

CESM2 Whole Atmosphere Community Climate (WACCM) Chemical Forecast Project using GEOS-FP forecast fields.

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The Community Earth System Model Version2 (CESM2) Whole Atmosphere Community Climate (WACCM) Version 6, has been set up to routinely produce a 10-day forecast of chemical and dynamical weather. WACCM6 runs on a 1.25° longitude x 0.95° latitude horizontal grid, and extends vertically from the surface to ~ 150 km. It includes comprehensive chemistry for the troposphere, stratosphere, mesosphere, and lower thermosphere, with interactive aerosols in both troposphere and stratosphere. The model is coupled to the community land model version 5 (CLM5) and to the Model of Emissions of Gases and Aerosols from Nature (MEGAN 2.0) to derive biogenic emissions. Anthropogenic emissions are from CMIP6, repeating emissions from the year 2015. Fire emissions are updated every day using the Fire INventory from NCAR (FINN). The specified dynamics model version, as used for this product, calculates physics and dynamics internally, but forces meteorological fields closer to the analysis and forecast fields generated by the NASA Goddard Earth Observing System (GEOS) Model, namely the GEOS Forward Processing (GEOS-FP). Wind fields, temperatures, and surface fluxes, are then nudged every time step (30 min) by 10% towards the GEOS-FP forecast fields (i.e., a 5-hour Newtonian relaxation time scale for nudging), regridded to the model horizontal resolution, between surface and 50 km. Between 50-60 km, the model transitions towards 100% WACCM fields, with no nudging above 60km. The model has been spun-up for at least 2 years and provides 3-hour and 6-hour output fields of meteorological and chemical information. In addition, forecast plots are provided with interest for both tropospheric air quality, as well as stratospheric aerosols, chemistry and dynamics, including the evolution of the ozone hole (<https://www.acom.ucar.edu/waccm/forecast/>). These chemical forecasts are widely used as initial and boundary conditions in regional models, specifically for WRF-Chem applications where we provide a pre-processing tool (mozbc). We plan on exploring ways to improve the chemical forecast by the near-real-time assimilation of satellite retrievals of chemical observations.