Geophysical Research Abstracts
Vol. 15, EGU2013-5617, 2013
EGU General Assembly 2013

A spectral analysis of surface CO_2 mole fraction data

James Barlow and Paul Palmer
School of GeoSciences, University of Edinburgh, Edinburgh, UK (j.m.barlow-2@sms.ed.ac.uk)

A current challenge in studies of the global carbon cycle is to quantify the response of natural emissions and uptake of CO_2 to rapidly changing climate. We use wavelet analysis to interpret observed temporal variations in ground-based CO_2 mole fraction data across the world over the past 3-4 decades. Most importantly, the wavelet analysis allows us to decompose a timeseries as a function of frequency and time. We examine temporal and spatial variations in the atmospheric growth rate of CO_2 and quantify long term trends in the amplitude of the seasonal oscillations of CO_2 concentration values. We define a metric to estimate changes in the length of the CO_2 uptake period in the Northern Hemisphere, allowing us to quantify changes to the start and end dates of this period and consider how the long term trends vary zonally. We present the results of the seasonal cycle trend analysis which exhibit increasing amplitudes in the Northern Hemisphere, with the exception of the mid-latitudes, and where the magnitude of the increase is typically greater towards the higher latitudes. There is little change in amplitude in the Southern Hemisphere. We also find that the start/end dates of the uptake period are becoming earlier at nearly all latitudes. The advance in Spring and Autumn phases typically results in a small net change to the overall length of the carbon uptake period. Finally we present the performance of a multi-parameter linear regression model, driven by gridded model analyses of temperature, short-wave infrared radiation, and precipitation, to reproduce observed CO_2 variations across the globe.