Scientific Focus Areas (SFA)

Temporal, Spatial, and Uncertainty Aspects of Carbon Dioxide Emissions from Fossil Fuel Combustion: Highlights of the Last Two Years of TES Funding

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Continued TES funding has led to improvements in understanding fossil fuel carbon dioxide emissions, especially in terms of their temporal distribution, spatial distribution, and uncertainties associated with those emissions. Research continues in all of these areas with TES support.

Temporally, monthly inventories of fossil fuel carbon dioxide emissions have been completed from January 1950 to December 2010. The basic spatial unit of data is at the scale of nations (which then can be summed to regional and global totals). These data are available in numerical tables or graphically distributed. One of the primary results of this monthly research is that the global monthly time series is statistically significantly different from a uniform distribution throughout the year.

Spatially, the annual and monthly data are gridded at one degree latitude by one degree longitude. This data presentation format has proven so useful to the broader community that others have made several attempts to improve upon the gridding methodology originally published in 1996 (Andres et al., Global Biogeochem. Cycles 10:419-429). Each of these gridding attempts suffer from spatial, temporal and/or coverage uncertainties.

Research on uncertainties associated with fossil fuel emissions has been concentrated in two areas: global totals and gridded distributions. A new global uncertainty analysis has been completed and submitted for publication in Tellus. The analysis includes three separate uncertainty assessments, resulting in a multifaceted examination of the uncertainty associated with fossil fuel carbon dioxide emission estimates. Each assessment has its own strengths and weaknesses and none give a full uncertainty assessment of the emission estimates. This approach grew out of the lack of independent measurements at the spatial and temporal scales of interest. Issues of dependent and independent data are considered as well as the temporal and spatial relationships of the data. The three assessments collectively give a range that spans 1.0 to 13% (2 sigma). Greatly simplifying the assessments gives a global fossil fuel carbon dioxide uncertainty value of 8.4 % (2 sigma). Uncertainty assessments on gridded distributions has begun.

Peer-reviewed publication of this work continues. Since the last TES presentation two years ago, TES funding has contributed to 12 major publications as well as meeting abstracts, presentations, and interactions. Also of note are a contributing authorship to IPCC AR5 Working Group III chapter 5, preliminary efforts toward the Coupled Model Intercomparison Project Phase 6 (CMIP6) activities, the Global Carbon Project Global Carbon Atlas (http://www.globalcarbonatlas.org), and press interactions.