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Explaining the variability of Photochemical Reflectance Index (PRI): deconvolution of variability related to Light Use Efficiency and Canopy attributes.

Elodie Merlier (1), Gabriel Hmimina (1), Eric Dufrêne (2), and Kamel Soudani (1)

(1) Univ. Paris-Sud, Laboratoire Ecologie Systématique et Evolution, UMR8079, Orsay F-91405, (2) CNRS, Laboratoire Ecologie Systématique et Evolution, UMR8079, Orsay F-91405

The Photochemical Reflectance Index (PRI) was designed as a proxy of the state of xanthophyll cycle which is used as a response of plants to excess of light (Gamon et al., 1990; 1992). Strong relationships between PRI and LUE were shown at leaf and canopy scales and over a wide range of species (Garbulsky et al., 2011). However, its use at canopy scale was shown to be significantly hampered by effects of confounding factors such as the PRI sensitivity to leaf pigment content (Gamon et al. 2001; Nakaji et al. 2006) and to canopy structure (Hilker et al. 2008). Several approaches aimed at correcting such effects and recent works focused on the deconvolution of LUE related and LUE unrelated PRI variability (Rahimzadeh-Bajgiran et al. 2012).In this study, the PRI variability at canopy scale is investigated over two years on three species (Fagus sylvatica, Quercus robur and Pinus sylvestris) growing under two water regimes. At daily scale, PRI variability is mainly explained by radiation conditions. As already reported at leaf scale in Hmimina et al. (2014), analysis of PRI responses to incoming photosynthetically active radiation over seasonal scale allowed to separate two sources of variability : a constitutive variability mainly related to canopy structure and leaf chlorophyll content and a facultative variability mainly related to LUE and soil moisture content. These results highlight the composite nature of PRI signal measured at canopy scale and the importance of disentangling its sources of variability in order to accurately assess ecosystem light use efficiency.

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