README

The accompanying netcdf file contains monthly global 3-D maps from the GEOS-CHEM model of the impact of reduced carbon fluxes from terrestrial and anthropogenic sources on the distribution of surface atmospheric CO_2. The netfile was created by Parv Suntharalingam. Lat-lon coordinate descriptions are embedded within the netcdf file. These maps are the same as those described in:

Suntharalingam, P., J.T. Randerson, N.Y. Krakauer, D.J. Jacob, and J.A. Logan. 2005. The influence of reduced carbon emissions and oxidation on the distribution of atmospheric CO_2: Implications for inversion analyses. Global Biogeochemical Cycles. 19: GB4003. doi: 10.1029/2005GB002466.

The file needs to be gunzipped and tar extracted (CO2adjustment.tar.gz) before the netcdf file may be accessed.

In many global modeling studies, exchange of carbon between the atmosphere and terrestrial ecosystems is assumed to occur in the form of CO_2. Although carbon mostly enters terrestrial ecosystems as CO_2 (fixation associated with GPP), a few percent of return flux from terrestrial ecosystems to the atmosphere occurs in the form of reduced carbon species such as VOCs, CH_4, and CO. These reduced carbon compounds are oxidized to CO_2 within the atmosphere, often far from the initial surface source. Thus even if total biosphere-atmosphere carbon exchange is at steady state, reduced gas oxidation will create small CO_2 gradients within the atmosphere.

Similarly, anthropogenic emissions are often assumed to occur in the form of CO_2, yet a few percent of these emissions occur in the form of CO, CH_4, and as other reduced gas species.

If the reduced gas emissions described above are neglected in atmospheric transport modeling studies (with carbon fluxes represented solely the form of CO2), then the models will overestimate CO2 concentrations near the surface and near reduced gase source regions. As a consequence, the strength of carbon sinks over land may be overestimated if near surface measurements of carbon dioxide are used as the primary data constraint.

To account for this reduced gas cycle in models that do not explicitly represent atmospheric chemistry processes, the following monthly maps of CO_2 mixing ratio (ppm) may be added model forward CO_2 estimates prior to comparisons with the observations. These maps are the same as the chemical pump adjustment (delta y) in the Suntharalingam et al. paper and have units of CO_2 mixing ratio (ppm).

These estimates were constructed by making two simulations with GEOS-CHEM. In one, all reduced gas fluxes for the mid-1990s were released at the surface and the steady state 3-D distribution of CO2 arising from their oxidation was recorded (run 1). In a second simulation, the same surface flux was emitted, but in the form of CO_2 (run 2). The

difference between these two simulations (2-1) is same as ‘delta y’ in the paper and is appropriate for adding to forward model CO_2 concentration estimates prior to comparison with observations. The maps are negative over source regions in the northern hemisphere (as low as -0.6 ppm) and imply that tracer model estimates of CO_2 in these regions can be too high because they neglect reduced gas emissions and remote oxidation.