Atmospheric chemistry impacts and feedbacks on the global carbon cycle

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B. Scientific advances to be accomplished within this project

The scientific advances of this project will be the creation of an atmospheric chemistry-coupled climate carbon model for use climate prediction. Issues to be addressed include the quantification of the impact of the atmospheric oxidation of CO (and precursors) on atmosphere CO2 inversions. This activity will lead to a more accurate assessment of uncertainty in the global carbon cycle. The main thrust of this project is to quantify and implement feed backs between atmospheric chemistry and the global carbon cycle. The project includes an assessment of the impact of tropospheric ozone on carbon uptake and sequestration in the terrestrial biosphere. The specific goal of this project is to quantify the climate variable impact of global biogeochemical cycles as related to atmospheric chemistry through feedbacks involving CO2, CH4, aerosols and the oxidative state of the atmosphere. The end goal is to create a model that can quantitatively predict the climate of Earth including the feedbacks between the global ozone, nitrogen, carbon and water cycles.

C. Necessary model capability (general): within atmospheric chemistry, and in other CCSM modules

The model is required to:

Predict 3-D atmospheric CO2 production as a function of the CCSM3 atmospheric chemistry module including hydrocarbons, CO etc.

Include 3-D atmospheric CO2 production in online CO2 source/sink inversion studies.

Include impacts of atmospheric ozone, nitrogen and regional pollution on CO2 uptake by the terrestrial and oceanic biosphere.

Predict the biogeochemical cycles of CH4 and CO2 under various climate change scenarios.

Quantify the impacts and feedbacks between global biogeochemistry, the global carbon cycle and atmospheric chemistry.

D. Current status of models / model development. Key scientific personnel needed. Who will do it? Do we have internal/external funds?

Atmospheric chemistry is presently in offline and separate versions of CAM. Coupling of biogeochemistry/atmospheric chemistry in CCSM3 is in progress.

Key scientific personnel include NCAR, university and national laboratory scientists.

E. What types of CCSM simulations are needed ? What are the benchmark tests & validation ?

Validation is the usual evaluation of chemical fields against field observations, satellite data etc.

F. Time frame

The time frame for this project is 2-6 years.

G. Computing resources needed

The type of model described here will increase the run time of CCSM3 by a factor of 10-100.