Geophysical Research Abstracts,
Vol. 11, EGU2009-2444-3, 2009
EGU General Assembly 2009

Can intra-annual stable isotope signals in tree-ring cellulose be used to extend Fluxnet data-model analysis to larger temporal and spatial scales?

J. Ogée (1), L. Wingate (1), J. Jouanguy (1), D. Bert (1,2), C. Lambrot (1), M. Devaux (1), M. Stievenard (3), M. Pierre (3), D. Loustau (1), and P. Berbigier (1)

(1) INRA, UR1263 EPHYSE, F-33130 Villenave d'Ornon, France (jogee@bordeaux.inra.fr), (2) INRA, BIOGECO, Cestas-Pierroton, France, (3) CEA/CNRS, LSCE, Gif/Yvette, France

Long-term eddy covariance measurements of CO_2 and water fluxes are essential to validate forest ecosystem models. However, to test these models and improve our predictions over larger forested areas or longer time frames, complementary datasets are required. In this respect, high-resolution intra-annual measurements of the carbon and oxygen stable isotope composition of cellulose in annual tree rings ($\delta^{13}C_{cellulose}$and $\delta^{18}O_{cellulose}$, respectively) may provide a solution. This is because well-defined seasonal patterns of plant carbon and water dynamics are recorded in the tree ring cellulose over the growing season in response to climatic variability. We explored this potential by collecting a 10-year, high-resolution cellulose dataset from maritime pine trees growing in the flux tower footprint at Le Bray. To link these isotopic tree-ring signals to the continuous 10-year record of flux measurements a simple, single-substrate model describing wood growth and isotopic discrimination was used. Over this decade seasonal patterns of the observed $\delta^{13}C_{cellulose}$and $\delta^{18}O_{cellulose}$ exhibited strong year-to-year variability. This novel dataset was then compared against model simulations of $\delta^{13}C_{cellulose}$and $\delta^{18}O_{cellulose}$ and a sensitivity analysis to the main parameters and climate variables was performed to identify which aspects of the model were best constrained by the isotopic chronologies.