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A GLOBAL CARBON CYCLE DATA ASSIMILATION SYSTEM (CCDAS) TO INFER ATMOSPHERE-BIOSPHERE CO2 EXCHANGES

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Atmospheric inversion studies have become an important tool for identifying terrestrial sources and sinks of CO2 at the interannual time scale. For determing detailed patterns, they suffer from the inverse problem being seriously underconstrained. Such methods are usually contrasted with process-based models of the terrestrial or oceanic carbon cycle. Such models, however, cannot take into account information gained from CO2 measurements such as the extensive flask sampling network. Here, we present results of a two-stage assimilation study of satellite radiances (identifying vegetation activity) and atmospheric CO2 concentration data into a terrestrial biosphere model. The assimilation optimizes the tunable parameters in the model, and thus we predict the model evolution using the optimized parameters. Via the optimized model we identify the processes responsible for the interannual variabilty in the terrestrial fluxes. For example, we find a highly significant correlation between El Nino/Southern Oscillation and terrestrial CO2 fluxes, with CO2 lagging by a few months. Net CO2 outgassing is caused by a reduction of photosynthesis in large parts of the tropics, notably the Amazon basin and Central Africa. The most important deviation of this pattern is found after the eruption of Mount Pinatubo in 1991. The system allows us also the computation of uncertainties in net CO2 fluxes, which is discussed for the example of some major regions.