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PNSWSH

Technical Implementation Notice 15-xx
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From: Timothy McClung
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        NWS Office of Science and Technology Integration

Subject: Upgrade to HIRES Window and Introduction of
        High-Resolution Ensemble Forecast: Effective
        June 30, 2015

Effective June 30, 2015, beginning with the 1200 Coordinated
Universal Time (UTC) run, the National Centers for Environmental
Prediction (NCEP) will upgrade the High-Resolution Window
Forecast System (HIRESW). This upgrade includes:

-Changes to the model components
-Increase in vertical resolution
-Modifications to parameterized physics
-New product fields
-File name changes
-New High-Resolution Ensemble Forecast (HREF) suite of products.

Model Changes:

The HIRESW model will be updated from Weather Research and
Forecasting (WRF) version 3.5 code to 3.6.1 code for the Advanced
Research WRF (ARW) member. The Nonhydrostatic Multiscale Model on
B-grid (NMMB) will be updated from a late 2013 to early 2015
version of the code, but it will retain the microphysics used
with the current HIRESW system.

The number of vertical levels will increase from 40 to 50 in both
the WRF-ARW and NMMB systems.

Physics Changes:

The WRF Single Moment 6-Class (WSM6) microphysics of the WRF-ARW
will be modified to decrease the amount of falling graupel, which
will leave more moisture for snow production in the anvil region.

Post-processing Changes:

Simulated radar reflectivity for the WRF-ARW model will now be generated by the post-processing code rather than by the model microphysics. This change tends to reduce reflectivity at the melting layer, which primarily impacts the composite reflectivity.

Simulated reflectivity (instantaneous and hourly maximum) and echo top height fields will be defined in this upgrade by the nearest-neighbor value on the model grid rather than through bilinear interpolation as was done previously.

The bitmapping of echo top heights for which no point in the column has a sufficient value of reflectivity to define a height will be removed. A zero height value will be assigned instead.

Output Product Changes:

The order of records within the gridded output files will change due to significant software changes in how the products are produced.

The hourly maximum and minimum temperature and relative humidity fields at 2 meters above ground will now be labeled in Grib2 as temporal maxima and minima.

New fields only for 5 km output grids:

- Cloud ceiling height
- Simulated radar reflectivity at -10 C level

Changes to content of the 2.5-3 km NDFD output grids:

- Duplicate fields of surface height, land-sea mask, and Haines Index in the three hourly files will be removed.

- A total cloud percentage will be uniformly defined for all forecast hours. This replaces a surface total cloud percentage field that was previously only in three hourly files.

- The one and two hour old 2 m temperature and dew point temperature fields will be included for forecasts valid at 00Z and 12Z. This was previously included for all three hourly output except at those valid times.

- A best (4 layer) lifted index field will be added to the three hourly output. This field was previously in the non-three hourly output only.

- Precipitation type and 2 m temperature and dew point temperature fields will be removed from the non-three hourly output in the NMMB run over Hawaii.

- A bug that was leading to incomplete Guam output files every

six hours will be corrected. The following fields will be added
to the incomplete Guam files:

Accumulated precipitation
Probability of wetting rain
Planetary Boundary Layer (PBL) depth
2 m dew point temperature
Surface wind gust
Height of lowest wet bulb 0 C temperature
Surface geopotential height
Surface pressure
Land-sea mask
Maximum and minimum 2 m relative humidity (RH)
Probability of precipitation
Composite reflectivity
Average PBL RH
Snow depth accumulation
2 m specific humidity
Maximum and minimum 2 m temperature
2 m temperatures
10 m U and V winds
Surface visibility
Average PBL wind direction
Average PBL wind speed
Accumulated snow water equivalent

File name changes:

The filenames of existing output files will change to a new
naming convention. All output files will now have "hiresw" as
the leading character string. Legacy "awpreg", "awp5km", and
"smart" strings will be discontinued. For gridded output, the
output file grid spacing in kilometers will be provided in the
file name, with decimals represented by a "p" (2.5 km is 2p5km in
a file name). Please reference Table 1 for all Grib2 file name
changes.

The BUFR output file names will also change, generally following
the same rules applied for the gridded output. Please reference
Table 2 for all BUFR file name changes.

Addition of new BUFR Sounding Products:

BUFR sounding products will be made available for each HIRESW
domain. The file names for these products will be:

hiresw.tCCz.domain[arw|nmmb].bufrsnd.tar.gz

where CC is the cycle (00 and 12 for CONUS, Guam, and Hawaii and
06 and 18 for Alaska and Puerto Rico)
and domain is conus, ak, guam, hi, or pr
In addition to the single monolithic files for each model run,
the BUFR output will also be split out by individual station.

The individual station files have names of the format:

domain[arw|nmmb]bufr.station.cycle

where domain is conus, ak, guam, hi, or pr
where station is the 6-digit identifier
and where cycle is the YYYYMMDDCC formatted time of the model
initial time (YYYY is the 4-digit year, MM is the month, DD is
the day, and CC is the cycle (00, 06, 12, 18)).

The new HREF products:

The new HREF is a set of probabilistic products generated from
the three most recent HIRESW model runs [both WRF-ARW and NMMB
members] and the five most recent North American Mesoscale (NAM)
model nest runs to create an 11 member time-lagged ensemble. In
this initial implementation, products will be generated only for
the Contiguous United States (CONUS) domain. Despite using the
same name, this product has very little in common with the HREF
output previously provided by HIRESW v5.

HREF products will be generated every 6 hours at 00Z, 06Z, 12Z,
and 18Z. Mean, spread, and probability products will be produced
at 3 hour forecast intervals from 3 h to 36 h.

The file names for the mean, spread, and probability product
files will be:

href.tCCz.mean.fFF.grib2
href.tCCz.sprd.fFF.grib2
href.tCCz.prob.fFF.grib2

where CC is the cycle (00, 06, 12, 18)
and where FF is the forecast hour (03, 06, 09, ..., 30, 33, 36)

The contents of the mean and spread files will be:

Sea level pressure
500 hPa height
850 hPa height, temperature, U and V winds, and wind speed
700 hPa vertical velocity and relative humidity
500 hPa absolute vorticity
Precipitable water (column total)
Surface visibility
3 h accumulated precipitation
Cloud ceiling height
Surface vertical speed shear

The contents of the probability files will be:

1000 m AGL simulated reflectivity > 40 dBZ
Hourly maximum 1000 m AGL simulated reflectivity > 40 dBZ
Hourly maximum 2-5 km AGL updraft helicity > 25 m^2/s^2
Hourly maximum updraft over 400-1000 hPa layer (m/s) > (1, 5, 10)

Hourly maximum downdraft over 400-1000 hPa layer (m/s) >
 (1, 5 10)
Hourly maximum 10 m AGL U wind component > 15.4 m/s
Hourly maximum 10 m AGL V wind component > 15.4 m/s
Precipitable water (column total, kg/m^2) > (25, 37.5, 50)
Surface visibility (m) < (400, 800, 1600, 3200, 6400)
Column maximum (composite) simulated reflectivity (dBZ) > (10,
20, 30, 40, 50)
Echo top height (m) > (1000, 3000, 5000, 7600, 10000)
3 h precipitation (kg/m^2) > (0.24, 6.34, 12.4, 25.1, 50, 75)
Precipitation type: rain, freezing rain, ice pellets, snow
10 m AGL wind speed (m/s) > (10.3, 15.4, 20.6)
80 m AGL wind speed (m/s) > (10.3, 15.4, 20.6)
850 hPa wind speed (m/s) > (10.3, 20.6, 30.9, 41.2, 51.5)
500 hPa wind speed (m/s) > (10.3, 20.6, 30.9, 41.2, 51.5)
250 hPa wind speed (m/s) > (10.3, 20.6, 30.9, 41.2, 51.5)
Flight category (1-4)
Haines Index (2-5, 5-6, 6-7)
Cloud ceiling height (m) < (305, 610, 915, 1372, 1830, 3050)
Surface vertical speed shear (1/s) > 20
Wind speed over 300 to 850 hPa above ground < 5 m/s

Data Availability and Schedule Changes:

During the 2015 hurricane season, NCEP does not plan to reinstate
the preemption of HIRESW runs, but in subsequent years NCEP may
need to resume preemption based on resources in the NCEP
Production Suite.

The HIRESW data is currently available on the NWS FTP server, the
NCEP server, NOMADS, and on NOAAPORT. The HREF products will
also be available on the NWS FTP server, the NCEP server, and
NOMADS, but they are not available on NOAAPORT.

Product delivery timing of current HIRESW products is not
expected to change as a result of this implementation, although
downscaled (2.5 to 3 km) output from the CONUS and AK domains
will be available somewhat earlier. Currently it arrives as much
as 30 minutes later than the 5 km gridded output; with this
upgrade that delay will be reduced to about five minutes.

More information regarding the current operational HIRESW and
associated products can be found at:

http://www.emc.ncep.noaa.gov/mmb/mmbpll/nestpage_4km/

A consistent parallel feed of data is currently available on the
NCEP HTTP server at the following URL:

http://para.nomads.ncep.noaa.gov/pub/data/nccf/com/hiresw/para/

Table 1: Grib2 File Name Changes

Contiguous United States (CONUS):

conus[arw|nmmb].tCCz.awp5kmfFF.grib2 ->
hiresw.tCCz.[arw|nmmb]_5km.fFF.conus.grib2
conus[arw|nmmb].tCCz.smartconusfFF.grib2 ->
hiresw.tCCz.[arw|nmmb]_2p5km.fFF.conus.grib2

Hawaii:
hi[arw|nmmb].tCCz.awpregfFF.grib2 ->
hiresw.tCCz.[arw|nmmb]_5km.fFF.hi.grib2
hi[arw|nmmb].tCCz.smarthifFF.grib2 ->
hiresw.tCCz.[arw|nmmb]_2p5km.fFF.hi.grib2

Puerto Rico:
pr[arw|nmmb].tCCz.awpregfFF.grib2 ->
hiresw.tCCz.[arw|nmmb]_5km.fFF.pr.grib2
pr[arw|nmmb].tCCz.smartprfFF.grib2 ->
hiresw.tCCz.[arw|nmmb]_2p5km.fFF.pr.grib2

Alaska:
ak[arw|nmmb].tCCz.awpregfFF.grib2 ->
hiresw.tCCz.[arw|nmmb]_5km.fFF.ak.grib2
ak[arw|nmmb].tCCz.smartakfFF.grib2 ->
hiresw.tCCz.[arw|nmmb]_3km.fFF.ak.grib2

Guam:
guam[arw|nmmb].tCCz.awpregfFF.grib2 ->
hiresw.tCCz.[arw|nmmb]_5km.fFF.guam.grib2
guam[arw|nmmb].tCCz.smartguamfFF.grib2 ->
hiresw.tCCz.[arw|nmmb]_2p5km.fFF.guam.grib2

where CC is the model cycle (00 or 12 for CONUS, Alaska, and Guam
domains and 06 or 18 for Hawaii and Puerto Rico domains)
and where FF is the forecast hour (00, 01, 02, ..., 46, 47, 48).

Table 2: BUFR File Name Changes

conusarw.tCCz.class1.bufr -> hiresw.tCCz.conusarw.class1.bufr
conusnmmb.tCCz.class1.bufr -> hiresw.tCCz.conusnmmb.class1.bufr
hiarw.tCCz.class1.bufr   -> hiresw.tCCz.hiarw.class1.bufr
hinmmb.tCCz.class1.bufr   -> hiresw.tCCz.hinmmb.class1.bufr
prarw.tCCz.class1.bufr   -> hiresw.tCCz.prarw.class1.bufr
prnmmb.tCCz.class1.bufr   -> hiresw.tCCz.prnmmb.class1.bufr
akarw.tCCz.class1.bufr   -> hiresw.tCCz.akarw.class1.bufr
aknmmb.tCCz.class1.bufr   -> hiresw.tCCz.aknmmb.class1.bufr
guamarw.tCCz.class1.bufr   -> hiresw.tCCz.guamarw.class1.bufr
guamnmmb.tCCz.class1.bufr -> hiresw.tCCz.guamnmmb.class1.bufr

where CC is the model cycle (00 or 12 for CONUS, Alaska, and Guam
domains and 06 or 18 for Hawaii and Puerto Rico domains).

NCEP encourages all users to ensure their decoders are flexible
and are able to adequately handle changes in content order,
changes in the scaling factor component within the product
definition section (PDS) of the GRIB files, and also any volume
changes which may be forthcoming. These elements may change with

future NCEP model implementations. NCEP will make every attempt to alert users to these changes prior to any implementations.

For questions regarding these changes, please contact:

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NWS National Technical Implementation Notices are online at:

http://www.weather.gov/os/notif.htm

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