Geophysical Research Abstracts, Vol. 7, 09171, 2005
SRef-ID: 1607-7962/gra/EGU05-A-09171

Distinct respiration processes impose strong seasonal asymmetry in net carbon gain of Mediterranean evergreen forest

S. Rambal (1), **R. Joffre** (1), JM. Ourcival (1), M. Staudt (1), A. Rocheteau (2)

(1) Dream Unit, Centre d'Ecologie Fonctionnelle et Evolutive, CNRS, Montpellier, France

(2) UR CLIFA, IRD-CNRS, Montpellier, France

richard.joffre@cefe.cnrs.fr / Fax + 33 4 67 41 21 38

Net carbon gain of forest is determined by the difference between gross photosynthesis and respiratory losses of CO2. In temperate ecosystems, the long-term monthly means of the different terms of the carbon balance (NEE net ecosystem exchange, RE ecosystem respiration, GPP gross primary production) present similar regular distributions approximately centered on July. These distributions follow to a great extent the main climatic determinants (PAR, temperature and rainfall). In absence of strong water limitation or severe climate anomalies (heat shock of summer 2003), photosynthesis of temperate ecosystem is primarily constrained by available PAR and vary according to seasonal pattern of air temperature. Ecosystem respiration incorporates respiration of heterotrophic organisms as well as the above- and belowground autotrophic respiration of plants. Furthermore, the plant contribution to ecosystem respiration aggregate two distinct phenomena corresponding to growth and maintenance respiration. Main determinants of these distinct respiration processes (available energy and water, soil and air temperature) are not necessarily in phase and could present distinct seasonal pattern. This is particularly true in Mediterranean regions which are characterized by a hot drought period in summer.

Analyzing long-term measurements (1998-2004) of eddy covariance CO2 fluxes over an evergreen Mediterranean oak forest allowed us to gain insight into the regulation of gross photosynthesis and the distinct respiration processes. Apart from July and August, GPP followed the time-course of radiation with values remarkably similar

in Spring and Autumn. As expected, summer drought controlled GPP in July and August resulting in an obvious decoupling with radiation and a strong decrease in carbon assimilation.

RE monthly pattern resulted from distinct respiration processes. High values measured in May and June corresponded to the superimposed growth respiration component in phase with the growth patterns of leaves and stems. Soil dryness drastically reduced all carbon fluxes in Summer. Over the studied period, Autumn rainfall occurred generally in September and allowed a rapid rewetting of soil which combined with very high soil temperature provoked important losses of carbon through high values of soil CO2 efflux. As a result of this asymmetry in regulating factors of GPP and RE, the monthly NEE showed an irregular distribution distinct of that of temperate ecosystem. Remarkably, the important intra-annual variability of climatic conditions was not reflected by high variance of monthly fluxes. Comparing our results with those obtained on others Mediterranean ecosystems could help us to validate the proposed seasonal pattern of carbon gain in Mediterranean conditions.