



Tower-Based Photochemical Reflectance Index measurements to assess ecophysiological responses in a mature deciduous forest.

Gabriel Hmimina, Eric Dufrêne, Nicolas Delpierre, and Kamel Soudani

Univ. Paris-Sud, Laboratoire Ecologie Systématique et Evolution, UMR8079, Orsay F-91405, France

The Photochemical Reflectance Index (PRI) is a remotely-sensed index indicative of the xanthophyll de-epoxydation linked to photosynthesis down-regulation mechanism in plants (Gamon et al., 1990, 1992). It has been extensively used as an estimator of light use efficiency (LUE) (Asner et al. 2004, Raman et al. 2004, Drolet et al. 2005, 2008). The relationship between the PRI and the LUE has been documented for a wide range of species at the leaf level (Gamon et al. 1998, Sims et al. 2002). However, its use at stand scale was proven difficult since the PRI might show structure and species related differences (Barton and North 2001, Stylinski et al. 2002).

In this study, the daily and seasonal variations of the PRI observed in a French deciduous forest site during five consecutive years were investigated and related to several micro-climatic variables.

These measurements were made half-hourly from the top of eddy-covariance flux tower above a deciduous oak Forest (Barbeau, France). The LUE was calculated as the ratio of the eddy-covariance GPP and the measured absorbed PAR (APAR). This survey allowed us to illustrate the influence of illumination conditions, geometries, vegetation structure, and ecophysiological states. Significant relationships between LUE and PRI were found for all years but these relationships varied from one year to another and in the same year between different periods. The main climatic factors controlling these relationships such as the APAR, the sky conditions, vapour pressure deficit, potential evapotranspiration were related to PRI and LUE variations, and separated from directional effects.