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PNSWSH

Service Change Notice 21-38
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          -NOAA Weather Wire Service
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From: Michael Farrar
          Director, National Centers for Environmental Prediction

Subject: Upgrade to High Resolution Ensemble Forecast (HREF) and High-Resolution
            Window (HIRESW) effective May 4, 2021

Effective on or about May 4, 2021, beginning with the 1200 Coordinated Universal Time
(UTC) run, the National Centers for Environmental Prediction (NCEP) will upgrade the
HREF and HIRESW systems to change the following:

  - HIRESW modeling system
  - HREF model membership
  - HIRESW output products, including NOAAPORT
  - HREF output products, including NOAAPORT

A real-time feed of HREFv3 and HIRESWv8 is available on para NOMADS for both
NCEP Web services and NOAAPORT output here:
http://para.nomads.ncep.noaa.gov/pub/data/nccf/com/hiresw/para/
http://para.nomads.ncep.noaa.gov/pub/data/nccf/noaaport/hiresw/

1) Changes in the HIRESW modeling system

  - A Finite Volume Cubed Sphere (FV3) model replaces the Nonhydrostatic Multiscale
Model on B-grid (NMMB) within the HIRESW system.

  - The HiresW-FV3 increases the resolution of the HiresW-NMMB it replaces (from
3.2 km to 3.0 km horizontal grid spacing, and from 50 levels to 60 levels in the vertical),
and extends the forecast range from 48 h to 60 h.

  - The initialization of the HiresW-FV3 differs from the HiresW-NMMB it replaces for all
domains except Guam. All HiresW-FV3 domains are initialized from a 6 h old cycle of

the Global Forecast System (GFS). Previously the HiresW-NMMB used North American Model (NAM) surface conditions for all non-Guam domains, and took atmospheric initial conditions from the Rapid Refresh (RAP) for the CONUS and Puerto Rico domains.

   - The HiresW-FV3 also uses a very different set of physics than the HiresW-NMMB being replaced. In both models no parameterized convection is used, but the HiresW-FV3 otherwise is using GFS-style physics, while the HiresW-NMMB utilized NAM-style physics. More details on the model configuration change is available at slide 16 of this document:
https://www.emc.ncep.noaa.gov/mmb/mpyle/hiresw/doc/HREF_od_brief.pdf

2) Changes to the HREF model membership

   - The HIRESW-FV3 replaces the HIRESW-NMMB for all domains within the HREF.

   - The High Resolution Rapid Refresh (HRRR) is added as a new member for the CONUS and Alaska domains of HREF. A 6 h old time-lagged member of HRRR also is added for these domains. HREF membership size increases from 8 to 10 for CONUS, and from 6 to 8 for Alaska. The membership size of the Hawaii and Puerto Rico domains remains unchanged at 6 members.

3) Changes to HIRESW output products provided on NOMADS/FTPPRD web services (including OPeNDAP and Grib Filter) and the Satellite Broadcast System (SBN)/NOAAPort

   - GRIB output changes:

In all comparisons here, CC is the cycle time, and FF is the forecast hour. The name following --> indicates the file name in the new system. The switch from NMMB to FV3 model output leads to a change in the output file names.

Additionally, FV3 files are produced out to FF = 60 as opposed to FF = 48 in NMMB.

   a) For the main 5 km output grids:

hiresw.tCCz.nmmb_5km.fFF.DOM.grib2
  --> hiresw.tCCz.fv3_5km.fFF.DOM.grib2
          Where DOM is domain (conus|guam|hi|pr|ak)

The new FV3 files have these products not in NMMB:

  WEASD:surface:FF hour fcst: (instantaneous WEASD)
  APCP:surface:0-FF hour acc fcst:(running total APCP)

FV3 also has consistent average latent heat flux (LHTFL) and sensible heat flux (SHTFL)computed over the previous hour - the NMMB averaged fluxes with a 3 h bucket, so the period covered varied with forecast hour (f01 averaged f00-f01, f02 averaged f00-f02, f03 averaged f00-f03, f04 averaged f03-f04, and so on).

Likewise, the NMMB did APCP and WEASD accumulation using a 3 h bucket, while the FV3 accumulates over the length of the forecast. The NMMB thus had partial bucket values (such as an f00-f02 accumulation at f02, an f03-f05 accumulation at f05) that are not present in the FV3.

The small domains (guam | hi | pr) have 0-6 km shear added to match what already exists for the ak and conus output in both the ARW and FV3 output:

VUCSH:0-6000 m above ground:FF hour fcst:
VVCSH:0-6000 m above ground:FF hour fcst:

  b) For the 2p5km and 3km NDFD grids:

hiresw.tCCz.nmmb_2p5km.fFF.DOM.grib2
  --> hiresw.tCCz.fv3_2p5km.fFF.DOM.grib2
      Where DOM is domain (conus|guam|hi|pr)

hiresw.tCCz.nmmb_3km.fFF.ak.grib2
  --> hiresw.tCCz.fv3_3km.fFF.ak.grib2

In both ARW and FV3 output for non-CONUS domains, 5000-2000 minimum updraft helicity (MNUPHL) is added. Older versions of wgrib2 may list this field as "var discipline=0 center=7 local_table=1 parmcat=7 parm=200"

The new FV3 files also have these products not in NMMB:

WEASD:surface:FF hour fcst: (instantaneous WEASD)
APCP:surface:0-FF hour acc fcst:(running total APCP)

As in the 5km product, NMMB computed APCP and WEASD accumulation utilizing a 3 h bucket, while the FV3 accumulates over the length of the forecast. The NMMB thus had partial bucket values (such as an f00-f02 accumulation at f02, an f03-f05 accumulation at f05) that are not present in the FV3.

   c) The 00 h output in both the ARW and FV3 model has eliminated hourly maximum and minimum fields, average fields, and accumulation fields, all of which lack meaning at the 00 h forecast time.

      1) For the 00 h main 5 km output grids:

hiresw.tCCz.nmmb_5km.f00.DOM.grib2
     --> hiresw.tCCz.fv3_5km.f00.DOM.grib2
and
hiresw.tCCz.arw_5km.f00.DOM.grib
        Where DOM is domain (conus|guam|hi|pr|ak)
and
hiresw.tCCz.arw_5km.f00.DOMmem2.grib
        Where DOM is domain (conus|hi|pr|ak)
these records are removed:

MAXUVV:100-1000 mb::
MAXDVV:100-1000 mb::
MAXUW:10 m above ground::
MAXVW:10 m above ground::
MAXREF:1000 m above ground::
MXUPHL:5000-2000 m above ground::
MXUPHL:3000-0 m above ground::
REFD:263 K level:0-0 day max fcst:
MNUPHL:5000-2000 m above ground::
MNUPHL:3000-0 m above ground::
TMAX:2 m above ground::
MAXRH:2 m above ground::
TMIN:2 m above ground::
MINRH:2 m above ground::

for the fv3,
WEASD:surface:0-0 day acc fcst:
is replaced by
WEASD:surface:anl:

And these records are only removed by shifting from NMMB to FV3 output (no such records exist in ARW output):

SHTFL:surface:0-0 day ave fcst:
LHTFL:surface:0-0 day ave fcst:

   2) For the 00h 2p5km and 3km NDFD output grids:

hiresw.tCCz.nmmb_2p5km.f00.DOM.grib2
     --> hiresw.tCCz.fv3_2p5km.f00.DOM.grib2
hiresw.tCCz.nmmb_3km.f00.ak.grib2
     --> hiresw.tCCz.fv3_3km.f00.ak.grib2
hiresw.tCCz.arw_2p5km.f00.DOM.grib2
hiresw.tCCz.arw_3km.f00.ak.grib2
          Where DOM is domain (conus|guam|hi|pr|ak)

these records are removed:

MAXUVV:100-1000 mb::
MAXDVV:100-1000 mb::
MAXREF:1000 m above ground::
MXUPHL:5000-2000 m above ground::
TMAX:2 m above ground::
TMIN:2 m above ground::
MAXRH:2 m above ground::
MINRH:2 m above ground::
MAXUW:10 m above ground::
MAXVW:10 m above ground::

for the fv3,
WEASD:surface:0-0 day acc fcst:
is replaced by
WEASD:surface:anl:

   - BUFR output changes:

In comparisons here,
CC is the cycle time and DOM is the domain (conus|guam|hi|pr|ak)

File names are modified as follows:

hiresw.tCCz.DOMnmmb.class1.bufr
    --> hiresw.tCCz.DOMfv3.class1.bufr
hiresw.tCCz.DOMnmmb.class1.bufr.wcoss
    --> hiresw.tCCz.DOMfv3.class1.bufr.wcoss
hiresw.tCCz.DOMnmmb.bufrsnd.tar.gz
    --> hiresw.tCCz.DOMfv3.bufrsnd.tar.gz
and
bufr.DOMnmmbCC/DOMnmmbbufr.ST.YYYYMMDDCC
    --> bufr.DOMfv3CC/DOMfv3bufr.ST.YYYYMMDDCC
    where ST is the station number
    and YYYYMMDD is the forecast cycle year, month and day

53 stations that existed in CONUS NMMB BUFR output are eliminated in CONUS FV3 BUFR output due to a smaller integration domain. The associated station identifiers and station numbers for the eliminated stations are listed below:

CHRL - 14	CNLK - 16	WJA - 17
MRYS - 256	S#1 - 310	NW4 - 333
NW5 - 334	NW6 - 335	NW9 - 338
B#G - 46006	G#A - 90010	G#D - 90013
G#G - 90016	CWZV - 710310	CYPE - 710680
CYYL - 710780	CYTH - 710790	CYZT - 711090
CWSE - 711190	CYEG - 711230	CYLJ - 711250
CYBU - 711300	CWZB - 711970	CWSA - 716000
CYQY - 717070	CYQX - 718030	CYDF - 718090
CYZV - 718110	CYJT - 718150	CYAH - 718230
CYTL - 718480	CYFO - 718575	CYQD - 718670
CYXS - 718960	CWLB - 719310	MMZC - 765255
TXKF - 780160	MUNG - 782210	MUCM - 782550
MUMZ - 782560	MUBY - 782593	MUCU - 782640
MUGT - 782670	MUBA - 782680	MUMO - 782684
MUCL - 783334	MUVT - 783570	MUGM - 783670
MTCH - 784090	MDPP - 784570	MDST - 784600
MDSD - 784850	DSD - 784860	

For the Alaska domain, a single station that was in the AK NMMB BUFR output is eliminated in the AK FV3 BUFR output due to a smaller integration domain.   The associated station identifier and station number for the eliminated station is below:

NW8   337

The stations provided by FV3 BUFR output for Hawaii, Puerto Rico, and Guam match the list of stations previously provided by the NMMB BUFR output.

For all domains, FV3 BUFR output is produced to forecast hour 60, while NMMB BUFR was only produced to forecast hour 48.

  - HIRESW SBN:

For all domains, the main difference will be the change from NMMB output to FV3 output. The forecast hours and the product lists from forecast hour 03 onward will be unchanged, but for f00, the FV3 product lacks the WEASD 0-0 day accumulation field that is currently produced in NMMB.

For the CONUS output, the distinct East and West output grids are consolidated into a single CONUS grid.

All HiresW WMO header T1 characters will change as follows:

T1 = L --> T1 = Y   and   T1 = M --> T1 = Z

such that

LACA00 KWBS --> YACA00 KWBS, MACB00 KWBS --> ZACB00 KWBS, etc.

A complete list of new HiresW WMO headers can be found at
https://www.nco.ncep.noaa.gov/pmb/changes/new_headers_hiresw_v8.pdf

A complete list of removed HiresW WMO headers can be found at
https://www.nco.ncep.noaa.gov/pmb/changes/removed_headers_hiresw_v8.pdf

4) Changes to HREF output products provided on NOMADS/FTPPRD web services (including Grib Filter) and SBN/NOAAPort

- HREF output products are generated out to 48 h (current operational HREFv2 only generates product to 36 h).

- Adds a new local probability-matched mean (lpmm) output file type for precipitation.

- Adds a new Ensemble Agreement Scale (EAS) output file type for precipitation and snow probabilities.

- Adds new precipitation products for probability of exceedance of flash flood guidance (FFG) values and of average recurrence interval values for the CONUS domain only, described below in the description of the new "ffri" output product.

- The extension of products to 48 h does create an approximately 12 minute delay for the 06Z and 18Z CONUS HREF output. This delay is for the 00-36 h output.

Modified - href.tCCz.DOM.mean.fFF.grib2
        Where CC is cycle, and FF is forecast hour, and DOM is the domain (conus|ak|pr|hi)

  - Adds surface TMP
  - Changes the mean sea level pressure field from the standard Schuell pressure reduction (PRMSL) to the "Eta" pressure reduction (MSLET).

Modified - href.tCCz.DOM.pmmn.fFF.grib2

  - Removes updraft helicity (UPHL) field

Modified - href.tCCz.DOM.sprd.fFF.grib2

  - Removes updraft helicity (UPHL) field
  - Changes the mean sea level pressure field from the standard Schuell pressure reduction (PRMSL) to the "Eta" pressure reduction (MSLET).
  - Adds surface TMP

Modified - href.tCCz.DOM.avrg.fFF.grib2

  - Removes the following fields:
  REFD:1000 m above ground

MAXREF:1000 m above ground:
REFC:entire atmosphere (considered as a single layer):
RETOP:entire atmosphere (considered as a single layer):
UPHL:5000-2000 m above ground:
MXUPHL:5000-2000 m above ground:
HGT:surface:

New - href.tCCz.DOM.lpmm.fFF.grib2 (localized probability matched mean output)

- 1 h APCP (every hour)
- 3 h APCP (every 3rd hour)

New (CONUS only) - href.tCCz.conus.ffri.fFF.grib2 (flash flood and recurrence interval output)

- non-3hourly times:
(1 h FFG exceedance)
    1 h PPFFG prob >1
- 3 hourly time has the above plus:
(3 h FFG exceedance)
    3 h PPFFG prob >3
- 3 hourly times for f06 and beyond has the above plus:
(6 h FFG exceedance)
    6 h PPFFG prob >6
(exceedance of 2 year recurrence interval for 6 h period)
    6 h APCP prob >2
(exceedance of 5 year recurrence interval for 6 h period)
    6 h APCP prob >5
(exceedance of 10 year recurrence interval for 6 h period)
    6 h APCP prob >10
(exceedance of 100 year recurrence interval for 6 h period)
    6 h APCP prob >100
- 3 hourly times for f24 and beyond has the above plus:
(exceedance of 2 year recurrence interval for 24 h period)
    24 h APCP prob >2
(exceedance of 5 year recurrence interval for 24 h period)
    24 h APCP prob >5
(exceedance of 10 year recurrence interval for 24 h period)
    24 h APCP prob >10
(exceedance of 100 year recurrence interval for 24 h period)

24 h APCP prob >100

New - href.tCCz.DOM.eas.fFF.grib2 (ensemble agreement scale probability output)

   - non 3 hourly times
       1 h APCP prob >0.254 mm, >6.35 mm, >12.7 mm
       1 h WEASD prob >2.54 mm, >7.62 mm
   - 3 hourly times have the above plus:
       3 h APCP prob >0.254 mm, >6.35 mm, >12.7 mm
       3 h WEASD prob >2.54 mm, >7.62 mm
   - f06 and f09 have above plus
       6 h APCP prob > 0.254 mm, >6.35 mm, >12.7 mm, >25.4 mm
       6 h WEASD prob >2.54 mm, >7.62 mm, >15.24 mm
   - 3 hourly times for f12 and beyond have the above plus:
       12 h APCP prob >2.54 mm, >6.35 mm, >12.7 mm, >25.4 mm, 50.8 mm
   - 3 hourly times for f24 and beyond have the above plus:
       24 h APCP prob >2.54 mm, >6.35 mm, >12.7 mm, >25.4 mm, >50.8 mm, >76.2
mm

Modified - href.tCCz.DOM.prob.fFF.grib2

 (for all hours):
   - the following parameters are eliminated:
    UPHL:5000-2000 m above ground prob >25 m^2/s^2, >100 m^2/s^2
    MXUPHL:5000-2000 m above ground prob > 100 m^2/s^2
    1 h APCP prob >0.25 mm, > 6.35 mm
   - the following parameters are added:
    MXUPHL:5000-2000 m above ground prob >75 m^2/s^2, >150 m^2/s^2
    LTNG:surface: prob >0.01 (prob >0.2 for CONUS)
    WIND:10 m above ground:10 hour fcst:prob >18.01 m/s, >25.72 m/s
   - All 10 m AGL wind probability products are changed from a point probability to a
neighborhood maximum probability type.

(for 3 hourly files)
   - the above changes plus:
     adds 3 h APCP > 127 mm
     eliminates 3 h APCP prob >0.25 mm, >6.35 mm

(for 3 hourly files at f06 and beyond)
   - the above changes plus

adds 6 h APCP > 127 mm
eliminates 6h APCP prob >0.25 mm, >6.35 mm

(for 3 hourly files at f12 and beyond)
   - the above changes plus:
     adds 12 h APCP > 203.2 mm
     eliminates 12 h APCP prob >2.54 mm, >6.35 mm

(for 3 hourly files at f24 and beyond)
   - the above changes plus:
     adds 24 h APCP > 203.2 mm
     eliminates 24 h APCP prob >2.54 mm, >6.35 mm

NOAAPort/SBN Modifications:

- With this upgrade the products available through NOAAPORT/SBN will be slightly
changed, along with the forecast hours for which they are provided.

The forecast hours provided are changing from 'hourly to f36' to 'hourly to f30, and then
three hourly to f48'. The exception is for the 06Z and 18Z CONUS cycles, which will
stay '3 hourly to f36' as in current operations.

A complete list of new HREF WMO headers can be found at
https://www.nco.ncep.noaa.gov/pmb/changes/new_headers_href_v3.pdf

No HREF WMO headers are removed or replaced with this upgrade.

mean SBN output:

The mean sea level pressure field is changed from the standard Schuell reduction type
(PRMSL) to the Eta model style reduction (MSLET) type.

pmmn SBN output:

The Updraft Helicity (UPHL) field is removed

The 1 h APCP field is changed from a probability matched mean to a localized
probability matched mean field

In 3 hourly files, the 3 h APCP field is changed from a probability matched mean to a localized probability matched mean field

prob SBN output:

the following parameters are removed:

UPHL prob >25 m^2/s^2
UPHL prob >100 m^2/s^2
MXUPHL prob >25 m^2/s^2
MXUPHL prob >100 m^2/s^2
10 m AGL wind speed prob >15.4 m/s

the following parameters are added:

MXUPHL prob >75 m^2/s^2
MXUPHL prob >150 m^2/s^2
10 m AGL wind speed prob >18.01 m/s
10 m AGL wind speed prob >25.72 m/s

EAS probability type replaces neighborhood maximum probability type for:

(for all forecast hours)
 1 h APCP (> 0.254 mm, > 6.35 mm)

(for 3 hourly files)
   - the above change plus

   3 h APCP (> 0.254 mm, > 6.35 mm)
   3 h WEASD (> 2.54 mm)

(for 3 hourly files at f06 and beyond)
   - the above changes plus

   6 h APCP (> 0.254 mm, > 6.35 mm)
   6 h WEASD (> 2.54 mm)

(for 3 hourly files at f12 and beyond)
   - the above changes plus

12 h APCP (> 2.54 mm, > 6.35 mm)

(for 3 hourly files at f24 and beyond)
  - the above changes plus

24 h APCP (> 2.54 mm, > 6.35 mm)

For CONUS output only, probability of flash flood guidance (FFG) exceedance is added:

1 h FFG exceedance at all forecast hours
3 h FFG exceedance at 3 hourly times
6 h FFG exceedance at 3 hourly times at f06 and beyond

NCEP urges all users to ensure their decoders can handle changes in content order, changes in the scaling factor component within the product definition section (PDS) of the GRIB files, and volume changes. These elements may change with future NCEP model implementations. NCEP will make every attempt to alert users to these changes before implementation.

Please send questions, comments or requests regarding this implementation to the contacts below. We will review any feedback and decide whether to proceed.

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For questions regarding the data flow aspects, please contact:

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NWS Service Change Notices are online at:
https://www.weather.gov/notification

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