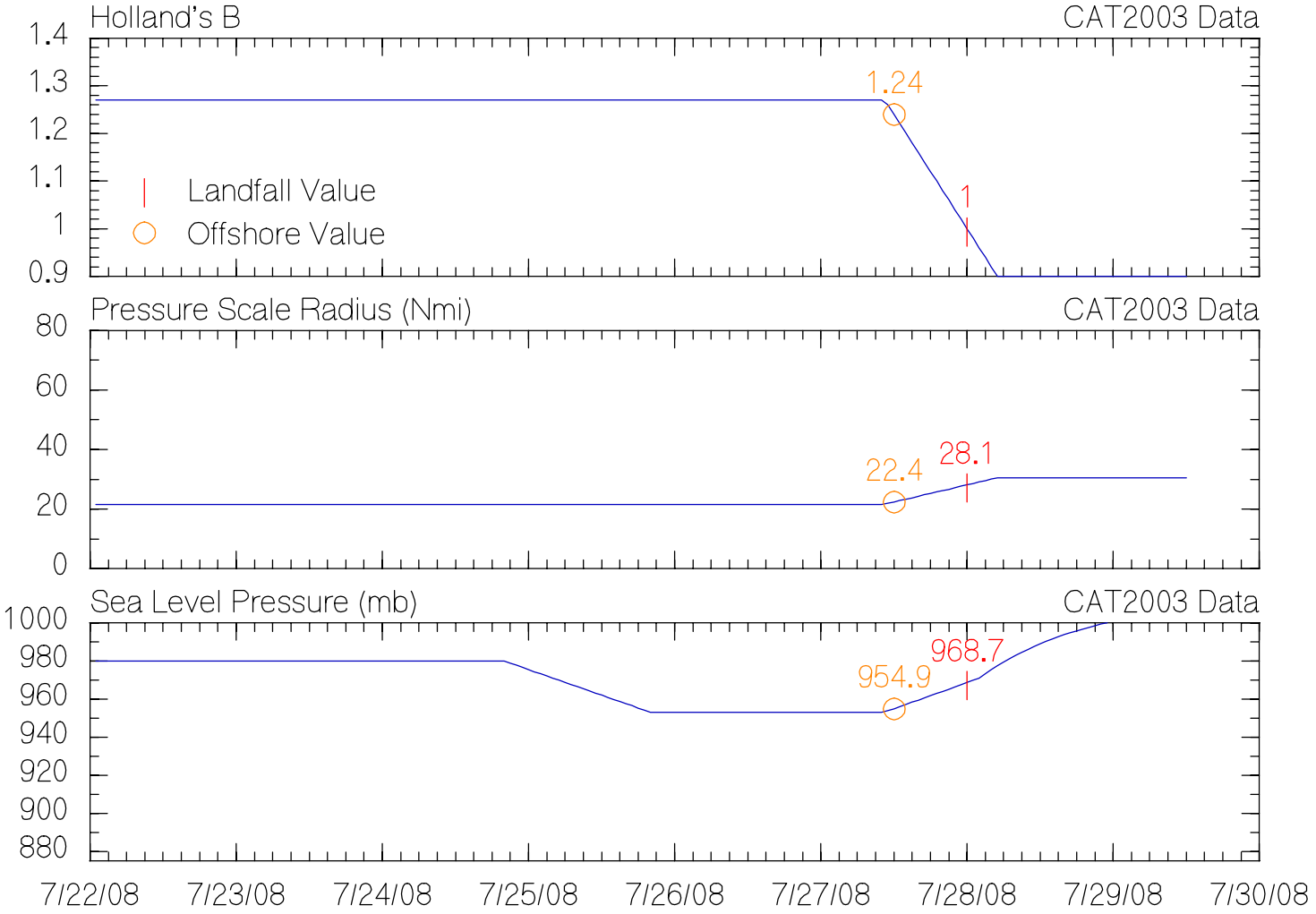
CAT2003 Data



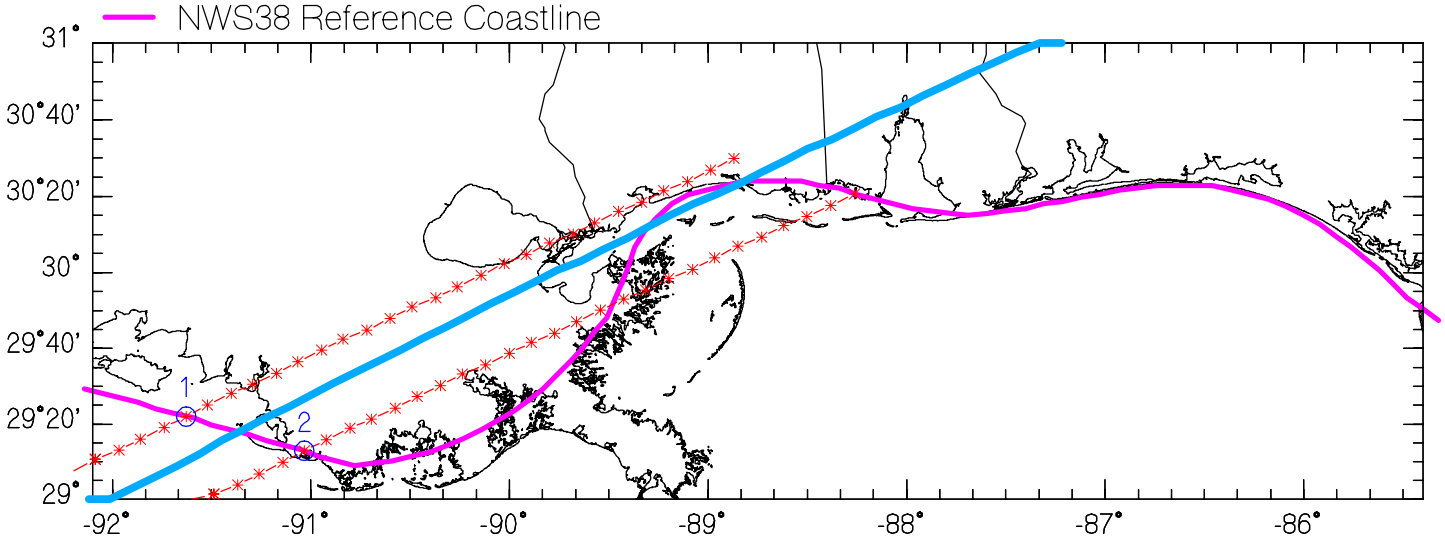


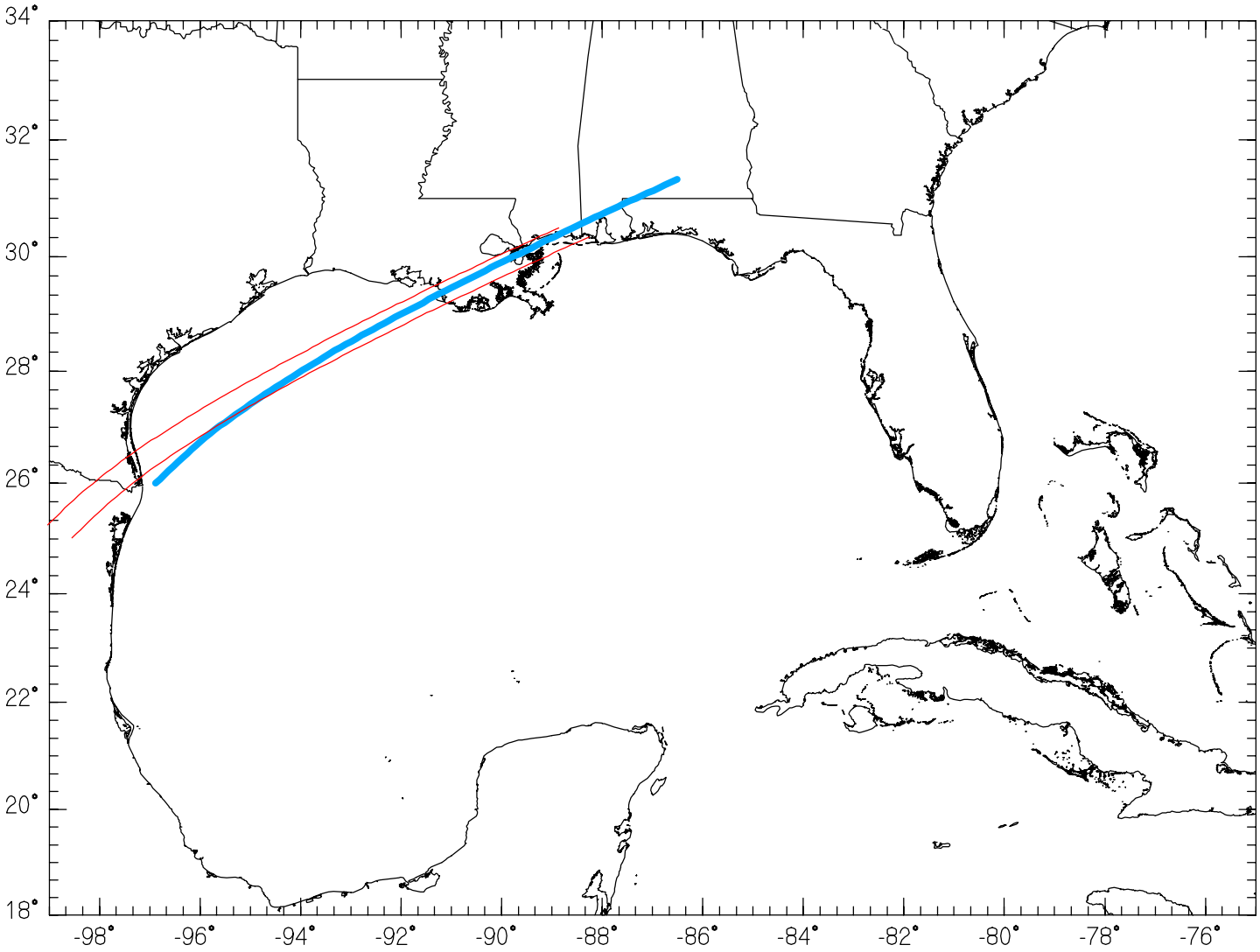
URS JPM-OS6 Production Tracks

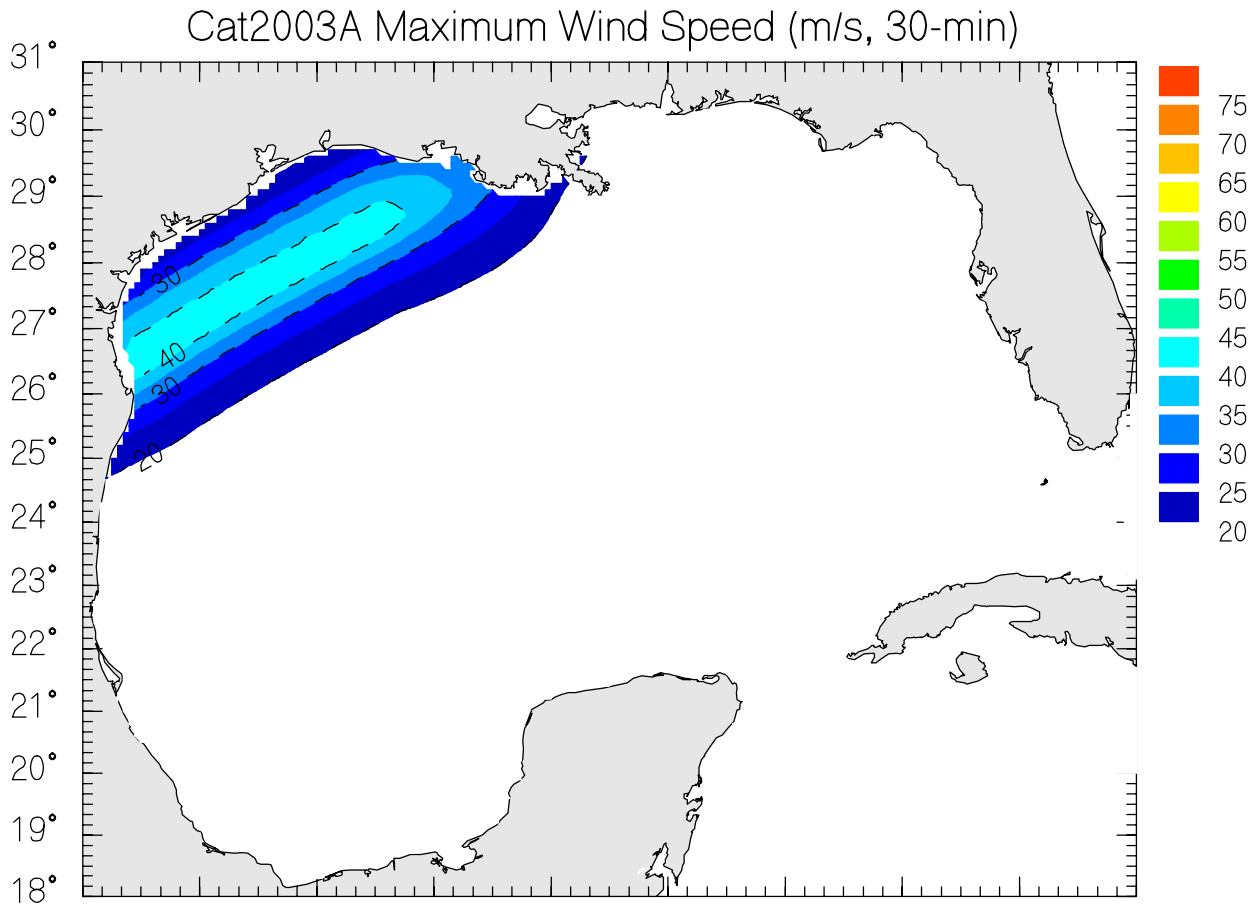
CAT2003 Data

Reference Track — Production Tracks — Production Track Landfall

NWS38 Reference Coastline






Cat2003A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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75
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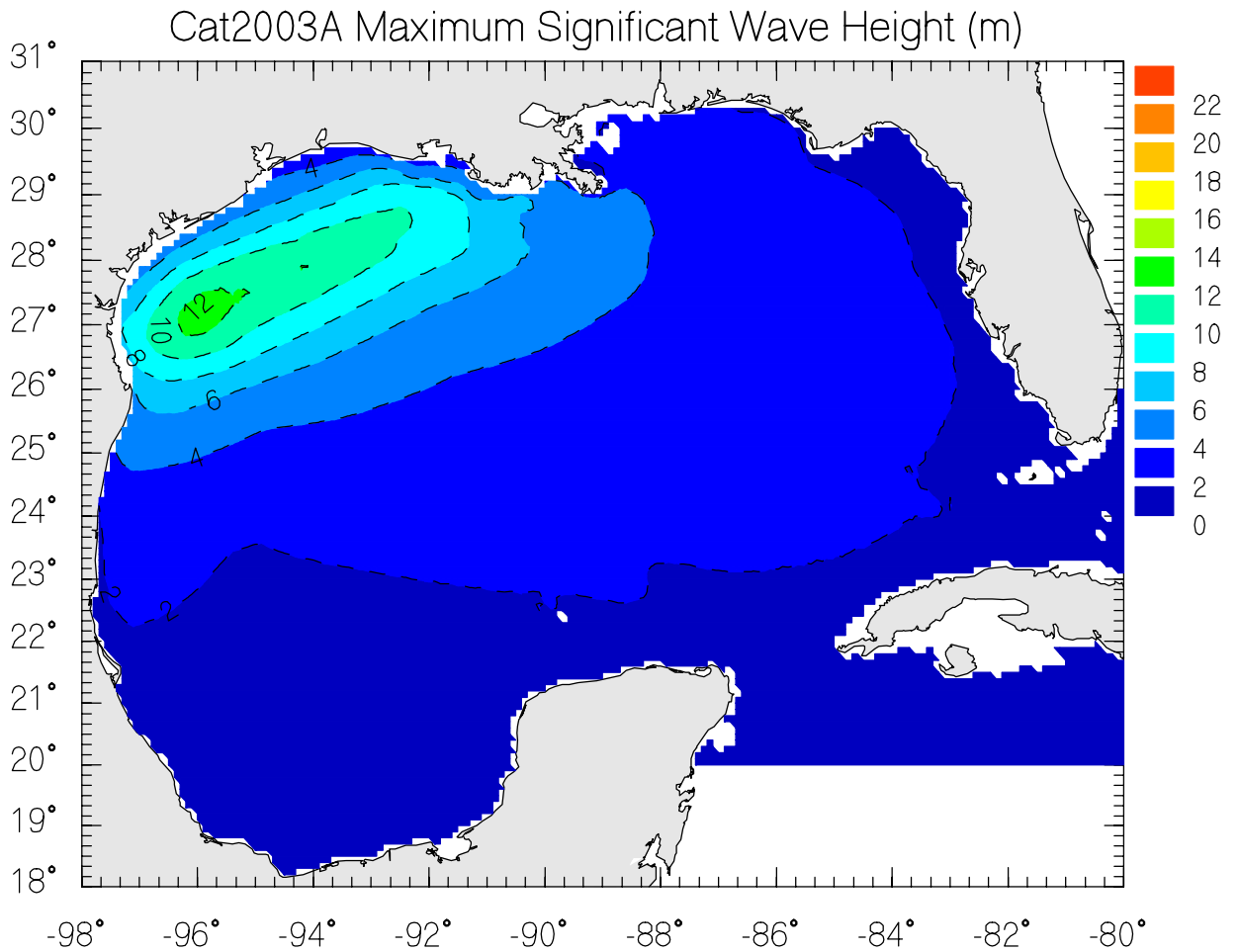
50
45
40
35
30
25
20


Cat2003A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
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25°
24°
23°
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21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
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22
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18
16
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12
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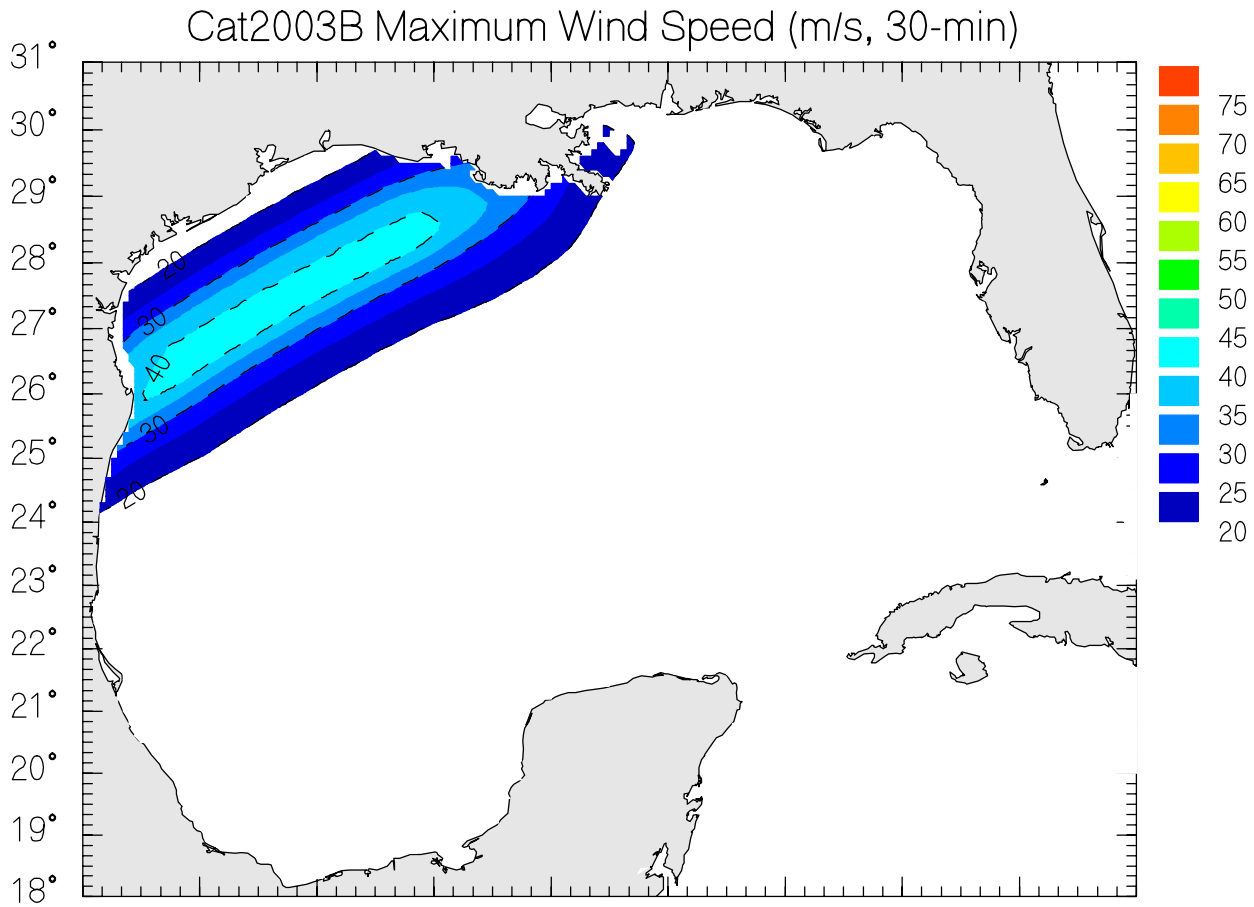
6
4
2
0


Cat2003B Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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30
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75
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50
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35
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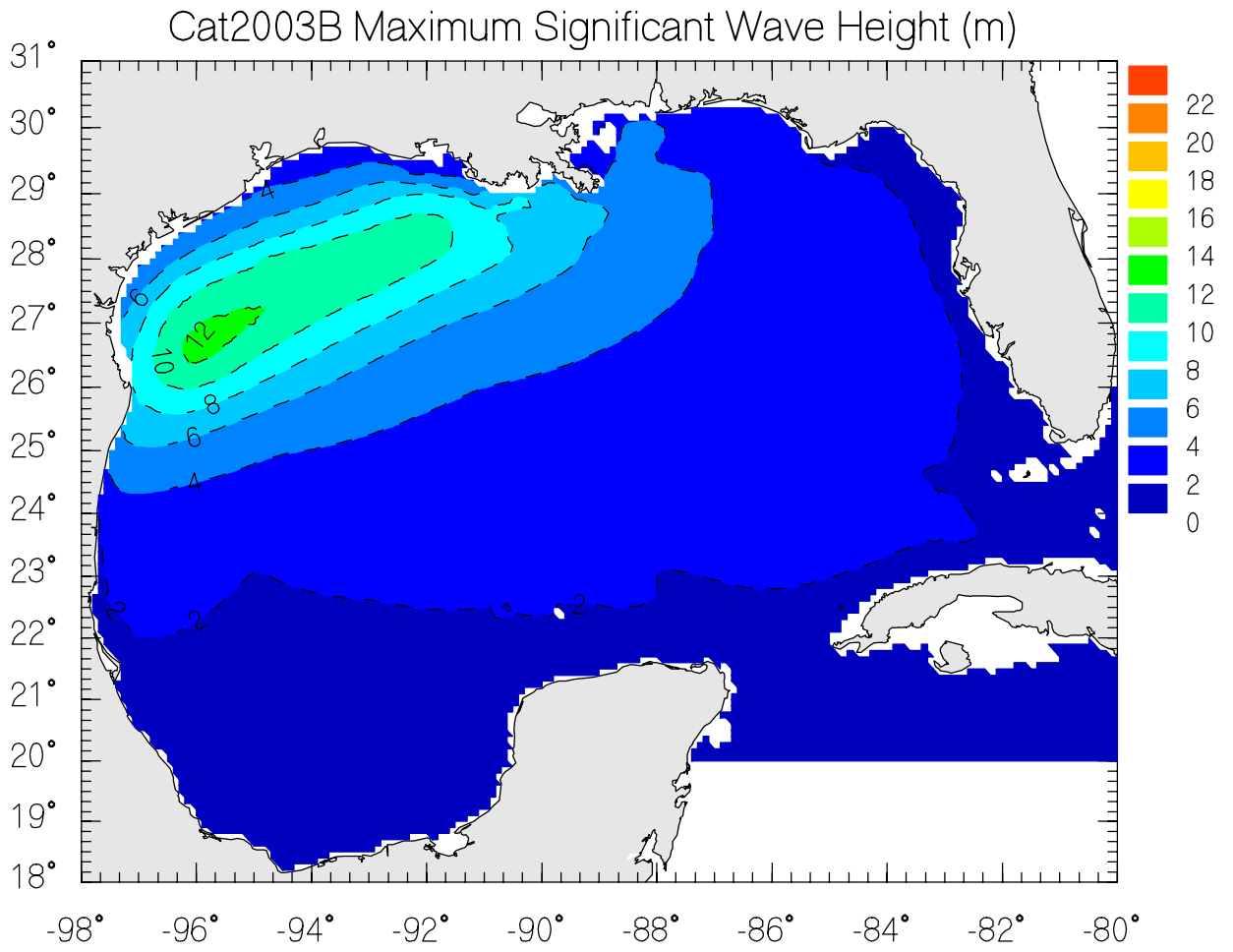
25
20


Cat2003B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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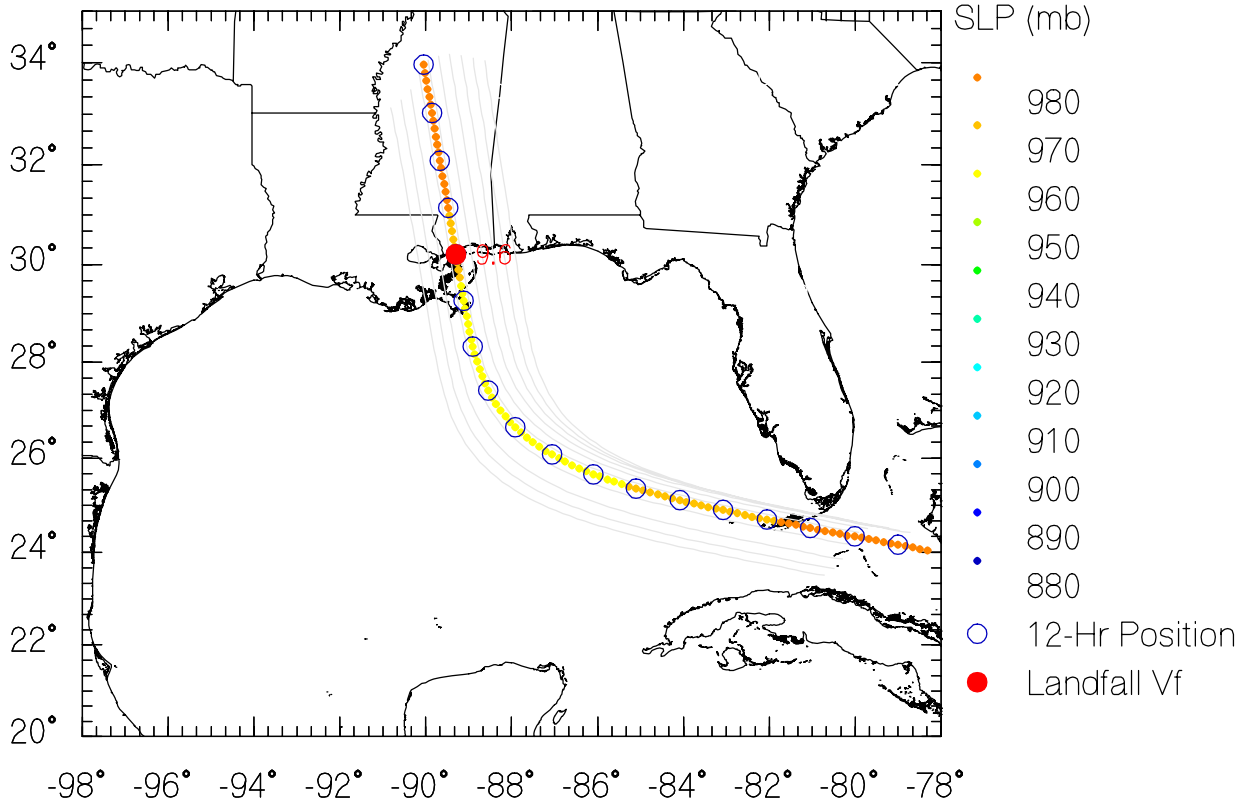
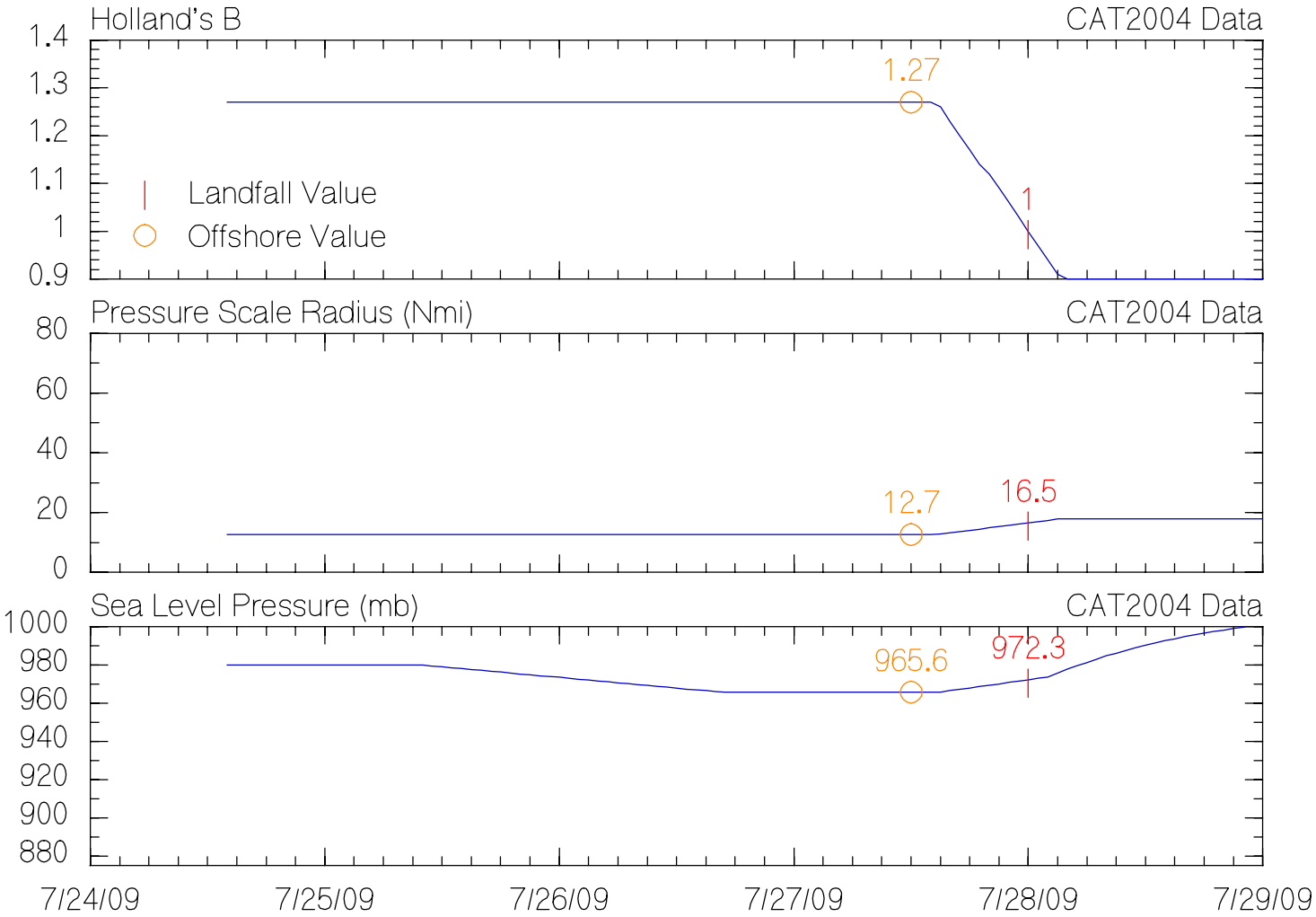
12
10
8
6
4
2
0

CAT2004 Data

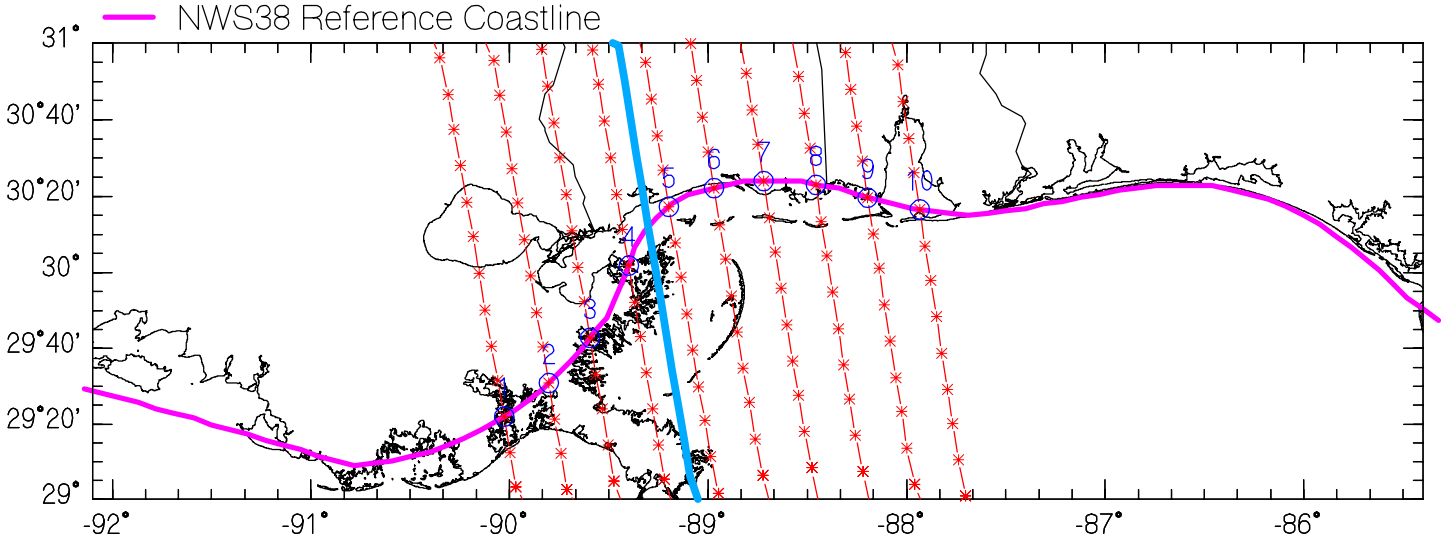


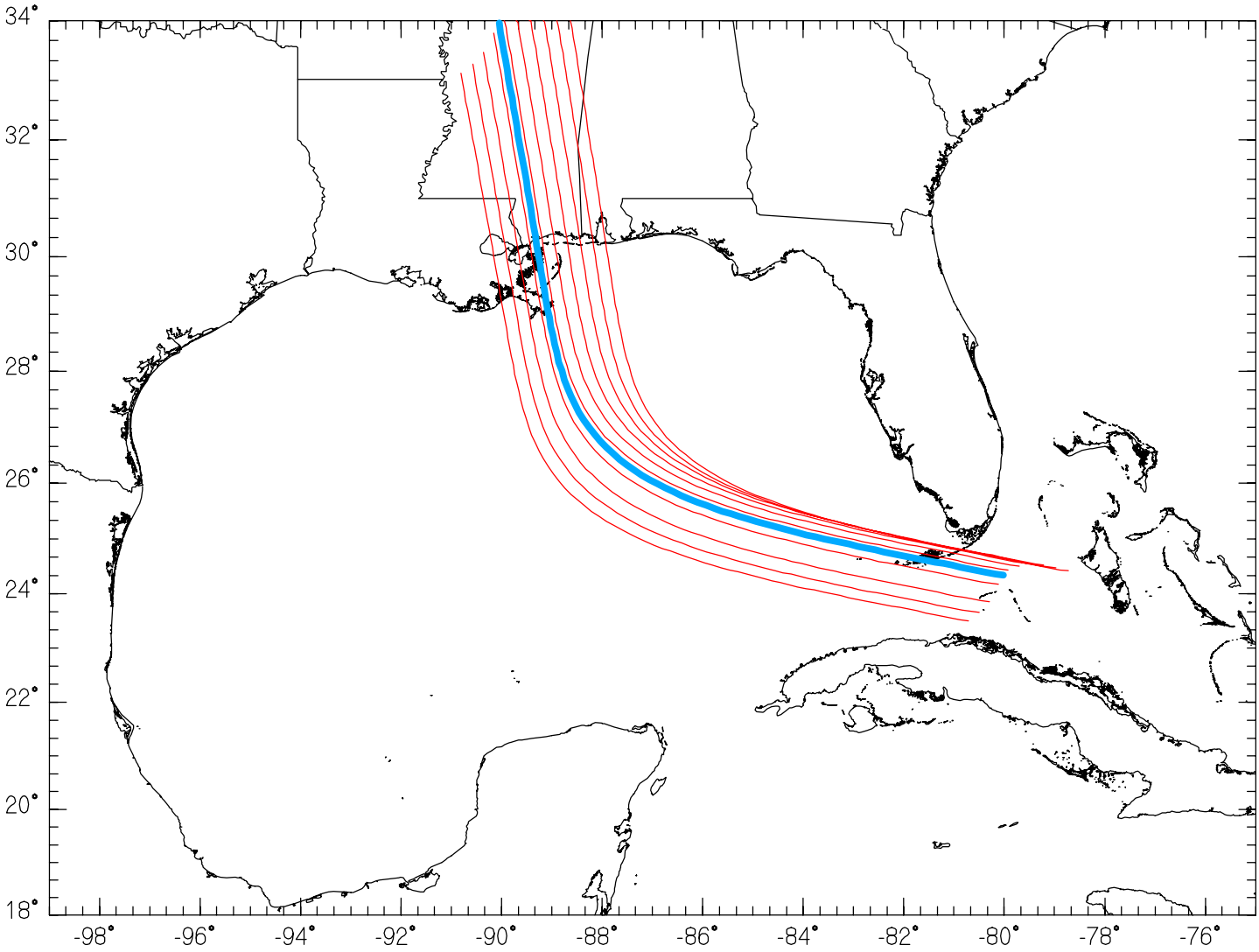


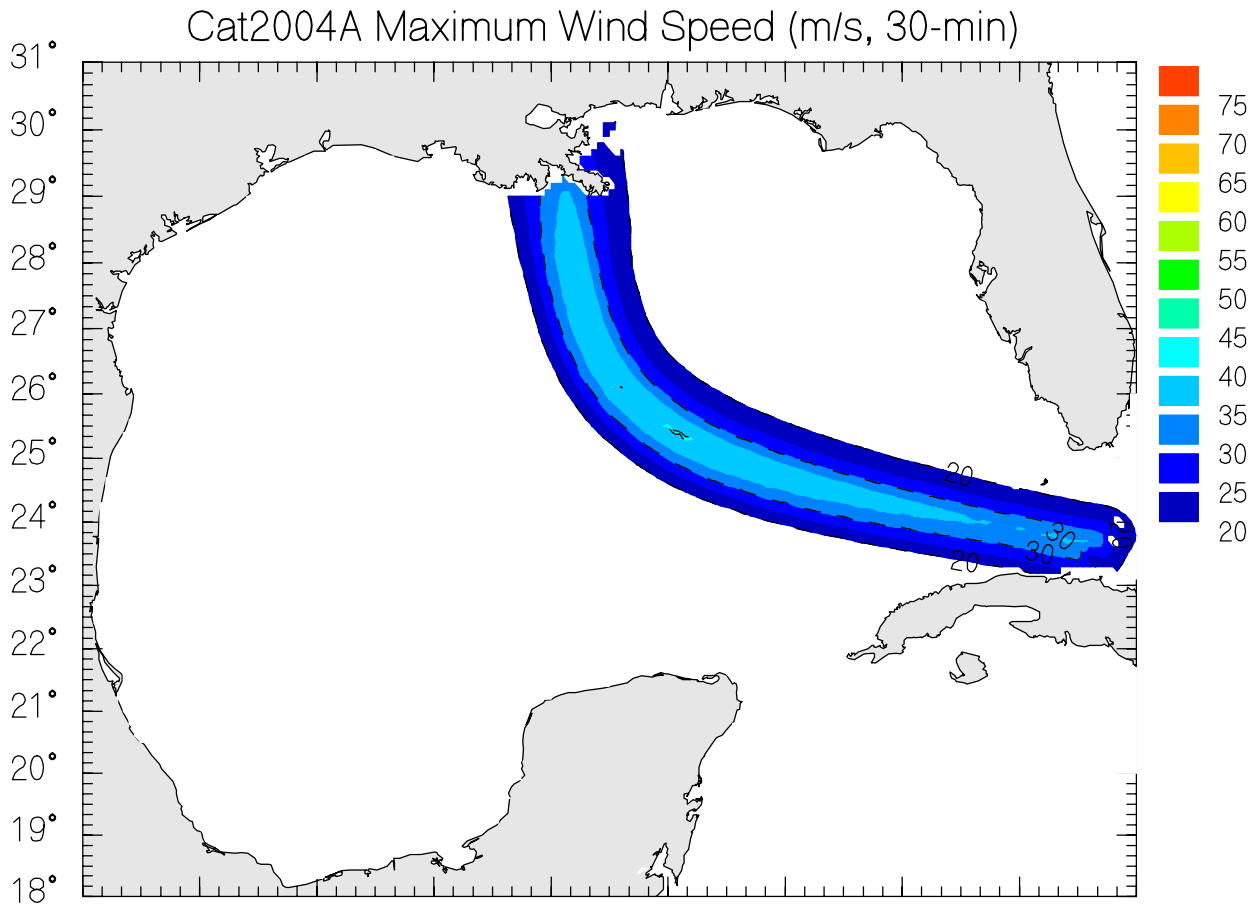
URS JPM-OS6 Production Tracks

CAT2004 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






Cat2004A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
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35
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25
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20
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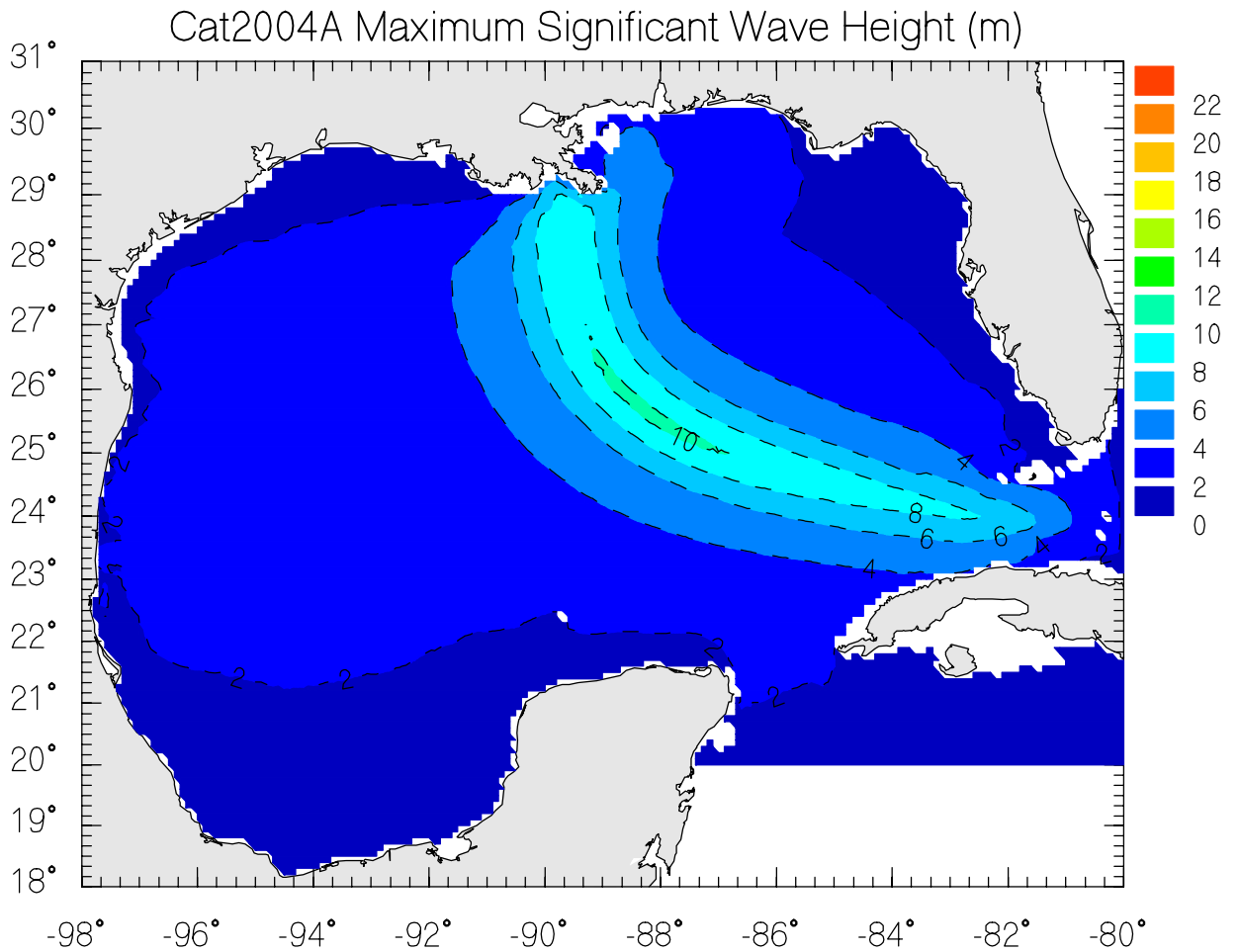
30
20


Cat2004A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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18°
-98°
-96°
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-88°
-86°
-84°
-82°
-80°
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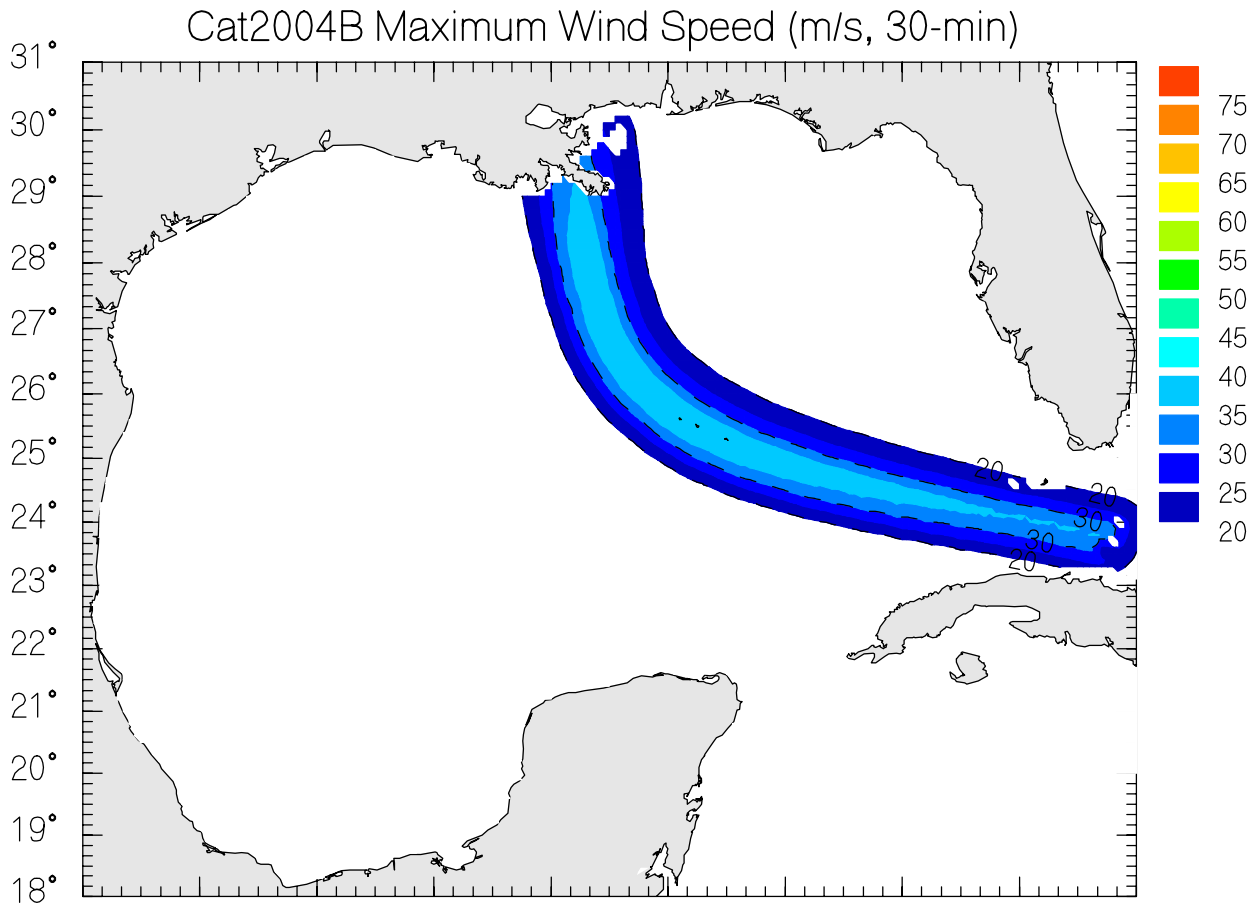
2
2


Cat2004B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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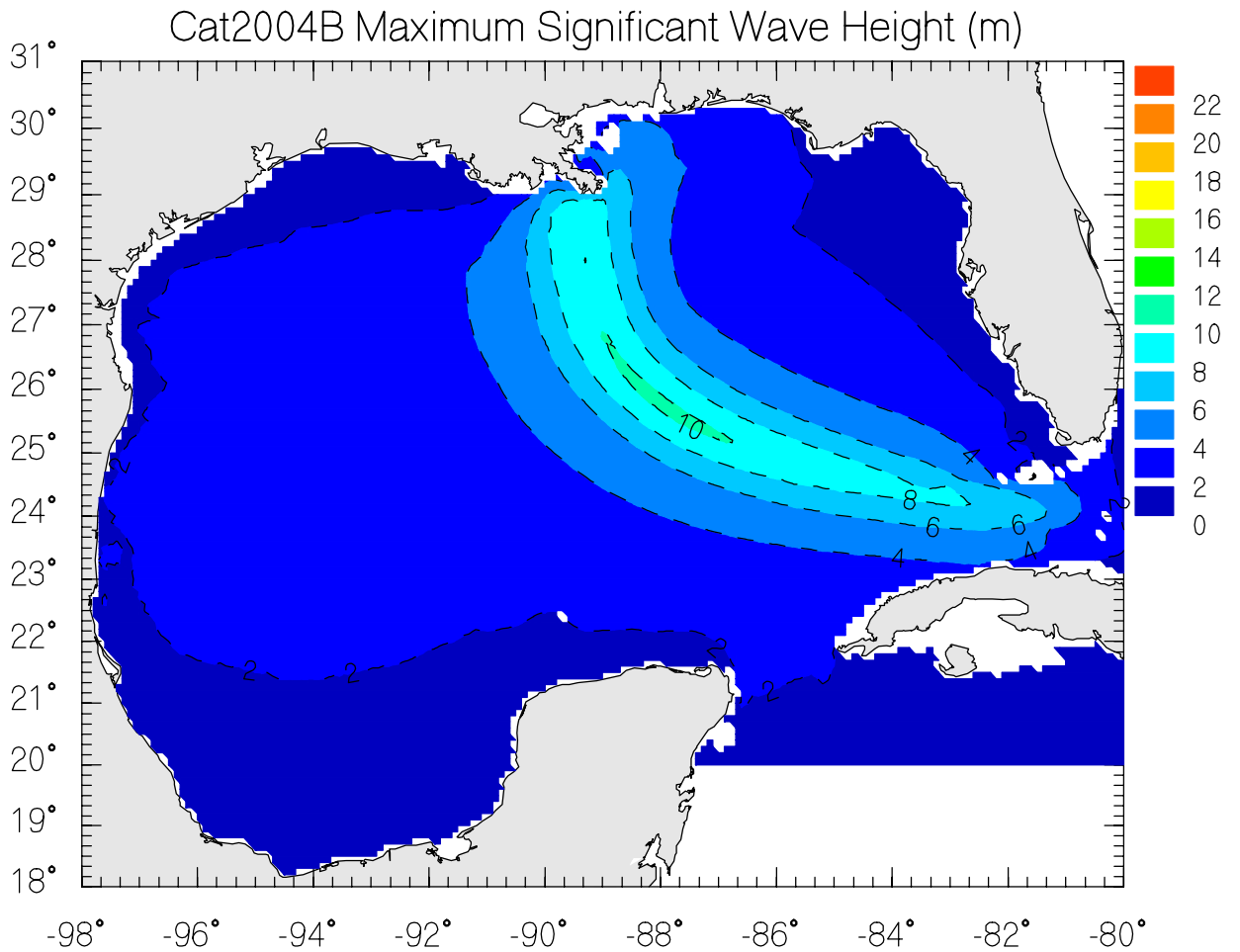
30
20


Cat2004B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
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-88°
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-84°
-82°
-80°
22
20
18
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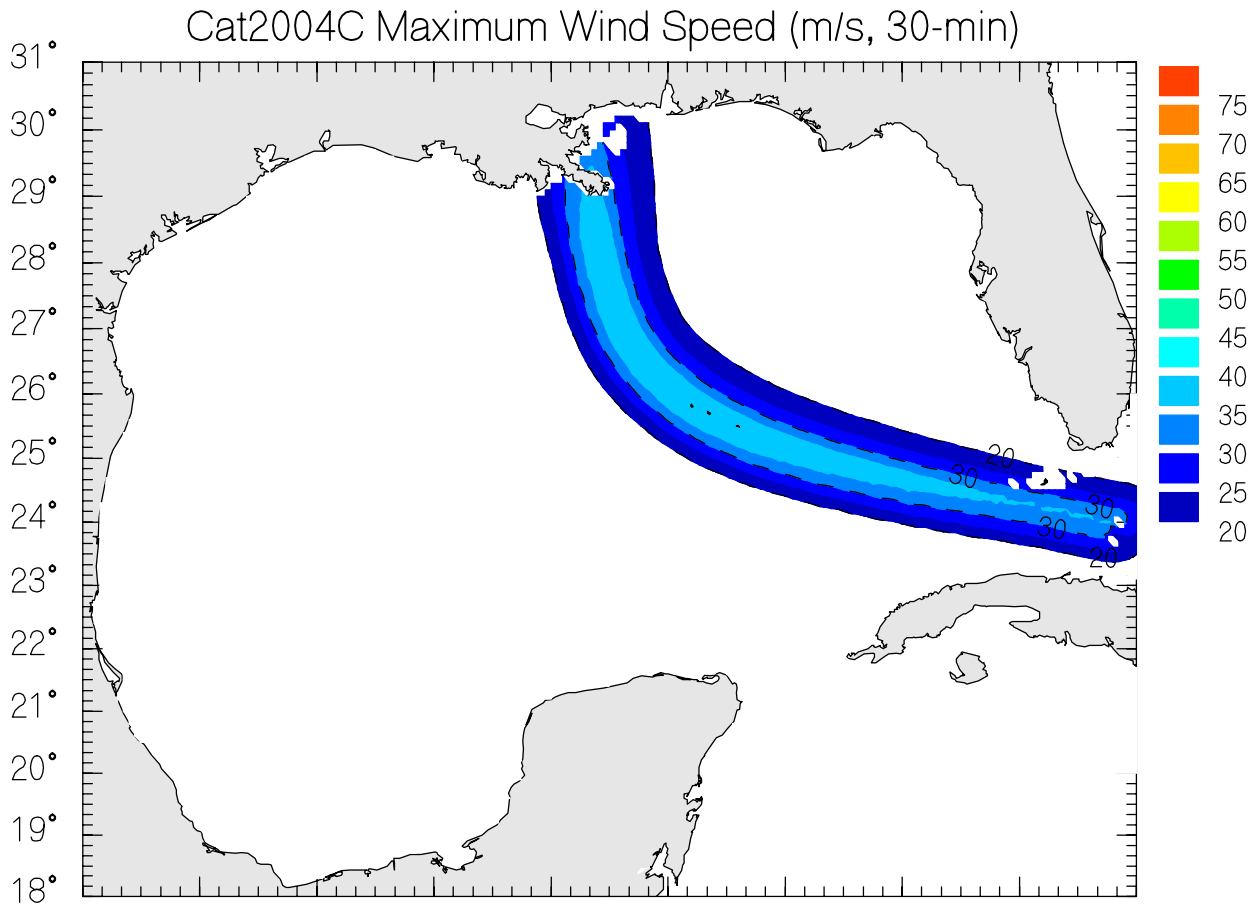
2


Cat2004C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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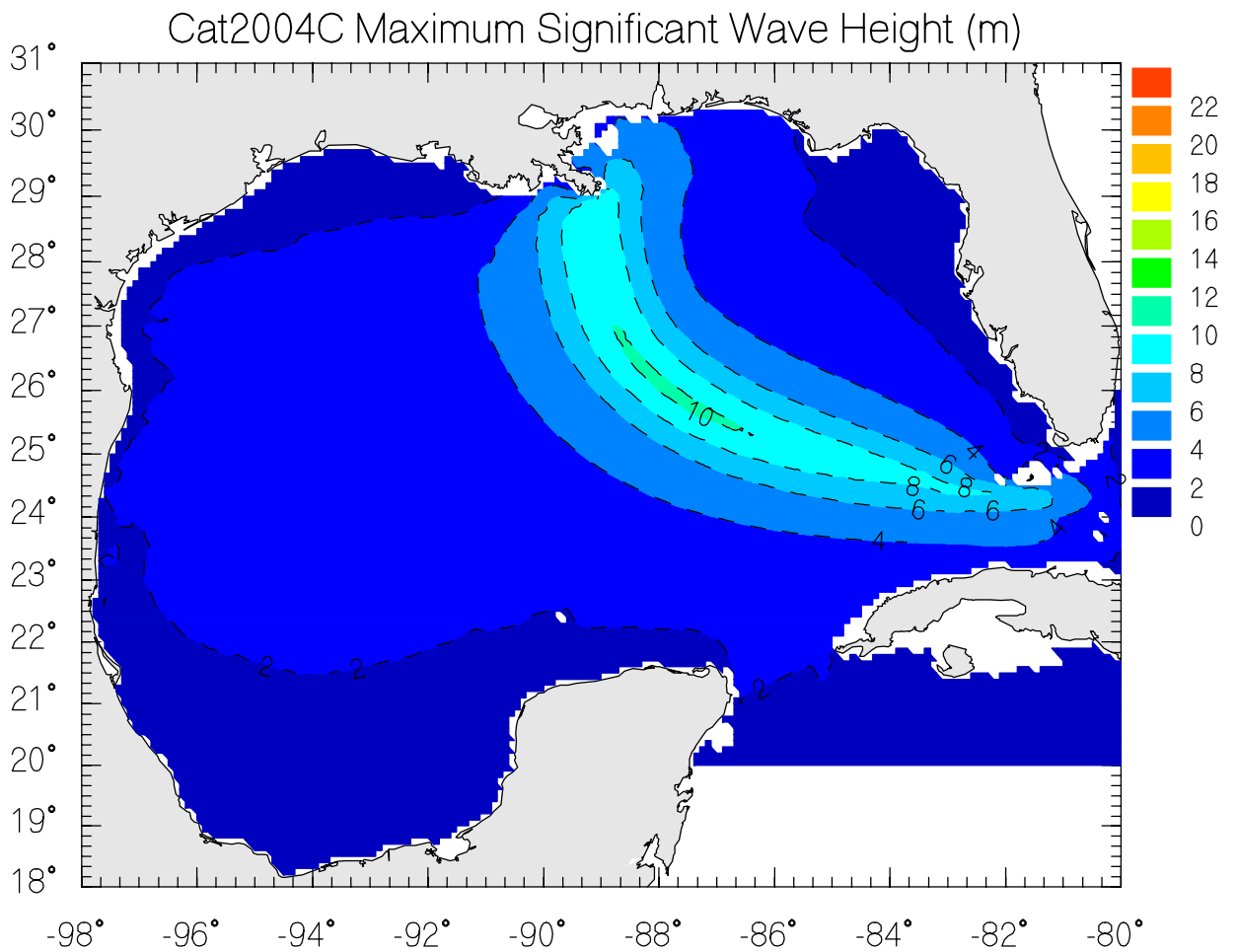
20


Cat2004C Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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-96°
-94°
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-88°
-86°
-84°
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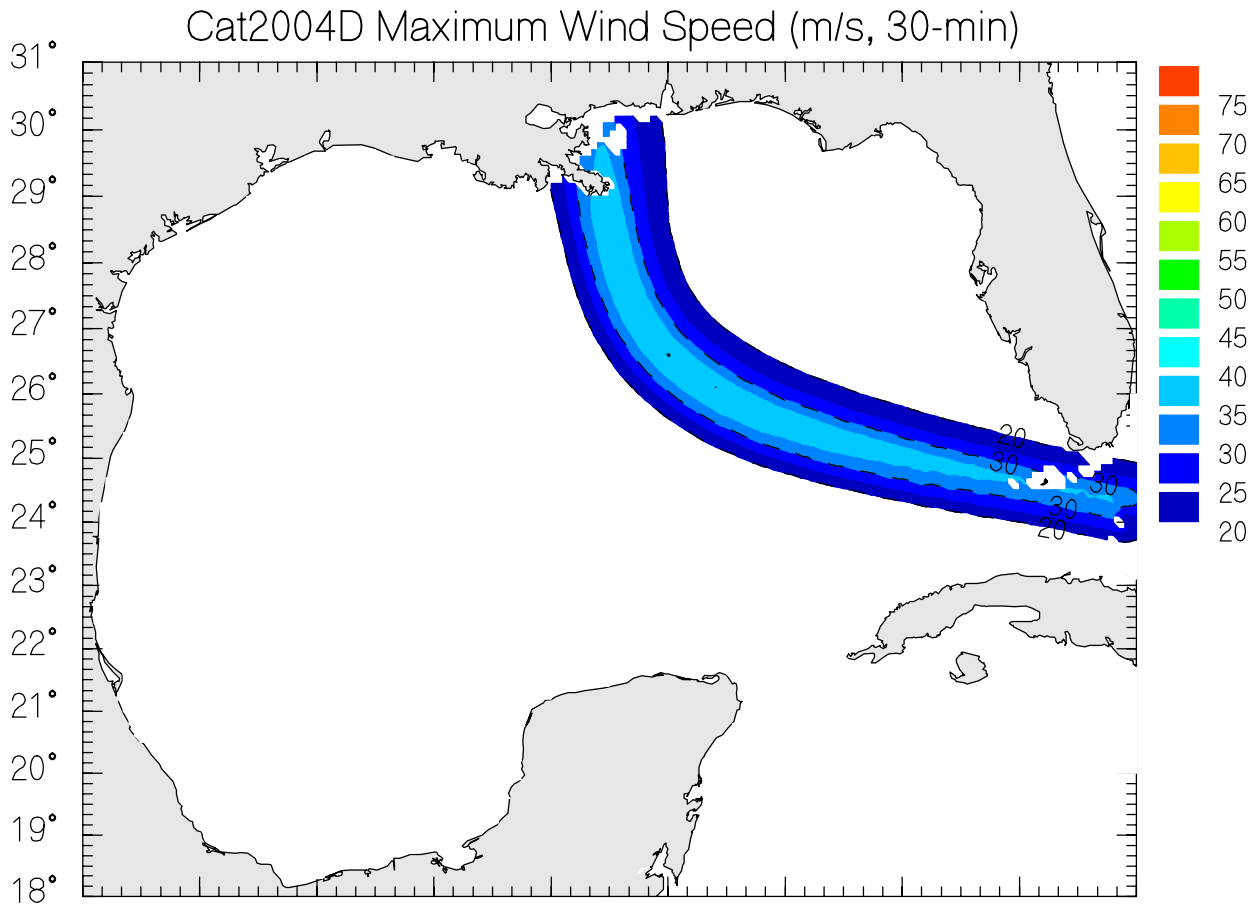
Cat2004D Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
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30
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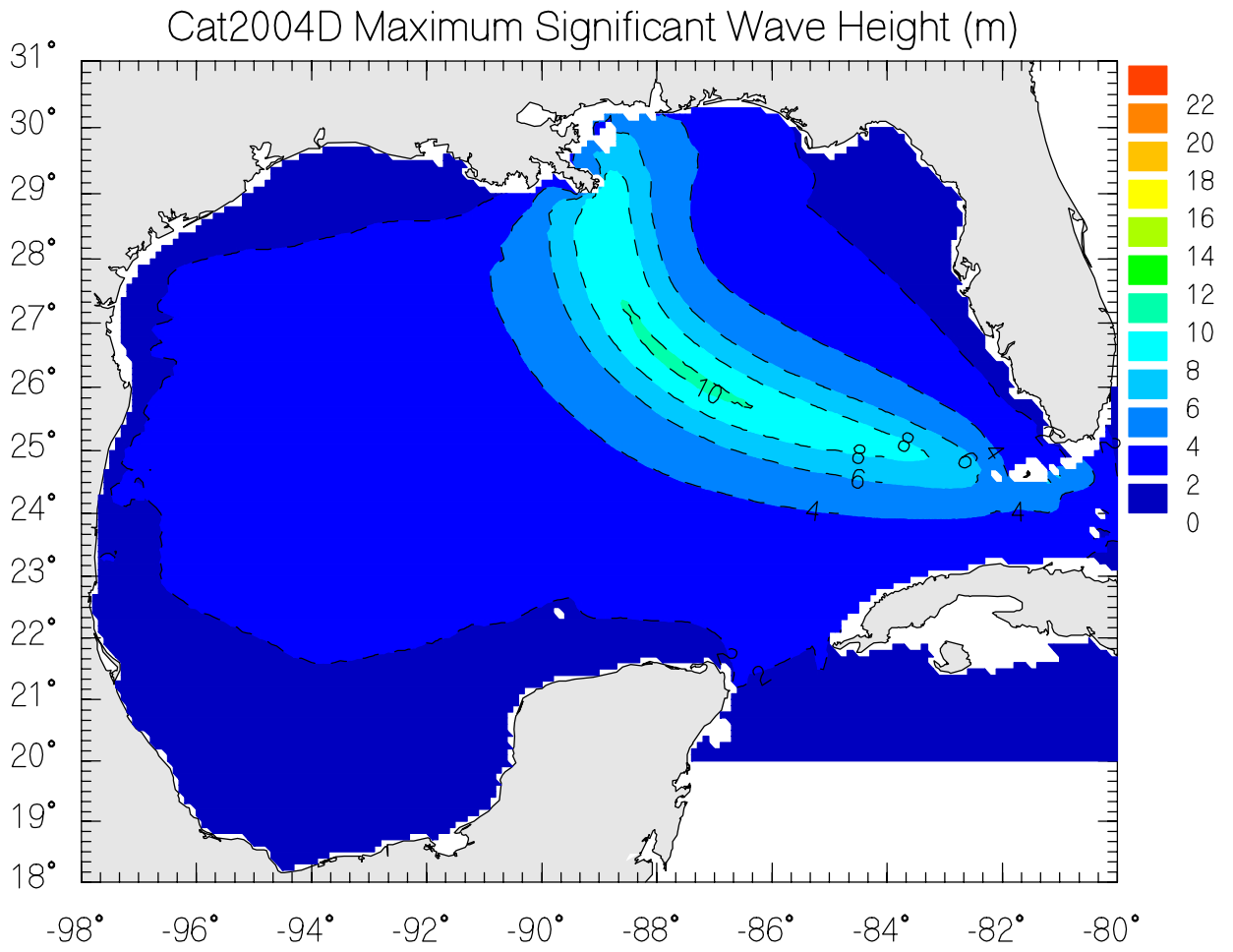
25
20


Cat2004D Maximum Significant Wave Height (m)
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18°
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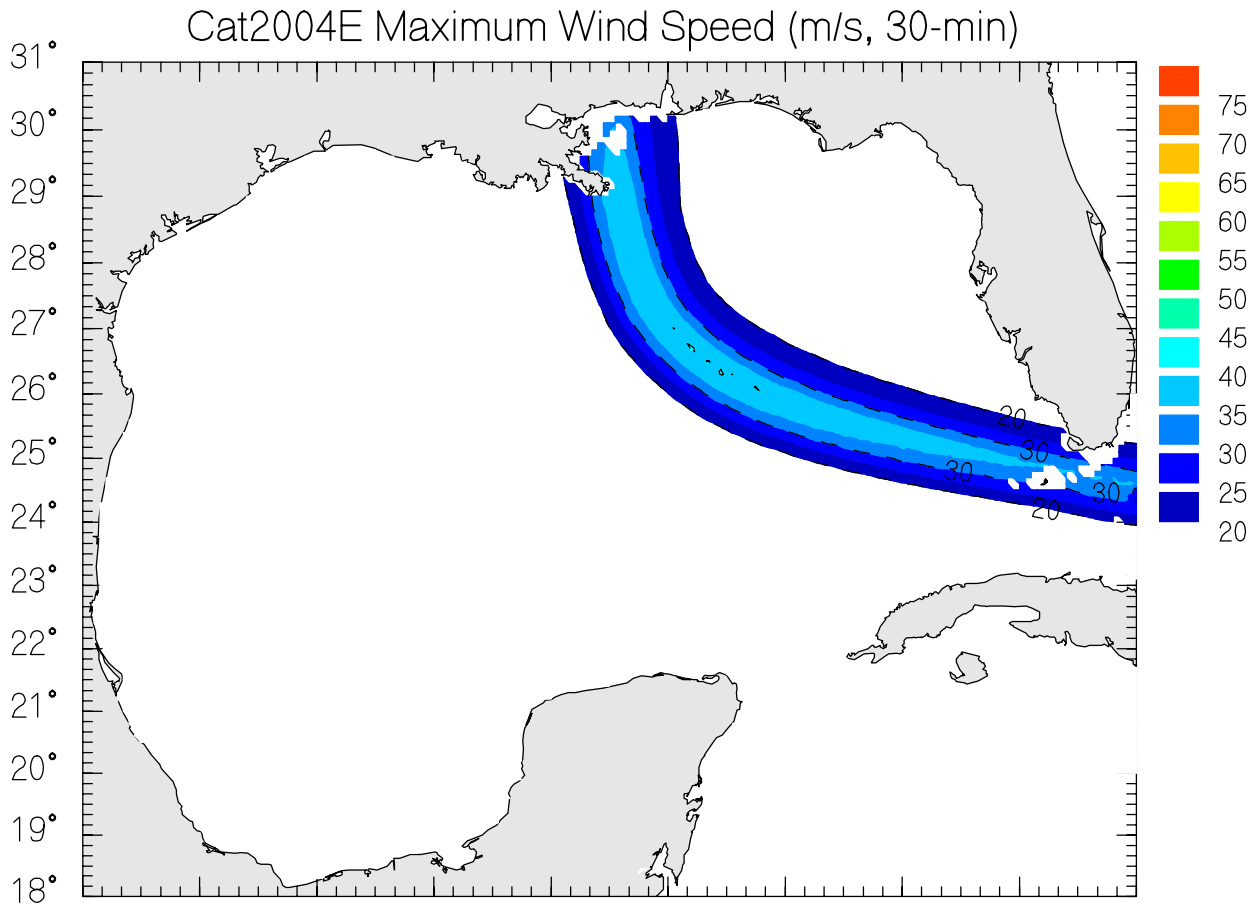
-82°
-80°


Cat2004E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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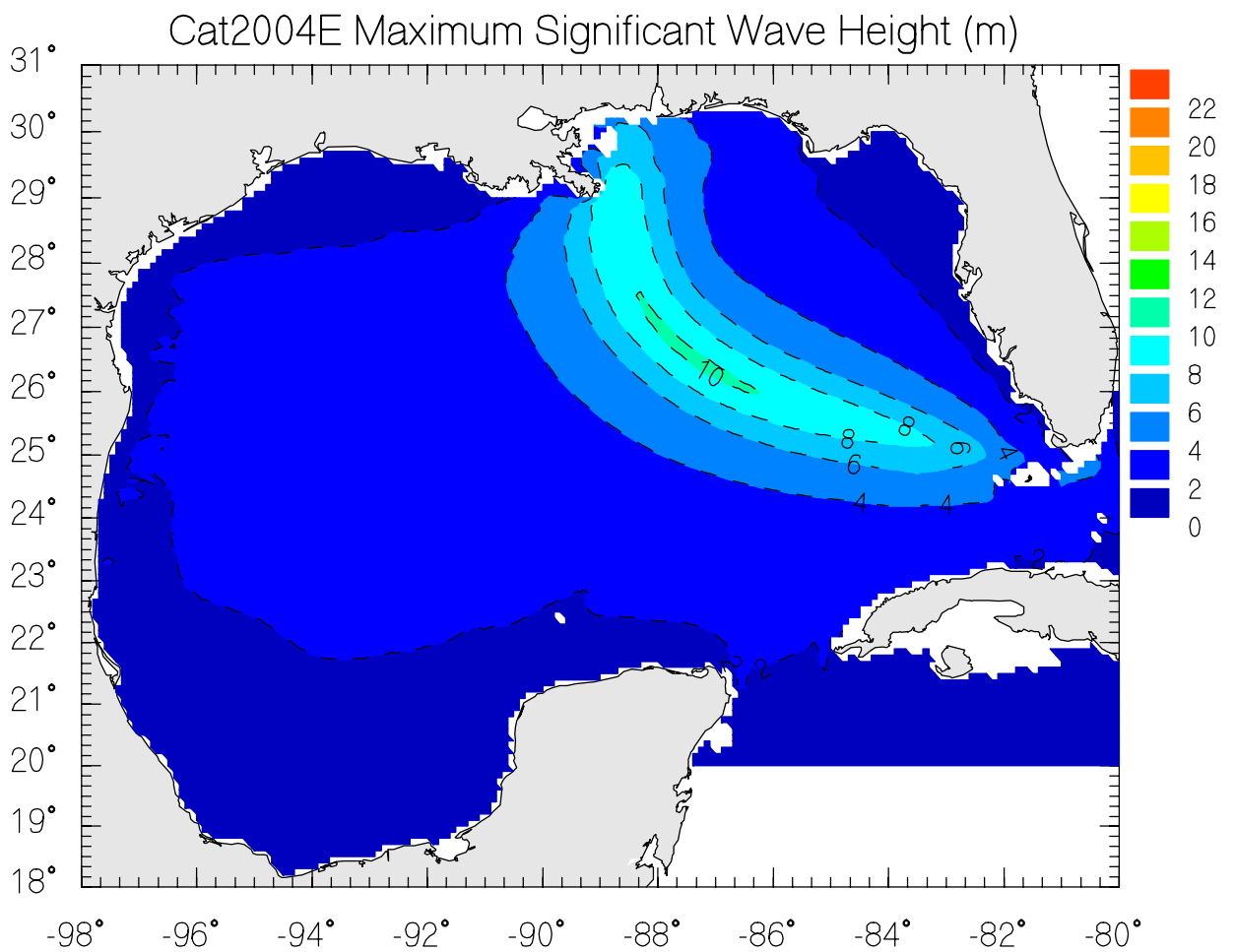
Cat2004E Maximum Significant Wave Height (m)
31°
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19°
18°
-98°
-96°
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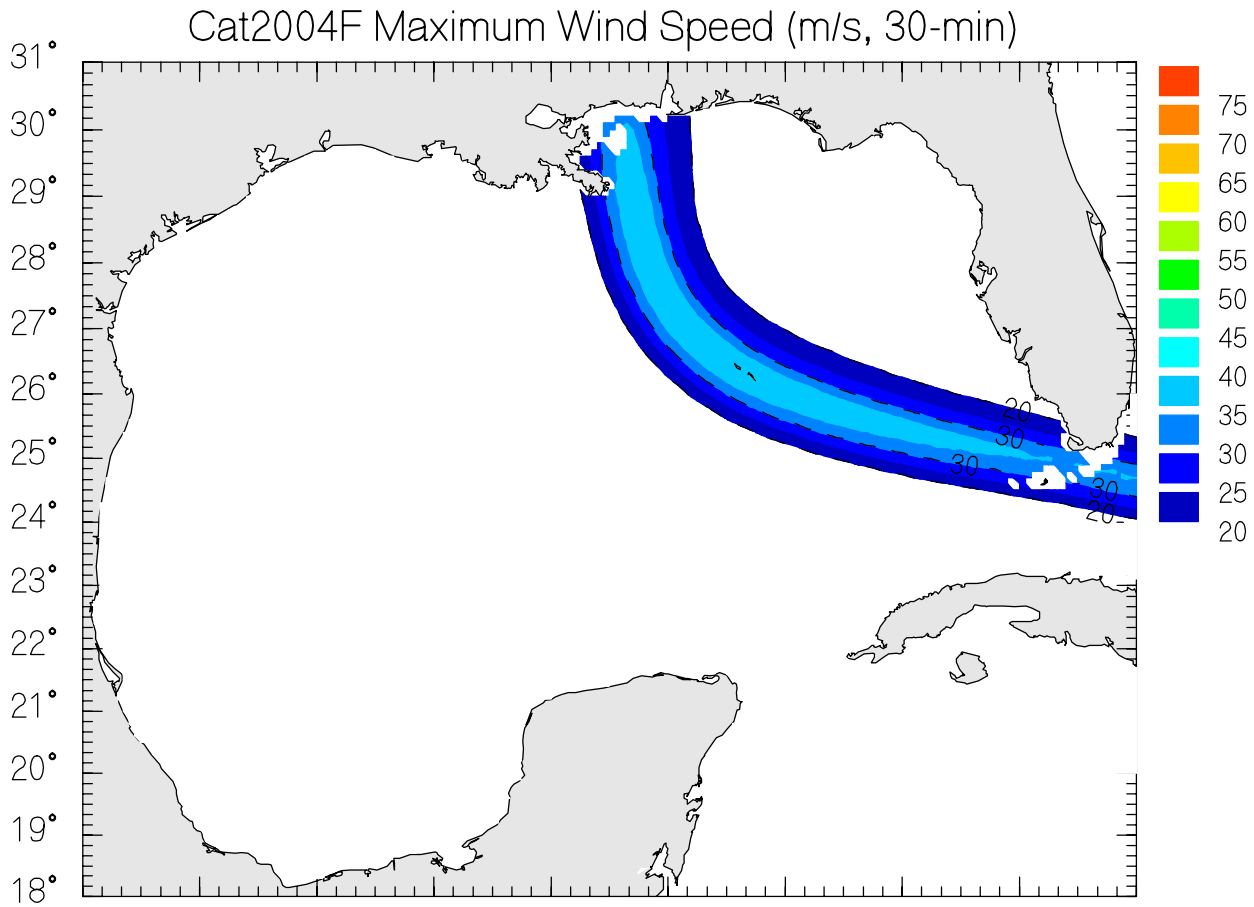
Cat2004F Maximum Wind Speed (m/s, 30-min)
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29°
28°
27°
26°
25°
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21°
20°
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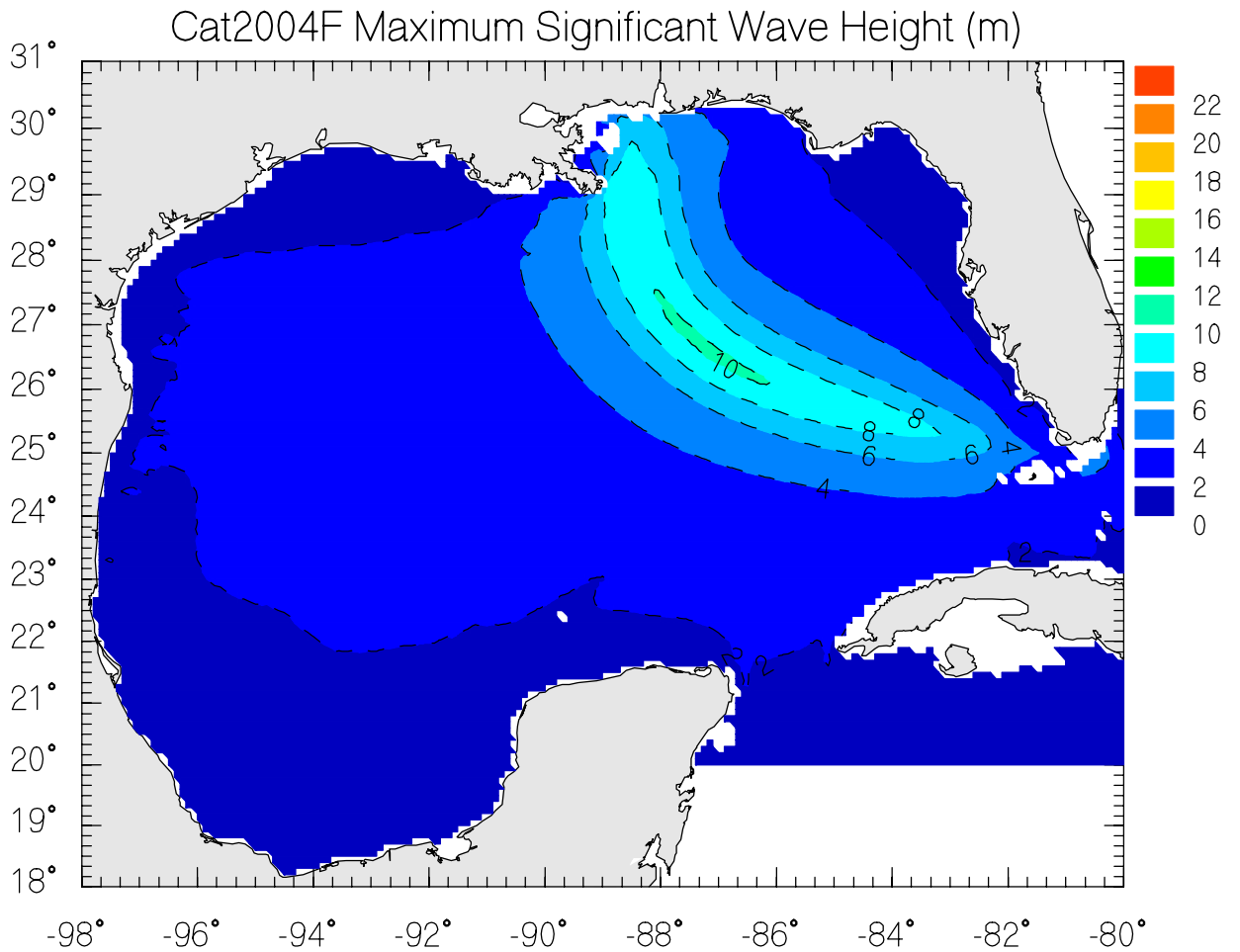
Cat2004F Maximum Significant Wave Height (m)
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27°
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19°
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-96°
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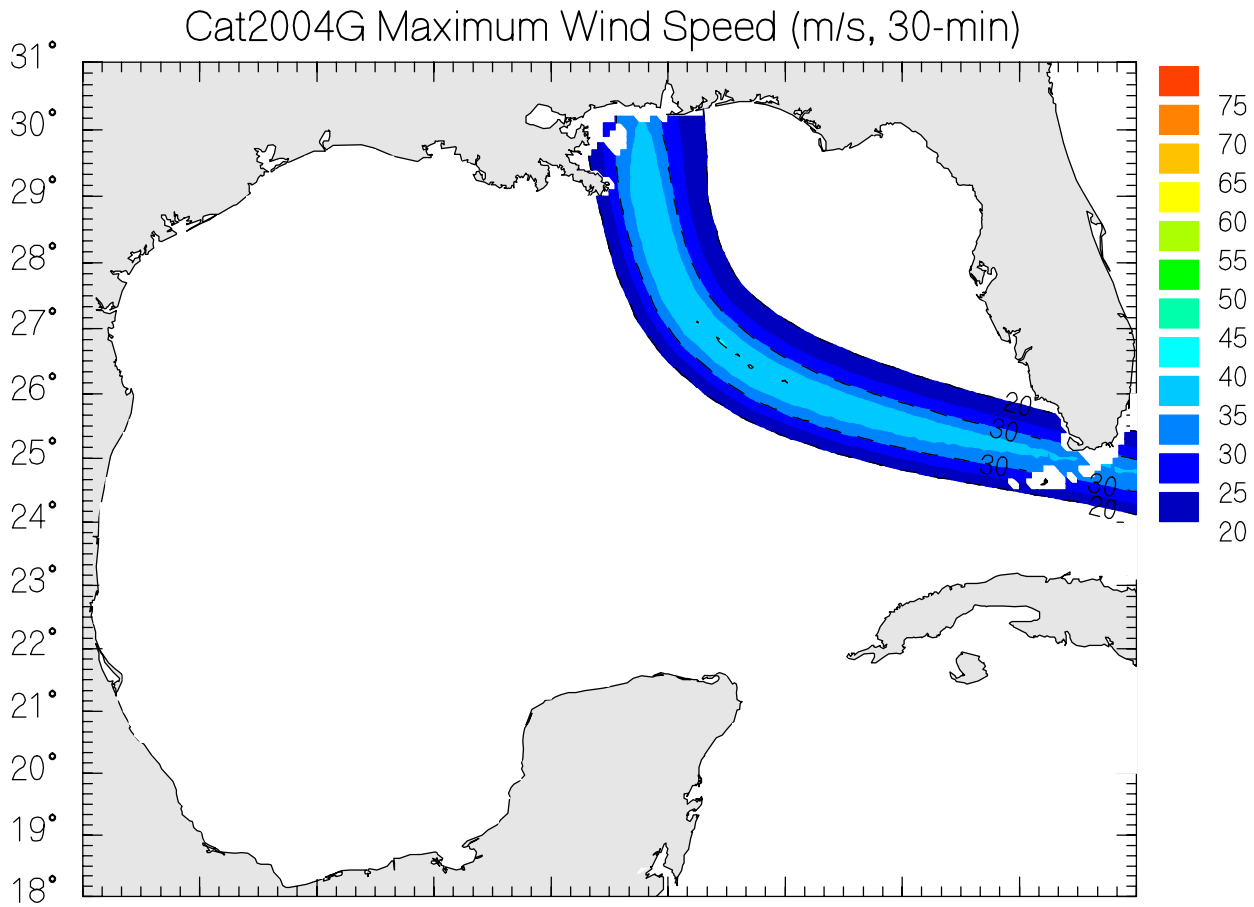
Cat2004G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
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24°
23°
22°
21°
20°
19°
18°
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75
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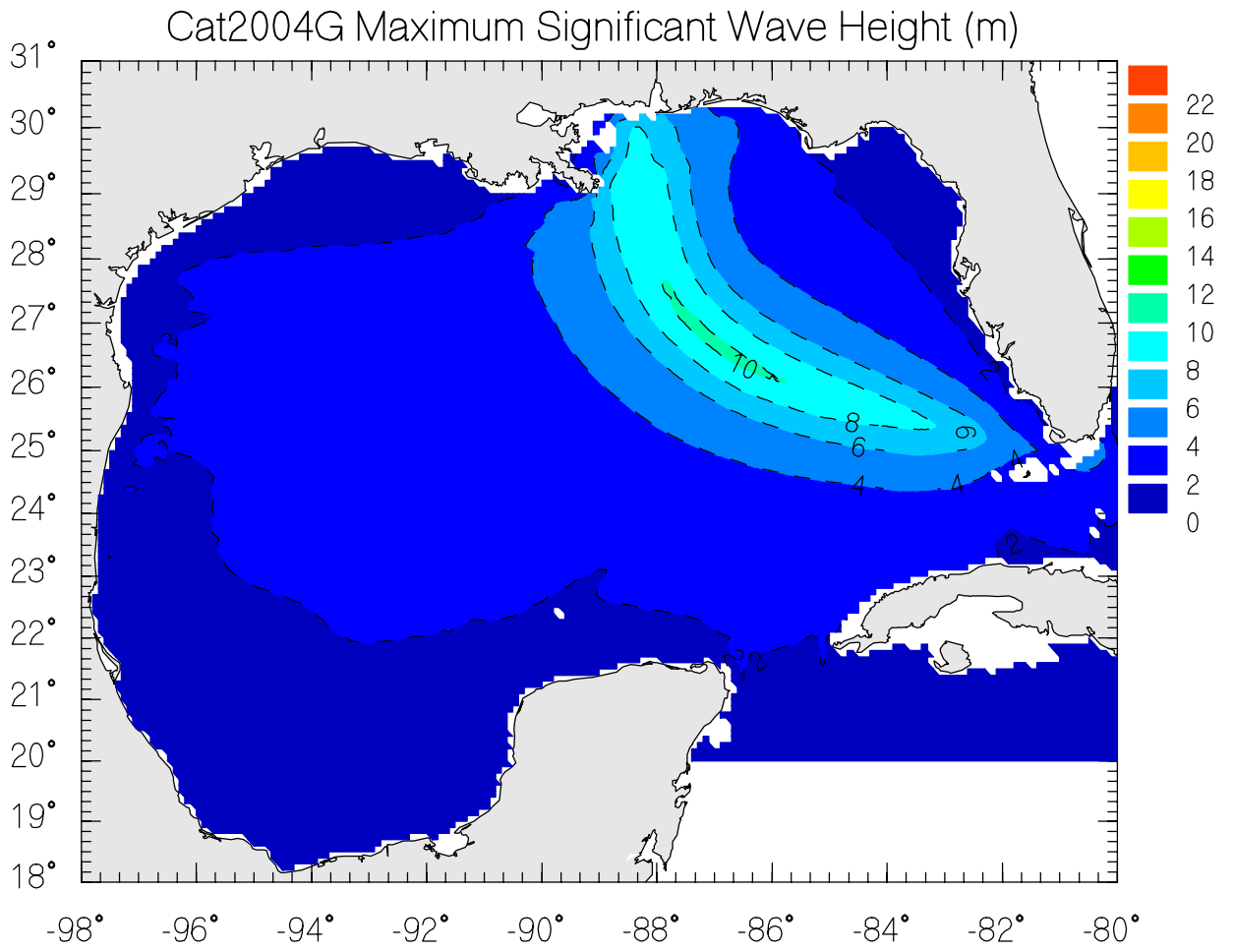
25
20


Cat2004G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
10
8
6
4
2
22
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18
16
14
12
10
8
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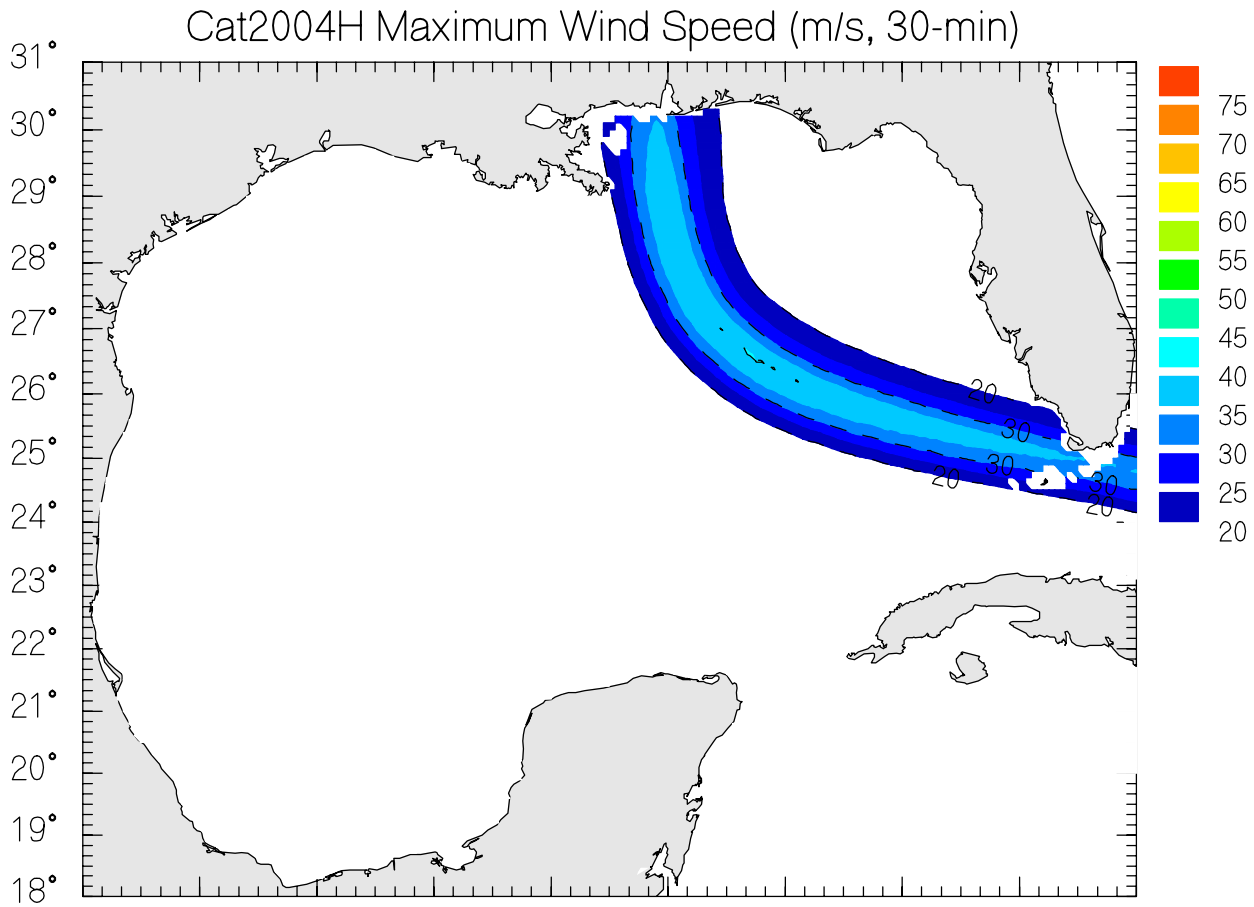
0
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


Cat2004H Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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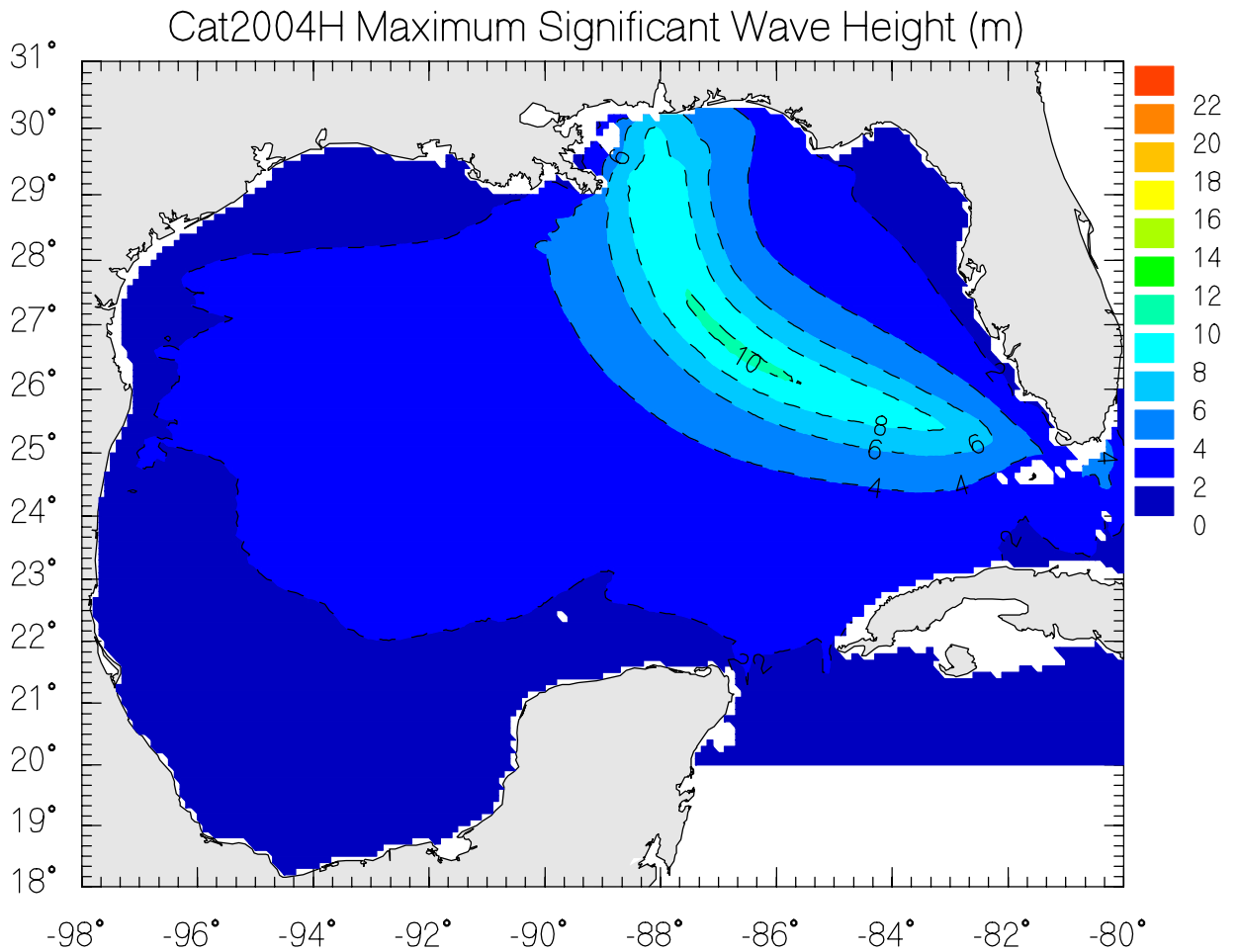
20
30
30
20
30
20


Cat2004H Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
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23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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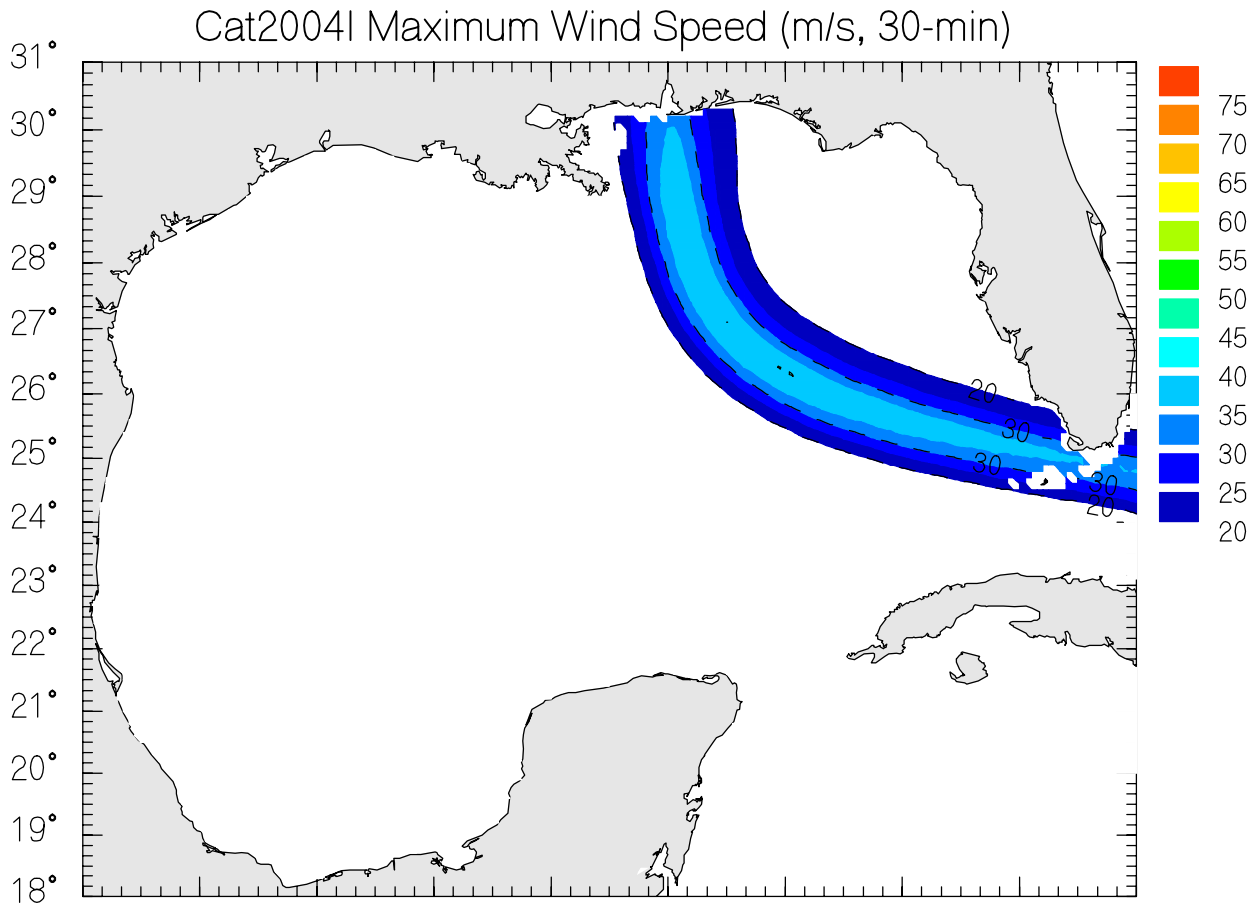
Cat2004I Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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20
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30
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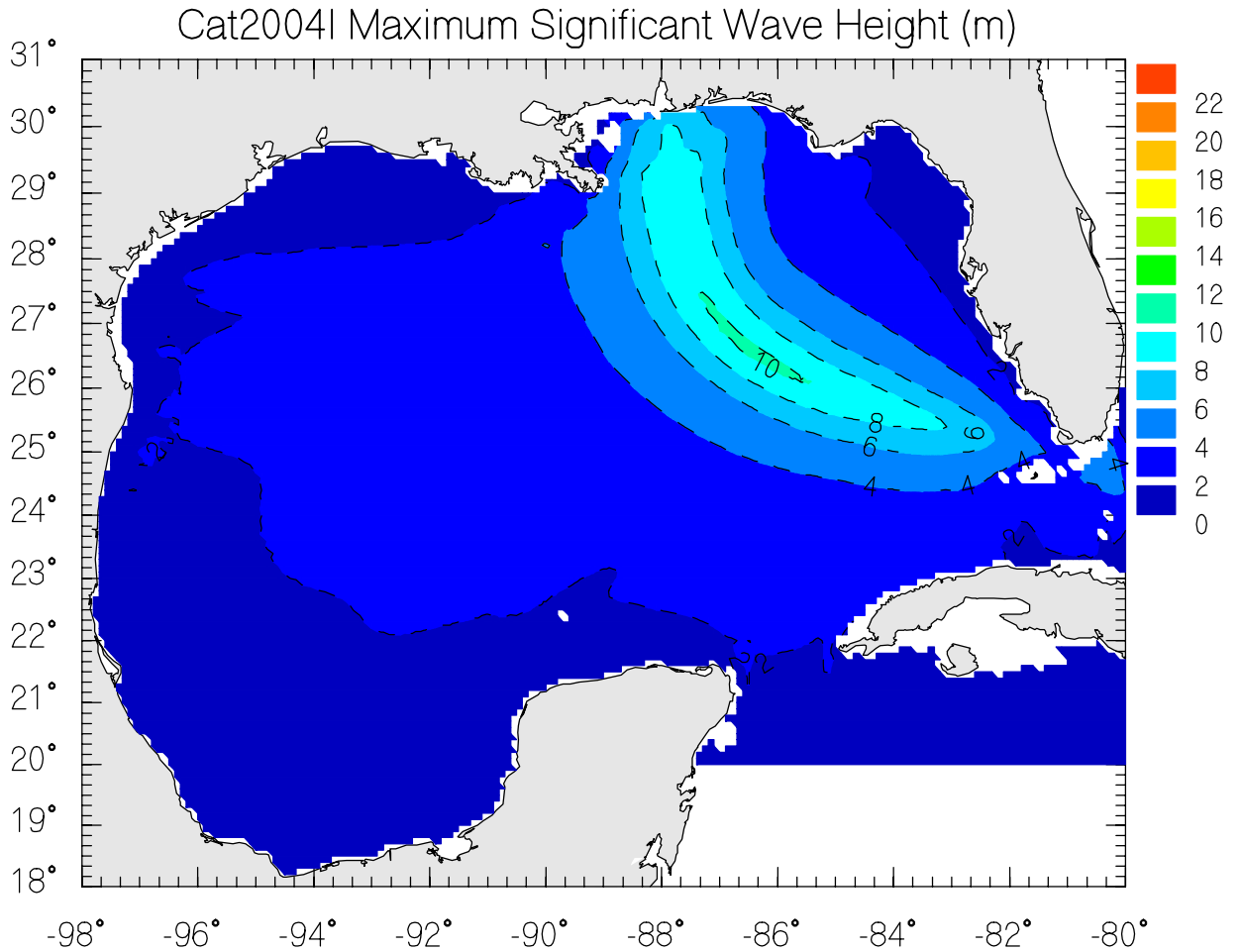
Cat2004I Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
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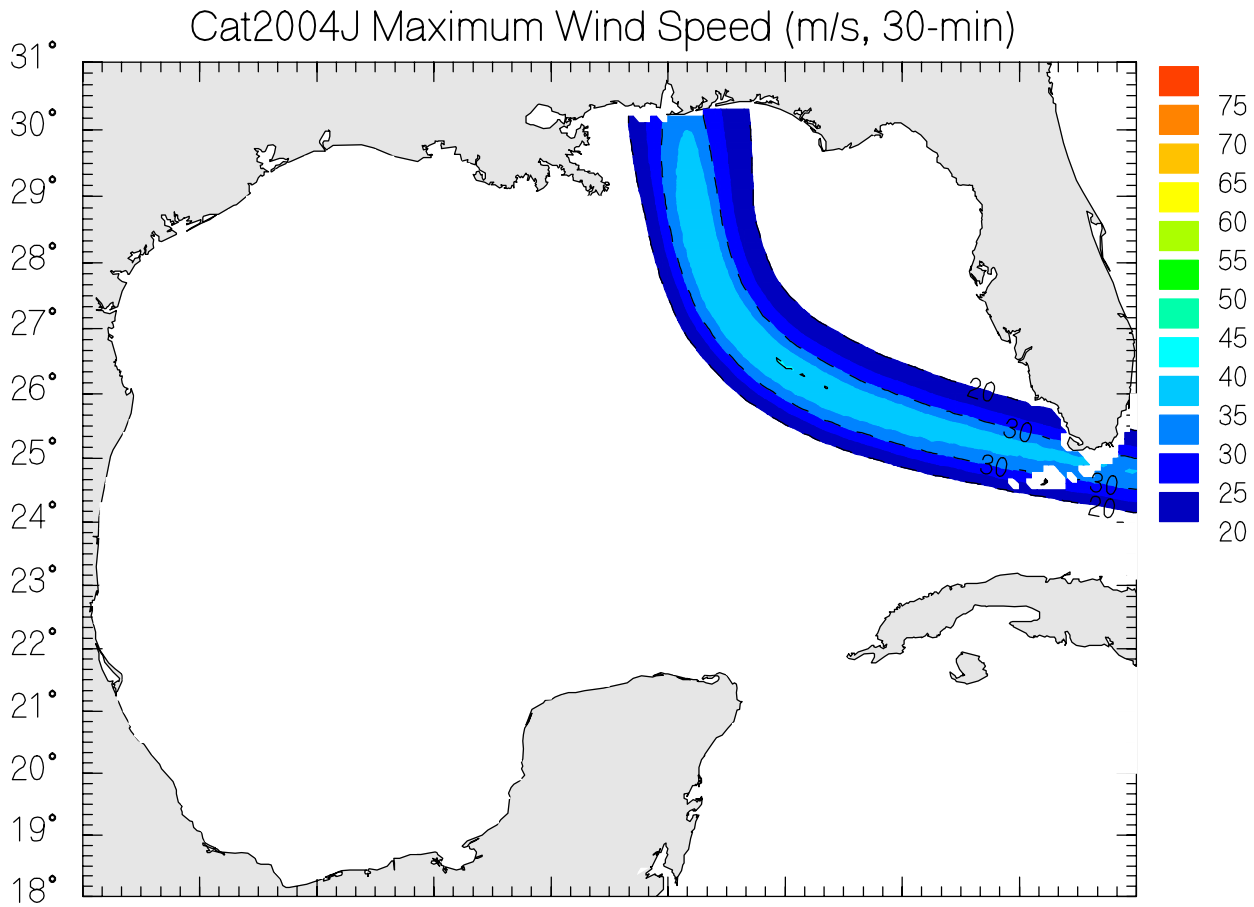
Cat2004J Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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65
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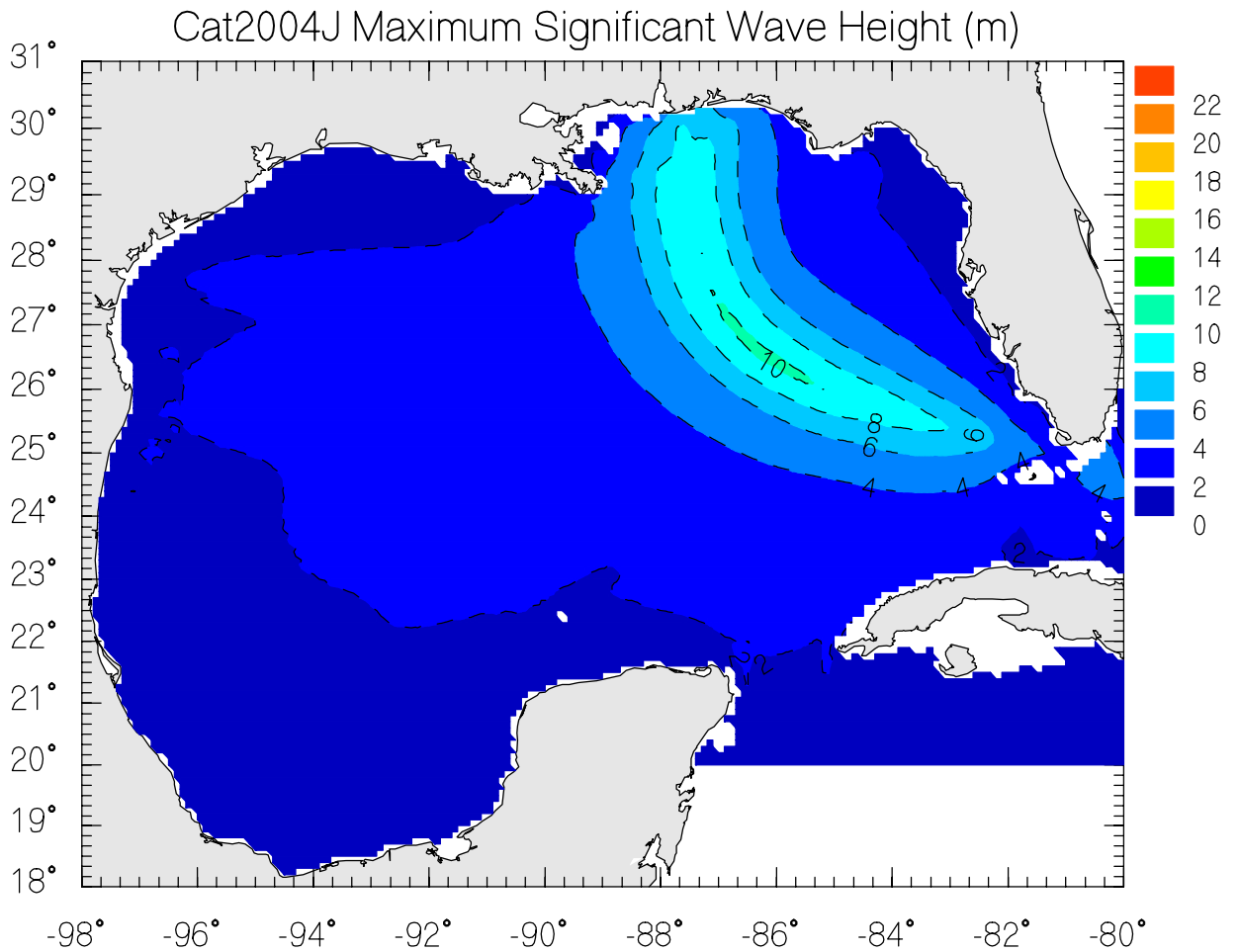
30
30
20


Cat2004J Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
22
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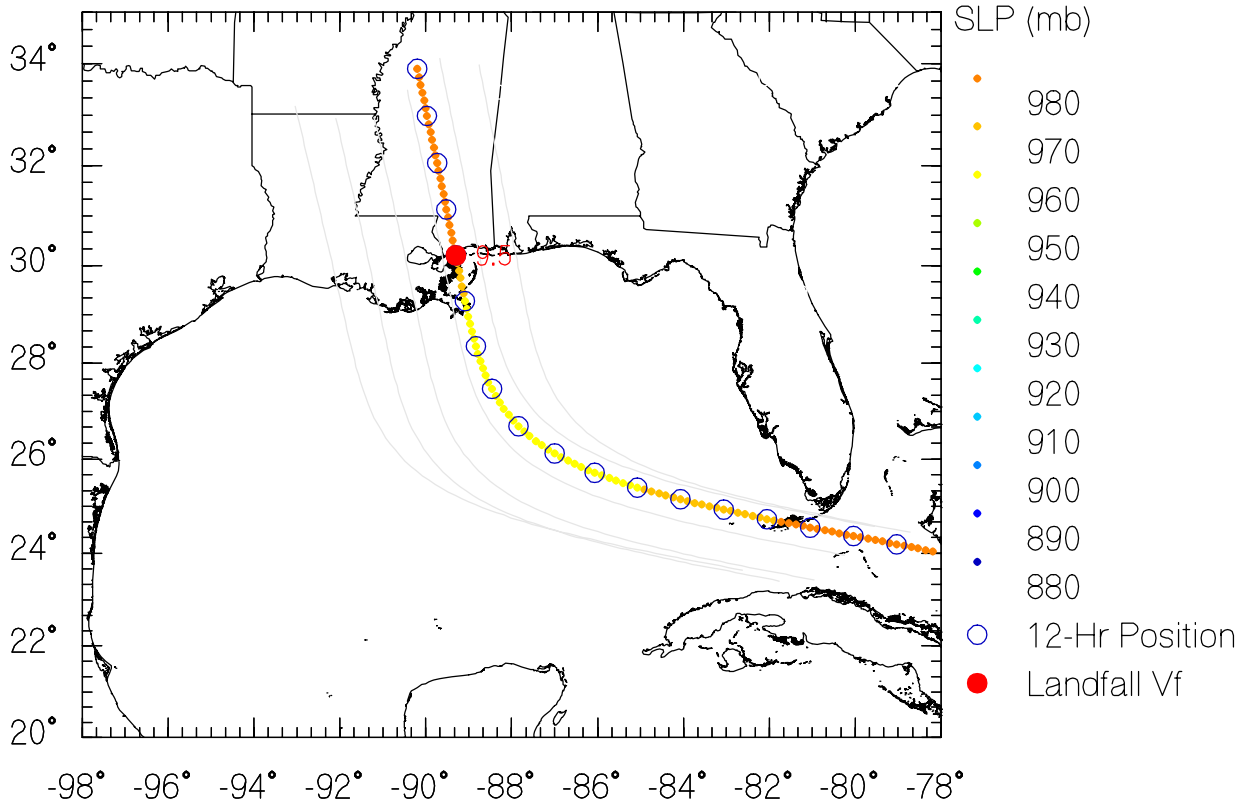
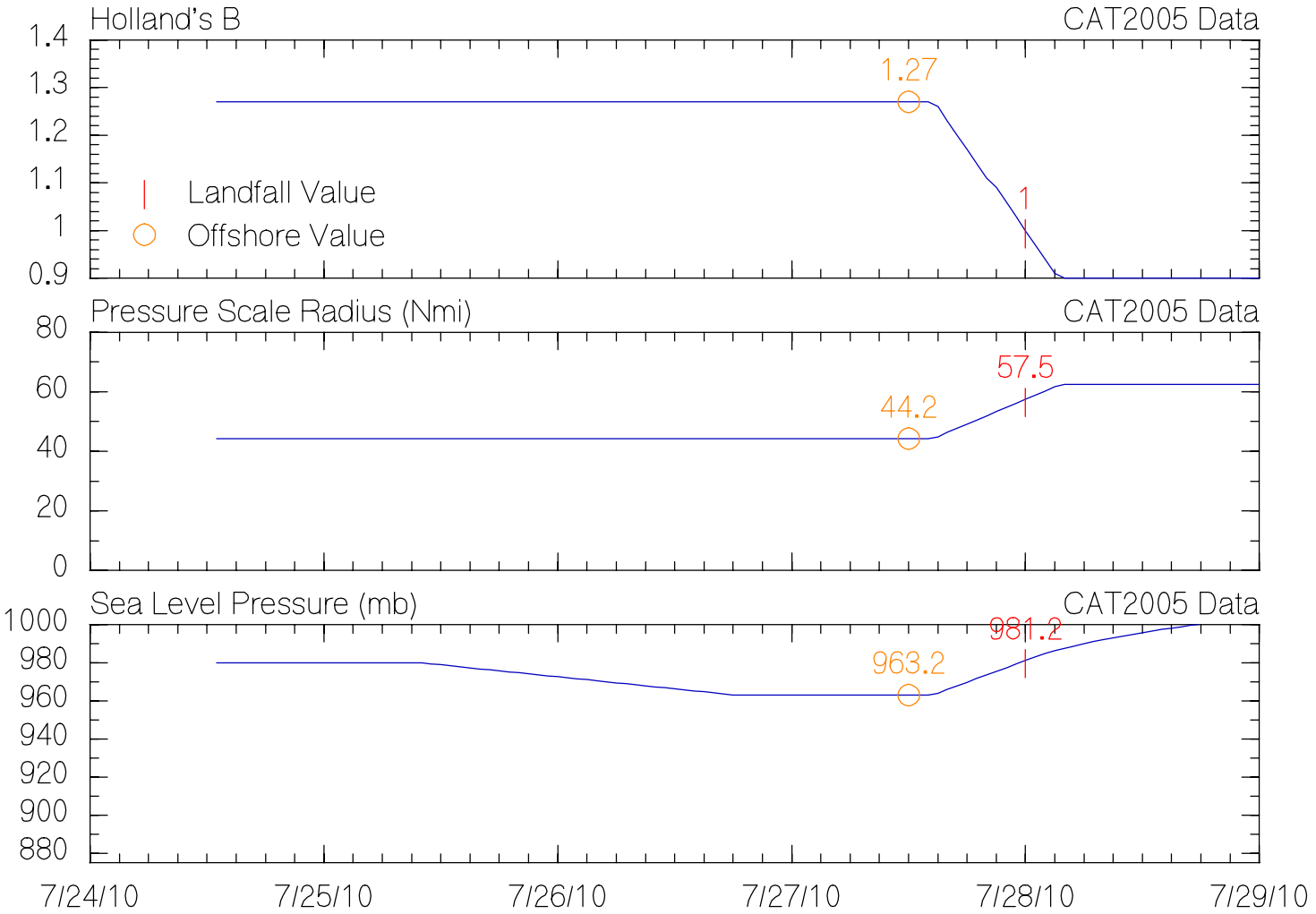
2

CAT2005 Data

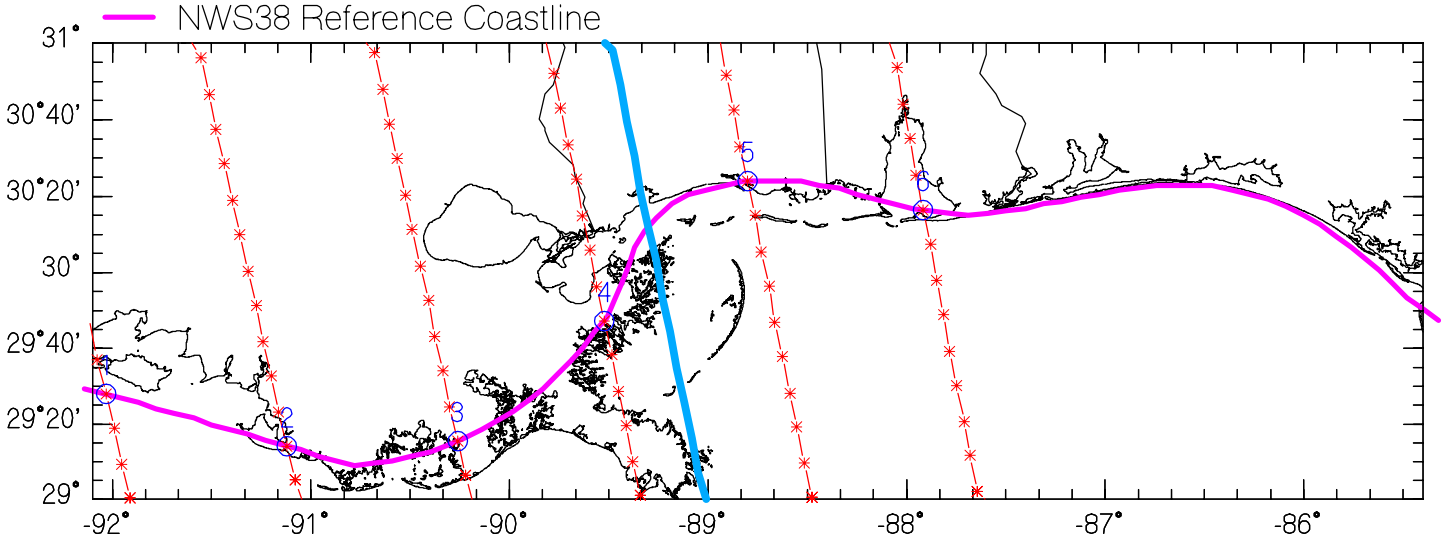


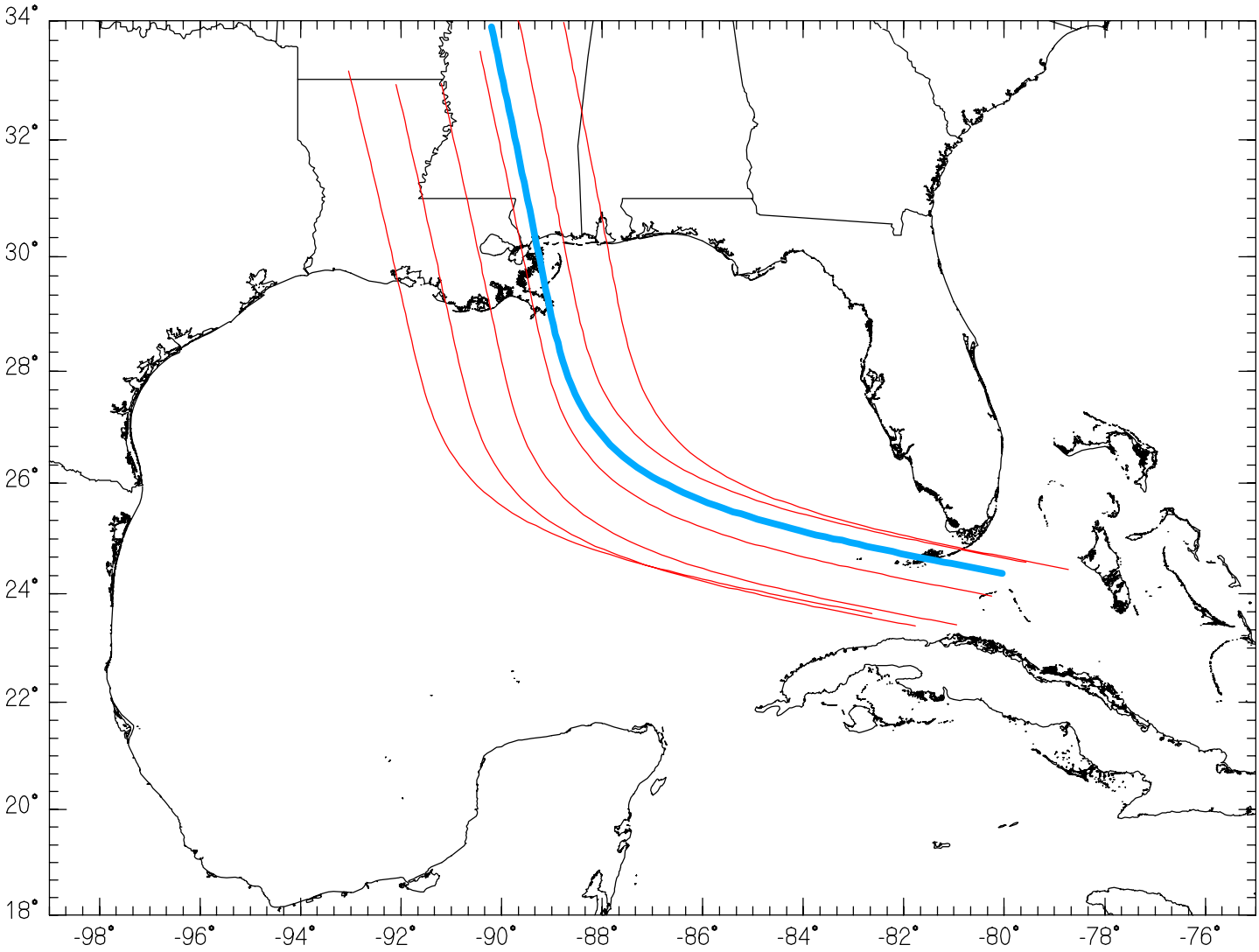


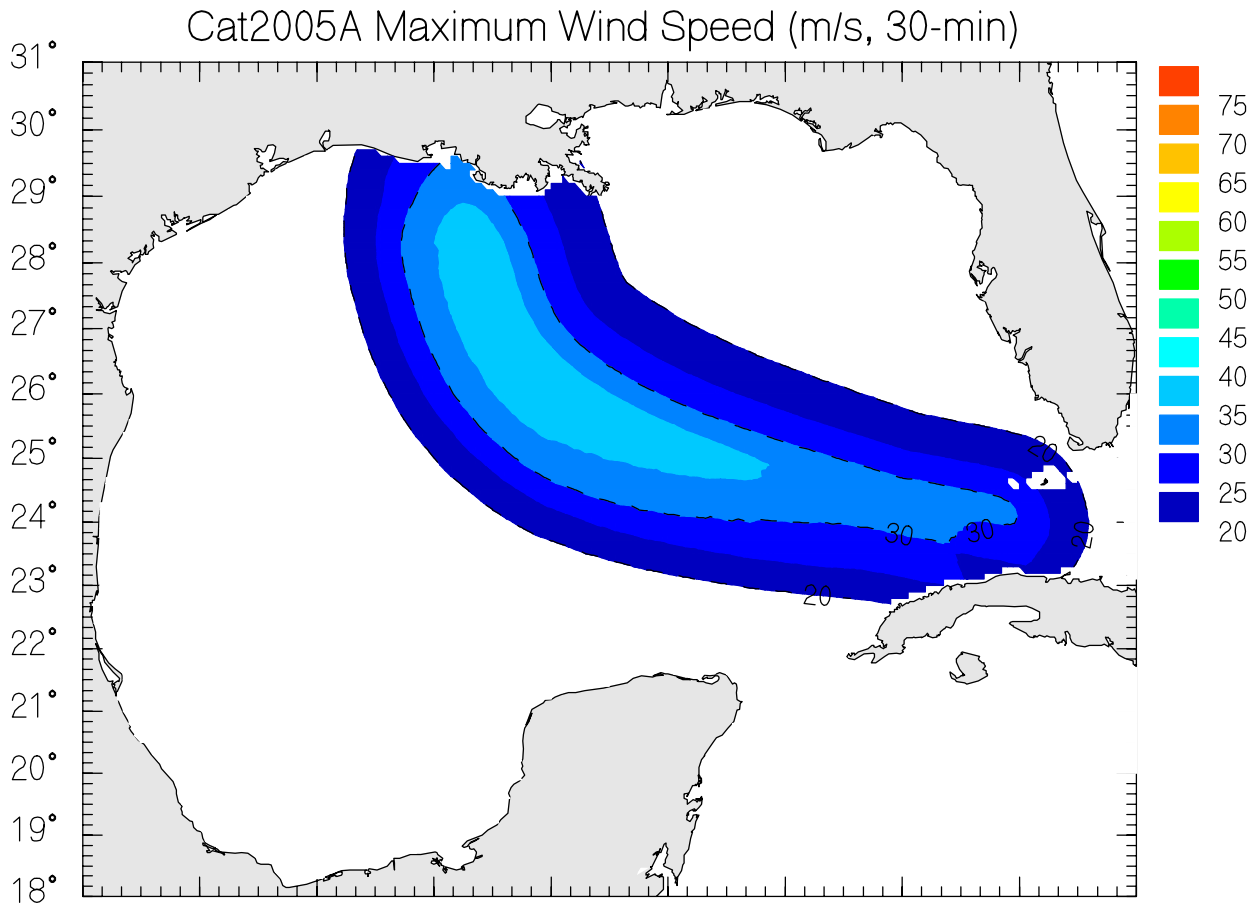
URS JPM-OS6 Production Tracks

CAT2005 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






Cat2005A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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65
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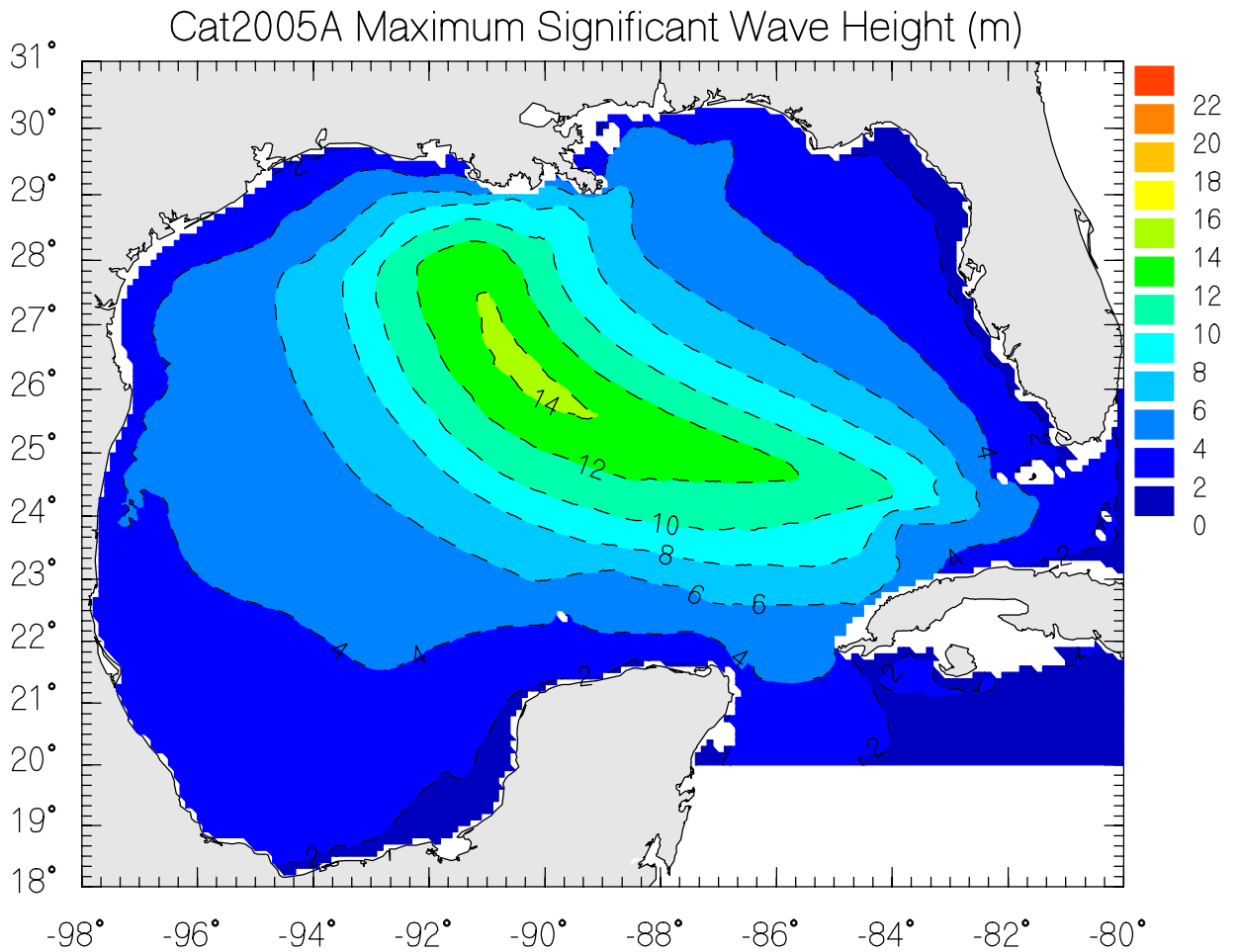
20
20


Cat2005A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
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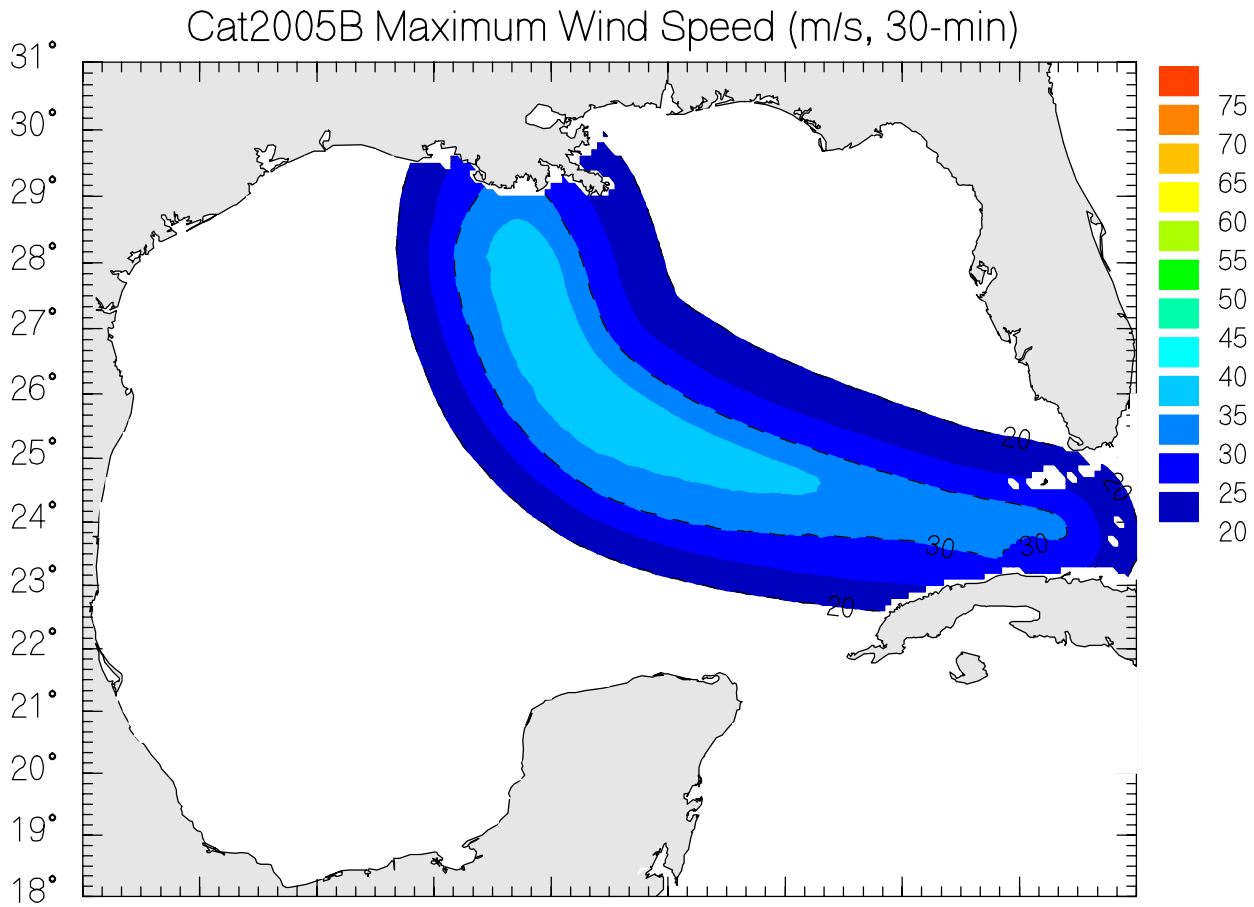
Cat2005B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
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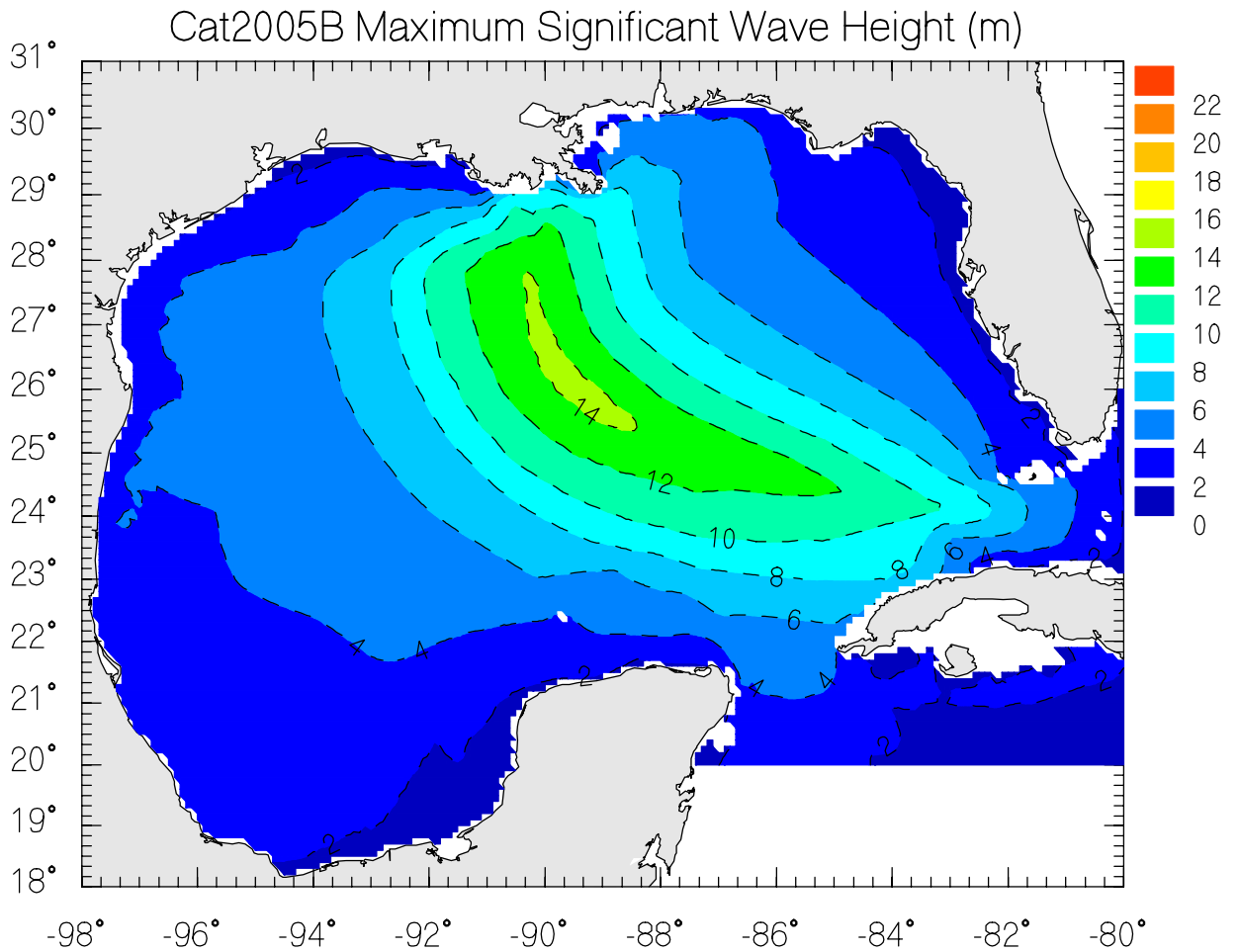
25
20
20
30
30
20


Cat2005B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
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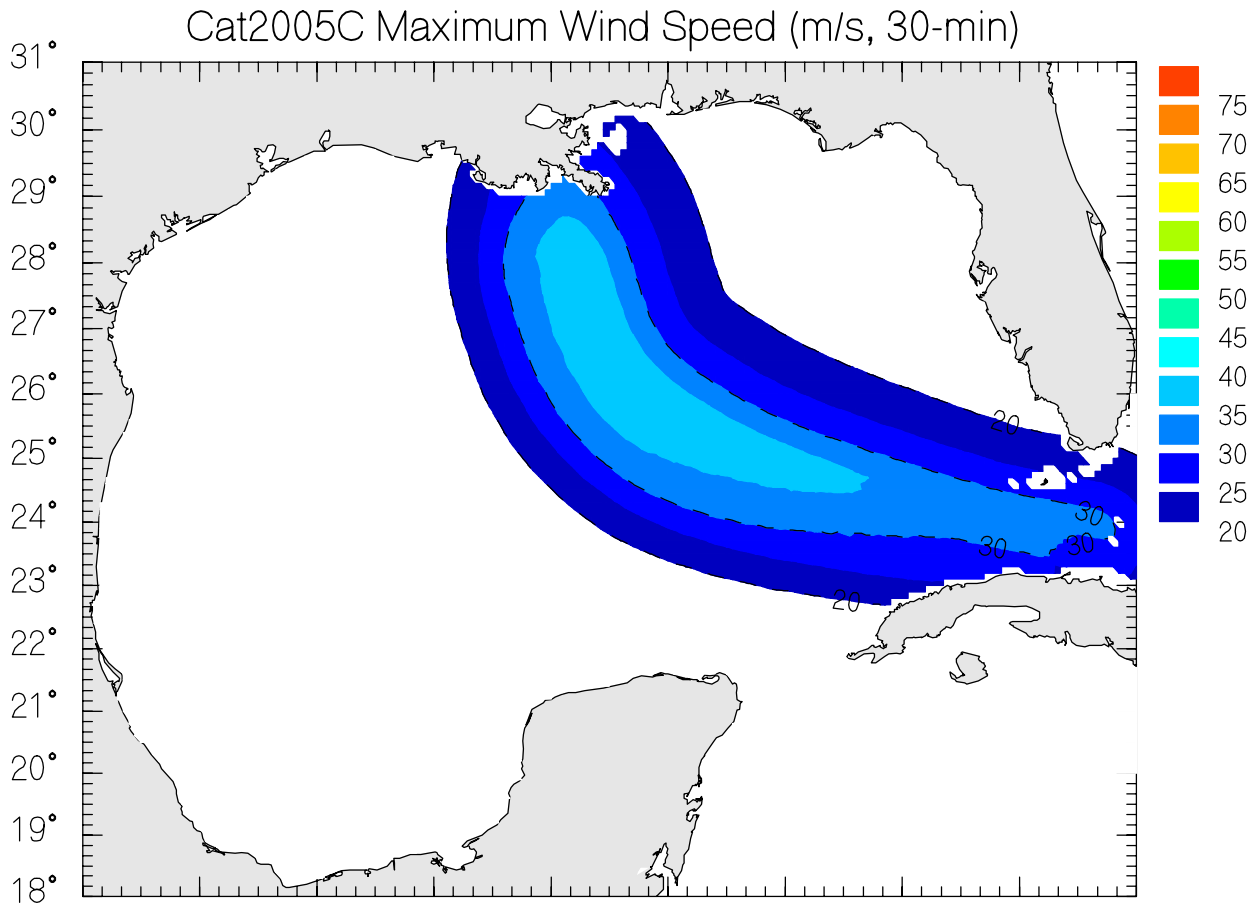
Cat2005C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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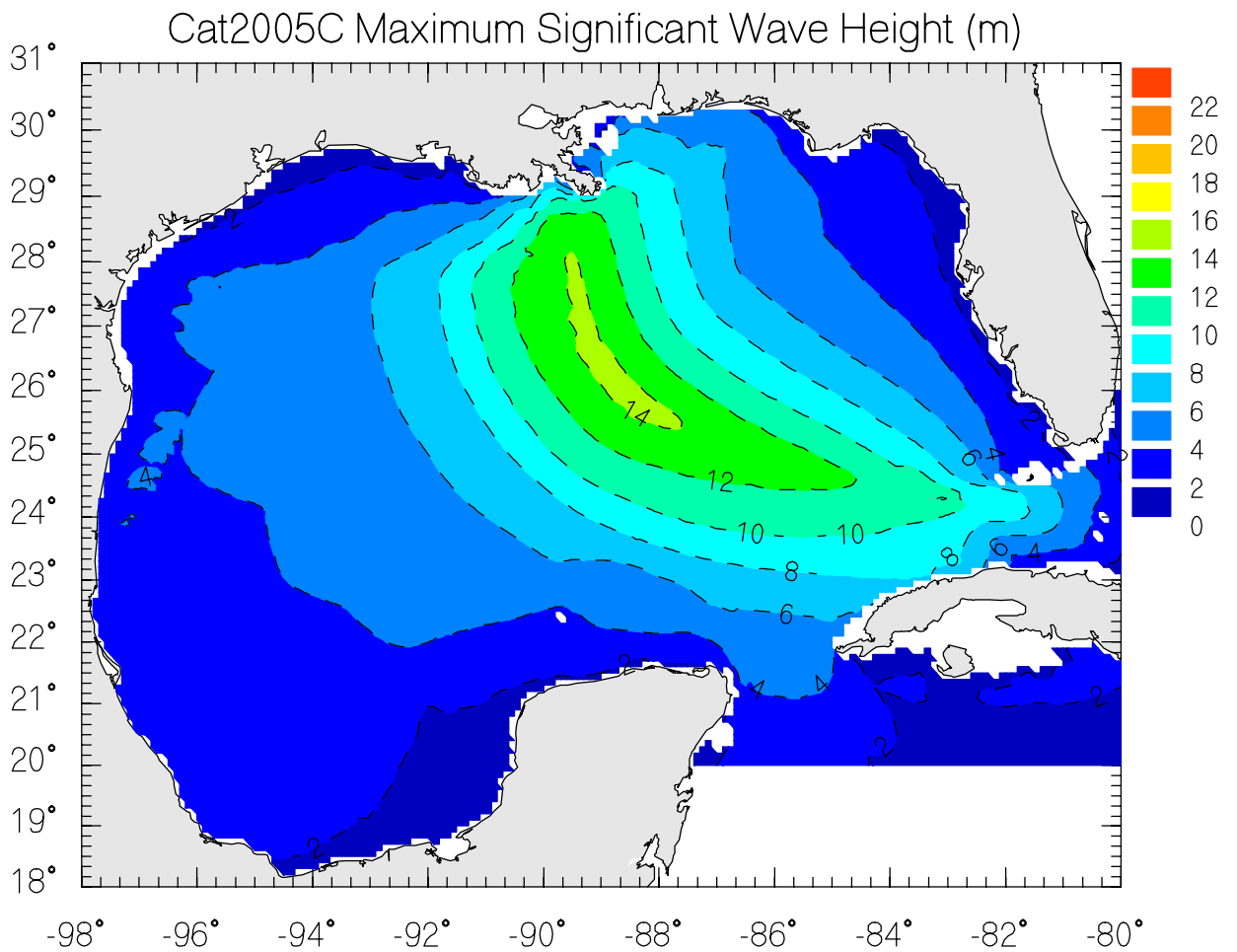
Cat2005C Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
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8
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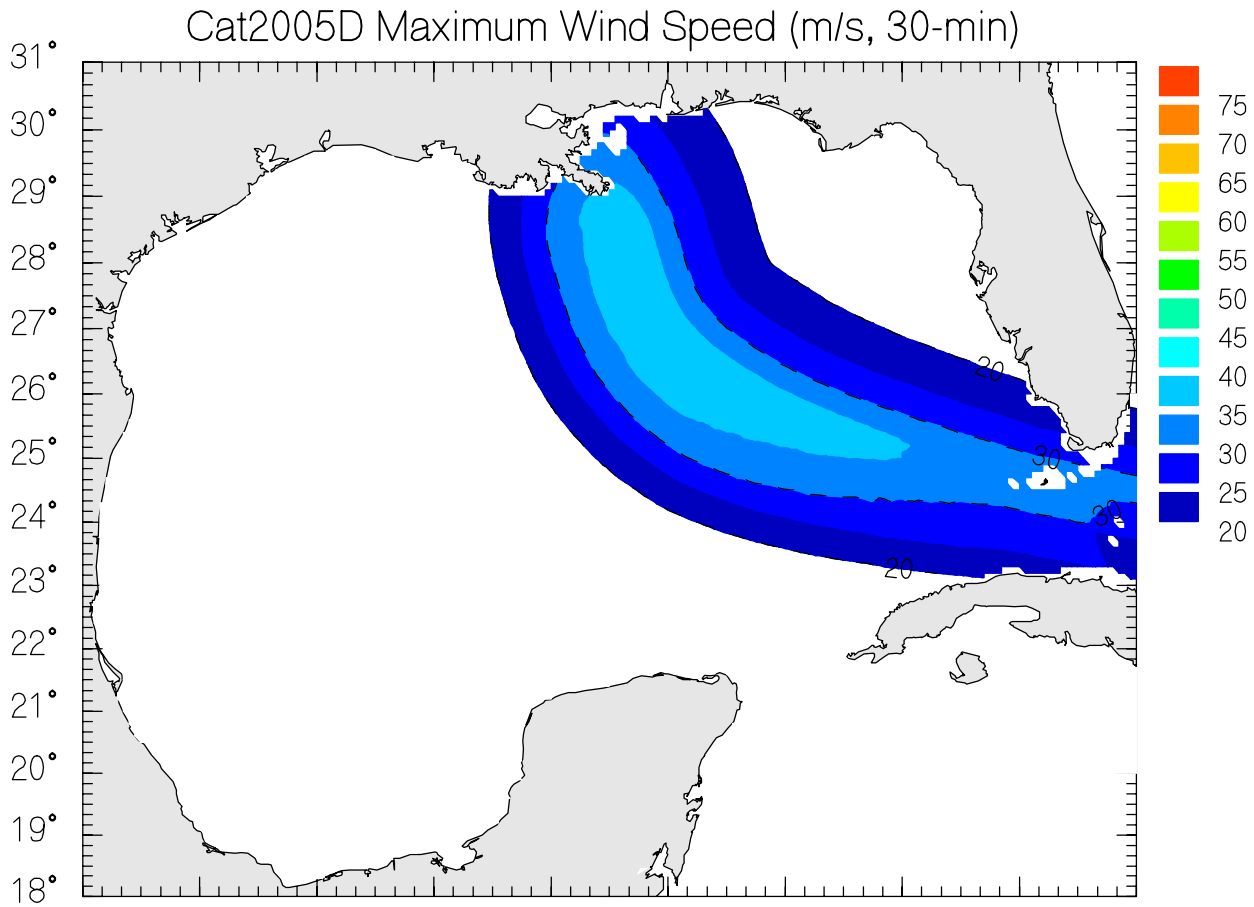
Cat2005D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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20
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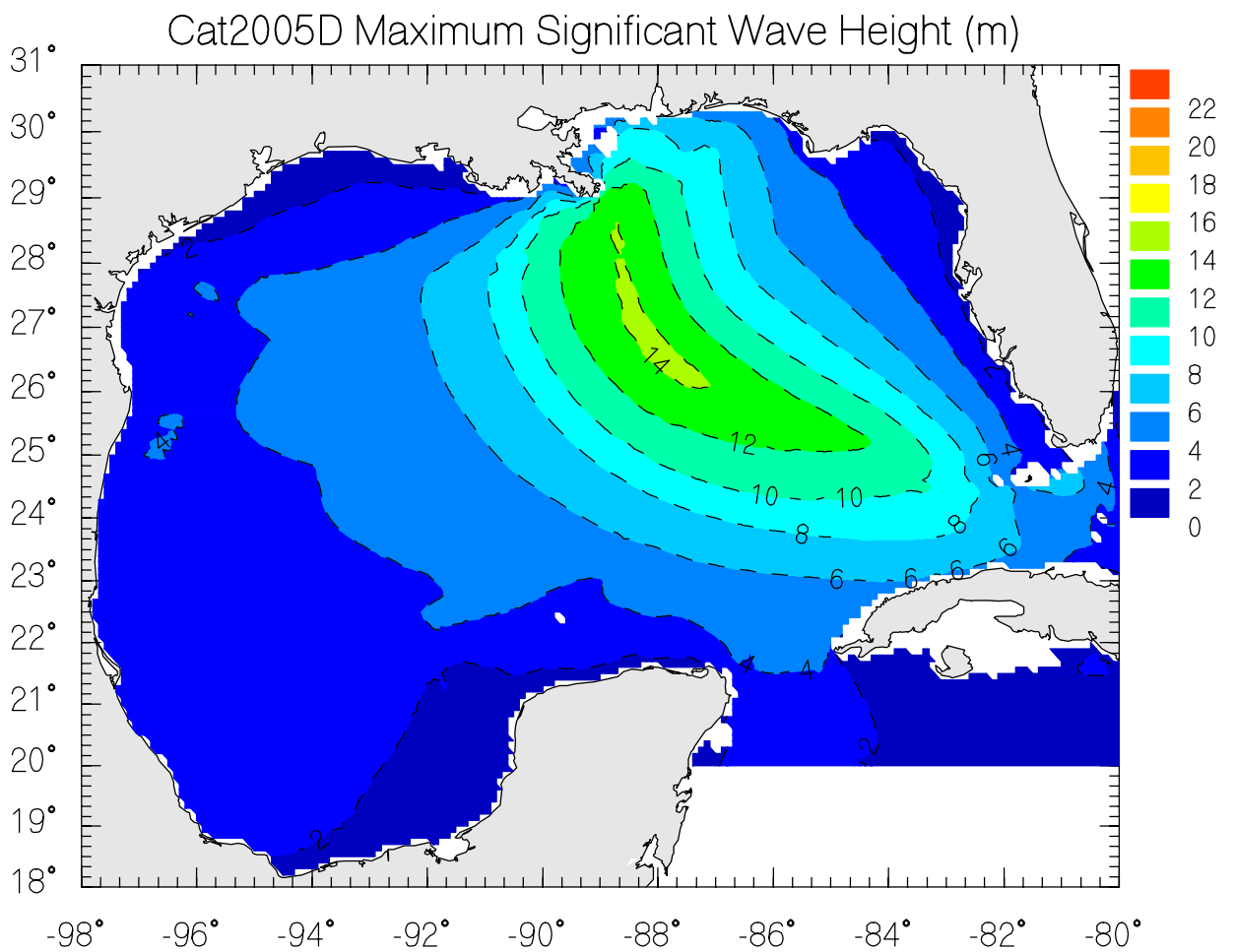
Cat2005D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
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23°
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21°
20°
19°
18°
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18
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-98°
-96°
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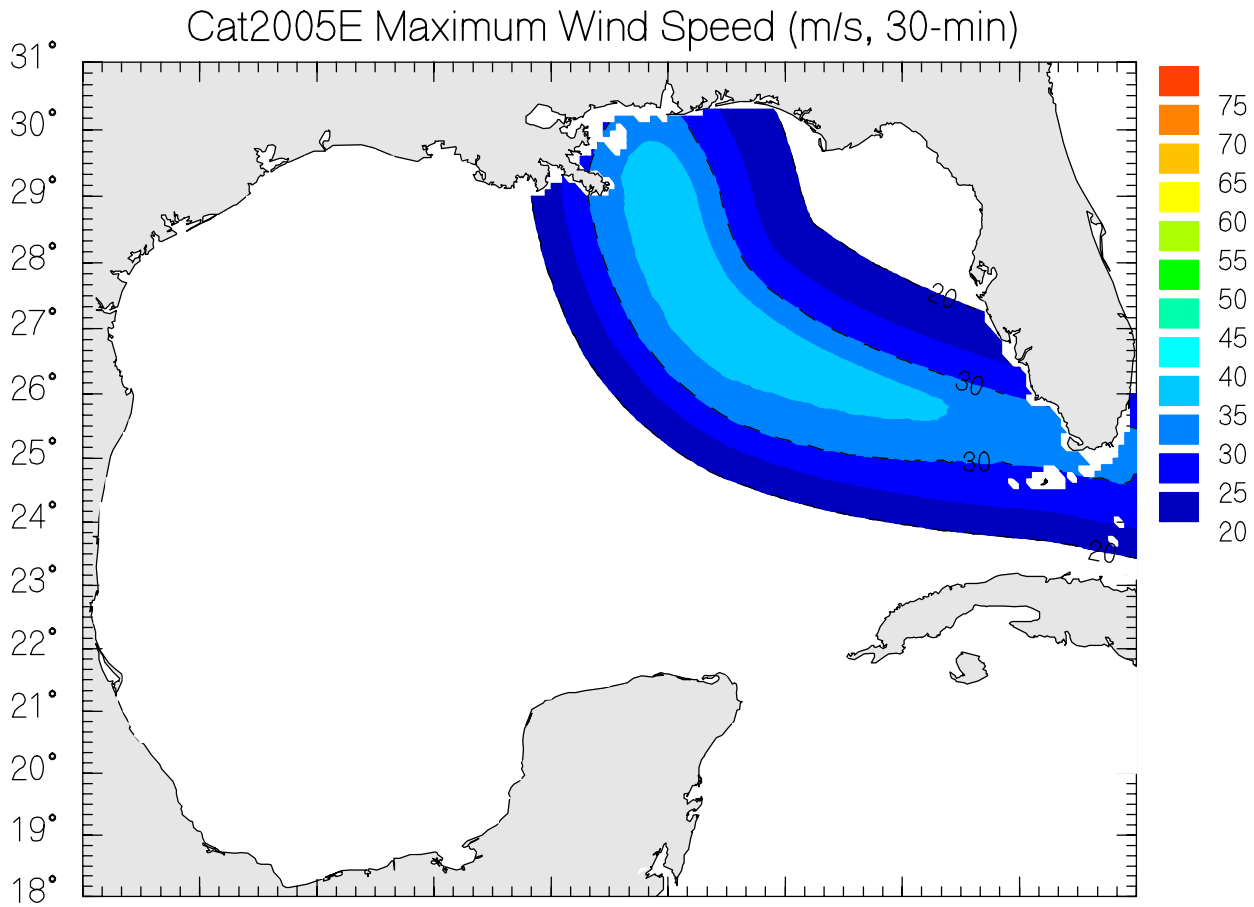
-88°
-86°
-84°
-82°
-80°


Cat2005E Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
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21°
20°
19°
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25
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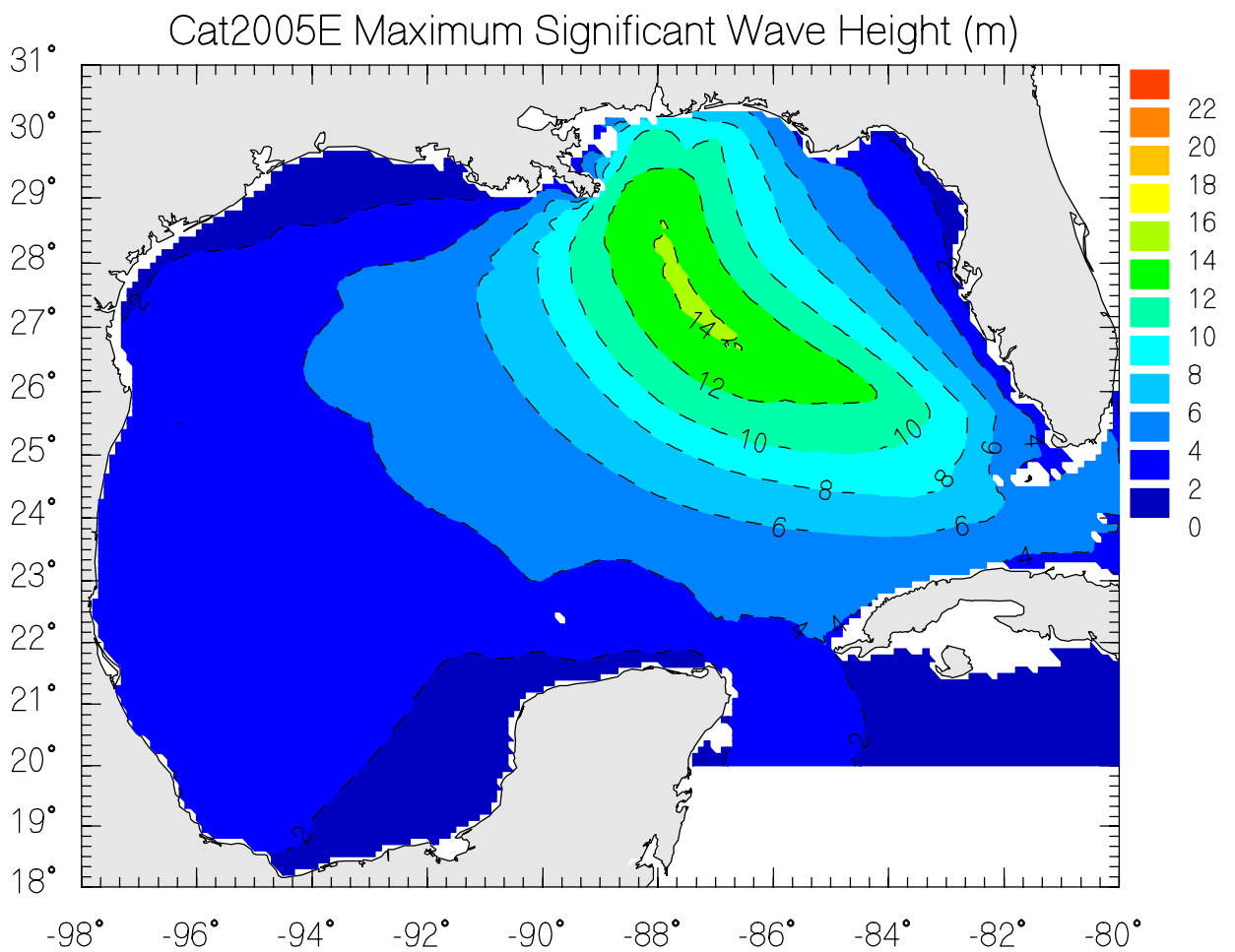
Cat2005E Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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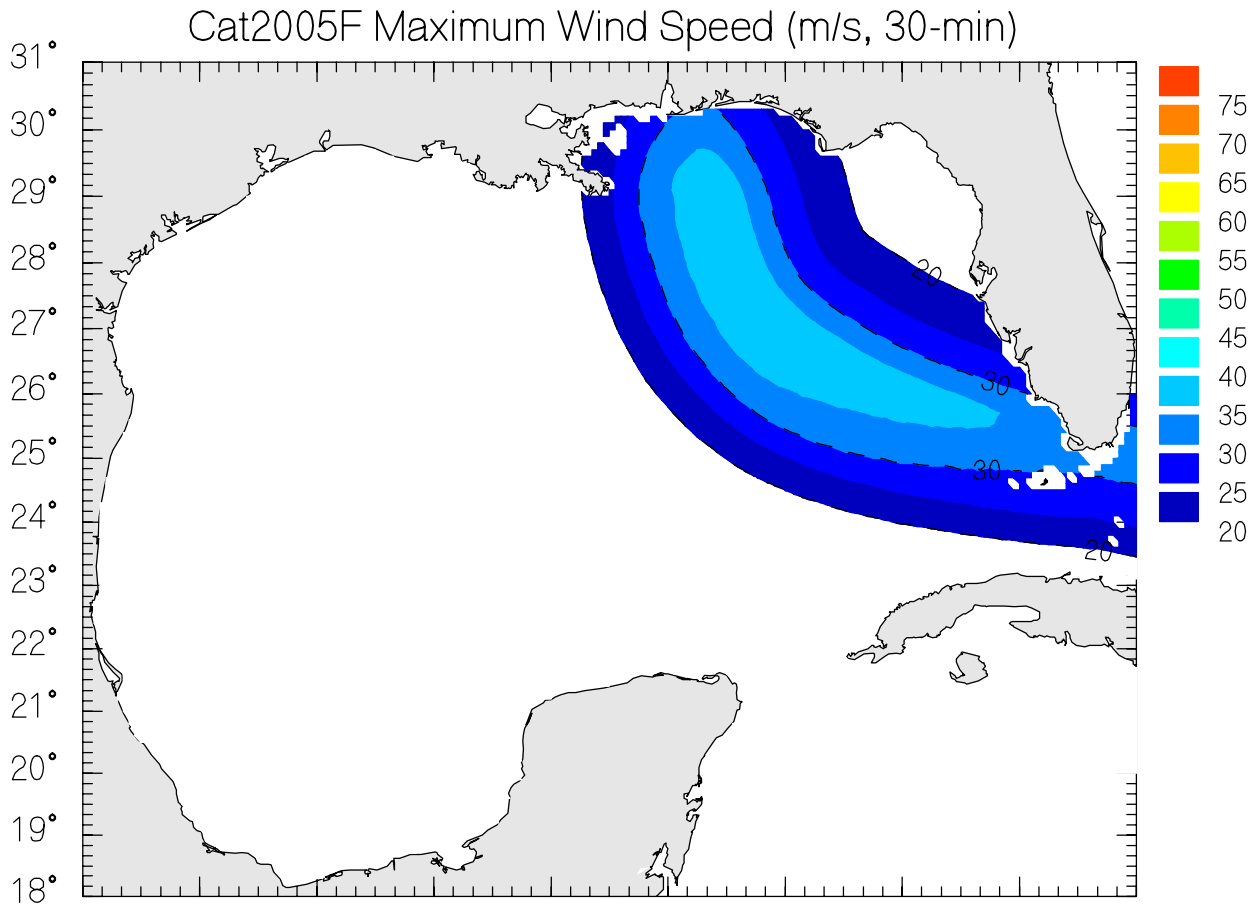
Cat2005F Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
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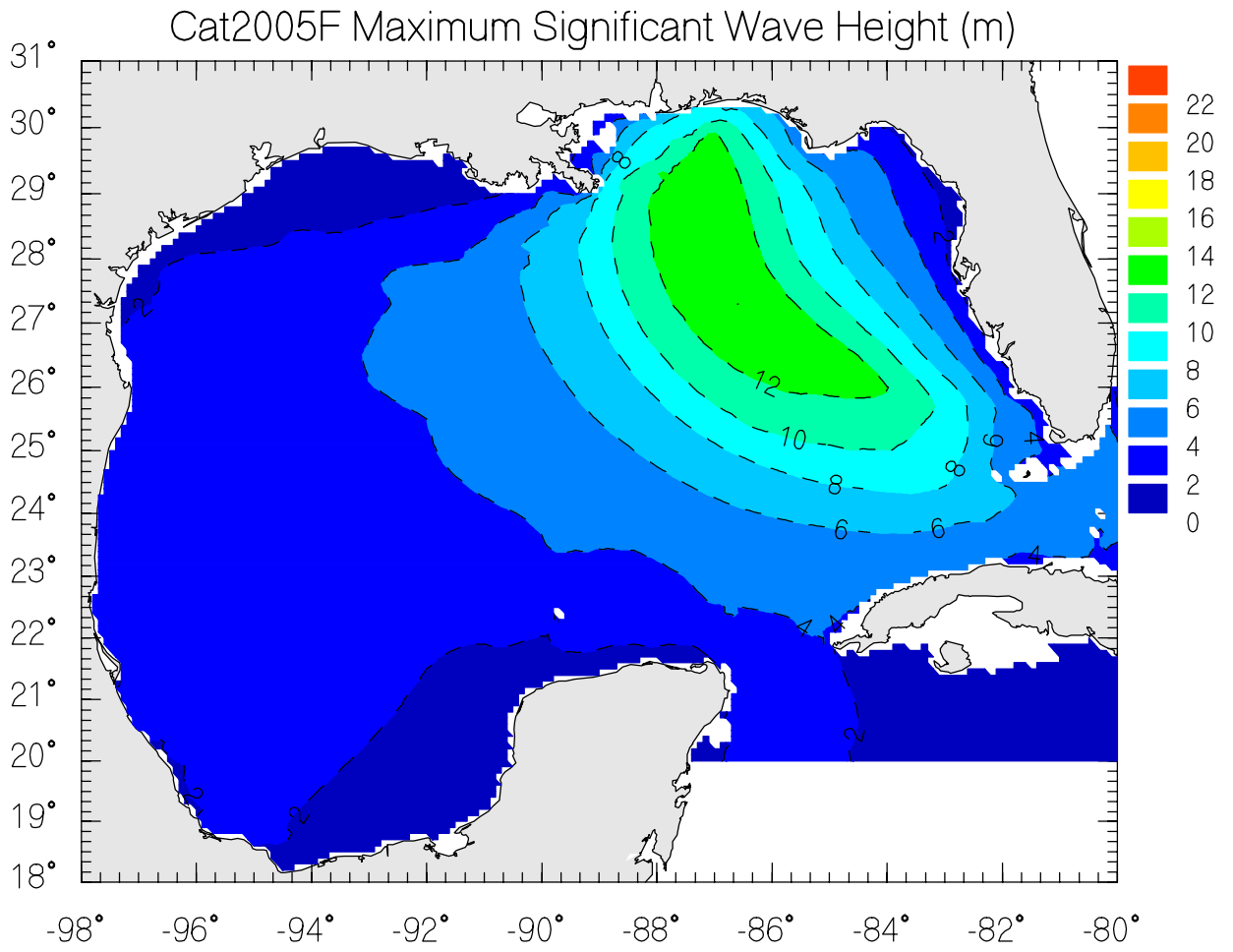
25
20


Cat2005F Maximum Significant Wave Height (m)
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28°
27°
26°
25°
24°
23°
22°
21°
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-96°
-94°
-92°
-90°
-88°
-86°
-84°
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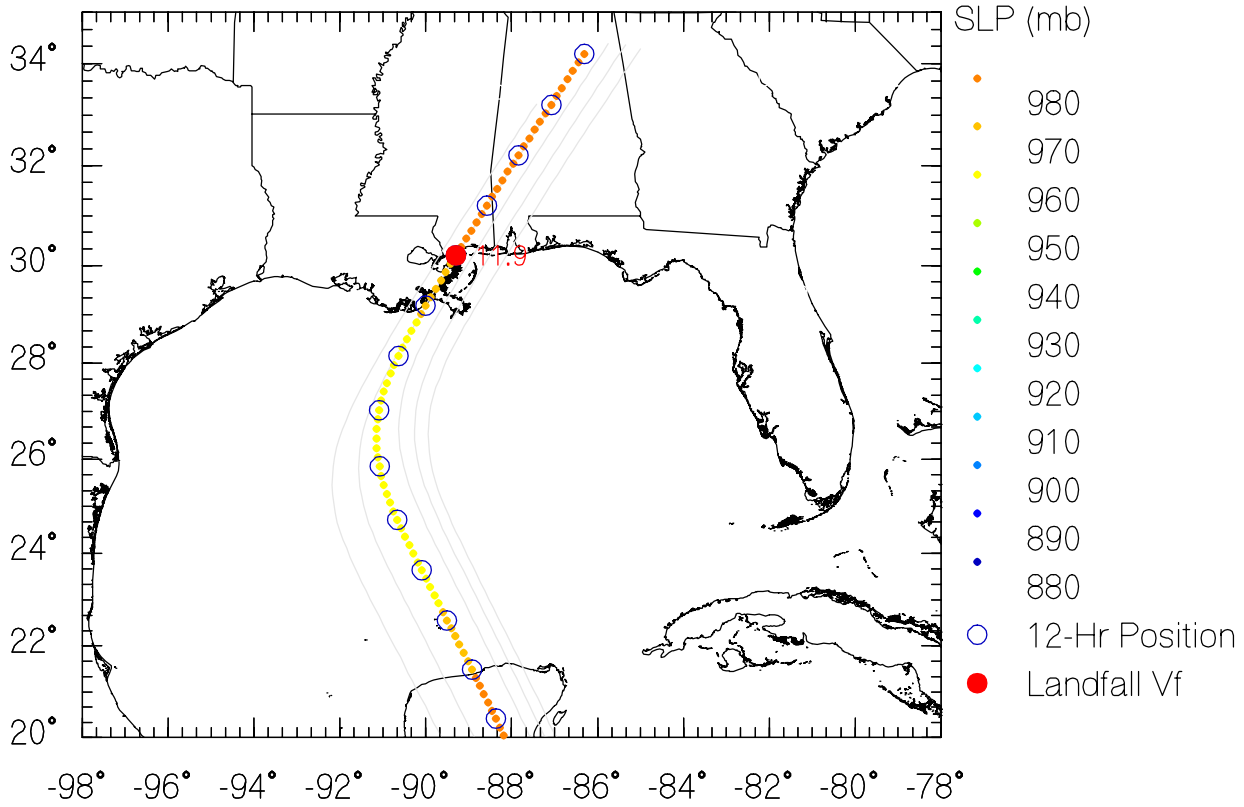
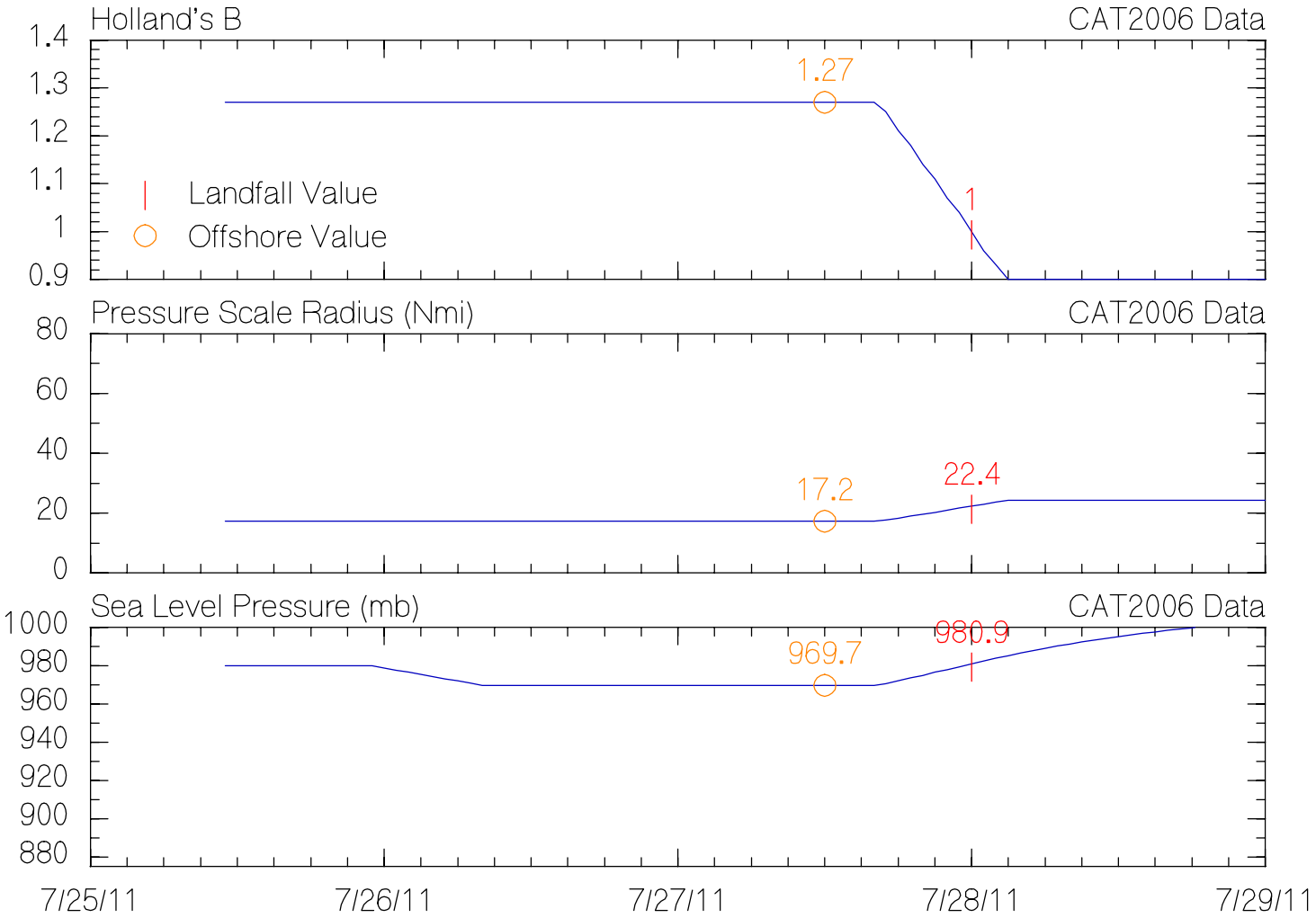
CAT2006 Data



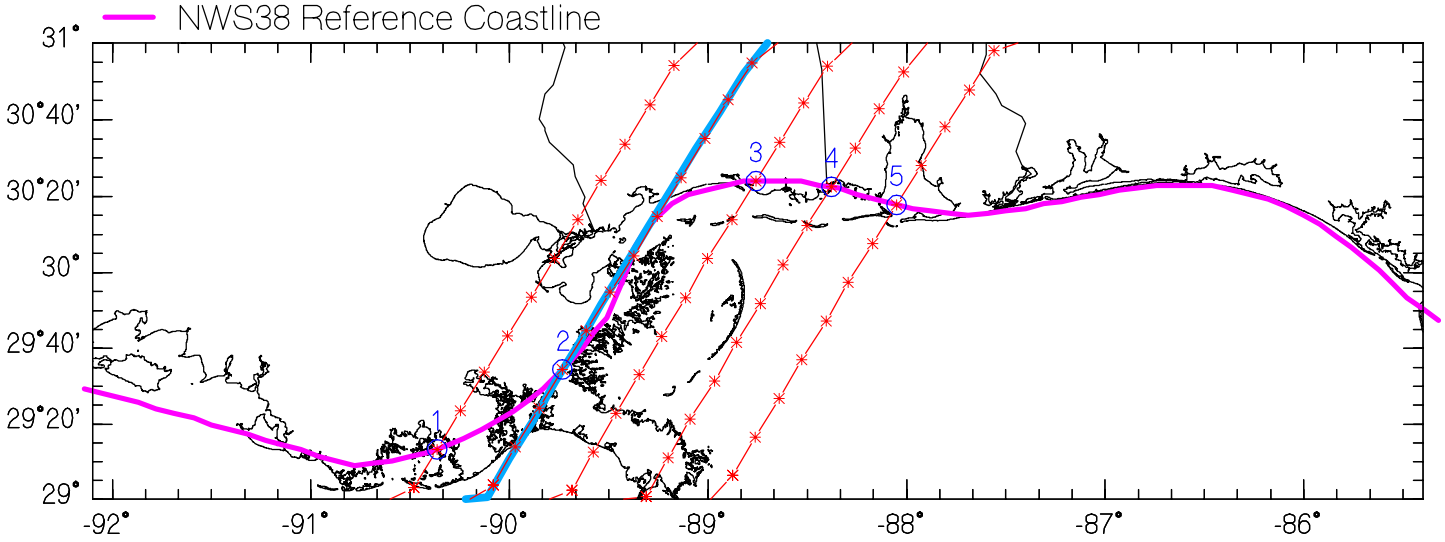


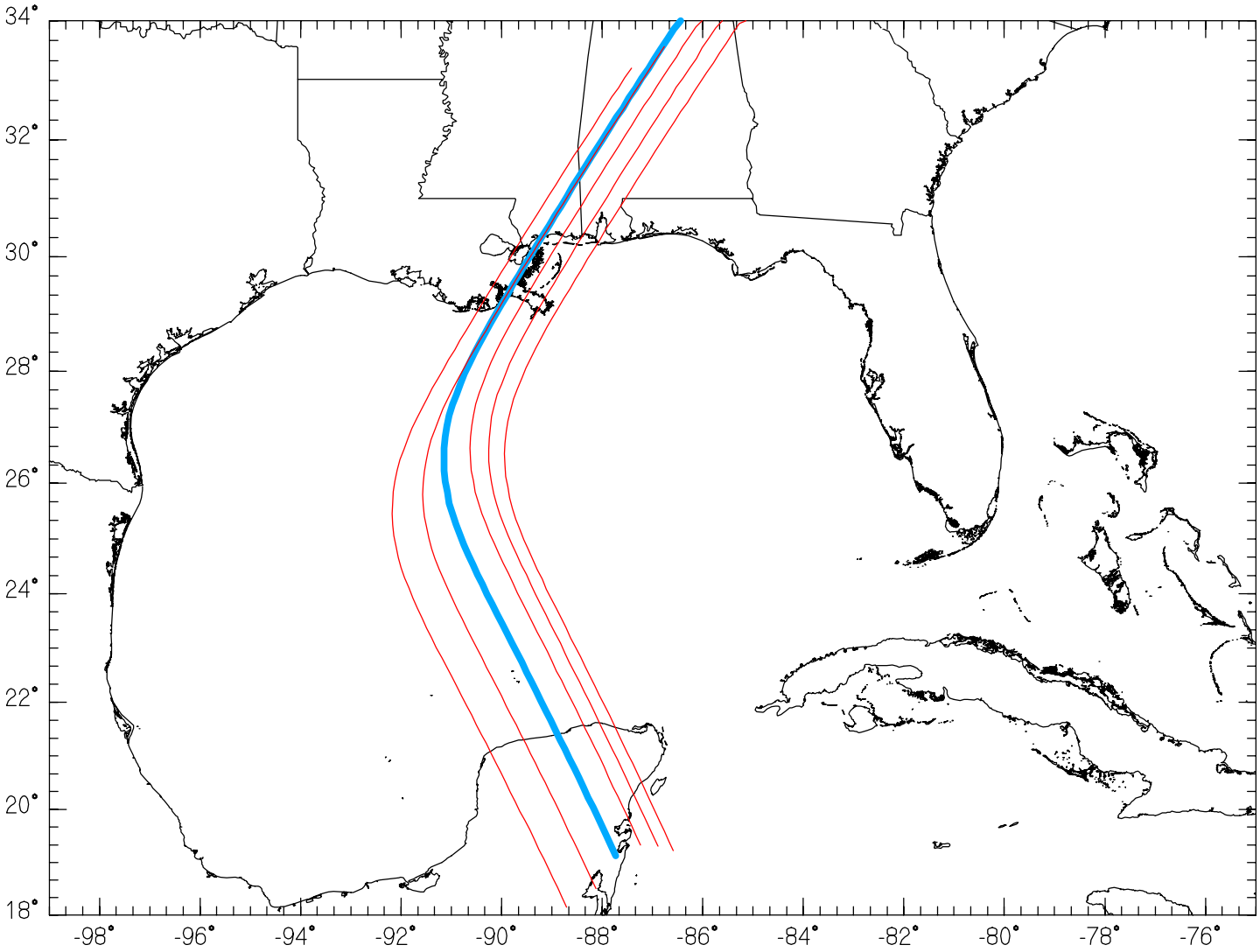
URS JPM-OS6 Production Tracks

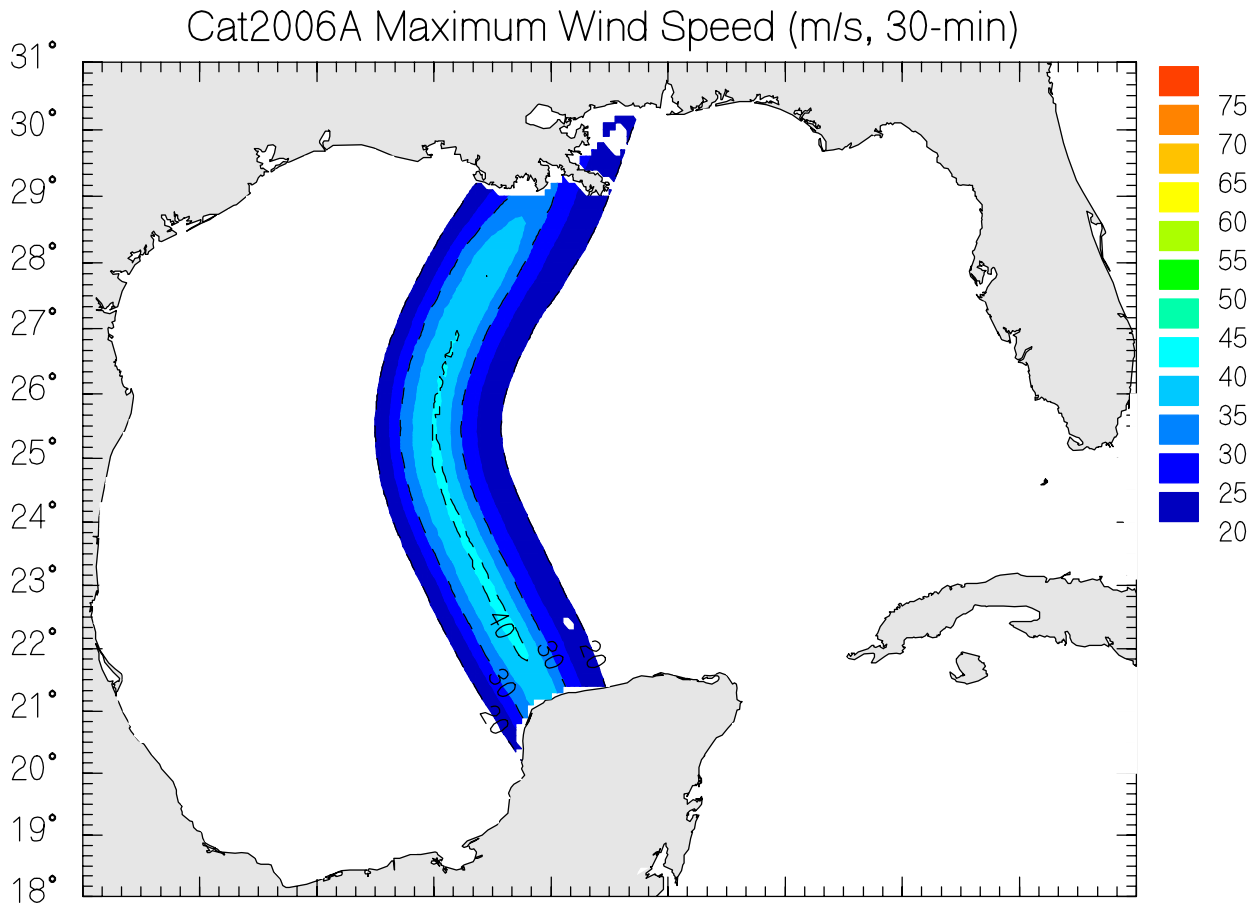
CAT2006 Data

Reference Track — Production Tracks — Production Track Landfall

NWS38 Reference Coastline






Cat2006A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
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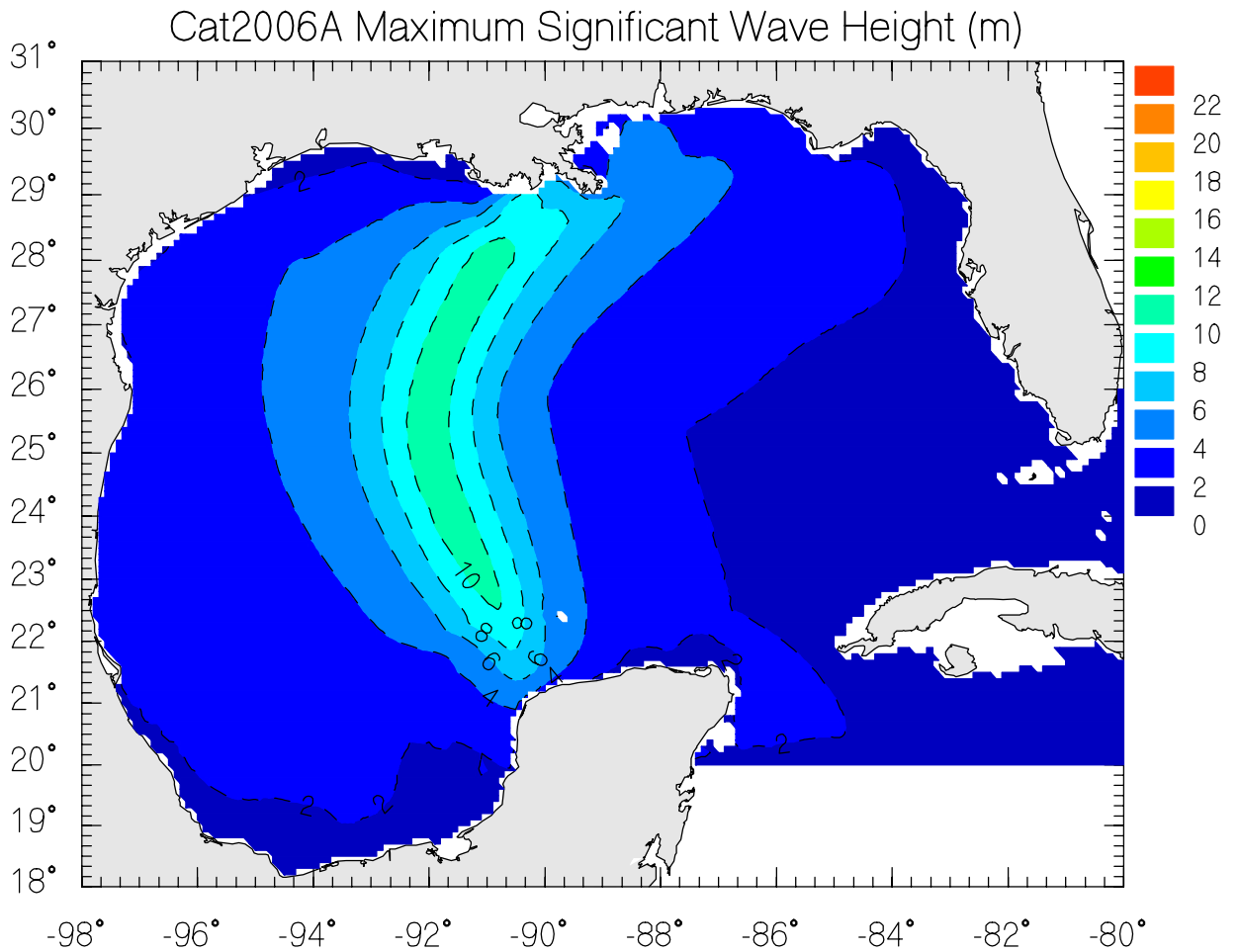
30
20


Cat2006A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
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-92°
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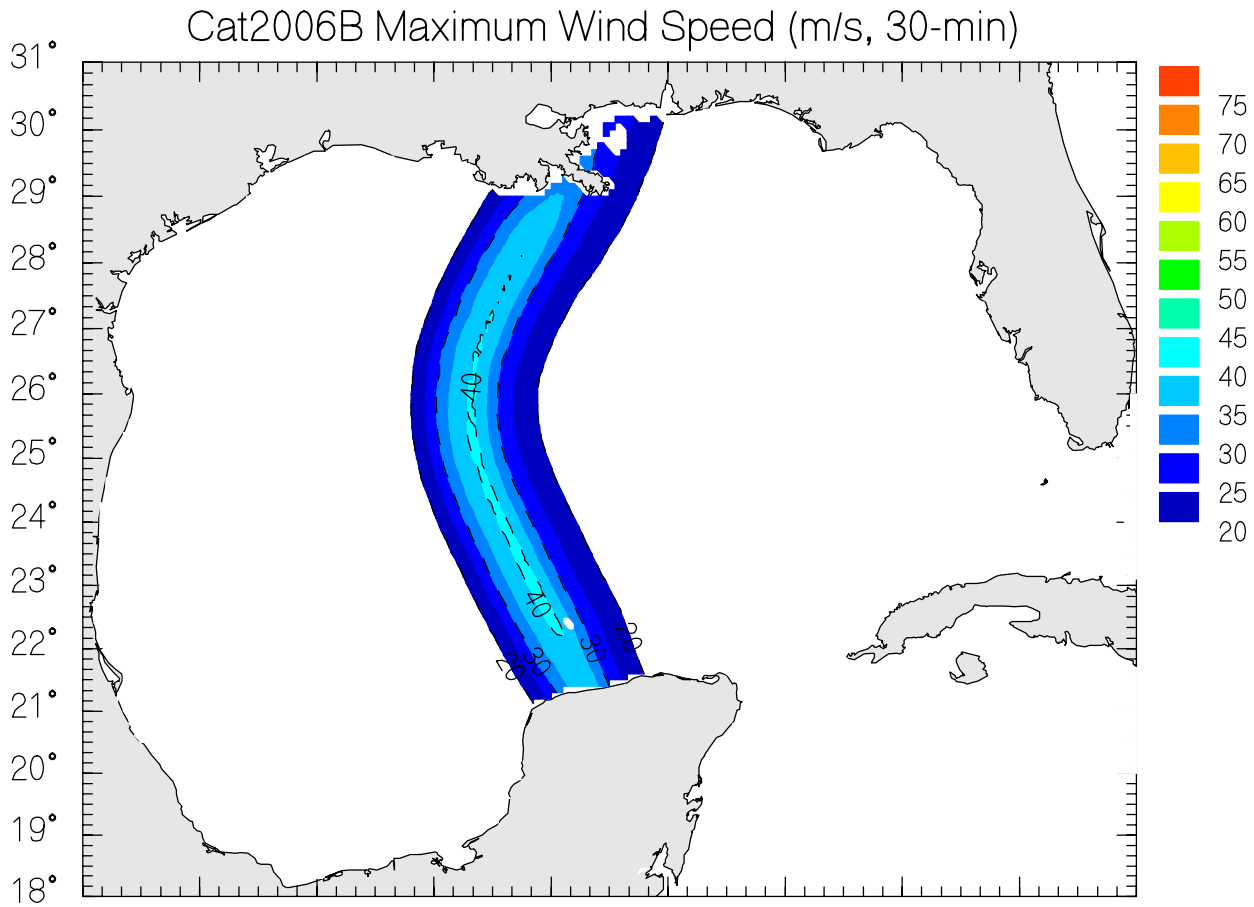
Cat2006B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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35
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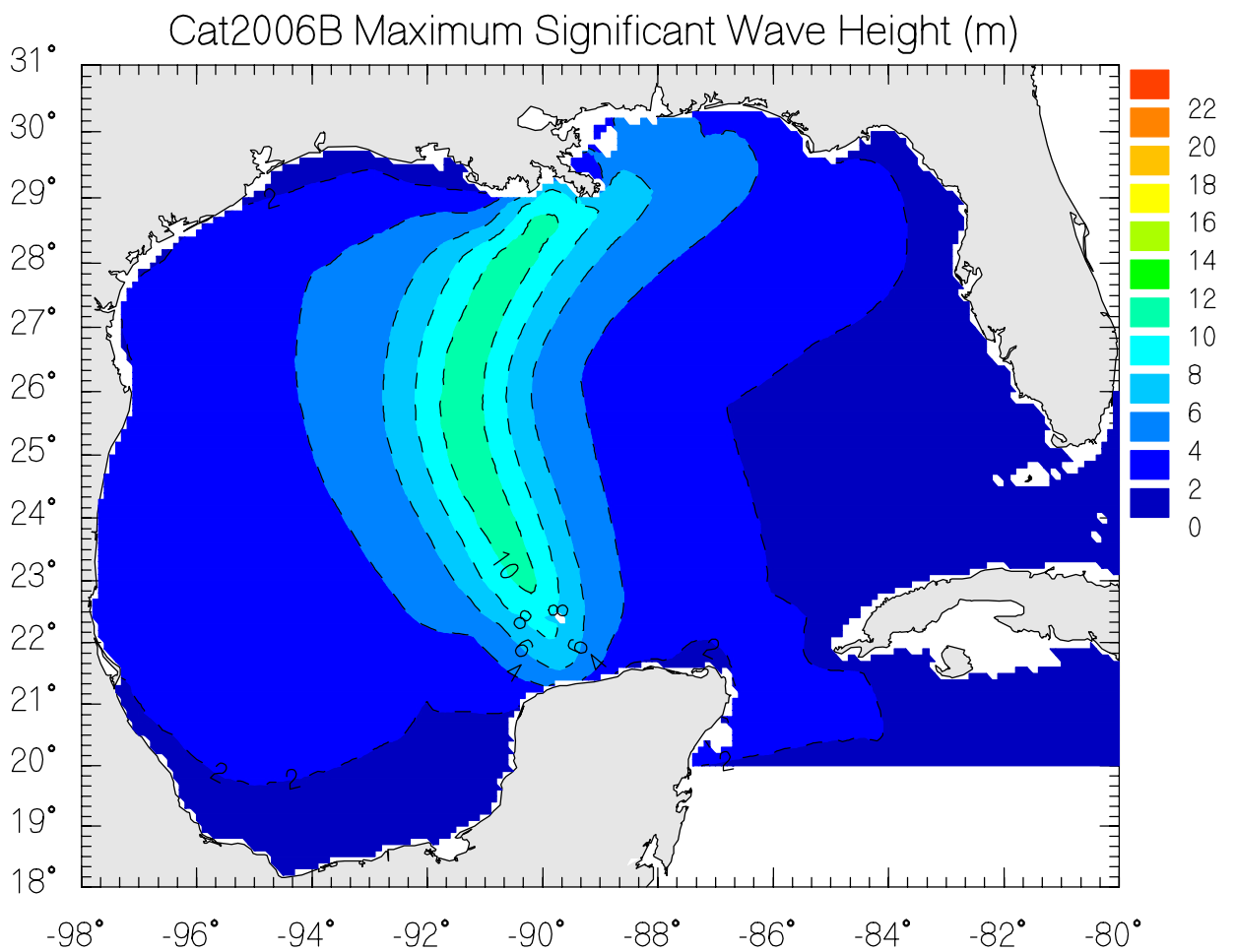
25
20


Cat2006B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
-98°
-96°
-94°
-92°
-90°
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-82°
-80°
22
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18
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6
4
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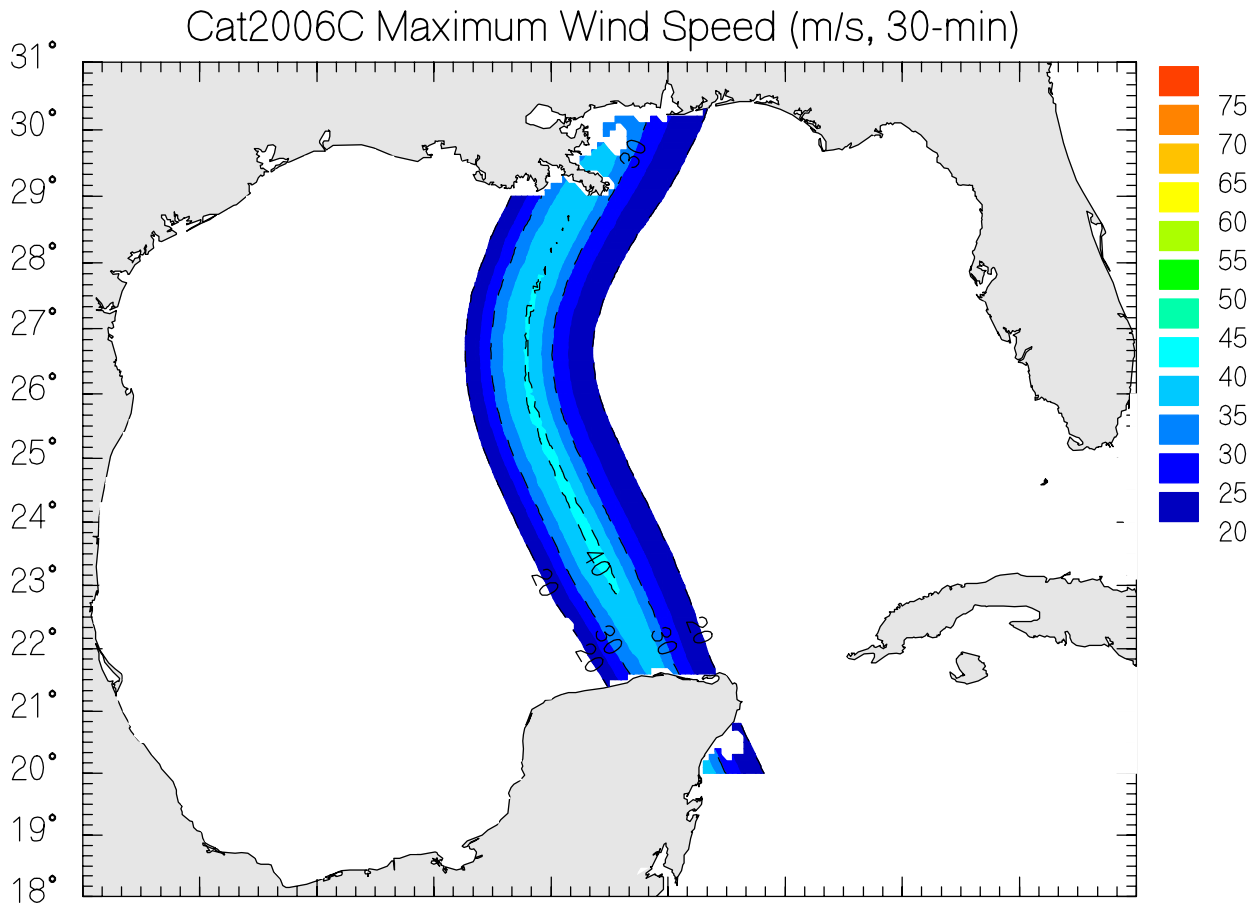
0


Cat2006C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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70
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55
50
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40
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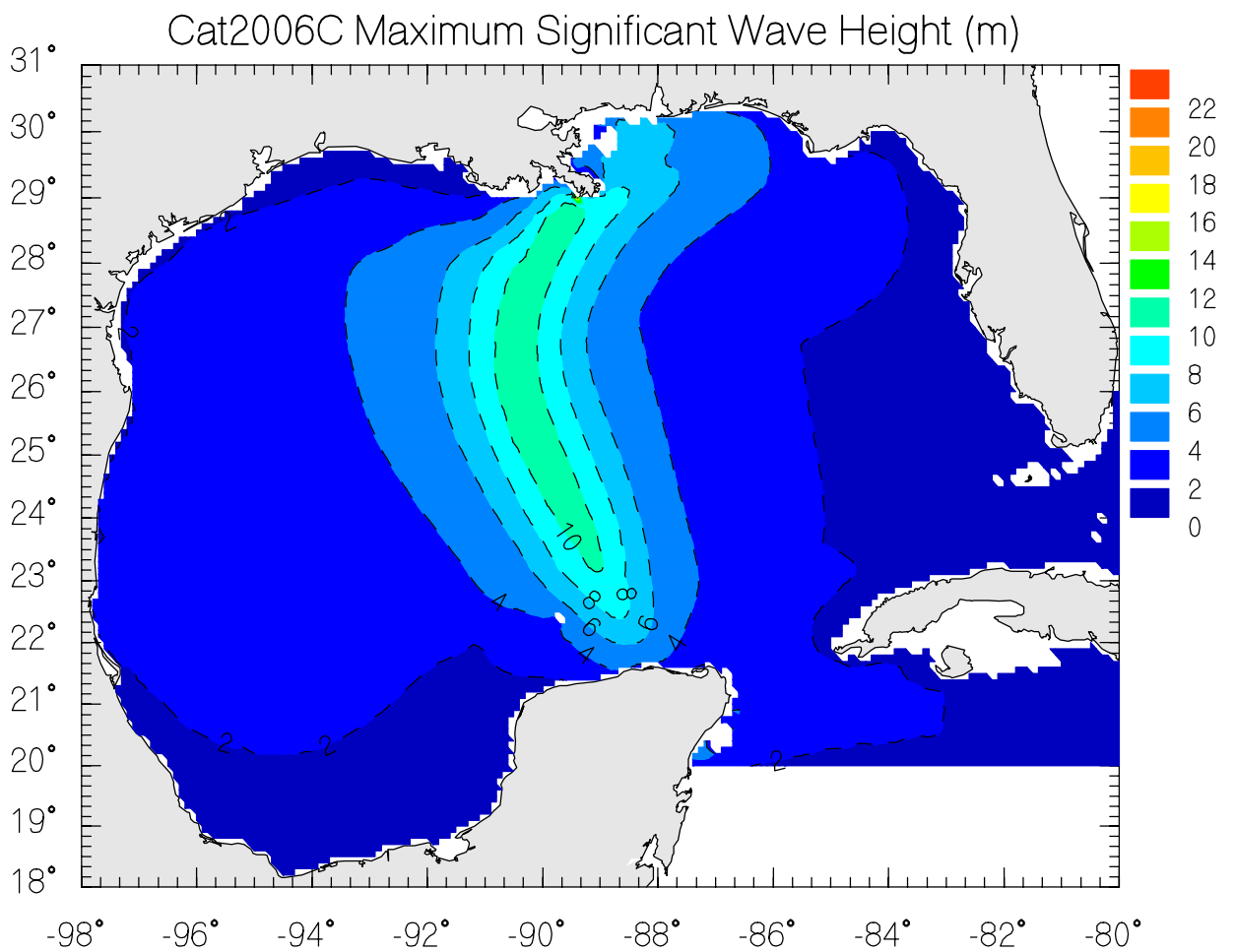
30
25
20


Cat2006C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
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-96°
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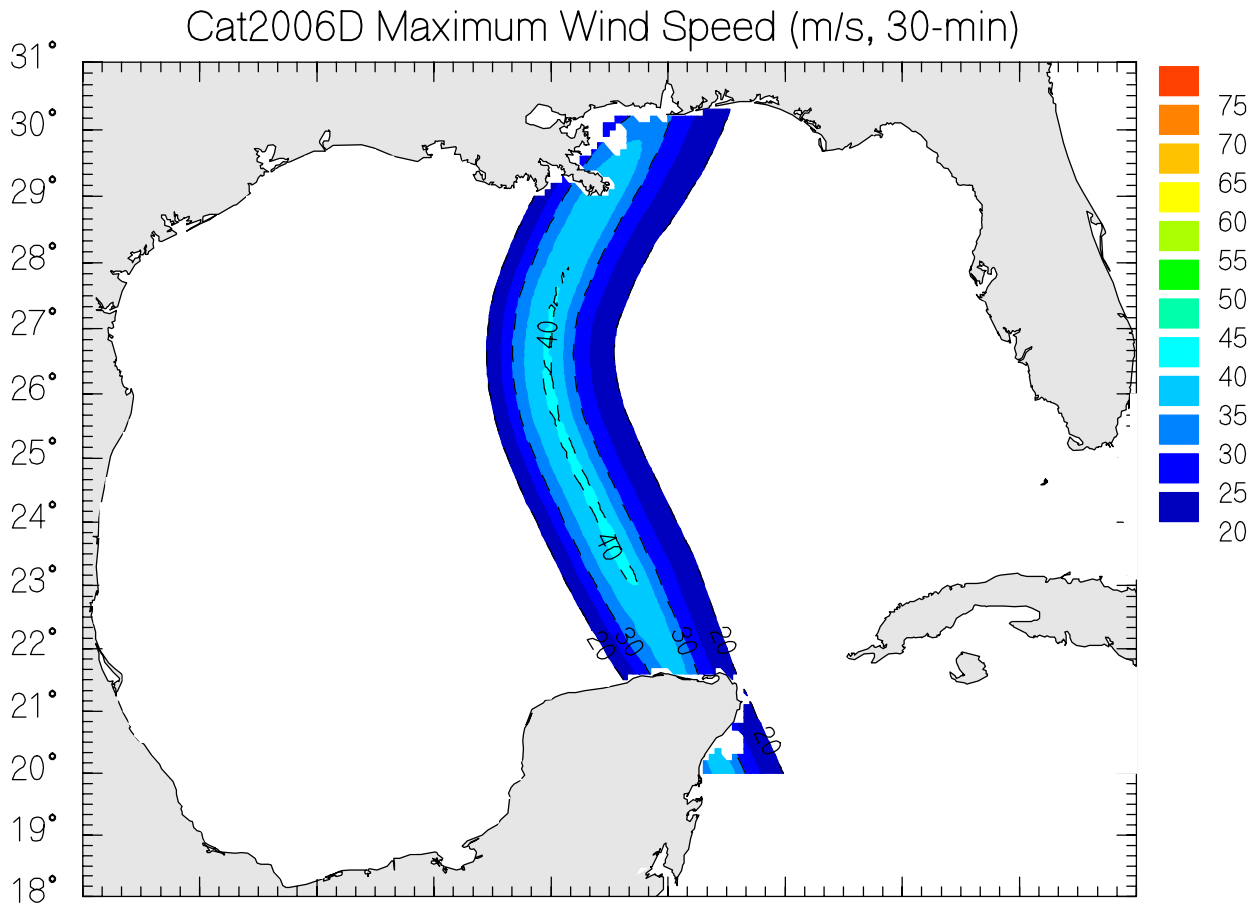
Cat2006D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
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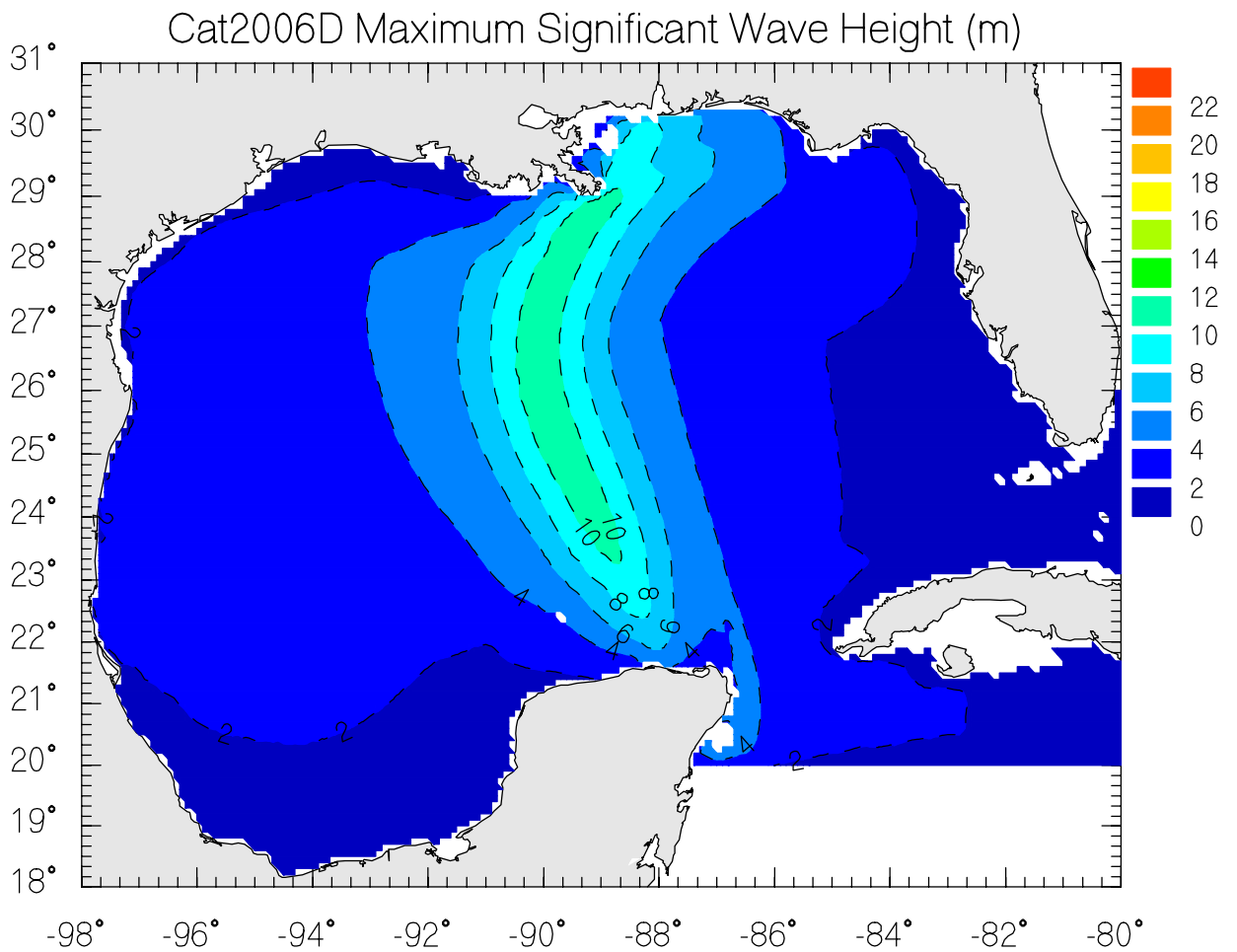
25
25


Cat2006D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
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21°
20°
19°
18°
22
20
18
16
14
12
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8
6
4
2
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10
8
8
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6
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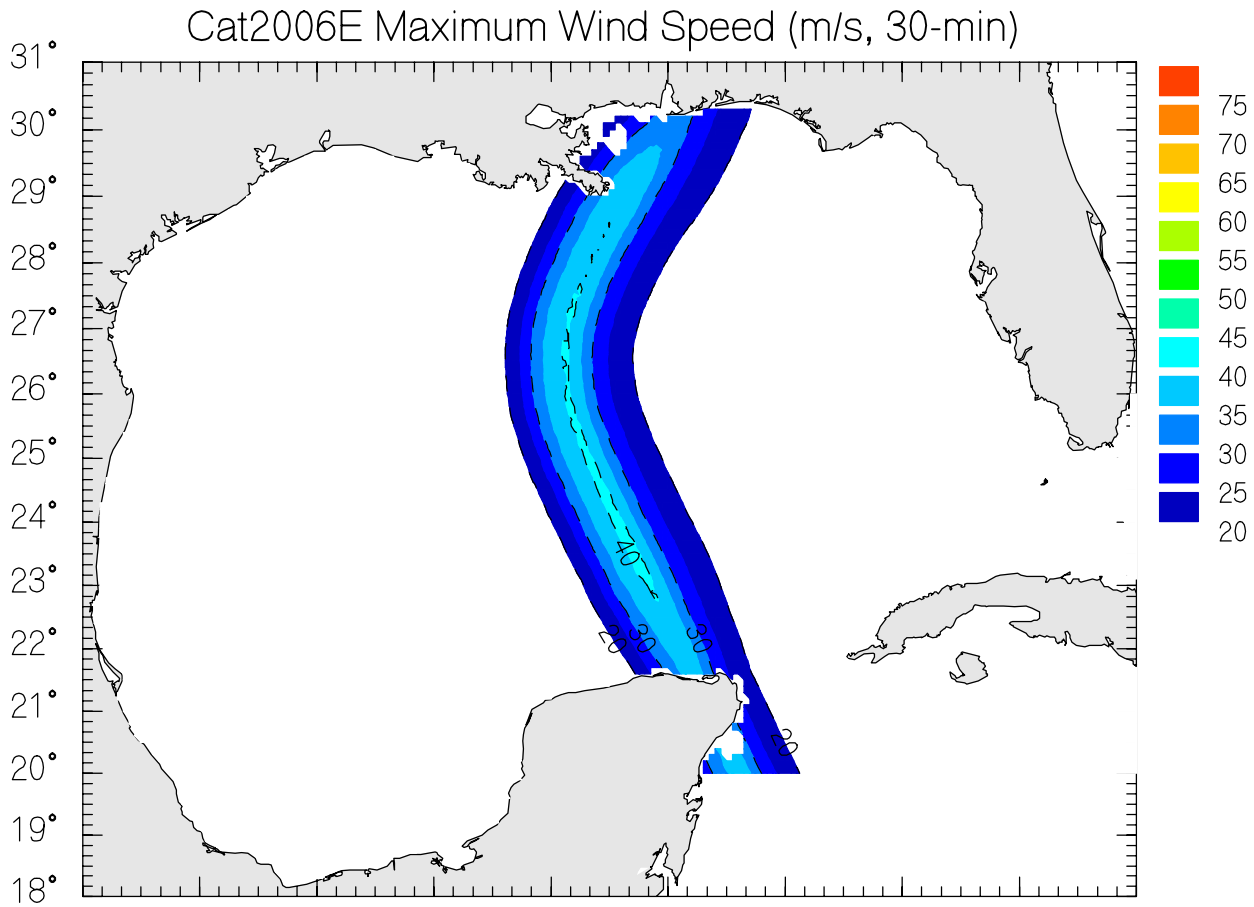
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


Cat2006E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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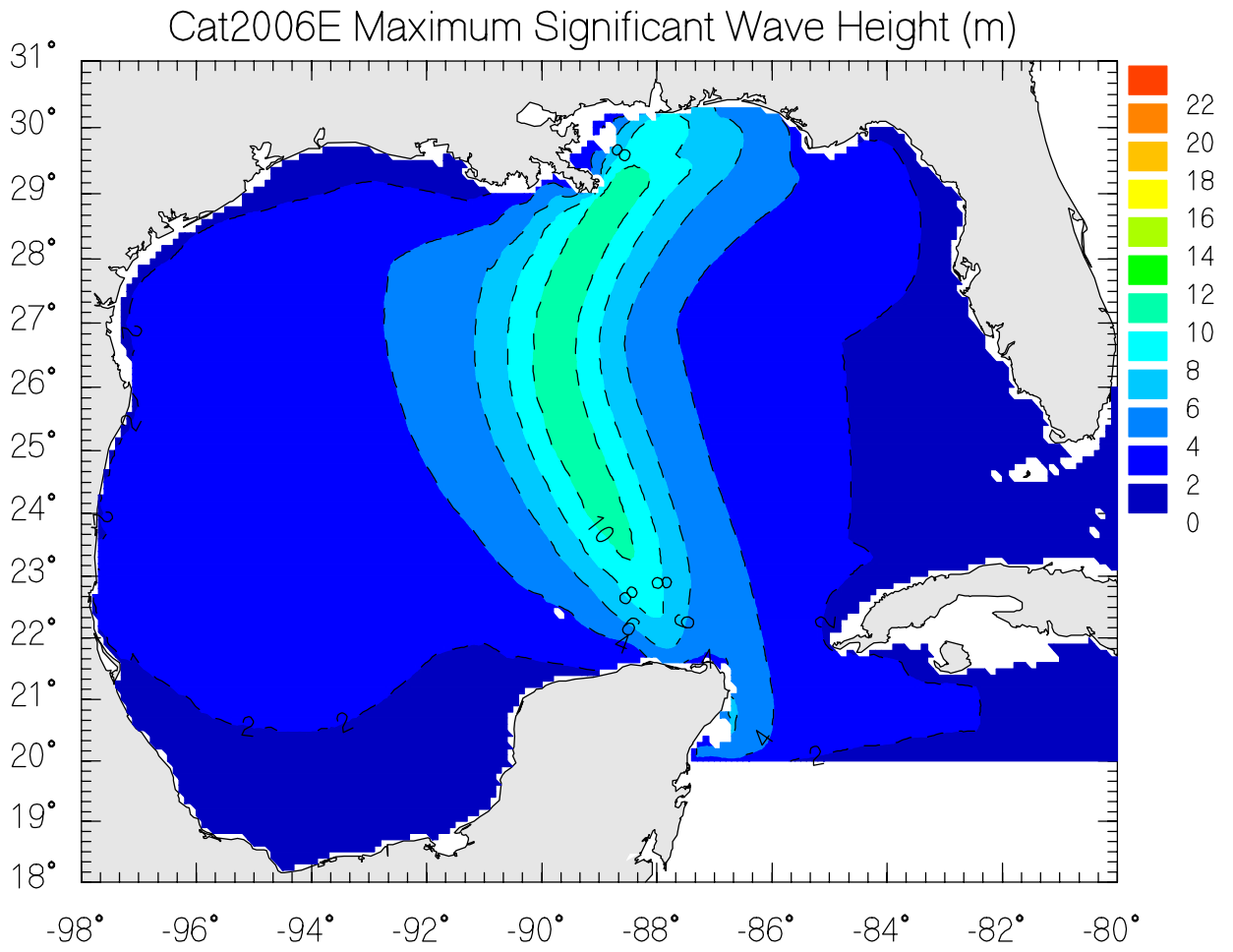
Cat2006E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
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22°
21°
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18°
-98°
-96°
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-92°
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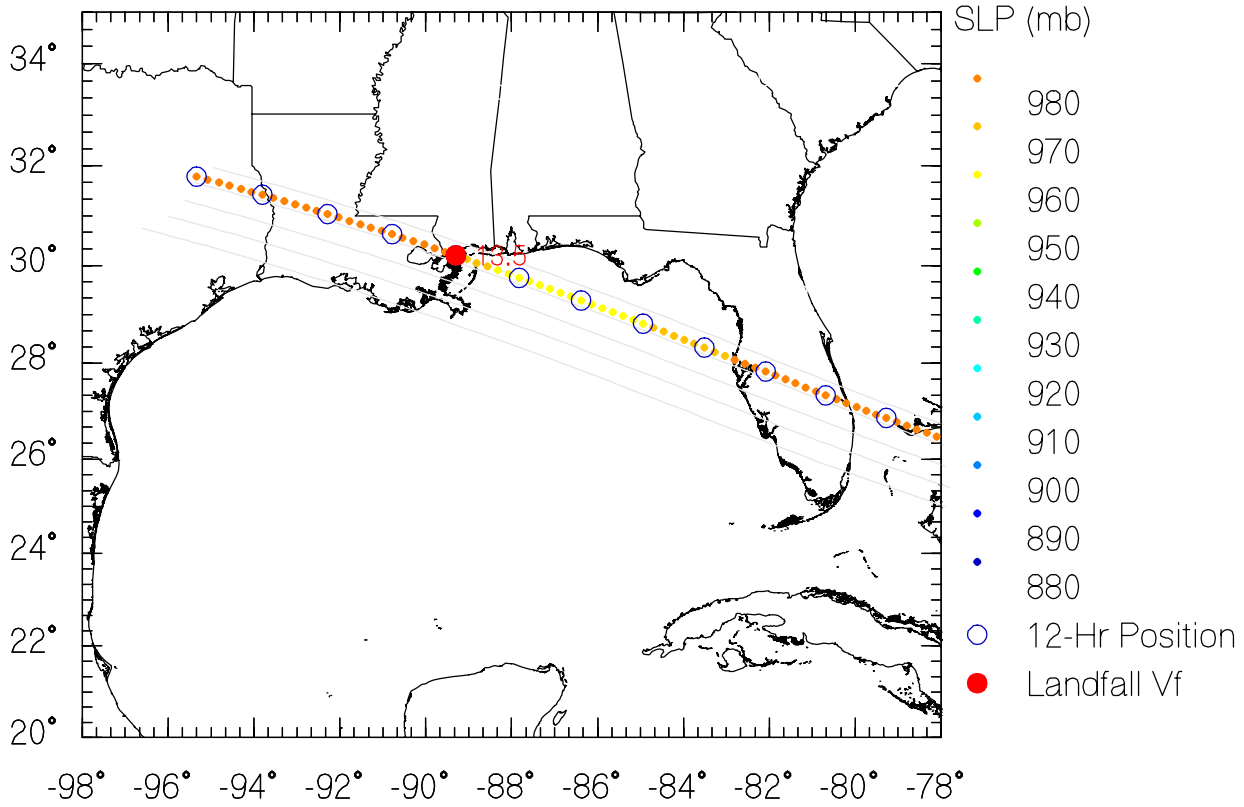
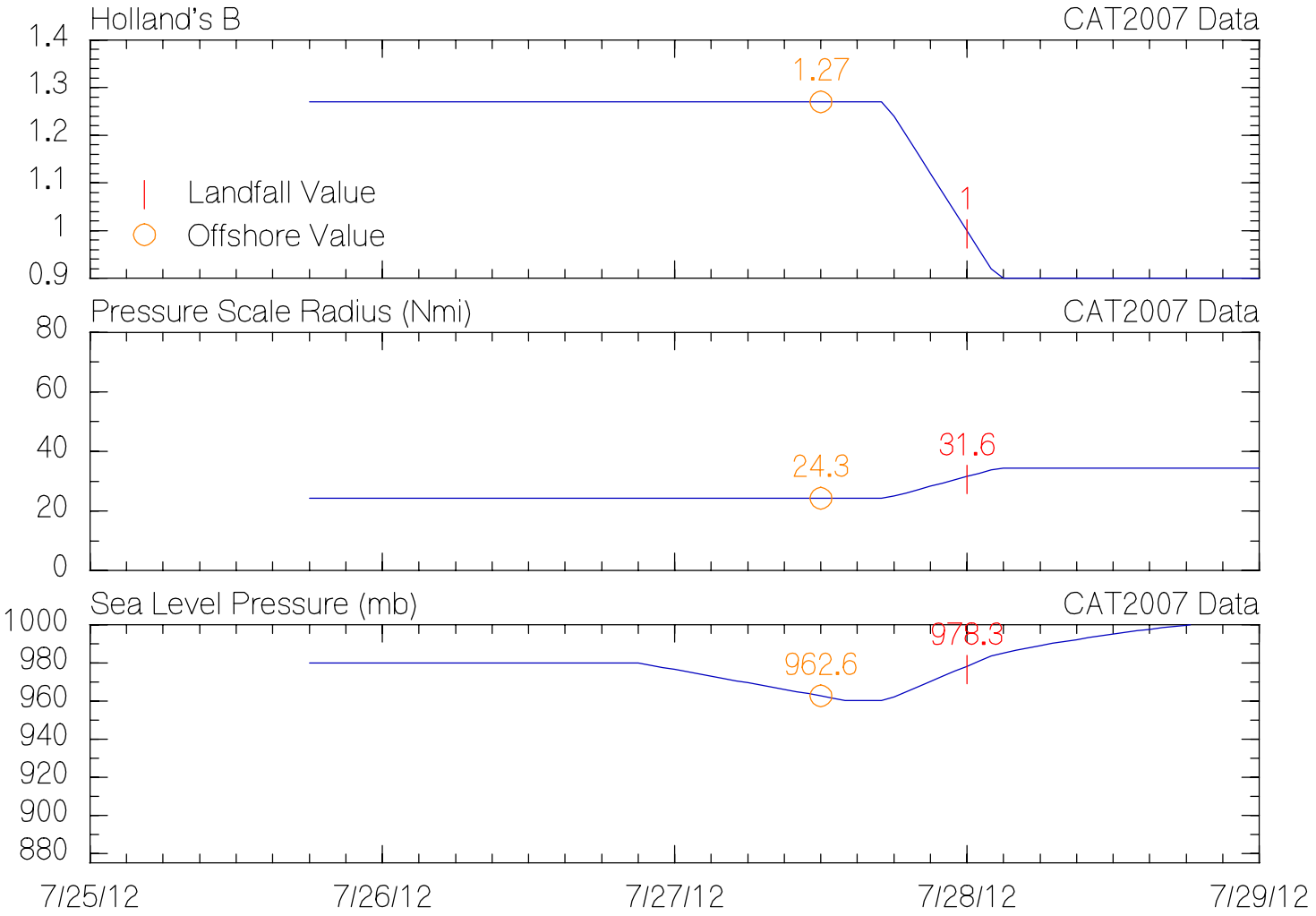
2

CAT2007 Data

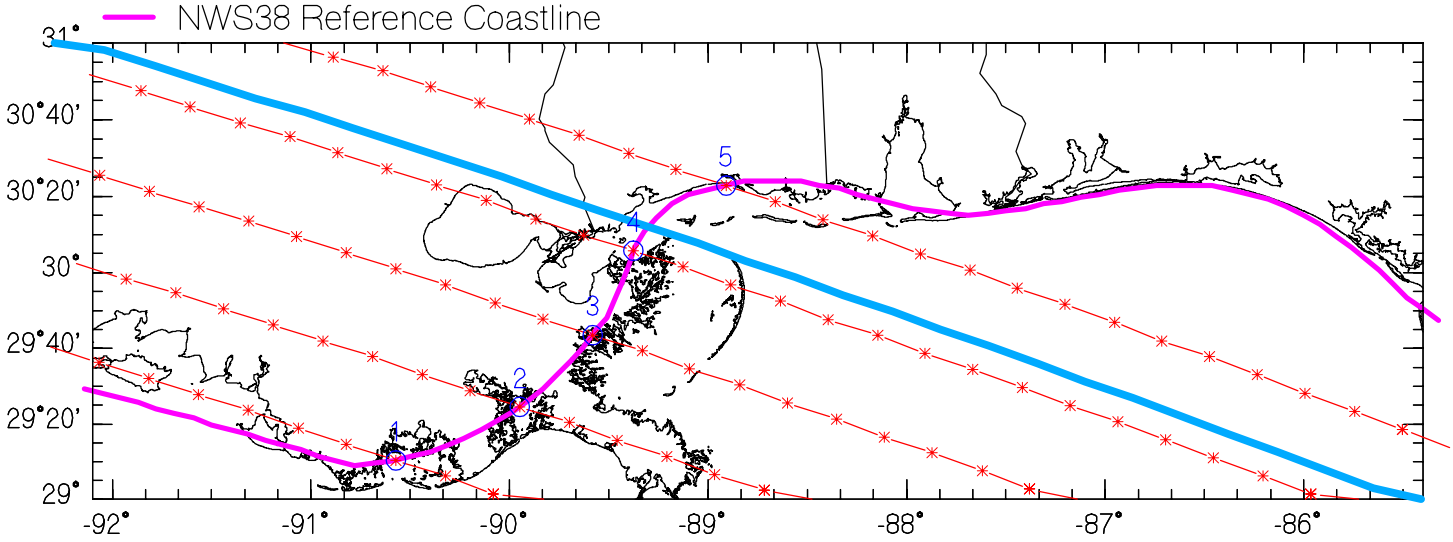


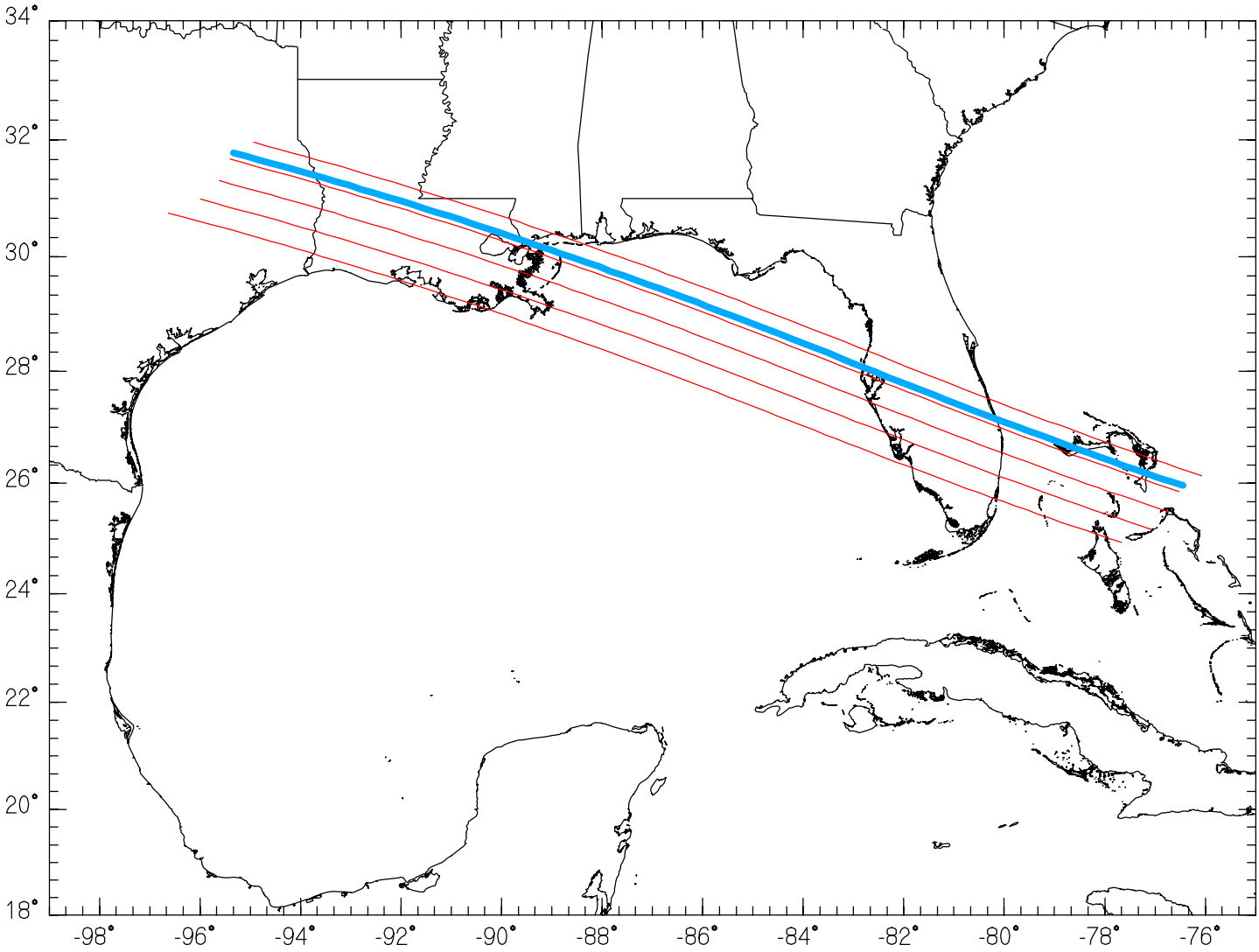


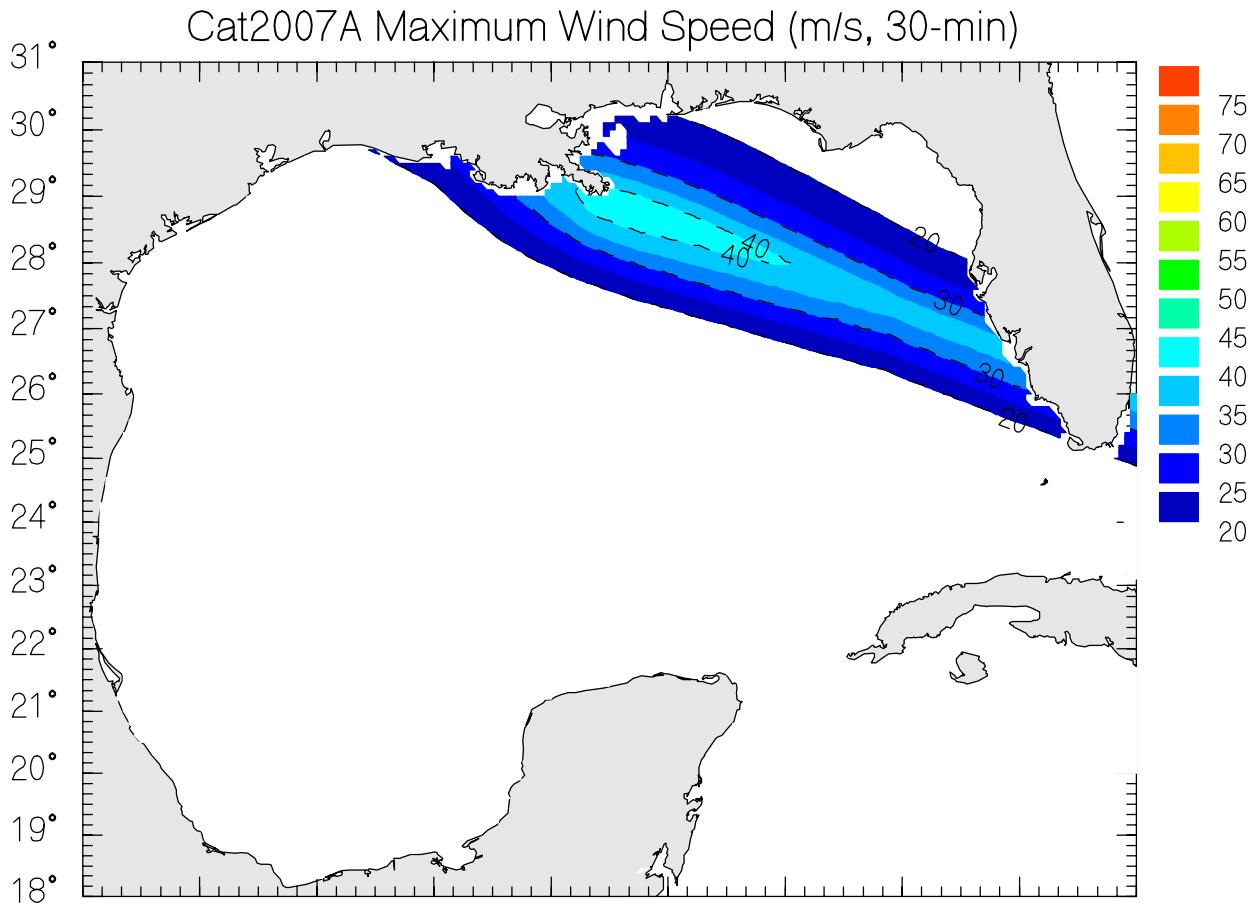
URS JPM-OS6 Production Tracks

CAT2007 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






Cat2007A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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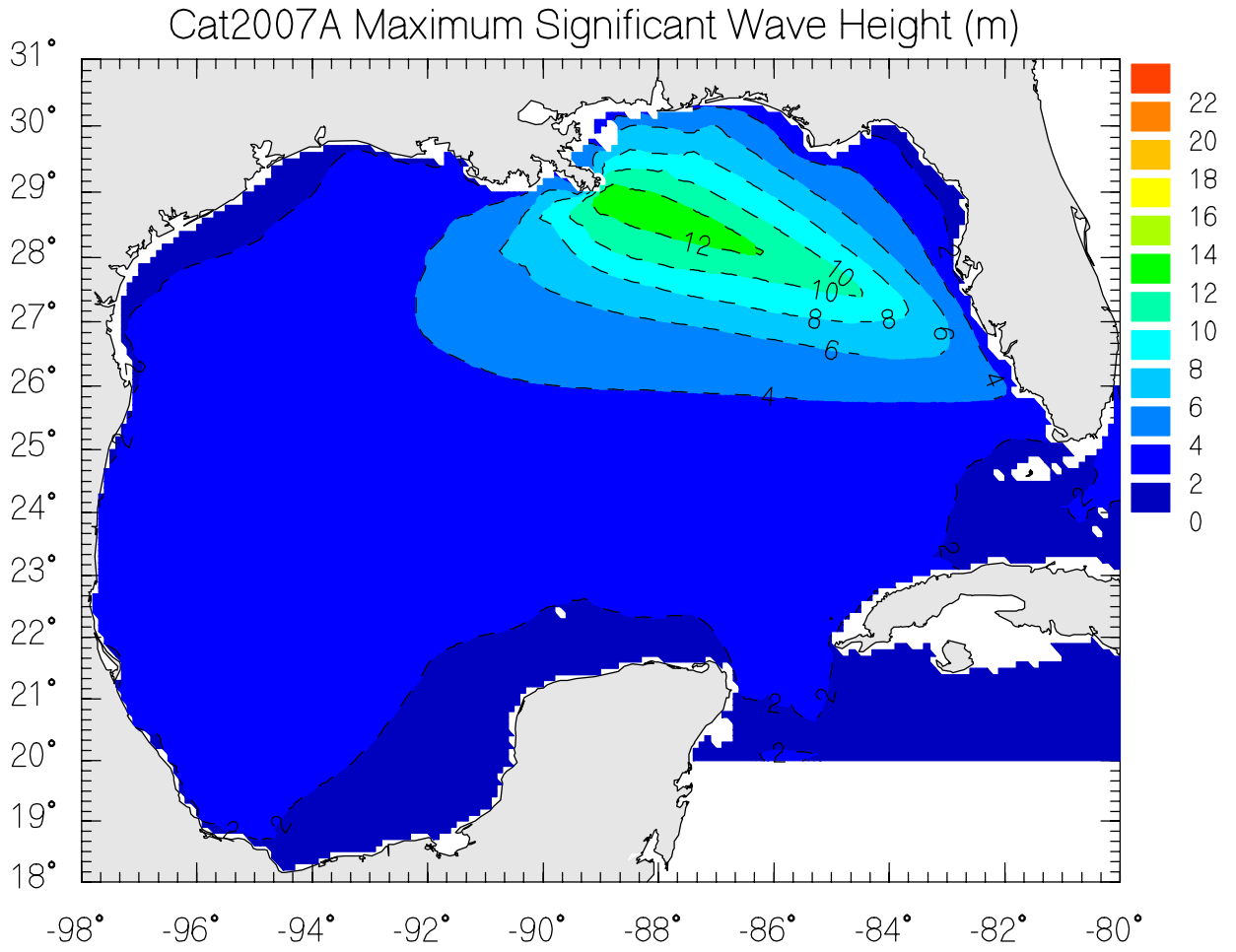
25
20


Cat2007A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
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21°
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19°
18°
-98°
-96°
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-88°
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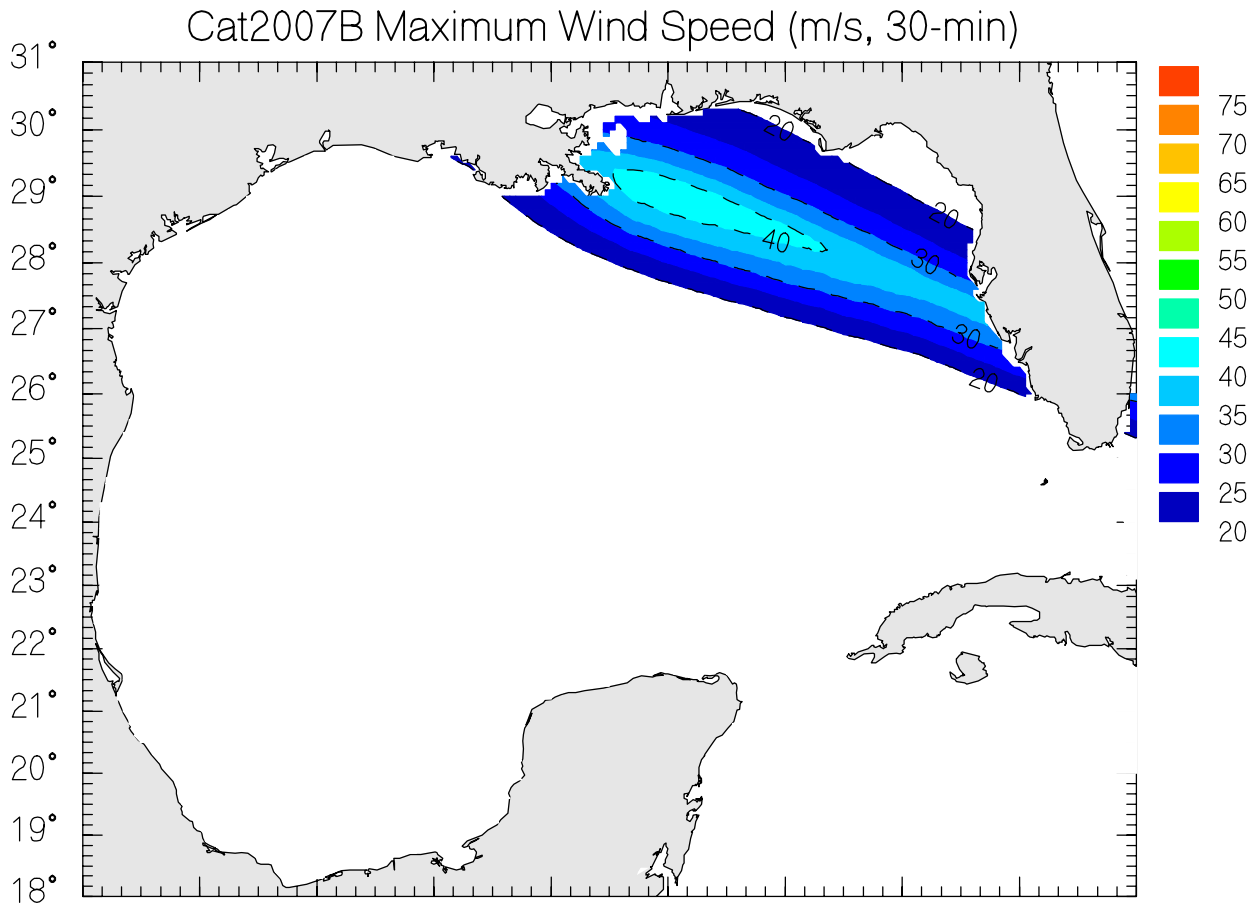
Cat2007B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
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27°
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24°
23°
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21°
20°
19°
18°
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75
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55
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45
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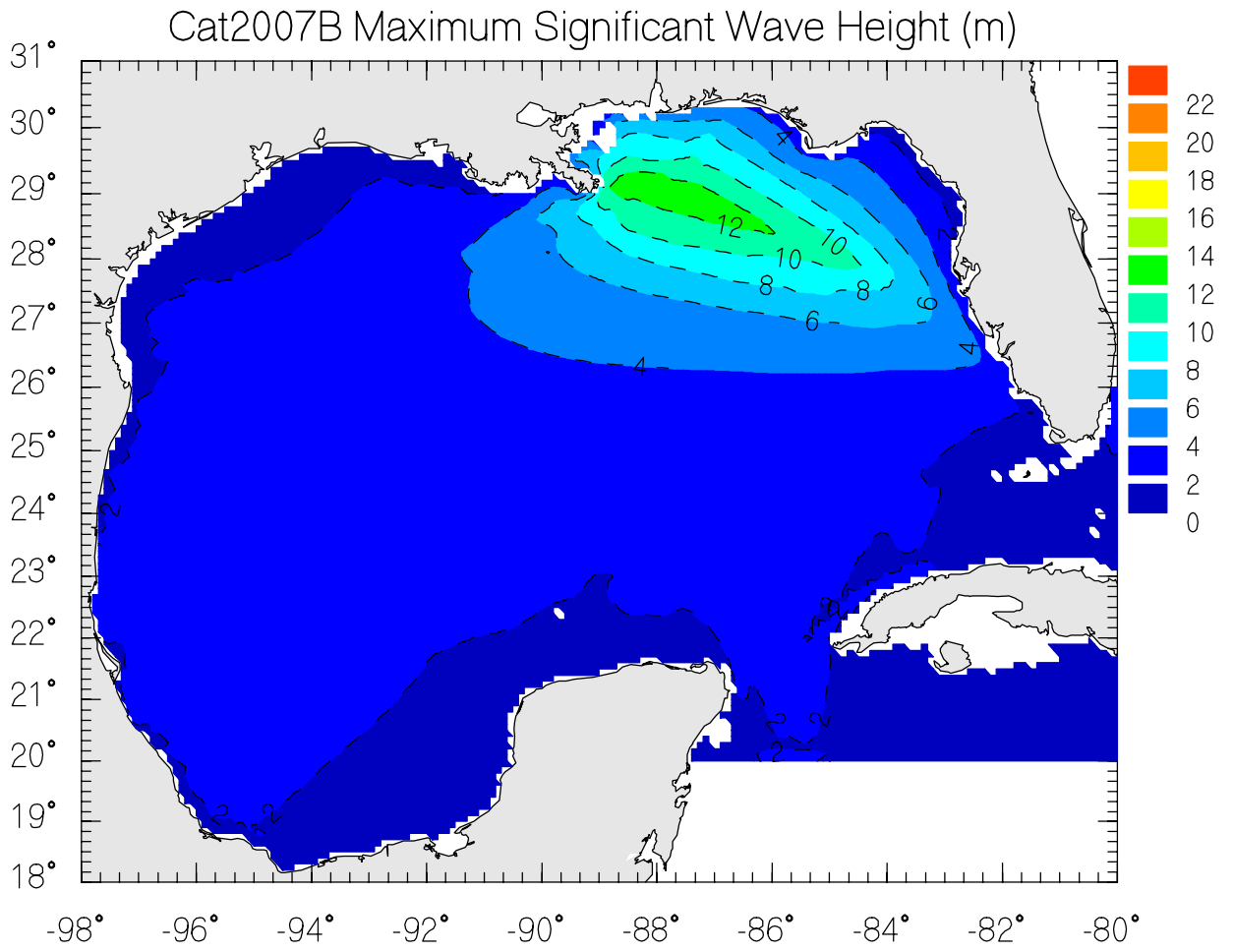
35
30
25
20


Cat2007B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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18°
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-94°
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-86°
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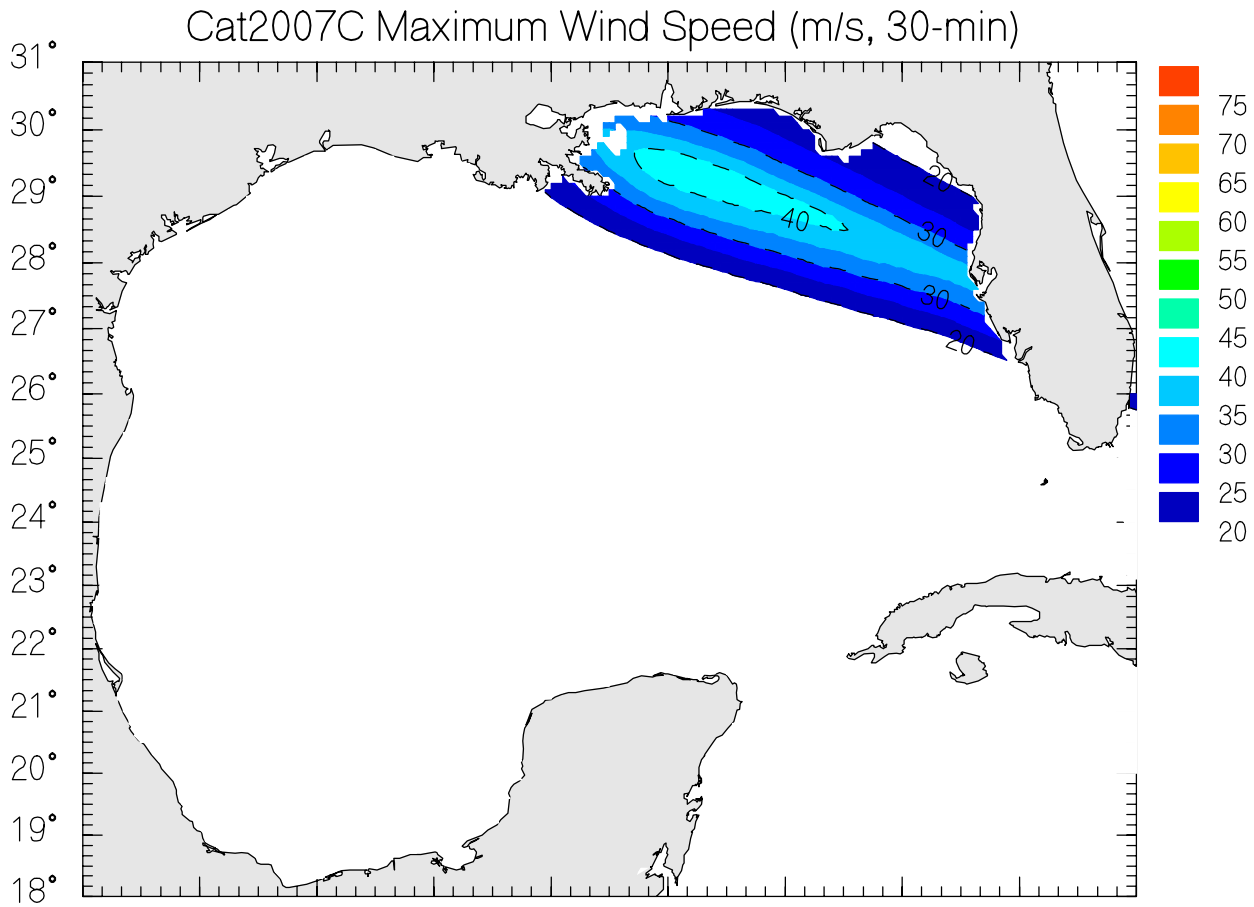
Cat2007C Maximum Wind Speed (m/s, 30-min)
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30°
29°
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21°
20°
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18°
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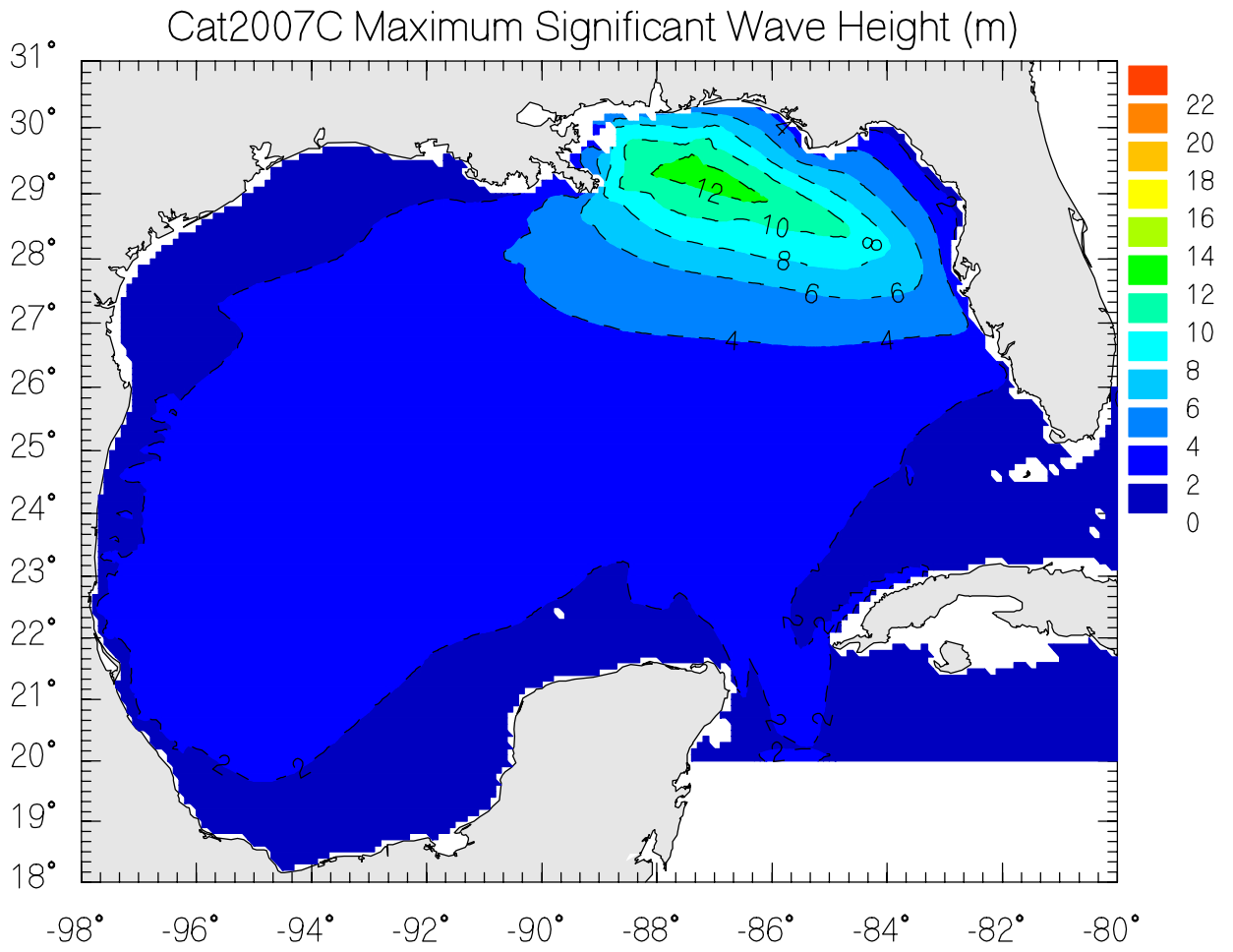
Cat2007C Maximum Significant Wave Height (m)
31°
30°
29°
28°
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23°
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21°
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18°
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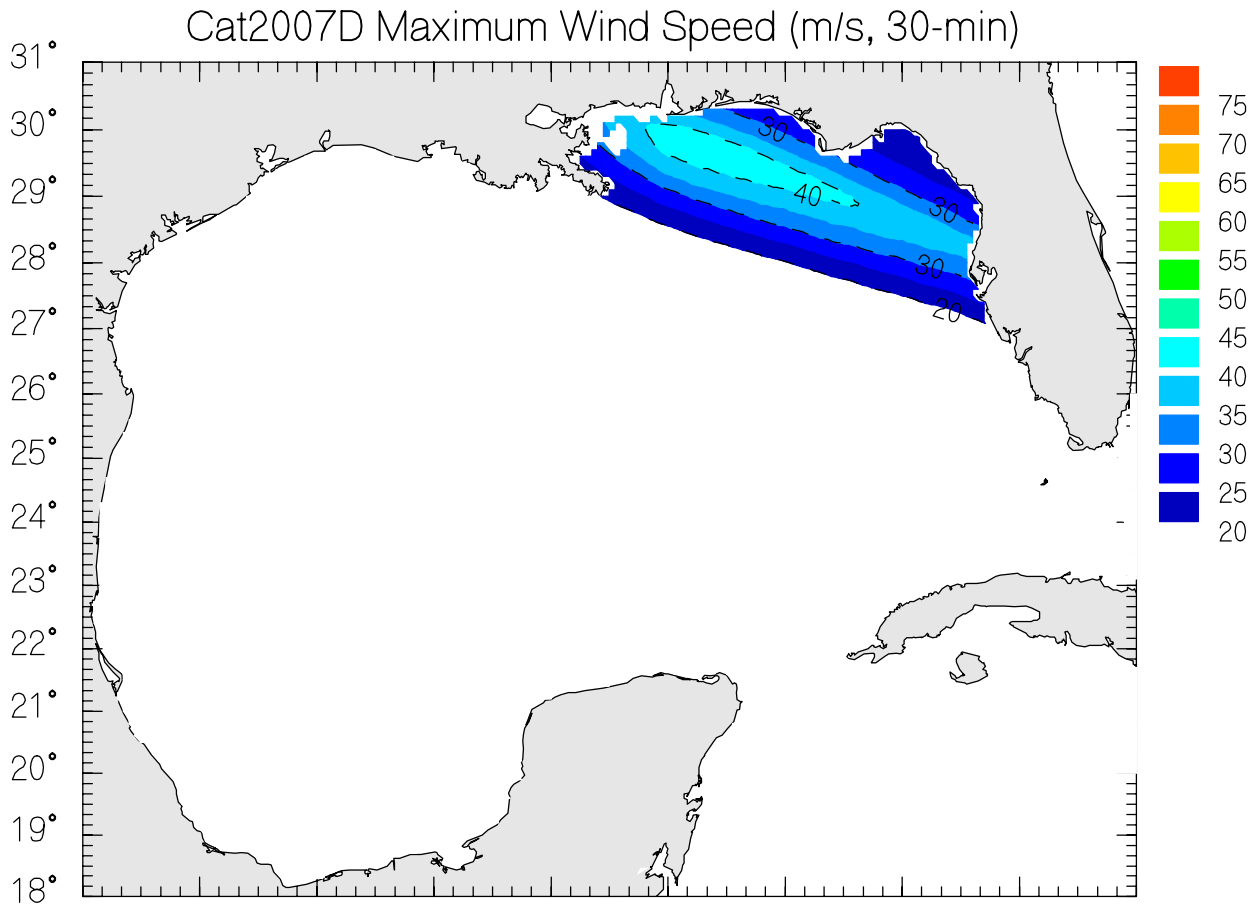
Cat2007D Maximum Wind Speed (m/s, 30-min)
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29°
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27°
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24°
23°
22°
21°
20°
19°
18°
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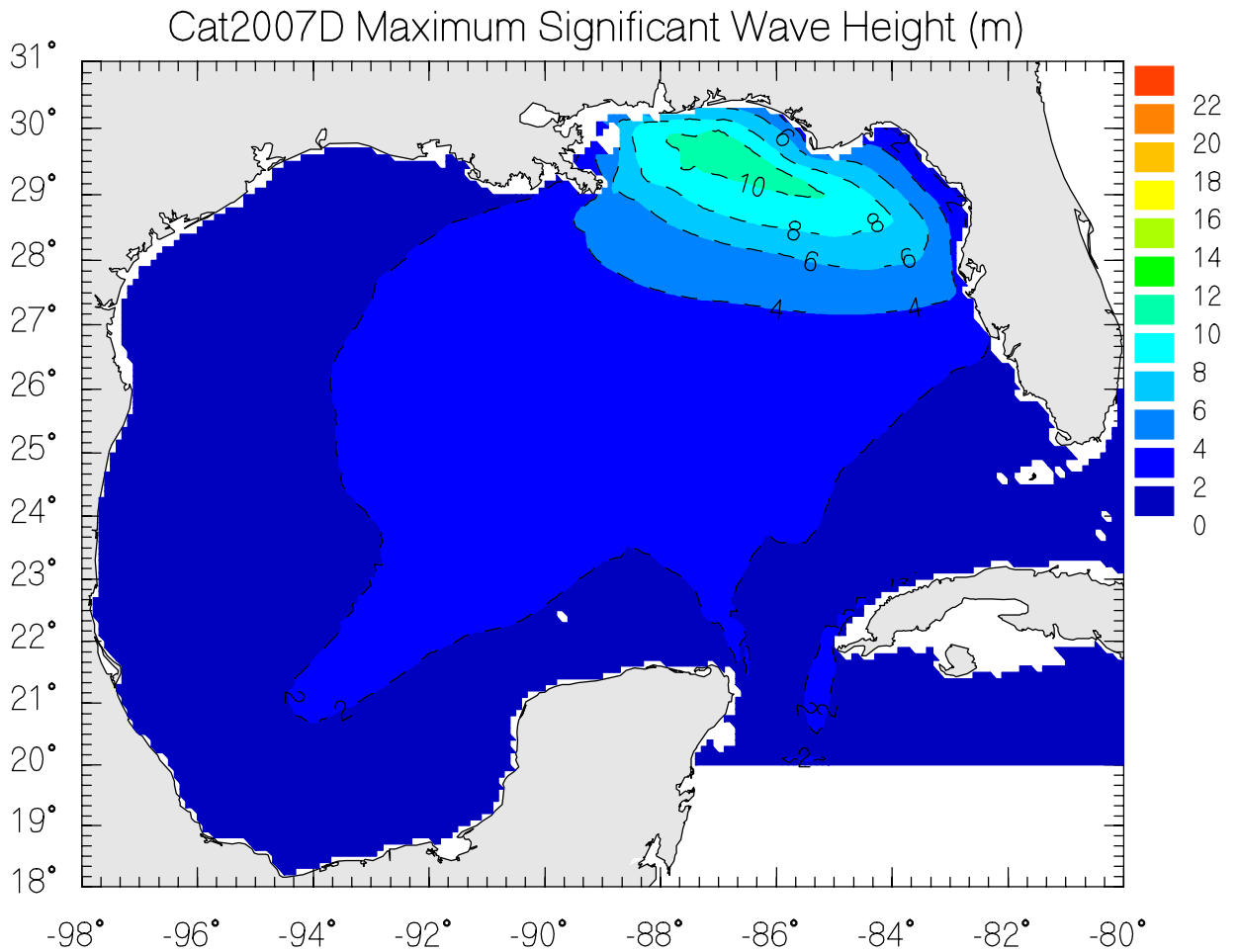
Cat2007D Maximum Significant Wave Height (m)
31°
30°
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18°
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-86°
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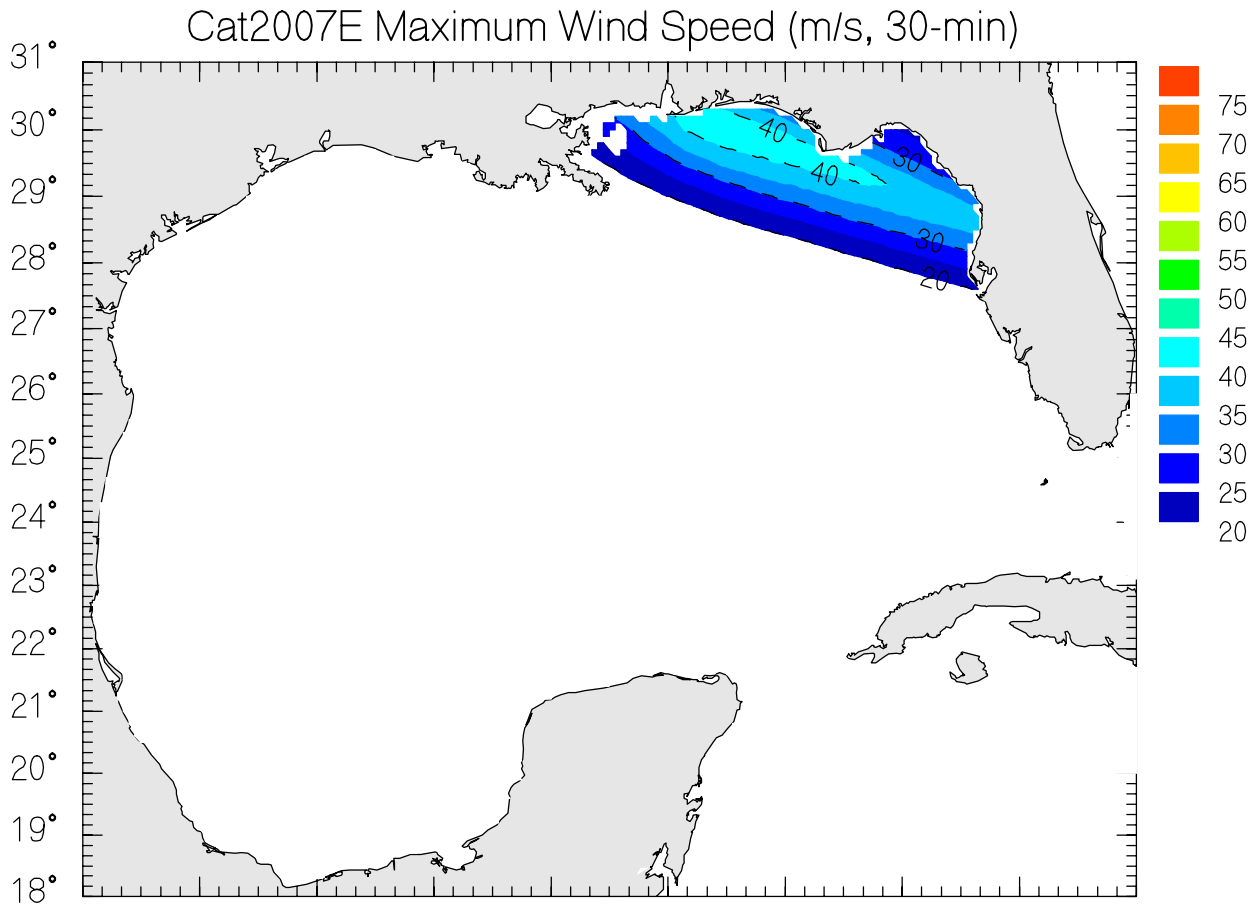
-82°
-80°


Cat2007E Maximum Wind Speed (m/s, 30-min)
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29°
28°
27°
26°
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24°
23°
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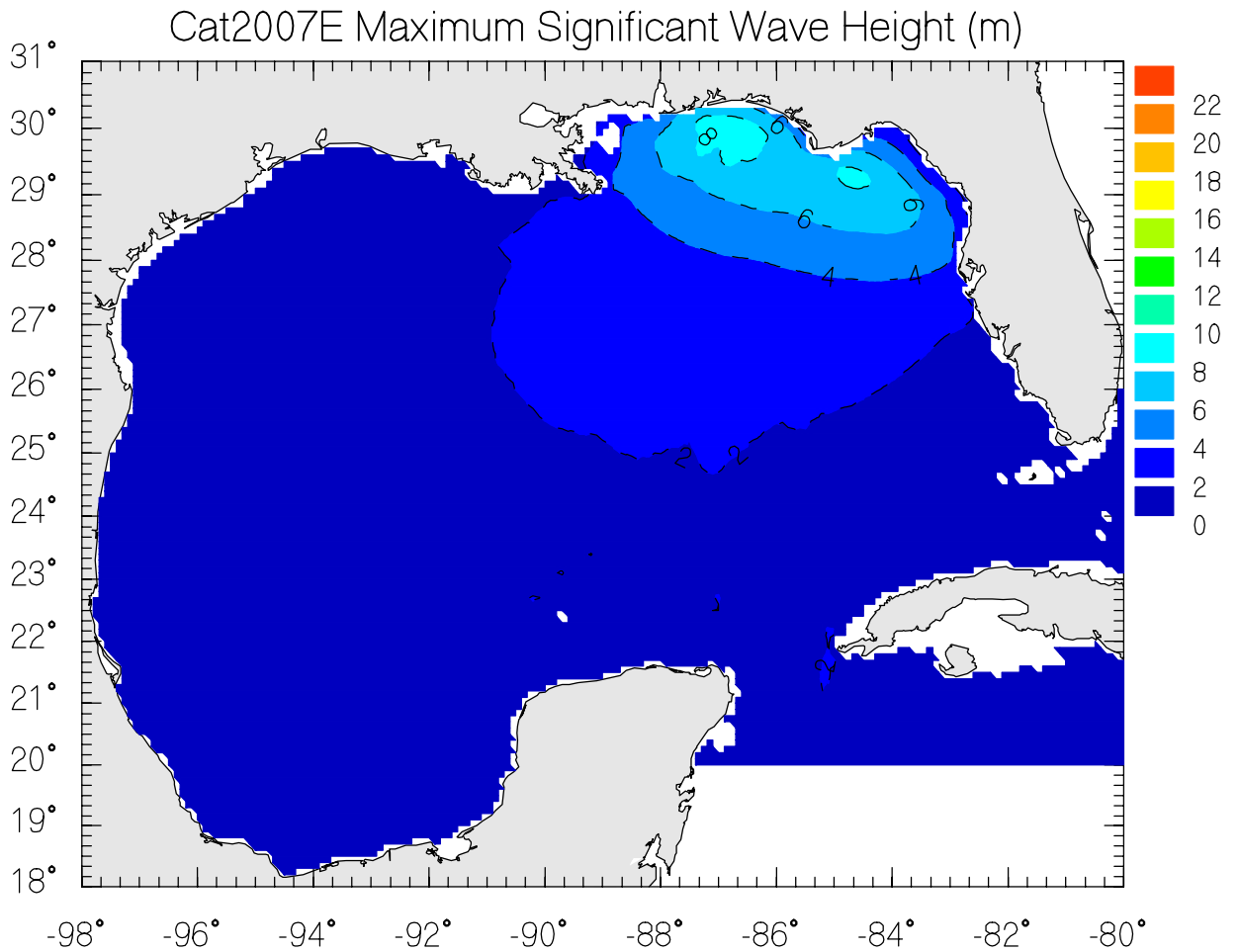
Cat2007E Maximum Significant Wave Height (m)
31°
30°
29°
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23°
22°
21°
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18°
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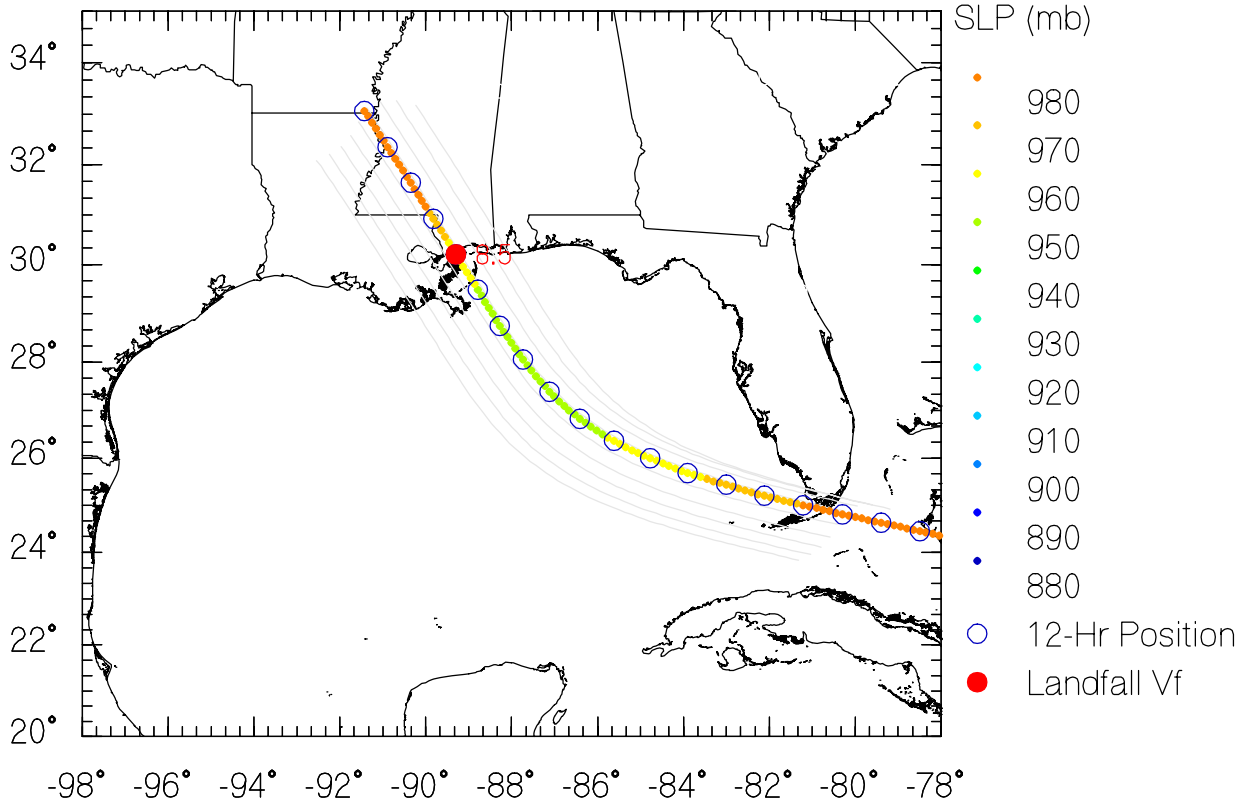
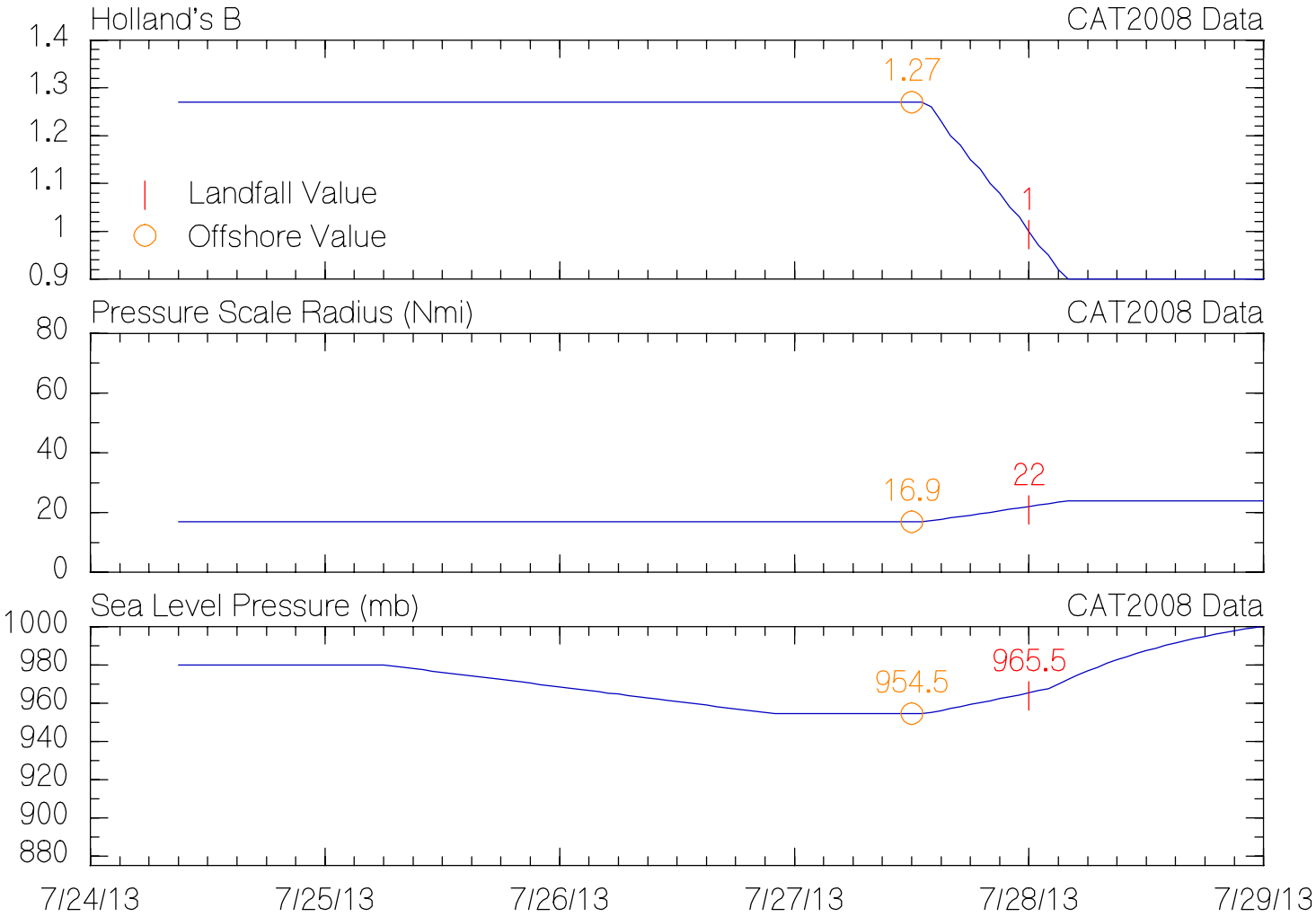
-86°
-84°
-82°
-80°

CAT2008 Data

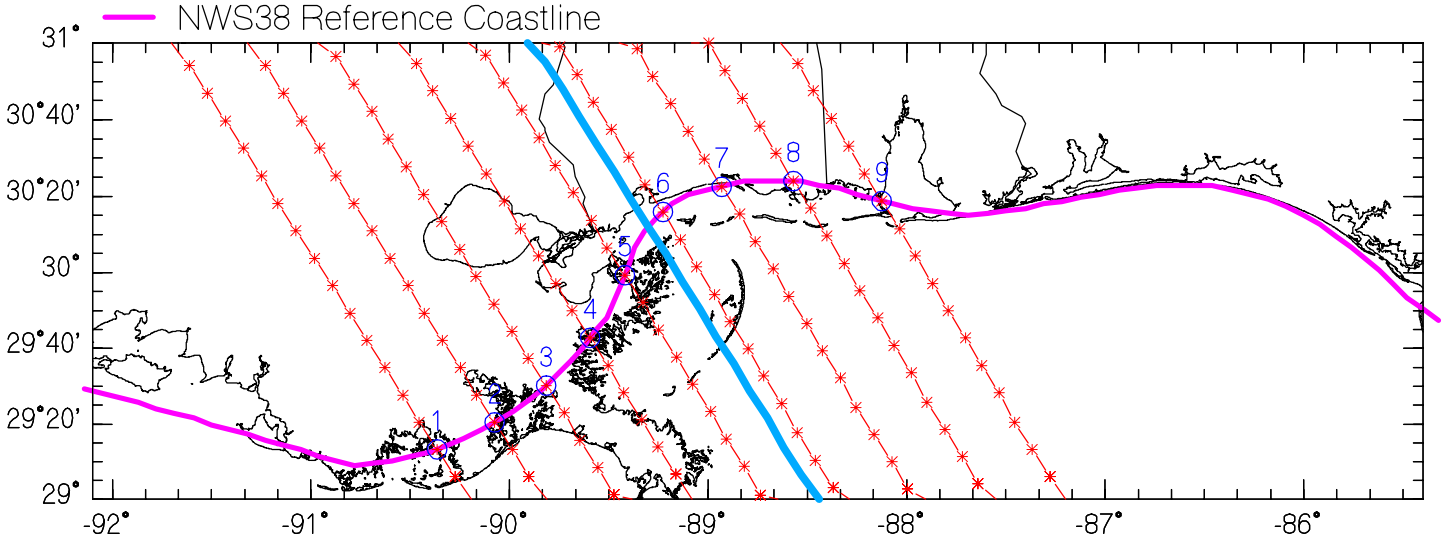


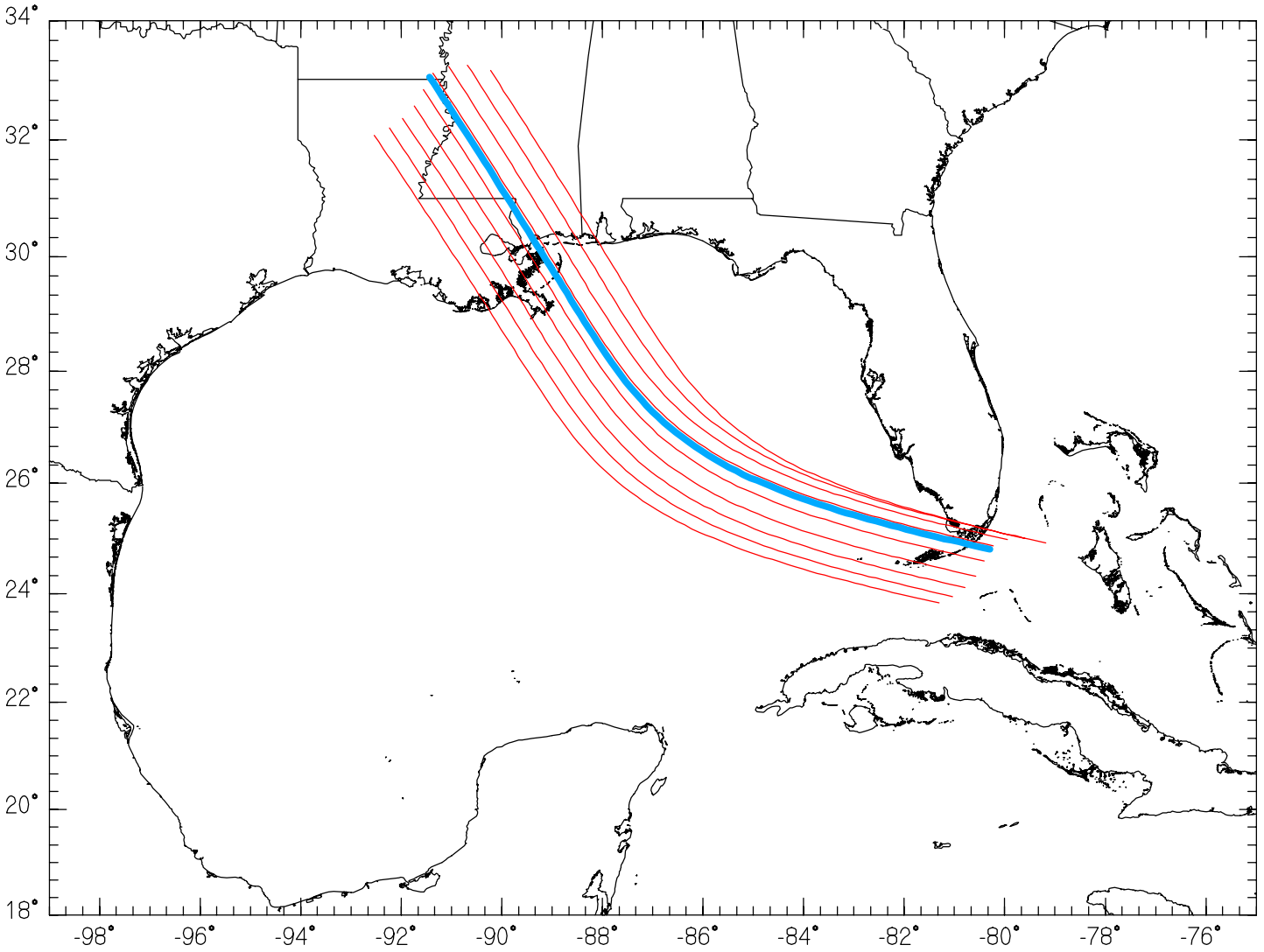


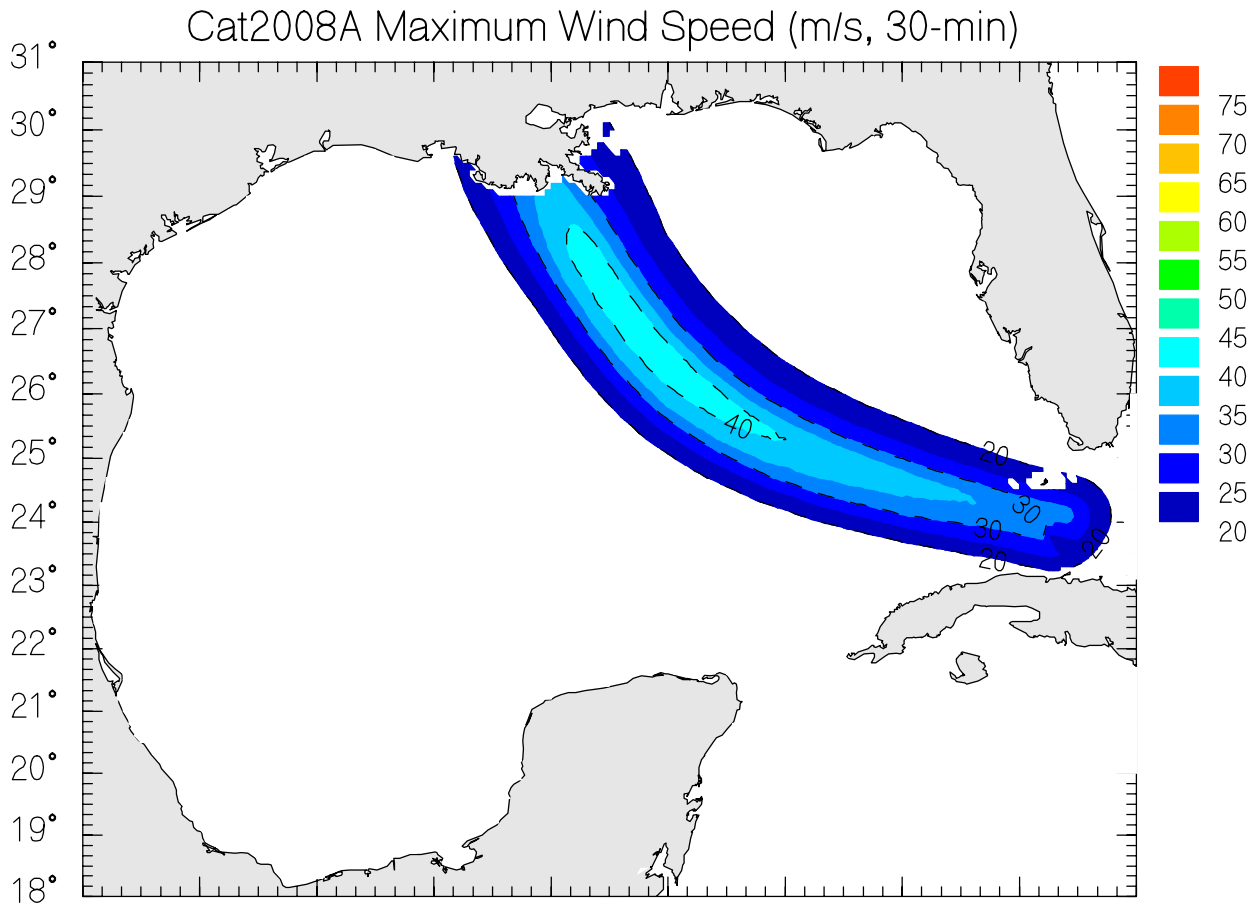
URS JPM-OS6 Production Tracks

CAT2008 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






Cat2008A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
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24°
23°
22°
21°
20°
19°
18°
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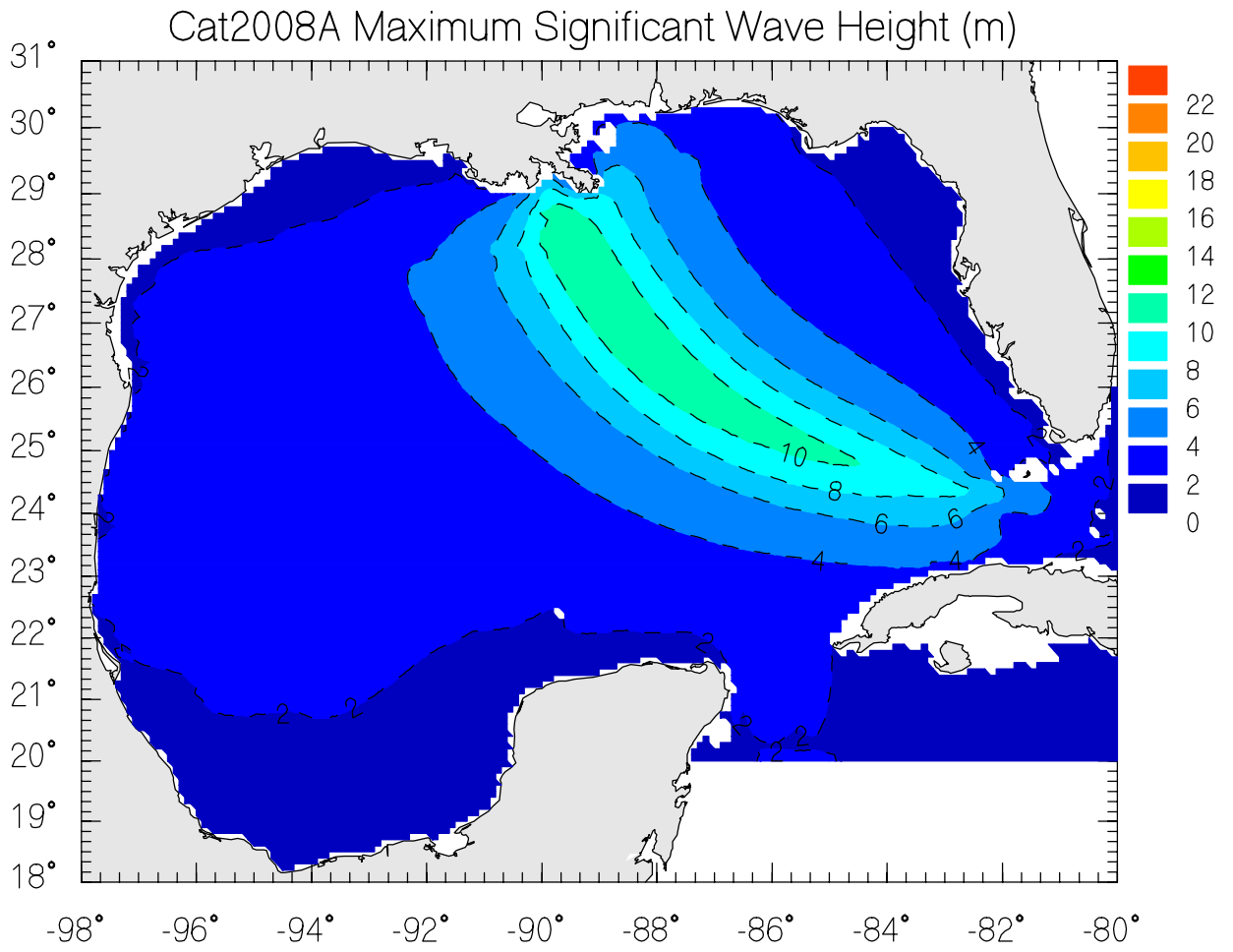
Cat2008A Maximum Significant Wave Height (m)
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30°
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23°
22°
21°
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-98°
-96°
-94°
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-88°
-86°
-84°
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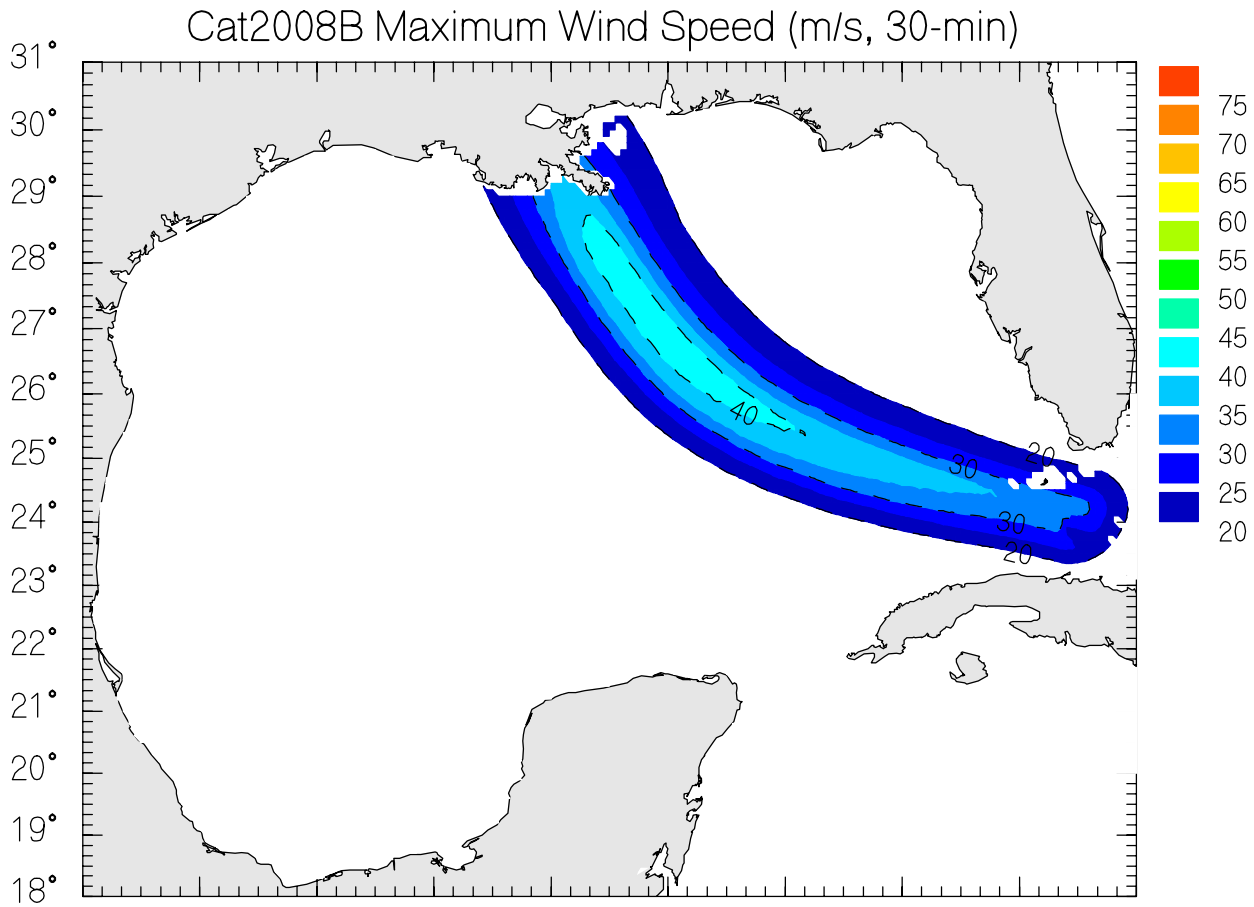
Cat2008B Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
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21°
20°
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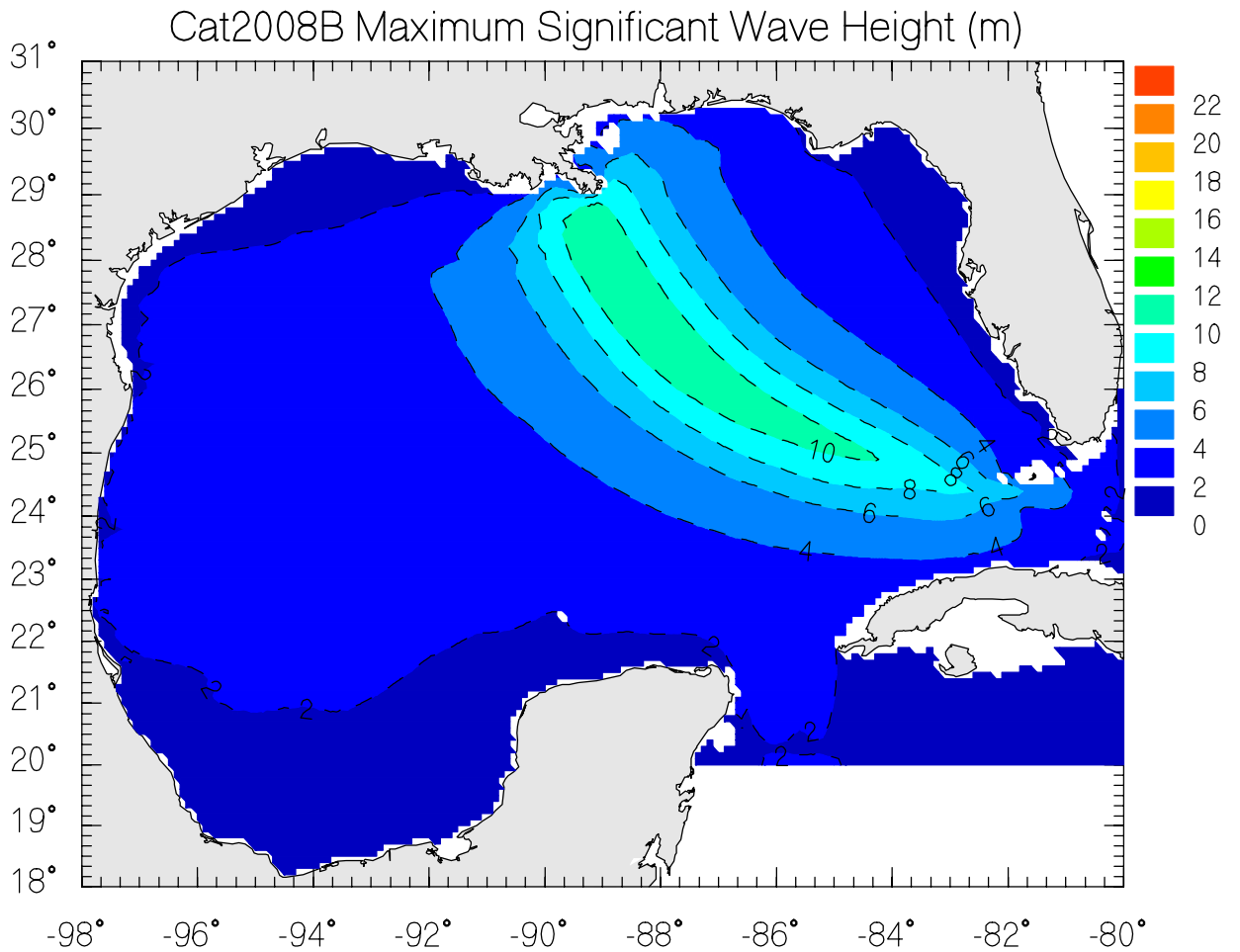
Cat2008B Maximum Significant Wave Height (m)
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30°
29°
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27°
26°
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23°
22°
21°
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-96°
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-88°
-86°
-84°
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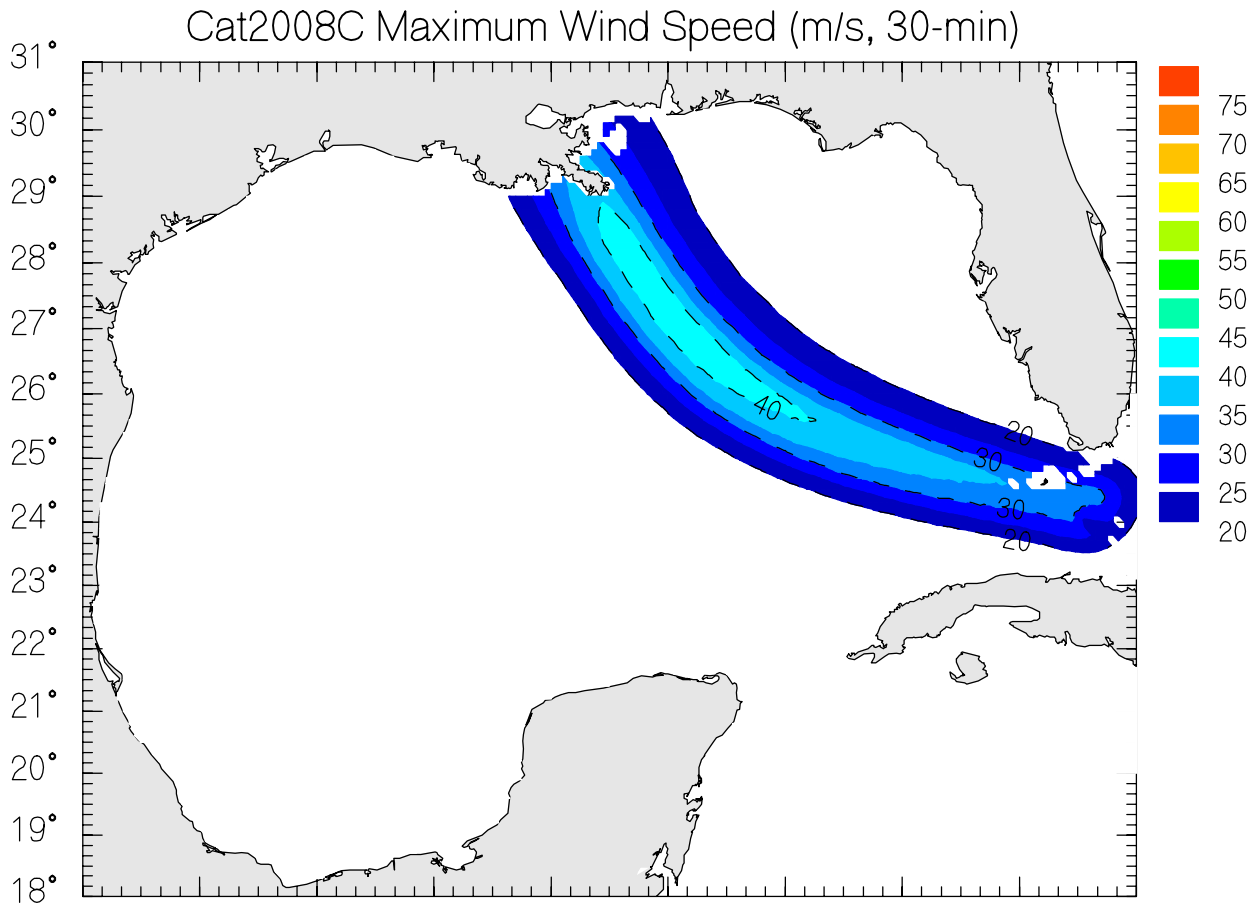
Cat2008C Maximum Wind Speed (m/s, 30-min)
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30°
29°
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27°
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20°
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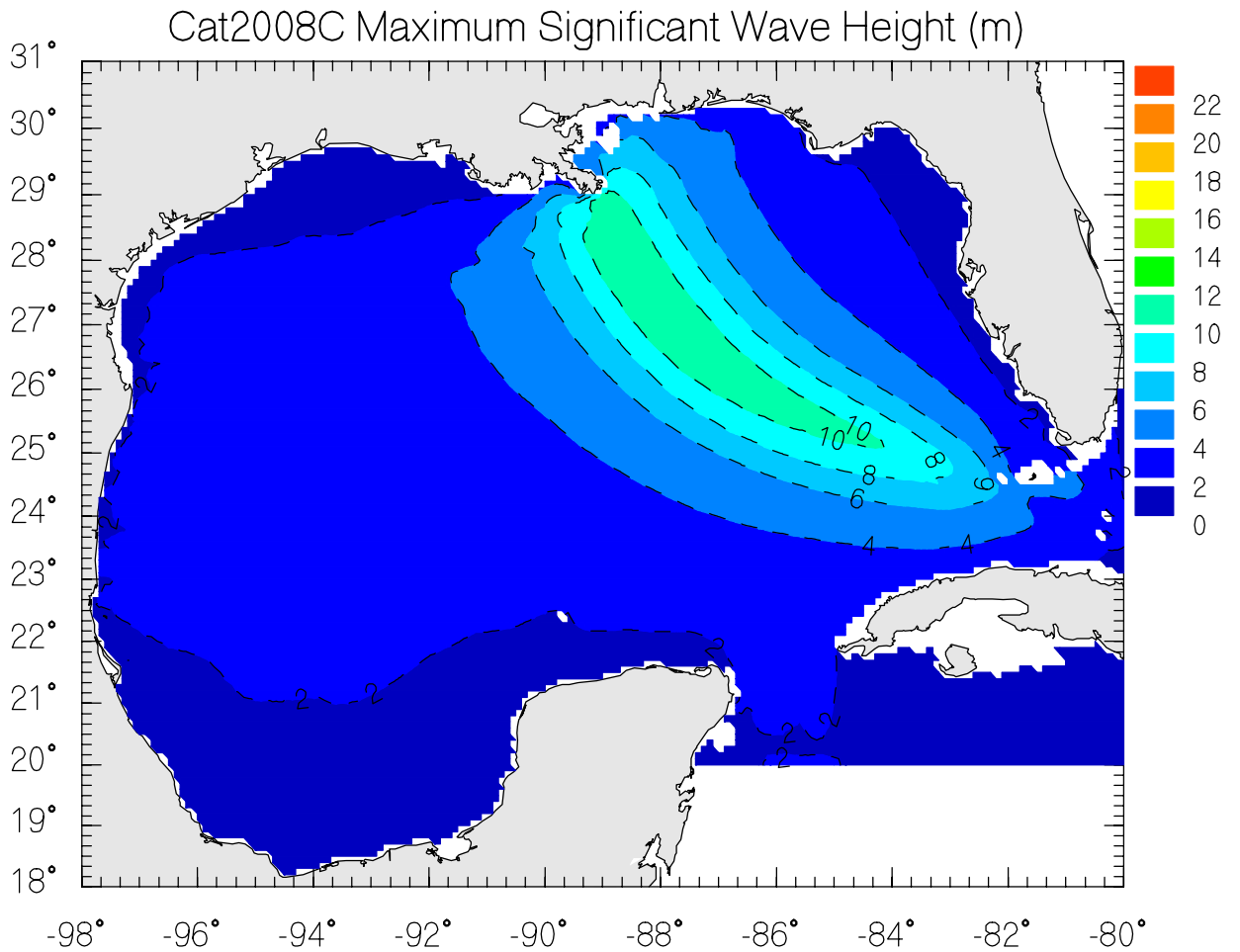
Cat2008C Maximum Significant Wave Height (m)
31°
30°
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23°
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21°
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19°
18°
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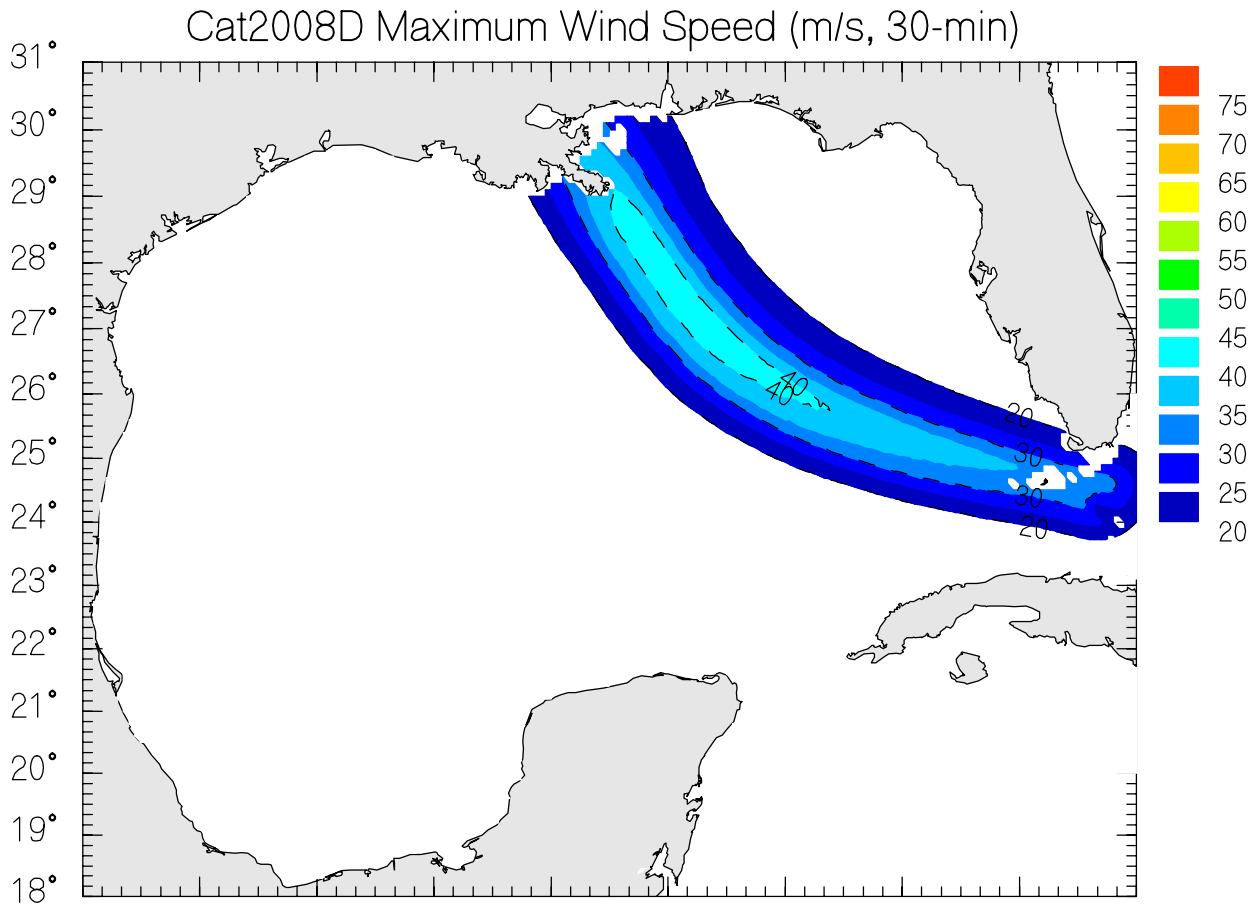
Cat2008D Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
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20°
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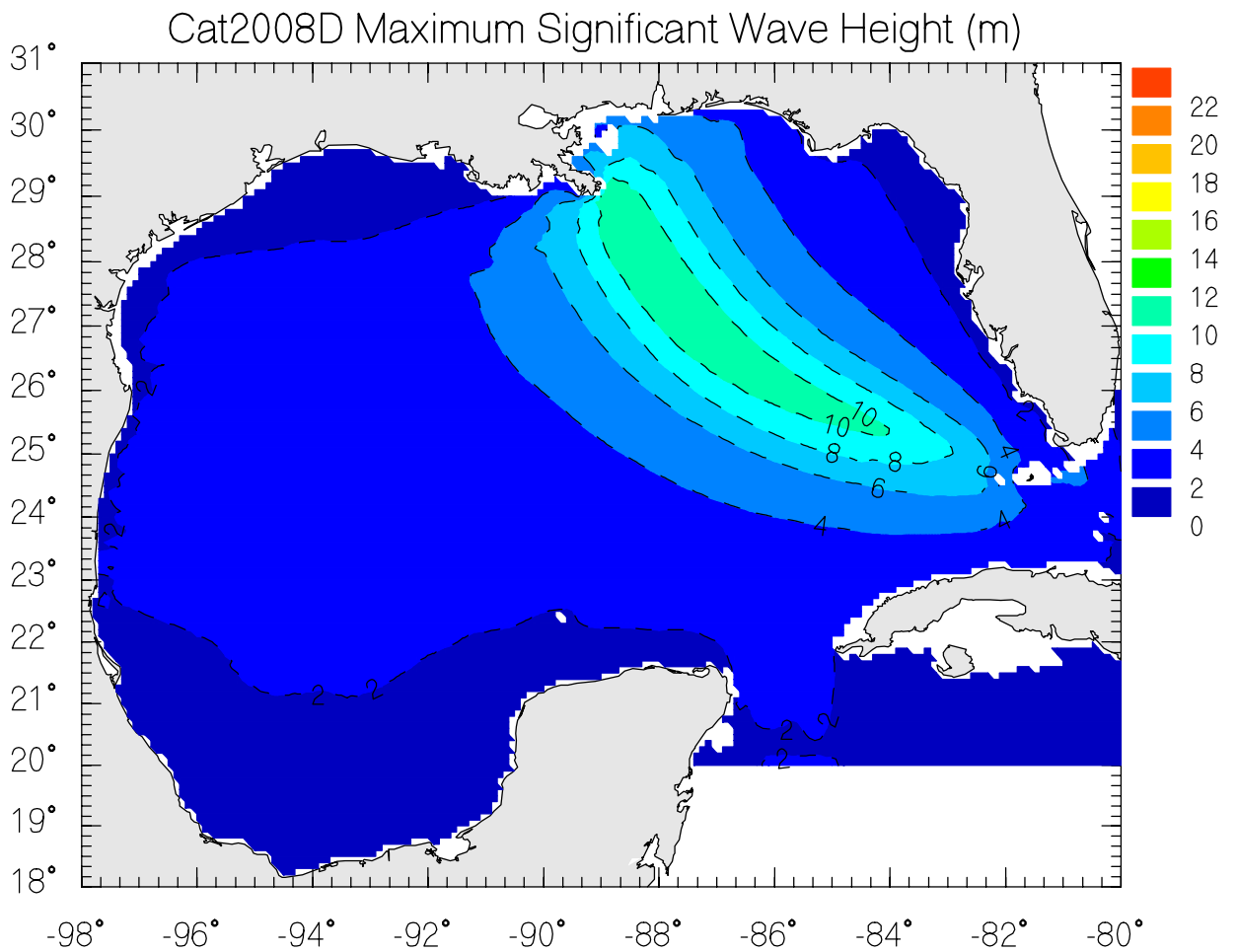
Cat2008D Maximum Significant Wave Height (m)
31°
30°
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21°
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18°
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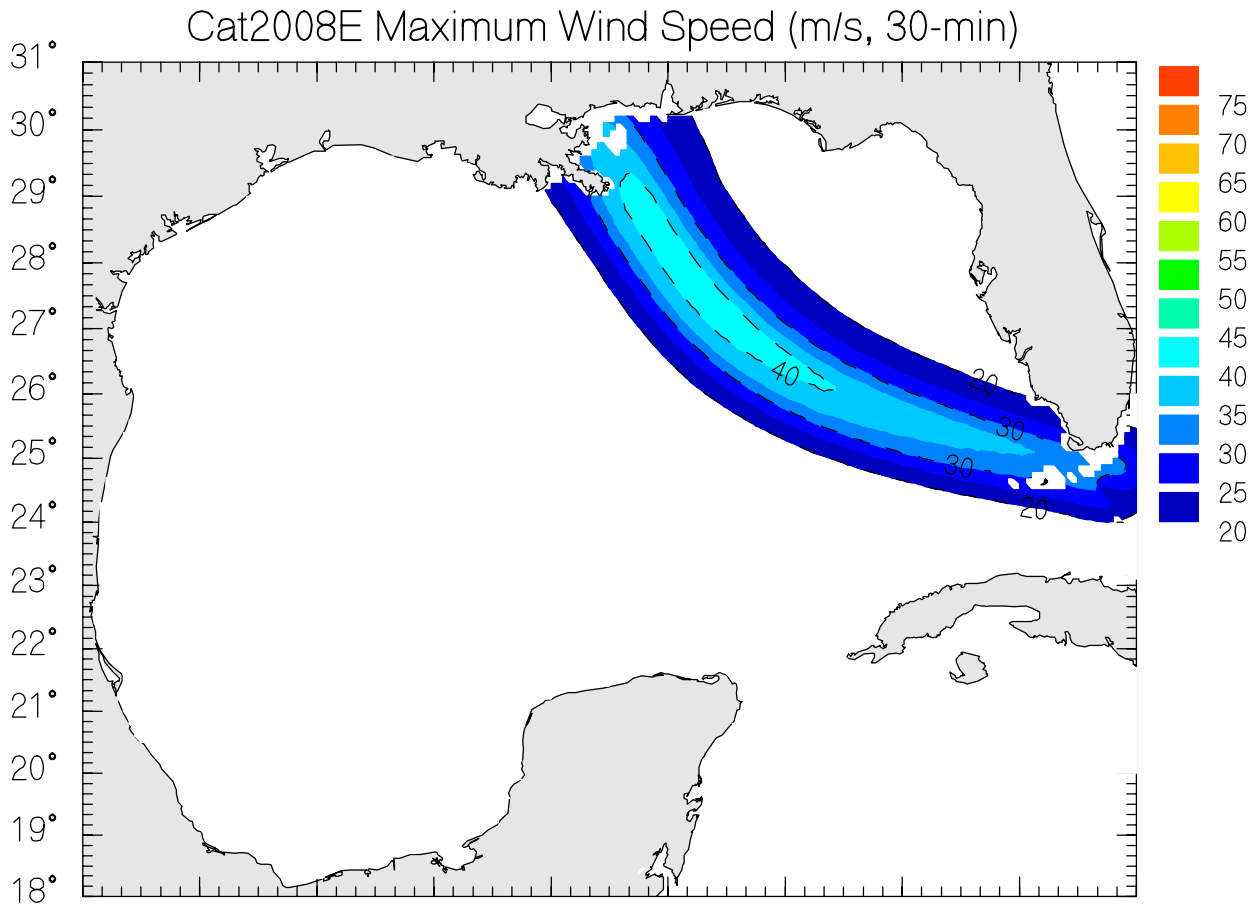
Cat2008E Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
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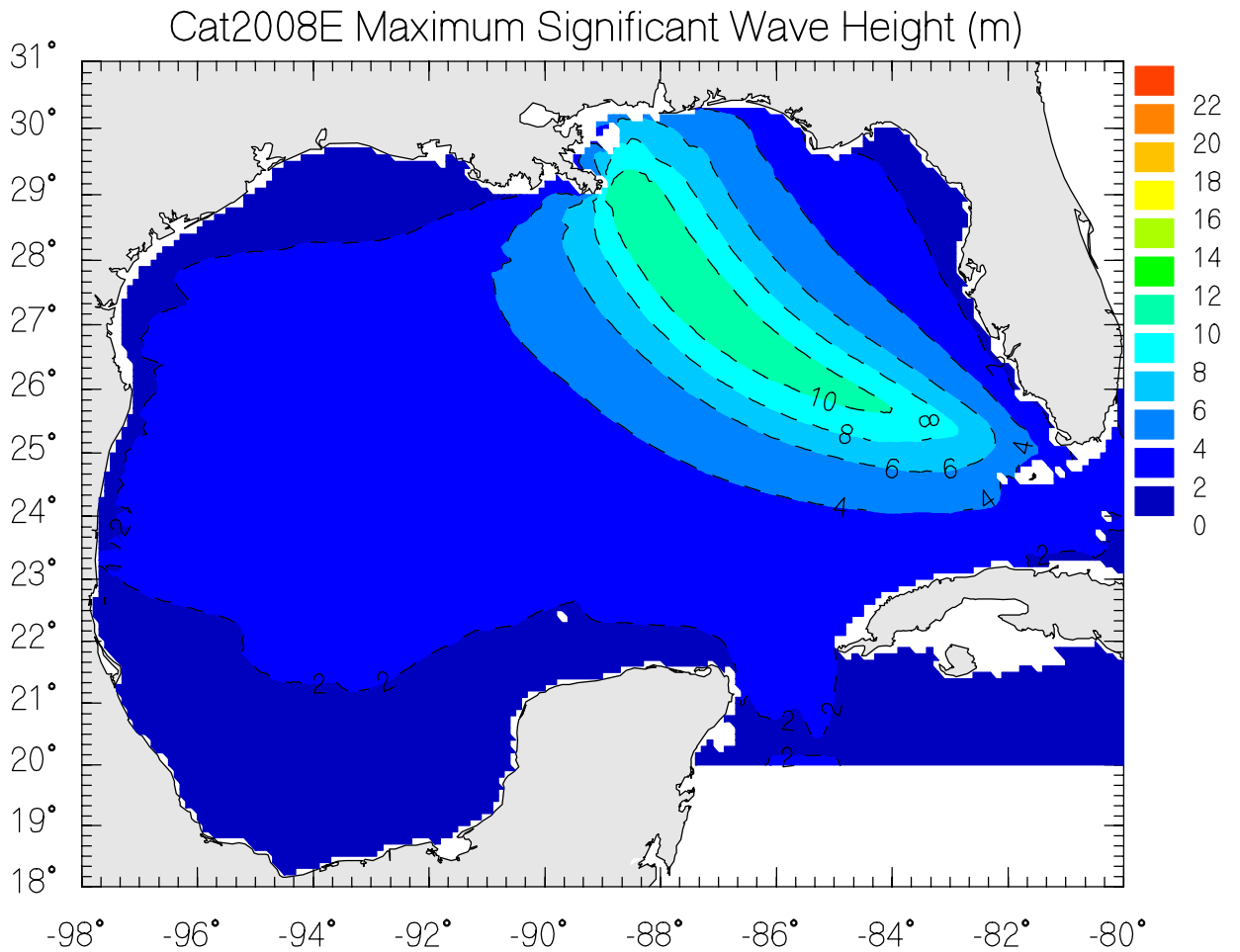
Cat2008E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
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-88°
-86°
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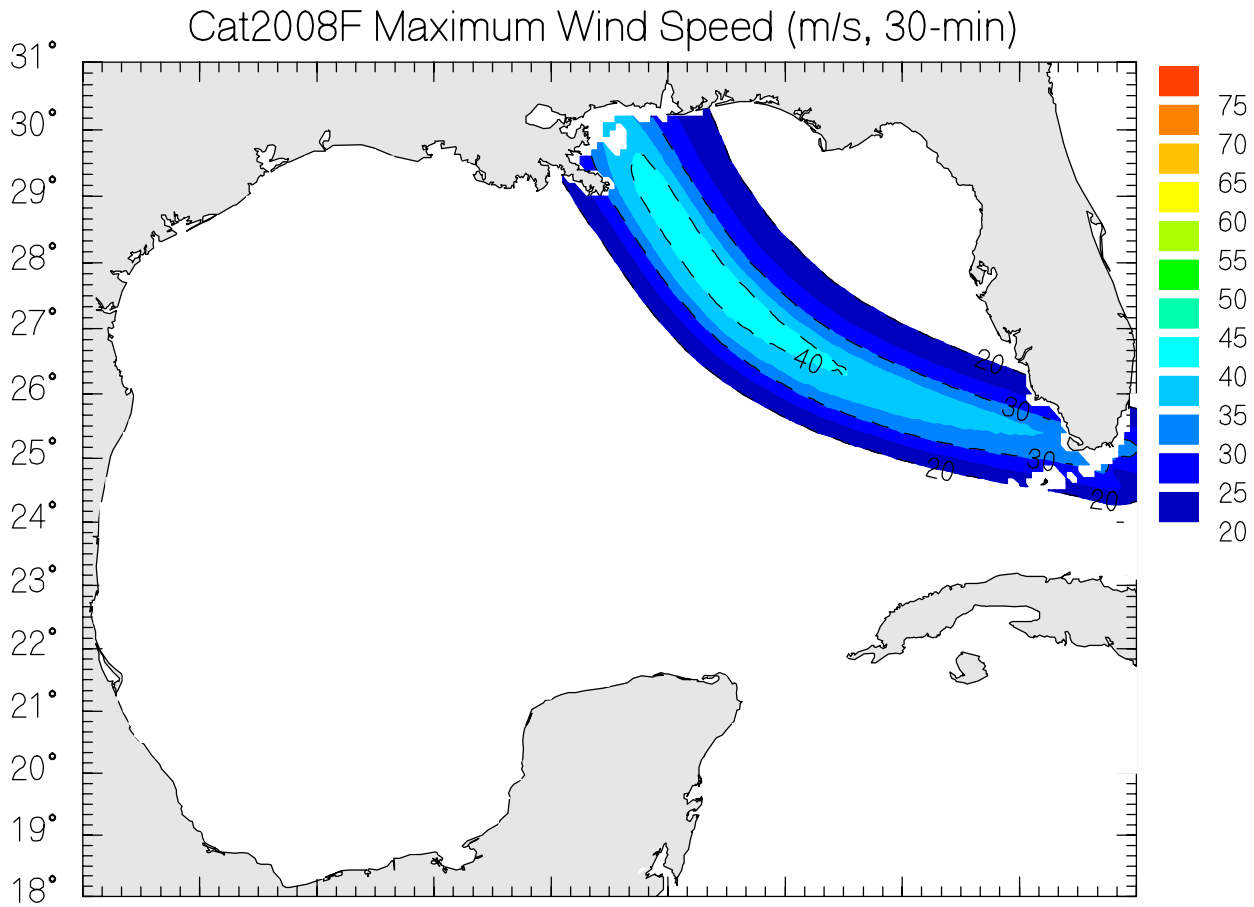
Cat2008F Maximum Wind Speed (m/s, 30-min)
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29°
28°
27°
26°
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23°
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21°
20°
19°
18°
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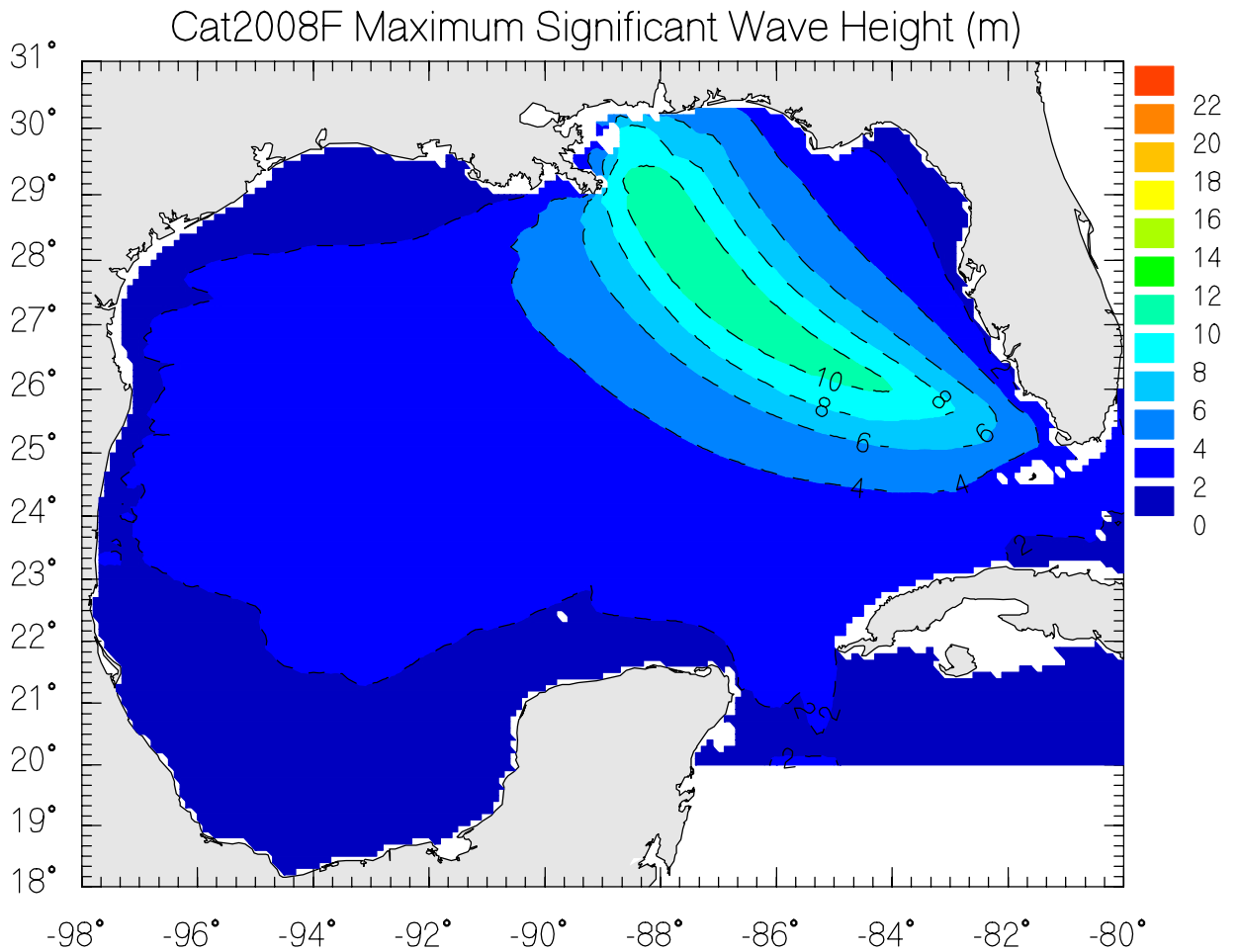
Cat2008F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
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23°
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21°
20°
19°
18°
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8
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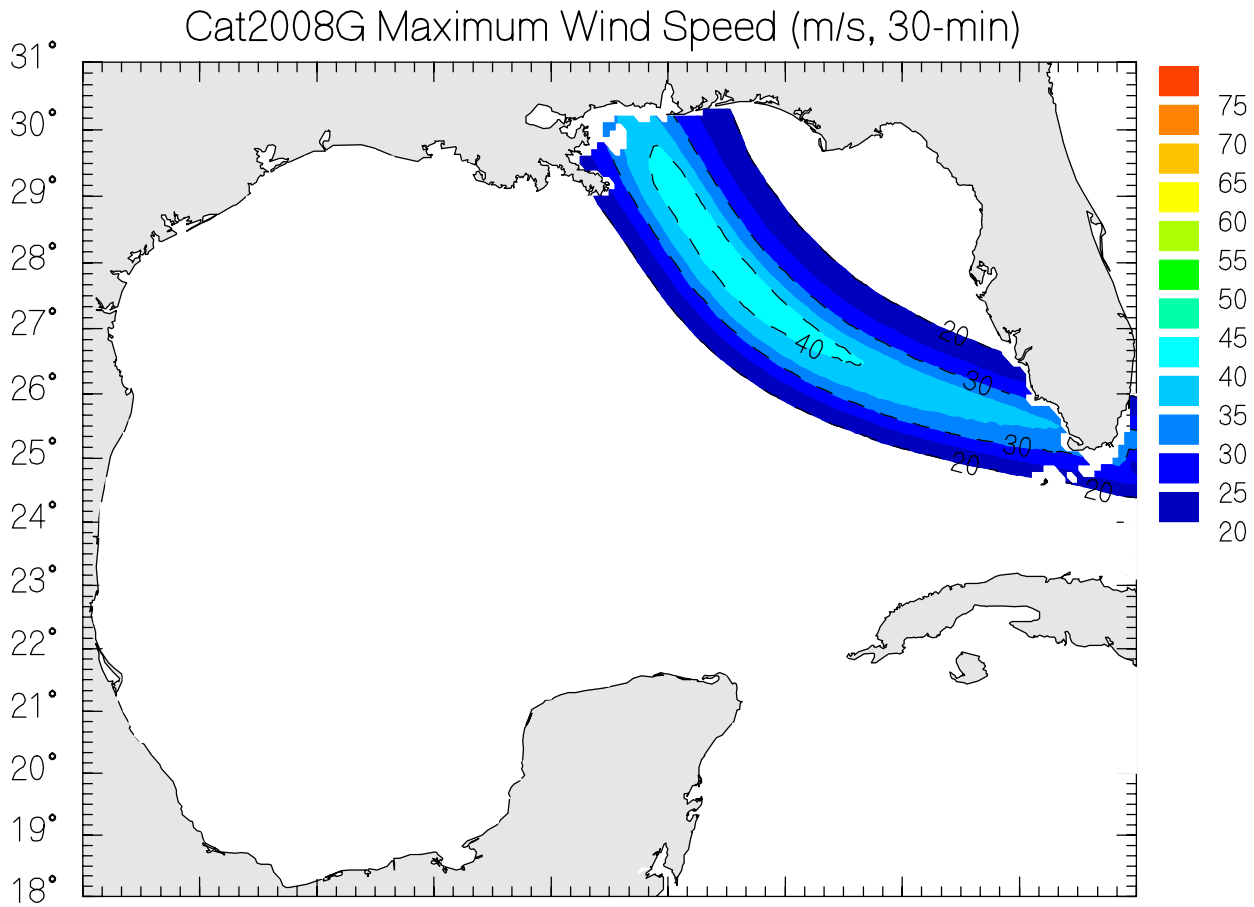
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


Cat2008G Maximum Wind Speed (m/s, 30-min)
31°
30°
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27°
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24°
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20°
19°
18°
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75
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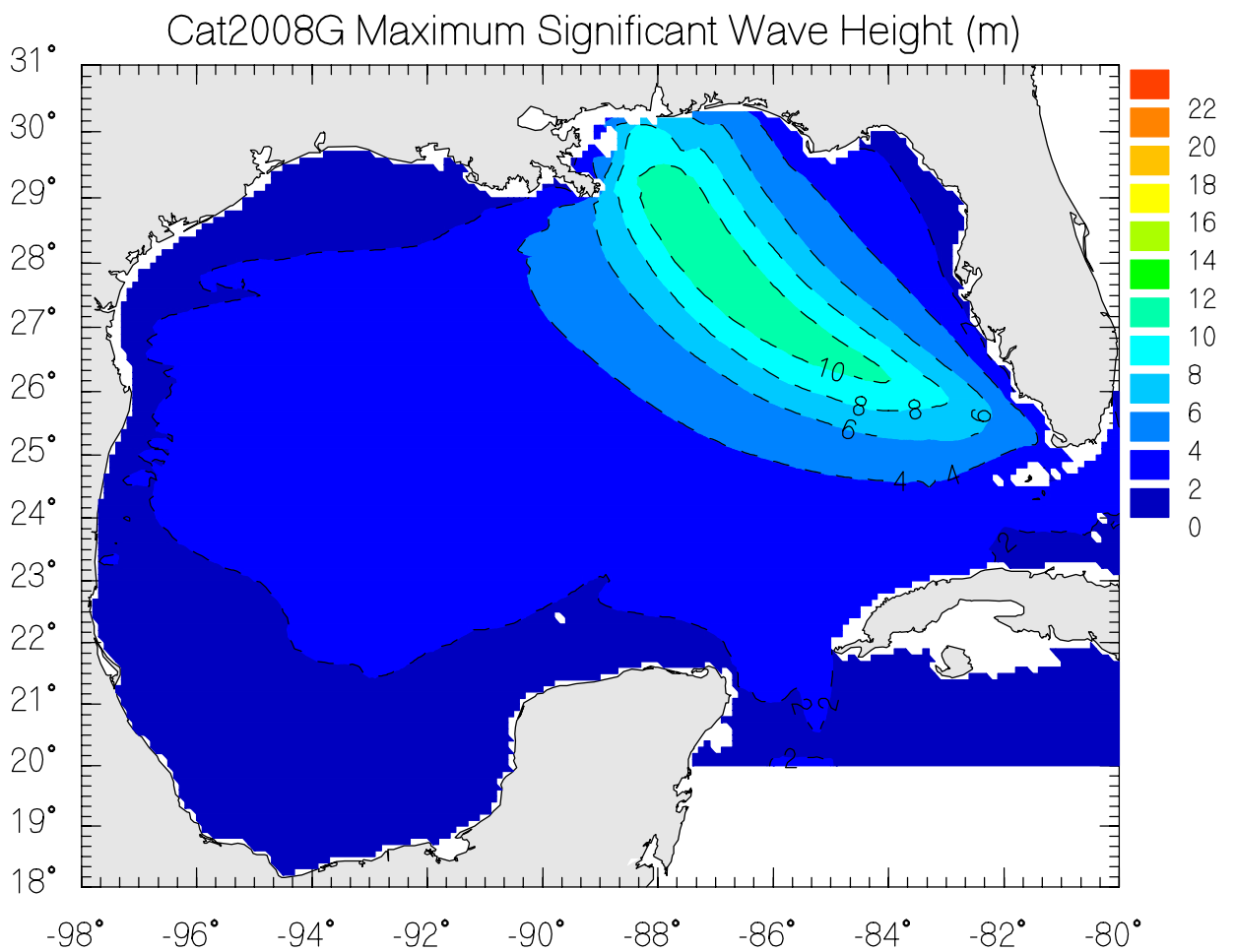
Cat2008G Maximum Significant Wave Height (m)
31°
30°
29°
28°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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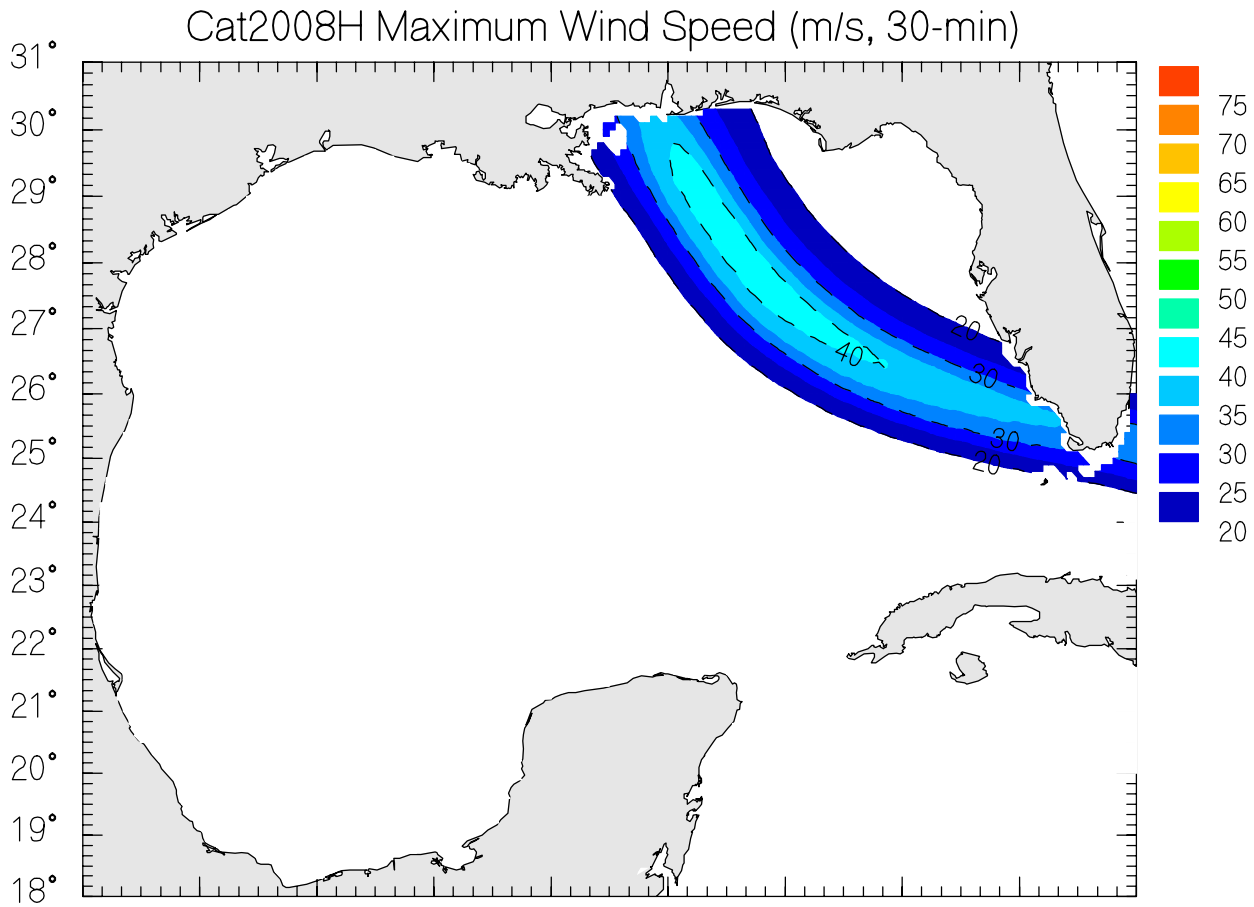
Cat2008H Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
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20
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30
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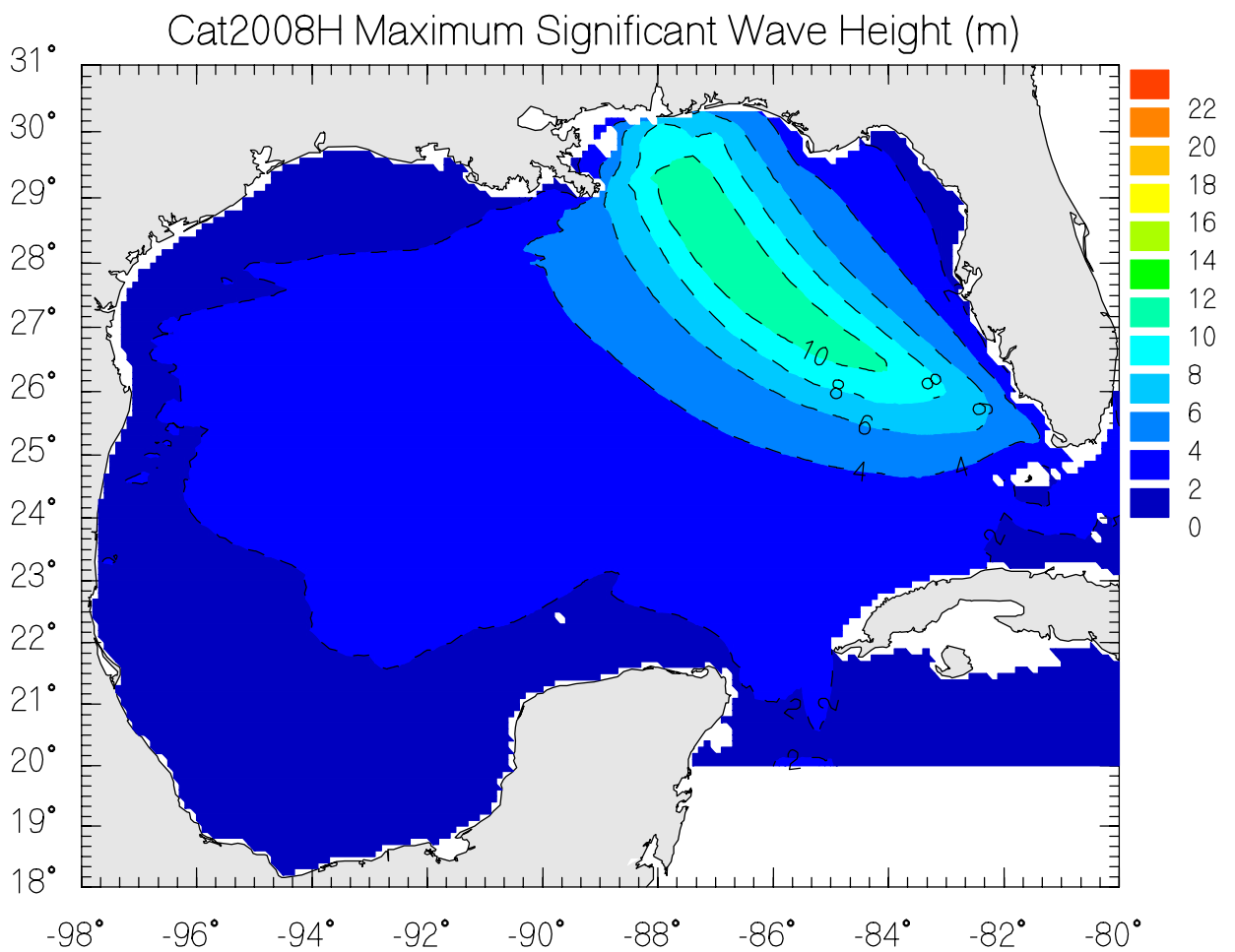
Cat2008H Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
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22°
21°
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18°
-98°
-96°
-94°
-92°
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-88°
-86°
-84°
-82°
-80°
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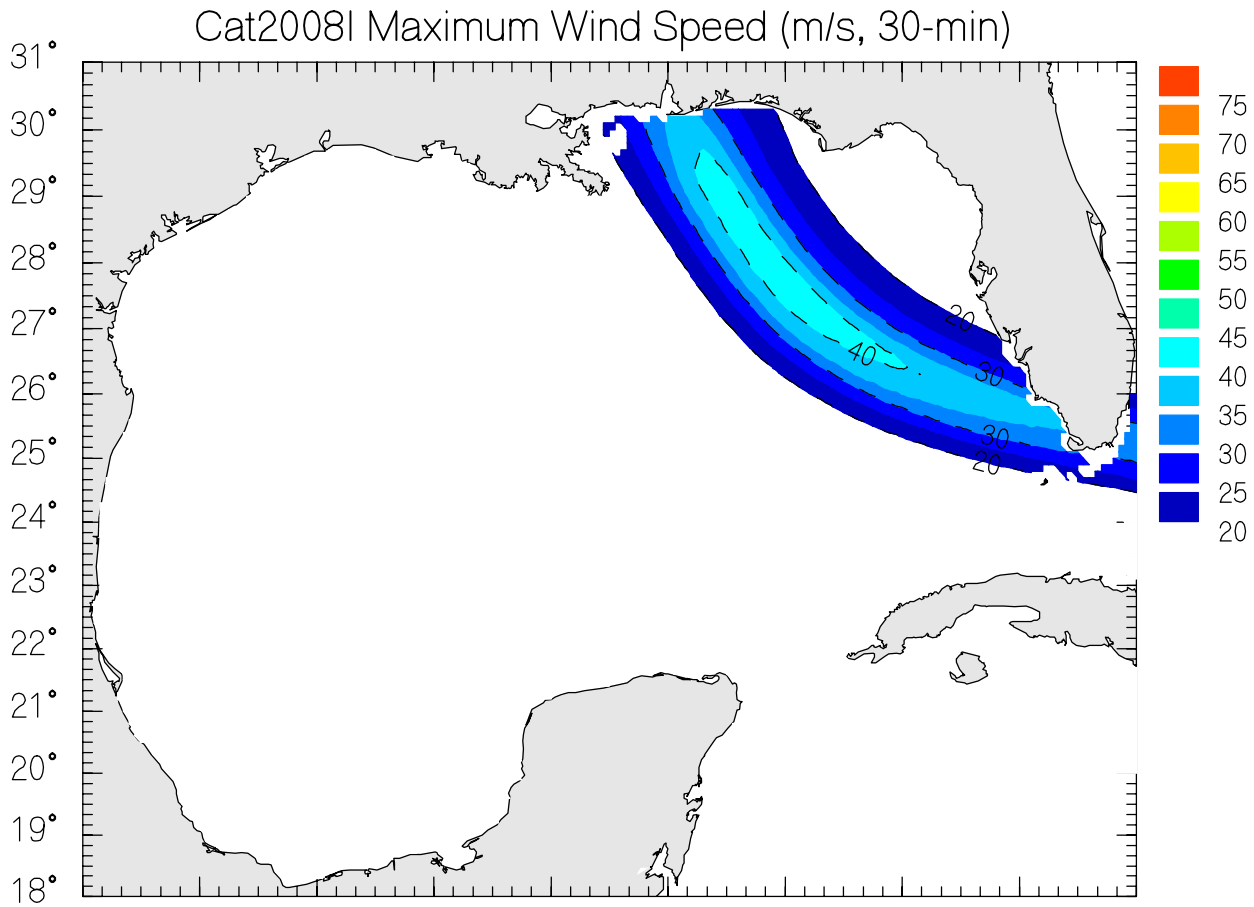
Cat2008I Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
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24°
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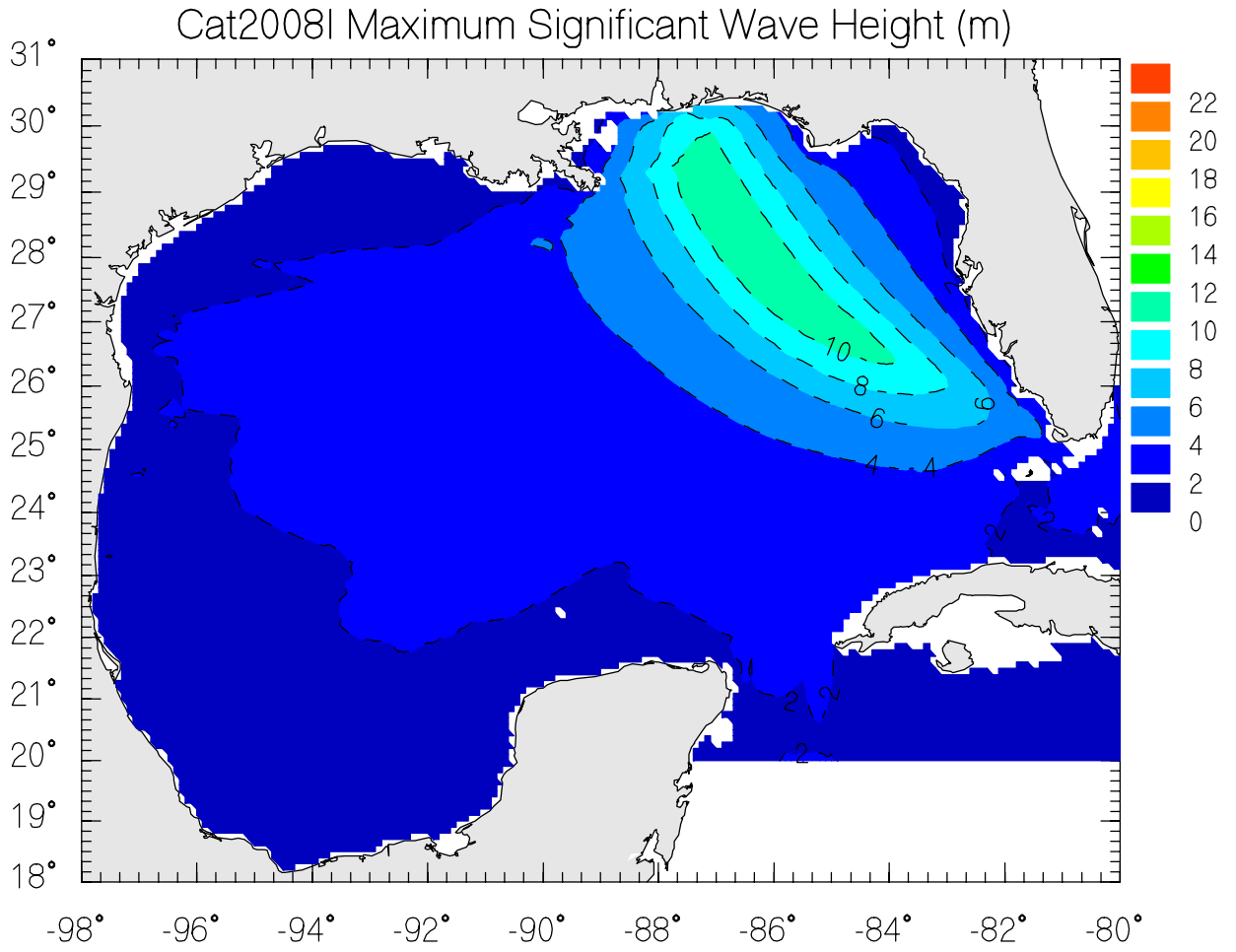
Cat2008I Maximum Significant Wave Height (m)
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30°
29°
28°
27°
26°
25°
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21°
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18°
22
20
18
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-98°
-96°
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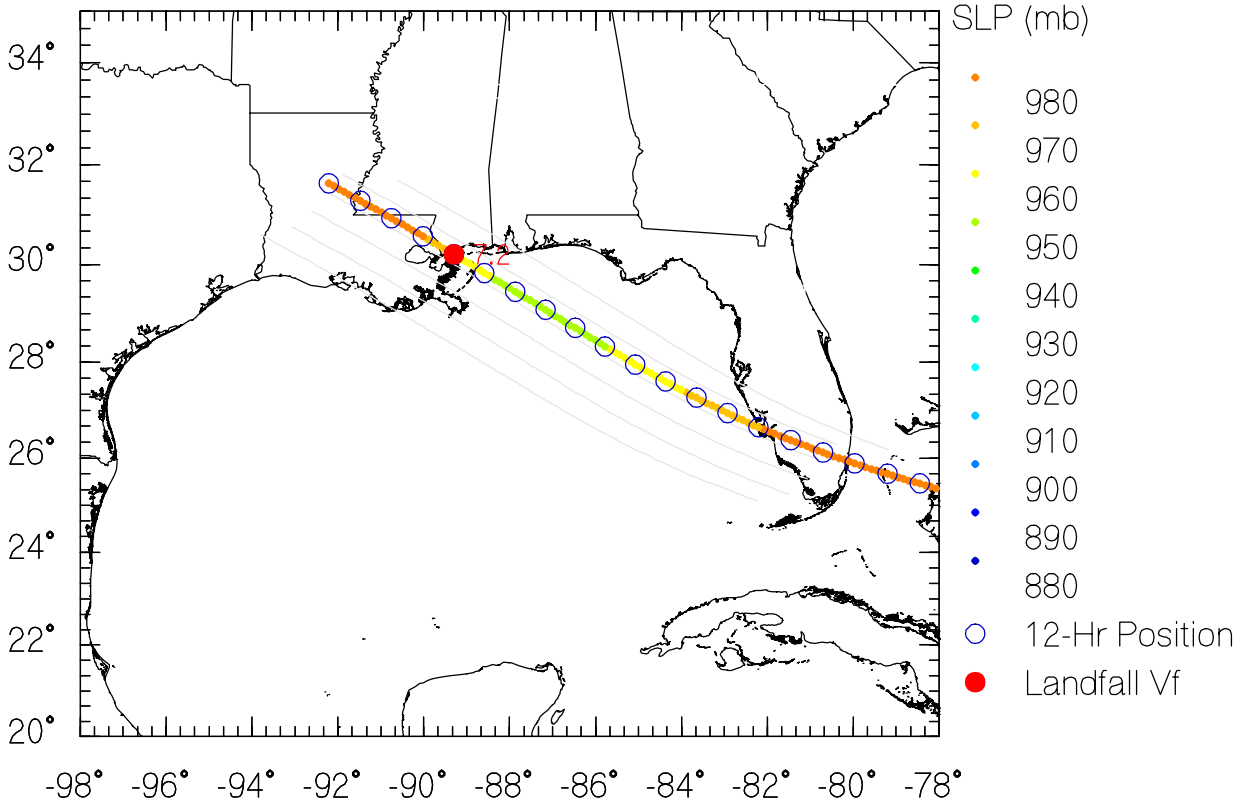
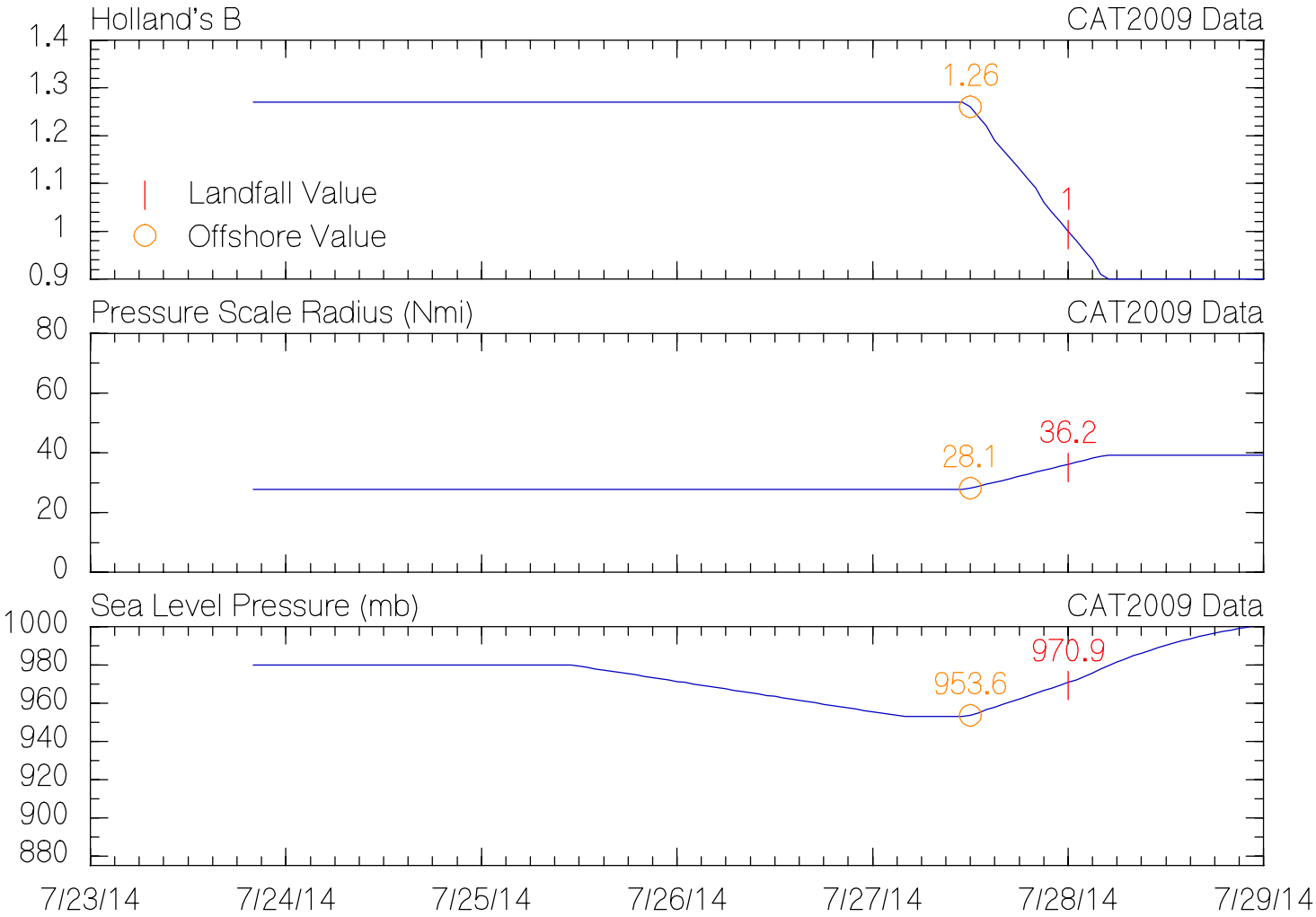
-86°
-84°
-82°
-80°

CAT2009 Data

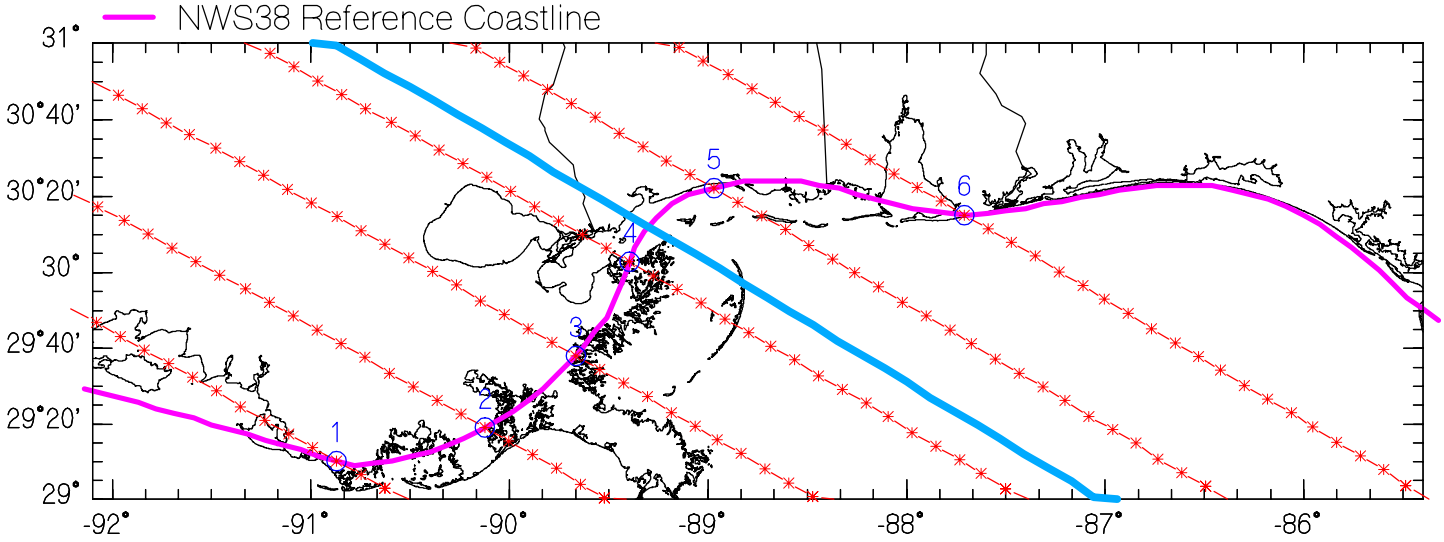


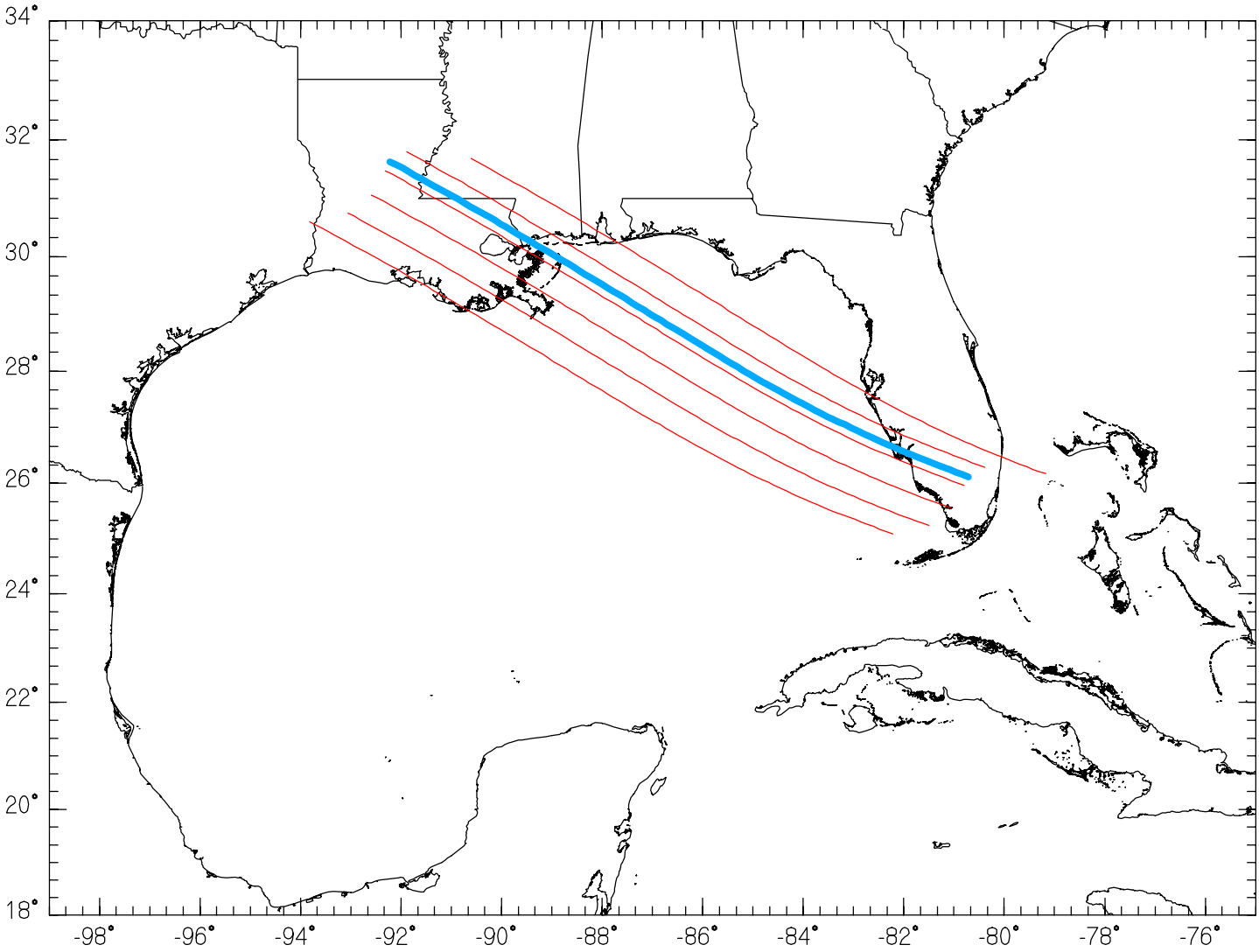


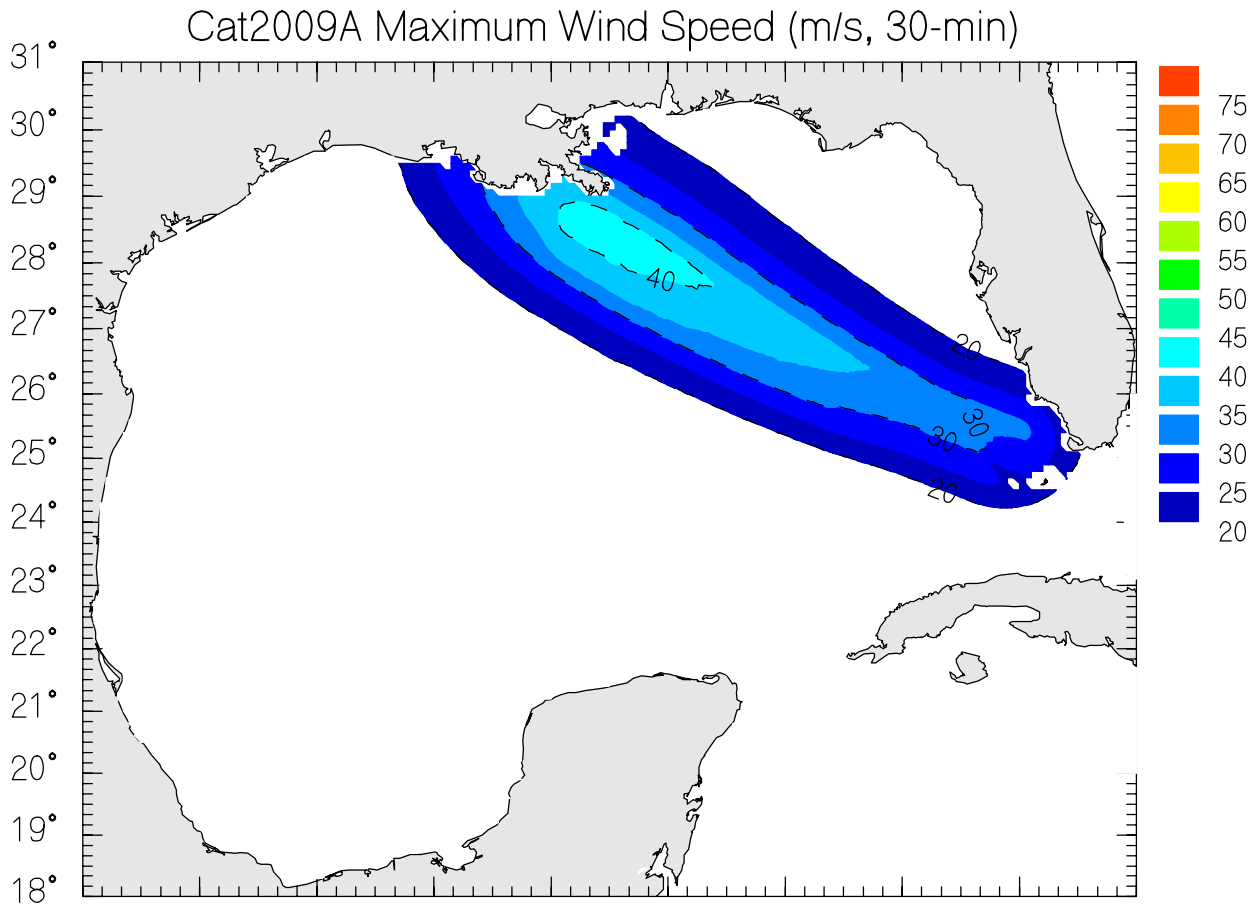
URS JPM-OS6 Production Tracks

CAT2009 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






Cat2009A Maximum Wind Speed (m/s, 30-min)
31°
30°
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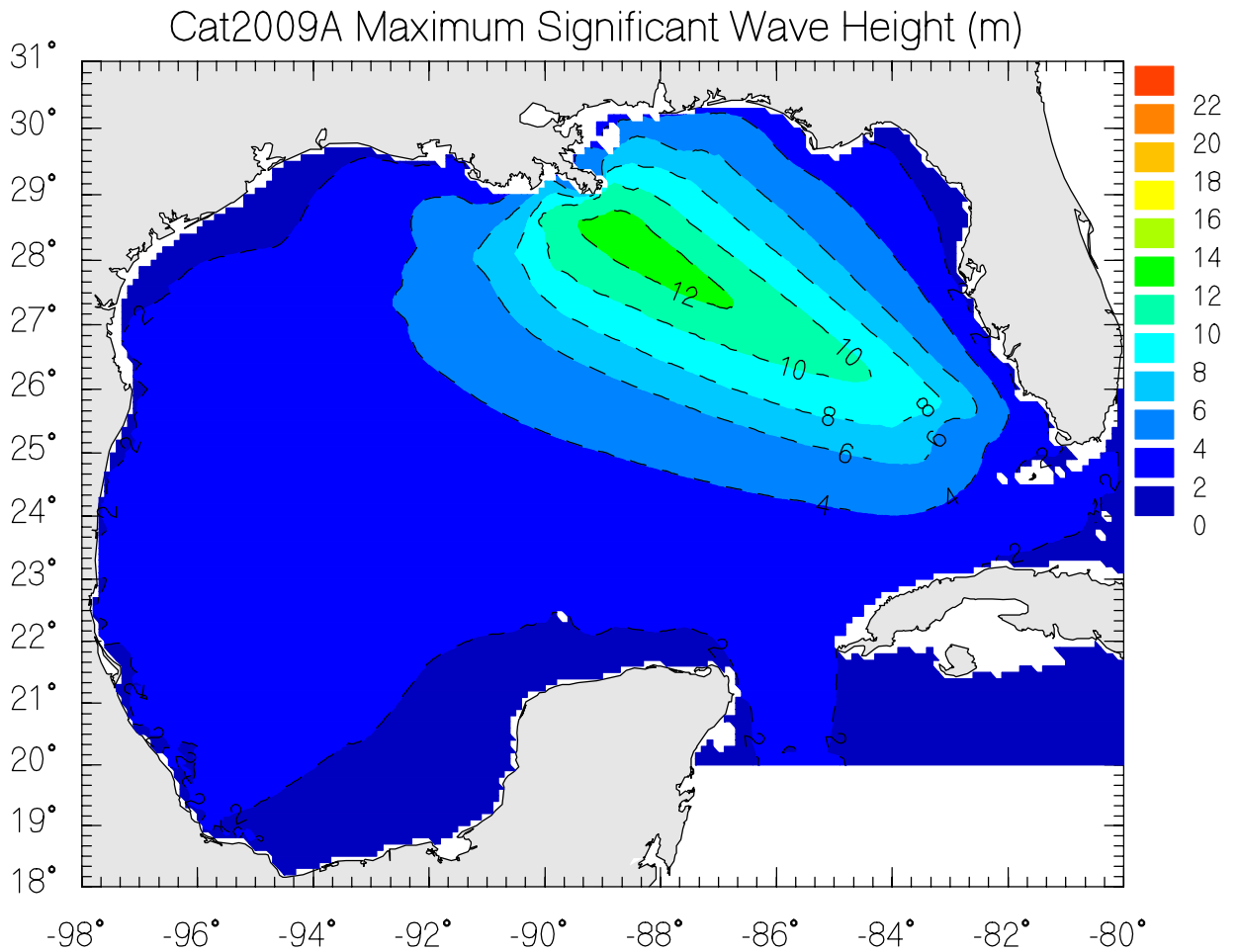
Cat2009A Maximum Significant Wave Height (m)
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30°
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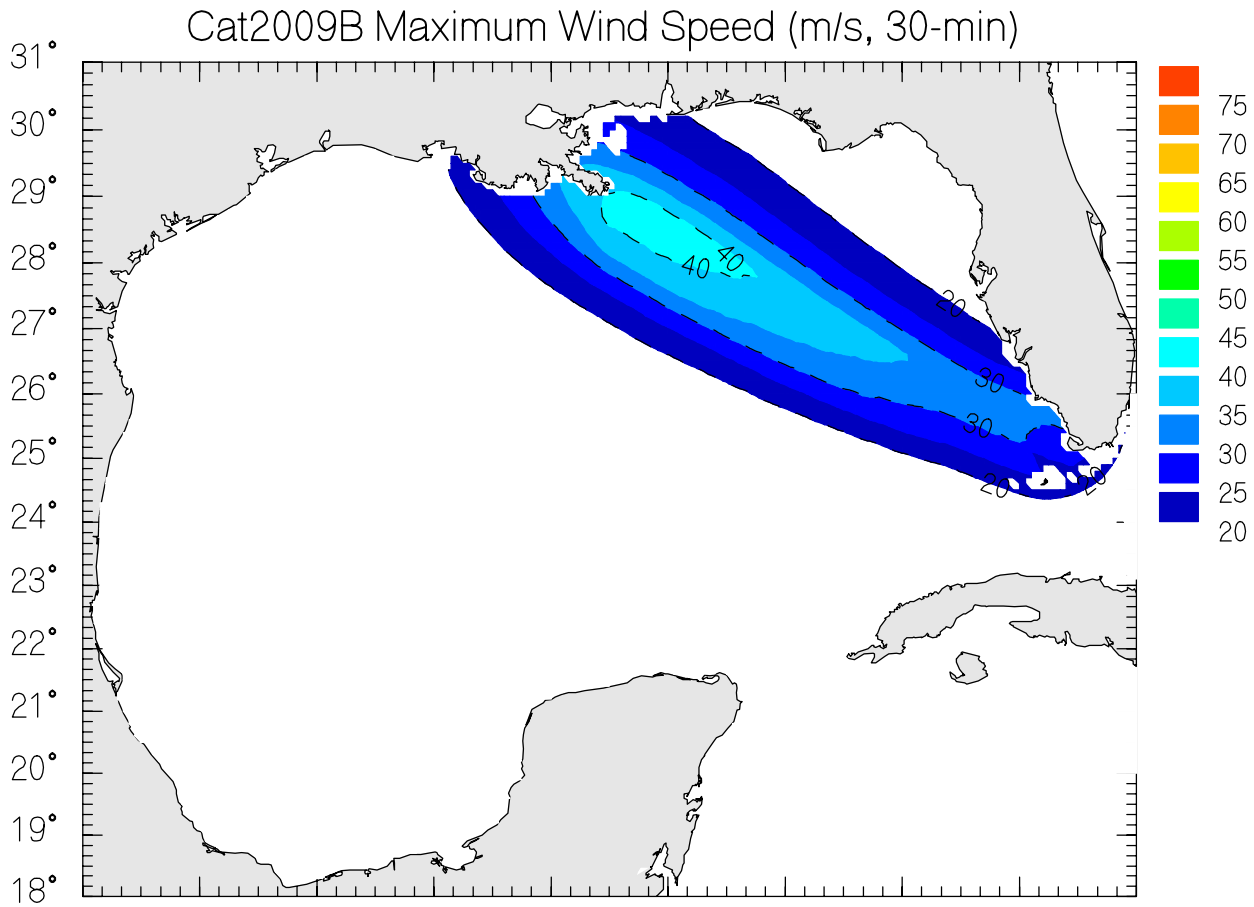
Cat2009B Maximum Wind Speed (m/s, 30-min)
31°
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21°
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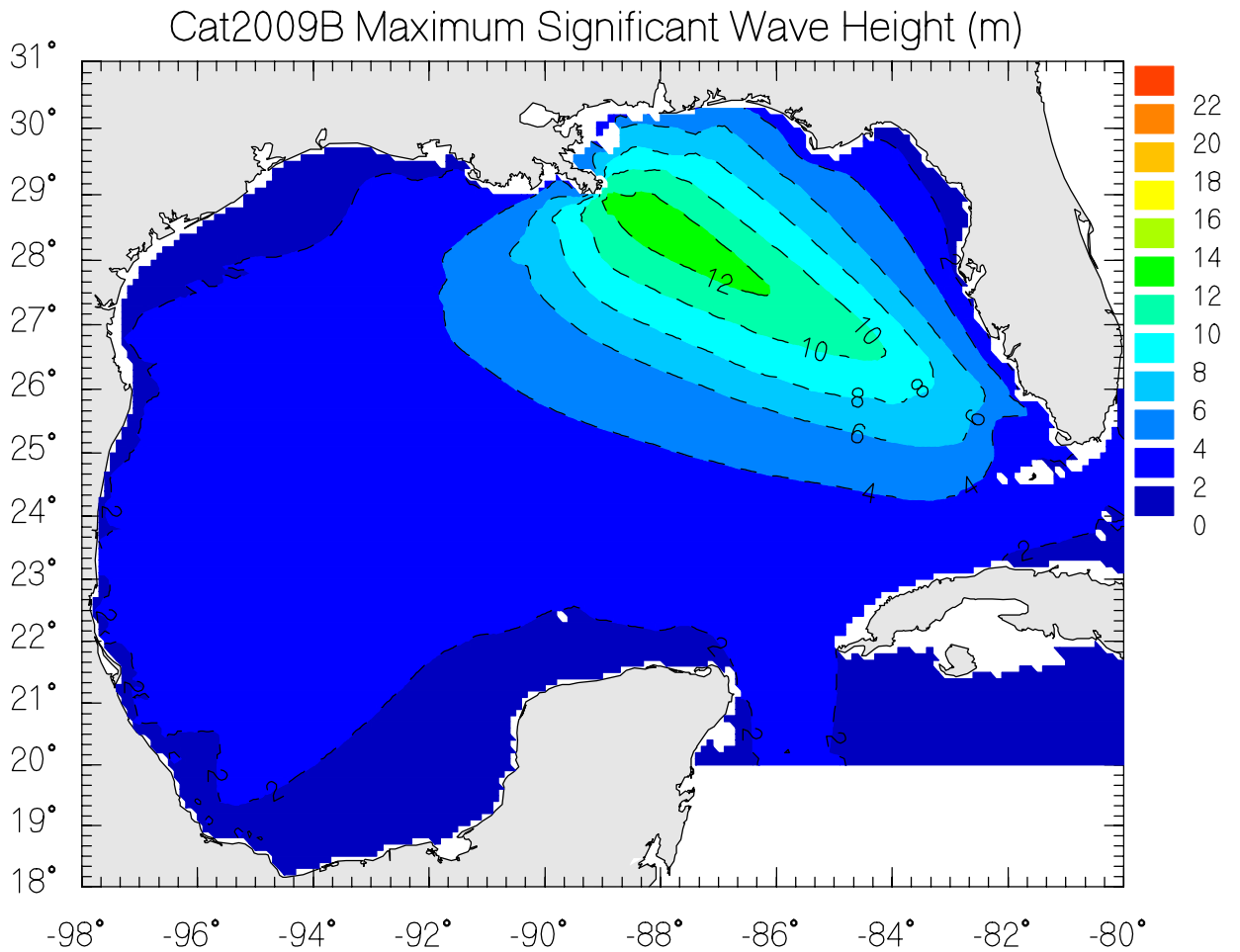
Cat2009B Maximum Significant Wave Height (m)
31°
30°
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19°
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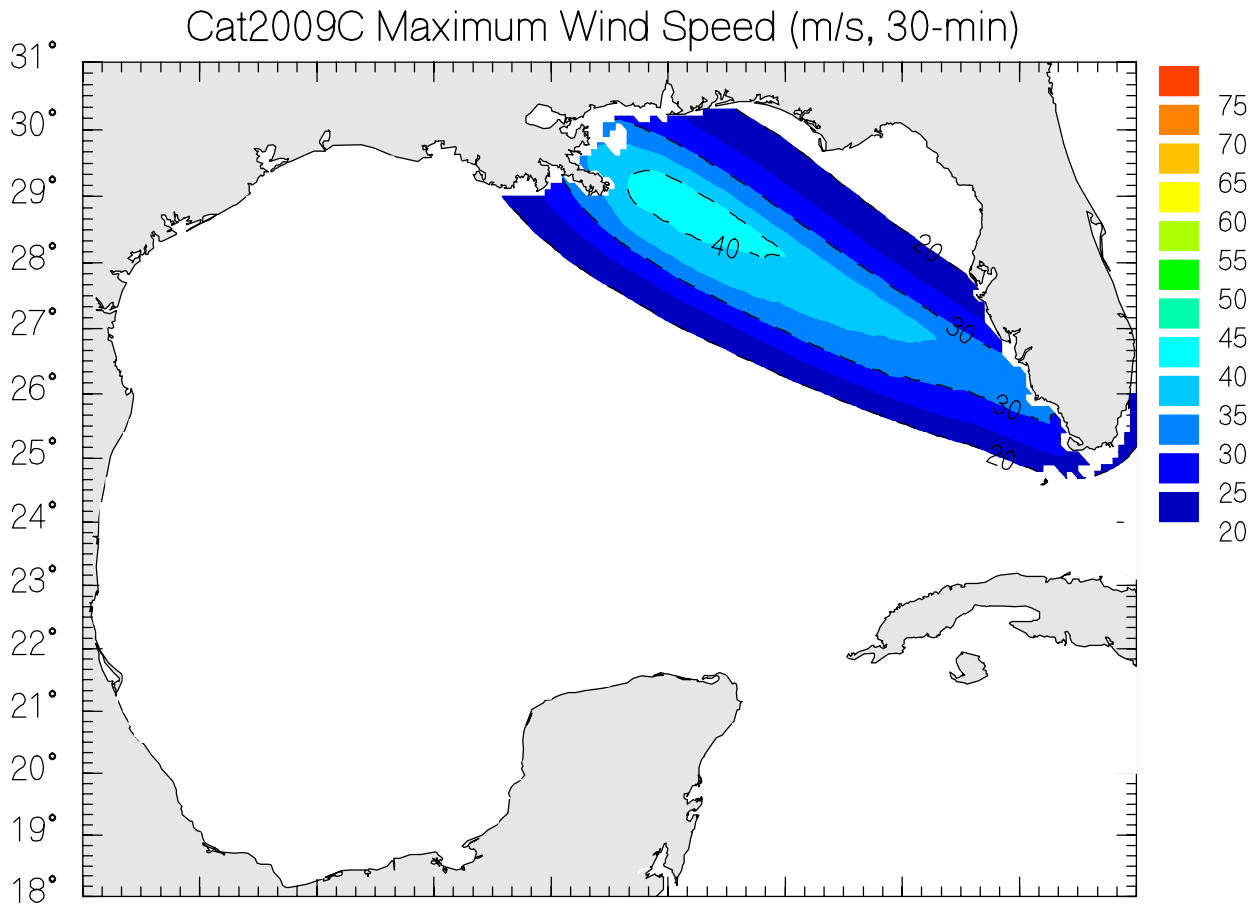
Cat2009C Maximum Wind Speed (m/s, 30-min)
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30°
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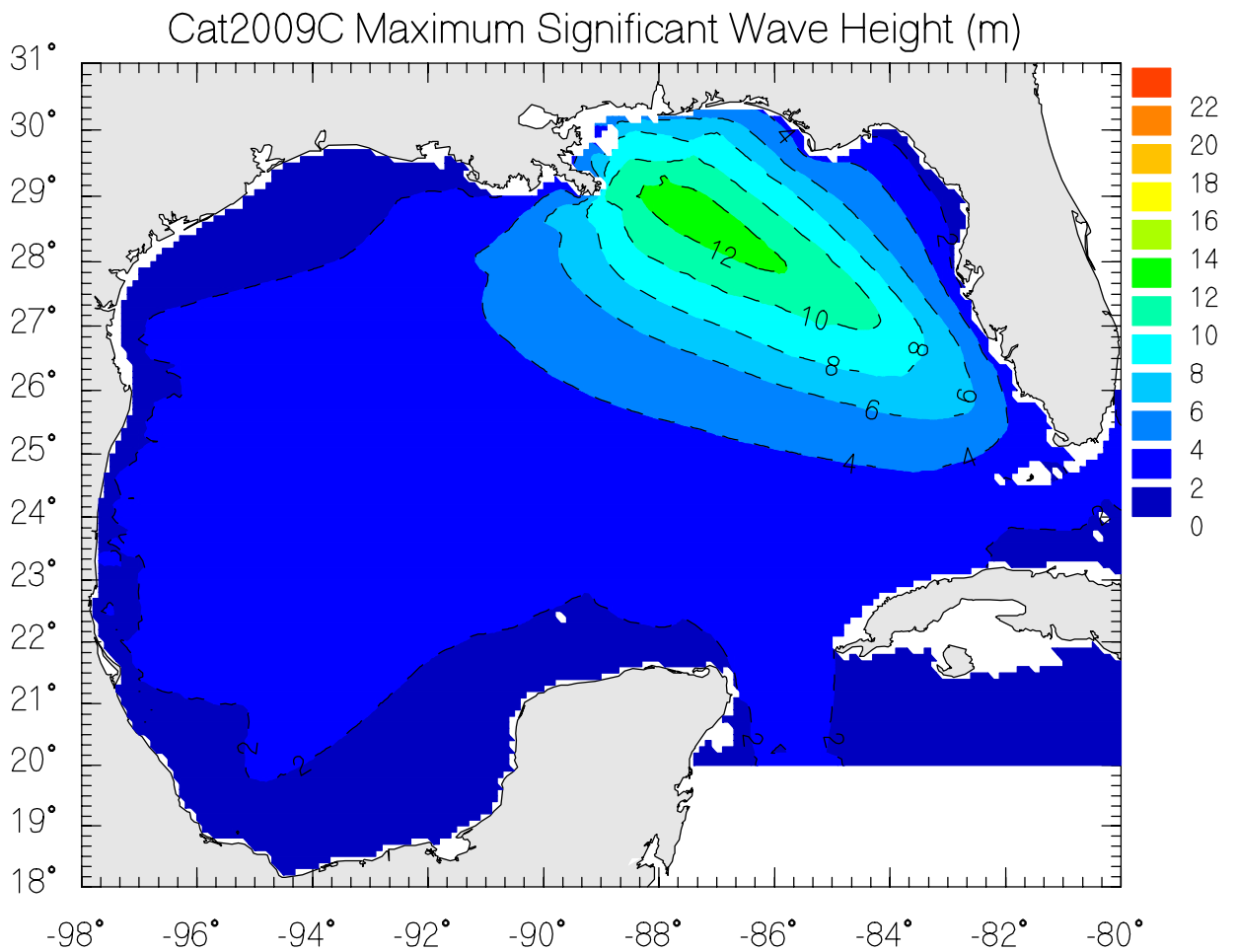
Cat2009C Maximum Significant Wave Height (m)
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18°
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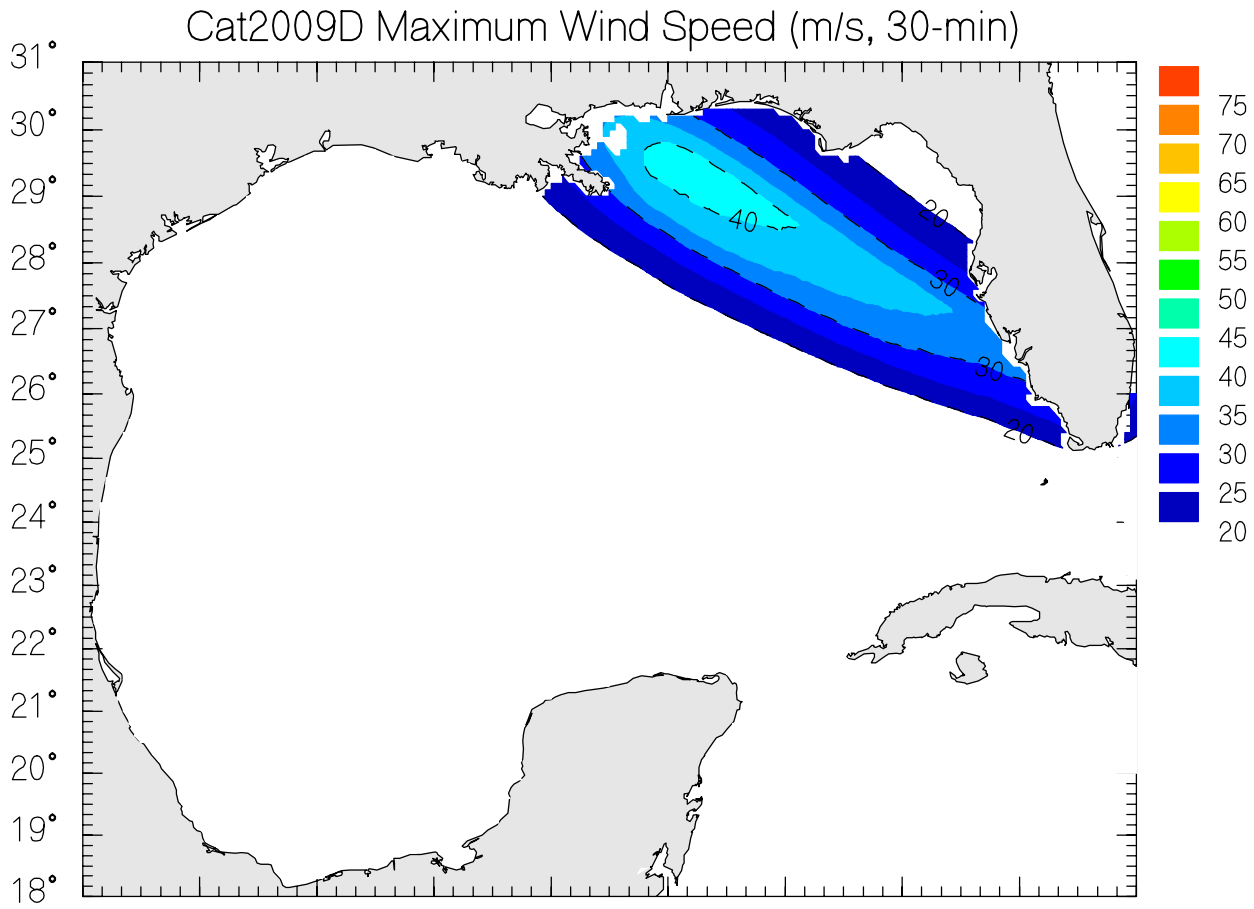
Cat2009D Maximum Wind Speed (m/s, 30-min)
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30°
29°
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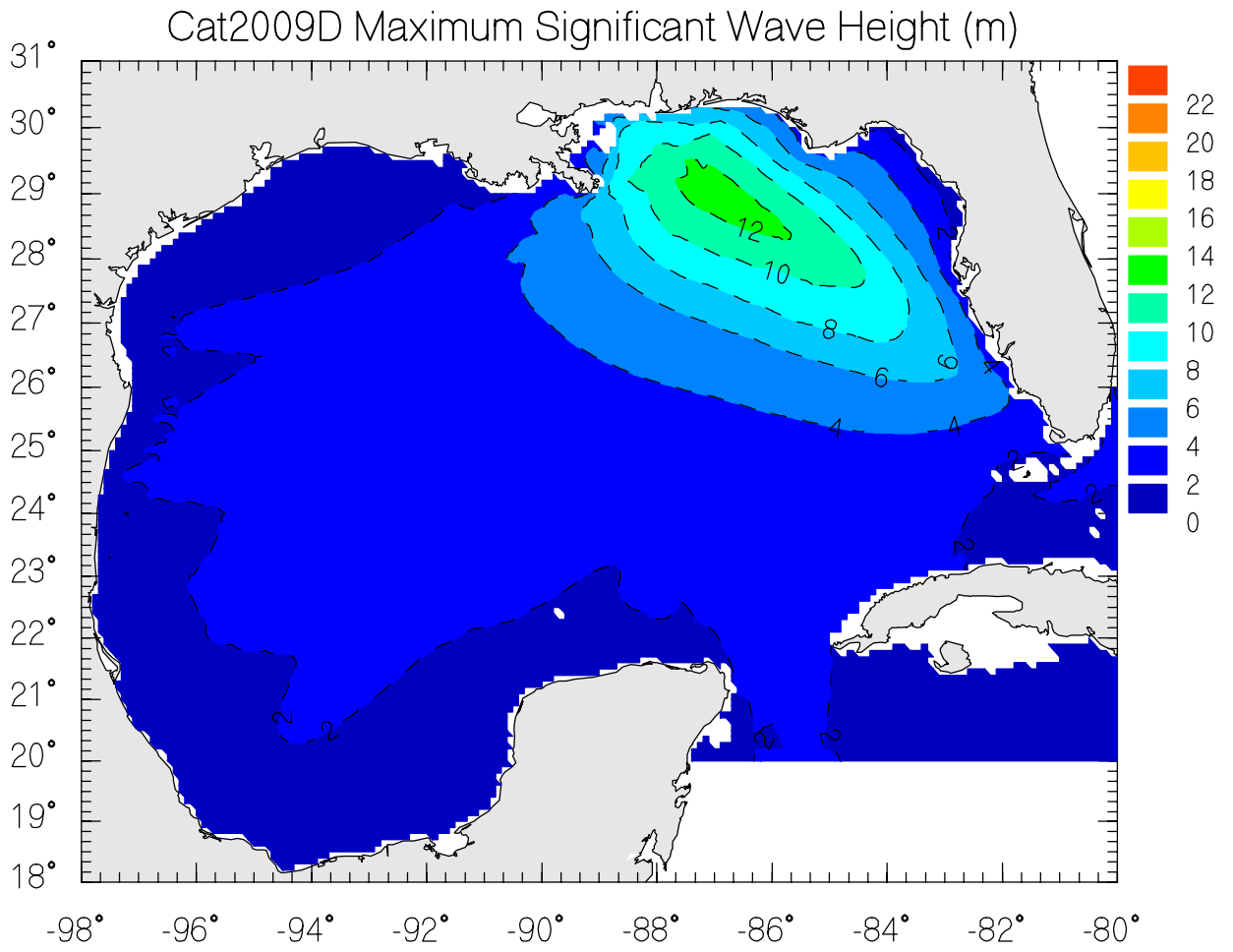
Cat2009D Maximum Significant Wave Height (m)
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27°
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-96°
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-92°
-90°
-88°
-86°
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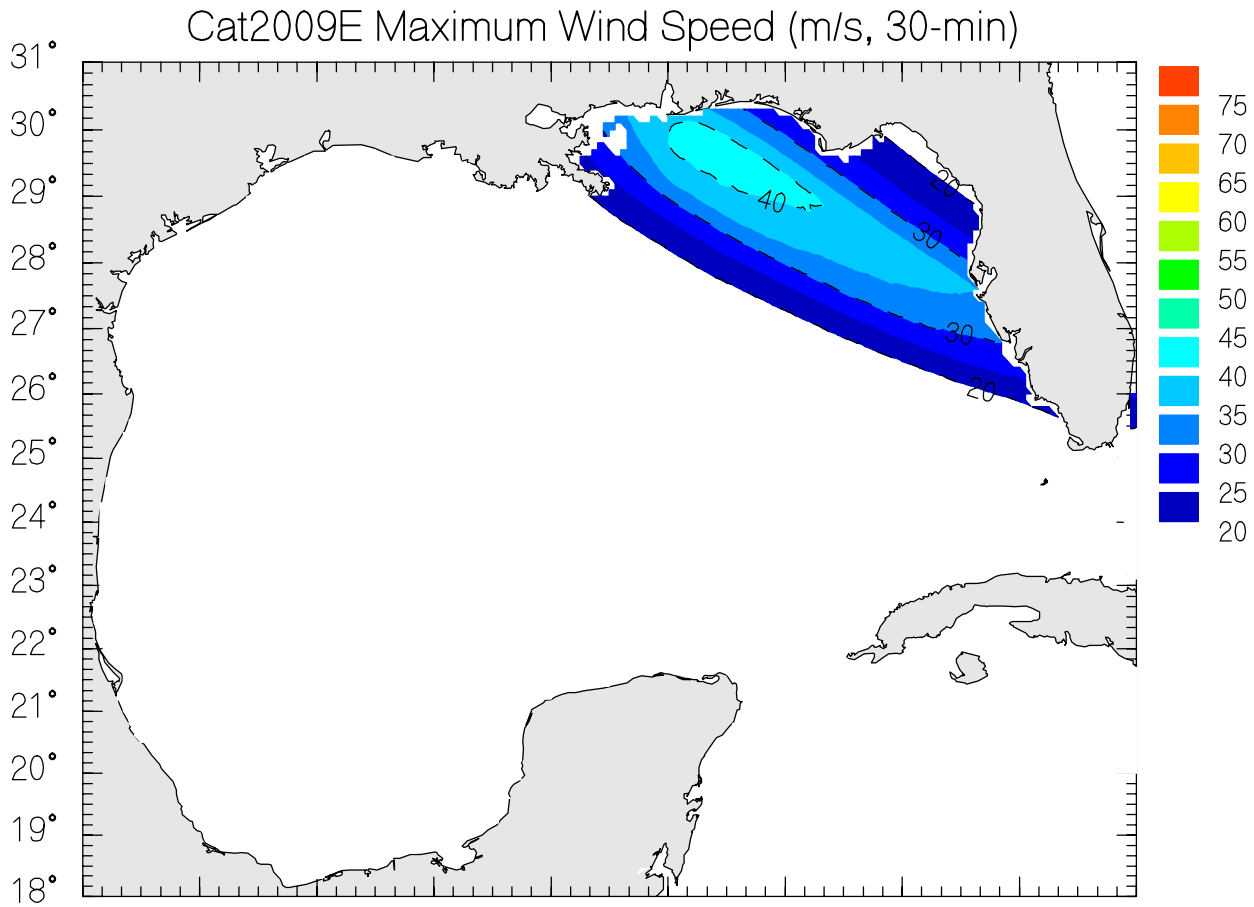
Cat2009E Maximum Wind Speed (m/s, 30-min)
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30°
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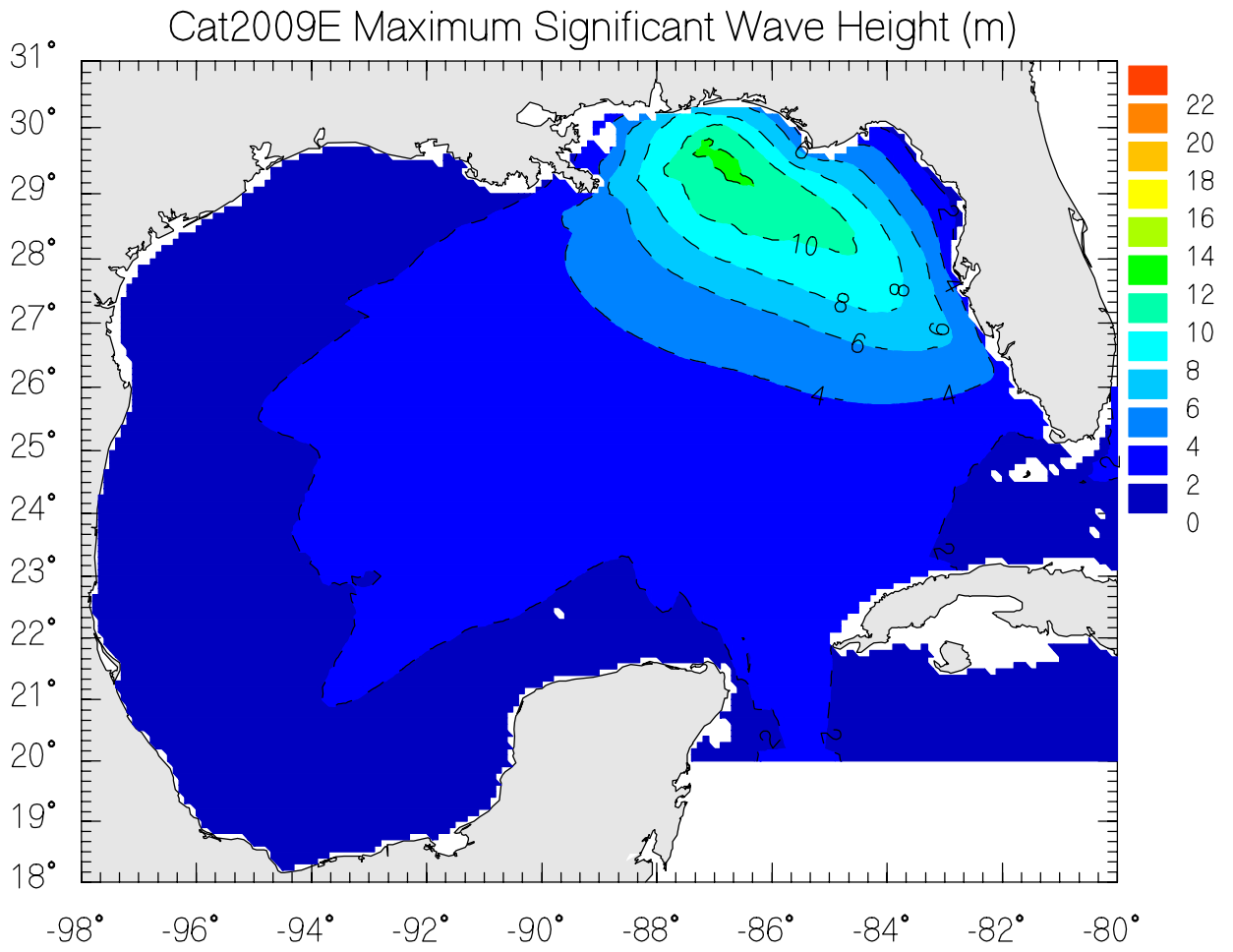
Cat2009E Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
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23°
22°
21°
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-94°
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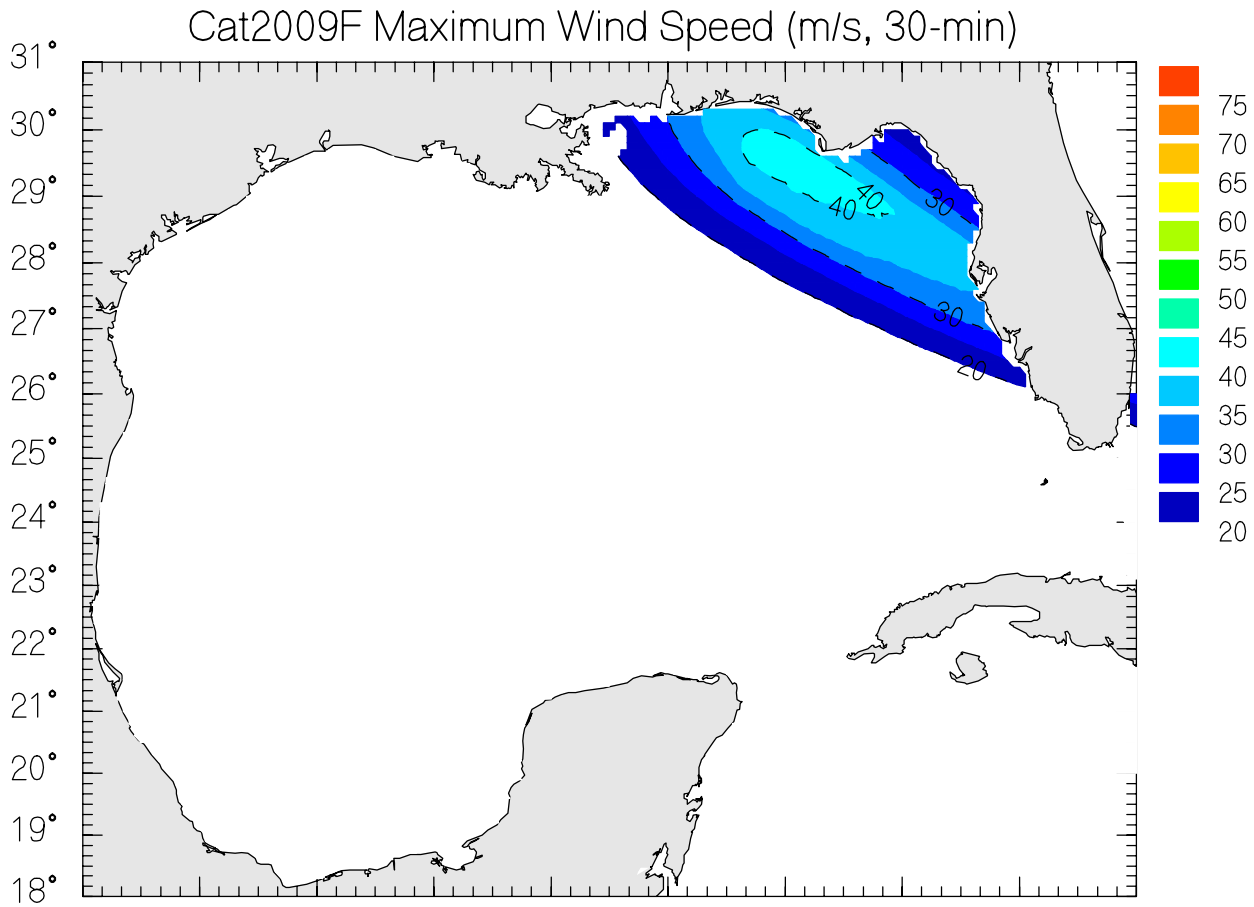
Cat2009F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
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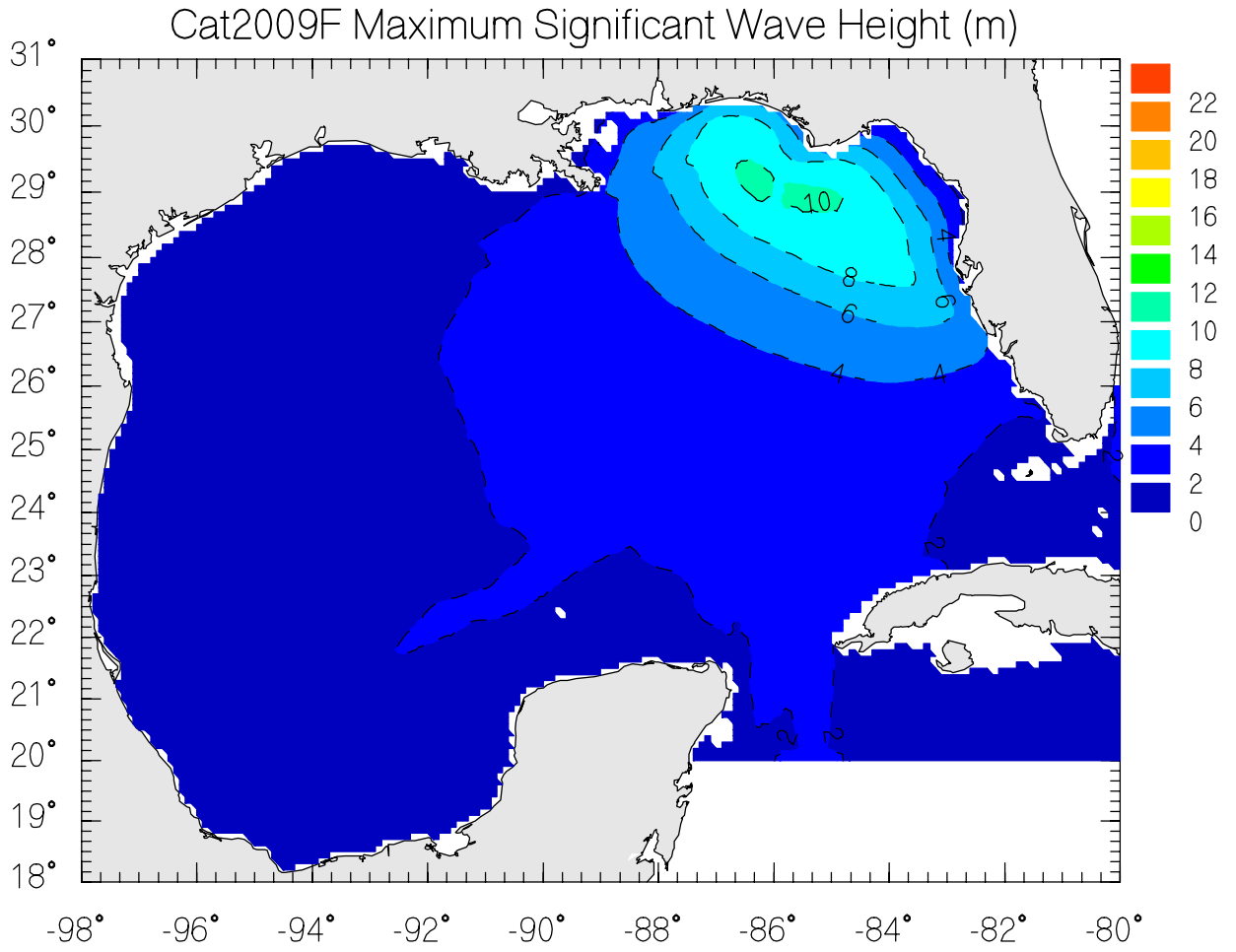
Cat2009F Maximum Significant Wave Height (m)
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30°
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20°
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18°
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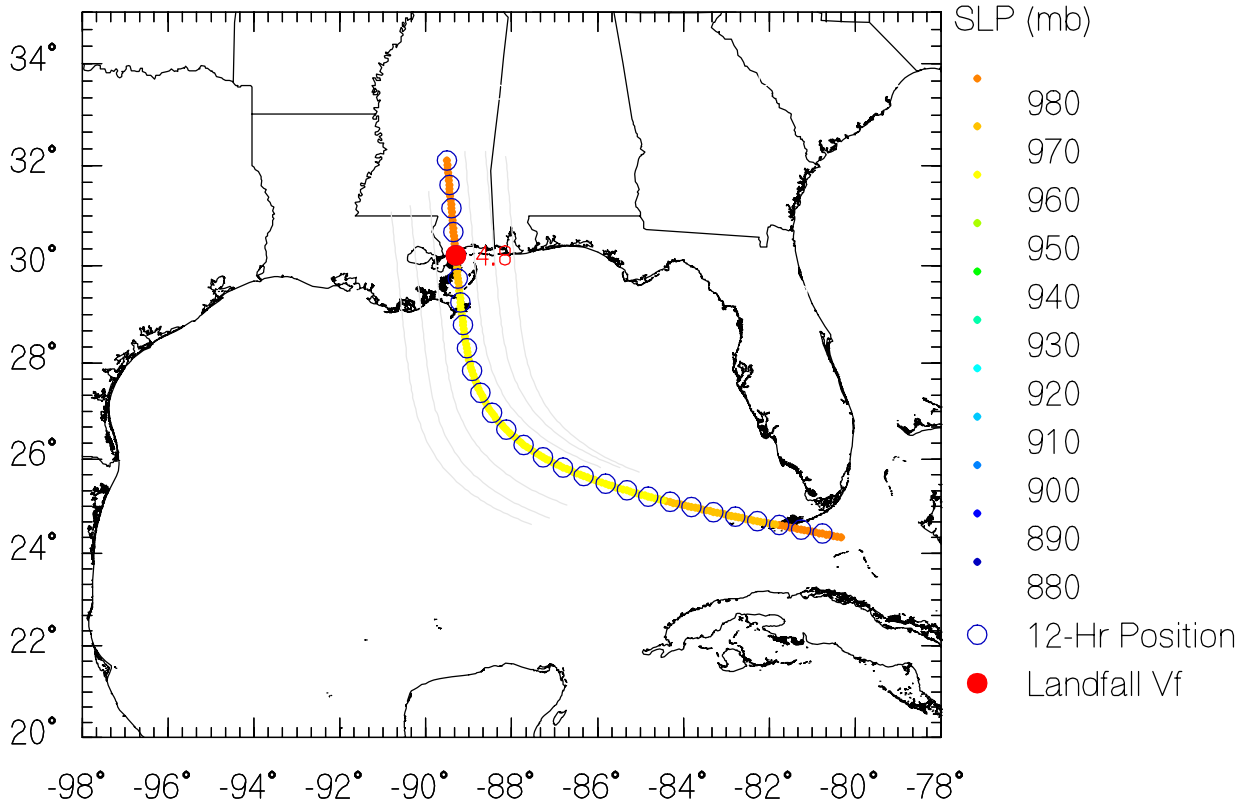
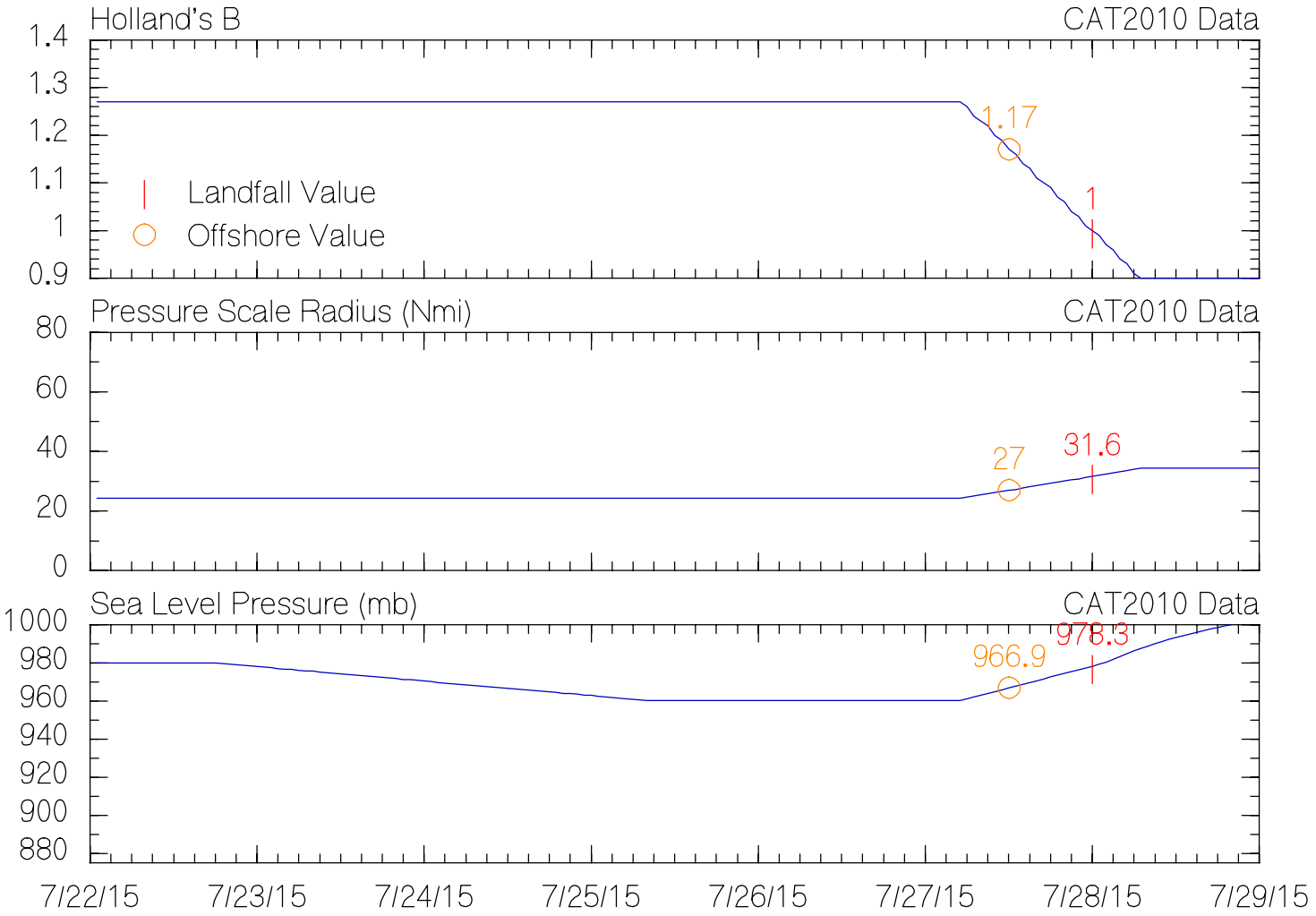
-86°
-84°
-82°
-80°

CAT2010 Data

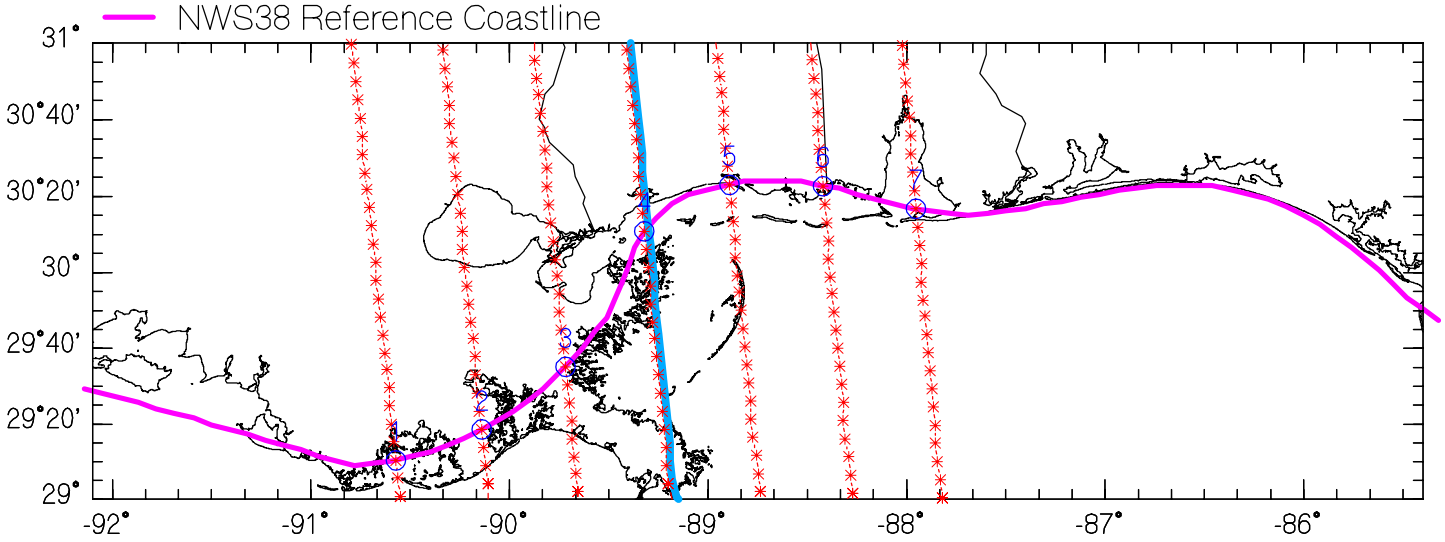


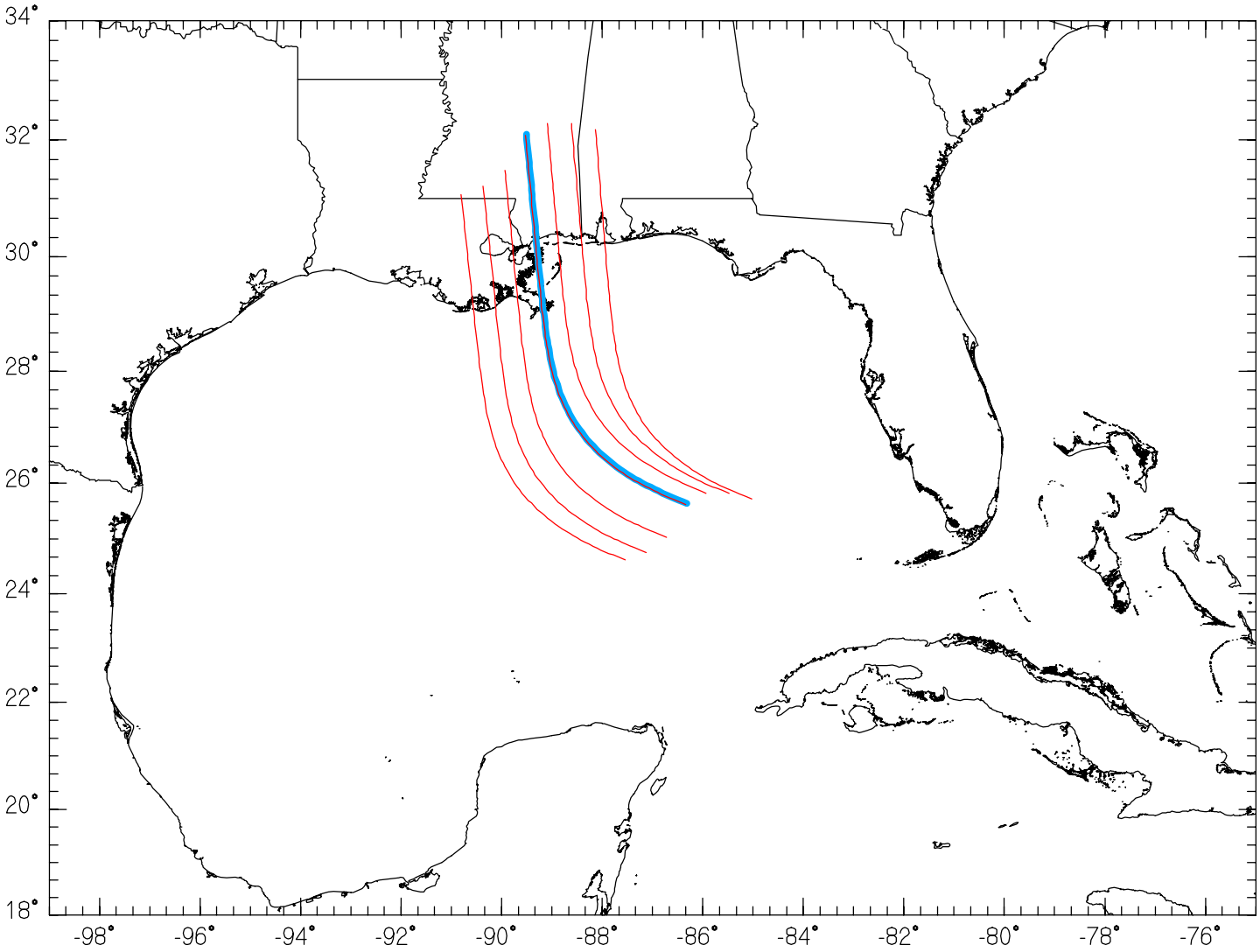


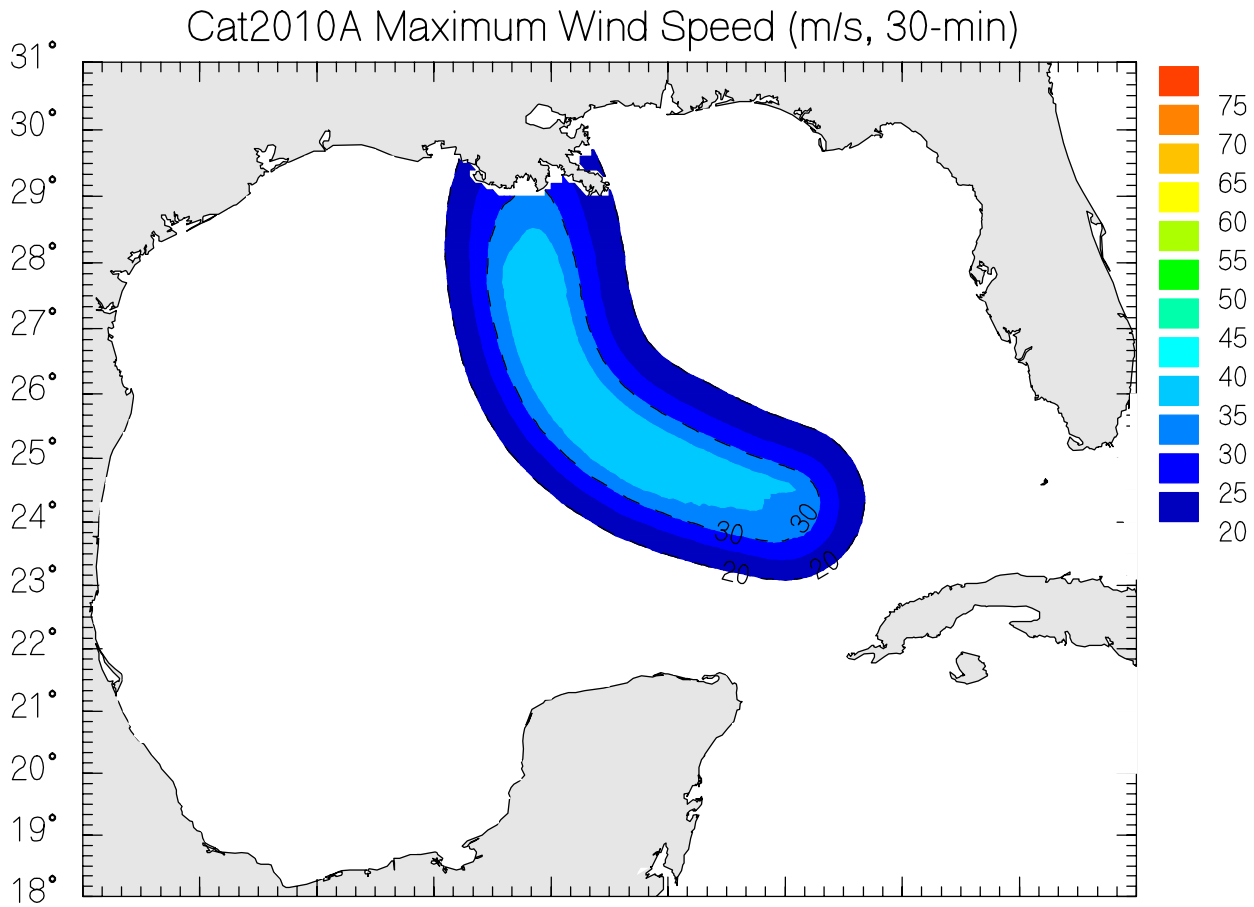
URS JPM-OS6 Production Tracks

CAT2010 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






Cat2010A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
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24°
23°
22°
21°
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18°
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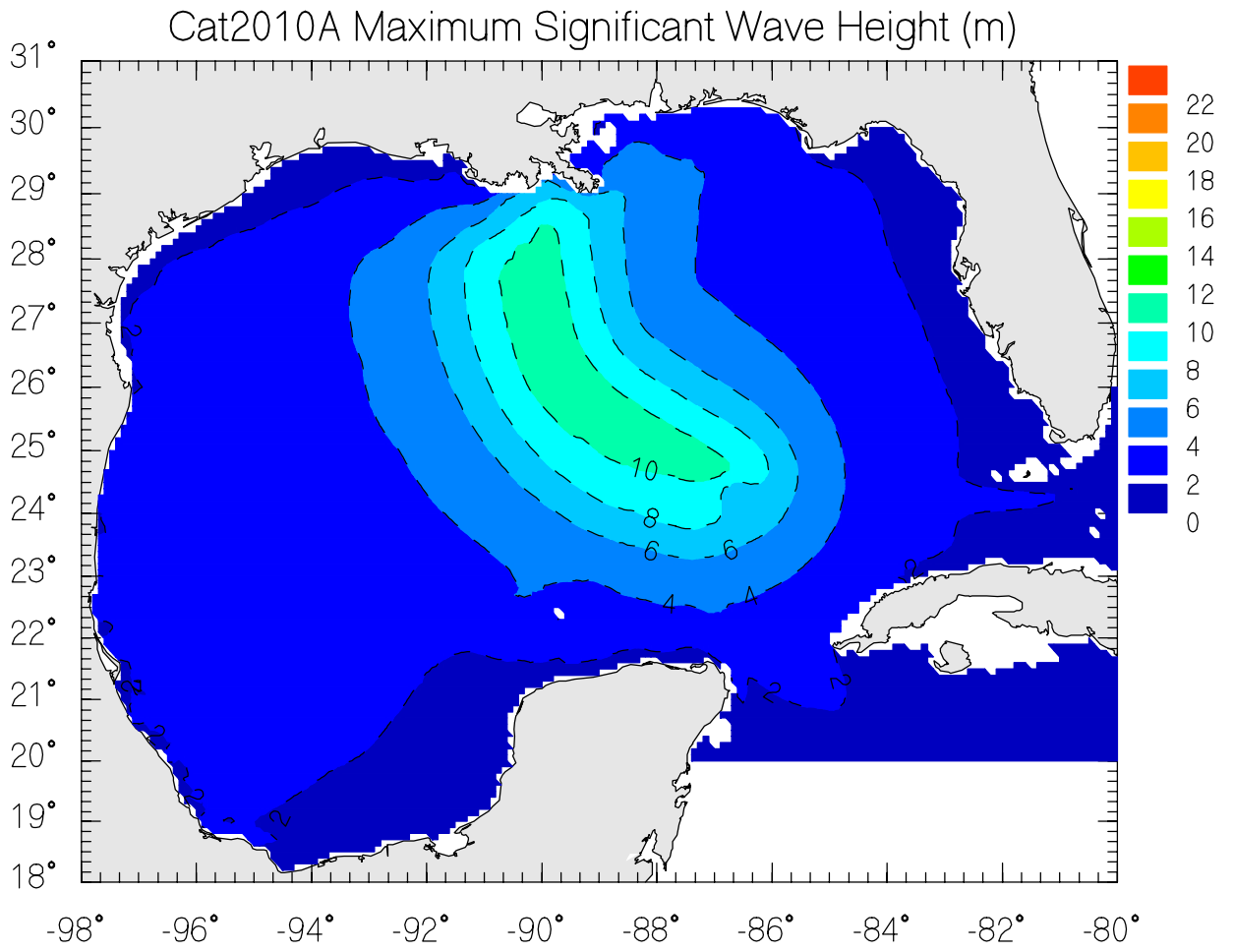
Cat2010A Maximum Significant Wave Height (m)
31°
30°
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-92°
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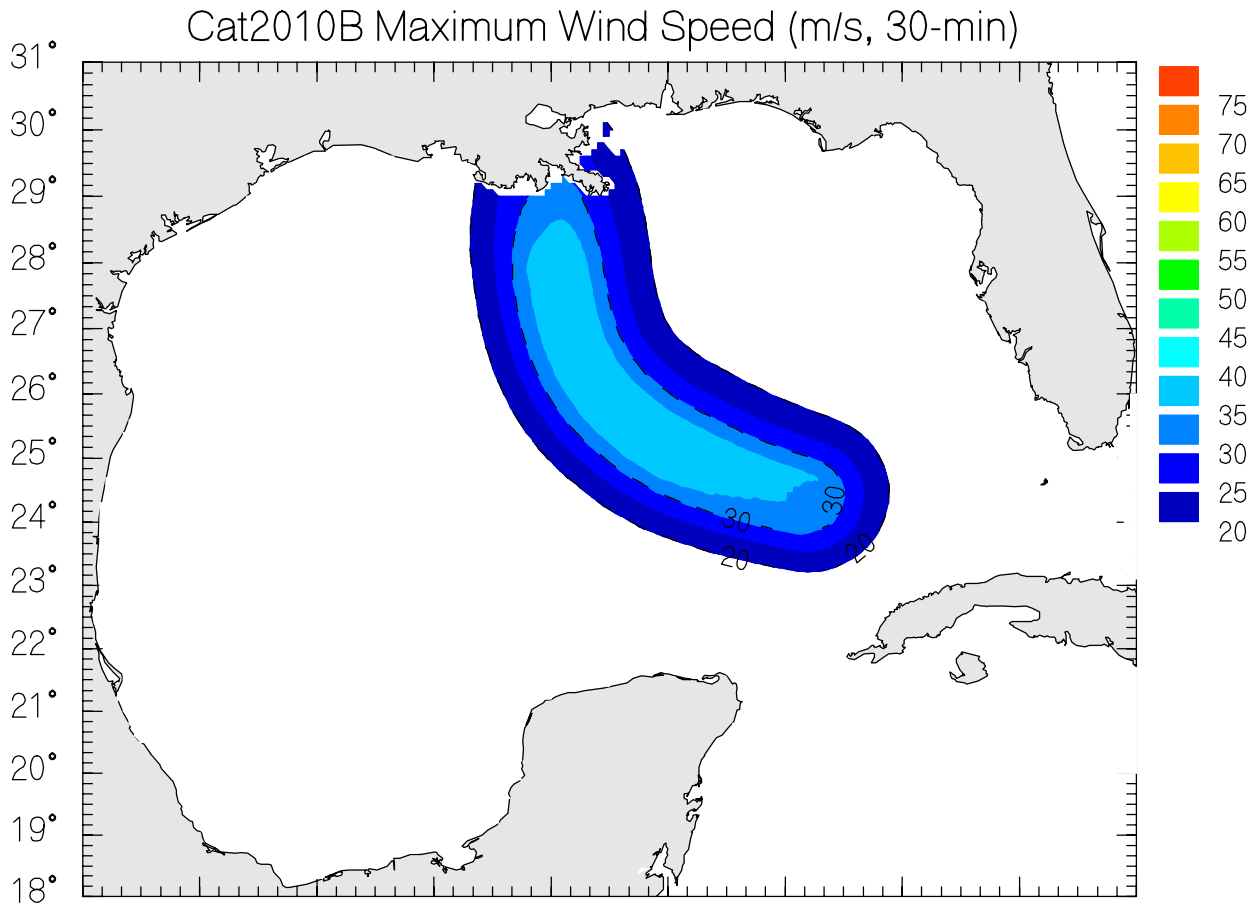
-88°
-86°
-84°
-82°
-80°


Cat2010B Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
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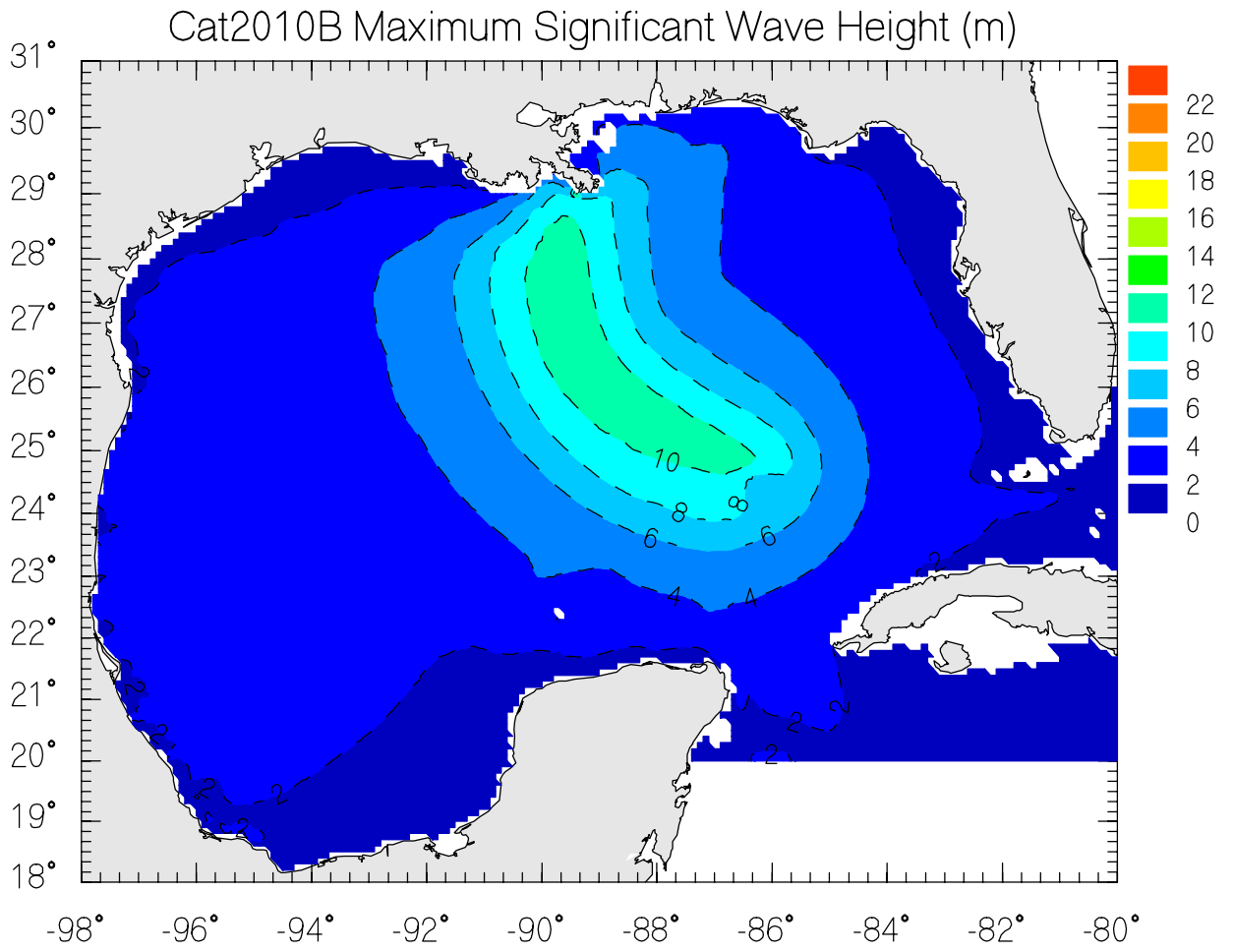
Cat2010B Maximum Significant Wave Height (m)
31°
30°
29°
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18°
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-92°
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-88°
-86°
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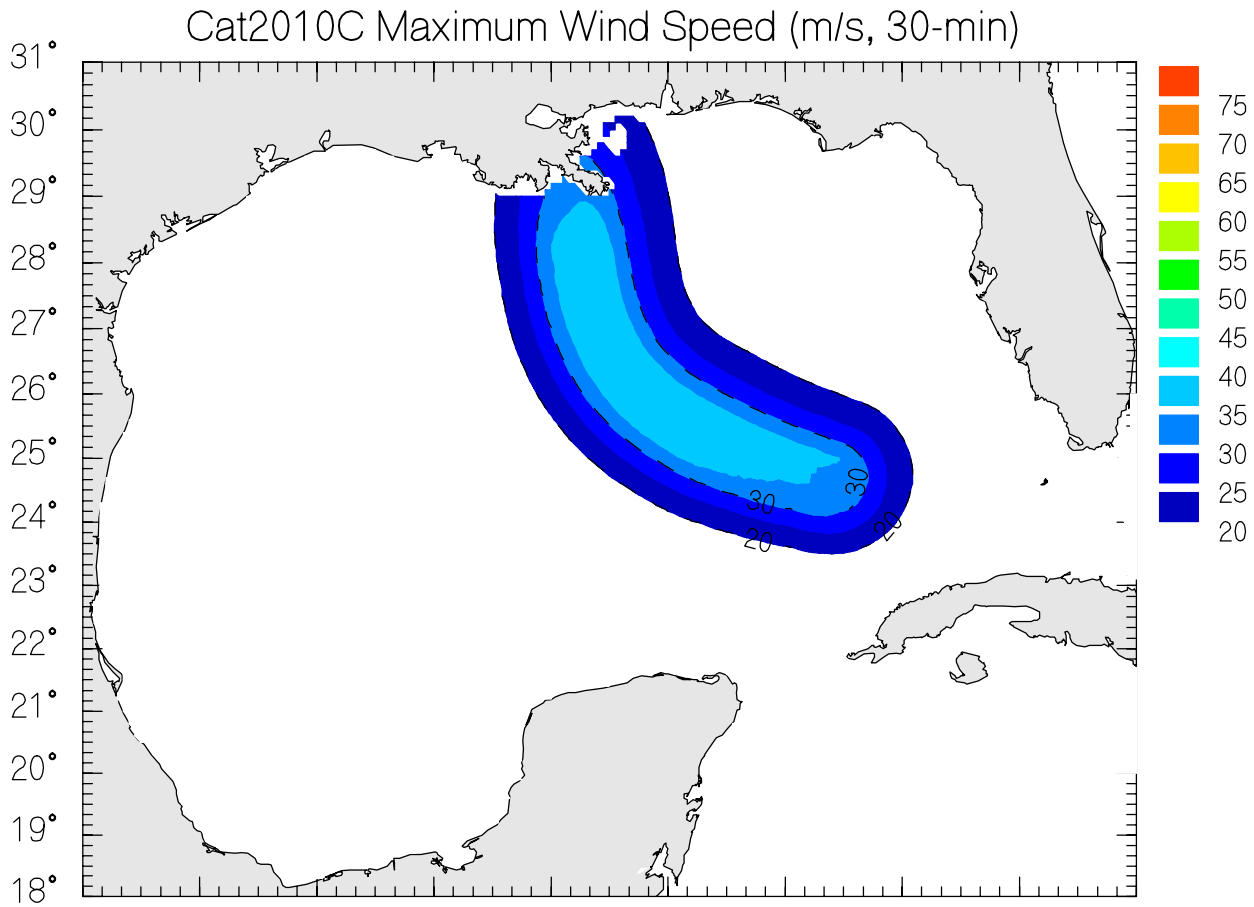
-82°
-80°


Cat2010C Maximum Wind Speed (m/s, 30-min)
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30°
29°
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27°
26°
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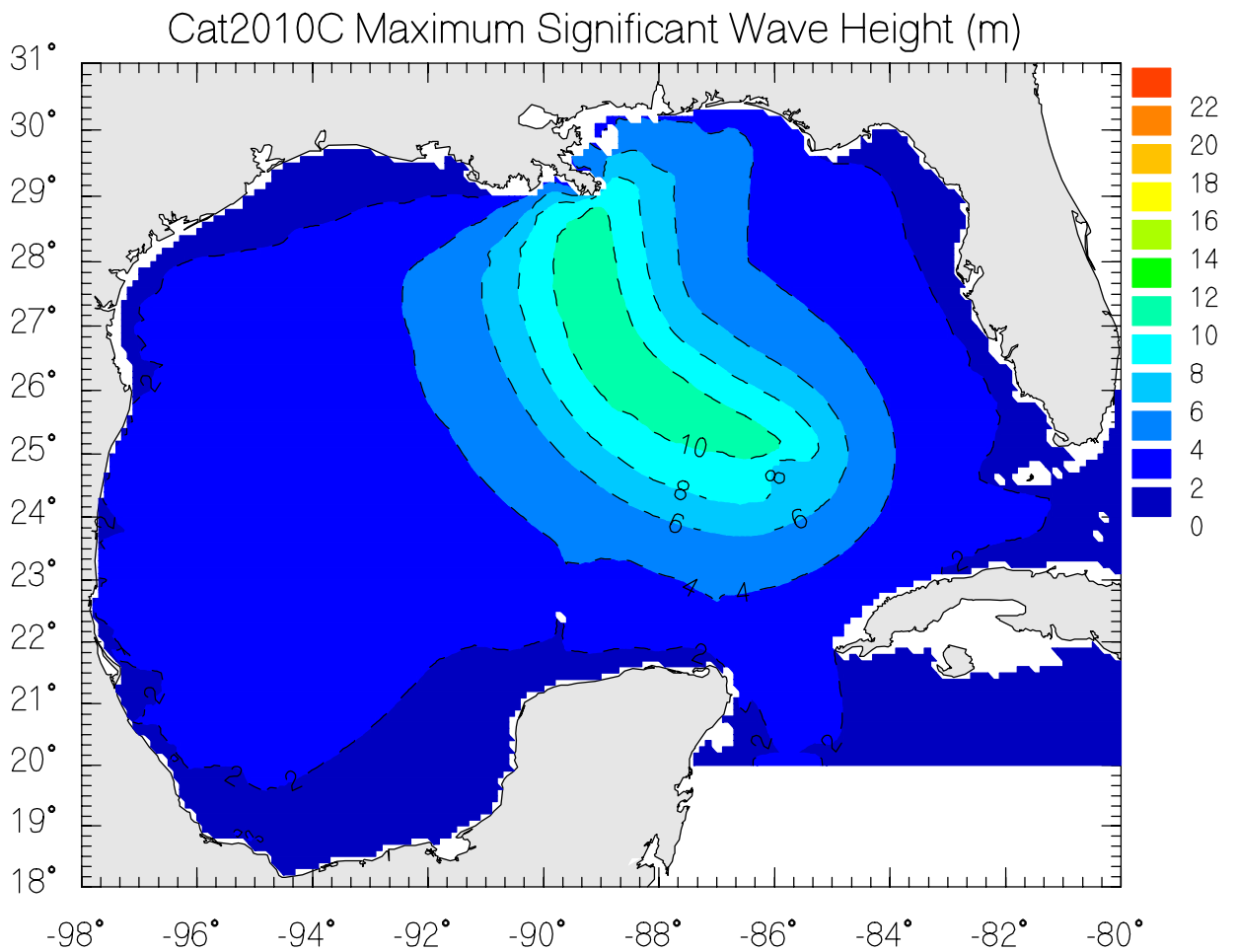
Cat2010C Maximum Significant Wave Height (m)
31°
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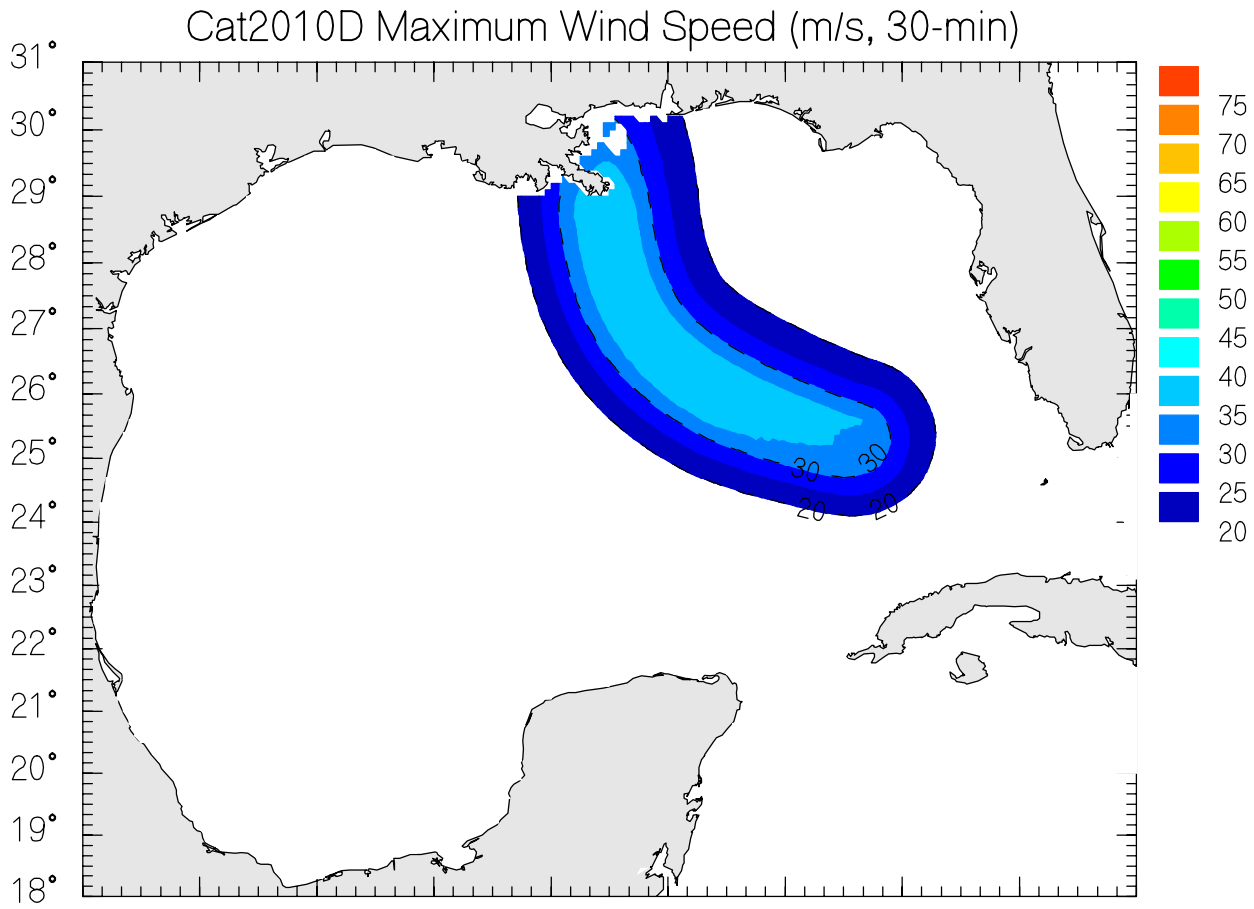
Cat2010D Maximum Wind Speed (m/s, 30-min)
31°
30°
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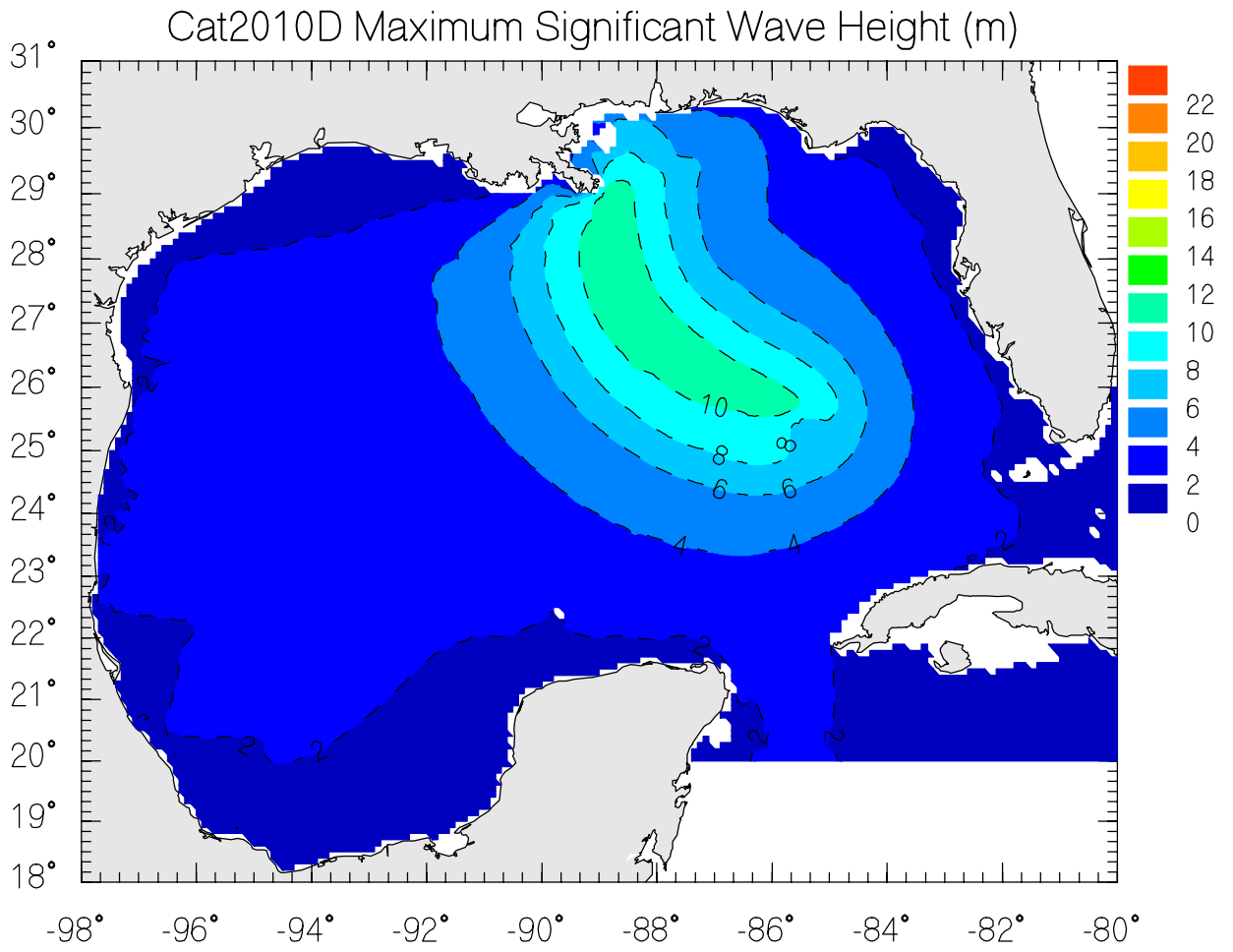
Cat2010D Maximum Significant Wave Height (m)
31°
30°
29°
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19°
18°
-98°
-96°
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-88°
-86°
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-82°
-80°
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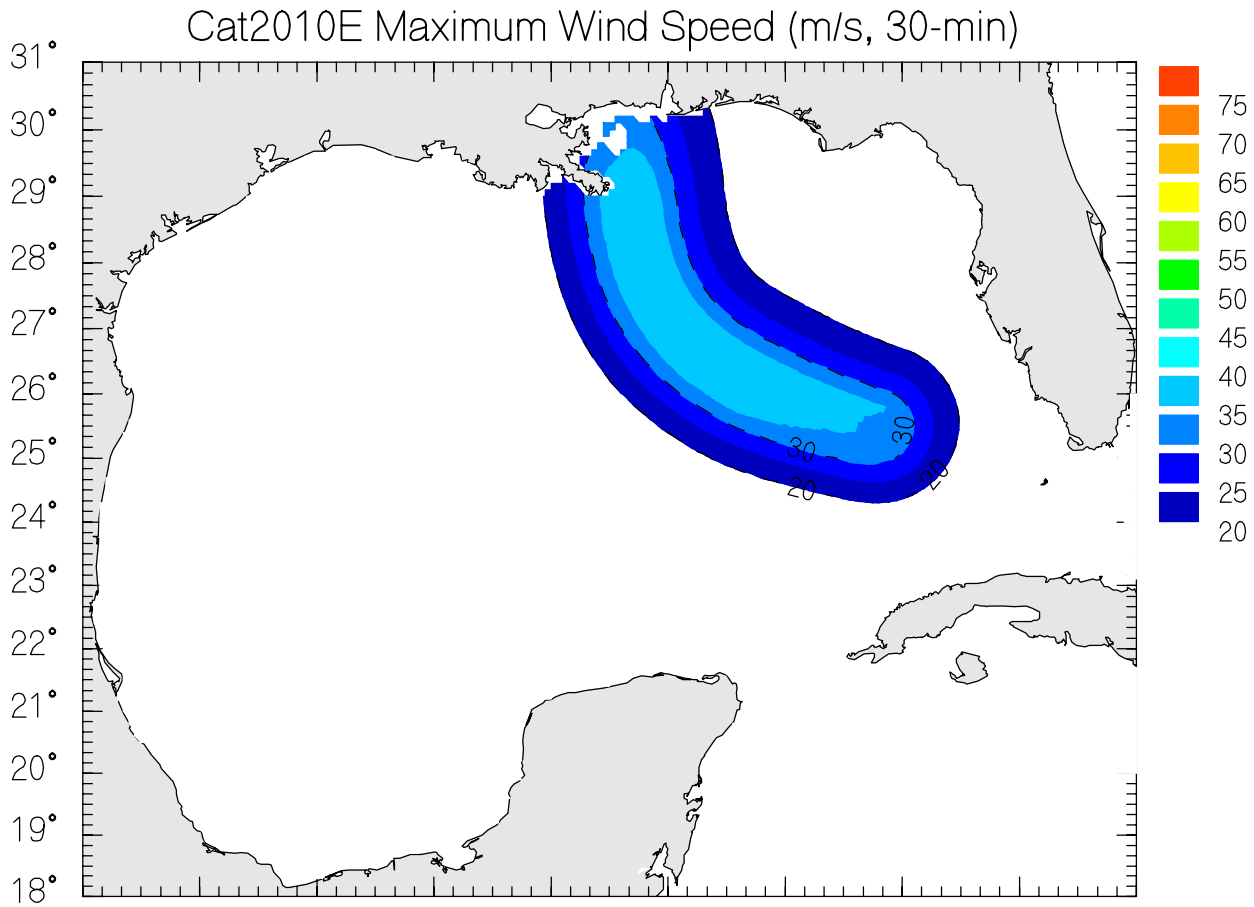
Cat2010E Maximum Wind Speed (m/s, 30-min)
31°
30°
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25
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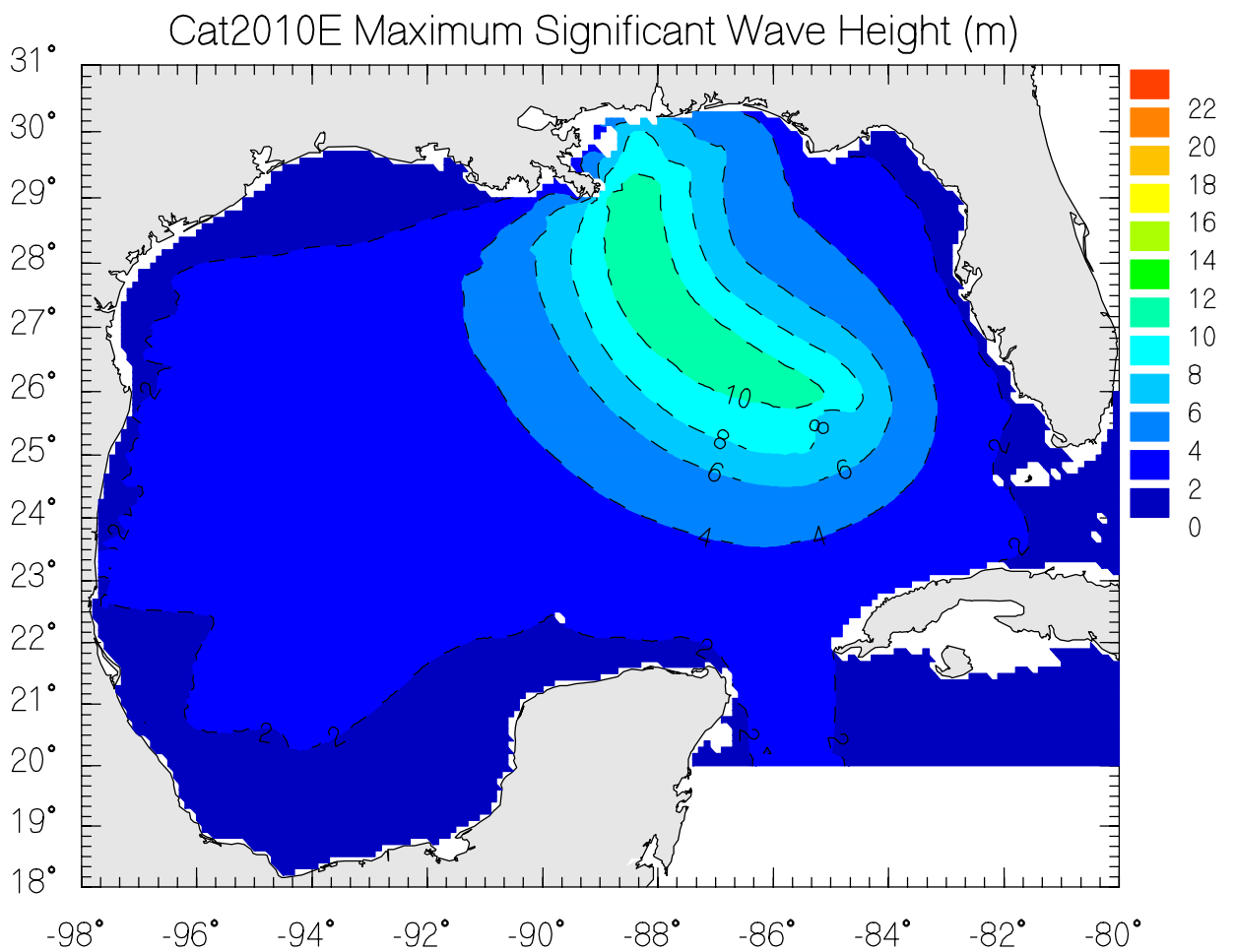
Cat2010E Maximum Significant Wave Height (m)
31°
30°
29°
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26°
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21°
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18°
-98°
-96°
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-88°
-86°
-84°
-82°
-80°
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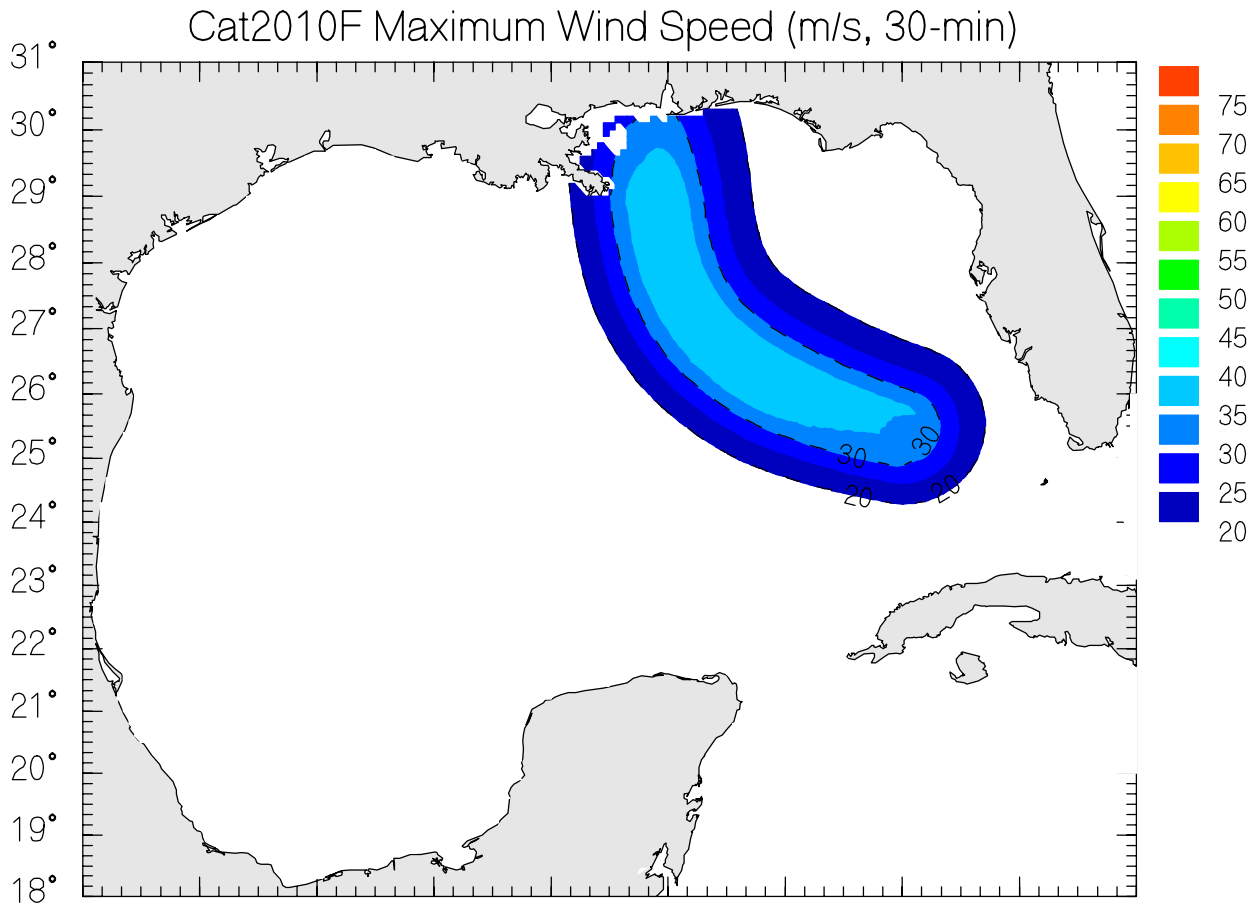
Cat2010F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
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27°
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24°
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20°
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35
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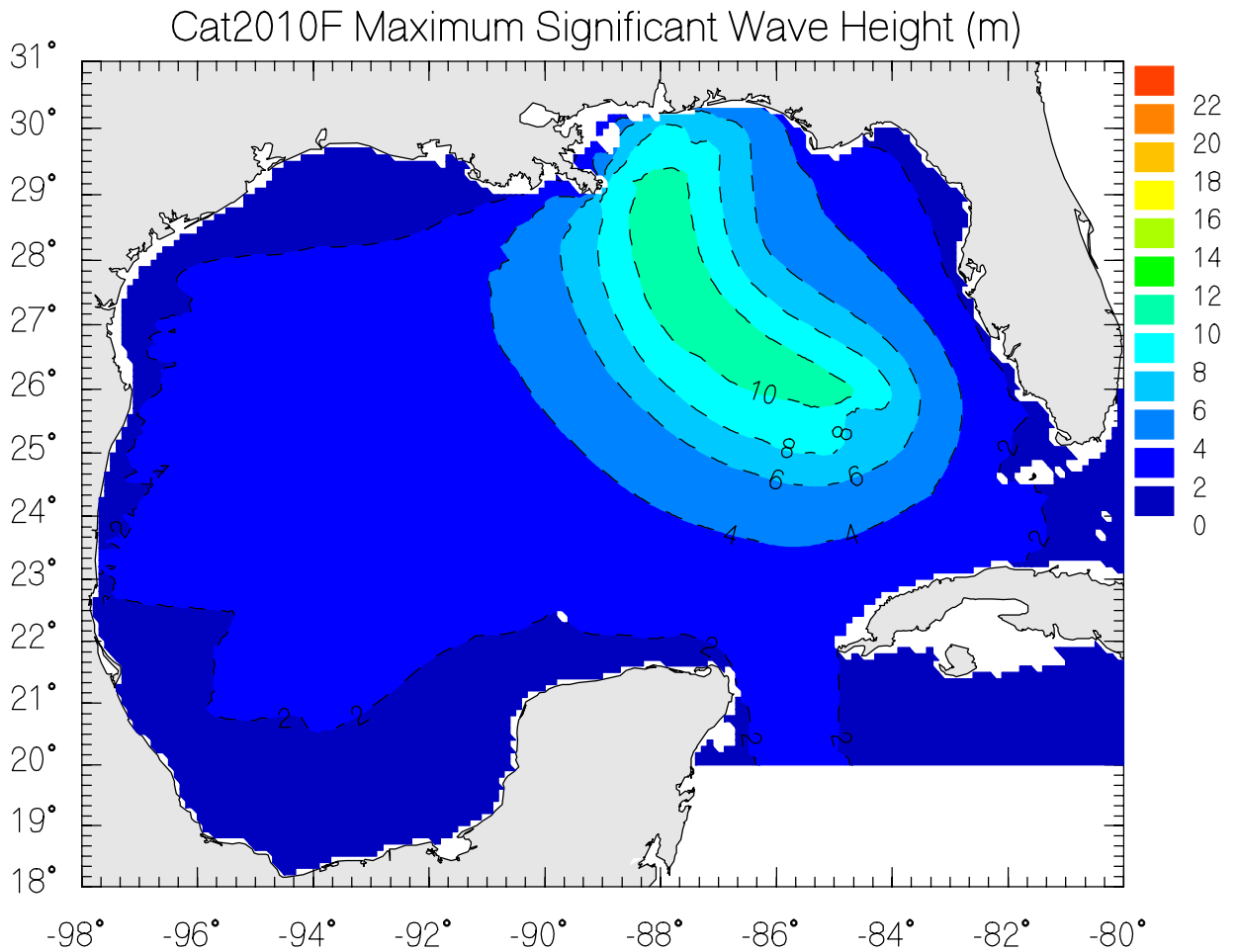
Cat2010F Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
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23°
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21°
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-92°
-90°
-88°
-86°
-84°
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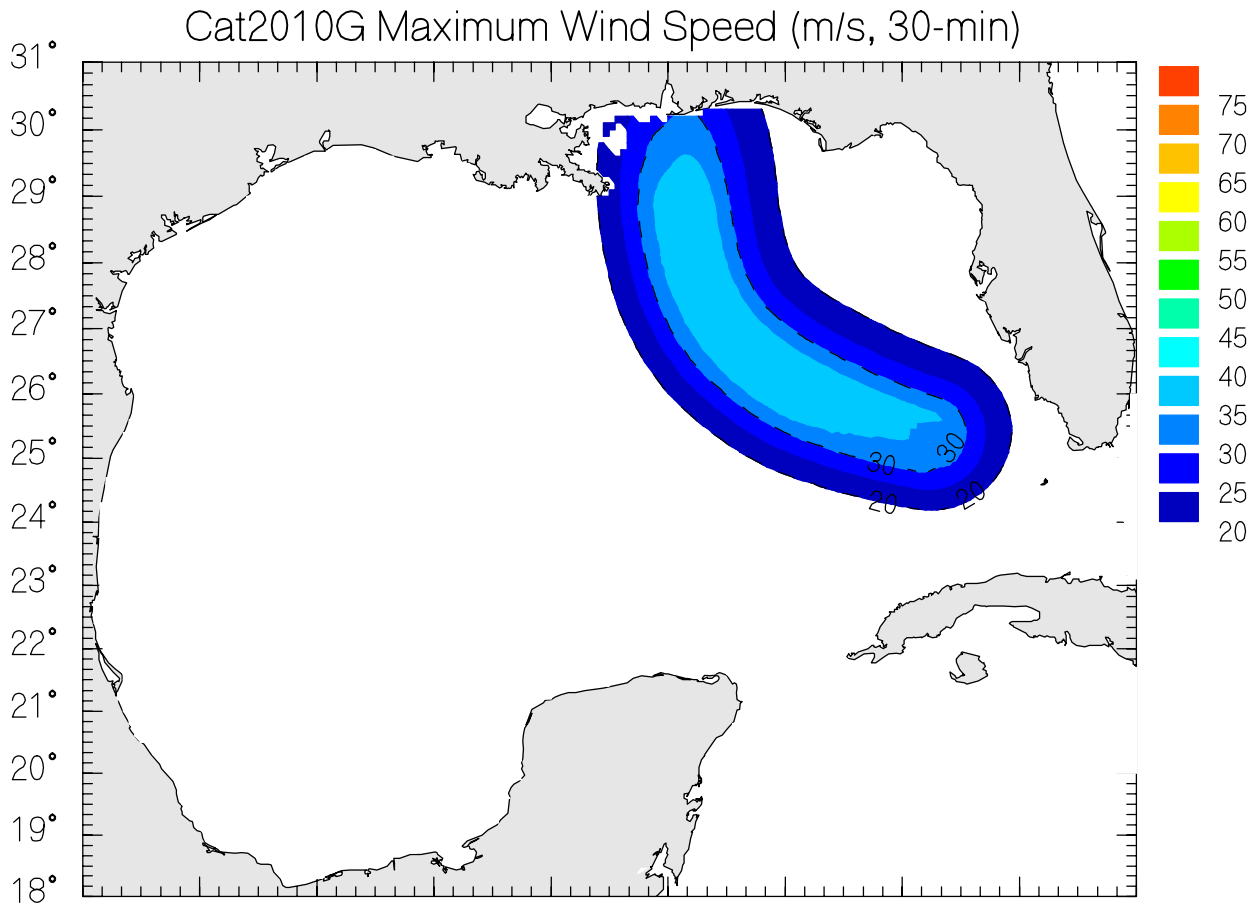
Cat2010G Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
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21°
20°
19°
18°
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25
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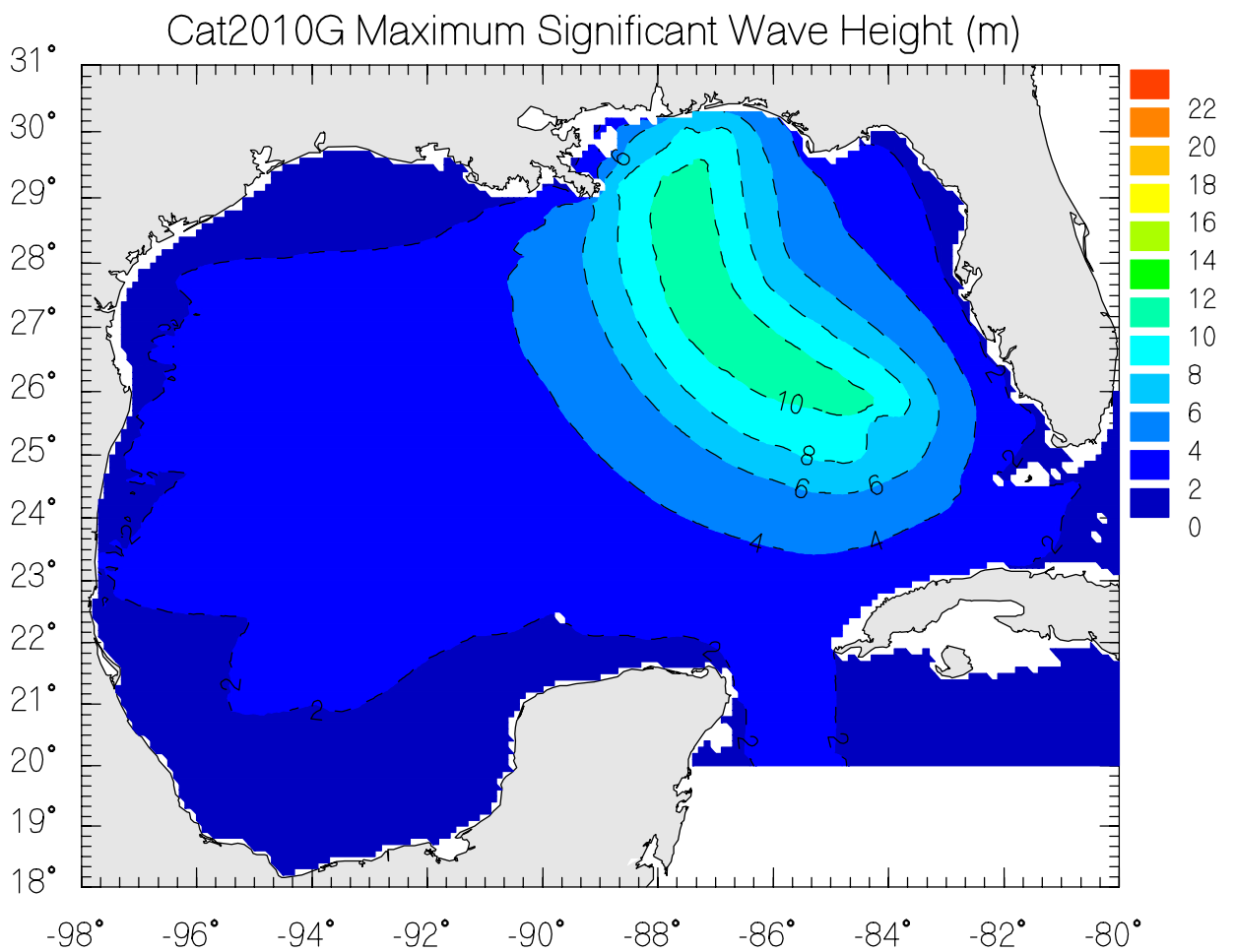
Cat2010G Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
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-86°
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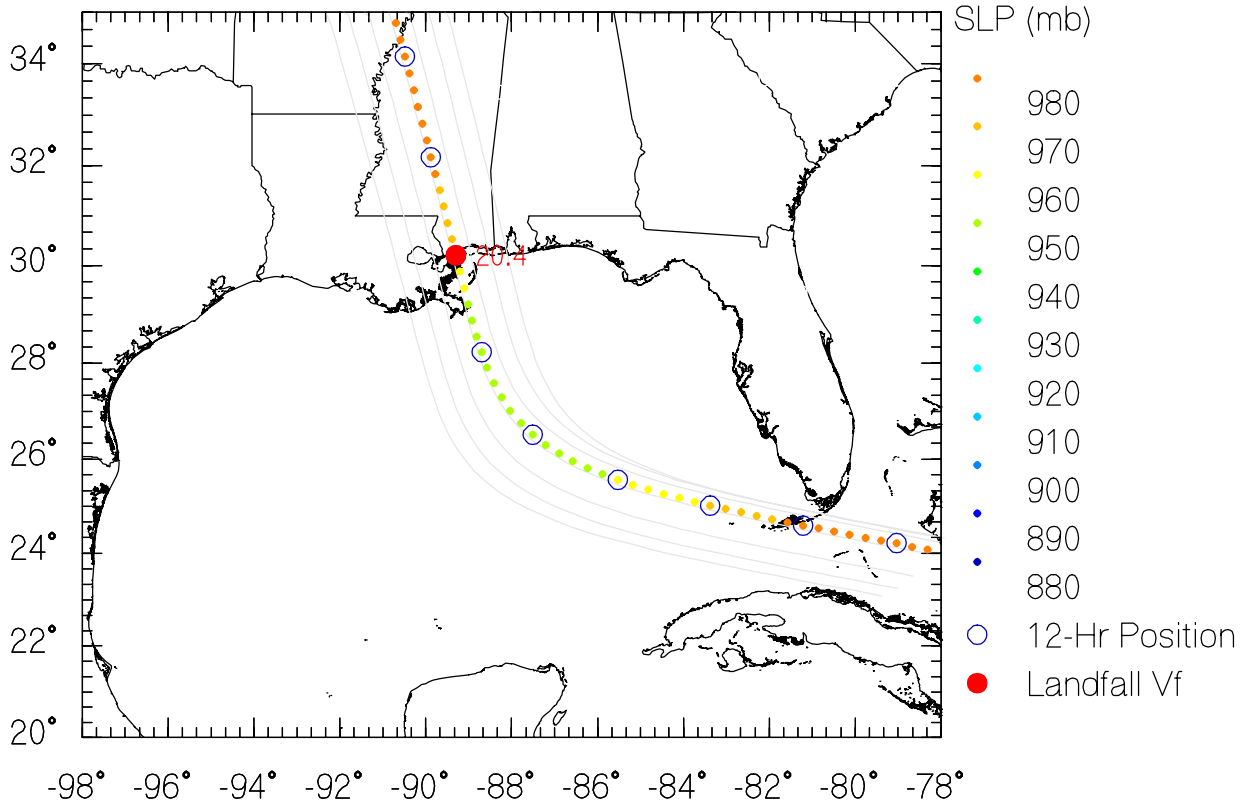
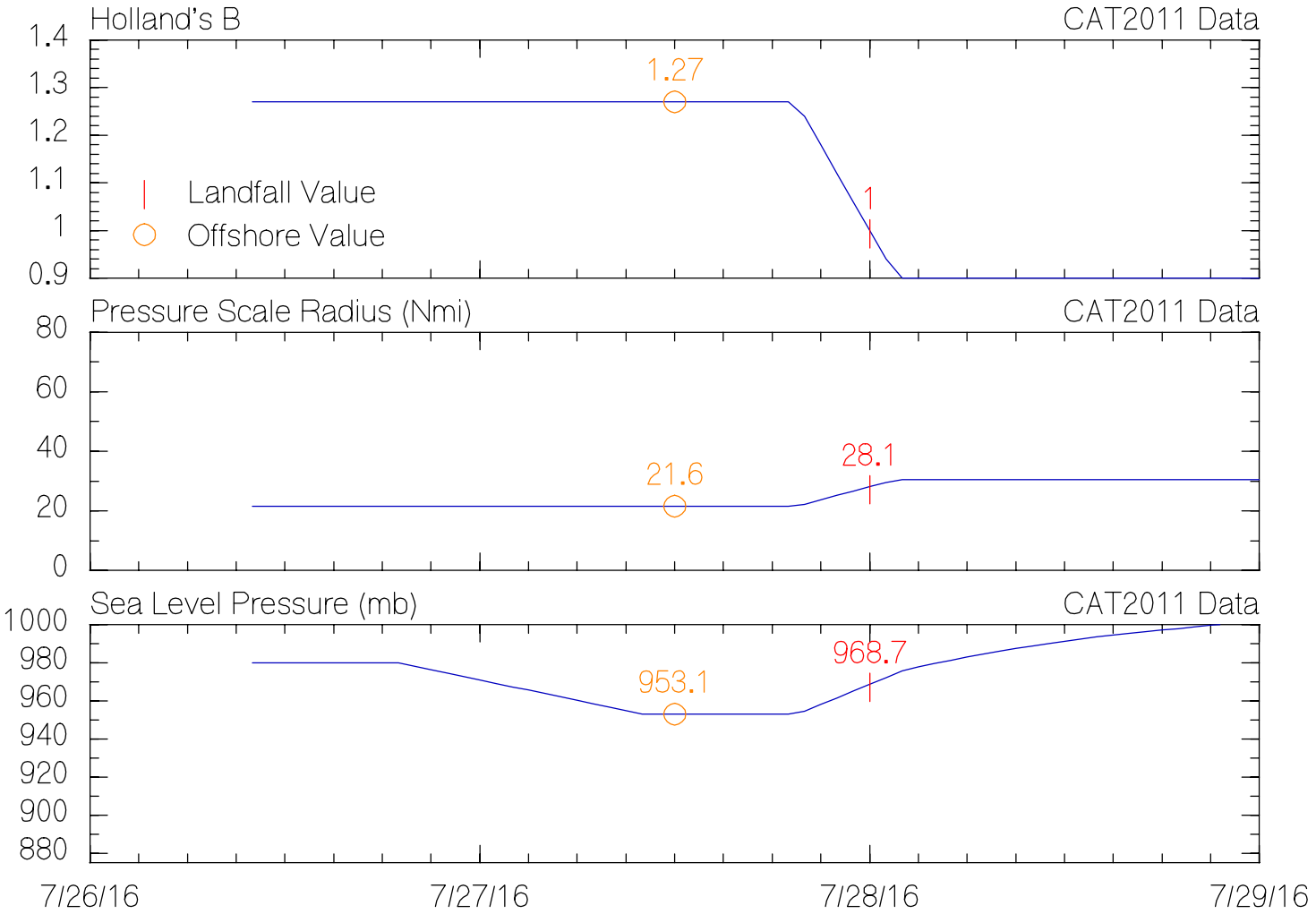
CAT2011 Data

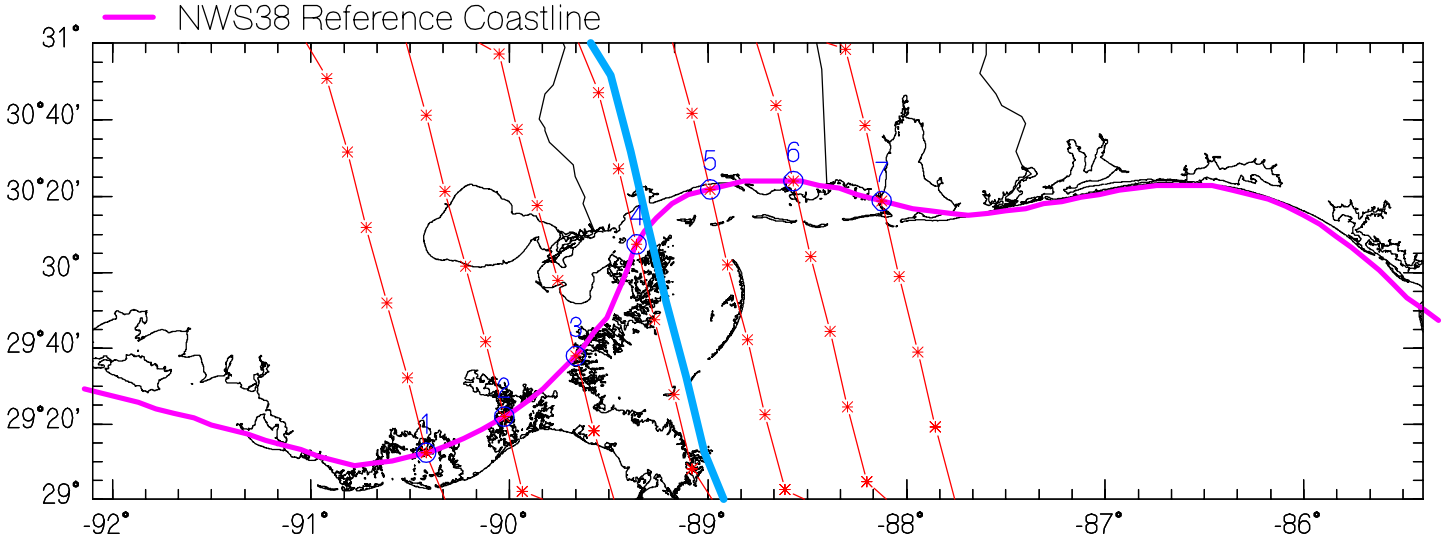


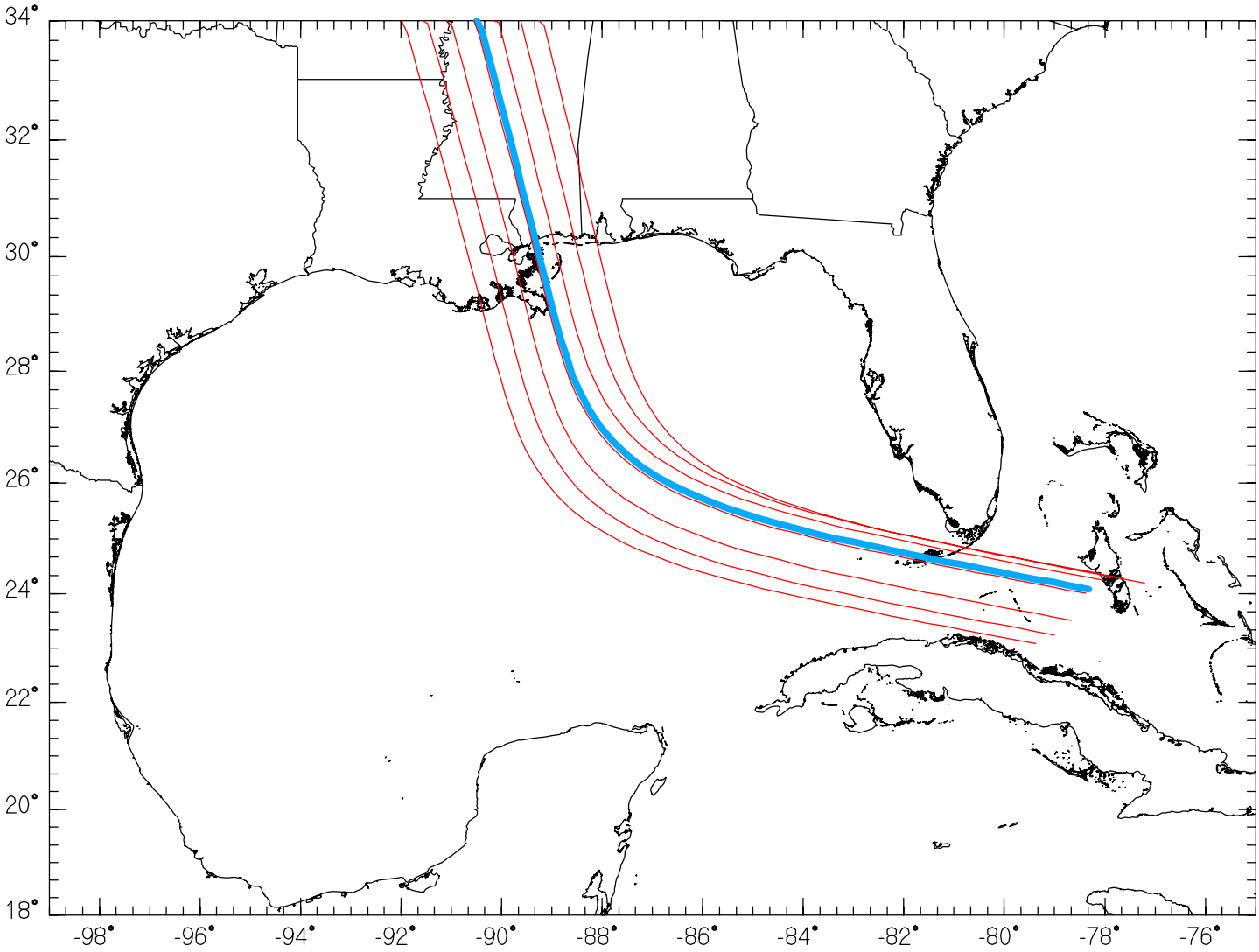


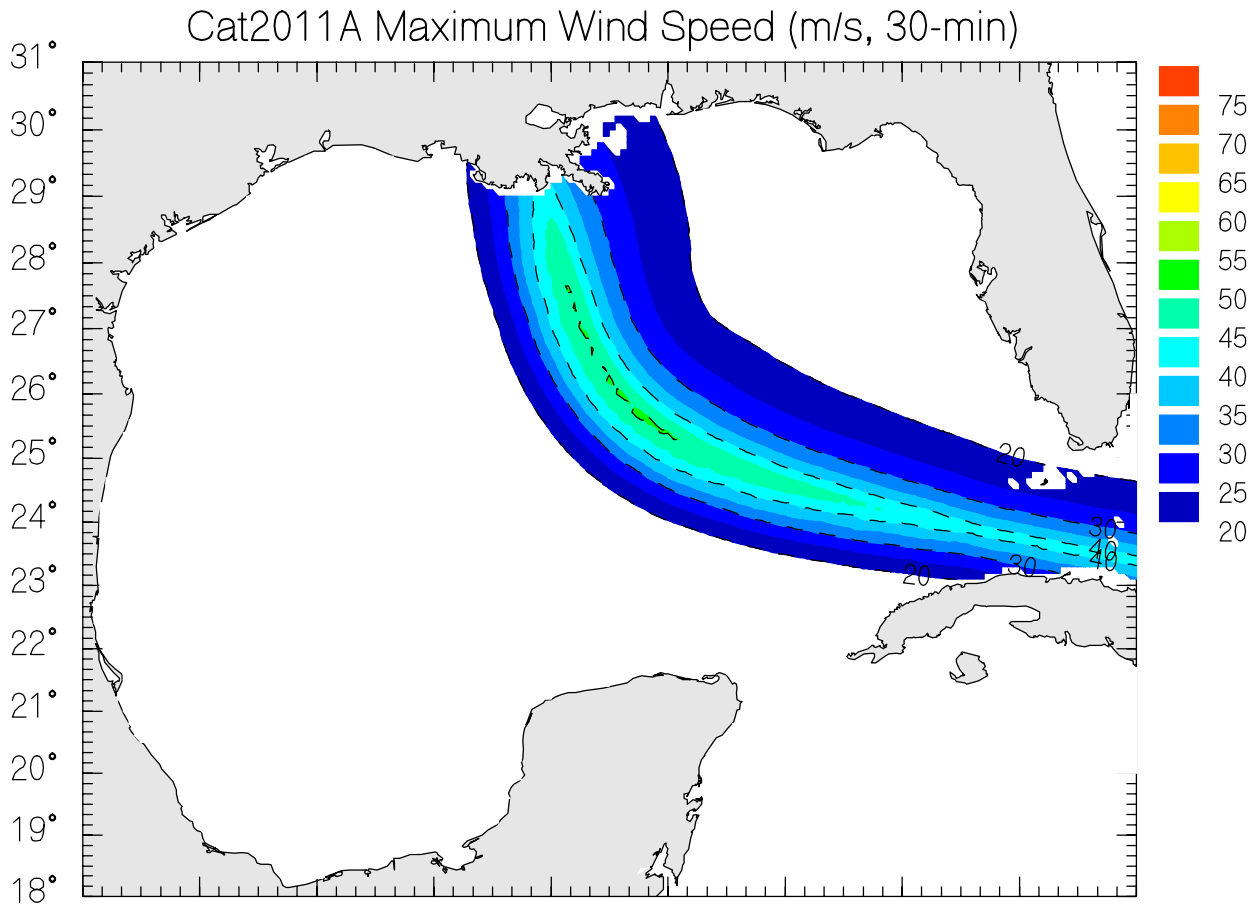
URS JPM-OS6 Production Tracks

CAT2011 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






Cat2011A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
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21°
20°
19°
18°
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70
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20
30
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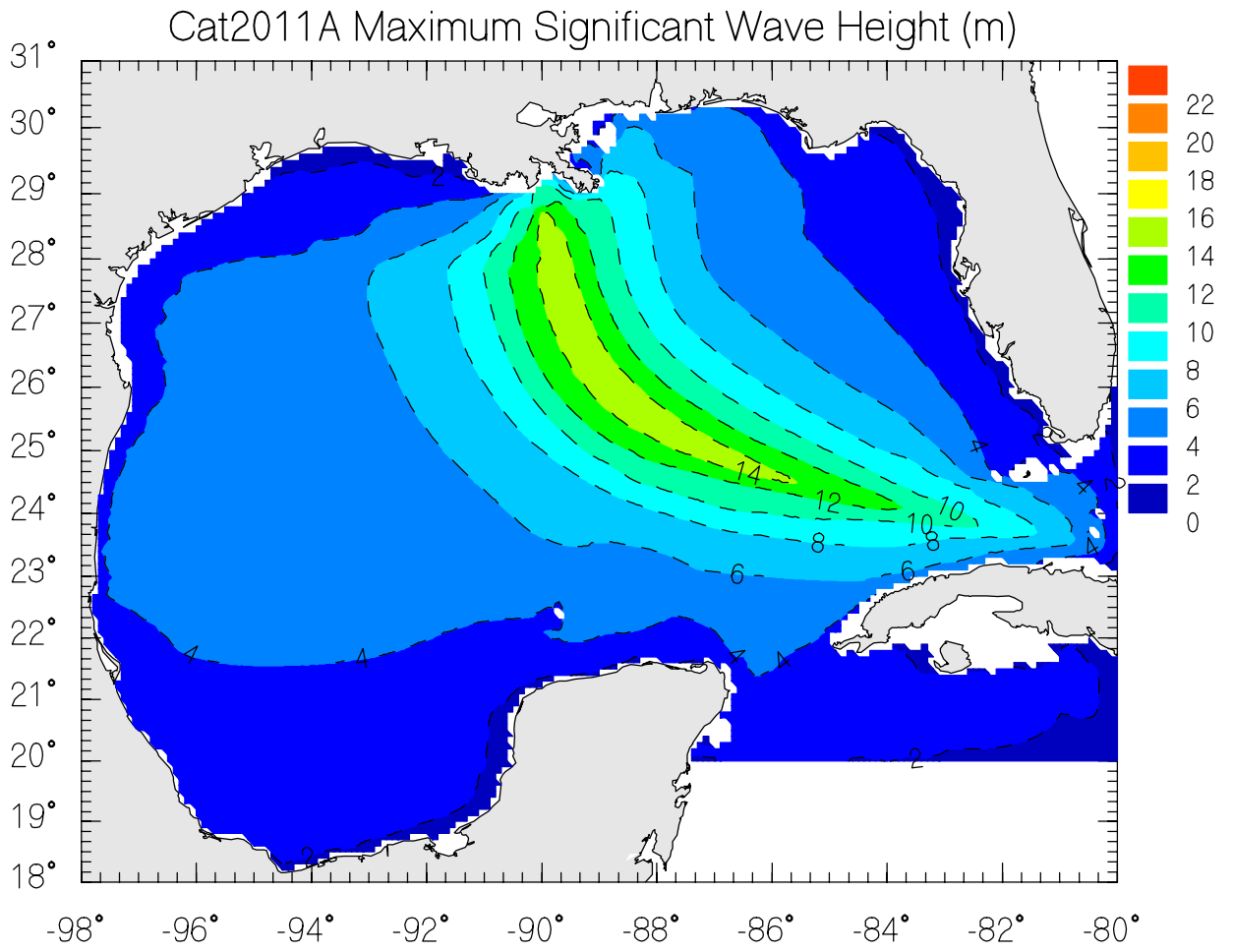
Cat2011A Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
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23°
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21°
20°
19°
18°
-98°
-96°
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-90°
-88°
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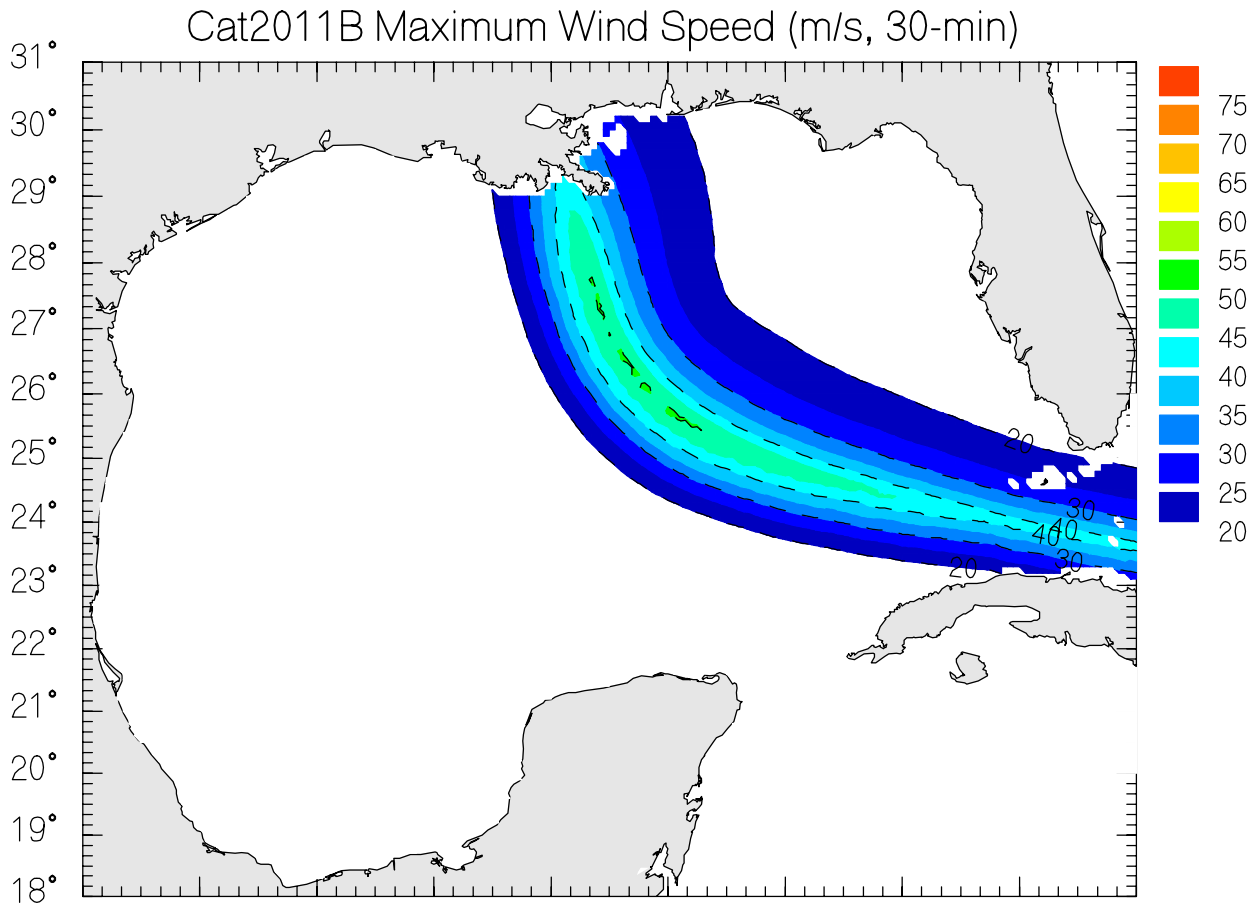
Cat2011B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
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25°
24°
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21°
20°
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18°
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25
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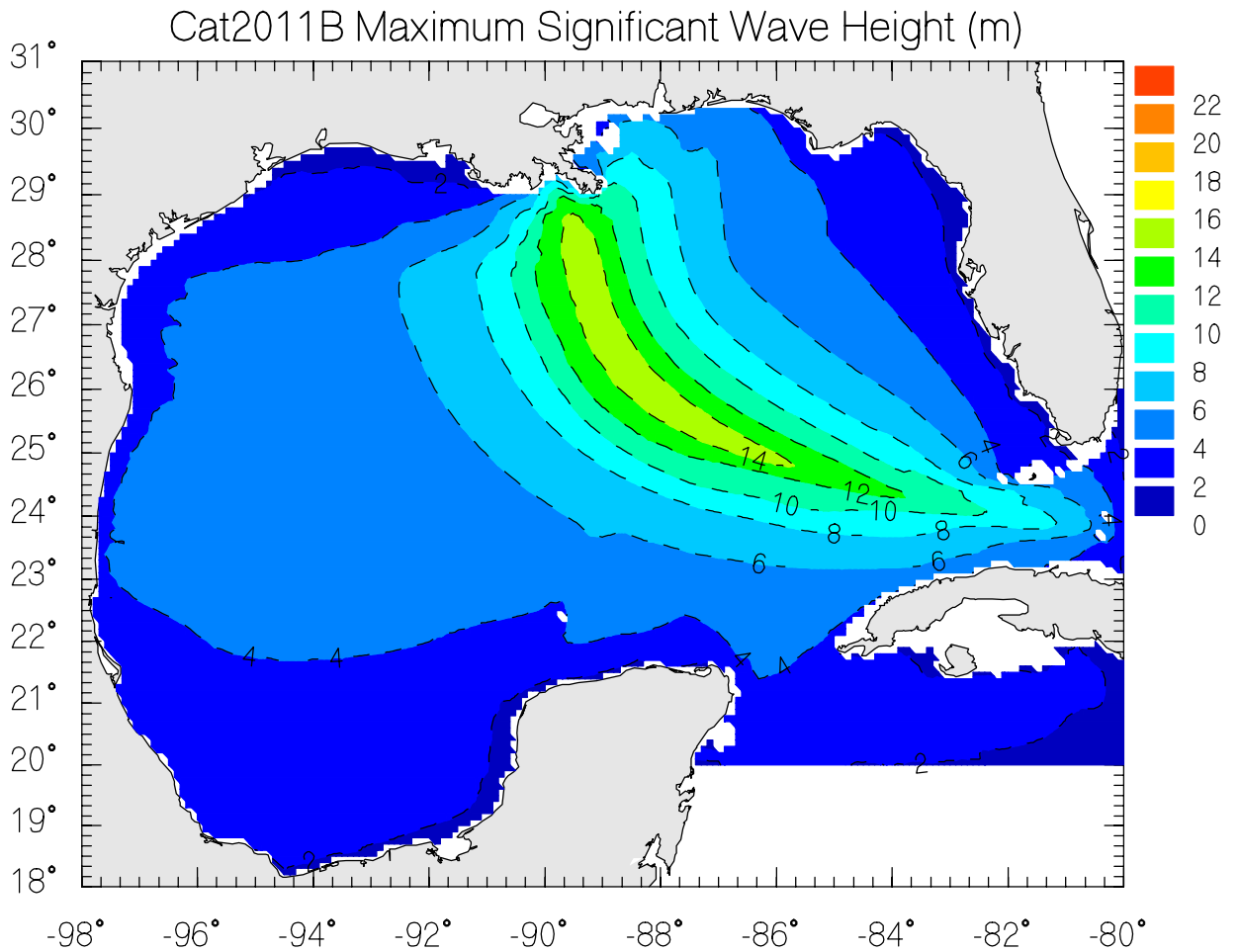
Cat2011B Maximum Significant Wave Height (m)
31°
30°
29°
28°
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25°
24°
23°
22°
21°
20°
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18°
-98°
-96°
-94°
-92°
-90°
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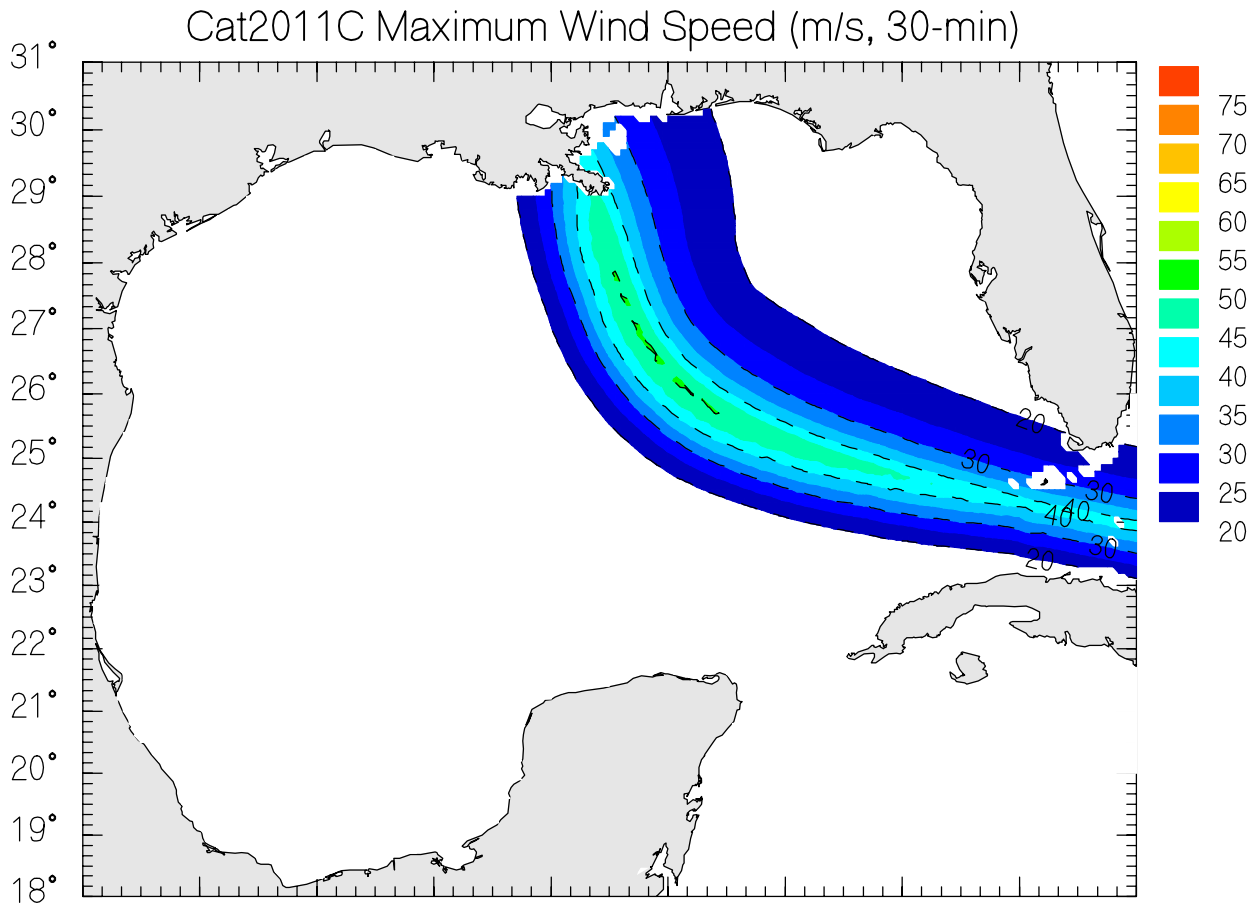
Cat2011C Maximum Wind Speed (m/s, 30-min)
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30°
29°
28°
27°
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24°
23°
22°
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20°
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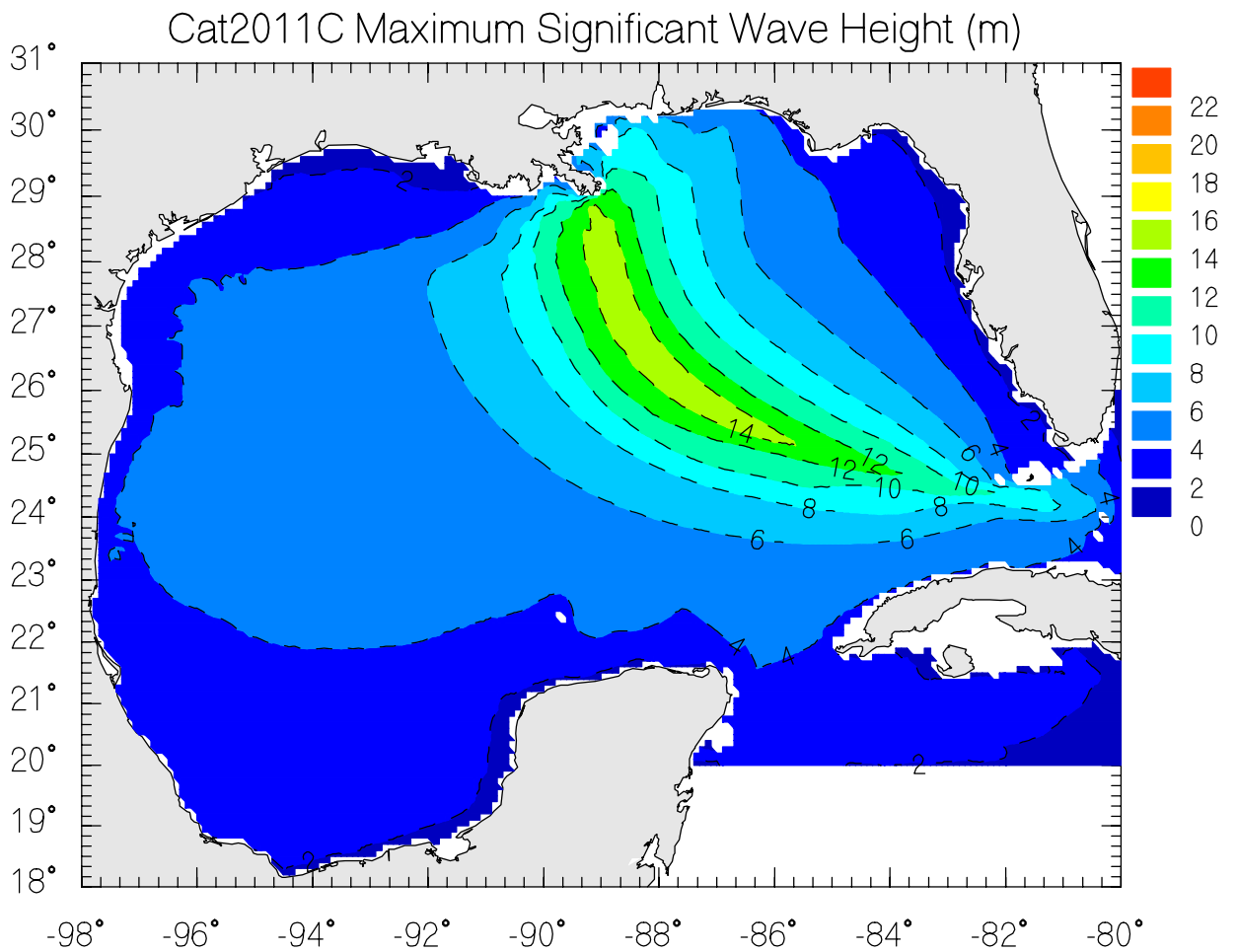
Cat2011C Maximum Significant Wave Height (m)
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18°
-98°
-96°
-94°
-92°
-90°
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-86°
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-82°
-80°
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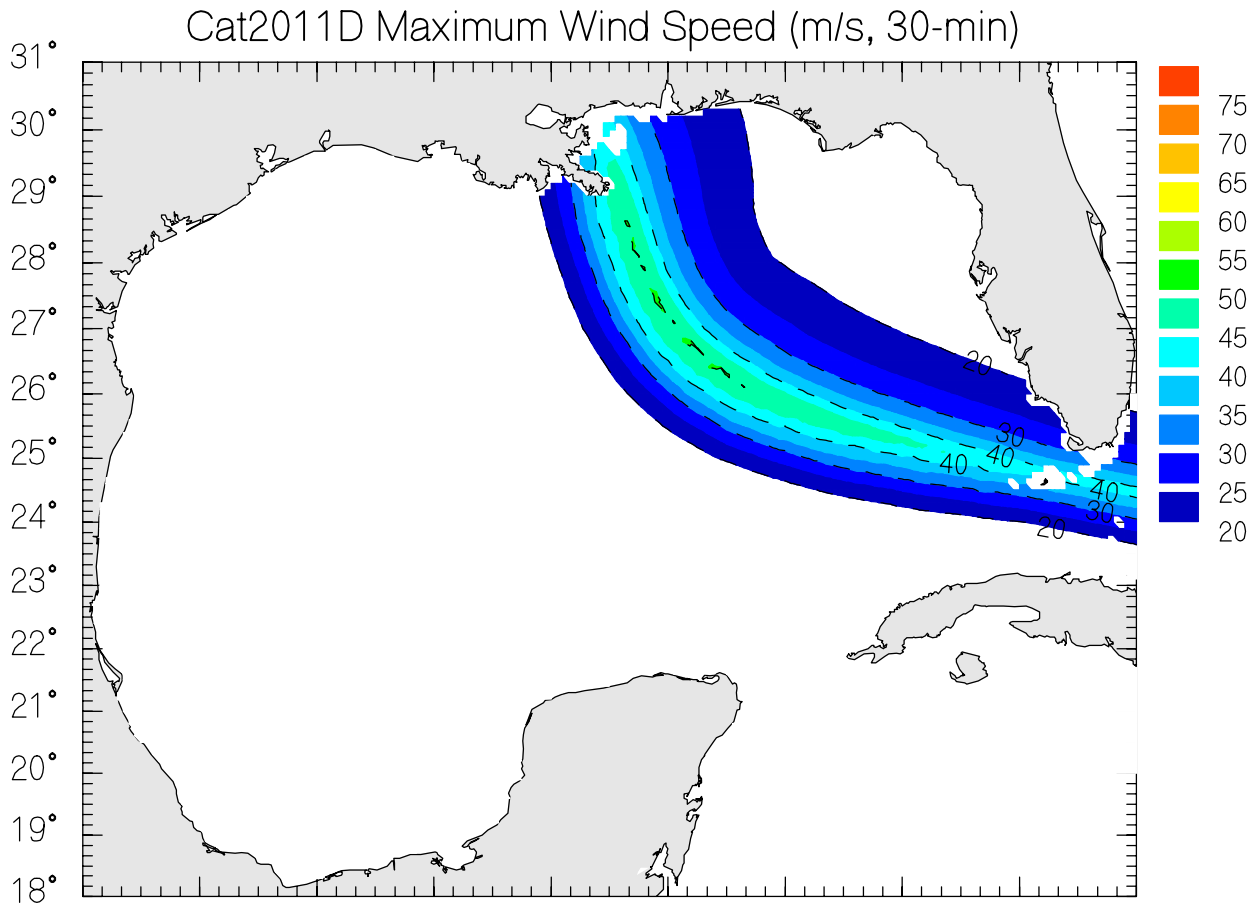
Cat2011D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
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27°
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20°
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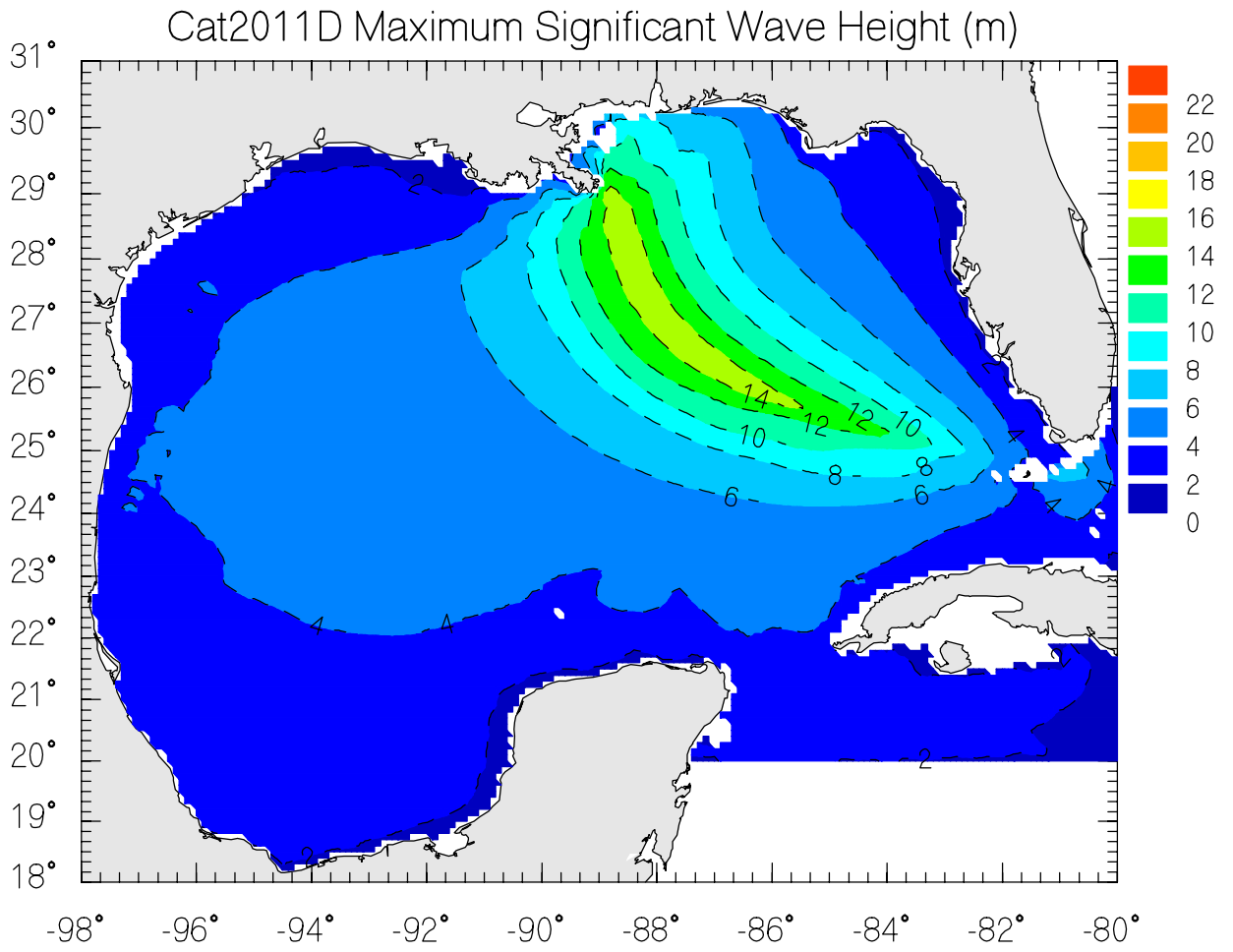
Cat2011D Maximum Significant Wave Height (m)
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30°
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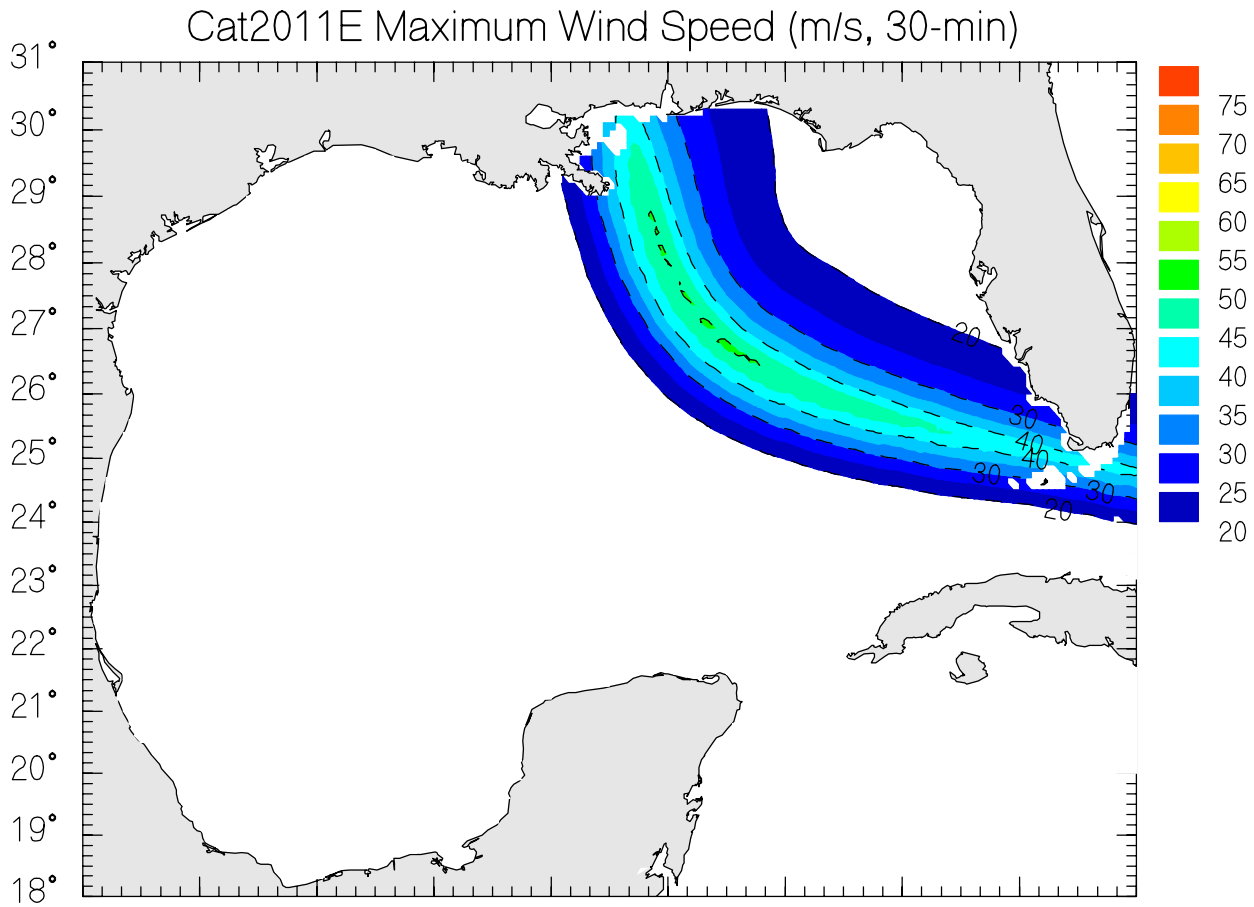
Cat2011E Maximum Wind Speed (m/s, 30-min)
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30°
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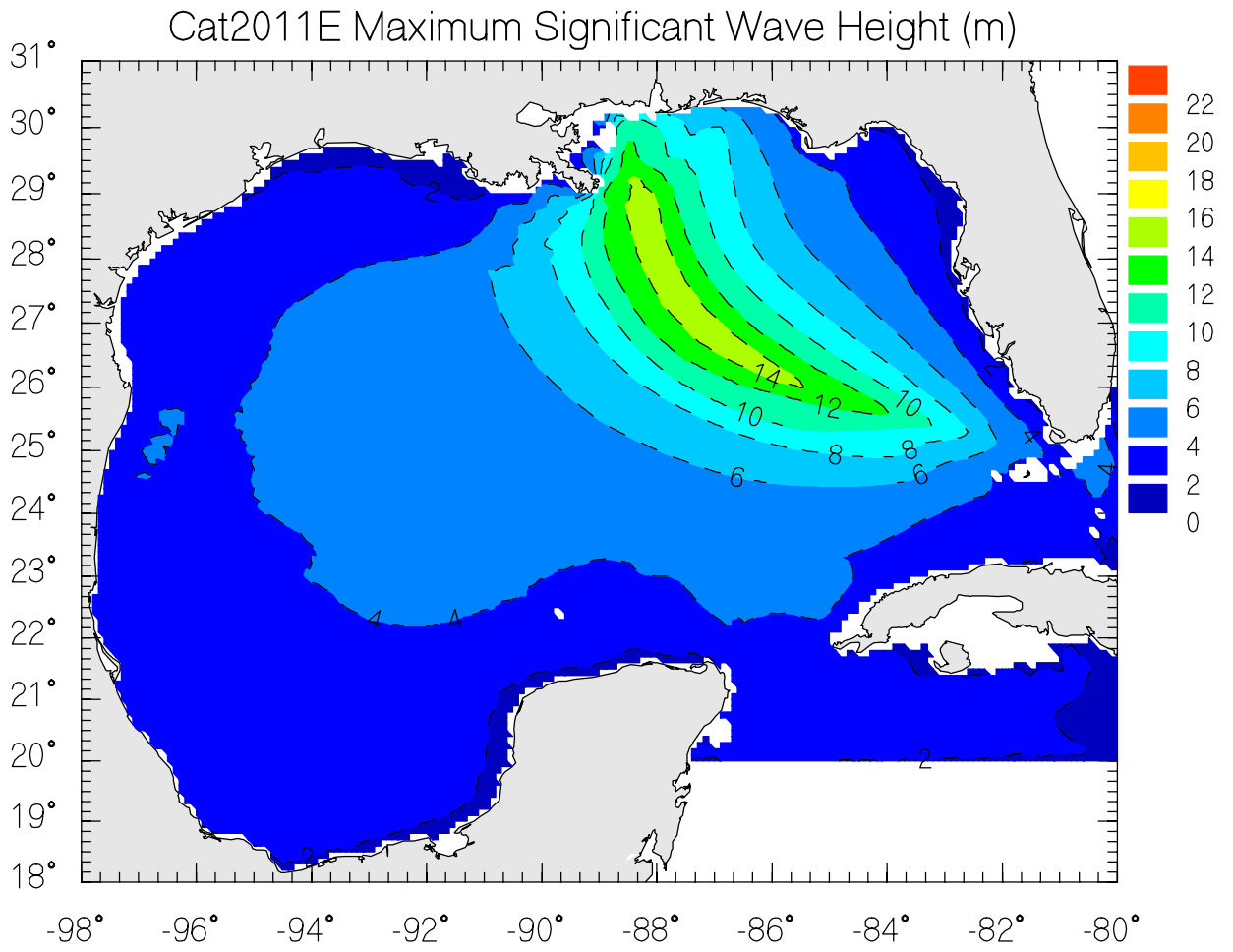
Cat2011E Maximum Significant Wave Height (m)
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19°
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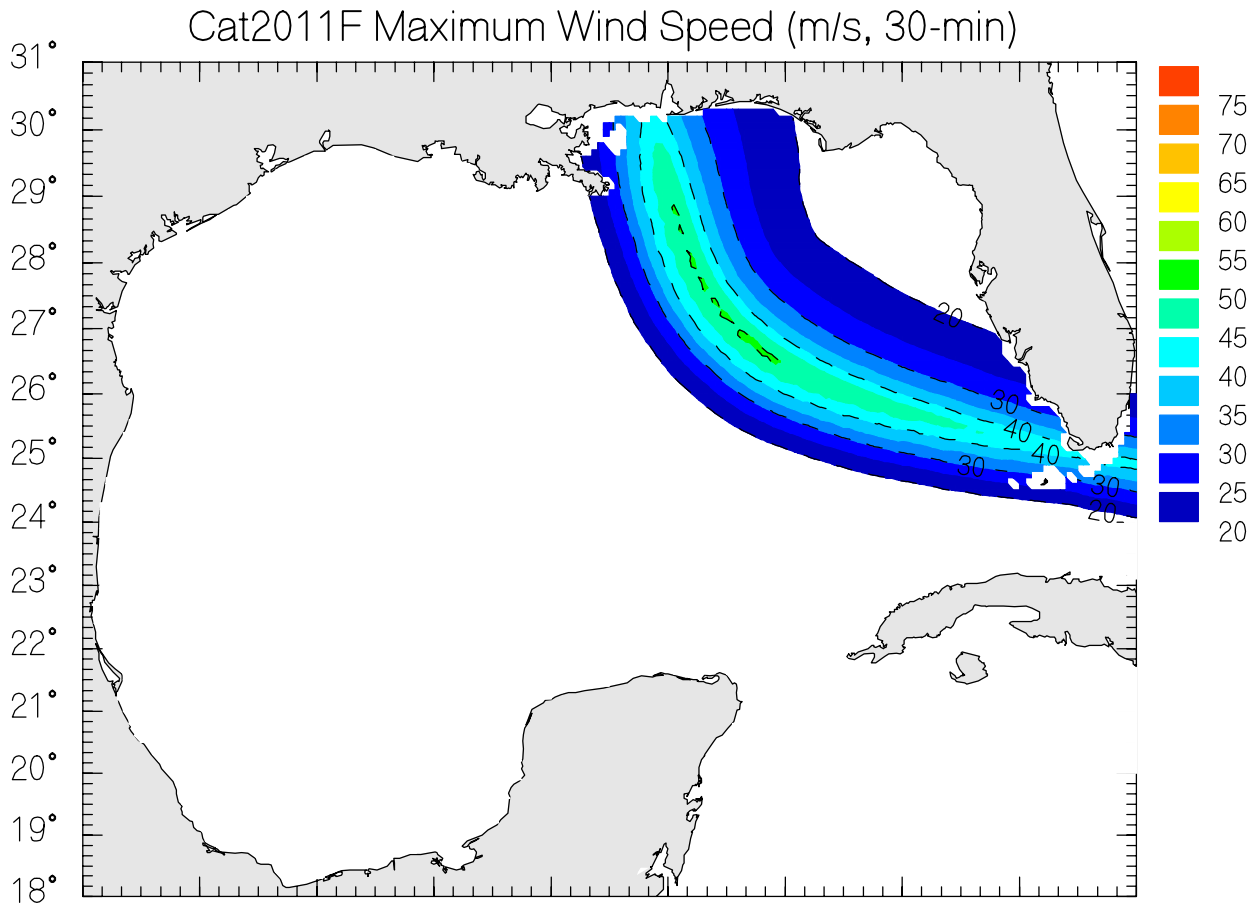
Cat2011F Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
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20°
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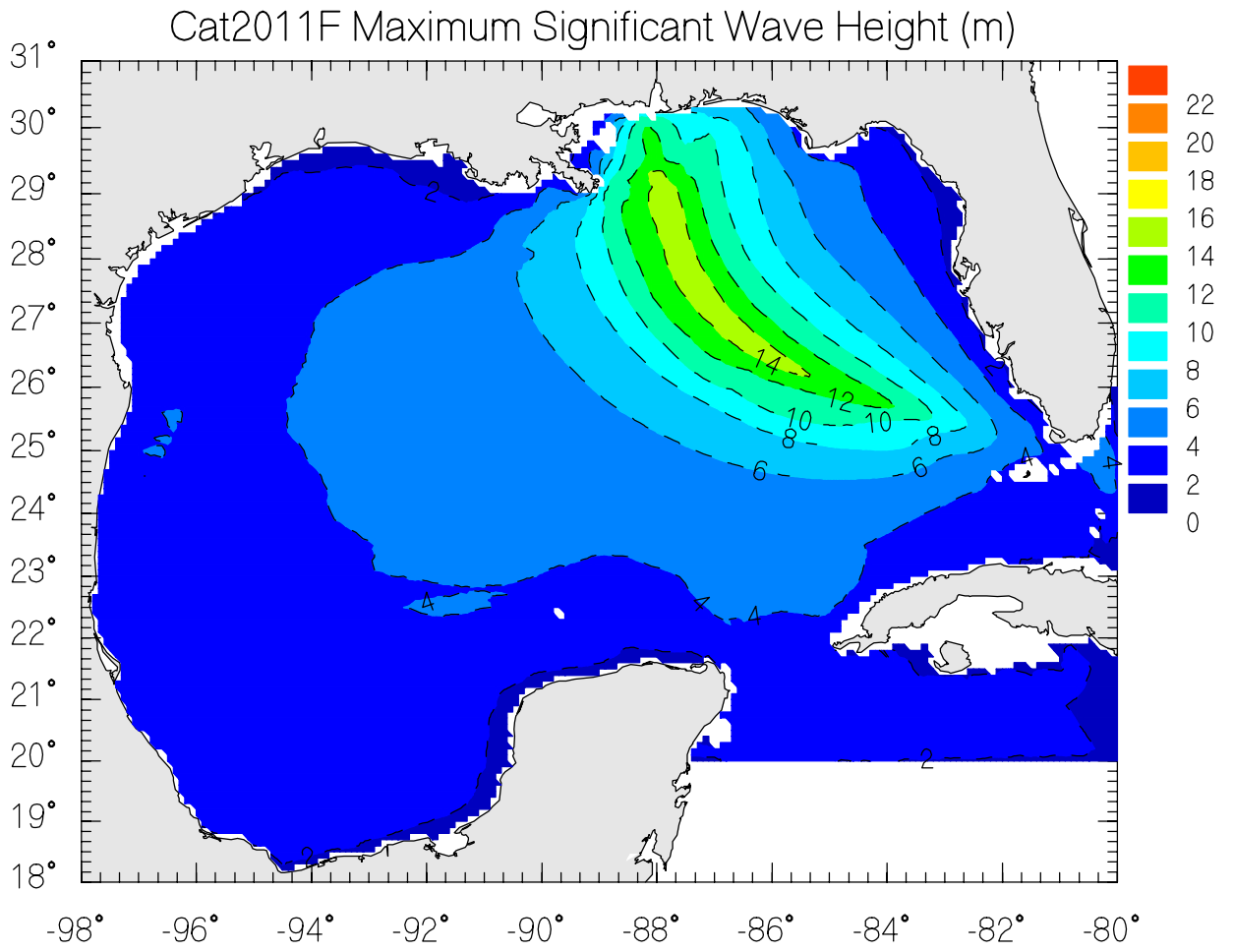
Cat2011F Maximum Significant Wave Height (m)
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-86°
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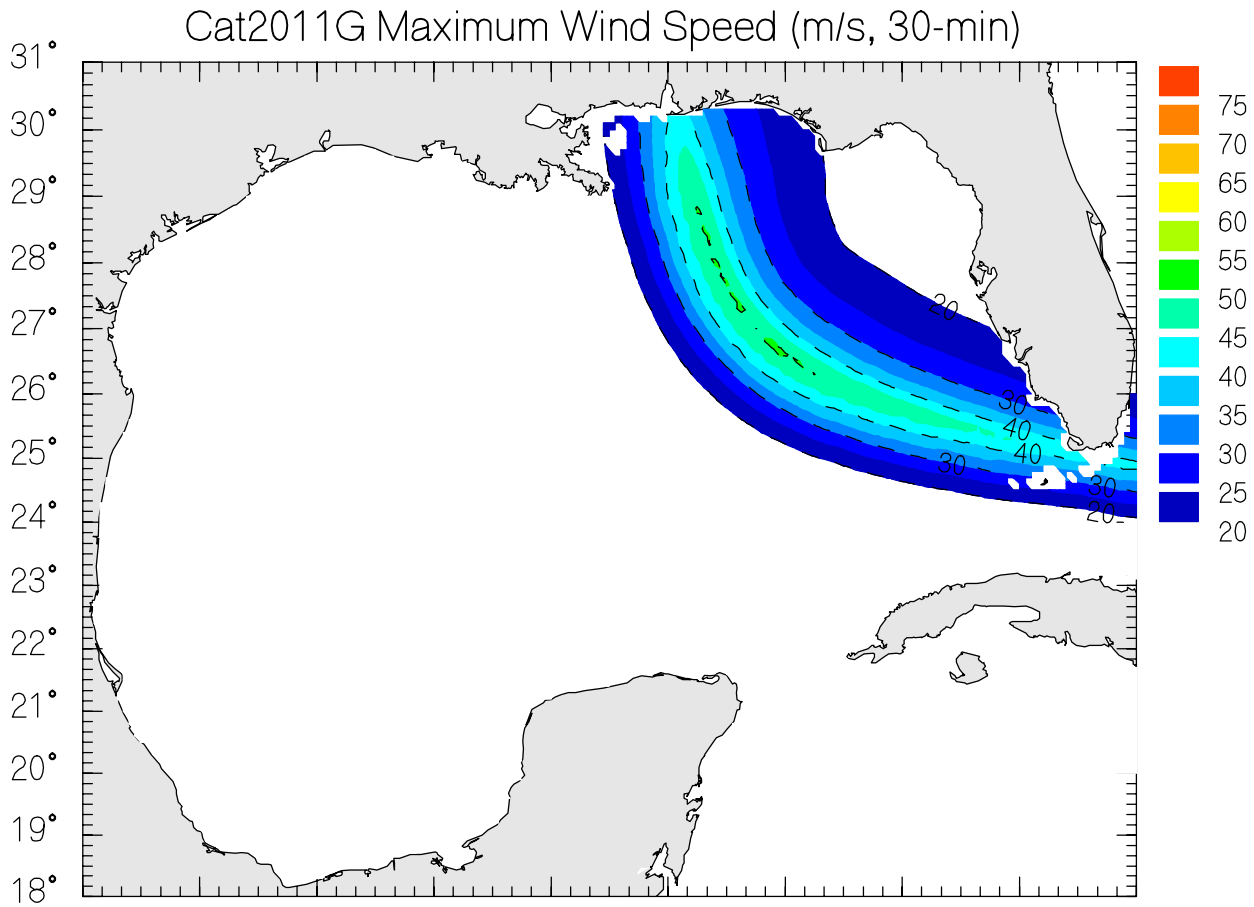
-80°


Cat2011G Maximum Wind Speed (m/s, 30-min)
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29°
28°
27°
26°
25°
24°
23°
22°
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20°
19°
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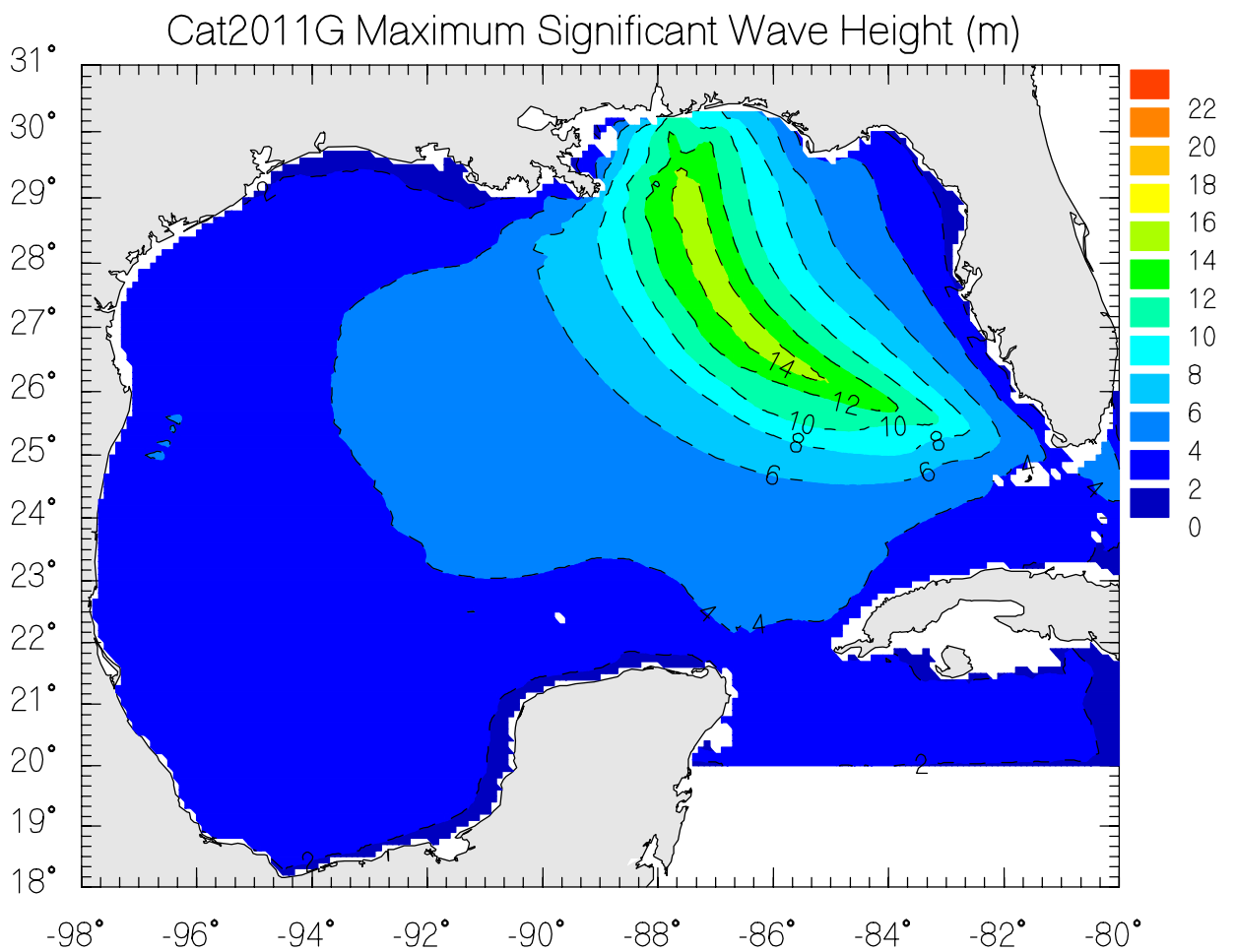
Cat2011G Maximum Significant Wave Height (m)
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30°
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21°
20°
19°
18°
22
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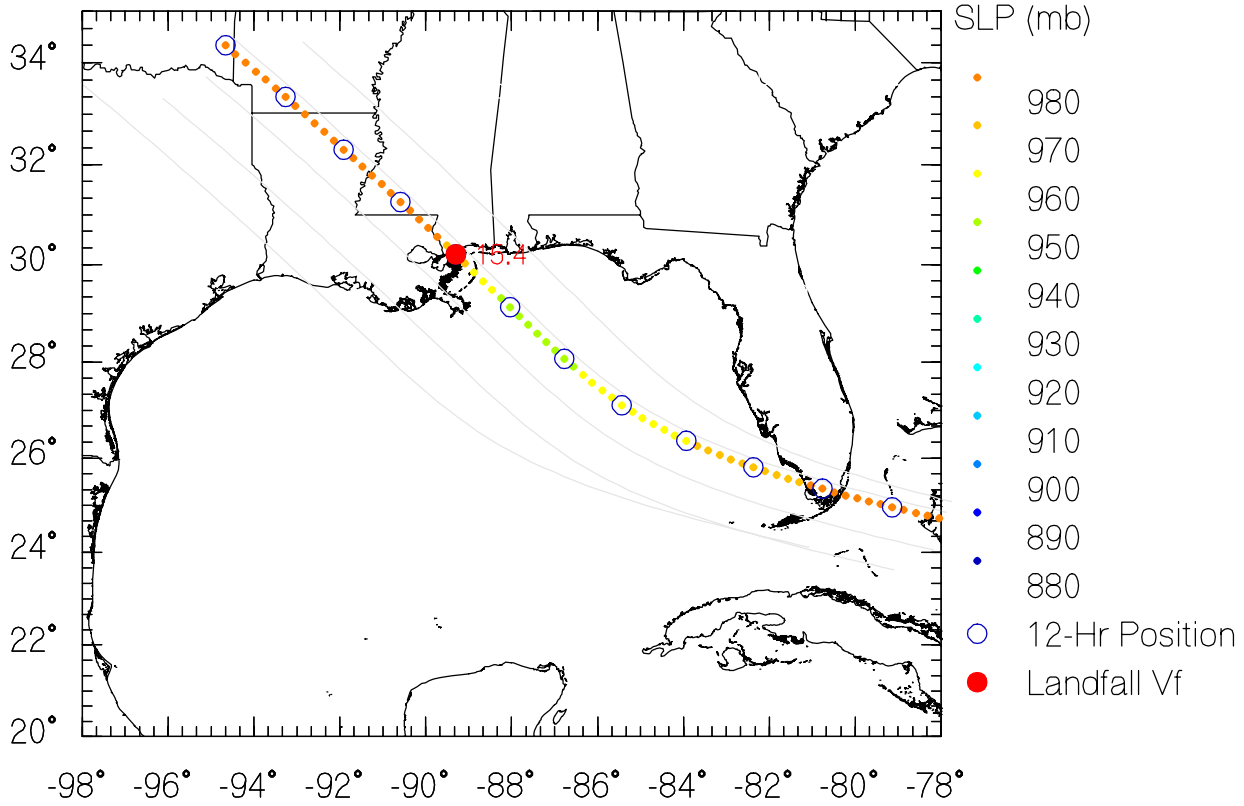
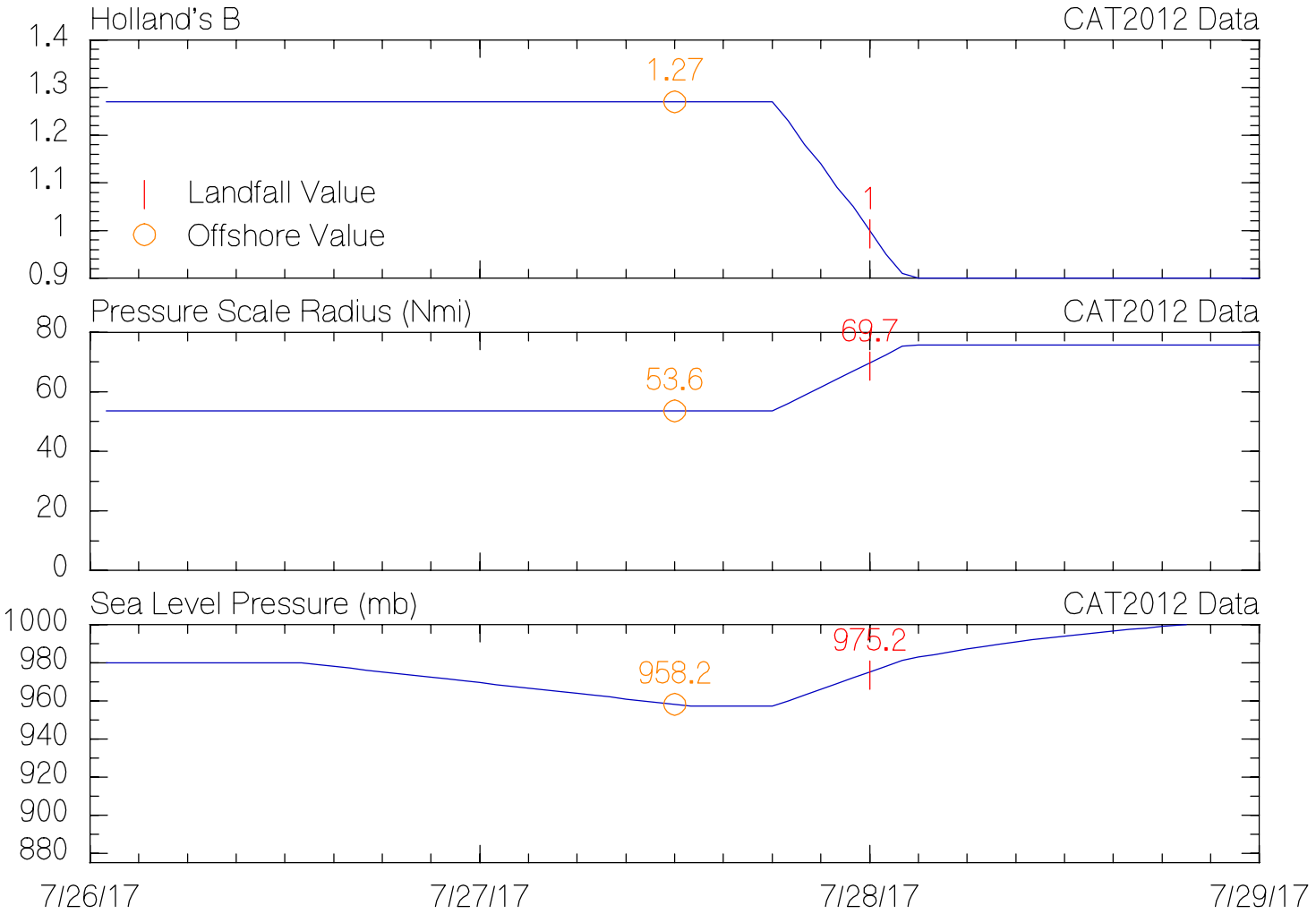
-84°
-82°
-80°

CAT2012 Data

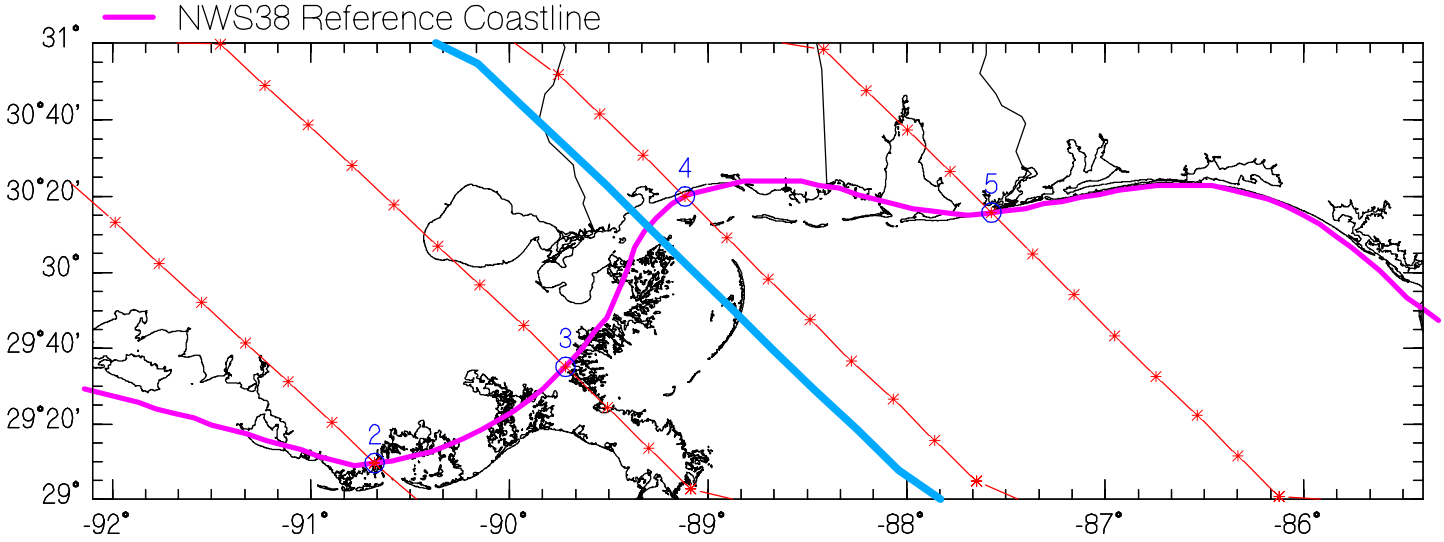


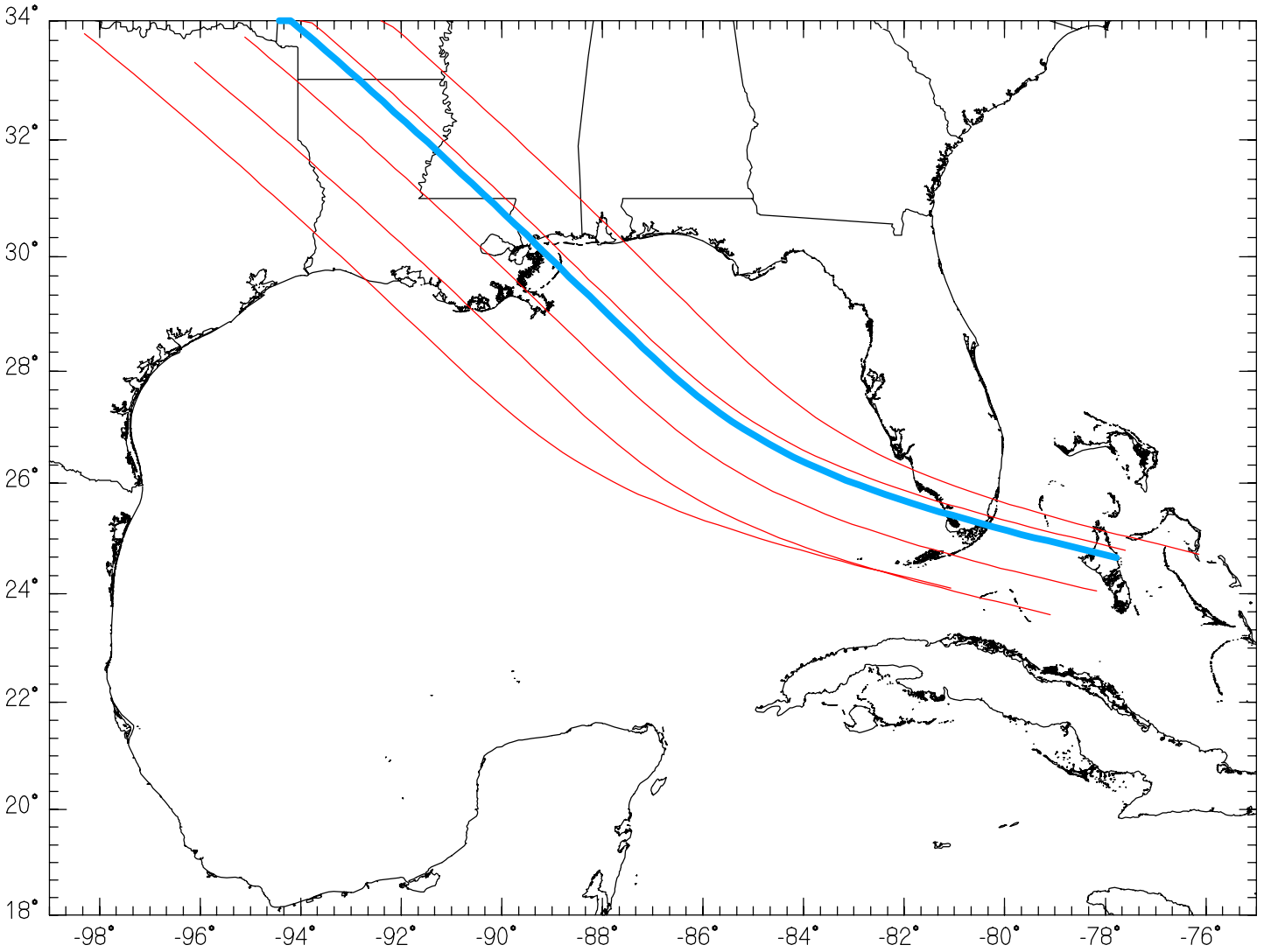


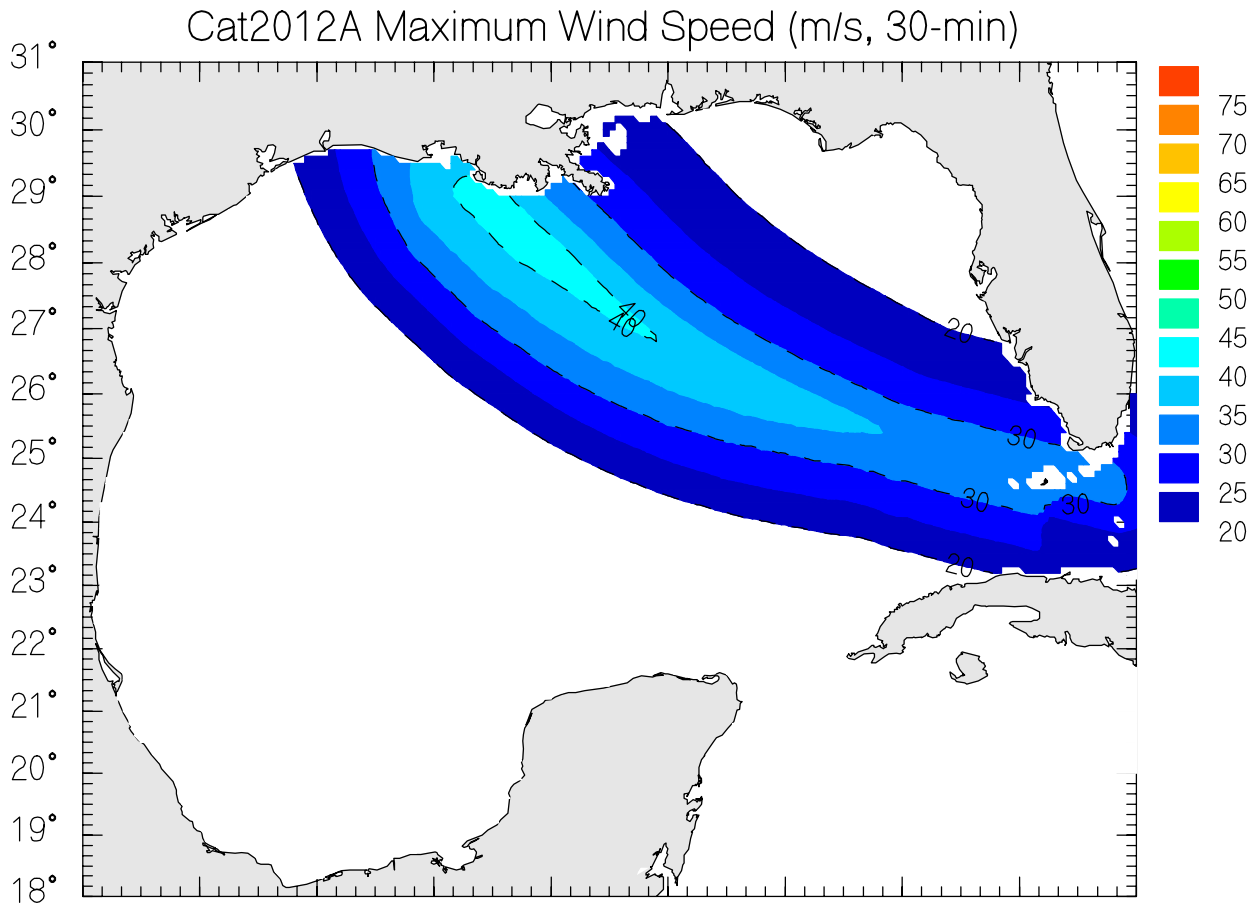
URS JPM-OS6 Production Tracks

CAT2012 Data

Reference Track
Production Tracks
Production Track Landfall
NWS38 Reference Coastline






Cat2012A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
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23°
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21°
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18°
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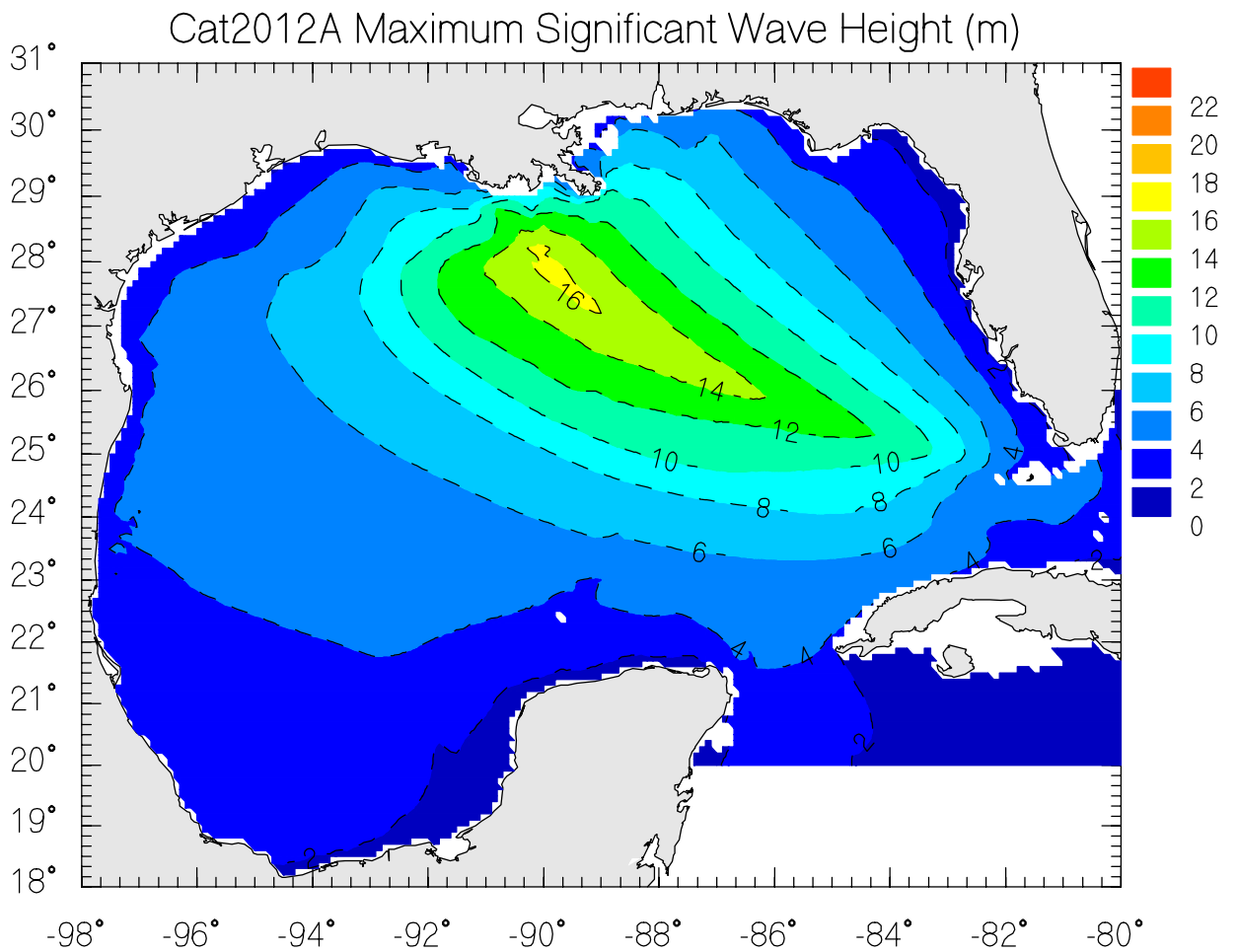
Cat2012A Maximum Significant Wave Height (m)
31°
30°
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19°
18°
-98°
-96°
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-92°
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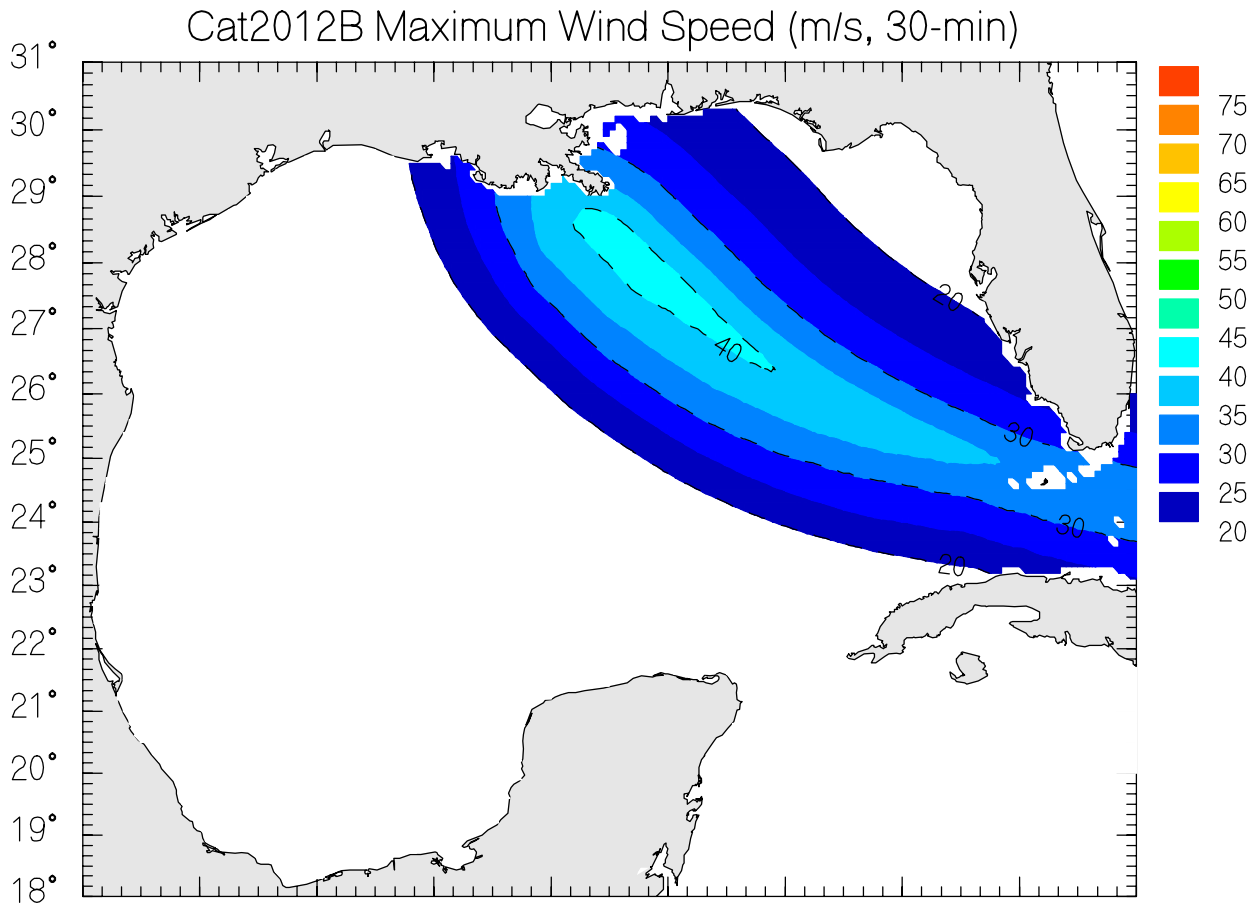
Cat2012B Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
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23°
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21°
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18°
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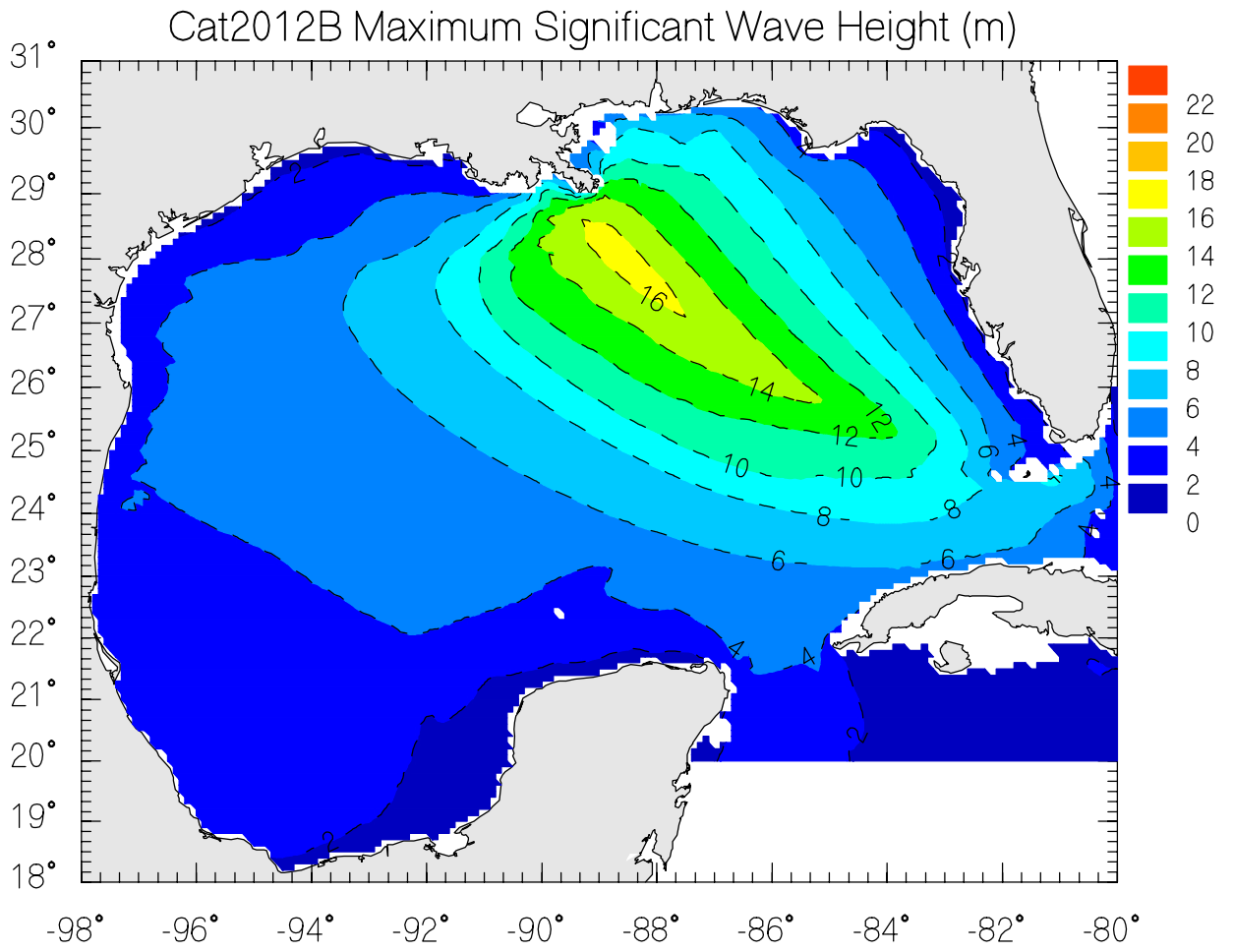
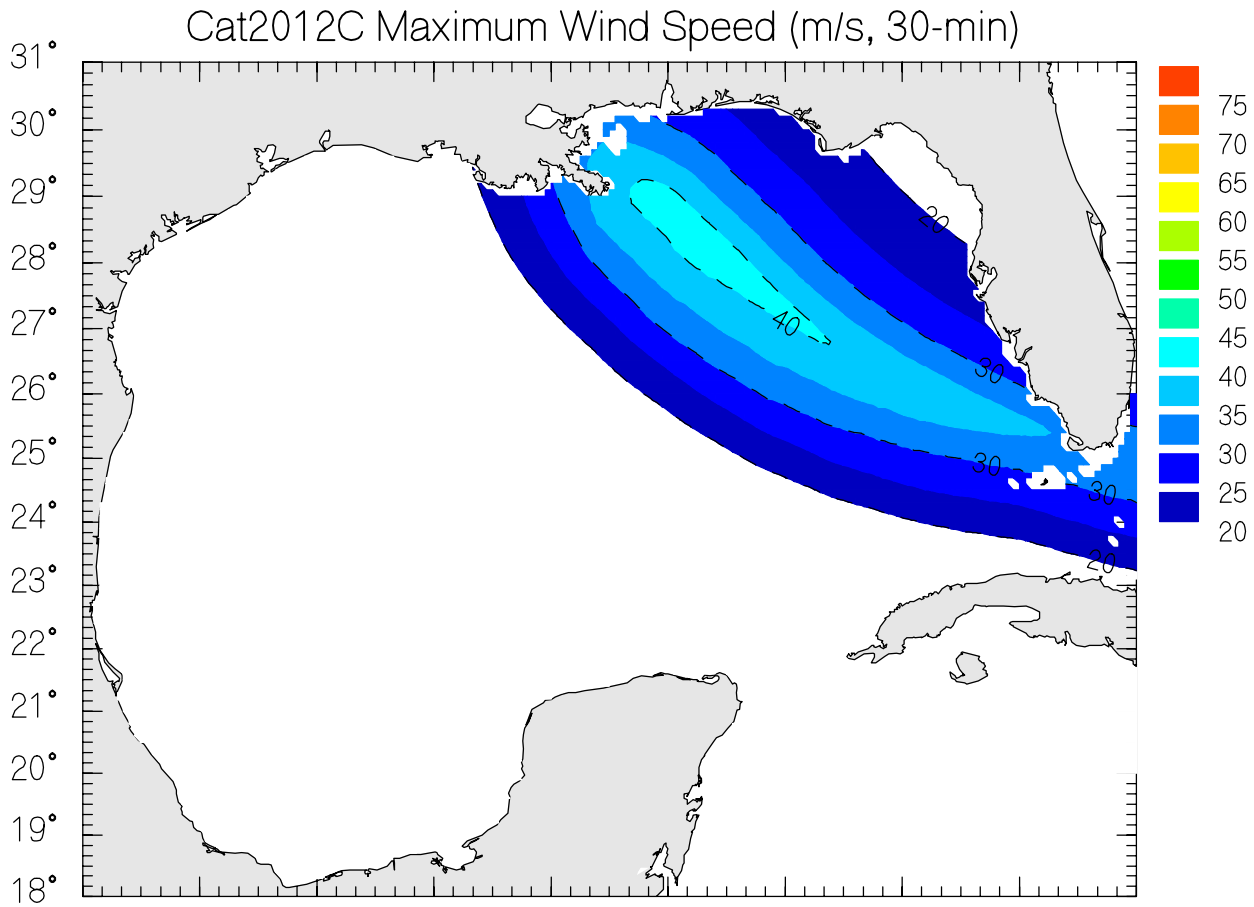
20
20


Cat2012B Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
10
8
6
4
2
0
16
14
12
12
10
10
8
8
6
6
4
4
2
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


Cat2012C Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
75
70
65
60
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45
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35
30
25
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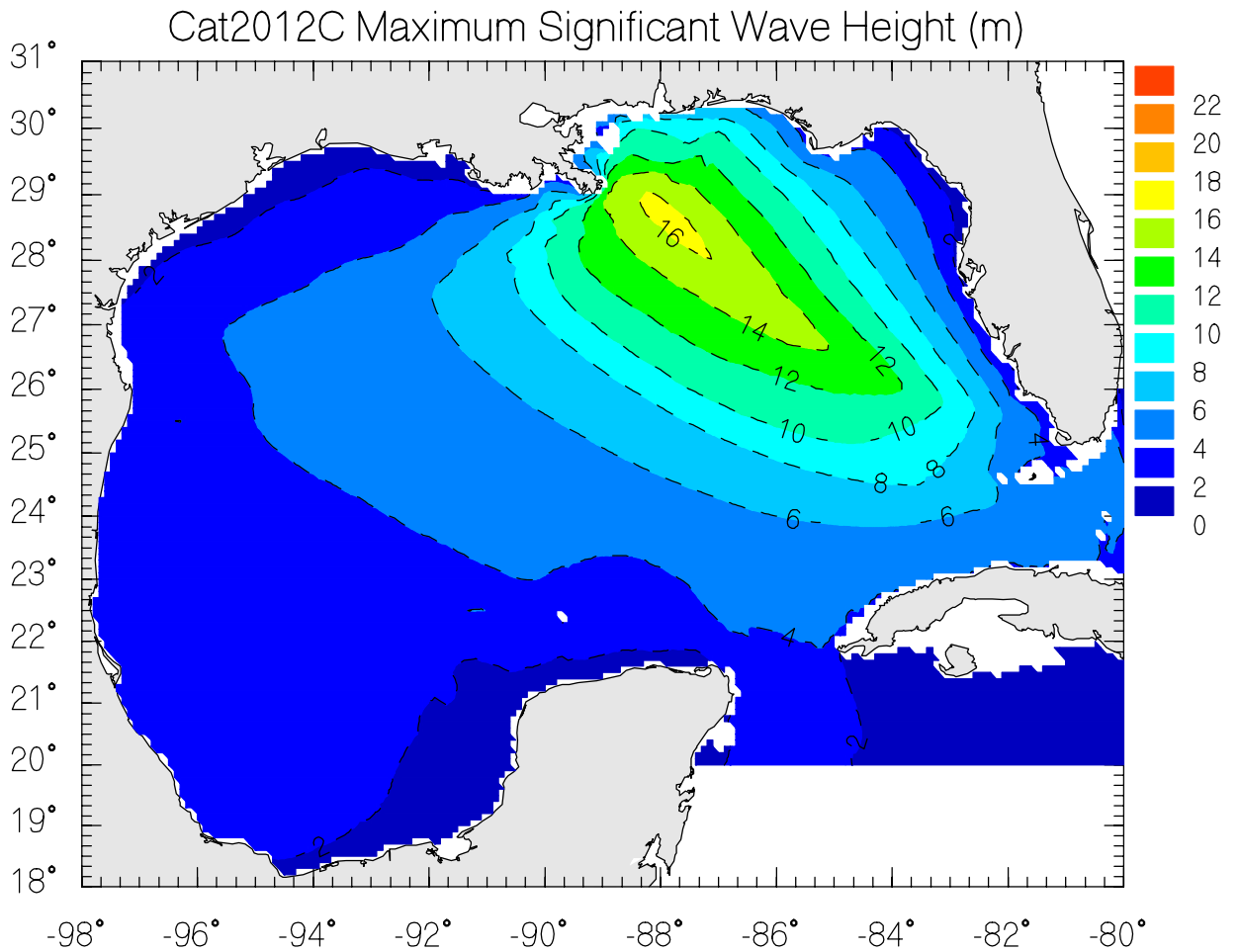
40
30
30
30
20
20


Cat2012C Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
22
20
18
16
14
12
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8
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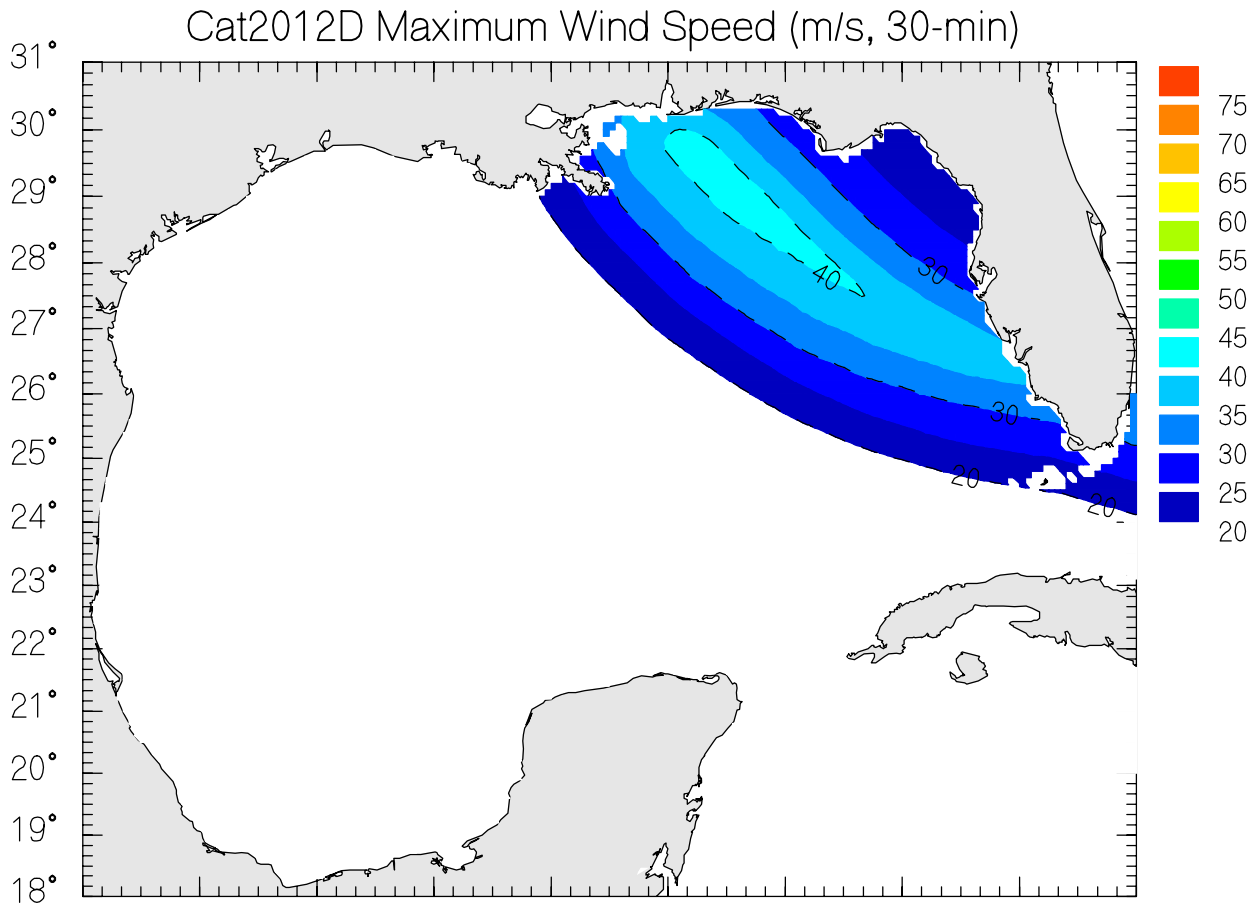
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°


Cat2012D Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
40
30
30
20
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75
70
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55
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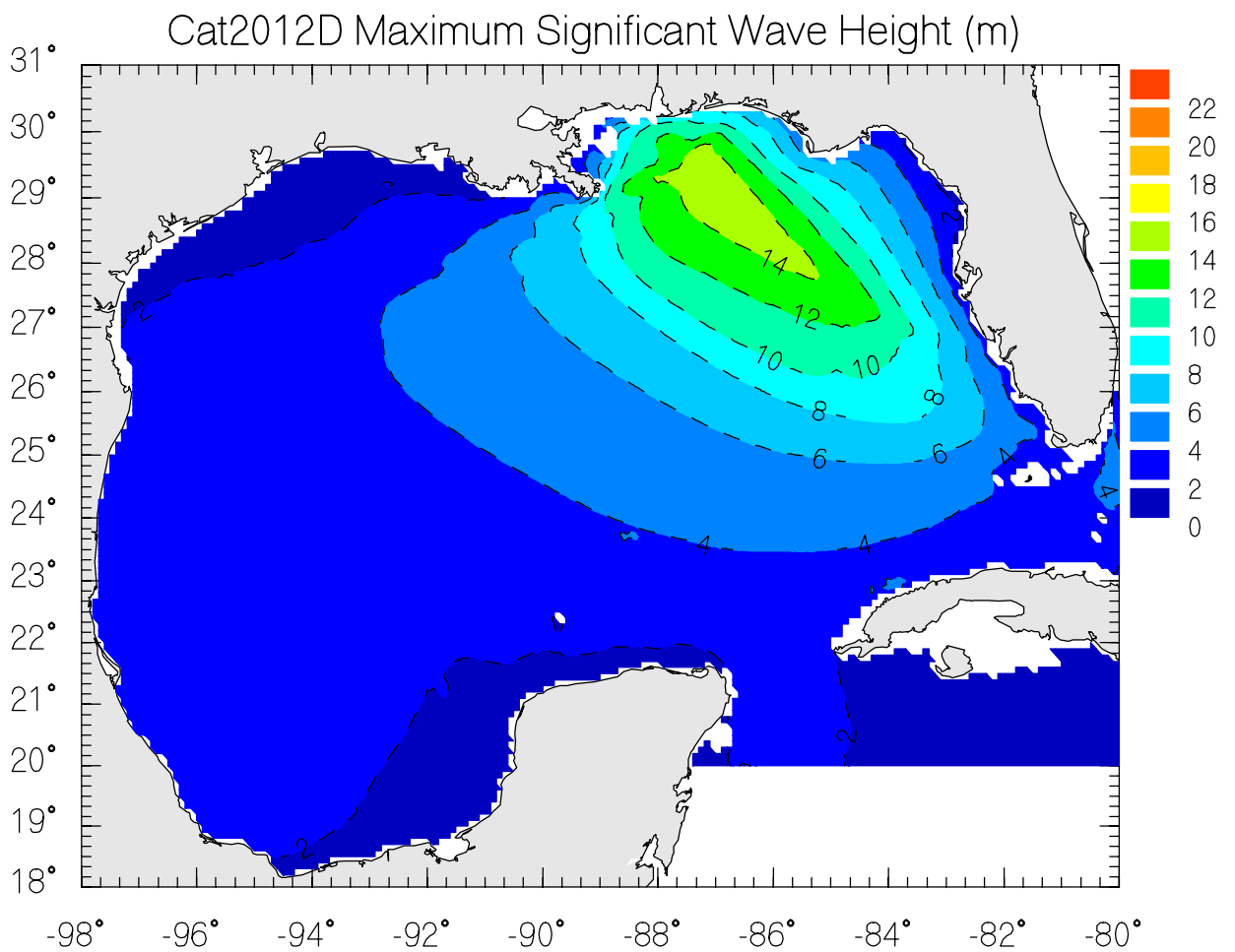
45
40
35
30
25
20


Cat2012D Maximum Significant Wave Height (m)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
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19°
18°
-98°
-96°
-94°
-92°
-90°
-88°
-86°
-84°
-82°
-80°
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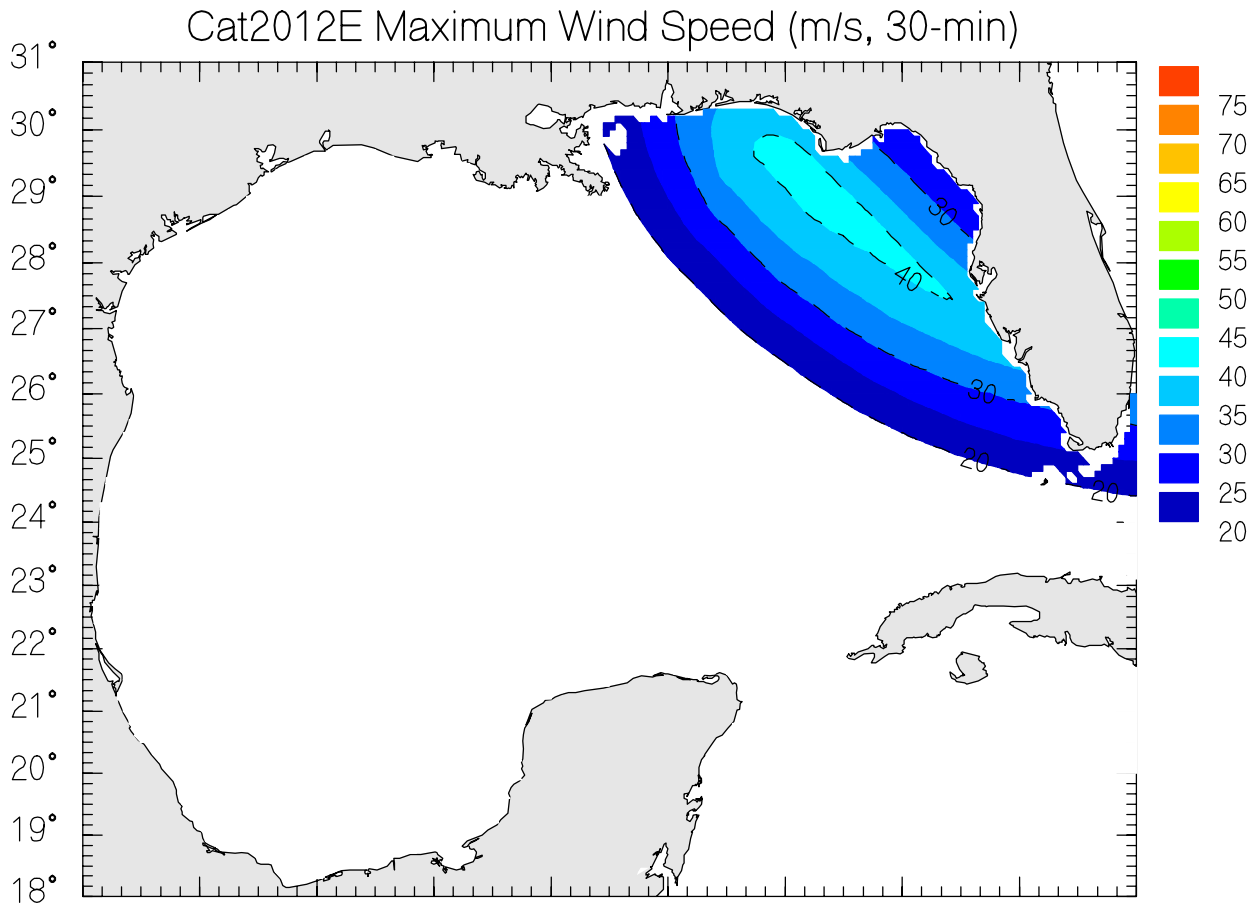
Cat2012E Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
18°
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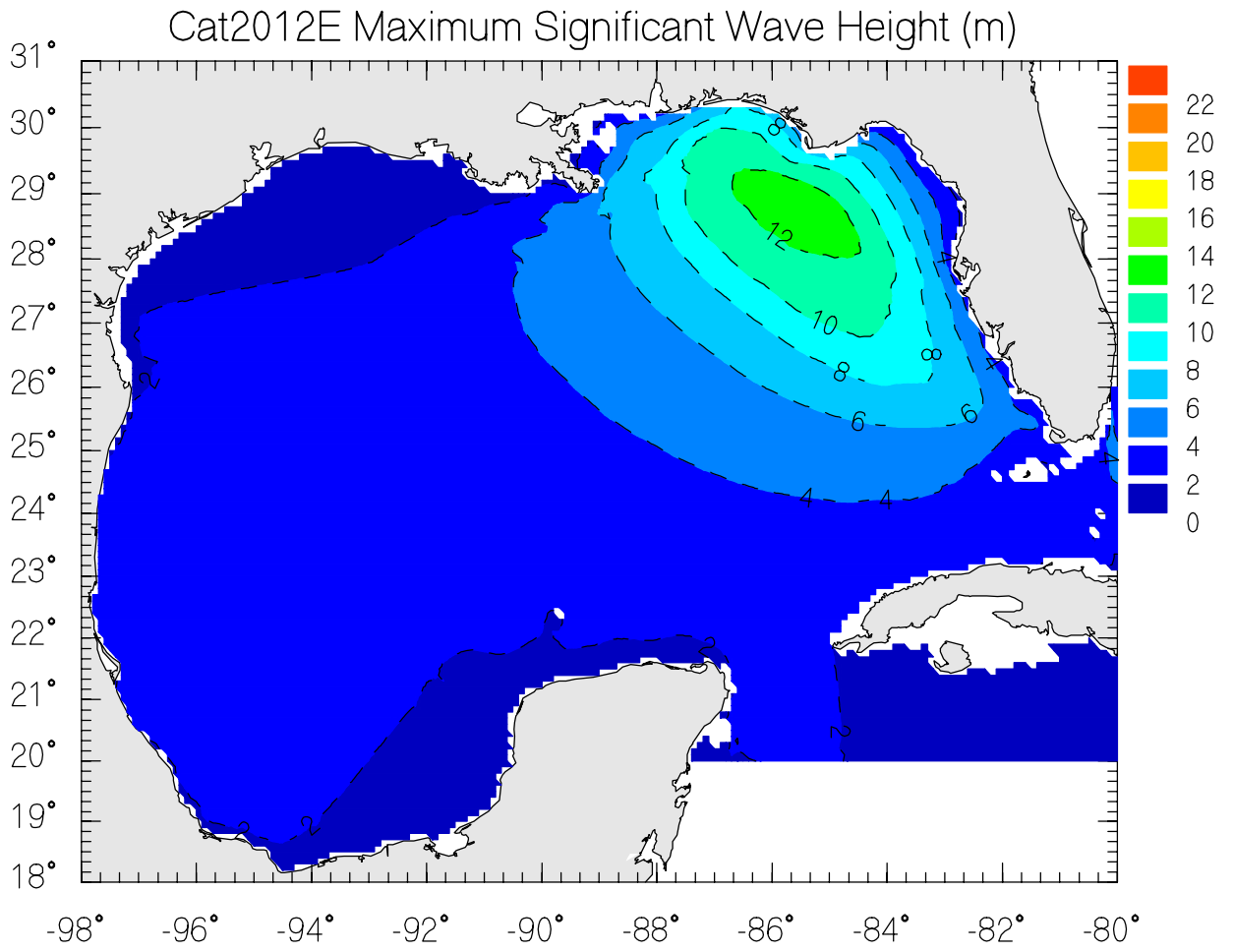
Cat2012E Maximum Significant Wave Height (m)
31°
30°
29°
28°
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26°
25°
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23°
22°
21°
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18°
-98°
-96°
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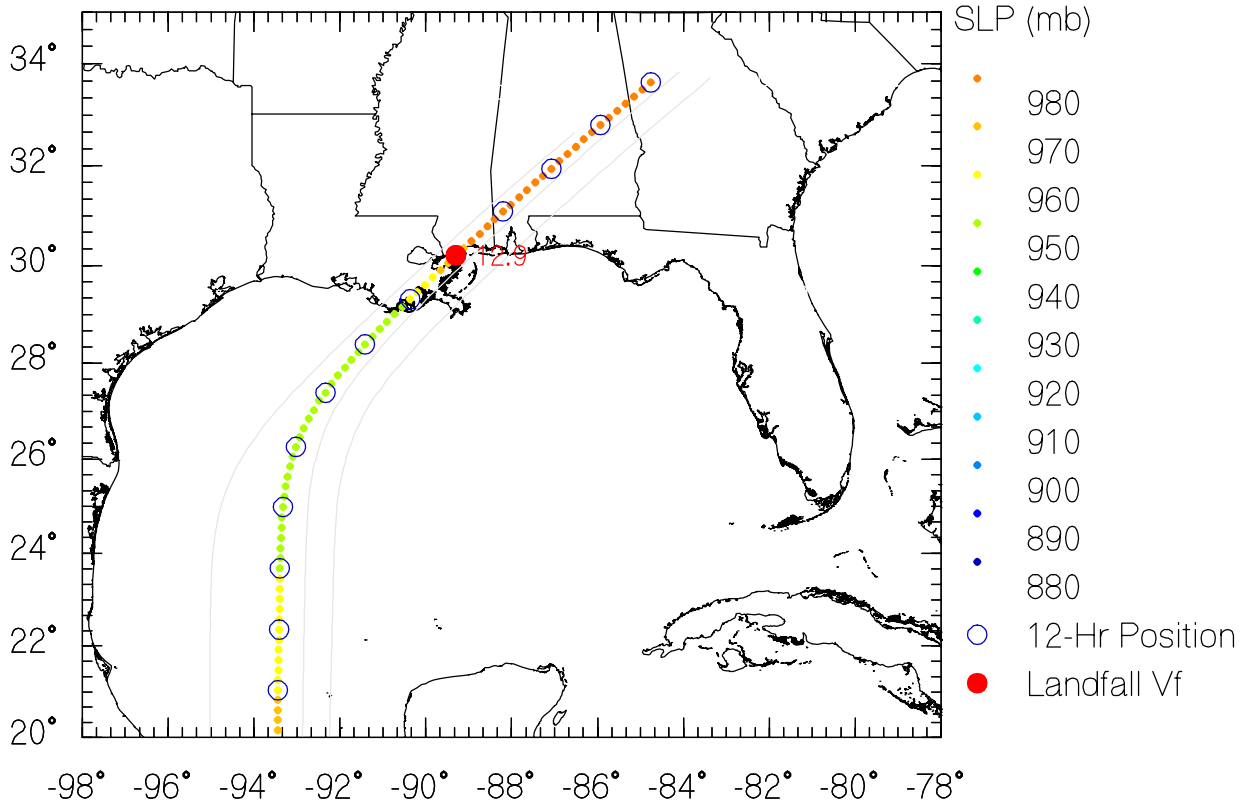
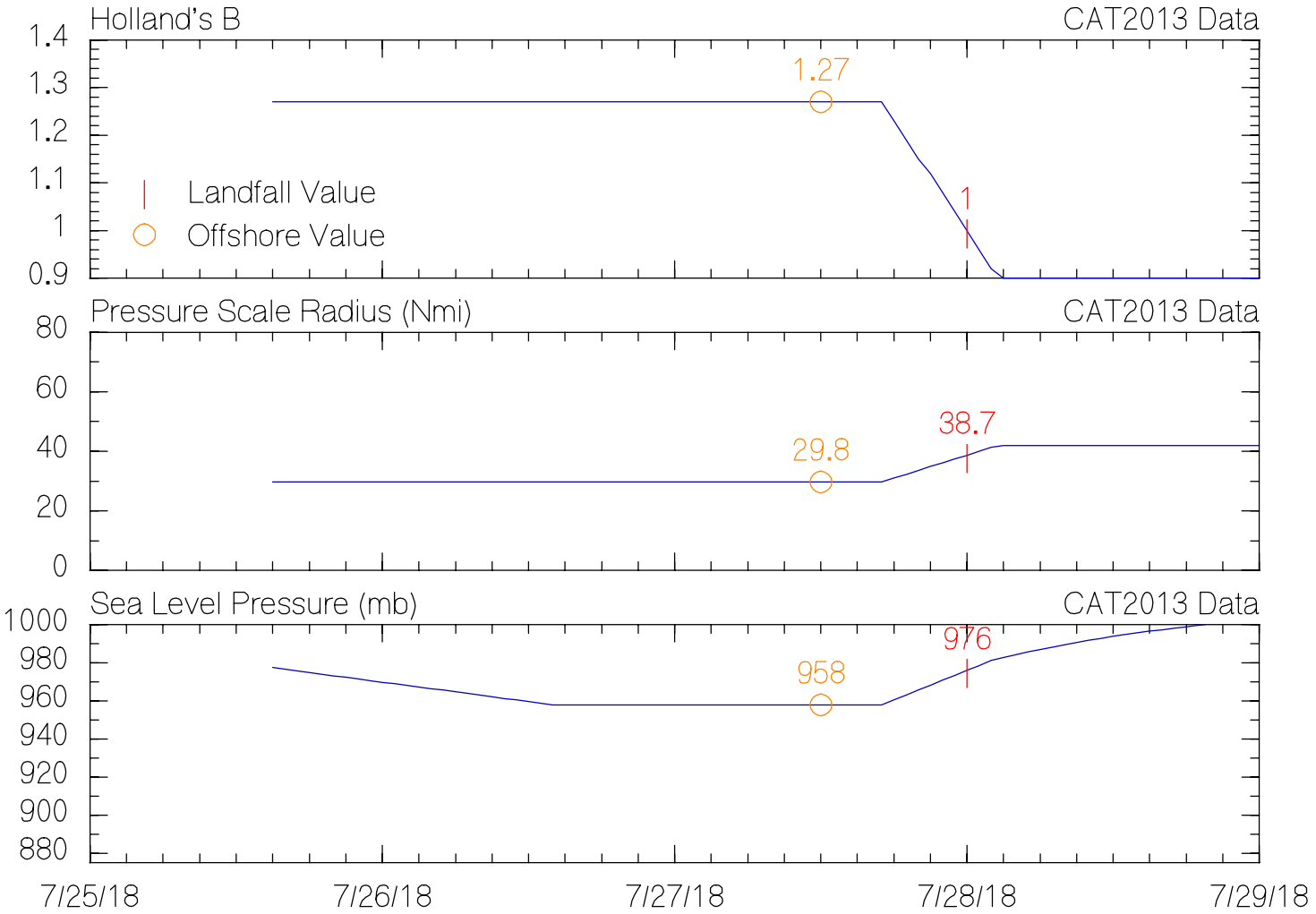
CAT2013 Data



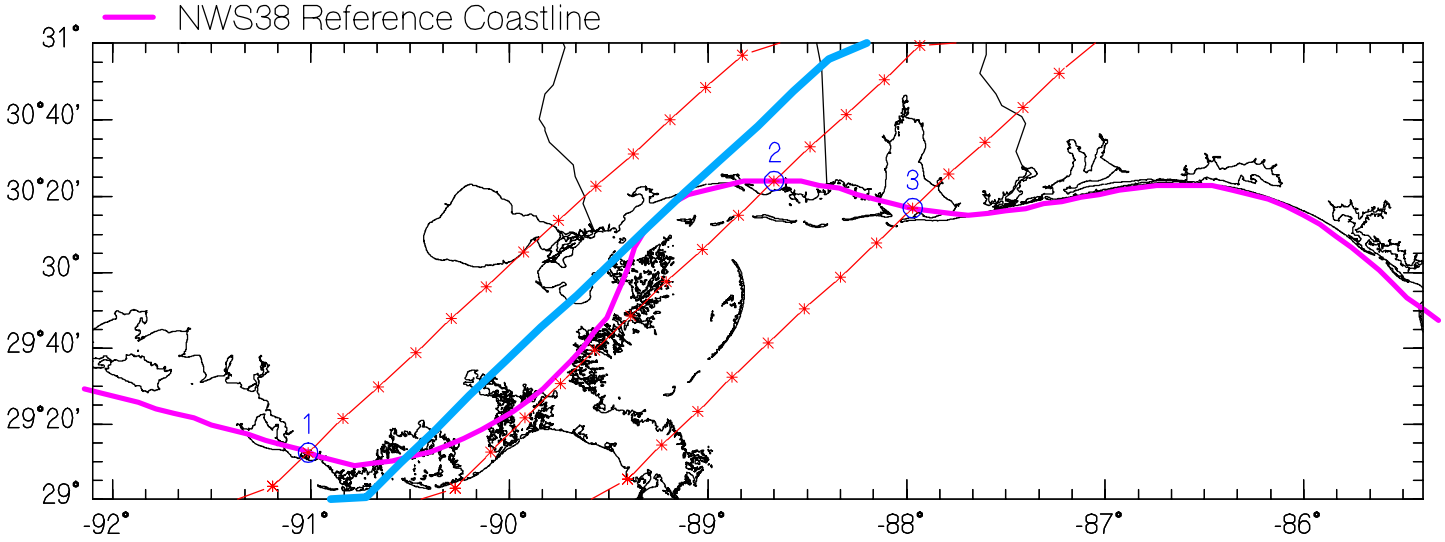


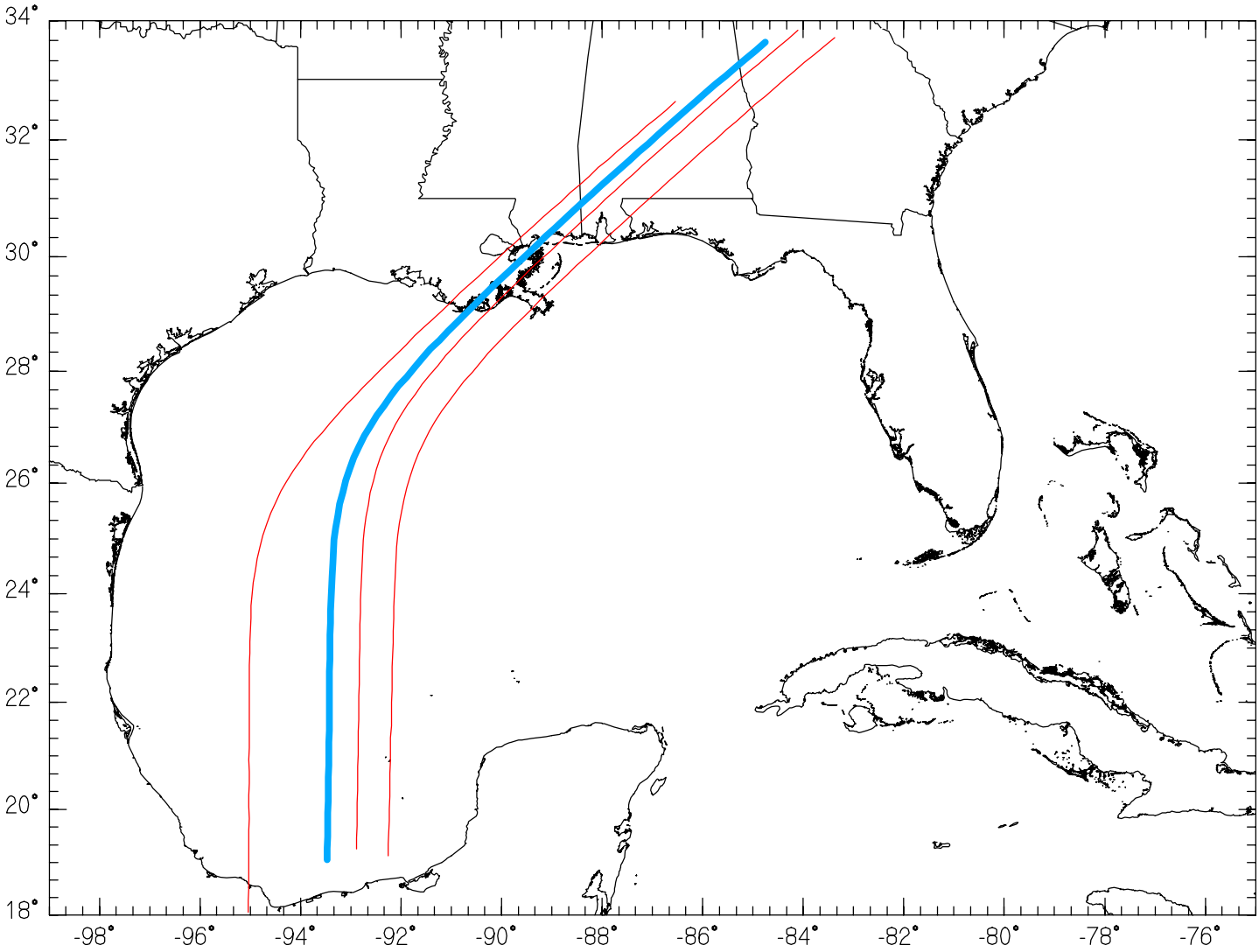
URS JPM-OS6 Production Tracks

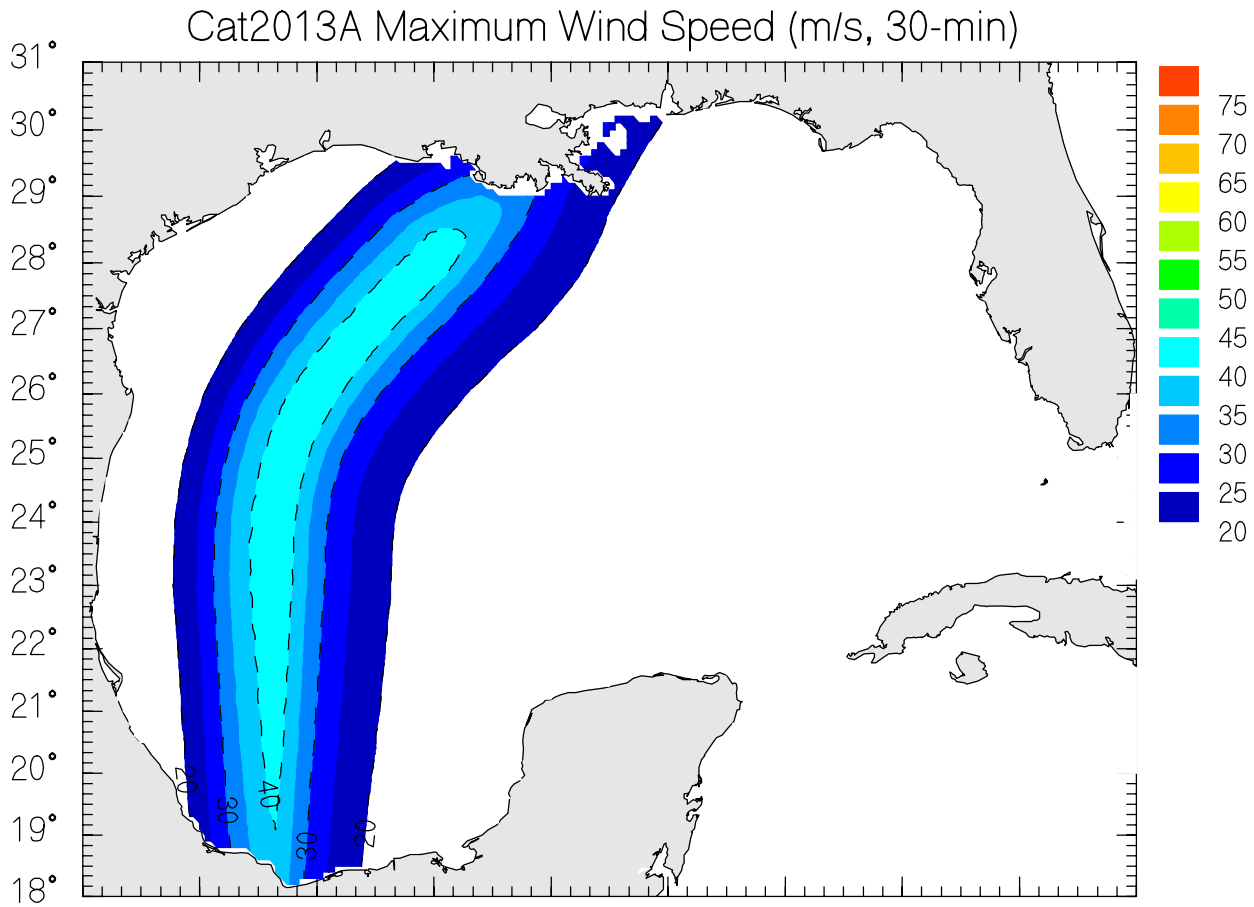
CAT2013 Data

Reference Track — Production Tracks — Production Track Landfall

NWS38 Reference Coastline






Cat2013A Maximum Wind Speed (m/s, 30-min)
31°
30°
29°
28°
27°
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21°
20°
19°
18°
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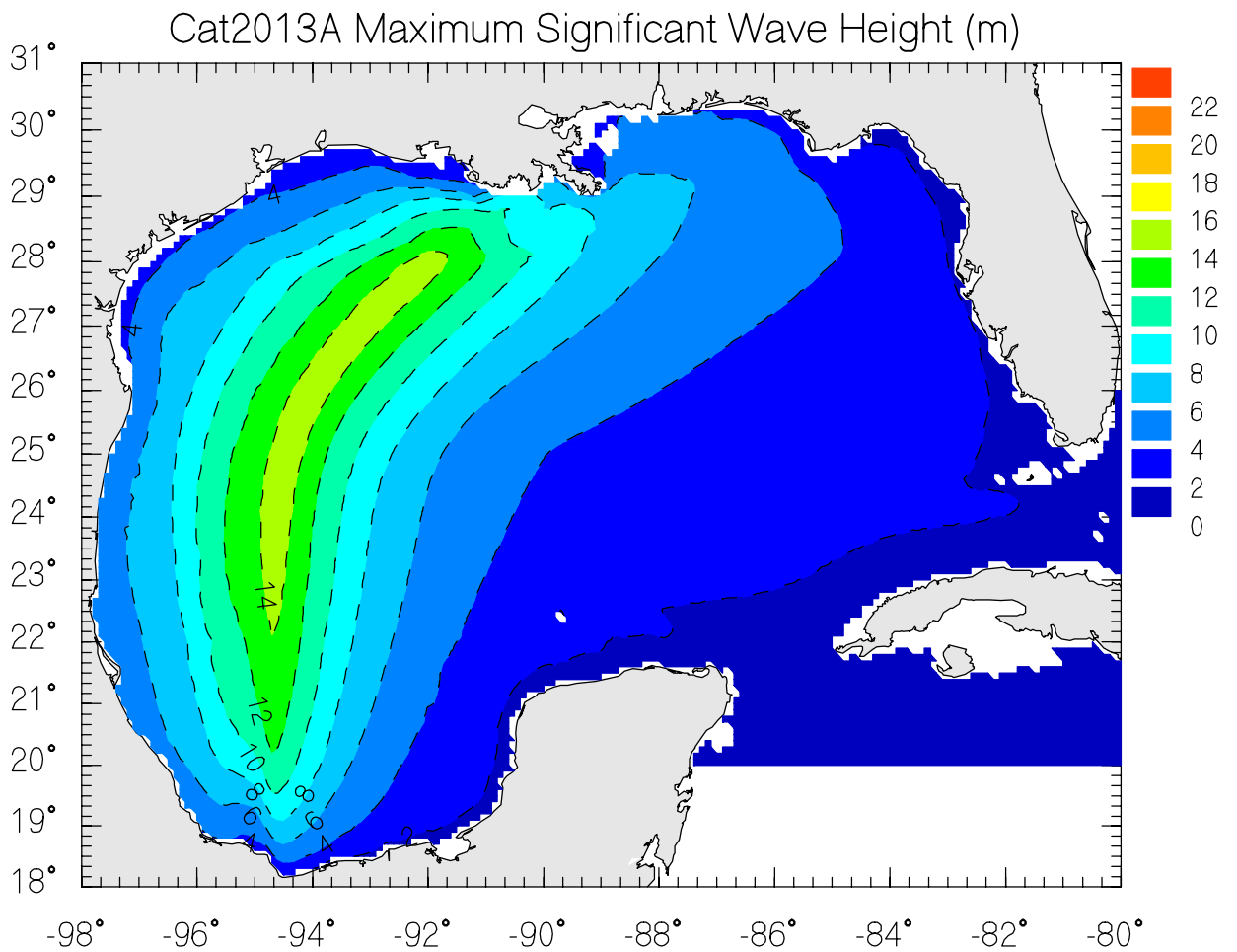
30
20


Cat2013A Maximum Significant Wave Height (m)
31°
30°
29°
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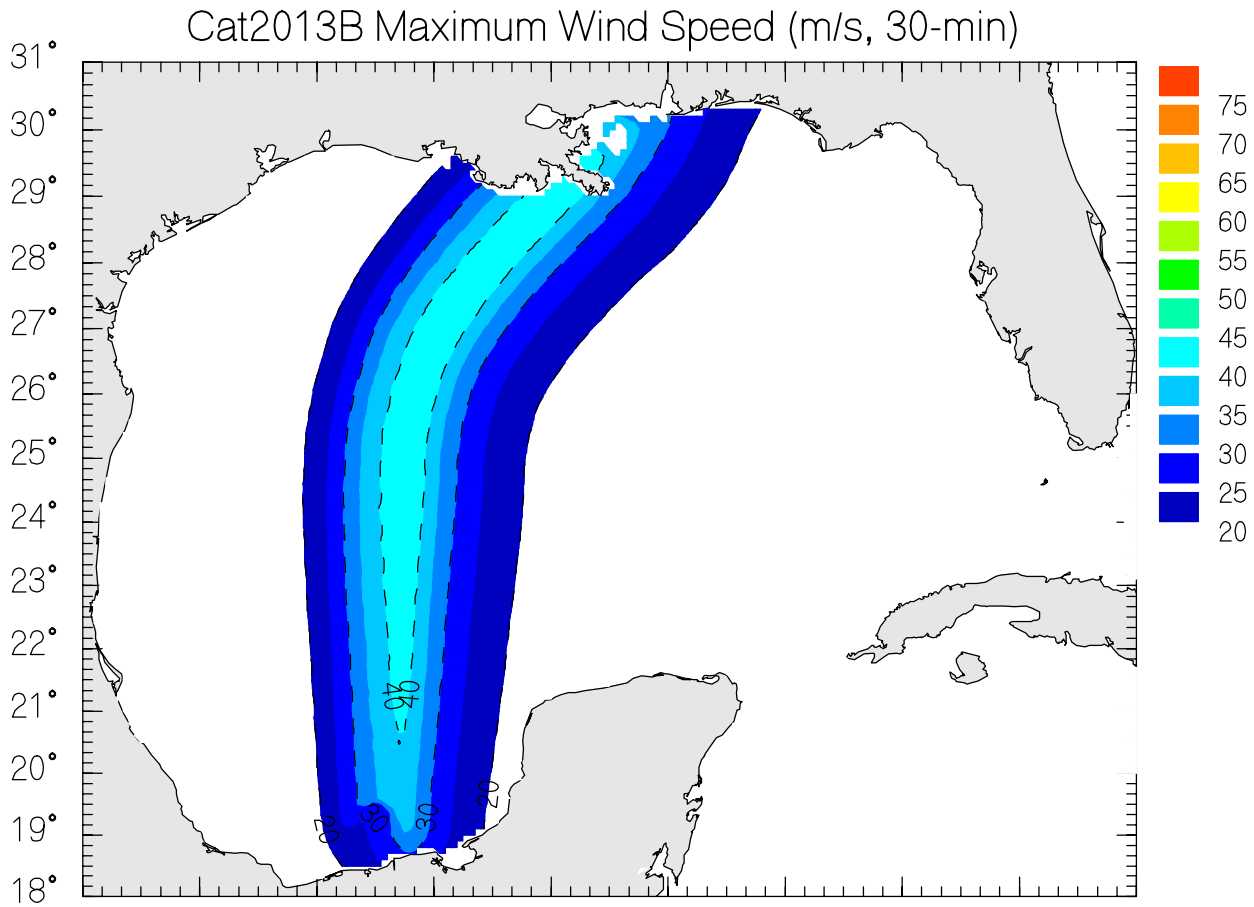
Cat2013B Maximum Wind Speed (m/s, 30-min)
31°
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20°
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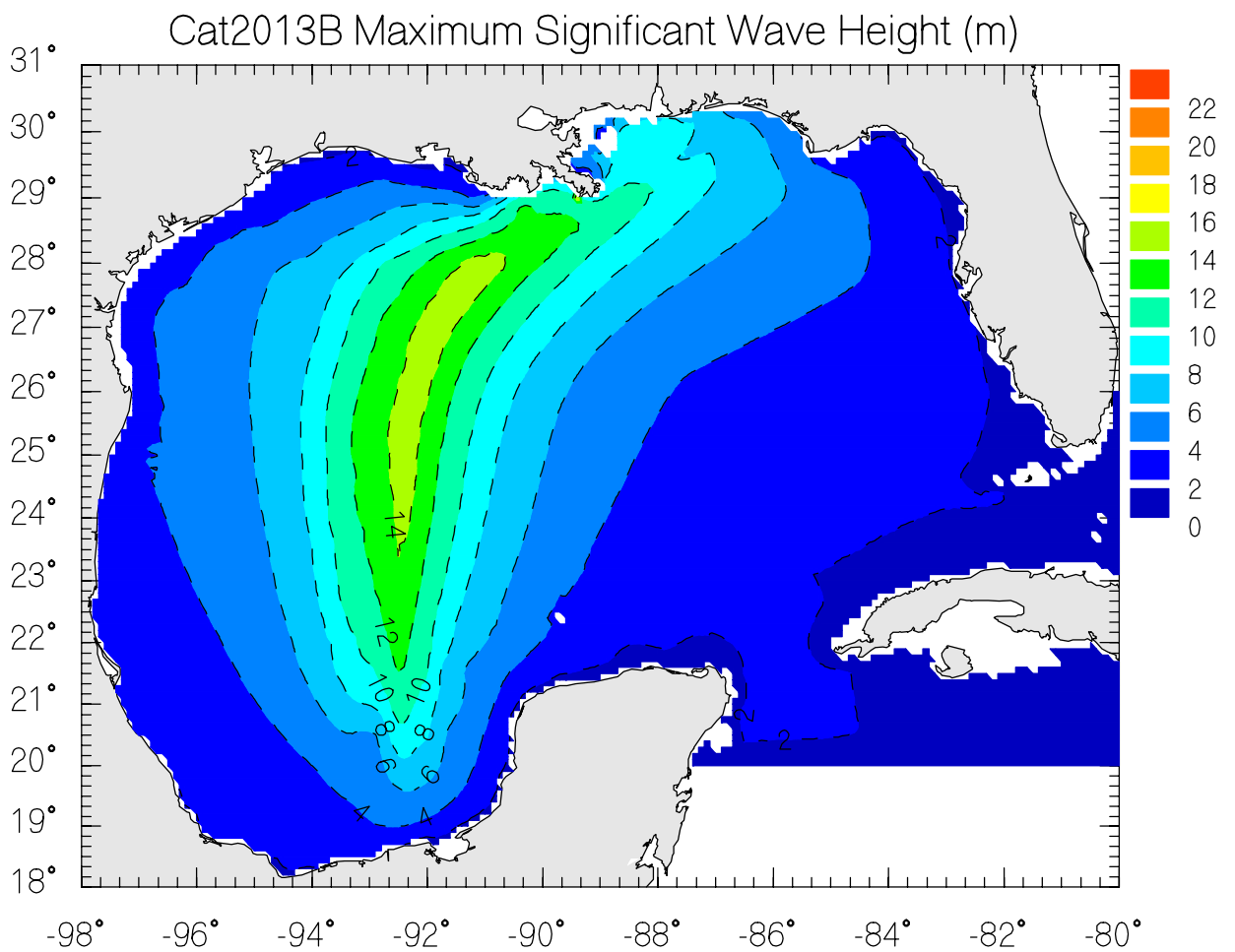
Cat2013B Maximum Significant Wave Height (m)
31°
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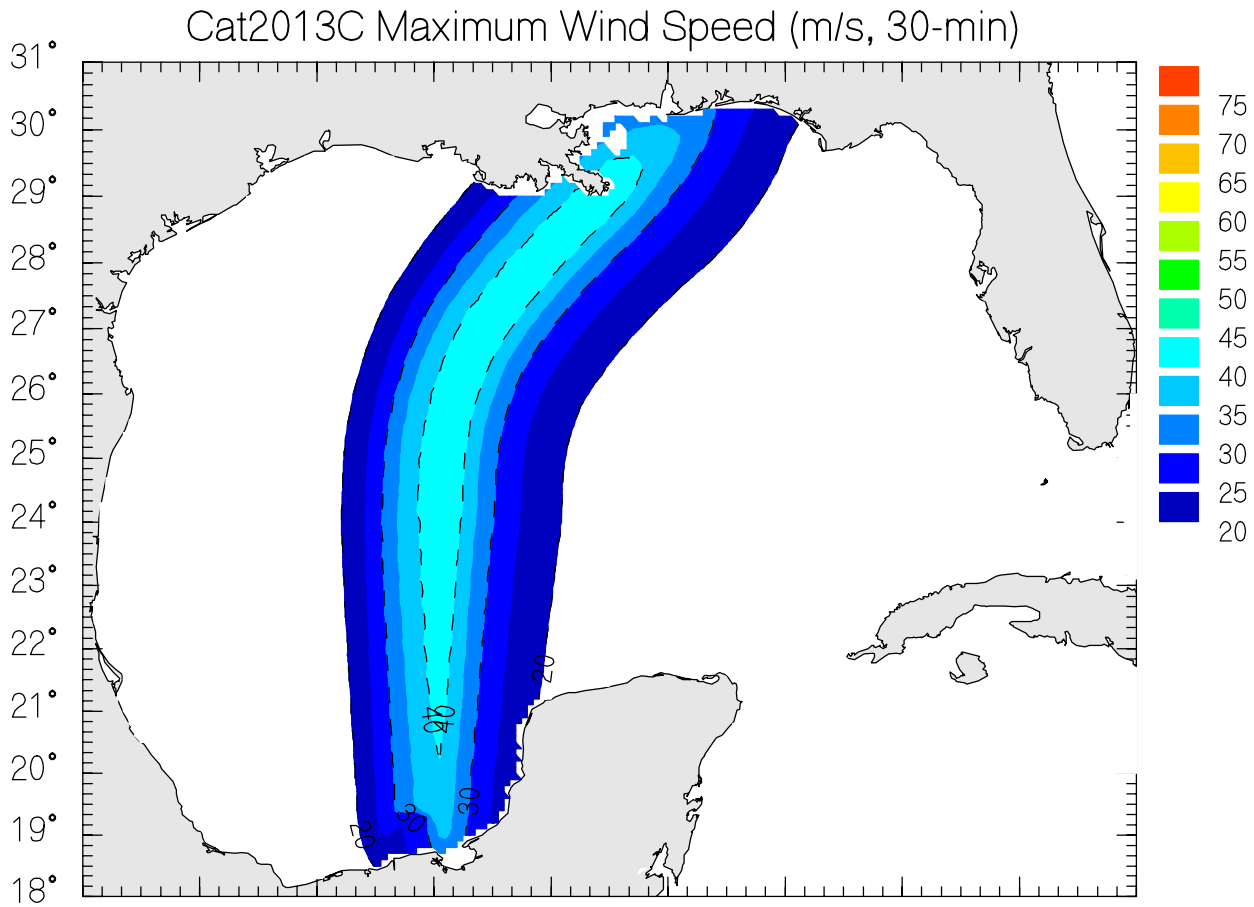
Cat2013C Maximum Wind Speed (m/s, 30-min)
31°
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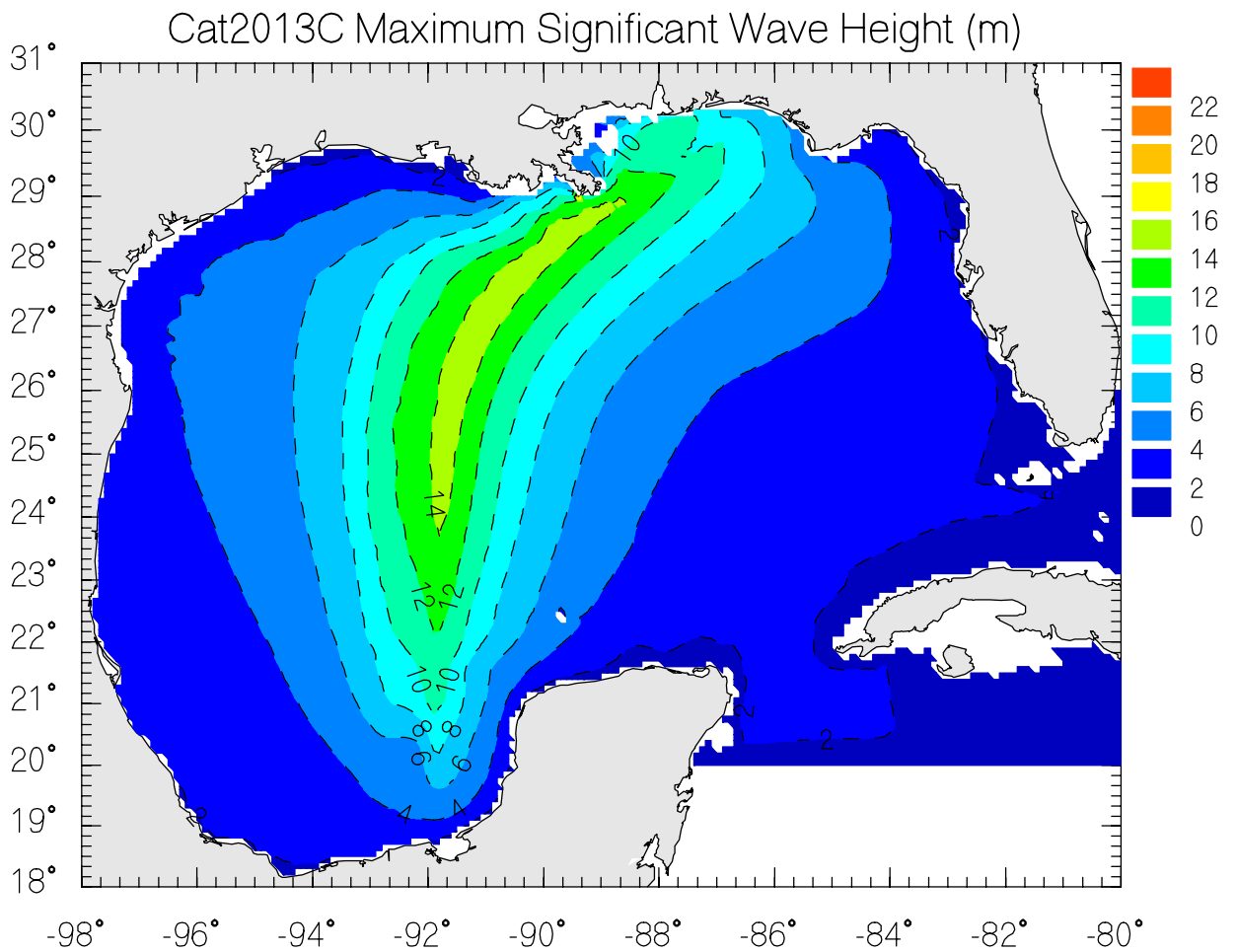
Cat2013C Maximum Significant Wave Height (m)
31°
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