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Subject: Implementation of the Upgrade of the Whole Atmosphere Model-Ionosphere Plasmasphere Electrodynamics Model (WAM-IPE) Forecast System (WFS) to Version 1.2: Effective August 1, 2023

Effective August 1, 2023, The Space Weather Prediction Center (SWPC) at the National Centers for Environmental Prediction (NCEP) is pleased to announce the implementation into production of an upgrade for the Whole Atmosphere Model-Ionosphere Plasmasphere Electrodynamics Model (WAM-IPE) Forecast System (WFS), most notably including an additional concept of operations: the WAM-IPE Real-time System (WRS). In the event of a Critical Weather Day (CWD), the implementation may be delayed.

The WRS constantly ingests real-time solar wind data in support of a nowcast system capable of capturing rapid changes in the ionosphere and thermosphere due to the sudden onset of geomagnetic storms. Its nowcast segments are reinitialized every six hours using the current WFS state to include the latest forcing from the lower atmosphere. The segments are eight hours in length to ensure that at least one nowcast is always running. Should there be an outage in the availability of real-time solar wind data from the ACE or DSCOVR spacecraft, WRS outputs would be delayed until the situation is resolved. In the event that a substantial outage occurs during a period of overlap among successive nowcast segments, the older nowcast may be terminated and not resumed.

Additionally, the upgrade is highlighted by an improved empirical relationship for Bz -- the north-south component of the interplanetary magnetic field (IMF) -- from the forecasted planetary K-index, which is used when real-time observations are unavailable. This is expected to modestly improve the forecast accuracy of the WFS on a global basis, especially during periods of increased geomagnetic activity.

Output from both the WFS and WRS will be available on the NOAA Operational Model Archive and Distribution System (NOMADS). Previous WFS versions provided hourly tar files containing all model outputs valid during that hour. With this upgrade, the tar files have been replaced with the files they used to contain: two-dimensional outputs at five-minute cadence and three-dimensional outputs at ten-minute cadence. While there are no

internal metadata changes with respect to those NetCDF files, the neutral atmosphere "gsm" files have been renamed to "wam".

Additionally, model guidance will now be made available on NOMADS as it is generated, in contrast to waiting for the conclusion of each model run. Thus, outputs will begin to arrive approximately two hours earlier than they did previously; however, because WFSv1.2 runs more slowly overall, outputs from the end of each forecast segment are expected to arrive 10-15 minutes later than the current implementation.

Model guidance from the WRS will be made available using a similar filename convention of `wrs.tHHz.[wam/ipe][05/10].yyyymmdd_hhmmss.nc`. These files have the same properties as their WFS counterparts.

Finally, the space weather parameters used to drive each model run will be made available with the filename convention `[wfs/wrs].tHHz.input_parameters.nc`. These files contain interpolated, minute-cadence values of the 10.7cm solar radio flux (F10.7), 41-day averaged F10.7, planetary K- and A-indices (Kp and Ap), 24-hour averaged Kp and Ap, Northern and Southern hemispheric powers and their respective indices, as well as various properties of the solar wind and IMF. Due to the nature of each system, the WFS driver file will be available at the beginning of its forecast segment, while the WRS driver file will be available at the conclusion of its nowcast segment, even if it does not complete its planned eight hours of integration.

For questions regarding this new model forecast guidance, please contact:

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