Exploring the Recent Biennial Cycle in Observed CO_2 Growth Rate Using CarbonTracker

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Since 2002, atmospheric CO_2 growth rates estimated from NOAA Cooperative Air Sampling Network stations in northern extratropical latitudes have manifested an apparent oscillation with a period of about 2 years (Figure 1). Peak growth rates of around 3 ppm yr^{-1} occur in January 2003, 2006, and 2008, and troughs below 1 ppm yr^{-1} occur in spring 2004, January 2007, and January 2009. Time series of CO_2 mole fractions extracted from CarbonTracker for the same stations were used to compute the growth rate surface, and we find that the model reproduces this oscillation. In CarbonTracker, this feature is almost exclusively due to variations in the terrestrial biosphere CO_2 tracer--air-sea exchange and fossil fuel emissions do not contribute significantly. Intriguingly, the feature is also present in simulations using unoptimized "prior" land fluxes, but with a significantly smaller amplitude than in the optimized CarbonTracker product. Further analysis suggests that land flux anomalies cannot by themselves explain the observed growth rate variability, implying that interannual variability in atmospheric transport plays a large role in creating this feature. Using CarbonTracker as an analysis tool, we will explore the causes of this growth rate feature, and discuss implications for analysis of atmospheric time series.

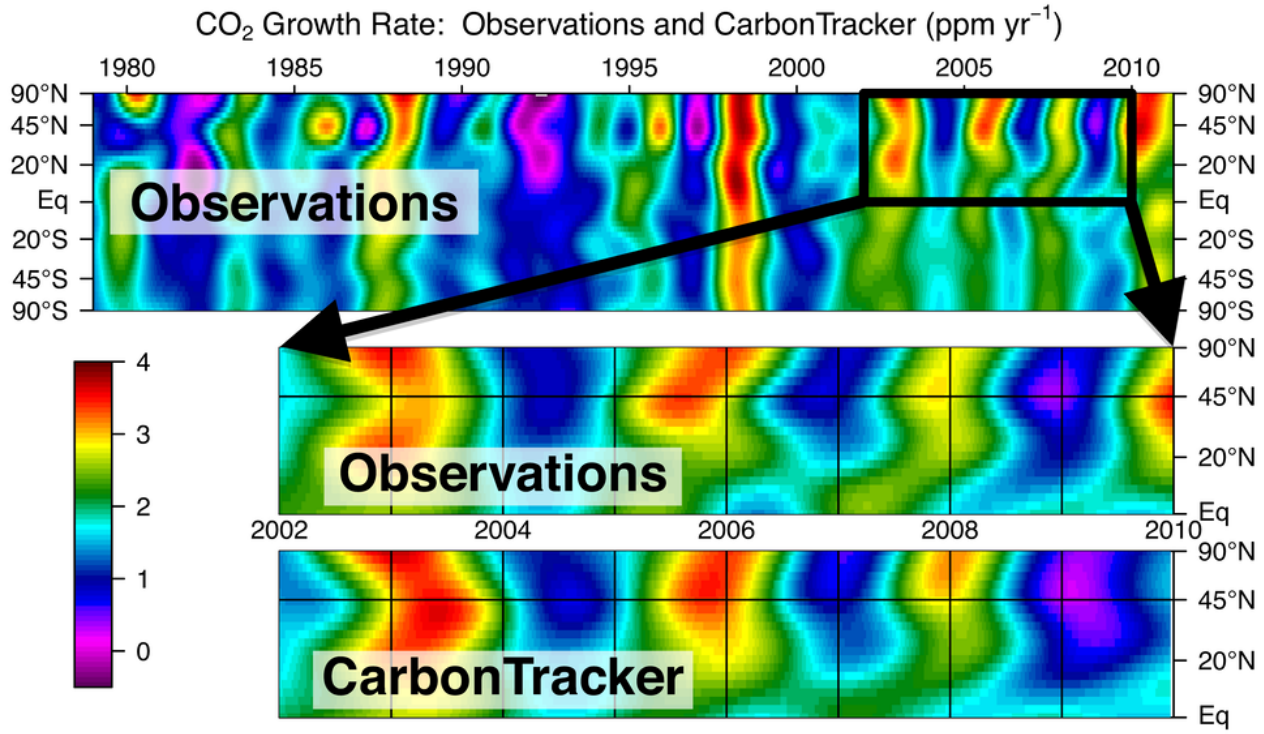

Figure 1. CO_2 growth rates estimated from observed and modeled mole fractions.