Geophysical Research Abstracts
Vol. 15, EGU2013-8324, 2013
EGU General Assembly 2013

Investigation of a long time series of CO_2 from a tall tower using WRF-SPA

Luke Smallman (1,2), Mathew Williams (1,2), and John B. Moncrieff (1)

(1) School of GeoSciences, University of Edinburgh, United Kingdom (t.l.smallman@sms.ed.ac.uk), (2) National Centre of Earth Observation, University of Edinburgh, United Kingdom

Atmospheric observations from tall towers are an important source of information about CO_2 exchange at the regional scale. Here, we have used a forward running model, WRF-SPA, to generate a time series of CO_2 at a tall tower for comparison with observations from Scotland over multiple years (2006-2008). We use this comparison to infer strength and distribution of sources and sinks of carbon and ecosystem process information at the seasonal scale.

The specific aim of this research is to combine a high resolution (6 km) forward running meteorological model (WRF) with a modified version of a mechanistic ecosystem model (SPA). SPA provides surface fluxes calculated from coupled energy, hydrological and carbon cycles. This closely coupled representation of the biosphere provides realistic surface exchanges to drive mixing within the planetary boundary layer. The combined model is used to investigate the sources and sinks of CO_2 and to explore which land surfaces contribute to a time series of hourly observations of atmospheric CO_2 at a tall tower, Angus, Scotland.

In addition to comparing the modelled CO_2 time series to observations, modelled ecosystem specific (i.e. forest, cropland, grassland) CO_2 tracers (e.g., assimilation and respiration) have been compared to the modelled land surface assimilation to investigate how representative tall tower observations are of land surface processes. WRF-SPA modelled CO_2 time series compares well to observations (R^2 = 0.67, rmse = 3.4 ppm, bias = 0.58 ppm). Through comparison of model-observation residuals, we have found evidence that non-cropped components of agricultural land (e.g., hedgerows and forest patches) likely contribute a significant and observable impact on regional carbon balance.