

Hurricane Threat Grids in the NDFD

Product Description Document

Part I - Mission Connection

- a) Product Description – The National Weather Service (NWS) provides access to operational and experimental gridded forecasts of weather elements (e.g., maximum temperature, sky cover) through the National Digital Forecast Database (NDFD). The NDFD contains a seamless mosaic of digital forecasts from NWS Weather Forecast Offices (WFOs) working in collaboration with the National Centers for Environmental Prediction (NCEP), and is the primary means by which digital information is available to NWS customers and partners.

The following four Hurricane Threat grids are available in NDFD:

- WindThreat
- StormSurgeThreat
- FloodingRainThreat
- TornadoThreat

The Hurricane Threat grids provide the reasonable worst-case scenario, or “threat”, associated with each of the hazards. The grids implicitly use probability information so that decision-makers can consistently factor-in an appropriate safety margin when implementing preparedness plans according to an associated hurricane hazard. The methodology for creating these grids takes into account the forecast magnitude and the associated forecast uncertainty for each of the four hazards. There are five threat levels, distinguished by color (Gray, Yellow, Orange, Red, and Magenta) used in the threat grid for each of the hazards. The labels for each threat level are specific to the hazard such that:

Table 1. Wind Threat Labels

Wind Threat
Potential for wind greater than 110 mph
Potential for wind 74 to 110 mph
Potential for wind 58 to 73 mph
Potential for wind 39 to 57 mph
Wind less than 39 mph

Table 2. Storm Surge Threat Labels

Storm Surge Threat
Potential for storm surge flooding greater than 9 ft above ground
Potential for storm surge flooding greater than 6 ft above ground
Potential for storm surge flooding greater than 3 ft above ground
Potential for storm surge flooding greater than 1 ft above ground
Little to no storm surge flooding

Table 3. Flooding Rain Threat Labels

Flooding Rain Threat
Potential for extreme flooding rain
Potential for major flooding rain
Potential for moderate flooding rain
Potential for localized flooding rain
Little to no potential for flooding rain

The following disclaimer should be included in any display of the Flooding Rain Threat grid (i.e., on the NDFD site), but does not need to be included in the GRIB2 file or otherwise tagged:

DISCLAIMER: The flooding rain threat graphic considers flooding from rain and does not directly consider contributions from either storm surge or from rivers and their tributaries (streams, creeks, etc). Please refer to any NWS storm surge watches or warnings or NWS river flood/flash flood statements, watches, or warnings that may be in effect for your area.

Table 4. Tornado Threat Labels

Tornado Threat
Potential for an outbreak of tornadoes
Potential for many tornadoes
Potential for several tornadoes
Potential for a few tornadoes
Tornadoes not expected

The threat grids are produced by coastal WFOs along the Atlantic and Gulf coasts as well as San Juan, PR and Honolulu, HI whenever tropical cyclone watches and warnings are in effect for their area of responsibility (AOR).

The threat grids are valid from the current time through the remainder of the event, as they do not convey specific timing. Updates will be provided at least every six hours

shortly after the NHC/CPHC advisory time, and will cease when tropical cyclone watches and warnings are no longer in effect for a WFOs AOR.

- b) Purpose – Provides support of the mission described in the National Weather Service Strategic Plan for FY2011 - FY 2020, “Improve weather decision services for events that threaten safety, health, the environment, economic productivity, or homeland security”. The NDFD is the primary means by which digital information is available to customers and partners. As part of this digital database, TC threat grids are made available in response to growing user needs for planning purposes and critical safety decisions. The grids depict the spatial distribution of threat levels associated with hurricane hazards (Wind, Surge, Flooding Rain, and Tornadoes) which conveys the extent to which protective actions should be taken.
- c) Audience – The audience for the Hurricane Threat grids includes large volume users of forecast information, emergency managers, the media, numerous local, state, and federal government agencies (including NWS field offices), academia, and many other groups. They are also for anyone who wishes to decode and explore various applications of the Hurricane Threat grids; or simply view, post, or distribute the data or graphic images.
- d) Presentation Format – As with all NDFD elements, these elements are available in Gridded Binary Data Edition 2 (GRIB2) via file transfer protocol (ftp), eXtensible Markup Language (XML), and Web browser. The TC threat elements are only available for the CONUS, Puerto Rico, and Hawaii sectors.

1. GRIB2 format at 2.5 km horizontal grid spacing for the CONUS and Hawaii and 1.25 km for Puerto Rico, via ftp and http: The GRIB2 files can be decoded and converted to other formats, such as shapefiles, netCDF files, etc.

CONUS Sector

<http://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/DF.gr2/DC.ndfd/AR.conus/VP.001-003/>
<ftp://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/DF.gr2/DC.ndfd/AR.conus/VP.001-003/>

Hawaii Sector

<http://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/DF.gr2/DC.ndfd/AR.hawaii/VP.001-003/>
<ftp://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/DF.gr2/DC.ndfd/AR.hawaii/VP.001-003/>

Puerto Rico Sector

<http://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/DF.gr2/DC.ndfd/AR.puertori/VP.001-003/>
<ftp://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/DF.gr2/DC.ndfd/AR.puertori/VP.001-003/>
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with the following file names used:

- Wind ds.tcwt.bin
- Storm Surge ds.tcsst.bin
- Flooding Rain ds.tcfrt.bin
- Tornado ds.tctt.bin

It is important to note that when a user downloads these grids, they will continue to see grid values of 0, 4, 6, 8, or 10 that should be mapped to the threat labels shown in Tables 1-4 in Part I, Section a. Please see Part II - Technical Description for instructions to map the labels in the grids to these labels.

2. Extensible Markup language (XML): Users can request NDFD elements over the Internet using the NDFD XML Simple Object Access Protocol (SOAP) server. The response to the user request is returned in XML format. For more information, please refer to the NDFD XML Service Description Document online at:

http://products.weather.gov/PDD/Extensible_Markup_Language.pdf

3. Online NDFD graphics: Graphics for the Hurricane Threats will be available via the NDFD map viewer located at:

<http://digital.weather.gov>

To access these and other NDFD elements, or for further availability and technical information (e.g., temporal and spatial resolutions, forecast projections, and geographic coverage), please visit the following URL:

<http://www.weather.gov/ndfd/technical.htm>

4. Keyhole Markup Language (KML): Users can download threat grid KML files at:

<http://weather.gov/hti>

e) Feedback Method

National Weather Service

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Part II - Technical Description

a. **Format & Science Basis** – The Hurricane threat grids are produced by forecasters utilizing the Graphical Forecast Editor (GFE) in AWIPS. It is important to note that when a user downloads these grids, they will continue to see grid values of 0, 4, 6, 8, or 10 that should be mapped to the threat labels as described below for each hazard. There are five levels to describe each threat (all threat levels are based on the reasonable worst-case scenario):

Wind Threat – values are based on the official NDFD wind grids created from the official hurricane center forecast along with a measure of uncertainty provided by the official tropical cyclone wind speed probabilities.

1. Grid value 0 – Wind less than 39 mph
2. Grid value 4 - Potential for wind 39 to 57 mph
3. Grid value 6 – Potential for wind 58 to 73 mph
4. Grid value 8 - Potential for wind 74 to 110 mph
5. Grid value 10 - Potential for winds greater than 110 mph.

Storm Surge Threat – grid is computed based on the probabilistic storm surge guidance. The guidance used will be the same the National Hurricane Center uses to determine the range of values used in their public advisories.

1. Grid value 0 - Little to no storm surge flooding
2. Grid value 4 - Potential for storm surge flooding greater than 1 ft above ground
3. Grid value 6 - Potential for storm surge flooding greater than 3 ft above ground
4. Grid value 8 - Potential for storm surge flooding greater than 6 ft above ground
5. Grid value 10 - Potential for storm surge flooding greater than 9 ft above ground

Flooding Rain Threat – grid is computed using a combination of the official NDFD QPF forecasts, flash flood guidance from the river forecast centers, and the Excessive Rainfall Probabilities and Probabilistic QPF products from the Weather Prediction Center (WPC). In simplest terms, threat levels are described as follows:

1. Grid value 0 - Little to no potential for flooding rain
2. Grid value 4 - Potential for localized flooding rain
3. Grid value 6 - Potential for moderate flooding rain
4. Grid value 8 - Potential for major flooding rain
5. Grid value 10 - Potential for extreme flooding rain

Tornado Threat – this is computed for the event analyzing SPC Tornado Probabilities for day 1 and severe weather probabilities as a proxy for tornado threat for days 2 and 3 (in case event falls in days 2 or 3). In simplest terms, threat levels are described as follows:

1. Grid value 0 - Tornadoes not expected
2. Grid value 4 - Potential for a few tornadoes
3. Grid value 6 - Potential for several tornadoes
4. Grid value 8 - Potential for many tornadoes
5. Grid value 10 - Potential for an outbreak of tornadoes

b. Product Availability – The threat grids are produced by coastal WFOs along the Atlantic and Gulf coasts as well as San Juan, PR and Honolulu, HI whenever tropical cyclone watches and warnings are in effect for their area of responsibility (AOR). The grids are valid for the duration of the event as they do not convey specific timing. The grids are updated around every 6 hours.

c. Additional Information – A full description of other NWS Tropical Cyclone Weather Services Program Products is provided in NWSI 10-601, which is available on the Internet at:

<http://www.nws.noaa.gov/directives/010/010.htm>