Regional CO_2 Flux Estimates for North America

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One of the goals of the North American Carbon Program (NACP) is to quantify sources and sinks of CO_2 within the conterminous United States. This requires a dense observational network, as well as a transport model to relate these observations to the surface fluxes. Ideally, this transport model spans the global domain to ensure consistency with global constraints on the carbon cycle and to compare the U.S. carbon budget to that of other countries. But regional scale modeling in a global framework is beyond our current computational capacity with traditional, uniform grid models.

The two-way nested global transport model TM5 can satisfy the need for high-resolution modeling in a global domain, in a computationally efficient way. This is achieved by calculating detailed transport (~70 × 100 km) for the U.S., nested within a global simulation with a coarser (~400 × 600 km) grid. The TM5 model was used to calculate the air mass history of every CMDL discrete air sample taken since January 1, 2000, (N = 12,985) (see Figure 1 for an example). Combining these histories with the observations in a Bayesian inversion, weekly CO_2 fluxes will be retrieved at sub-continental scales. Even better resolved fluxes (down to the fine model grid-size) can be calculated in combination with geostatistical techniques for which the framework has been developed at CMDL [Michalak et al., A geostatistical approach to surface flux estimation of atmospheric trace gases, *J. Geophys. Res*., accepted, 2004].

Here, we will present the first CO_2 flux estimates for 2000-2003 performed with new CMDL sites and the TM5 model.

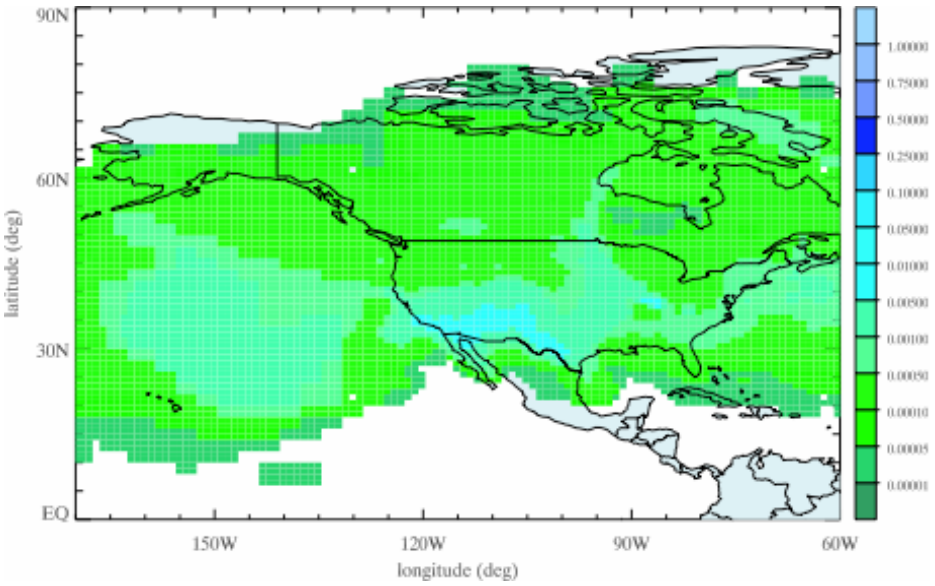

Figure 1. The relative influence of each surface grid box on a measurement taken at Harvard Forest at 4500 m, on August 22, 2002. Combining the information of 12,000 of such maps in a Bayesian inversion yields detailed global CO_2 surface flux estimates.