Geophysical Research Abstracts
Vol. 13, EGU2011-6005-3, 2011
EGU General Assembly 2011

Endogenous plant rhythms control daily fluctations in terrestrial carbon dioxide exchange

Victor Resco (1), Michael L Goulden (2), Kiona Ogle (3), Andrew D Richardson (4), David Y Hollinger (5), Eric A Davidson (6), Josu G Alday (7), Greg A Barron-Gafford (8), Arnaud Carrara (9), Andrew S Kowalski (10), and the Endogenous Rhythms Research Team

(1) Universidad de Castilla-la mancha, Spain (victor.resco@uclm.es), (2) University of California, Irvine, (3) Arizona State University , (4) Harvard University, (5) USDA Forest Service, (6) Woods Hole Research Center, (7) Universidad del País Vasco, (8) University of Arizona, (9) Fundación CEAM, (10) Universidad de Granada

Molecular-based biological clocks are partly responsible for ∼24-h rhythms in photosynthetic gas exchange and other physiological processes. Circadian regulation of leaf-level gas exchange is relatively well documented, but the role of biological clocks in controlling the metabolism of entire ecosystems has seldom been considered. Indeed, our current understanding of terrestrial carbon cycling assumes that daily oscillations in CO2 exchange are driven almost exclusively by direct responses to meteorological conditions. It remains to be tested, however, whether the circadian clock influences the net ecosystem exchange of CO2 (NEE) between the land surface and the atmosphere. Here we employed filtering techniques to remove environmental effects on NEE and we show that diurnal oscillations in the NEE of diverse ecosystems across a 74º latitudinal gradient are consistent with regulation by an endogenous biological clock. The magnitude of the endogenously-driven NEE oscillation at some sites was comparable to daily NEE fluctuations observed in the field, and these endogenously-controlled fluctuations were tightly correlated with the usual temporal pattern of meteorological conditions. Our results support the hypothesis that endogenous clocks are adaptive by allowing metabolism to anticipate highly predictable diurnal oscillations in the physical environment.