V7.0.0 - released June 16, 2017

Installation details:

Check out https://svnemc.ncep.noaa.gov/projects/hrw/tags/hiresw.v7.0.0/

The modulefile used for the build is in modulefiles/HIRESW/v7.0.0.

Running ./build_hiresw.scr from the main hiresw.v7.0.0/sorc directory should produce all needed executables. It does a module purge and module load of HIRESW/v7.0.0 before compiling all codes in sequence.

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Update details:
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* Unifies the horizontal grid spacing at 3 km for both the ARW and NMMB models (3.2 km for both over CONUS).

Horizontal grid spacing changes (new km/old km) for the WRF-ARW runs over the five domains:

- CONUS (3.2/4.2)
- Alaska (3.0/3.5)
- Hawaii (3.0/3.8)
- Guam (3.0/3.8)
- Puerto Rico (3.0/3.8)

For the NMMB run, only the CONUS domain changes resolution (from 3.6 to 3.2 km)

* Adds a second ARW member for all domains except for Guam that is initialized from the NAM. This second member also utilizes the Mellor Yamada Janjic (MYJ) planetary boundary layer (PBL) and MYJ surface layer, so differs from primary ARW member in terms of the physics used in addition to having a different source of initial and lateral boundary conditions. It also has just 40 vertical levels, while the primary ARW member has 50 levels.

* The NMMB run increases the call frequency for PBL/surface physics and microphysics from every fourth model timestep to every other timestep.

* The vertical level structure within the primary 50 level ARW runs are changed for all domains except Alaska. Counting from the surface upward, layers 7-18 (roughly 970 to 760 hPa for a surface pressure of 1010 hPa) are made somewhat thicker, and layers 19-30 (roughly 690 to 330 hPa for a surface pressure of 1010 hPa) are made somewhat thinner. The change was

made for Alaska in a prior upgrade to improve numerical stability, and is extended to all domains with this upgrade.

Initialization changes:

* Run considerably earlier within production suite by utilizing 6 h old GFS (or NAM for the second ARW member) files to generate lateral boundary conditions. Runs that use the GFS for initial conditions now utilize a 6 h forecast from the 6 h old GFS for initialization.

* Changes from 0.5 degree to 0.25 degree GFS data for use in producing initial and lateral boundary conditions.

* The Puerto Rico domain runs previously initialized from the GFS now are initialized from the RAP; the new second ARW member for Puerto Rico is NAM initialized.

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Output changes:
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For the *_5km.*.grib2 and *subset.grib2 output grids, these new products are added:

- 2000-5000 m AGL hourly minimum updraft helicity
- 0-3000 m AGL hourly maximum updraft helicity
- 0-3000 m AGL hourly minimum updraft helicity
- 100-1000 hPa hourly maximum updraft velocity (replaces a 400-1000 hPa hourly maximum updraft velocity field)
- 100-1000 hPa hourly maximum downdraft velocity (replaces a 400-1000 hPa hourly maximum downdraft velocity field)

For the *_2p5km*.grib2 and *_3km*.grib2 (non-subset) grids, two new products are added:

- Cloud ceiling height
- Cloud base height

The CONUS “subset” grid with a reduced number of products now is output on a 1799 x 1059 point 3 km grid (the same grid utilized for HRRR and NAM CONUS nest output).

Its file name structure is changed to reflect the change in output grid spacing:

hiresw.tCCz.*_5km.fFF.conus.subset.grib2 → hiresw.tCCz.*_3km.fFF.conus.subset.grib2
And for the new “mem2” CONUS domain, hiresw.tCCz.*_3km.fFF.conusmem2.subset.grib2

Some BUFR output points have been eliminated or redefined:

All eliminated points are fictitious stations over the ocean previously added to fill in around the limited stations on land for HI, PR, and GUAM

HI domain eliminates 10 oceanic points

HI1	99230		HI6	99235
HI2	99231		HI7	99236
HI3	99232		HI8	99237
HI4	99233		HI9	99238
HI5	99234		HI10	99239

PR domain eliminates 27 oceanic points

PR2	99202		PR12	99212		PR21	99221
PR3	99203		PR13	99213		PR22	99222
PR4	99204		PR14	99214		PR23	99223
PR5	99205		PR15	99215		PR24	99224
PR6	99206		PR16	99216		PR25	99225
PR7	99207		PR17	99217		PR26	99226
PR8	99208		PR18	99218		PR27	99227
PR9	99209		PR19	99219		PR28	99228
PR11	99211		PR20	99220		PR29	99229

For the Guam domain,

PGWT station identifier is changed from 99100 to 912310

And these six oceanic points are eliminated:

PG#1	99101		PG#4	99104
PG#2	99102		PG#5	99105
PG#3	99103		PG#6	99106

And while not documented, all domains that had a change in resolution (all ARW domains, and the CONUS NMMB) will have some slight changes in the exact location of individual BUFR output stations. Changes to the grid resolution modifies the grid dimensions and grid point locations, and because the BUFR output is taken from values at the nearest grid point it may be shifted by up to a few kilometers.

##############################
Resource changes:
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JHIRESW_UNGRIB changes

Para timing (in 2:00 to 2:40 range; 45-60 seconds for new mem2), runs on 1 node (4 tasks/node)
Prod timing (in 0:30 to 0:45 range), runs on 1 node (4 tasks/node)

JHIRESW_METGRID changes

Para timing (in 0:25 to ~3:15 range), runs on 9 nodes (1 task/node)
Prod timing (in 0:20 to ~4:05 range), runs on 1 node (9 tasks/node)

JHIRESW_PREPFINAL changes

Para timing (in ~0:30 to ~3:45 range), runs on 3 nodes (6 tasks/node)
Prod timing (in ~0:23 to ~2:09 range), runs on 3 nodes (3 tasks/node)

JHIRESW_NEMSINTERP* changes

Para timing (in ~0:15 to ~2:39 range), runs on 1 node (4 tasks/node)
Prod timing (in ~0:22 to ~2:15 range), runs on 1 node (4 tasks/node)

JHIRESW_PREPRAP changes

Para timing (CONUS ~5:49 to ~6:20) runs on 3 nodes (3 tasks/node)
Prod timing (CONUS ~3:28 to ~3:41) runs on 3 nodes (3 tasks/node)

New para (PR ~0:52 to ~1:14) runs on 3 nodes (3 tasks/node)

JHIRESW_FORECAST changes

	Current production nodes	Proposed system nodes	Current production run time (min)	Proposed run time (min)
CONUS NMMB	25	41	63	64
CONUS ARW	35	71	61	73
CONUS ARW mem2	-	58	-	62
Alaska NMMB	25	27	63	66
Alaska ARW	35	54	58	61
Alaska ARW mem2	-	40	-	63
Hawaii NMMB	3	2	35	58
Hawaii ARW	3	3	35	63
Hawaii ARW mem2	-	3	-	46
PR NMMB	4	5	50	58
PR ARW	5	6	39	57
PR ARW mem2	-	5	-	51
Guam NMMB	3	3	44	56
Guam ARW	3	4	34	51
Total 00/12	72	185		
Total 06/18	69	137		

JHIRESW_POST changes

NOTE: In my dev testing I've run the CONUS POST jobs in two streams (odd and even forecast hours). Timing for CONUS NMMB post quite variable (44-128 seconds for a recent case) on development machine. ARW not quite as bad (44-88 seconds, but still maybe not capable of keeping up with model). May be different on less busy production machine.

	Current production tasks/nodes	Proposed system tasks/nodes
CONUS NMMB	24/3	16/4 (x 2 if do even/odd hours separately)
CONUS ARW	24/2	22/2** (x 2 if do even/odd hours separately)
CONUS ARW mem2	-	16/2**
Alaska NMMB	24/3	24/3
Alaska ARW	16/2	16/2**
Alaska ARW mem2	-	16/2**
Hawaii NMMB	2/1	2/1
Hawaii ARW	2/1	2/1
Hawaii ARW mem2	-	2/1
PR NMMB	2/1	2/1
PR ARW	2/1	2/1
PR ARW mem2	-	2/1
Guam NMMB	2/1	2/1
Guam ARW	2/1	2/1
Total 00/12	9	13 (19 if CONUS even/odd done separately)
Total 06/18	7	10

** Task geometries for the large ARW domains now are specified in hiresw_post_rank_order_* files in the fix/ directory. The model data for these domains is read in on a single task that is given a full node, and then distributed to all other tasks for subsequent processing.

JHIRESW_PRDGEN changes (volume listed includes WRFPOST output copied to com and SMARTINITB output going to com - effectively all of the GRIB2 output)

	Current production tasks/nodes	Proposed tasks/nodes	Current production volume to /com (GB/cyc)	Proposed volume to /com (GB/cyc)
CONUS NMMB	13/1	14/3	52.3	64.9
CONUS ARW	13/1	14/3	48.1	69.4
CONUS ARW mem2	-	14/3	-	65.7
Alaska NMMB	5/1	5/1	31.1	32.1
Alaska ARW	5/1	5/1	28.3	36
Alaska ARW mem2	-	5/1	-	33.7
Hawaii NMMB	2/1	2/1	2.3	2.4
Hawaii ARW	2/1	2/1	1.5	2.0
Hawaii ARW mem2	-	2/1	-	1.9
PR NMMB	2/1	2/1	3.5	3.7
PR ARW	2/1	2/1	2.5	3.4
PR ARW mem2	-	2/1	-	3.3
Guam NMMB	2/1	2/1	2.0	2.1
Guam ARW	2/1	2/1	1.4	2.0
TOTAL (full day)			346	645.2

JHIRESW_WRFBUFRSND changes

The primary CONUS ARW and CONUS NMMB runs have been running as a pair of jobs (even and odd hours). Definitely appears necessary for CONUS NMMB (recent run on dev machine took ~124-174 seconds for each hour processed; too slow to keep up with model on a single stream), but might not be needed for CONUS ARW (where a recent run took ~44-103 seconds for each hour processed). There is a chance this job will run much better on the less busy filesystem of a production machine.

Running the pair of jobs adds 2 nodes relative to current operations, but only for the 00Z and 12Z cycle times.

JHIRESW_SMARTINIT changes

All now are 13 tasks (1 node) jobs - current ops has 8 task (1 node) jobs. The new “mem2” domains actually only utilize 11 tasks within the job due to having fewer vertical levels, but triggering this job and specifying 13 tasks will not cause problems for “mem2”.

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Distribution and archiving issues:
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The big new piece of output that creates some questions about distribution and archiving is the new “mem2” ARW run made now for CONUS, AK, HI, and PR. My hope is that at least for non-AWIP distribution it will be treated like the other HiresW domains.

For HPSS, please add

- the *mem2*.class1.bufr.* files to the HiresW “bufr” runhistory tar file
- the *_5km.*mem2.grib2* files to the “5km” runhistory tar file (at a 3 hourly interval)
- [and if space allows it], the *_3km*subset.grib2 (generated for CONUS domain output) to the “5km” runhistory tar file (at a 3 hourly interval)