Product Description Document:
NCEP Model Analyses & Guidance
March 2024

Part I: Mission

The Model Analyses and Guidance (MAG) website showcases the National Weather Service's observational 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 public 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:

https://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 four categories:

- **Model Guidance**
    - North American Mesoscale (NAM)
    - NAM-HIRES
    - Fire Weather
    - Global Forecast System (GFS)
    - GFS-WAVE
    - Short Range Ensemble Forecast (SREF)
    - Rapid Refresh Analysis & Forecast System (RAP)
    - High Resolution Rapid Refresh Analysis & Forecast System (HRRR)
    - High Resolution Window (HRW-FV3)
    - High Resolution Window (HRW-ARW)
    - Polar Ice Drift (ICE-DRIFT)
    - Global Ensemble Forecast System (GEFS)
    - North American Ensemble Forecast System(NAEFS)
    - Surge and Tide Operational Forecast System (STOFS)
    - High Resolution Ensemble Forecast (HREF)
    - National Blend of Models (NBM)
    - High Resolution Window - WRF - member 2 (HRW-ARW2)
    - Storm-tracks
    - Panels
    - GEFS-WAVE

- **Observations and Analyses**
    - Real Time Mesoscale Analysis (RTMA)
    - Observed Upper Air Data
    - Skew-T Sounding

- **Tropical Guidance**
    - Hurricane Analysis and Forecast System (HAFS)
    - Automated Tropical Cyclone Forecasting System (ATCF)

- **Forecast BUFR Soundings**
    - Global Forecast System (GFS) soundings
    - 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.

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.

Comments and Questions- Please email to sdb.support@noaa.gov

Part II: Science and Technology

A. Format & Science Basis

Graphics from Numerical Weather Prediction models are available. The models described in this document are: NAM, NAM-HIRES, FIREWX, GFS, GFS-WAVE.

HREF, SREF, RAP, HRRR, HRW(ARW, ARW2, and FV3), ICE-DRIFT, GEFS, GEFS-WAVE, NBM, NAEFS, STOFS, STORM TRACKS, HAFS, RTMA, UAIR, SKEWT, NAM-SND and GFS-SND.

North American Mesoscale (NAM), including NAM-HIRES & FIREWX

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.

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

- North America
- Western North Atlantic
- North Pacific
- Eastern North Pacific

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

1) 3 km resolution (NAM-HIRES) at forecast intervals of three hours out to 60 hours for the following regions:
    - CONUS
    - Northeast United States
    - Northwest United States
    - Southwest United States
    - Southeast United States
    - North Central United States
    - South Central United States
    - Alaska
    - Hawaii

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:
https://www.emc.ncep.noaa.gov/emc/pages/numerical_forecast_systems/nam.php

Global Forecast System (GFS)

The GFS is a global numerical weather prediction system containing a global computer model and variational analysis run by the U.S. 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:

- North America (namer)
- South America (samer)
- Pacific Ocean
- North Pacific
- South Pacific
- Eastern North Pacific
- Western North Atlantic
- North Atlantic Ocean Basin
- Polar
- Europe
- Asia
- Arctic
- Alaska
- India
- American Samoa

The link to the latest information about the GFS is:
https://www.emc.ncep.noaa.gov/emc/pages/numerical_forecast_systems/gfs.php

GFS-WAVE

The MAG website presents the GFS-WAVE model for the following regions :

- Atlantic

- North Pacific
- East Pacific
- Entire North Atlantic and North Pacific ocean
- Western North Atlantic, including Southeast US, Central America and Caribbean.
- Europe
- Alaska
- Hawaii
- Arctic
- NW-coast
- NE-coast
- SE-coast
- WA-OR (Washington and Oregon)
- GOM (Gulf of Mexico)
- SOUTH-CAL (southern California)
- NORTH-CAL (northern California)
- PAC-REGION (including regions in the far South Pacific).
- Africa
- EAST-GOA (East Gulf of Alaska)
- WEST-GOA (West Gulf of Alaska)
- Guam
- India
- Polar
- PR
- U.S. Mid-Atlantic Coast (MID-ATL)

NCEP is merging the operational standalone global deterministic WAVEWATCH III based wave model Multi_1 (wave_multi_1.v3.3) into the GFS system. The WAVEWATCH III model is updated and coupled to the GFS using a one-way coupling scheme in which the atmospheric model provides forcing to the wave model using the NOAA Environmental Modeling System (NEMS).

GFS-WAVE forecasts are produced every six hours at 00, 06, 12 and 18 UTC, every 3 hours upto 072fhr and every six-hour upto 180.

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 GFS-WAVE is:
https://github.com/NOAA-EMC/WW3/tree/production/GFS.v16

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:

- North America
- 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 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
https://www.emc.ncep.noaa.gov/mmb/SREF/SREF.html

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 51 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

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 48 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:

- CONUS
- Northeast United States
- Northwest United States
- Southwest United States
- Southeast United States
- North Central United States
- South Central United States

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

High Resolution Window (HRW-FV3)

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 (FV3).

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

- 00/12 UTC:
    - CONUS
    - Northeast United States
    - Northwest United States
    - Southwest United States
    - Southeast United States
    - North Central United States
    - South Central 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) https://www.weather.gov/news/fv3

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).

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
  - Northeast United States
  - Northwest United States
  - Southwest United States
  - Southeast United States
  - North Central United States
  - South Central 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:

https://www.mmm.ucar.edu/models/wrf

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).

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/

Global Ensemble Forecast System (GEFS)

The GEFS is a GFS-based modeling system run with 30 ensemble members per cycle plus one control run. GEFS forecasts are produced every six hours at 00Z, 06Z, 12Z, and 18Z. 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 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.

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://www.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

Surge and Tide Operational Forecast System (STOFS)

The Surge and Tide Operational Forecast System (STOFS, formerly ESTOFS) is a collaboration between the NOAA/NOS/OCS/Coast Survey Development Lab, University of Notre Dame, Virginia Institute of Marine Science and NOAA/NCEP.

STOFS contains the former two-dimensional depth averaged global component (STOFS-2D-Global) based on the ADvanced CIRCulation (ADCIRC) model core. STOFS also includes a three-dimensional (3D) model component for the Atlantic basin (STOFS-3D-Atlantic) based on the SCHISM model core (Semi-implicit Cross-scale Hydroscience Integrated System Model). The STOFS system runs on NCEP's central computing system.

STOFS-2D-Global runs four times daily producing numerical storm surge and tide model forecast guidance globally out to 180 hours. The model is forced by real time output of winds and pressure from the NCEP Global Forecast System (GFS). The domain of the operational STOFS-2D-Global forecast guidance covers the entire globe, including the floodplain of the coastal U.S., the Caribbean area surrounding Puerto Rico, and Alaska. STOFS-3D-Atlantic runs daily to provide one day of nowcast and two days of water level and surface current forecast guidance. STOFS-3D-Atlantic makes uses of outputs from the National Water Model to include inland hydrology and extreme precipitation effects on coastal flooding; forecast guidance from the NCEP Global Forecast System (GFS) and High-Resolution Rapid Refresh (HRRR) model as the surface meteorological forcing; and the combined tidal and subtidal water level, and three-dimensional water temperature, salinity, and currents from the NCEP Global Real-Time Ocean Forecast System (G-RTOFS) as the open ocean boundary forcing.

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

Note: The 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 STOFS 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

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:

- CONUS
- Northeast United States
- Northwest United States
- Southwest United States
- Southeast United States
- North Central United States
- South Central United States

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 up to 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 264 hours for :

precip_p06
precip_ptot

The link to the latest information about the NBM is:
https://vlab.noaa.gov/web/mdl/nbm

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
- Northeast United States
- Northwest United States
- Southwest United States
- Southeast United States
- North Central United States
- South Central 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).

Storm tracks

Model storm tracks for GFS are plotted for the following areas:

- CONUS
- Alaska
- Asia
- Atlantic
- Europe
- North Pacific

Model storm tracks for NAM are plotted for the following areas:

- CONUS
- Alaska

Single model ensemble storm tracks for GFS-NAM are plotted for the following areas:

- CONUS
- Alaska

GEFS and SREF ensemble storm tracks is plotted for the area:

- Alaska.

Probabilistic ensemble storm tracks for GEFS and SREF is plotted for the area:

- Alaska

Panels

All products displayed on this page are panels of four different products from different models on one page.

Panel displays are valid for the following areas:

- NAMER
- CONUS
- Africa
- Alaska
- Arctic
- Asia
- Atlantic
- East Pacific
- Europe
- India
- Northeast United States
- Northwest United States
- North Central United States
- North Pacific
- Polar
- Southwest United States
- Southeast United States
- South Central United States
- South America
- South Pacific

GEFS-WAVE

The MAG website presents the GEFS-WAVE model for the following regions :

- Atlantic
- North Pacific
- East Pacific
- Entire North Atlantic and North Pacific ocean
- Western North Atlantic, including Southeast US, Central America and Caribbean.
- Europe
- Alaska
- Hawaii
- Arctic
- NW-coast
- NE-coast
- SE-coast
- WA-OR (Washington and Oregon)
- GOM (Gulf of Mexico)
- SOUTH-CAL (southern California)
- NORTH-CAL (northern California)
- PAC-REGION (including regions in the far South Pacific).
- Africa
- EAST-GOA (East Gulf of Alaska)
- WEST-GOA (West Gulf of Alaska)
- Guam
- India
- Polar
- PR
- U.S. Mid-Atlantic Coast (MID-ATL)

The Global Ensemble Forecast System - Wave (GEFS-Wave) is a one-way coupling of the GEFS atmospheric model with the WAVEWATCH III wave model. This allows for an increase in frequency of the wind forcing from 3 hours to 1 hour. This unified system has 30 members and the wave model is initialized with the previous member's 6 hour forecast. The wave model has a spatial resolution of 0.25 x 0.25 degrees. The system runs four cycles per day (00, 06, 12 and 18Z). The wave forecast has been extended from 10 to 16 days.

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:

- Southwest U.S.
- California
- North Carolina/South Carolina
- Colorado
- North Dakota/South Dakota
- Midwest region of U.S.
- Gulf Coast region of U.S.
- Mid-Atlantic region of U.S.
- Michigan
- Montana
- New England
- Ohio Valley
- Texas
- Pacific Northwest region of U.S.
- Wisconsin
- Florida
- Alaska

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.

Skew-T Soundings

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

Hurricane Analysis and Forecast System (HAFS)

As a Unified Forecast System (UFS) application, HAFS is an FV3 (Finite Volume CubedSphere Dynamical Core) based multi-scale model and data assimilation system capable of providing Tropical Cyclone (TC, including Hurricanes and Typhoons) analyses and forecasts of the inner core structure and the large-scale environment. The HAFS development targets an operational analysis and forecast system for Hurricane forecasters with reliable, robust and skillful guidance on TC track and intensity (including rapid intensification), storm size, genesis, storm surge, rainfall and tornadoes associated with TC's. HAFS will provide an advanced analysis and forecast system for cutting-edge research on modeling, physics, data assimilation, and coupling to earth system components for high resolution TC predictions within the outlined Next Generation Global Prediction System (NGGPS)/Strategic Implementation Plan (SIP) objectives of the Unified Forecast System (UFS).

Information about the HAFS can be found here:
https://wpo.noaa.gov/the-hurricane-analysis-and-forecast-system-hafs/
https://hfip.org/hafs

Automated Tropical Cyclone Forecasting (ATCF) System

The ATCF, developed by the Naval Research Laboratory - Monterey, is a computer program to automate the forecasting of tropical cyclones and is used by operational forecasting agencies across the Federal government ecosystem (see Sampson & Schrader, 1999). Version 5.0 of the MAG now displays ATCF output – specifically, forecast storm center placement and intensity. It is generated as-needed every six hours – 00Z, 06Z, 12Z, and 18Z – for a given tropical cyclone.

Information on the ATCF can be found here:
https://www.nrlmry.navy.mil/atcf_web/

Global Forecast System (GFS) BUFR Soundings

The GFS model soundings, a.k.a., BUFR sounding or PFC sounding, provide SKEW-T images over upper air sounding stations in the North America region. It is made available up to 120 hours with a 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.

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 in the North America region. It is made available up to 84 hours with a 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/sdb/.

b) For more information about Models products please contact:

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