The analysis highlighted both interspecific differences and environmental effects on light-use efficiency and GPP. The effects of viewing angle on vegetation reflectance and estimated PRI were also analyzed.

TOWARDS NEAR-OPERATIONAL GLOBAL AND REGIONAL MONITORING OF CARBON FLUXES OVER LAND USING EO DATA

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The Observatory of Natural Carbon fluxes (ONC) of the GEOLAND Integrated Project (2004-2006), co-funded by the European Commission within the GMES initiative in FP6, aims at producing a pre-operational global carbon accounting system describing natural carbon fluxes and stocks that are fully consistent with soil water content and water vapour fluxes. The system will be dealing with the impact of weather and climate variability on soil and vegetation carbon fluxes and stocks.

To monitor the biosphere vegetation-atmosphere CO_2 exchange using remote sensing data, a combination of an interactive vegetation land surface model with a data assimilation system is a powerful tool. The existing land data assimilation projects (NLDAS, GLDAS, ELDAS) only account for soil moisture and not for vegetation biomass, which limits the use of remote sensing data.

In the framework of ONC, the operational land surface models of Météo-France and ECMWF (ISBA and TESSEL, respectively) were upgraded. New versions (ISBA-A-gs and C-TESSEL) are able to simulate the CO_2 fluxes and the above-ground biomass. They were validated by using local field campaigns (e.g. Fluxnet sites) and global EO-derived LAI products. The development of a version of ISBA-A-gs able to produce carbon storage and the root biomass is well advanced (the first tests over local sites were performed).

Regarding data assimilation, it is shown that the vegetation biomass has to be analysed together with soil moisture. A strategy to implement such a pre-operational system is presented as well as a prototype 2D assimilation system, implemented over SW France. The system is tested at the local scale by using the SMOSREX data, and 2D in conjunction with the CarboEurope Regional Experiment. MODIS data are assimilated over SW France together with synthetic SMOS brightness temperatures and other soil moisture estimates.

ABILITY OF EO PRODUCTS TO VALIDATE AND CONSTRAIN A TERRESTRIAL BIOSPHERE MODEL

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To monitor the biosphere vegetation-atmosphere CO_2 exchange using remote sensing observations, the combination of a vegetation land surface model and a data assimilation system is a powerful tool. This paper presents an overview of recent developments performed in the framework of the ONC/GEOLAND project concerning the assimilation of space-based observations of leaf area dynamics into the ORCHIDEE (ORganizing Carbon and Hydrology In Dynamics EcosystEms) global terrestrial biosphere model. This model has been developed at the Institut Pierre Simon Laplace (IPSL, Paris, France) for climate studies. It simulates the main processes of the energy, water and carbon cycles (e.g. surface fluxes at the soil-plant-atmosphere interface, photosynthesis, autotrophic and heterotrophic respiration, and water routing) and of the dynamic evolution of the vegetation (e.g. light competition processes, fire, and establishment). ORCHIDEE can be also coupled with the CM4 atmosphere-ocean model of the IPSL in order to simulate coupled climate-land surface dynamics.

A stand alone configuration of ORCHIDEE (*i.e.* without coupling with atmosphere) has been evaluated using different climate forcing data products (CRU, ERA40, NCEP). Particular attention has been given to the global vegetation products derived from remotely sensed observations. We have focussed on the potential utility of the biophysical products derived from the MODIS, AVHRR, and VEGETATION sensors. In addition, a sequential assimilation procedure of Leaf Area Index (LAI) products has been developed within ORCHIDEE. This procedure allows modification of the simulated LAI whenever a new observed-satellite LAI becomes available, with an explicit account of the observational uncertainties. Two years (2000-2001) of monthly composite 1 km resolution MODIS-LAI and MODIS-Quality Flag (QF) global fields have been assimilated within the ORCHIDEE land surface model. The LAI dataset, provided by Boston University, is derived from MODIS TERRA surface reflectance observations using the inversion of a radiative transfer model. The impacts of the MODIS-LAI assimilation on simulated surface CO_2 fluxes have been analysed and conclusions drawn regarding the frequency and uncertainties of MODIS observations.