Geophysical Research Abstracts
Vol. 12, EGU2010-2164, 2010
EGU General Assembly 2010

An analysis of the decadal variability of Carbon fluxes in European forests through process-based modelling

Nicolas Delpierre (1), Kamel Soudani (1), Christophe François (1), Christian Bernhofer (2), Werner Kutsch (3), Laurent Misson (4), Timo Vesala (5), and Eric Dufrêne (1)

(1) Université Paris Sud XI, Orsay, France., UMR 8079 (LESE), Ecophysiologie végétale, Orsay, France (nicolas.delpierre@u-psud.fr), (2) Department of Meteorology, Institute of Hydrology and Meteorology, Technische Universitat, Dresden, Germany, (3) Johann Heinrich von Thünen-Institut, Institute of Agricultural Climate Research, Braunschweig, Germany, (4) CNRS, Centre d'Ecologie Fonctionnelle et Evolutive, Montpellier, France, (5) Department of Physical Sciences, Helsinki, Finland

With several sites measuring mass and energy turbulent fluxes for more than ten years, the CarboEurope database appears as a valuable resource for addressing the question of the determinism of the interannual variability of carbon (C) balance in forests ecosystems.
Apart from major climate-driven anomalies during the anomalous 2003 summer and 2007 spring, little is known about the factors driving interannual variability (IAV) of the C balance in European forests.
We used the CASTANEA process-based model to simulate the C balances of four European forests for the 2000-2007 period, spanning a large latitudinal range (44-62°N). The model fairly reproduced the day-to-day variability of measured fluxes, and accounted for 36-82% (mean=63%, n=4) of the observed interannual variance in daytime NEP.
We used CASTANEA as a tool for disentangling the influence of climate and biological drivers on C fluxes at mutiple time scales. A set of constrained simulation was performed to identify the proper effects of climate (PAR, temperature, relative humidity, soil water content) and biological drivers (canopy phenology, plant and soil C stocks) on flux variability. Their relative contributions to flux variance across timescales was quantified through orthonormal wavelet decomposition of the single-driver effects time series.
As a general feature, we observed a declining contribution of climate drivers to flux (GPP, Reco or NEP) interannual variance from daily to annual timescale. Our analyses revealed that most (40-90%, mean=70%) of the simulated NEP interannual variance at annual scale was caused by climate anomalies, with biological drivers playing a more modest role in such mature and relatively undisturbed forests.
We contrast results obtained through this novel process-based modelling approach with those arising from more classical data-mining analyses.

Keywords: Process-based model, interannual variability, Carbon balance, water balance, phenology, biological drivers, climate drivers.