6.083 Utilizing model sensitivity analysis to set research priorities and constrain the global acetone budget..

Early Career Scientist

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Abstract:

Acetone is one of the most abundant carbonyl compounds in the atmosphere, and a major source of HO_X radicals in the upper troposphere. Thus, understanding the global budget of acetone is essential to understanding global oxidation capacity. Significant uncertainties remain regarding the flux of acetone out of and into the biosphere. Crucially unconstrained processes include dry deposition, fluxes of acetone into and out of the ocean, direct emissions of acetone from the terrestrial biosphere, direct emissions of secondary sources of acetone such as the oxidation of monoterpenes from the terrestrial biosphere, and loss of acetone due to photolysis.

We have performed an elementary effects sensitivity analysis of the GEOS-Chem global 3-D CTM (version 10-01, www.geos-chem.org) for the global atmospheric distribution of acetone using the Morris method. This method provides a ranking of both the comparative direct importance, as well as non-linear effects and interactions of the tested input factor uncertainties, at a relatively low computational cost. The sensitivity analysis was bounded using literature minima and maxima for six sources of uncertainty related to specific sources and sinks. The uncertainties with the largest impact on acetone concentration are the uncertainties in direct acetone emissions from the terrestrial biosphere, the uncertainties in modeled j-values used to represent acetone photolysis, and the uncertainties in the concentration of acetone in the ocean mixed layer. Future work to improve the global acetone budget should therefore be primarily focused on improving the representation of these three processes within global CTMs.