Geophysical Research Abstracts
Vol. 15, EGU2013-8603, 2013
EGU General Assembly 2013
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Recent trends of land use change carbon fluxes across Europe derived from the CASA model

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LULUCF (Land Use, Land-Use Change and Forestry) activities are an uncertain component of the carbon cycle, but new satellite data provides consistent estimates of the rates of LULUCF across the globe. In this study, we explored the most recent land cover, environmental and meteorological data combined with newly developed modeling techniques to quantify LULUCF carbon fluxes for selected regions in Europe with high resolution.

We used the MODIS Land Cover Type product which contains multiple classification schemes, describing land cover properties derived from Terra and Aqua satellites. With MODIS MCD12Q1 v.51, the trends of managed land use changes in the past 10 years such as changes of urban areas and croplands are revealed. Changes in NPP and GPP corresponding to the same changing lands are obtained utilizing MODIS data MOD17A3 and MOD17A2 with 1 km resolution.

NEE calculation of the changing lands is achieved by simplified version of the CASA model, capable of simulating NPP , GPP and NEE with 1 km resolution.

This model combines several data sets from different sources and fits them into 1km x 1km pixels. Several MODIS products are used, including MOD15A2 and MOD15Y2 for fPAR, and MOD16 for Potential Evapotranspiration. High resolution meteorological data compiled by MPI-Jena (0.25 x 0.25 degree) are also employed.

Calibration is done by comparing NEE at Fluxnet sites and NEE from this model at the sites assuming Fluxnet sites provide correct NEE values. The sigma value of the deviation distribution between the NEE from CASA and from Fluxnet sites provides an estimate of uncertainty at site level. Uncertainty estimation of NEE in a large area (upscaling) is achieved by applying the rule of error propagation to the site-level uncertainty.