

The proposed GCAFSv1.0 implementation will be accompanied by the retirement of the GEFS v12 aerosol product as described in the Public Information Statement 25-52 https://www.weather.gov/media/notification/pdf_2025/pns25-52_soliciting_comments_gefs_aerosol_termination.pdf.

GCAFS v1.0 will instead provide the following products, transitioning from the previous four-cycle per day operation to a reduced two-cycle per day cadence. This new operational schedule will include a 5-day GCAFS forecast run at the 00 and 12 UTC cycles producing 3-hourly output:

For the 00 and 12 UTC forecasts (5 day forecast):

2D Column, Aerosol Optical and Surface Products (pgrb2ap25)

The pgrb2ap25 output file contains two-dimensional (2D) fields representing column-integrated and surface-level aerosol properties. This dataset is the primary source for air quality and visibility applications, featuring surface mass concentrations for PM2.5 (Fine) and PM10 (Coarse/Total) particulate matter. It also provides a comprehensive suite of optical parameters, including Aerosol Optical Depth (AOD), Single Scattering Albedo, and Asymmetry Factor across multiple spectral bands (UV to IR). These fields are critical for tracking aerosol plumes (such as wildfire smoke and dust storms), calculating radiative forcing, and facilitating direct comparisons with satellite imagery from instruments like VIIRS and ABI.

The following products will be provided:

- Aerosol Optical Depth (AOD) at 0.25 deg, ShortName: AOTK, Level: Column, Description / Spectral Bands: Total Aerosol: 340, 440, 550, 640, 860 nm; 1.64, 11.1 um. Speciated: 550 nm only (Dust, Sea Salt, Sulfate, Organic Matter, Black Carbon).
- Scattering AOD, ShortName: SCTAOTK, Level: Column, Description / Spectral Bands: Total & Speciated: 550 nm.
- Single Scattering Albedo, ShortName: SSALBK, Level: Column, Description / Spectral Bands: Total Aerosol: 340 nm.
- Asymmetry Factor, ShortName: ASYSFK, Level: Column, Description / Spectral Bands: Total Aerosol: 340 nm.
- Surface Particulate Matter (PM2.5), ShortName: PMTF, Level:

- Surface, Description / Spectral Bands: Mass concentration (< 2.5 um) for Total Aerosol, Dust, and Sea Salt.
- Surface Particulate Matter (PM10), ShortName: PMTC, Level: Surface, Description / Spectral Bands: Mass concentration (< 10 um) for Total Aerosol and Dust.
 - Column Mass Density, ShortName: COLMD, Level: Column, Description / Spectral Bands: Integrated mass for Total Aerosol, Dust, Sea Salt, Sulfate, Organic Matter, and Black Carbon.

3D Aerosol Mixing Ratios (pgrb2ap5)

The pgrbap5 output file contains three-dimensional volumetric mixing ratios for all GCAFS aerosol species, distributed across 23 isobaric pressure levels. Unlike the column-integrated products, this dataset captures the full vertical structure of the atmosphere from the surface to the upper troposphere. It features size-fractionated bins for Dust and Sea Salt (spanning fine to coarse modes) and distinguishes between hydrophobic and hydrophilic modes for Black Carbon and Particulate Organic Matter. These 3D fields are essential for diagnosing the vertical extent of aerosol plumes, determining whether pollutants are located at the surface or transported aloft.

The following products will be provided:

- Dust Mixing Ratio, ShortName: PMTF / PMTC, Level: 23 Pressure Levels, Species & Size Bins (Effective Radius): 5 Bins: 0.2 - 2.0 um (Fine), 2.0 - 3.6 um (Fine), 3.6 - 6.0 um (Coarse), 6.0 - 12.0 um (Coarse), 12.0 - 20.0 um (Coarse).
- Sea Salt Mixing Ratio, ShortName: PMTF / PMTC, Level: 23 Pressure Levels, Species & Size Bins (Effective Radius): 5 Bins: 0.06 - 0.2 um (Fine), 0.2 - 1.0 um (Fine), 1.0 - 3.0 um (Coarse), 3.0 - 10.0 um (Coarse), 10.0 - 20.0 um (Coarse).
- Sulfate Mixing Ratio, ShortName: PMTF, Level: 23 Pressure Levels, Species & Size Bins (Effective Radius): 1 Bin: 0.139 um (Fine).
- Particulate Organic Matter, ShortName: PMTF, Level: 23 Pressure Levels, Species & Size Bins (Effective Radius): 2 Modes (0.042 um): Hydrophobic (Dry), Hydrophilic (Wet).
- Black Carbon Mixing Ratio, ShortName: PMTF, Level: 23 Pressure Levels, Species & Size Bins (Effective Radius): 2

Modes (0.024 um): Hydrophobic (Dry), Hydrophilic (Wet).

A new analysis, the Global Constituent Data Assimilation System (GCDAS), will provide analyses of aerosol species at the 00, 06, 12, and 18 UTC cycles to initialize the GCAFS forecasts.

For the 00, 06, 12, and 18 Coordinated Universal Time (UTC) cycle, identical products to above will be provided valid only at initialization time.