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PNSWSH

Service Change Notice 21-60 Updated
National Weather Service Headquarters Silver Spring MD
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From: Mike Farrar, Director
 National Centers for Environmental Prediction

Subject: Updated: Air Quality Prediction v6 (AQM) Update: Effective July
20, 2021

Updated to add section F, the list of new World Meteorological
Organization (WMO) headers that are being included under existing
superheaded products.

Effective on or about July 20, 2021, beginning with the 1200 Coordinated
Universal Time (UTC) run, the National Centers for Environmental
Prediction (NCEP) will upgrade the Air Quality Model (AQM) capability over
the Contiguous United States (CONUS), Alaska, and Hawaii. The AQM uses
the Community Multi-scale Air Quality (CMAQ) modeling system to provide
ozone and fine particulate matter air quality predictions.

The scope of this upgrade includes:

- For CONUS, the CMAQ Kalman Filter Analog (KFAN) bias correction system
for fine Particulate Matter (PM2.5) and Ozone will be improved to use a
consistent training data set, additional monitor sites, and a unified KFAN
bias correction system.
- Over CONUS, Alaska and Hawaii, the CMAQ code will be unified with the
Environmental Protection Agency (EPA) Version 5.3.1 using an updated 2016
National Emissions Inventory (NEI 2016).
- All domains will be driven by the NWS Global Forecast System (GFS) v16
meteorology with air quality forecasts extended from 48 to 72 hours for
the 06 and 12 UTC run cycles.
- The Air Resources Laboratory (ARL) Fengsha dust model will be updated
with improved threshold velocities by soil type.
- The Updated Biomass Emissions Land Database (BELD) will be updated to v5
for biogenic emissions processing.
- Greenness vegetation fraction (GVF) will be updated daily with a 7-day
average GVF provided by the National Environmental Satellite, Data and
Information Service (NESDIS) satellite products.
- Leaf Area Index (LAI) will be updated from a constant value in space and
time to a climatological field.
- The NESDIS Global Biomass Burning Emissions Product eXtended (GBBEPx)
product will be used to initialize fire particulate and gas-phase
emissions and its associated Fire Radiative Power, which is used to drive
fire smoke plume rise. Both GVF and LAI are used for biogenic and

deposition processes and should result in better land-related processes.

The full list of changes is described in the operational changelog that is accessible from the EMC NAQFC webpage at:

<http://www.emc.ncep.noaa.gov/mmb/aq>

Expected benefits from this upgrade include an extension of ozone and PM2.5 forecasts to 72 forecast hours with upgrades to the CMAQ model and the use of the more recent National Emissions Inventory (2016). In addition, CMAQ will no longer be driven by NWS North American Mesoscale Forecast System (NAM) meteorology. Instead, CMAQ v5.3.1 will be driven by the 13 km NWS GFS meteorological forecast model while using a more realistic land surface greenness vegetation fraction and leaf area index. More accurate raw and bias-corrected surface ozone and PM2.5 are expected. Ozone predictions around wildfires should be better represented with the inclusion of precursor gas emissions from fires.

Daily maximum 8-hour average surface ozone and 1-hour daily maximum and 24-hour average surface PM2.5 concentration outputs will be extended from 2 days (48 hours) to three days (72 hours). Hourly averaged ozone and PM2.5 concentration predictions will also be extended from 48 to 72 hours.

Operational products will continue to be available on:

<http://airquality.weather.gov>

Predictions from the Experimental updated AQM will be made available through a parallel feed at the following location:

<https://para.nomads.ncep.noaa.gov/pub/data/nccf/com/aqm/para/>

Experimental CMAQ ozone and PM2.5 predictions over the contiguous U.S. (CONUS) will also be available on the EMC air quality webpage at:

<http://www.emc.ncep.noaa.gov/mmb/aq/cmaq/web/html>

Model Output Changes

A. Extension of the forecast period

For all domains, hourly predictions for surface ozone and PM2.5 will be extended from 48 to 72 forecast hours for raw outputs. Bias-corrected outputs for CONUS will be extended to 72 hours as well. Daily 8-hour maximum ozone for day 3 (49 - 72 hours) and 24hr average PM2.5 for day 3 will be produced from the 06 UTC and 12 UTC cycle runs. Output file names will remain unchanged.

NCEP services:

<ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/aqm/prod>
<https://nomads.ncep.noaa.gov/pub/data/nccf/com/aqm/prod/>

For these NCEP services sites, the grib2 model outputs will now have predictions for hours 49-72 for the 06 and 12 UTC cycle runs. The files impacted on ftpprd and nomads for CONUS, Alaska, and Hawaii are:

- aqm.t{CC}z.avg_{MM}hr_{VARB}.{GRD}.grib2: Raw MM hour average ozone predictions added for hours 49-72.
- aqm.t{CC}z.avg_{MM}hr_{VARB}_bc.227.grib2: Bias corrected MM hour average ozone predictions added for hours 49-72.
- aqm.t{CC}z.max_{MM}hr_{VARB}.{GRD}.grib2: Raw MM hour average daily maximum ozone predictions added for day 3 (computed from forecast hours 49-72)
- aqm.t{CC}z.max_{MM}hr_{VARB}_bc.227.grib2: Bias corrected MM hour average daily maximum ozone predictions for added for day 3 (computed from hours 49-72).
- aqm.t{CC}z.ave_24hr_pm25.{GRD}.grib2: Raw 24-hour average PM2.5 predictions added for day 3 (averaged from forecast hours 49-72).
- aqm.t{CC}z.ave_24hr_pm25_bc.227.grib2: Bias corrected 24-hour average PM2.5 predictions added for day 3 (averaged from forecast hours 49-72)

where CC = 06 or 12 for UTC Cycle;

MM = 1 or 8 average hour for ozone, 1 for pm25;

VARB = pm2.5 or o3 for fine particulate matter or ozone respectively;

and GRD = 227, 198, or 196 for CONUS, Alaska or Hawaii, respectively.

For Native CMAQ tangent Lambert Conformal 12 km grib2 grid 148, no changes are made.

NWS services:

for the CONUS domain:

<https://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/DF.gr2/DC.ndgd/GT.aq/AR.conus/>

for the Alaska domain:

<https://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/DF.gr2/DC.ndgd/GT.aq/AR.alaska/>

for the Hawaii domain:

<https://tgftp.nws.noaa.gov/SL.us008001/ST.opnl/DF.gr2/DC.ndgd/GT.aq/AR.hawaii/>

For all these NWS services sites, the gridded binary version two (grib2) model outputs will now have predictions for hours 49-72 for the 06 and 12 UTC cycle runs. The files impacted on tgftp for CONUS, Alaska and Hawaii are (note, no bias correction output for Alaska and Hawaii):

- ds.apm25h01.bin: Raw 1-hour average PM2.5 predictions5 added for hours 49-72.
- ds.apm25h01_bc.bin: Bias corrected 1-hour average PM2.5 added for hours 49-72.
- ds.apm25h24.bin: Raw 24-hour average PM2.5 predictions added for day 3 (averaged from forecast hours 49-72).
- ds.apm25h24_bc.bin: Bias corrected 24-hour average PM2.5 predictions added for day 3 (averaged from forecast hours 49-72).
- ds.mozoneh01.bin: Raw 1-hour average daily maximum ozone predictions added for day 3 (averaged from forecast hours 49-72).

- ds.mozoneh01_bc.bin: Bias corrected 1-hour average daily maximum ozone predictions added for day 3 (averaged from forecast hours 49-72).
- ds.mozone08.bin: Raw 8-hour average daily maximum ozone predictions added for day 3 (computed from forecast hours 49-72).
- ds.mozone08_bc.bin: Bias corrected 8-hour average daily maximum ozone predictions added for day 3 (computed from forecast hours 49-72).
- ds.ozone01.bin: Raw 1-hour average ozone predictions added for hours 49-72.
- ds.ozone01_bc.bin: Bias corrected 1-hour average ozone predictions added for hours 49-72.
- ds.ozone08.bin: Raw 8-hour average ozone predictions added for hours 49-72.
- ds.ozone08_bc.bin: Bias corrected 8-hour average ozone predictions added for hours 49-72.

B. Update to Ozone Prediction Display

The display of CONUS ozone predictions at airquality.weather.gov will continue to show bias-corrected ozone predictions, which will be updated within two weeks of the system upgrade. The graphics for the CONUS domain will be delayed by about 20 minutes to 11:20 and 17:20 UTC for the 06 and 12 UTC runs, respectively.

Web graphics: <http://airquality.weather.gov/>

C. Timing Changes

Output file dissemination will be delayed by about 70 minutes for the 06 and 12 UTC runs and 110 minutes for the 00 and 18Z runs from the original dissemination time. This is due to 1) forecast range extension and 2) changes in driving meteorology from NAM to GFS. Output files of the 00, 06, 12 and 18 UTC runs will be available at around 03:45, 11:20, 17:20 and 21:45 UTC, respectively.

D. File Size Increase

The file size for 06 and 12 UTC runs will increase to account for the forecast hour extension to 72 hours. Files affected are:

NOMADS/ftpprd:

- aqm.t{CC}z.avg_{MM}hr_{VARB}.{GRD}.grib2
- aqm.t{CC}z.avg_{MM}hr_{VARB}_bc.{GRD}.grib2
- aqm.t{CC}z.max_{MM}hr_{VARB}.{GRD}.grib2
- aqm.t{CC}z.max_{MM}hr_{VARB}_bc.{GRD}.grib2
- aqm.t{CC}z.ave_24hr_pm25.{GRD}.grib2
- aqm.t{CC}z.ave_24hr_pm25_bc.{GRD}.grib2

TGFTP:

- ds.apm25h01.bin
- ds.apm25h01_bc.bin
- ds.apm25h24.bin
- ds.apm25h24_bc.bin
- ds.mozoneh01.bin
- ds.mozoneh01_bc.bin
- ds.mozone08.bin
- ds.mozone08_bc.bin
- ds.ozone01.bin

- ds.ozone01_bc.bin
- ds.ozone08.bin
- ds.ozone08_bc.bin

For the description of these files, see section A above.

E. New Files

For 06 and 12Z data, 49-72 hour forecasts of raw and bias corrected PM2.5 on the NOMADS/ftpprd site will be stored in the following files:

- aqm.t{CC}z.pm25.f{FF}.148.grib2
 - aqm.t{CC}z.pm25_bc.f{FF}.148.grib2
- where FF = 49, ..., 72 for forecast hours.

F. New WMO Headers

A list of new WMO headers being produced for each region can be found here:

https://www.nco.ncep.noaa.gov/pmb/changes/new_headers_aqm_v6.php

Dissemination of ozone and PM2.5 forecast guidance products (raw and bias-corrected) will continue through ArcGIS REST Services at:

https://idpgis.ncep.noaa.gov/arcgis/rest/services/NWS_Forecasts_Guidance_Warnings

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.

Any questions, comments or requests regarding this implementation should be directed to the contacts below. We will review any feedback and decide whether to proceed.

For questions regarding these updated model forecast guidance, please contact:

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For questions regarding the data flow, please contact:

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National Service Change Notices are online at:

<https://www.weather.gov/notification/>

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