

## Updates on the interactive tropospheric chemistry for E3SM

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Tropospheric chemistry plays an important role in the Earth climate system. The Energy Exascale Earth System Model version 3 will include an interactive tropospheric chemistry package (named chemUCI) based on the University of California, Irvine (UCI) chemistry transport model (CTM). We rewrote the chemUCI mechanism for the chemistry pre-processor, coded the customized chemUCI reactions, and linked it with other modeling processes (such as photolysis, emissions, wet/dry depositions). This new chemistry package enables new capabilities: interactive O<sub>3</sub>, diagnosing the stratosphere troposphere exchange O<sub>3</sub> flux, CH<sub>4</sub> chemistry and lifetime, oxidants for aerosols (secondary organic aerosols, nitrate, and sulfate), and a tracer-based (E90) tropopause. More importantly, with the new theta-I dynamical core and Semi-Lagrangian (SL) advection scheme, the chemUCI chemistry only adds ~10% of computational cost to the atmosphere-only simulations, much more efficient than the traditional full tropospheric package and hence affordable in the production runs. This is mainly due to the chemUCI tracer number (31) falls within the optimal range of the theta-I-SL dynamical core. We will also present some preliminary chemUCI results from a decadal test simulation.

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