

# Tropical Cyclone 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 Tropical Cyclone (TC) Threat grids are available in NDFD:

- WindThreat
- StormSurgeThreat
- FloodingRainThreat
- TornadoThreat

The TC Threat grids provide the worst-case plausible scenario or threat associated with each of the hazards. The methodology for creating the grids takes into account the forecast magnitude and the associated forecast uncertainty for each of the hazards. There are five levels which describe each threat grid; Little to None, Elevated, Moderate, High, Extreme.

The threat grids are produced only by coastal WFOs along the Atlantic and Gulf coasts as well as San Juan, PR 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at least every six hours shortly after NHC's advisory, and will cease when tropical cyclone watches and warnings are no longer in effect for a WFOs AOR.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 being 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 TC 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 TC 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 and Puerto Rico sector.

1. GRIB2 format at 2.5 km horizontal grid spacing for CONUS (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://weather.noaa.gov/pub/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/>

Puerto Rico Sector

<http://weather.noaa.gov/pub/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/>

with the following file names used:

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

A user-defined GRIB2 access method is also available. That service allows the user to input latitude/longitude points for two corners and select a single weather element. The resulting GRIB2 message is built “on-the-fly” and downloaded by the user. For more information about user-defined GRIB2 access, please refer to the Service Description Document at: [http://products.weather.gov/PDD/User\\_Defined\\_Grib2.pdf](http://products.weather.gov/PDD/User_Defined_Grib2.pdf).

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](http://products.weather.gov/PDD/Extensible_Markup_Language.pdf).

3. Online NDFD graphics: Graphics for the TC Threats will be available via the NDFD map viewer located at: <http://graphical.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>.

e. Feedback Method

National Weather Service  
Attn: John F. Kuhn  
1325 East-West Highway, Room 13124  
Silver Spring, MD 20910-3283

[john.f.kuhn@noaa.gov](mailto:john.f.kuhn@noaa.gov)

## **Part II - Technical Description**

- a. Format & Science Basis – The TC threat grids are produced by forecasters utilizing the Graphical Forecast Editor (GFE) in AWIPS.

There are five levels to describe each threat (all threat levels are based on worst case plausible 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) Little to None (Grid value 0) – The potential for wind to remain less than 39 mph.
- 2) Elevated (Grid value 4) - The potential for winds equal to or greater than 39 mph and less than 58 mph.
- 3) Moderate (Grid value 6) – the potential for winds equal to or greater than 58 mph and less than 74 mph.
- 4) High (Grid value 8) - potential for winds equal to or greater than 74 mph, and less than 111 mph.
- 5) Extreme (Grid value 10) - the potential for winds equal to or greater than 111 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) Little to None (Grid value 0) - Potential for inundation from storm surge plus tide to remain less than 1 foot above ground level (AGL).
- 2) Elevated (Grid value 4) - Potential for inundation from storm surge plus tide to be greater or equal to 1 foot and less than 3 feet AGL.

- 3) Moderate (Grid value 6) - Potential for inundation from storm surge plus tide to be greater or equal to 3 feet and less than 6 feet AGL.
- 4) High (Grid value 8) - Potential for inundation from storm surge plus tide to be greater or equal to 6 feet and less than 9 feet AGL.
- 5) Extreme (Grid value 10) - Potential for inundation from storm surge plus tide to be greater or equal to 9 feet AGL.

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 from the Weather Prediction Center (WPC). In simplest terms, threat levels are described as follows:

- 1) Little to None (Grid value 0) - Potential for rain amounts to remain below flash Flood guidance values with no to minimal impacts anticipated.
- 2) Elevated (Grid value 4) - Potential for highest rain amounts near values conducive to flash flooding capable of resulting in limited damage from fresh water flooding.
- 3) Moderate (Grid value 6) - Potential for highest rain amounts to notably exceed values conducive to flash flooding capable of producing significant damage from fresh water flooding.
- 4) High (Grid value 8) - Potential for highest rain amounts to well exceed values conducive to flash flooding capable of producing extensive damage from fresh water flooding.
- 5) Extreme (Grid value 10) - Potential for highest rain amounts to greatly exceed values conducive to flash flooding capable of producing devastating to catastrophic damage from fresh water flooding.

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) Little to None (Grid value 0) - There is no discernable potential for tornadoes from hurricanes or tropical storms. Appreciable damage is unlikely.
- 2) Elevated (Grid value 4) - Potential for isolated tornadoes capable of producing limited to locally significant damage.
- 3) Moderate (Grid value 6) - Potential for scattered locations to experience tornadoes (with a few strong) capable of producing significant damage.
- 4) High (Grid value 8) - Potential for numerous locations to experience tornadoes (with several strong) capable of producing extensive damage. Description consistent with an outbreak event.
- 5) Extreme (Grid value 10) - Potential for numerous locations to experience tornadoes capable of producing devastating to catastrophic damage. Description consistent with a historic outbreak event.

- b. Product Availability – The threat grids are produced by coastal WFOs along the Atlantic and Gulf coasts as well as San Juan, PR 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>.