THE CHANGING CARBON CYCLE AT MAUNA LOA OBSERVATORY

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The amplitude of the CO_2 seasonal cycle at MLO increased from the early 1970's to the early 1990's but decreased thereafter, despite continued warming over northern continents (Fig. 1). Because of its location relative to the large-scale atmospheric circulation, MLO receives mainly Eurasian air masses in NH winter but relatively more North American air masses in NH summer, thus permitting the analysis to separate the continental influences on the MLO CO_2. Complementing the work of Keeling et al. (1996), we find that the increase in the amplitude from the 1970's to the 1990's is dominated by enhanced photosynthetic drawdown of CO_2 in North American and enhanced respiration in Eurasia. In contrast, the recent decline in the CO_2 amplitude is correlated with reductions in carbon sequestration over North America associated with severe droughts from 1998 to 2003 and with changes in atmospheric circulation leading to decreased influence of Eurasian air masses. Our analysis shows that atmospheric CO_2 measurements at a single station can continue to play an important role in documenting changes in land carbon flux, including those related to widespread droughts, which are predicted to worsen as a result of global warming.

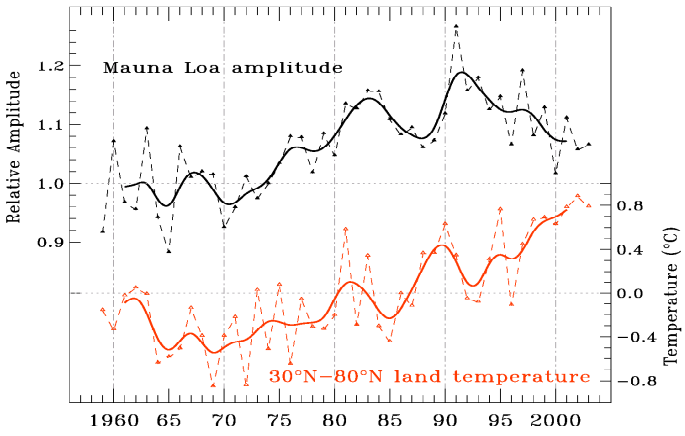

Fig. 1. Time series of the relative amplitude of the seasonal cycle of atmospheric CO_2 at MLO (black) and anomalies in observed annual temperatures (red) for land areas between 30-80N (except Greenland).

Keeling, C.D., J.F.S. Chin, T.P. Whorf (1996), Increased activity of northern vegetation inferred from atmospheric CO2 measurements. Nature, 382:146-149.

Buerman, W., B. Lintner, C.D. Koven, A. Angert, J. Pinzon, C.J. Tucker and I. Fung (2007). The changing carbon cycle at Mauna Loa Observatory. Proceedings of the National Academy of Sciences, USA, 104, 4249-4254. [This article is dedicated to the memory of Dr. Charles D. Keeling.]