

1.034 The Global Reactive Carbon Budget of the Troposphere: a Modeling Perspective .

Early Career Scientist

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Abstract:

Reactive carbon plays a key role in driving the oxidative chemistry of the atmosphere and is a precursor to ozone and particulate matter formation, both of which impact human health and climate. However, uncertainties on the lifecycle of reactive carbon in the atmosphere remain large. In part this can be attributed to the chemical complexity and variety of species reactive carbon in the atmosphere, and the resulting lack of mass closure in both ambient measurements and models. Furthermore, the complex oxidative chemistry of the troposphere and the implications for the formation and loss of organic aerosol, encourage a holistic perspective on the sources and sinks of all the reactive carbon in the atmosphere.

In this study, we present the first attempt to simulate the reactive carbon budget of the troposphere using a global chemistry transport model, GEOS-Chem. We add the oxidation of aromatics and monoterpenes to the existing chemical mechanism, we expand the treatment of dry and wet removal of organic species, we introduce a complete mass tracking of all reactive carbon species, and finally we update the chemical mechanism to achieve carbon closure. We use this updated model to construct a global reactive carbon budget, comparing the relative magnitude of the sources (emissions, oxidation) and sinks (wet removal, dry removal, oxidation to CO₂) of atmospheric reactive carbon. This study presents a new perspective on the processes controlling the spatial and temporal distribution of anthropogenic and biogenic reactive carbon in the atmosphere.