The First Global Evaluation of Dissolved Organic Carbon
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The Reactive Organic Carbon (ROC) is Essential for Tropospheric Chemistry

The Reactive Organic Carbon (ROC) is simulated by expanding the GEOS-Chem standard simulation, including: new emissions and chemistry, expanding the wet and dry deposition scheme, and ensuring carbon closure.
The global DOC is calculated from the wet deposition flux of atmospheric reactive carbon divided by the global precipitation.
Comparison of the 2010 simulated DOC with a 30-year record of available DOC measurements over different environments and regions, shows a good correlation.
The average carbon oxidation state is metric for the degree of oxidation of atmospheric organic species, a quantity that necessarily increases upon oxidation:

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\overline{OS_C} \approx 2 \frac{O}{C} - \frac{H}{C}
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Mass spectrometry techniques provide key information on the chemical composition of organics, such as the average carbon oxidation state, which can be derived from GEOS-Chem.
In the dissolved form, DOC OSc is generally higher than ROC OSc due to increase of solubility upon oxidation.
• In the atmosphere, ROC OSc is governed by alkanes with lower photochemistry (oxidation) leading to a lower OSc in winter of the Northern Hemisphere

• In the dissolved form, DOC OSc is more uniform and generally higher than
Conclusions and Future Work

- Wet deposition is the largest physical sink of reactive organic carbon
- Improving the understanding of the composition and evolution of dissolved organic carbon (DOC) will therefore provide constraints on atmospheric reactive organic carbon (ROC) lifecycle
- DOC depends on local sources and chemical processing of reactive organic carbon, as well as precipitation
  - ROC is dominated by chemically reduced hydrocarbons and acetone and DOC is dominated globally by semi-volatiles, formaldehyde, and POA.
  - $\overline{OS_c}$ is negative for most of ROC and DOC compounds and is higher in dissolved form due to increase of solubility upon oxidation.

Focus on the US: analysis of NADP data will provide DOC values and information on the sample chemical composition for model evaluation.