Geophysical Research Abstracts
Vol. 15, EGU2013-2610, 2013
EGU General Assembly 2013

Spatio-temporal characterisation of ecosystem functions based on macro habitats.

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The analysis and forecast of the spatial and temporal dynamics of the water and carbon cycles is an important element of sustainable land management. International initiatives have highlighted major scientific challenges in characterising, quantifying, monitoring and mapping stocks and flows of ecosystem functions accounting for both temporal and spatial variability. Only few studies approached the variability of provisioning of ecosystem functions over time. The aim of this paper was to analyse the spatial and temporal variability of various ecosystem functions using indices derived from remote sensing products in Scottish macro habitat types. The remote sensing data were derived from Terra Moderate Resolution Imaging Spectroradiometer (MODIS) data. The indices considered were i) Enhanced vegetation Index, ii) Leaf Area Index, iii) Land Surface Temperature, iv) primary productivity, v) Normalised Difference Water Index, vi) Evaporative fraction, and vii) length of season as calculated with TIMESAT. The indices were calculated every 8 or 16 days from 2000 to 2011. Various summary statistics were prepared, temporal (every year, over the considered period and per DOY over the considered period) and by habitat. Statistical analysis showed significant differences in the timing and intensity of the ecosystem function indicators between macro habitats (e.g. forest, grassland, peatland, moorland etc) derived from a detailed land cover map (LCM2007). The results can be used to model the provisioning of ecosystem functions by macro habitats and to improve predictions of the climate change on ecosystems. The study was implemented using open source software, in particular GRASS, R and PostGIS.