**RELEASE NOTES**

**Model:** nhc\_guidance\_v4.2.0

**Released to NCO on:** 2/16/2024

**Purpose:**  The National Hurricane Center utilizes a suite of simplified tropical cyclone track and intensity forecast models and consensus forecast models. All of the intensity models are statistically based, and the track models include simplified dynamical models, statistical models, and processing that reformats output from global models. This model upgrade includes retraining of SHIPS/LGEM, SHIPS-RII, and DTOPS to include the 2023 hurricane season.

**Primary developers:** Stephanie Stevenson/NHC/TSB, Rachel Zelinsky/NHC/TSB, Matt Onderlinde/NHC/TSB, Mark DeMaria/CIRA/CSU, John Kaplan/OAR/AOML, Jon Martinez/CIRA/CSU, and other contributors

**Runs on:** The National Weather Service (NWS) Weather and Climate Operational Supercomputing System (WCOSS). The guidance suite runs on demand for any number of storms that NHC/CPHC requests guidance to be run during each six hour forecast cycle when storms are present in the Atlantic, East Pacific and Central Pacific basins.

**Community software:** The suite of track and intensity models were developed by a number of agencies over the past three decades. The majority of the applications were developed by NCEP/NHC, NOAA/NESDIS, OAR/AOML and NCEP/EMC.

**Release tag:** git@git.nhc.noaa.gov:nhc\_guidance.git, tag/v4.2.0

**External software used:**

*Compilers*:

* ftn

*Modules:*

* *To build code:*
  + PrgEnv-intel/8.3.3
  + intel/19.1.3.304
  + craype/2.7.17
* *To run JNHC\_GUIDANCE:*
  + grib\_util/1.2.4
  + wgrib2/2.0.8
* *To run JNHC\_GUIDANCE\_HCCA\_TRAIN:* 
  + python/3.8.6
    - Python package dependencies: numpy, subprocess, os, datetime, sys, netCDF4, warnings, calendar, ctypes, logging
* *To run all four JNHC\_GUIDANCE\_GFS\_GRIB jobs:*
  + libjpeg/9c
  + grib\_util/1.2.4
  + wgrib2/2.0.8
* *To run both JNHC\_GUIDANCE\_ECM\_GRIB jobs:*
  + libjpeg/9c
  + grib\_util/1.2.4
* *To run JNHC\_STORM\_DATACHK:*
  + None

*Other WCOSS model dependencies:*

* gfs/v16.3
* hwrf/v13.2
* hmon/v3.2
* hafs/v1.0
* ens\_tracker/v1.3

**Package modifications:**

The following describes file changes that are Removed, New, or Modified in this release.

* doc/
  + Removed
    - All previous documentation
  + New
    - nhcg\_v4.2.0\_release-notes.docx
    - nhcg\_v4.2.0\_implementation-instructions.docx
    - nhcg\_v4.2.0\_test-plan.docx
    - nhcg\_v4.2.0\_production-overview.pdf
* ecf/
  + Modified
    - Bugzilla 1416: Removed RUN\_ENVIR
      * jnhc\_guidance.ecf
      * jnhc\_guidance\_chk.ecf
      * jnhc\_guidance\_ecm\_grib.ecf
      * jnhc\_guidance\_gfs\_grib.ecf
      * jnhc\_guidance\_hcca\_train.ecf
      * jnhc\_storm\_datachk.ecf
      * jnhc\_tcvitals\_devel.ecf
* include/
  + No changes
* jobs/
  + Modified
    - Bugzilla 1416: Removed RUN\_ENVIR
      * JNHC\_GUIDANCE
      * JNHC\_GUIDANCE\_CHK
      * JNHC\_GUIDANCE\_ECM\_GRIB
      * JNHC\_GUIDANCE\_GFS\_GRIB
      * JNHC\_GUIDANCE\_HCCA\_TRAIN
      * JNHC\_STORM\_DATACHK
      * JNHC\_TCVITALS\_DEVEL
* lib/sorc/
  + Bugzilla 1428: Added debug targets to all Makefiles
* parm/
  + Modified
    - dtops\_AL\_coefs\_2023.dat → dtops\_AL\_coefs\_2024.dat
    - dtops\_AL\_EMX\_regress\_2023.dat →dtops\_AL\_EMX\_regress\_2024.dat
    - dtops\_EP\_coefs\_2023.dat →dtops\_EP\_coefs\_2024.dat
    - dtops\_EP\_EMX\_regress\_2023.dat → dtops\_EP\_EMX\_regress\_2024.dat
    - shipl23\_coef\_atlc.dat → shipl24\_coef\_atlc.dat
    - shipl23\_coef\_epac.dat → shipl24\_coef\_epac.dat
    - ships23\_coef\_atlc.dat → ships24\_coef\_atlc.dat
    - ships23\_coef\_epac.dat →ships24\_coef\_epac.dat
    - nnfit\_coef\_AL.dat
    - nnfit\_coef\_CP.dat
    - nnfit\_coef\_EP.dat
    - rii2o\_al\_coef.dat
    - rii2o\_al\_prob.dat
    - rii2o\_ep\_coef.dat
    - rii2o\_ep\_prob.dat
* scripts/
  + No changes
* sorc/
  + Modified
    - All subdirectories
      * Bugzilla 1428: Added debug targets to all makefiles
      * Makefile\_nhclocal and Makefile\_wcoss2 were consolidated into a single Makefile
    - eohcadd.fd/
      * Modernized fortran write statements:
        + eohcadd.f90
        + eohcadd\_module.f90
        + estimate\_area\_averaged\_sst.f90
        + ncoda\_climo2\_module.f90
        + read\_lsdiag\_attributes.f90
    - iships.fd/
      * ahi.f: Removed GOTO statements (Bugzilla 239)
      * iships.f: Updated for 2024 coefficients
      * ohc\_module.f90: Modernized fortran write statements
      * rapidaga.f: Updated Atlantic RII for 2024 configuration
      * rapidge.f: Updated East Pacific RII for 2024 configuration
      * sst\_module.f90: Modernized fortran write statements
* ush/
  + Modified
    - anupdatem.ksh: Changed to exit with 0 instead of 1 if anupdatem was already completed (Bugzilla 1443)
    - enupdate.ksh: Added “set -ax” so echo statements reach main log file when errors occur (Bugzilla 1442)
    - get\_dtops\_realtime.bash: Bug fix, addition of SDCON consensus (50% DTOPS, 50% SHIPS-RII)
    - get\_dtops\_realtime\_ecmwf.bash: Bug fix, addition of SDCON consensus (50% DTOPS, 50% SHIPS-RII)
    - Redirect Python error message to main log (Bugzilla 1417)
      * get\_hcca\_input.bash
      * hcca\_run.bash
      * hcca\_update\_train.bash
    - hcca.py: Added logger configuration and logging, made code more synchronous, require n=10 training forecasts per model/time
    - hcca\_atcf\_BEST\_to\_nhc.py: Added logger configuration and logging
    - hcca\_atcf\_FCST\_to\_nhc.py: Added logger configuration and logging
    - hcca\_nhc\_to\_ATCF.py: Made code more synchronous
    - hcca\_nhc\_to\_netCDF.py: Added logger configuration and logging
    - hcca\_util.py: Added logger configuration and logging, made code more synchronous
    - nhc\_storm\_datachk.sh: Removed if block related to old bjobs command Bugzilla 1480)
* util/
  + No changes
* versions/
  + Modified
    - run.ver: Updated to match current v4.1.3 version

**Input:**

All of the input data below is identical to the previous delivery.

*WCOSS Inputs:*

* grib2 GFS files for SHIPS and LGEM (.../prod/com/gfs/${gfs\_ver}/gfs.YYYYMMDD/TT/atmos/)
* grib2 ECMWF files for SHIPS and LGEM (…/prod/dcom/YYYYMMDD/wgrbbul/ecmwf/DCD\*)
* UKmet WTNT80 bulletin for the UKMET model (.../prod/dcom/YYYYMMDD/wtxtbul/ukmet\_tropical\_storms)
* Coefficient and other static files for the CLIPER5/EPCLIPER/TCLIP/SHIPS/LGEM/NNIC/RII models   
  (.../prod/com/nhc/v4.2.0 /parm)
* NCEP global model trackers for DTOPS Rapid Intensification Index (RII), HCCA, & NNIC (…/prod/com/ens\_tracker/${ens\_tracker\_ver}/atcf/${strmid}/ncep\_a${strmid}.dat)
* HAFS model tracker for DTOPS, NNIC, and HCCA (…/prod/com/hafs/${hafs\_ver}/hfsa.YYYYMMDD/CC/atcf/${strmid}/ncep\_a${strmid}.dat)  
  (…/prod/com/hafs/${hafs\_ver}/hfsb.YYYYMMDD/CC/atcf/${strmid}/ncep\_a${strmid}.dat)
* HWRF/HMON model trackers for HCCA [Note: HCCA will still run without these inputs]  
  (.../prod/com/hwrf/${hwrf\_ver}/hwrf.YYYYMMDD/CC/atcf/${strmid}/ncep\_a${strmid}.dat)  
  (.../prod/com/hmon/${hmon\_ver}/hmon.YYYYMMDD/CC/atcf/${strmid}/ncep\_a${strmid}.dat)

*NHC-NCO-Dataflow Provided Inputs:*

* NHC and CPHC compute files. Naming format is bbnnyyyy.com where bb is the storm basin (CP, EP or AL), nn is the storm number, yyyy is the year.  
  (.../prod/dcom/nhc/atcf/zcom/)
* NHC/CPHC requesting server source files. Format is bbnnyyyy.ip, where bb, nn and yyyy are the same as for the .com files. File contents include a list containing the originating ATCF server’s IP address and time of submission (used to trigger runs).  
  (.../prod/dcom/nhc/atcf/return\_atcfIP/)
* NHC and CPHC b-deck files. Naming format is b[bbnnyyyy].dat where bb is the storm basin (CP, EP, or AL), nn is the storm number, yyyy is the year.

(.../prod/dcom/nhc/atcf/zfst/)

* GOES imagery for SHIPS model   
  (.../prod/dcom/nhc/ships/GOESarea/)
* SST Analysis for SHIPS model   
  (.../prod/dcom/nhc/ships/sst/)
* OHC Analysis for SHIPS model   
  (.../prod/dcom/nhc/ships/ohc)
* COAMPS, UKM + ensemble, and CHIPS trackers for HCCA

(.../prod/dcom/nhc/opah\_adecks/coamps/${strmid}\_YYYYMMDDHH.ctcx.dat)

(.../prod/dcom/nhc/opah\_adecks/ukmet/${strmid^^})

(.../prod/dcom/nhc/opah\_adecks/ukmet/MOGREPSG\_ADECK\_YYYYMMDDHH.txt)

(.../prod/dcom/nhc/misc\_adecks/chips/CHIPS.YYYYMMDDHH\_${snum}${basin}.xfer)

**Output:**

All of the primary output data below is similar to the previous delivery.

* Critical output:
  + ATCF a-deck   
    (.../prod/com/nhc/v4.0/storm-data/${stormid}/a${stormid}.dat)
  + GFS SHIPS output text files (.../prod/com/nhc/v4.0/storm-data/ships/stext/${ships\_prefix}\_ships.txt, …lsdiag.dat, …ships.edk)
* Other output:
  + ECMWF SHIPS output files (.../prod/com/nhc/v4.0/storm-data/ships/etext/EC\_${ships\_prefix}\_ships.txt, …lsdiag.dat, …ships.edk)
  + HCCA output logs with which models were included (.../prod/com/nhc/v4.0/hcca/output/log/input\_model\_logs/${stormid}\_${dtg}\_[INTENSITY|TRACK]\*.log)
* Sent back to NHC for future model development purposes:
  + IR radial profiles and principal component files (.../prod/com/nhc/v4.0/storm-data/${stormid}/ships/irprofs/${ships\_prefix}\_IRRP[1-3].[dat|inf], …IRPC0.dat)
  + GFS PACK files  
    (.../prod/com/nhc/v4.0/storm-data/gfs\_PACK.YYYYMMDD/A\*.DAT)
  + ECMWF PACK files (.../prod/com/nhc/v4.0/storm-data/ecm\_PACK.YYYMMDD/E\*.DAT)

**Resources:**

PBS entries in ecFlow submission scripts were created with this release with the following resource information:

*jnhc\_storm\_datachk.ecf:* select=1:ncpus=2:mem=500MB, serial job *jnhc\_guidance.ecf:* select=1:ncpus=2:mem=5GB, serial job

* Note: this job runs separately for each storm submission. The maximum number of storms able to run at one time are 5 storms at once, although usually it is much less. Any additional storms past the 5 storm limit are put into a processing queue until one of the original 5 systems has finished.

Pre-processing scripts to expedite jnhc\_guidance:

*jnhc\_guidance\_gfs\_grib\_00.ecf:* select=1:ncpus=2:mem=5GB, serial job *jnhc\_guidance\_gfs\_grib\_06.ecf:* select=1:ncpus=2:mem=5GB, serial job *jnhc\_guidance\_gfs\_grib\_12.ecf:* select=1:ncpus=2:mem=5GB, serial job *jnhc\_guidance\_gfs\_grib\_18.ecf:* select=1:ncpus=2:mem=5GB, serial job *jnhc\_guidance\_ecm\_grib\_00.ecf:* select=1:ncpus=2:mem=5GB, serial job *jnhc\_guidance\_ecm\_grib\_12.ecf:* select=1:ncpus=2:mem=5GB, serial job

Pre/Post-processing scripts to update HCCA’s training in real time:

*jnhc\_guidance\_hcca\_train.ecf: select=1:ncpus=1:mem=10GB, serial job*

**Runtime:**

Each storm job takes about 3-4 minutes of CPU time to complete.

The pre/post-processing HCCA training script takes < 10 minutes to complete.

**Disk space:**

Guidance jobs use less than 10 MB per storm run.

GRIB PACK jobs for the GFS and ECMWF use less than 100 MB per model cycle.

HCCA inputs and outputs use < 1 GB of disk space.

**Dissemination:**

Model output goes out via a dbnet alert to NCO Dataflow who inserts the data into an LDM queue to send back to the NHC, CPHC, and WPC ATCF systems.

No modifications required for this delivery.

**HPSS storage:**

No changes with this release.

Packed GFS and ECMWF files will be archived for one year on HPSS.