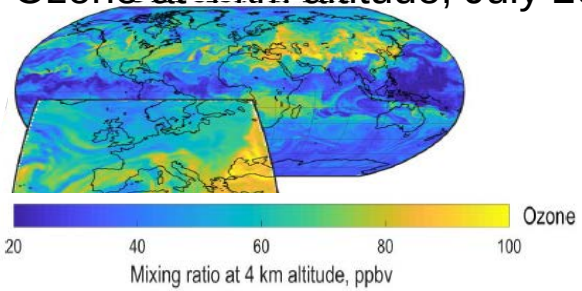
Development of high-performance GEOS-Chem (GCHP):

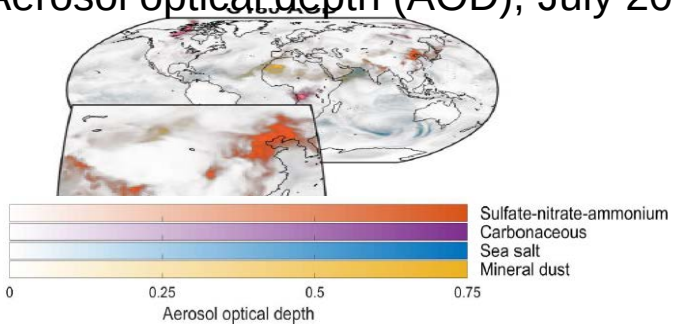
Massively parallel off-line capability for global chemical transport modeling enabled by ESMF/MAPL in partnership with GMAO

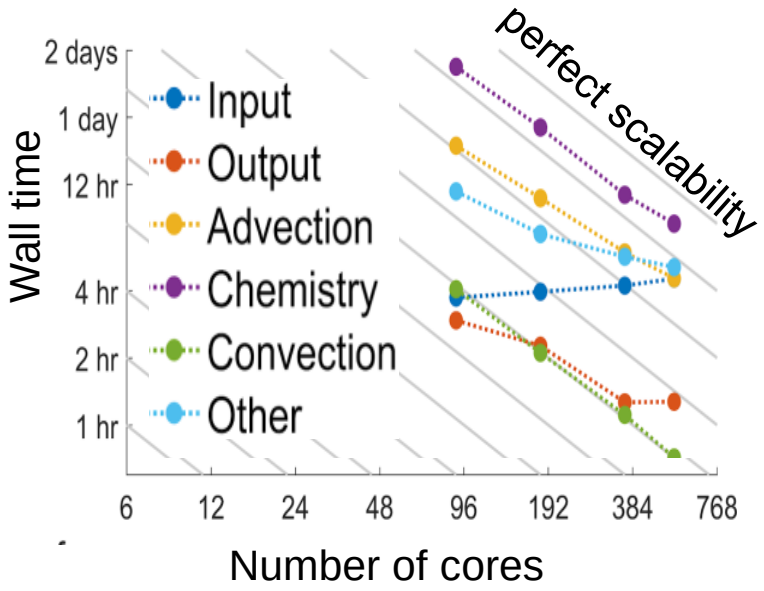
1-month simulation of troposphere-stratospheric chemistry at cubed-sphere 180 (~50 km) resolution requires only 1 day of wall time with 540 cores

Ozone at 4 km altitude, July 2016



Aerosol optical depth (AOD), July 2016





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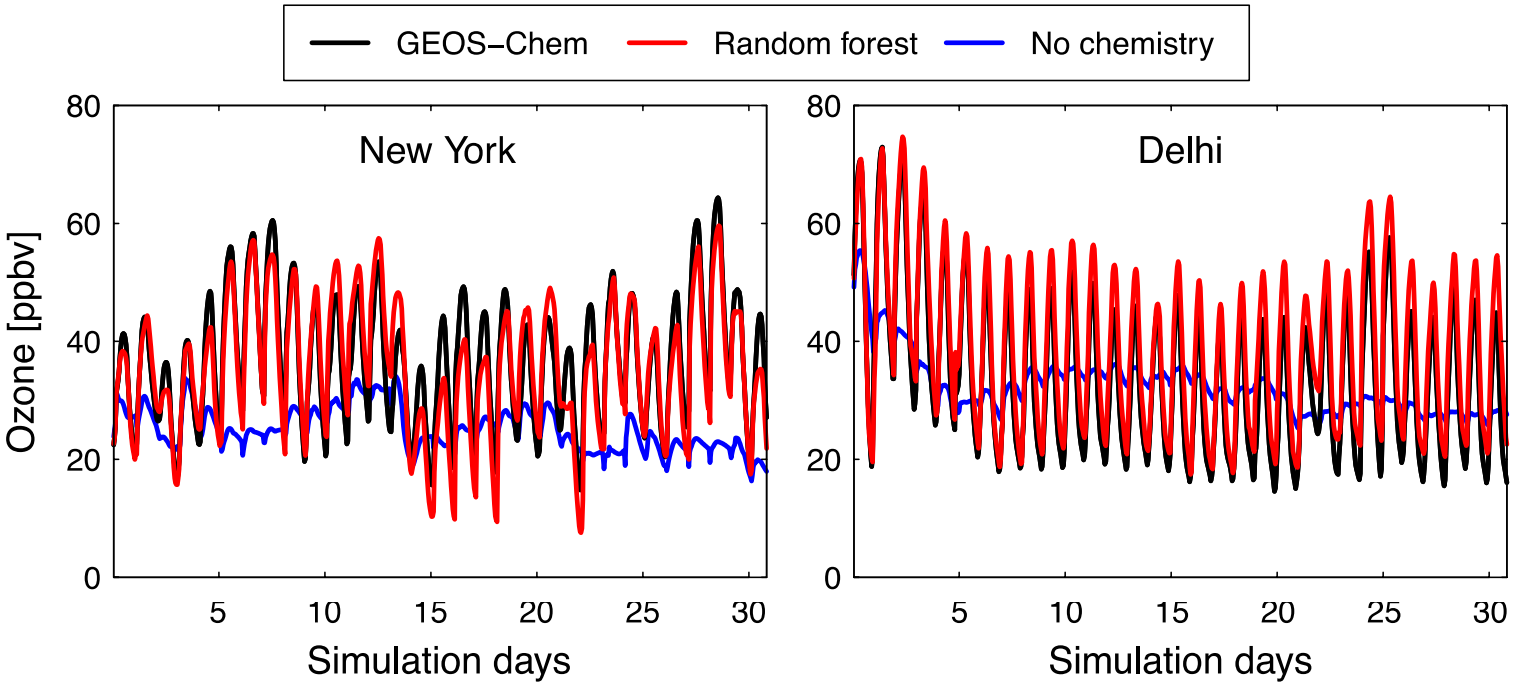
Atmospheric Chemistry Modeling using Machine Learning

- Numerical models of atmospheric chemistry are computationally expensive due to the stiffness of the ordinary differential equations that describe the chemical system
- Machine learning algorithms offer an alternative method that is potentially much faster
- A chemistry emulator based on the random forest regression method is able to reproduce the numerical solution with high accuracy even after 30 days of forward integration



Keller, C. A. and Evans, M. J.: Application of random forest regression to the calculation of gas-phase chemistry within the GEOS-Chem chemistry model v10, Geosci. Model Dev., 12, 1209-1225, https://doi.org/10.5194/gmd-12-1209-2019, 2019.