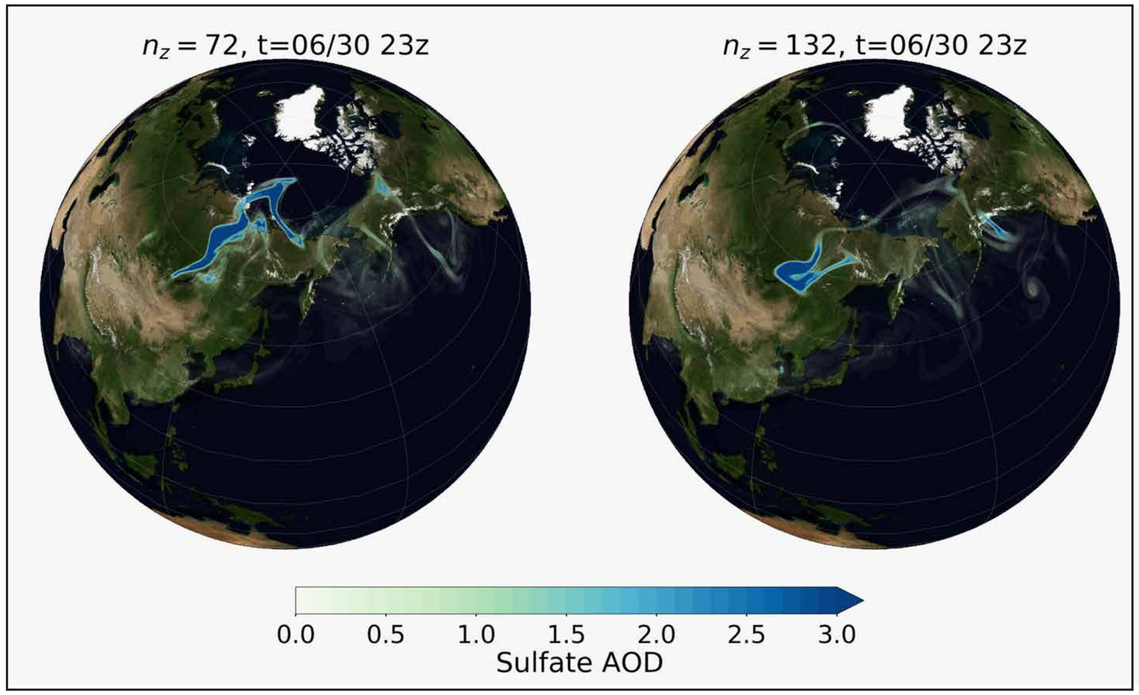
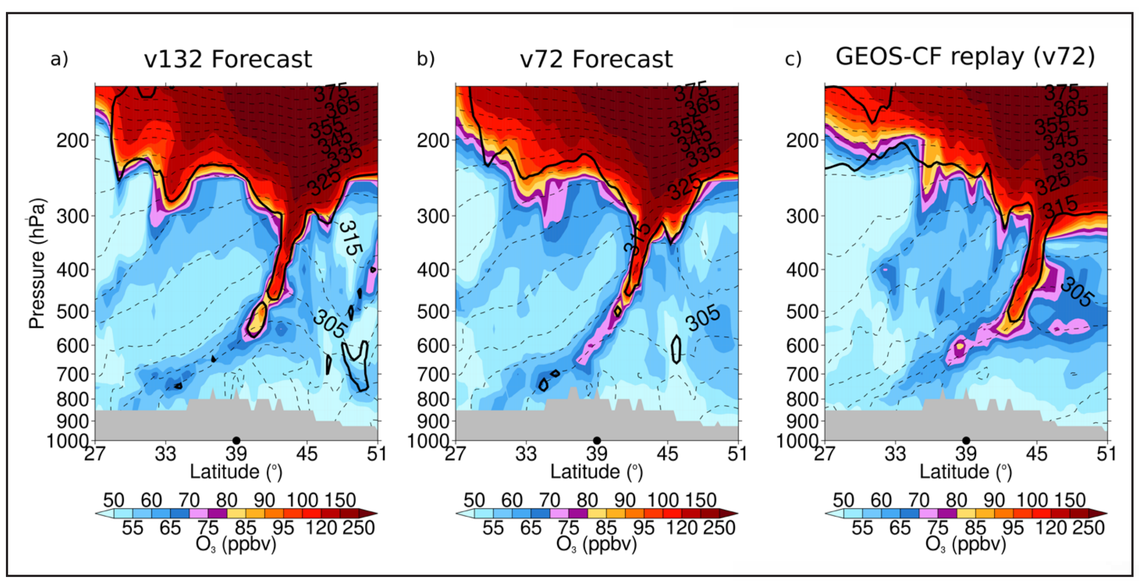
National Aeronautics and
Space Administration

Simulating Air Quality and Volcanic Plumes with NASA's GEOS CCM



Two different realizations from the last day of a GEOS model simulation of a volcanic aerosol plume produced by the Raikoke volcano on the Kuril Islands, Russia. The plume loading is represented by the sulfate aerosol optical depth (AOD), a measure of how much material is in the atmospheric column. The left image is from a simulation with 72 vertical levels, while the image at right is from a simulation with 132 levels, showing the different transport of the plume in each simulation. *Peter Colarco, NASA/Goddard; Parker Case, University of Colorado*



A stratospheric intrusion event that brought high ozone over the Colorado Front Range was captured in the GEOS Composition Forecast (GEOS-CF) replay for April 17–18, 2018. As shown above, higher concentrations of ozone reach closer to the surface (elevation in grey) in the v72 Forecast (b; with 72 vertical model layers) than in the v132 Forecast (a; with 132 layers), but the tropopause (black contour line) remains near 550 hPa in the v132 Forecast, similar to the 72-layer GEOS-CF Replay (c). The fold in the tropopause in the v72 Forecast has rebounded between 400 and 500 hPa. Dashed lines show equivalent potential temperature.
K. Emma Knowland, Elliot Sherman, NASA/Goddard

Using NASA's Goddard Earth Observing System (GEOS) Chemistry-Climate Model (CCM), we examined how changing the resolution of an atmospheric model affects simulation results, with the goal of improving predictions of air quality and the impacts of volcanic eruptions on surface temperature. In particular, we investigated how stratospheric ozone makes its way to Earth's surface and impacts air quality, and how the plume of a recent volcanic eruption affected the stratosphere. Our experiments showed that increasing the vertical resolution of the model improves the fidelity of both stratospheric intrusion events and volcanic plumes. These studies help us to interpret NASA satellite observations of Earth's atmosphere.

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