

HiresW v8.0.1 - updated January 15, 2021 (adds bulk shear product to small domain output)
HiresW v8.0.1 - updated December 18, 2020 (ARW fixes for GFSv16)
HiresW v8.0.1 - re-released November 18, 2020
HiresW v8.0.1 - released October 5, 2020

Google docs version at:

https://docs.google.com/document/d/158iwNB4Shz0rp4Bg9D9WDD3gC6HT_bvotohUN319Bm0/edit?usp=sharing

#####

Update overview

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* Includes changes for the FV3 to initialize from GFSv16 (changing from nemsio to netcdf files).
This version was built on top of the Nov 15 release of HiresW v8.0.0

#####

Obtaining and building the package

#####

Clone it with this command (but change hiresw.v8.0.1 to whatever you want to call it in the directory that it is cloned into):

git clone -b v8.0.1_beta https://github.com/MatthewPyle-NOAA/regional_workflow.git
hiresw.v8.0.1

Simplified installation directions:

1. Build the executables

```
cd src
```

```
./build_all.sh
```

Within this overall "build_all" script there are steps to check out external codes (for the FV3), and a copying in of fix files for both ARW and FV3.

The actual build work is being done by the arw/build_hiresw.sh script and fv3/build_all.sh scripts.

The BUILD_* variables near the top of the ARW build_hiresw.sh script allow for selecting which codes to build. The regional_build.cfg file in sorc/fv3 allows for specifying which components are compiled for the FV3 build.

2. Install the executables for both ARW and FV3

```
./install_all.sh
```

Again, the actual work is done by model specific scripts, in this case arw/install_hiresw.sh script and fv3/install_all.sh.

The arw/install_hiresw.sh script has INSTALL_* variables corresponding to the BUILD_* variables in arw/build_hiresw.sh in case there is a desire to only copy select executables to the final executable space. Executing the script copies the executables to the proper exec/arw/ space.

```
#####  
Job/script changes of note:  
#####
```

The JHIRESW_MAKE_BC job is reworked to generate all boundary information in two sequential chunks to prevent an effective doubling of node resources for this job with GFSv16 files, so will run up to 4 minutes longer than the original version for GFSv15.

JHIRESW_MAKE_BC (20 nodes/80 tasks for HI/PR/Guam; 40 nodes/160 tasks for CONUS and AK)

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Remaining details follow the release notes for HiresW v8.0.0

```
#####  
Product changes  
#####
```

GRIB output changes:

In all comparisons here, CC is the cycle time, and FF is the forecast hour. The right side of the --> indicates the file name in the new system.

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 heat flux computed over the previous hour - the NMMB averages fluxes with a 3 h bucket, so the period covered is variable (f01 would average f00-f01, f02 would average f00-f02, f03 would average f00-f03, f04 would average f03-f04)

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

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)

- c) The CONUS output for AWIPS/SBN distribution is changed from east CONUS and west CONUS grids into a single CONUS grid.

```
hiresw.tCCz.nmmb_5km.fFF.conus{east|west}.grib2 -->  
hiresw.tCCz.fv3_5km.fFF.conussbn.grib2
```

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 heat flux computed over the previous hour - the NMMB averages fluxes with a 3 h bucket, so the period covered is variable (f01 would average f00-f01, f02 would average f00-f02, f03 would average f00-f03, f04 would average f03-f04)

The same change to a single output grid for CONUS SBN also is made for the CONUS ARW output:

```
hiresw.tCCz.arw_5km.fFF.conus{east|west}.grib2 -->  
hiresw.tCCz.arw_5km.fFF.conussbn.grib2
```

- d) The CONUS and Alaska “subset” grids have the following changes:

```
hiresw.t??z.nmmb_3km.fFF.conus.subset.grib2 -->  
hiresw.t??z.fv3_3km.fFF.conus.subset.grib2
```

```
hiresw.t??z.nmmb_5km.fFF.ak.subset.grib2 -->  
hiresw.t??z.fv3_5km.fFF.ak.subset.grib2
```

The 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)

- e) The 00 h output in both the ARW and FV3 model output has been cleaned up by eliminating 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
```

+
hiresw.tCCz.arw_5km.f00.DOM.grib

Where DOM is domain (conus | guam | hi | pr | guam), 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::
APCP:surface:0-0 day acc fcst
WEASD:surface:0-0 day acc fcst:
TMAX:2 m above ground::
MAXRH:2 m above ground::
TMIN:2 m above ground::
MINRH:2 m above ground::

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 2p5km and 3km NDFD grid output:

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), these records are removed:

MAXUVV: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::

3) For the 00 h “subset” product grids for CONUS and Alaska:

```
hiresw.t??z.nmmb_3km.f00.conus.subset.grib2 -->  
hiresw.t??z.fv3_3km.f00.conus.subset.grib2  
  
hiresw.t??z.nmmb_5km.f00.ak.subset.grib2 -->  
hiresw.t??z.fv3_5km.f00.ak.subset.grib2  
  
+  
hiresw.t??z.arw_3km.f00.conus.subset.grib2  
hiresw.t??z.arw_5km.f00.ak.subset.grib2
```

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::
APCP:surface:0-0 day acc fcst
WEASD:surface:0-0 day acc fcst:

4) For the 00 h CONUS files specifically created for SBN:

Currently hiresw.tCCz.*_5km.f00.conus{east|west}.grib2
Becoming hiresw.tCCz.*_5km.f00.conussbn.grib2

This record is removed:

REFD:263 K level:0-0 day max fcst:

BUFR output changes:

In comparisons here, CC is the cycle time:

File names are modified:

```
hiresw.tCCz.conusnmb.class1.bufr -->
hiresw.tCCz.conusfv3.class1.bufr
hiresw.tCCz.conusnmb.class1.bufr.wcoss -->
hiresw.tCCz.conusfv3.class1.bufr.wcoss
```

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 stations eliminated are listed in the below table:

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

```
hiresw.tCCz.aknmb.class1.bufr --> hiresw.tCCz.akfv3.class1.bufr
```

For the Alaska domain, a single station that was in 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 station eliminated is listed in the below table

```
hiresw.tCCz.hinmb.class1.bufr --> hiresw.tCCz.hifv3.class1.bufr
hiresw.tCCz.prnmb.class1.bufr --> hiresw.tCCz.prfv3.class1.bufr
hiresw.tCCz.guammb.class1.bufr --> hiresw.tCCz.guamfv3.class1.bufr
```

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.

#####

Job/script changes of note:

#####

Eliminates jobs used only by the HiresW-NMMB system that is being removed.

JHIRESW_NEMSINTERP_1
JHIRESW_NEMSINTERP_2
JHIRESW_NEMSINTERP_3
JHIRESW_NEMSINTERP_4

New FV3-only preprocessing jobs are added to generate the model initial conditions and lateral boundary conditions, respectively. The JHIRESW_MAKE_BC job is designed to generate all boundary information simultaneously, so it is computationally intense but completes in about 4-7 minutes depending on domain.

JHIRESW_MAKE_IC (4 nodes, 16 tasks total)
JHIRESW_MAKE_BC (20 nodes/80 tasks for HI/PR/Guam; 40 nodes/160 tasks for CONUS and AK)

The FV3 uses JHIRESW_POST_ODD and JHIRESW_POST_EVEN for all domains (the NMMB and ARW only use them for the CONUS domain) . Snow depth changes for FV3 are computed by differencing the instantaneous snow depth at successive hours, so the odd/even hour jobs have a bit of overlap for the FV3 system. The JHIRESW_POST_EVEN job (and scripts/fv3/exhiresw_post_even.sh.ecf) handles all of this differencing. Both jobs need to be run to generate complete forecast output at a given hour.

A new odd/even hour PRDGEN job is added (only used by the FV3 for the Alaska and CONUS domains):

JHIRESW_PRDGEN_EVEN
JHIRESW_PRDGEN_ODD

Resource usage for the POST and PRDGEN jobs are listed in the resource changes section below.

The rocoto/hiresw_*.xml files show how the parallel test system launched jobs and assigned resources. Many of the resource definitions come from within rocoto/sites/wcoss_cray.ent

Resource changes for forecast job
#####

CONUS

Prod NMMB ~ 3720 seconds on 41 nodes
Para FV3 ~ 5373 seconds on 93 nodes (30 x 72 + 3 x 24)
Para FV3 ~ 7210 seconds on 151 nodes (32 x 108 + 7 x 24) [I/O hurt performance]

AK

Prod NMMB ~ 4020 seconds on 27 nodes
Para FV3 ~ 5638 seconds on 51 nodes (24 x 48 + 3 x 24)
Para FV3 ~ 4618 seconds on 102 nodes (24 x 96 + 6 x 24) [I/O limits performance]

PR

Prod NMMB ~ 3467 seconds on 5 nodes
Para FV3 ~ 4121 seconds on 10 nodes

HI

Prod NMMB ~ 3387 seconds on 2 nodes
Para FV3 ~ 3972 seconds on 7 nodes

GUAM:

Prod NMMB ~ 3417 seconds on 3 nodes
Para FV3 ~ 3815 seconds on 7 nodes

#####

Resource changes for post and prdgen jobs (combined)

#####

CONUS

Prod NMMB ~ (4+4 for post, 1 for prdgen) = 9 nodes total

Para FV3 ~ (3+3 for post, 1+1 for prdgen) = 8 nodes total

AK

Prod NMMB ~ (3 for post, 1 for prdgen) = 4 nodes total

Para FV3 ~ (2+2 for post, 1+1 for prdgen) = 6 nodes total

PR

Prod NMMB ~ (1 for post, 1 for prdgen) = 2 nodes total

Para FV3 ~ (1+1 for post, 1 for prdgen) = 3 nodes total

HI

Prod NMMB ~ (1 for post, 1 for prdgen) = 2 nodes total

Para FV3 ~ (1+1 for post, 1 for prdgen) = 3 nodes total

GUAM:

Prod NMMB ~ (1 for post, 1 for prdgen) = 2 nodes total

Para FV3 ~ (1+1 for post, 1 for prdgen) = 3 nodes total

#####

Resource changes for bufrpost jobs

#####

CONUS:

Prod NMMB ~ (2 x (1 task/1 node)) = 2 nodes

Para FV3 ~ (24 tasks/3 nodes) = 3 nodes

AK:

Prod NMMB ~ (1 task/1 node) = 1 node

Para FV3 ~ (8 tasks/1 node) = 1 node

PR, HI, Guam:

Prod NMMB ~ (1 task/1 node) = 1 node

Para FV3 ~ (1 tasks/1 node) = 1 node

```
#####  
DISK SPACE CHANGES -  
#####
```

ops com/hiresw/prod/ (just NMMB aspect)

341.9 GB hiresw.\${PDY} + NMMB awips and nawips aspects not currently under hiresw/prod/

para com/hiresw/prod/ (just FV3 aspect)

556.1 GB hiresw.\${PDY}

- + which includes awips and nawips pieces now going under \$COMOUT, and inputs stored under nwges

```
#####  
## Archiving to HPSS  
#####
```

Some limited changes to how HIRESW data is archived are being proposed. The first is to archive by cycle time rather than one single archive for the day. The second critical item is to replace any “nmmb” references with “fv3” due to the model change within the HiresW. Although the FV3 runs to 60 h, only the first 48 hours will be archived (just swapping nmmb with fv3 in what is currently saved)..

Comparing the size of just the NMMB aspects going to HPSS against the potential FV3 aspects, it looks like a very slight increase (~19.4 GB/day to ~20.0 GB/day) with this upgrade. An HPCRAC request has been drafted but hasn’t been submitted as of this writing.