Product Description Document:
NCEP Model Analyses & Guidance
June 2019

Part I Mission Connection

Product Description – The Model Analyses and Guidance (MAG) website showcases the National Weather Service's observational database and graphical suite of numerical model analysis and guidance. The site is maintained by National Centers for Environmental Prediction Central Operations (NCEP/NCO). In an effort to respond to user needs to protect life and property and support the nation's growing need for environmental information, a streamlined graphical approach in displaying products used by forecasters in making forecasts serves not only NWS Offices but also the private and public Sectors.

The link to the production model graphics web site is:

http://mag.ncep.noaa.gov/

The data sources covering various regions are described in this document. Links to descriptions of each data source are included in Part II. The data sources are grouped by the following three categories:

- **Model Guidance**
    1. North American Mesoscale (NAM)
        - NAM Fire Weather High Resolution Nested Runs
    2. Global Forecast System (GFS)
    3. Wave Watch III (WW3)
    4. Short Range Ensemble Forecast (SREF)
    5. Rapid Refresh Analysis & Forecast System (RAP)
    6. High Resolution Rapid Refresh Analysis & Forecast System (HRRR)
    7. High Resolution Window (HRW-NMMB)
    8. High Resolution Window (HRW-ARW)
    9. Polar Ice Drift (ICE-DRIFT);
    10. Global Ensemble Forecast System (GEFS)
    11. North American Ensemble Forecast System(NAEFS)
    12. Extratropical Surge and Tide Operational Forecast System (ESTOFS)
    13. High Resolution Ensemble Forecast (HREF)
    14. National Blend of Models (NBM)
    15. High Resolution Window - WRF - member 2 (HRW-ARW2)

- **Observations and Analyses**
    16. Real Time Mesoscale Analysis (RTMA)
    17. Observed Upper Air Data
    18. Skew-T Plots

- **Tropical Guidance**
    19. Multi-scale Ocean-coupled Non-Hydrostatic Model (HMON)
    20. Hurricane Weather Research and Forecasting (HWRF)

- **Forecast Soundings**
    21. Global Forecast System (GFS) soundings
    22. North American Mesoscale (NAM) soundings

A list of specific parameter graphics available for each of the forecast models is provided at the end of this document. The Observed Upper Air data and Forecast Soundings are presented as station values on a map and as Skew-T graphs for individual reports.

Note: The website content will be updated as changes to the NCEP model suite are implemented. This document will be updated accordingly.

Purpose - The forecast graphics are available on the NCEP website at nearly the same time products from these models are available to National Weather Service and private users. The website is updated as each model forecast hour is completed.

Audience - The major users of the website are the general public as well as governmental organizations, universities, and businesses.

Presentation Format - The data is presented in standard Graphics Interchange Format (GIF) including static images and looping images. The processing, which creates these forecast graphics uses the General Meteorology PAcKage (GEMPAK) software to convert forecast model output into images to be transferred from the Weather and Climate Operational Supercomputing System (WCOSS) to the MAG website. The forecast graphics are available on the MAG website at nearly the same time products from the models are available to National Weather Service and private users. The graphical model guidance is updated as each model forecast hour becomes available.

Feedback Method - Comments regarding the products may be emailed to:

Mag.helpdesk@noaa.gov

Part II Technical Section

A. Format & Science Basis

Graphics from thirteen Numerical Weather Prediction models are available. The models

described in this document are: NAM, GFS, WW3, SREF, RAP, HRRR, HRW, ICE-DRIFT, GEFS, NAEFS, RTMA, HMON and HWRF.

1. North American Mesoscale (NAM)

The NAM model is a regional mesoscale data assimilation and forecast model system based on the WRF common modeling infrastructure, currently running at 12 km resolution and 60 layers. NAM forecasts are produced every six hours at 00, 06, 12 and 18 UTC. The NAM graphics are available at three hour increments out to 84 hours. The NAM has non-hydrostatic dynamics and a full suite of physical parameterizations and a land surface model.
MAG_
Graphical model guidance for the NAM is available for the following regions:

1) North America
2) Western North Atlantic
3) North Pacific
4) Eastern North Pacific

High resolution nests from the NAM are also available with the following specifications:

1) 3 km resolution (NAM-HIRES) for the CONUS and Alaska, forecast intervals of three hours out to 60 hours.
    a) North West United States
    b) North Central United States
    c) North East United States
    d) South West United States
    e) South Central United States
    f) South East United States
    g) CONUS

2) 1.5 km resolution "fire weather" (FIREWX) nest with hourly forecast intervals out to 36 hours. The NAM fire weather nest is a small (roughly 500x500 km) nest that can be placed at any location in the CONUS or Alaska.

Information on the model is found at page:
http://www.nco.ncep.noaa.gov/pmb/products/nam/

The link to the latest information about the NAM model is:
http://www.emc.ncep.noaa.gov/mmb/mmbpll/etapll/

2. Global Forecast System (GFS)

The **Global Forecast System (GFS)** is a global numerical weather prediction system

containing a global computer model and variational analysis run by the U.S. National Weather Service (NWS).

The mathematical model is run four times a day; at 00, 06, 12 and 18 UTC; and produces forecasts for up to 16 days in advance, with decreased spatial resolution after 10 days. The model is a spectral model with a resolution of T1534 from 0 to 240 hours (0-10 days) and T574 from 240 to 384 hours (10-16 days). In the vertical, the model is divided into 64 layers and temporally, it produces forecast output every hour for the first 12 hours, every 3 hours out to 10 days, and every 12 hours after that.

The GFS horizontal resolution of the input gridded files was updated to ¼-degree from previous 1-degree in MAG V3.8, however, vorticity at 850mb and 500mb is down-scaled from ¼-degree to 1/2-degree to remove noise.

Information on the model products can be found at the production model web page http://www.nco.ncep.noaa.gov/pmb/products/gfs/.

Graphical model guidance for the GFS is available for the following regions:

1. North America
2. South America
3. Africa
4. North Pacific
5. South Pacific
6. Eastern North Pacific
7. Western North Atlantic
8. North Atlantic Ocean Basin
9. Polar
10. Europe
11. Asia
12. Arctic
13. Alaska
14. India
15. American Samoa

The link to the latest information about the GFS is:
http://wwwt.emc.ncep.noaa.gov/?branch=GFS&tab=doc

3. WAVEWATCH III (WW3)

The MAG website presents the WW3 model as three separate model names:

- WAVEWATCH III (WW3) for the regions Atlantic, North Pacific, East Pacific,

entire North Atlantic and North Pacific ocean and Western North Atlantic (Southeast US, Central America and Caribbean).

- WAVEWATCH III Eastern North Pacific (WW3-ENP) for the region of the Eastern North Pacific Ocean and Pacific Ocean
- WAVEWATCH III Western North Atlantic (WW3-WNA) for the region of Western North Atlantic Ocean.

WW3 is a third generation wave model developed at NCEP. WW3 forecasts are produced every six hours at 00, 06, 12 and 18 UTC. The WW3 graphics are based model fields of 1.0^0 x 1.25^0 to 5^0 x 5^0 and are available at six hour increments out to 87 hours. WW3 solves the spectral action density balance equation for wave number-direction spectra. Assumptions for the model equations imply that the model can generally be applied on spatial scales (grid increments) larger than 1 to 10 km, and outside the surf zone.

Information on the model products can be found at the production model web page http://www.nco.ncep.noaa.gov/pmb/products/wave/.

The link to the latest information about the WW3 is:
http://www.emc.ncep.noaa.gov/modelinfo

4. Short Range Ensemble Forecast (SREF)

The SREF system is a set of model runs called ensemble members using either a single model with different initial conditions or different models with the same initial conditions. SREF forecasts are produced every six hours at 03, 09, 15 and 21 UTC. The SREF graphics are available at three hour increments out to 87 hours across both the North American region and the Alaska region. SREF forecasts are also updated from 40 km to 16 km in horizontal resolution. The evaluation of SREF has shown improvements in providing CONUS forecasts during the one to three day time range. The SREF runs operationally four times daily. SREF produces ensemble forecasts from 21 members: five ETA members, five ETA Kain-Fristch members, five Regional Spectral Model (RSM) members, and three members each with the WRF-NMMB and WRF-ARW. The current SREF aviation ensemble forecast has 11 primary ensemble products, including the probability, mean and spread of: icing, turbulence, cloud, ceiling, visibility, jet stream, lower level wind shear, and tropopause height.
Graphical model guidance for the SREF is available for the following regions:

1) North America
2) Alaska

There are 26 individual members in SREF and members are clustered together by similarities at certain levels. There are up to six clusters for each forecast hour. SREF

cluster forecast products are listed under the SREF-CLUSTER model.
Graphical model guidance for the SREF-CLUSTER is available for the following region:

1) Conus

Information on the model products can be found at
http://www.nco.ncep.noaa.gov/pmb/products/sref.

The link to the latest information about the SREF model is
http://www.emc.ncep.noaa.gov/modelinfo

5. Rapid Refresh Analysis & Forecast System (RAP)

The RAP replaced the older RUC model at 12z on May 1, 2012. The RAP uses a RAP configuration of the WRF model with an ARW core. It has similar characteristics as the RUC model it replaced: It has a horizontal resolution of 13 km and 50 vertical layers. RAP utilizes an hourly data assimilation system. The RAP forecasts are produced every hour for the North American and Alaska regions. RAP graphics for the CONUS region are available for the most recent 24 hours at hourly increments out to 39 hours for 03, 09, 15, and 21 cycles, and out to 21 hours for all other cycles.. Information on the model products can be found at the production model web page
http://www.nco.ncep.noaa.gov/pmb/products/rap/.

The link to the latest information about the RAP model is http://rapidrefresh.noaa.gov

6. High Resolution Rapid Refresh Analysis & Forecast System (HRRR)

The HRRR was implemented into the NCEP production suite on or about September 23, 2014. It is a configuration of the WRF model similar to that used for the RAP model, but without any convective parameterization. The HRRR has a 3 km resolution updated hourly for the CONUS region. It provides forecast guidance at hourly intervals out to 36 hours for cycles 00, 06, 12, and 18, and out to 18 hours for all other cycles. A subset of data is available at a 15 minute temporal resolution.

Graphical model guidance for the HRRR is available for the following regions:

1. North West United States
2. North Central United States
3. North East United States
4. South West United States
5. South Central United States
6. South East United States

7. CONUS

Information on the model products can be found at the production model web page http://www.nco.ncep.noaa.gov/pmb/products/hrrr/.

The link to the latest information about the HRRR model is http://rapidrefresh.noaa.gov/hrrr

7. High Resolution Window (HRW-NMMB)

The High Resolution Window (HRW) contains forecast images from both the Weather Research and Forecasting(WRF) Advanced Research WRF (ARW) model and the Nonhydrostatic Multiscale Model on B-grid (NMMB).

HRW forecasts are produced over five different domains twice daily on the following schedule:

- 00/12 UTC:
    - CONUS
    - North Central United States
    - North East United States
    - South West United States
    - South Central United States
    - South East United States
    - Hawaii
    - Guam
- 06/18 UTC:
    - Alaska
    - Puerto Rico

The graphics are available at an hourly increment out to 48 hours

The NOAA Environmental Modeling System (NEMS)-NMMB model replaced the WRF-Nonhydrostatic Mesoscale Model (NMM) within the HRW system in 2014. It represents a continued development of the same general dynamical core in a different software framework.

More details are available at the NMMB Users' Page maintained by the Developmental Testbed Center (DTC) http://www.dtcenter.org/nems-nmmb/users/

Within the HRW, the NMMB runs at 3.0-3.6 km horizontal spacing (varies with domain), and 40 levels in the vertical (50 levels planned in 2015 upgrade).

8. High Resolution Window (HRW-ARW)

The High Resolution Window (HRW) contains forecast images from both the Weather Research and Forecasting (WRF) Advanced Research WRF (ARW) model and the Nonhydrostatic Multiscale Model on B-grid (NMMB).

HRW forecasts are produced over five different domains twice daily on the following schedule:

- 00/12 UTC:
  - CONUS
  - North Central United States
  - North East United States
  - South West United States
  - South Central United States
  - South East United States
  - Hawaii
  - Guam
- 06/18 UTC:
  - Alaska
  - Puerto Rico

The graphics are available at an hourly increment out to 48 hours

The WRF-ARW Model is a community-based next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting needs. It was originally developed by the National Center for Atmospheric Research (NCAR), and NCAR continues to maintain and develop the system, and coordinate code contributions from the WRF user community.

The link to the latest information about the WRF-ARW modeling system is: http://wrf-model.org/index.php

Within the HRW, the WRF-ARW runs at 3.5-4.2 km horizontal spacing (varies with domain), and 50 levels in the vertical (updated from 40 levels in May 2015).

9. Polar Ice Drift (ICE-DRIFT)

The Polar and Great Lakes Ice group works on sea ice analysis from satellite, sea ice modeling, and ice-atmosphere-ocean coupling. Automated analyses have been used by the NWS global atmospheric models for their sea ice conditions since February 1998.

ICE-DRIFT forecasts are produced once daily at 00 UTC. The ICE-DRIFTgraphics are available at 24 hour increments out to 384 hours. The analysis provides a daily, 0.5 degree resolution in latitude and longitude, condition for the models. During spring and fall, the sea ice edge can move by 200 km (2 degrees) in a week. Discussion of the use and representation of sea ice in the global weather models is available at http://polar.ncep.noaa.gov/seaice/Models.html.

The link to the latest information about the ice drift system is:
http://polar.ncep.noaa.gov/seaice

10. Global Ensemble Forecast System (GEFS)

The GEFS is a GFS-based modeling system run with 20 ensemble members per cycle plus one control at T126. GEFS forecasts are produced up to 28 levels every six hours at 00Z, 06Z, 12Z, and 18Z. All runs are shown out to 384 hrs at 6-hour intervals. The horizontal resolution of the GEFS input gridded files are ½-degree.

Graphical model guidance for the GEFS is available for the following regions:

1. North America
2. South America
3. Africa
4. North Pacific
5. East Pacific
6. Western North Atlantic
7. North Atlantic Ocean Basin
8. Europe
9. Asia
10. South Pacific
11. India
12. North Pole

Information on the model products can be found at the production model web page http://www.nco.ncep.noaa.gov/pmb/products/gens/.

The link to the latest information about the GEFS model is
http://www.emc.ncep.noaa.gov/modelinfo

The MAG website presents the GEFS model as

- GEFS-SPAG: GEFS individual members that run every 6 hrs that creates spaghetti charts.

- GEFS-MEAN-SPRD: GEFS mean and spread that runs every 6 hrs.

11. North American Ensemble Forecast System (NAEFS):

The North American Ensemble Forecast System is a global weather modeling system run jointly by the Meteorological Service of Canada (MSC) and the U.S. National Weather Service (NWS) to provide numerical weather prediction (NWP) probabilistic products to weather forecasters in both countries for a forecast period that runs out 16 days. The NAEFS combines the Canadian global forecast model ensemble and the NWS Global Ensemble Forecast System model (GEFS) into a joint ensemble that will create global weather forecasts which include all of North America. At present, all the national weather agencies in North America are participating in NAEFS - the Meteorological Service of Canada, the National Meteorological Service of Mexico, and the U.S. National Oceanic and Atmospheric Administration NWS.

NAEFS forecasts are produced every six hours at 00, 06, 12 and 18 UTC.
(Note: For 06 and 18 UTC graphical products are produced by NWS GEFS input only).
The NAEFS graphics are based on 70 km grid (T190) bias-corrected and are available at six hour increments out to 384 hours. The latest NAEFS and NWS GEFS major implementation was on Feb. 23rd 2010
(see: http://wwwt.emc.ncep.noaa.gov/gmb/ens/ens_imp_news.html for more information).

Graphical model guidance for the NAEFS is available for the following regions:

1. North America
2. North Atlantic Ocean Basin
3. Western North Atlantic
4. South America
5. North Pacific
6. South Pacific
7. Eastern North Pacific
8. Africa
9. Europe
10. Asia
11. Arctic
12. North Pole
13. India

12. Extratropical Surge and Tide Operational Forecast System (ESTOFS):

ESTOFS (Extratropical Surge and Tide Operational Forecast System) is a collaboration between the NOAA/NOS/Coast Survey Development Lab and NOAA/NCEP. ESTOFS provides a second operational set of forecast guidance in addition to the ET-SURGE

(ETSS) model with an increased resolution (2.5 km vs. 5 km for ET_SURGE) and uses the circulation model ADCIRC. Tides are included in ESTOFS and forced at its boundaries from the OSU TPXO v6.2 tides and refined further within ADCIRC.

The ESTOFS model is run on NCEP's central computing system four times daily out to 180 hours producing numerical storm surge guidance for extratropical systems. The model is forced by real time output of winds and pressures from the NCEP Global Forecast System (GFS). The current coverage of the operational ESTOFS forecast domains around the U.S. also includes the Caribbean area surrounding Puerto Rico.

The ready availability of numerical guidance from the operational ESTOFS will enhance the ability of NCEP (OPC and NHC/TAFB) to provide operational extratropical coastal storm surge guidance in the Marine Weather Discussion (MWD), also known as MIM.

Note: The Extra-Tropical Storm Surge information should not be used for tropical cyclone events. For official storm surge information associated with tropical cyclones, please consult advisories and warnings issued by the National Hurricane Center.

Graphical model guidance for the ESTOFS is available for the following regions:

1. West Gulf of Alaska
2. East Gulf of Alaska
3. Washington and Oregon
4. Northern California
5. Southern California
6. Hawaii
7. Northeast Coast
8. Middle Atlantic
9. Southeast Coast
10. East Gulf of Mexico
11. West Gulf of Mexico

13. High Resolution Ensemble Forecast (HREF)

The High Resolution Ensemble Forecast (HREF) produces ensemble products from several different models running at ~3 km horizontal grid spacing. Most of the model runs utilized in HREF are from the High Resolution Window: two different configurations of the Advanced Research Weather Research and Forecasting (WRF-ARW) model and a single Nonhydrostatic Multiscale Model on B-grid (NMMB) run. For the CONUS HREF, the North American Model (NAM) 3 km CONUS nest also is utilized. Information from each of these models is used in a time-lagged fashion, with the two most recent runs of each model combined to produce ensemble products. The HREF is an 8-member ensemble for the CONUS domain and generates output at an hourly temporal resolution to 36 hours of forecast.

Graphical model guidance for the HREF is available for the following regions:

1. North West United States
2. North Central United States
3. North East United States
4. South West United States
5. South Central United States
6. South East United States
7. CONUS

14. National Blend of Models (NBM)

The NBMs are nationally consistent and skillful suite of calibrated forecast guidance based on a blend of both NWS and non-NWS numerical weather prediction model data and post-processed model guidance.

NBM forecasts are produced over the conus domain for the 00z, 06z, 12z and 18z cycles for:

precip_p06
precip_ptot
2m_temp_10m_wnd
2m_relh_10m_wnd
2m_apparent_temp
2m_dewp_10m_wnd
10m_wnd_gust
total_cloud_cover.

NBM forecasts are produced for the conus domain for the 12z cycle for:

2m_min_temp
2m_max_temp

The graphics are available at an hourly increment from 1-hour forecast out to 36 hours and

at 3-hourly increment upto 264 hours for the following images:

2m_temp_10m_wnd
2m_relh_10m_wnd
2m_apparent_temp
2m_dewp_10m_wnd
10m_wnd_gust
total_cloud_cover

The graphics are available at 24-hour increment from 24-hour forecast and out to 264 hours

for :

2m_min_temp

The graphics are available at 24-hour increment from 36-hour forecast and out to 252 hours

for :

2m_max_temp

The graphics are available at 6-hour increment from 6-hour forecast and out to 228 hours for :

precip_p06

precip_ptot

The link to the latest information about the NBM is:
https://www.weather.gov/mdl/nbm_home

15. High Resolution Window Member 2 (HRW-ARW2)

The High Resolution Window (HRW) contains forecast images from the Weather Research and Forecasting (WRF) Advanced Research WRF (ARW) model, the Nonhydrostatic Multiscale Model on B-grid (NMMB) and Weather Research and Forecasting (WRF) Advanced Research - Member 2 WRF (ARW2) model.

HRW forecasts are produced over five different domains twice daily on the following schedule:

- 00/12 UTC:
  - CONUS
  - North Central United States
  - North East United States
  - South West United States
  - South Central United States
  - South East United States
  - Hawaii
  - Guam (The HRW-ARW2 is not run for the Guam domain).
- 06/18 UTC:
  - Alaska
  - Puerto Rico

The graphics are available at an hourly increment out to 48 hours

The WRF-ARW Model is a community-based next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting needs. It was originally developed by the National Center for Atmospheric Research (NCAR), and NCAR continues to maintain and develop the system, and coordinate code contributions from the WRF user community.

The link to the latest information about the WRF-ARW2 modeling system is: http://www.nws.noaa.gov/os/notification/scn17-106hires_href.htm

Within the HRW, the WRF-ARW2 runs at 3.5-4.2 km horizontal spacing (varies with domain), and 40 levels in the vertical (updated from 40 levels in May 2015).

16. Real Time Mesoscale Analysis (RTMA)

The MAG website presents the RTMA model by two separate regions:

- RTMA : Offers products available for the Continental United States
- RTMA-GUAM : Offers products available for Guam

The RTMA is a "quick look" analysis designed to meet the immediate need of those requiring a real time gridded analysis. This is the first phase of the "Analysis of Record" (AOR) underway at NWS. The RTMA is produced by down-scaling the RUC forecast/analysis from its horizontal resolution of 13 km to a 5 km NDFD grid. This is then used as a first guess for a 2D-Variational analysis which a) uses a full complement of surface observations; b) uses anisotropic background error covariance mapped to local terrain, c) produces analyses of 2 m temperature, 2m dew-point and 10 m wind and d) produces estimates of analysis uncertainty as well. The RTMA provides hourly, near real time, mesoscale analyses of surface hydrometeorological variables in a grid format. These grid hydrometeorological products are used by field forecasters for various operational applications. RTMA product destinations include all CONUS and OCONUS sites, NWS special centers, and external partners and customers.

Graphical model output for the RTMA is available for the following regions:

1) Southwest U.S.
2) California
3) North Carolina/South Carolina
4) Colorado
5) North Dakota/South Dakota
6) Midwest region of U.S.
7) Gulf Coast region of U.S.
8) Mid-Atlantic region of U.S.

9) Michigan
10) Montana
11) New England
12) Ohio Valley
13) Texas
14) Pacific Northwest region of U.S.
15) Wisconsin
16) Florida
17) Alaska

17. Observed Upper Air Data

Provides a selection of levels (1000 to 100 mb) and observations of station data within North America, South America, Africa, Alaska, and the Western North Atlantic.

18. Skew-T Plots

Provides Graphical Skew-T plots for stations in North America, South America, Africa, and the Northern Pacific for 00z and 12z.

19. HMON (Hurricanes in a Multi-scale Ocean coupled Non-hydrostatic model)

Hurricanes in a Multi-scale Ocean coupled Non-hydrostatic model (HMON) provides high-resolution intensity forecast guidance to NHC along with HWRF. It is based on the NMMB dynamic core which is currently being used in other NCEP's operational NAM (North American Mesoscale Model) and SREF (Short Range Ensemble Forecast) systems. It has been built using shared infrastructure with unified model development within NEMS. The NMMB dynamic core is much faster and more scalable than other contemporary dynamic cores deployed for modeling Hurricanes at NCEP. It is actively coupled to HYCOM (HYbrid Co-ordinate Ocean Model) and uses double nested configuration with increasing higher resolutions of 18, 6 and 2 km for the parent, intermediate nest and inner nest domains with 41 vertical levels.

Development of HMON (Hurricanes in a Multi-scale Ocean coupled Non-hydrostatic model) is an important step towards implementing a long-term strategy at NCEP/EMC for multiple static and moving nests globally, with one- and two-way interaction and coupled to other (ocean, wave, sea ice, surge, inundation, etc.) models using NEMS (NOAA's Environmental Modeling Environment) infrastructure. HMON's development has been supported by HFIP and NGGPS (Next Generation Global Prediction System) programs.

Hurricane forecasts from HMON are produced on demand every six hours at 00, 06, 12,

and 18 UTC for up to five tropical cyclones at a time in the North Atlantic and East Pacific basins. Graphics from HMON are available at six hour increments up to 126 hours.

Information about the HMON hurricane model can be found here:
http://www.emc.ncep.noaa.gov/gc_wmb/vxt/HMON/

20. Hurricane Weather Research Forecast (HWRF) model

The HWRF provides operational guidance for forecasters at the National Hurricane Center in both the Atlantic and East Pacific basins. Hurricane forecasts are produced on demand every six hours at 00, 06, 12, and 18 UTC for up to five tropical cyclones at a time. The HWRF hurricane model graphics are available at six hour increments up to 126 hours. Often, there are less than 126 hours.

The model is a nested grid system with an outermost domain and a nested grid with resolutions of 18km and 6 km respectively and 61 vertical levels. The HWRF vortex initialization uses the 6 hour forecast as the first guess, then uses regional GSI 3DAR data assimilation to produce the initial hurricane vortex that matches the intensity and structure parameters provided operationally by NHC. The HWRF is coupled to a high-resolution version of the Princeton Ocean Model for the Atlantic Basin. The ocean initialization system uses observed altimeter observations to provide a more realistic Loop Current and Gulf Stream conditions.

Information on the model products can be found at the production model web page
http://www.nco.ncep.noaa.gov/pmb/products/hur/

21. Global Forecast System (GFS) soundings

The GFS model soundings, a.k.a., BUFR sounding or PFC sounding, provide SKEW-T images over upper air sounding stations at the North America region. It is made available up to 120 hours with time interval of three hours. SKEW-T images provide vertical profiles of temperature, dew point temperature and wind along with instability indices such as LI and CAPE.

The BUFR sounding station locations are pre-selected from the grid points, which are not necessarily collocated with the RAOB station locations. The actual location is displayed on the station map by hovering over the plotted point, and in the station table next to the station id.

22. North American Mesoscale (NAM) soundings

The NAM model soundings, a.k.a., BUFR sounding or PFC sounding, provide SKEW-T images over upper air sounding stations at the North America region. It is made available

up to 84 hours with time interval of three hours. SKEW-T images provide vertical profiles of temperature, dew point temperature and wind along with instability indices such as LI and CAPE.

The BUFR sounding station locations are pre-selected from the grid points, which are not necessarily collocated with the RAOB station locations. The actual location is displayed on the station map by hovering over the plotted point, and in the station table next to the station id.

B. Product Availability

This service is provided at the web site http://mag.ncep.noaa.gov/. NCEP has no control over the reliability of the Internet. Users need to factor this uncertainty into their decision to use this service.

NCEP does not guarantee the service will be continuously available. However, every effort will be made to assure reliable provision of this service.

C. Additional Information

a) The Model Analyses & Guidance web pages are maintained by the NCEP Central Operations Systems Integration Branch. See the link http://www.nco.ncep.noaa.gov/sib/.

b) For more information about Models products please contact:
Ben Kyger (Acting Branch Chief)
Systems Integration Branch
NCEP Central Operations
NCWCP
5830 University Research Ct.
College Park, MD 20740-3818

Email: mag.helpdesk@noaa.gov

c) A list of specific parameter graphics available for all the models.

Model ESTOFS :

Storm Surge

Total Water Level

June 2018

Model FIREWX :

1-hr Minimum Relative Humidity, 10-m Wind

1000 m AGL Radar Reflectivity

12-H Accumulated Precipitation

24-H Accumulated Precipitation

36-H Accumulated Precipitation

850mb Temperature, Wind and Height

Best CAPE

Haines Index

Maximum 1-hr 10-m Wind

Maximum 1-hr Downdraft Vertical Velocity

Maximum 1-hr Updraft Vertical Velocity

Maximum 2-5 km Updraft Helicity

PBL Height

PBL Height (Based on Richardson Number)

Sea-level Pressure, 1-hr Accumulated Precip

Shelter (2-m) Dew Point Temperature

Shelter (2-m) Temperature

Snow Depth Change from F00

Total Column Precipitable Water

Transport Wind and Terrain Height

Ventilation Rate

Model GEFS-MEAN-SPRD :

10m Winds

2 meter Temperature

250mb Temperature

250mb Winds

500mb Temperature

500mb Vorticity and Height

500mb Winds

700mb Temperature

700mb Vorticity and Height

700mb Winds

850mb Temperature

850mb Vorticity and Height

850mb Winds

925mb Winds

Dominant Precipitation Type

Mean 24-hour Precipitation

Mean 6-hour Precipitation

Mean Convective Available Potential Energy

Mean Sea Level Pressure

Mean Snow Depth Change from F00

Probability of 6-hrly Precipitation > 0.25 (in)

Probability of 6-hrly Precipitation > 0.50 (in)

Probability of 6-hrly Precipitation > 1.00 (in)

Probability of CAPE > 2000

Probability of CAPE > 250

Probability of CAPE > 4000

Probability of CAPE > 500

Probability of Ice > 0.25 (in)

Spread of Snow Depth Change from F00

Model GEFS-SPAG :

200mb 1176 Height Contours

200mb 1188 Height Contours

200mb 1200 Height Contours

200mb 1212 Height Contours

200mb 1224 Height Contours

200mb 1230 Height Contours

500mb 510/552 Height Contours

500mb 516/558 Height Contours

500mb 522/564 Height Contours

500mb 528/570 Height Contours

500mb 534/576 Height Contours

500mb 540/582 Height Contours

MSLP 1000/1040 Isobar Contour

MSLP 1004/1044 Isobar Contours

MSLP 1008/1048 Isobar Contours

MSLP 1012/1052 Isobar Contours

MSLP 984/1024 Isobar Contours

MSLP 996/1036 Isobar Contours

Model GFS :

200mb Wind and Height

250mb Wind and Height

300mb Wind and Height

500mb Relative Humidity and Height

500mb Vorticity, Wind, and Height

500mb Wind and Height

700mb Relative Humidity, Height and Omega

850mb Height, Precipitable Water and Wind

850mb Relative Humidity and Height

850mb Temperature, Wind and Height

850mb Vorticity, 500mb Height, 200mb Wind

850mb Vorticity, Wind and Height

925mb Temperature, Wind and Height

Dominant Precipitation Type

MSLP, 1000-500mb thickness and 1-, 3-, or 12-hourly total precipitation

MSLP, 1000-850mb thickness and 3- or 12-hourly total precipitation

MSLP, 10m wind, 2m temperature, and 3- or 12-hourly total precipitation

MSLP, 10m wind, 6 houly total precip, 2m temperature

MSLP, 850-700mb thickness, and 3- or 12-hourly total precipitation

MSLP, 850mb temperature, 3- or 12-hourly total precipitation

Snow Depth Change from F00

Total Accumulated Precipitation of Period

Total Precipitation every 12 hours

Total Precipitation every 24 hours

Total Precipitation every 3 hours

Total Precipitation every 36 hours

Total Precipitation every 48 hours

Total Precipitation every 6 hours

Total Precipitation every 60 hours

Total Precipitation every hour

Model GFS-SND :

Model Sounding SKEWT

Model HMON-FULL :

200mb Vorticity, Wind, and Height

500mb Relative Humidity and Wind

500mb Vorticity, Wind, and Height

700mb Vorticity, Wind, and Height

850mb Vorticity, 500mb Height, 200mb Wind

850mb Vorticity, Wind, and Height

Mean Sea Level Pressure (PMSL) and 10 meter Wind

PMSL and 6-hourly Total Precipitation

Model HMON-NESTED :

200mb Vorticity, Wind, and Height

500mb Relative Humidity and Wind

500mb Vorticity, Wind, and Height

700mb Vorticity, Wind, and Height

850mb Vorticity, 500mb Height, 200mb Wind

850mb Vorticity, Wind, and Height

Mean Sea Level Pressure and 10 meter Wind

PMSL and 6-hourly Total Precipitation

Model HREF :

Accu 1h Mean Precip

Accu 3h Mean Precip

Accu Mean Precip

Accu 1h Blended Mean Precip

Accu 3h Blended Mean Precip

Accu 3h Mean Precip

PM-Mean 1km Reflectivity

PM-Mean Max Reflectivity

Probability of Reflectivity > 40dBZ

Probability of Max Reflectivity > 40dBZ

Probability of composite Reflectivity > 50dBZ

Prob rain

Prob sleet

Prob snow

Probability of Freezing Rain

Probability of Rain >0.5in in 3-hr

Probability of Rain >1in in 3-hr

Mean 1-hr Accumulated Snow

Mean 3-hr Accumulated Snow

Mean Accumulated Snow

Probability of Snow >1in in 1h

Probability of Snow >1in in 3h

Probability of Snow >3in in 3-hr

Mean PWAT

Probability of pwat > 1.5in

Probability of pwat > 2in

Mean 2m temp

Probability of 2m temp < 0C

Mean 2m dewpoint temp

Probability of 2m dewpoint temp > 55F

Probability of 2m dewpoint temp > 65F

Probability of 10m wind speed > 20kt

Probability of 10m wind speed > 30kt

Mean visibility

Probability of visibility < 0.5mi

Probability of echo top height > 30,000ft

Probability of echo top height > 35,000ft

Probability of ceiling height < 1000ft

Probability of ceiling height < 2000ft

Probability of ceiling height < 3000ft

Probability of Low Instrument flight rule

Probability of Instrument flight rule

Probability of marginal visual flight rule

Probability of marginal visual flight rule

Probability of visual flight rule

Mean mixed layer CAPE

Probability of mixed layer CAPE > 500 J/Kg

Probability of mixed layer CAPE > 1000 J/Kg

Probability of mixed layer CAPE > 2000 J/Kg

Probability of mixed layer CAPE > 3000 J/Kg

Mean vertical wind shear

Probability of vertical wind shear > 30 kt.

Probability of max updraft hlcy > 25m^2s^-2

Probability of max updraft hlcy > 100m^2s^-2

Model HRRR :

0-1km Helicity and Storm Motion

0-3km Helicity and Storm Motion

10 meter Wind

10 meter wind gust

2 meter Dew Point and 10 meter wind

2 meter Temperature and 10 meter Wind

250mb Wind

300mb Wind

500mb Temperature, Wind and Height

500mb Vorticity, Wind, and Height

700mb Relative Humidity, Wind, Height and Omega

850mb Temperature, Wind, and Height

925mb Temperature and Wind

Cloud Ceiling

Echo Tops

Hourly Total Precipitation

Lightning Flash Rate

Max 10m Wind Speed

Max 2-5km Updraft Helicity

Max Simulated Radar Reflectivity

Most Unstable Convective Available Potential Energy and Convective Inhibition

PMSL, 1000-500mb thickness, hourly precipitation

PMSL, 1000-850mb thickness, hourly precipitation

PMSL, 850-700mb thickness, hourly precipitation

Precipitation Rate

Precipitation Type

Simulated Radar Reflectivity 1km

Surface-Based Convective Available Potential Energy and Convective Inhibition

Total Accumulated Precipitation

Total Accumulated Snowfall

Visibility

Model HRRR, products with subhourly forecasts :

10 meter wind gust

2 Meter Dew Point and 10m Winds

2 Meter Temperature and 10m Winds

Dominant Precipitation Type

Simulated Radar Reflectivity 1km

Simulated Radar Max Reflectivity

Model HRW-ARW :

0-1km Helicity and Storm Motion

0-3km Helicity and Storm Motion

10 meter Wind

10 meter wind gust

2 meter Dew Point and 10 meter wind

2 meter Temperature and 10 meter Wind

250mb Wind and Height

300mb Wind and Height

500mb Vorticity, Wind, and Height

700mb Relative Humidity, Wind, and Height

850mb Temperature, Wind, and Height

Cloud Ceiling

Echo Tops

MSLP, 1000-500mb thickness, 3 hourly total precipitation

MSLP, 1000-850mb thickness, hourly total precipitation

MSLP, 10m wind, 6 houly total precip, 2m temperature

MSLP, 850-700mb thickness, hourly total precipitation

Max 2-5km Updraft Helicity

Most Unstable Convective Available Potential Energy and Convective Inhibition

Simulated Radar Reflectivity 1km

Surface-Based Convective Available Potential Energy and Convective Inhibition

Total Accumulated Precipitation

Total Precipitation every 1 hour

Total Precipitation every 12 hours

Total Precipitation every 24 hours

Total Precipitation every 3 hours

Total Precipitation every 36 hours

Total Precipitation every 48 hours

Total Precipitation every 6 hours

Visibility

Model HRW-NMMB :

0-1km Helicity and Storm Motion

0-3km Helicity and Storm Motion

10 meter Wind

10 meter wind gust

2 meter Dew Point and 10 meter wind

2 meter Temperature and 10 meter Wind

250mb Wind and Height

300mb Wind and Height

500mb Vorticity, Wind, and Height

700mb Relative Humidity, Wind, and Height

850mb Temperature, Wind, and Height

Cloud Ceiling

Echo Tops

MSLP, 1000-500mb thickness, 3 hourly total precipitation

MSLP, 1000-850mb thickness, hourly total precipitation

MSLP, 10m wind, 6 houly total precip, 2m temperature

MSLP, 850-700mb thickness, hourly total precipitation

Max 2-5km Updraft Helicity

Most Unstable Convective Available Potential Energy and Convective Inhibition

Simulated Radar Reflectivity 1km

Surface-Based Convective Available Potential Energy and Convective Inhibition

Total Accumulated Precipitation

Total Precipitation every 1 hour

Total Precipitation every 12 hours

Total Precipitation every 24 hours

Total Precipitation every 3 hours

Total Precipitation every 36 hours

Total Precipitation every 48 hours

Total Precipitation every 6 hours

Visibility

Model HWRF-FULL :

200mb Vorticity, Wind, and Height

500mb Relative Humidity and Wind

500mb Vorticity, Wind, and Height

700mb Vorticity, Wind, and Height

850mb Vorticity, 500mb Height, 200mb Wind

850mb Vorticity, Wind, and Height

MSLP and 6-hourly Total Precipitation

Mean Sea Level Pressure and 10 meter Wind

Model HWRF-NESTED :

200mb Vorticity, Wind, and Height

500mb Relative Humidity and Wind

500mb Vorticity, Wind, and Height

700mb Vorticity, Wind, and Height

850mb Vorticity, 500mb Height, 200mb Wind

850mb Vorticity, Wind, and Height

MSLP and 6-hourly Total Precipitation

Mean Sea Level Pressure and 10 meter Wind

Model ICE-DRIFT :

Polar Ice Drift

Model NAEFS :

10m Winds

2 meter Temperature

250mb Temperature

250mb Winds

500mb Temperature

500mb Vorticity and Height

500mb Winds

700mb Temperature

700mb Vorticity and Height

700mb Winds

850mb Temperature

850mb Vorticity and Height

850mb Winds

925mb Winds

Mean Sea Level Pressure

Model NAM :

200mb Wind and Height

250mb Wind and Height

300mb Wind and Height

500mb Relative Humidity and Height

500mb Vorticity, Wind, and Height

500mb Wind and Height

700mb Relative Humidity, Height and Omega

850mb Height, Precipitable Water and Wind

850mb Relative Humidity and Height

850mb Temperature, Wind and Height

850mb Vorticity, 500mb Height, 200mb Wind

850mb Vorticity, Wind and Height

925mb Temperature, Wind and Height

MSLP, 1000-500mb thickness, 3 hourly total precipitation

MSLP, 1000-850mb thickness, 3 hourly total precipitation

MSLP, 10m wind, 3 hourly total precip

MSLP, 10m wind, 3 hourly total precip, 2m temperature

MSLP, 850-700mb thickness, 3 hourly total precipitation

MSLP, 850mb temperature, 3 hourly total precipitation

Simulated Radar Reflectivity 1km

Snow Depth Change from F00

Total Accumulated Precipitation of Period

Total Precipitation every 12 hours

Total Precipitation every 24 hours

Total Precipitation every 3 hours

Total Precipitation every 36 hours

Total Precipitation every 48 hours

Total Precipitation every 6 hours

Total Precipitation every 60 hours

Model NAM-HIRES :

0-1km Helicity and Storm Motion

0-3km Helicity and Storm Motion

10 meter Wind

10 meter wind gust

2 meter Dew Point and 10 meter wind

2 meter Temperature and 10 meter Wind

200mb Wind and Height

250mb Wind and Height

300mb Wind and Height

500mb Temperature, Wind and Height

500mb Vorticity, Wind, and Height
700mb Relative Humidity, Height and Omega
850mb Height, Precipitable Water and Wind
850mb Temperature, Wind and Height
850mb Vorticity, 500mb Height, 200mb Wind
850mb Vorticity, Wind and Height
925mb Temperature, Wind and Height
Cloud Ceiling
Echo Tops
MSLP, 1000-500mb thickness, 3 hourly total precipitation
MSLP, 1000-850mb thickness, 3 hourly total precipitation
MSLP, 10m wind, 3 houly total precip, 2m temperature
MSLP, 850-700mb thickness, 3 hourly total precipitation
MSLP, 850mb temperature, 3 hourly total precipitation
Max 10m Wind Speed
Max 2-5km Updraft Helicity
Most Unstable Convective Available Potential Energy and Convective Inhibition
Simulated Radar Reflectivity 1km
Snow Depth Change from F00
Surface-Based Convective Available Potential Energy and Convective Inhibition
Total Accumulated Precipitation of Period
Total Precipitation every 12 hours
Total Precipitation every 24 hours
Total Precipitation every 3 hours
Total Precipitation every 36 hours
Total Precipitation every 48 hours
Total Precipitation every 6 hours
Total Precipitation every 60 hours
Total Precipitation every hour
Visibility

Model NAM-SND :

Model Sounding SKEWT

Model RAP :

10 meter wind gust

2 meter Dew Point and 10 meter wind

2 meter Temperature and 10 meter Wind

250mb Wind and Height

300mb Wind and Height

500mb Temperature, Wind and Height

500mb Vorticity, Wind, and Height

700mb Relative Humidity, Wind, Height and Omega

850mb Temperature, Wind, and Height

925mb Temperature, Wind and Height

Convective Available Potential Energy and Convective Inhibition

Echo Tops

Helicity and 30m Wind

Hourly Total Precipitation

MSLP, 1000-500mb thickness, hourly precipitation

MSLP, 1000-850mb thickness, hourly precipitation

MSLP, 850-700mb thickness, hourly precipitation

Precipitation Rate

Simulated Radar Reflectivity 1km

Total Accumulated Precipitation

Total Accumulated Snowfall

Visibility

Model RTMA :

10 meter Wind Direction and Speed

2 meter Dew Point

2 meter Temperature

Model RTMA-GUAM :

10 meter Wind Direction and Speed

2 meter Dew Point

2 meter Temperature

Model SREF :

10m Winds

250mb Vorticity and Height

250mb Wind

2m Temperature

500mb Vorticity and Height

700mb Relative Humidity

700mb Temperature

850mb Relative Humidity

850mb Temperature

850mb Wind

Mean 1000-500mb Thickness (m)

Mean 1000-850mb Thickness (m)

Mean 12-hour Precipitation

Mean 24-hour Precipitation

Mean 3-hour Precipitation

Mean 6-hour Precipitation

Mean 850-700mb Thickness (m)

Mean Convective Available Potential Energy

Mean Convective Inhibition

Mean Lifted Index

Mean Sea Level Pressure

Probability of 10m Wind Speeds > 25 knots

Probability of 6-hrly Precipitation > 0.25 (in)

Probability of Cape

Probablility of 2m Temperature < 0

Snow Total Mean

Snow Total Spread

Model SREF-CLUSTER :

250mb Wind and Height

300mb Wind and Height

500mb Vorticity and Height

700mb Relative Humidity, Height and Omega

850mb Temperature, Wind and Height

MSLP, 10m wind, 6 houly total precip, 2m temperature

Mean 1000-500mb Thickness (m)

Model UAIR :

1000mb plot

100mb plot

150mb plot

200mb plot

250mb plot

300mb plot

400mb plot

500mb plot

700mb plot

850mb plot

925mb plot

Model WW3 :

Peak Wave Direction and Period (sec)

Significant Wave Height and Wind

Wind Wave Direction and Period (sec)

Model WW3-ENP :

Regional WW3 Model Peak Wave Direction and Period

Regional WW3 Model Sig Wave Height and Wind

Regional WW3 Model Wind Wave Direction and Period

Model WW3-WNA :

Regional WW3 Model Peak Wave Direction and Period

Regional WW3 Model Sig Wave Height and Wind

Regional WW3 Model Wind Wave Direction and Period

Model NBM

6h Accu Precip

Accu Precip

2m temp 10m Wind

2m Relative Humidity 10m Wind

2m Apparent Temp

2m Min Temp

2m Max Temp

2m Dew Point Temp 10m Wind

10m Wind 10m Gust

Total Cloud Cover

Model HRW-ARW 2:

0-1km Helicity and Storm Motion

0-3km Helicity and Storm Motion

10 meter Wind

10 meter wind gust

2 meter Dew Point and 10 meter wind

2 meter Temperature and 10 meter Wind

250mb Wind and Height

300mb Wind and Height

500mb Vorticity, Wind, and Height

700mb Relative Humidity, Wind, and Height

850mb Temperature, Wind, and Height

Cloud Ceiling

Echo Tops

MSLP, 1000-500mb thickness, 3 hourly total precipitation

MSLP, 1000-850mb thickness, hourly total precipitation

MSLP, 10m wind, 6 houly total precip, 2m temperature

MSLP, 850-700mb thickness, hourly total precipitation

Max 2-5km Updraft Helicity

Most Unstable Convective Available Potential Energy and Convective Inhibition

Simulated Radar Reflectivity 1km

Surface-Based Convective Available Potential Energy and Convective Inhibition

Total Accumulated Precipitation

Total Precipitation every 1 hour

Total Precipitation every 12 hours

Total Precipitation every 24 hours

Total Precipitation every 3 hours

Total Precipitation every 36 hours

Total Precipitation every 48 hours

Total Precipitation every 6 hours

Visibility