ORCHIDEE : ORganizing Carbon and Hydrology In Dynamic EcosystEms

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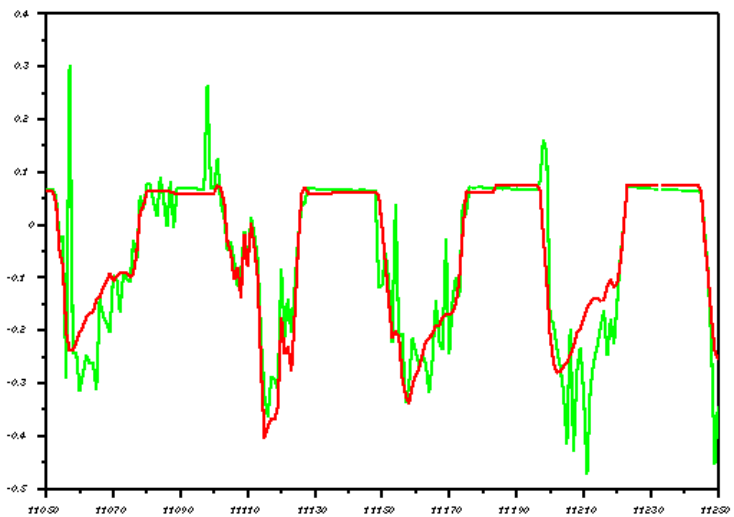
- The current state of some of ORCHIDEE's parameterizations.
- Planed improvements on the physical and bio-physical processes.
- Foreseen application areas of this new model.

Validation d'ORCHIDEE sur site

Walker branch, site de foret tempérée au U.S.A



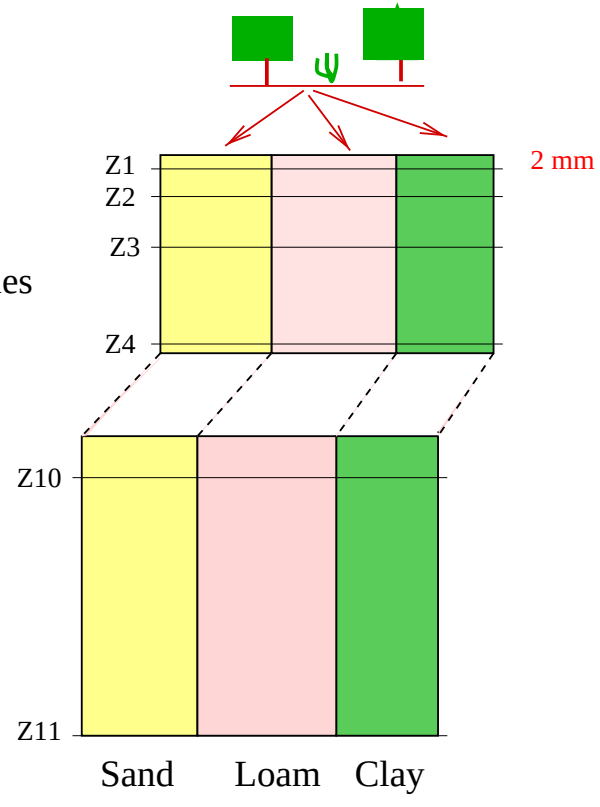
Flux net de CO2 (gC/jour) en Juillet 1995

SECHIBA

Collaboration CWRR-LMD

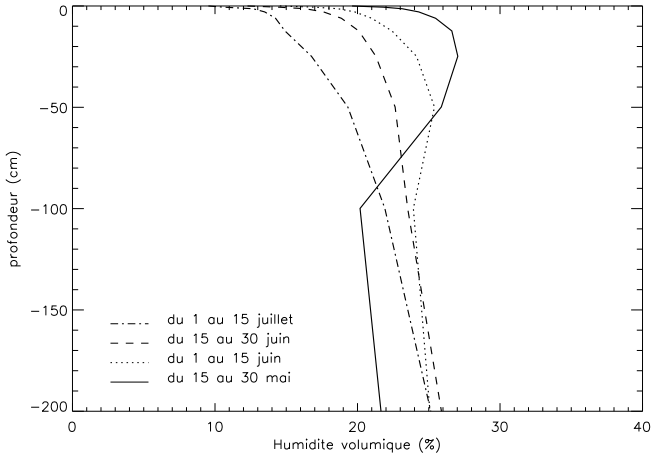
- N=11 layers
- Diffusion Equation (Fokker-Planck)
- Sub-grid scale variabilities of soil and vegetation

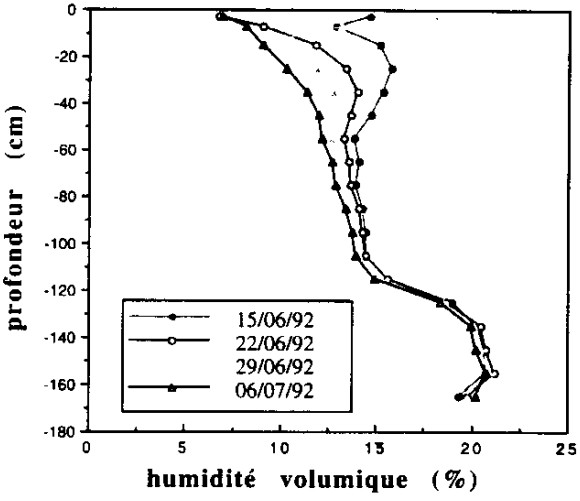
* de Rosnay and Polcher 1998
* de Rosnay et al. 2000

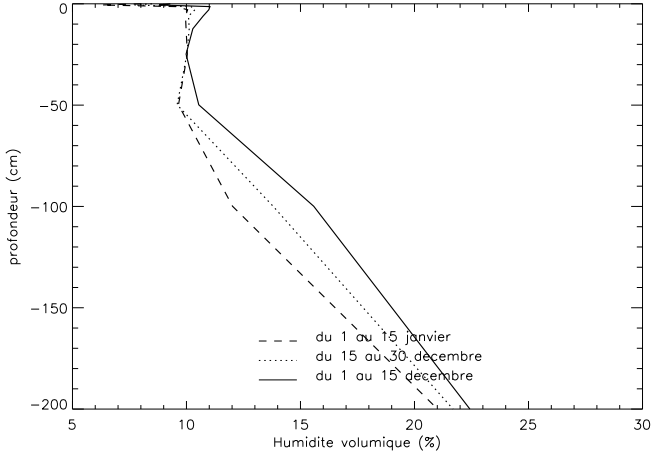


The simulated soil moisture profile

ORCHIDEE is now able to simulate in a realistic way the evolution of the soil moisture profile

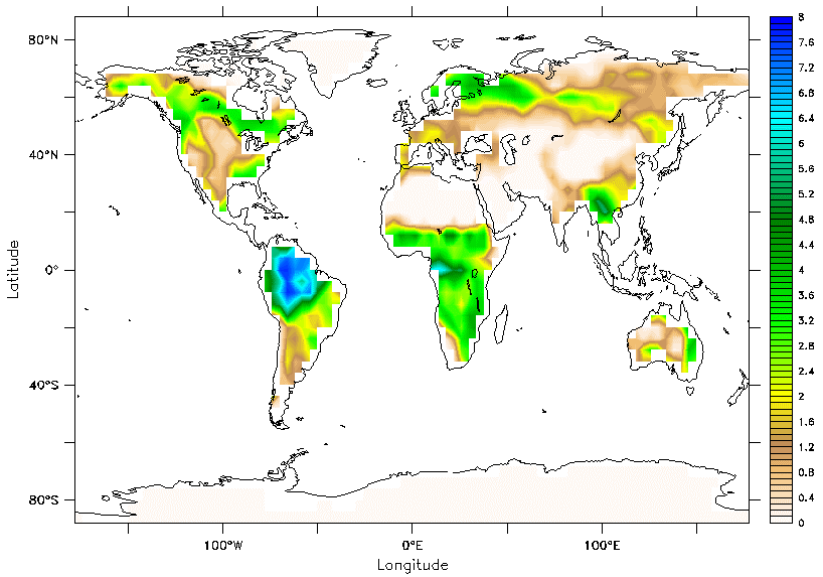




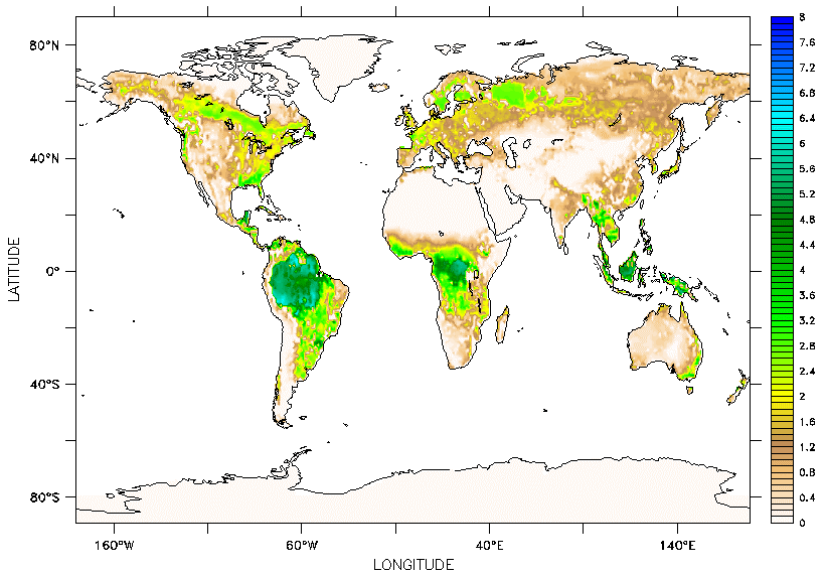


The observed profiles (above) are for the Lamto site in Ivory Coast. The modeled profiles (left column) are for the corresponding grid-box of the GCM. The top panel is for the dry season and the lower one for the wet season

Global validation of ORCHIDEE: Leaf Area Index



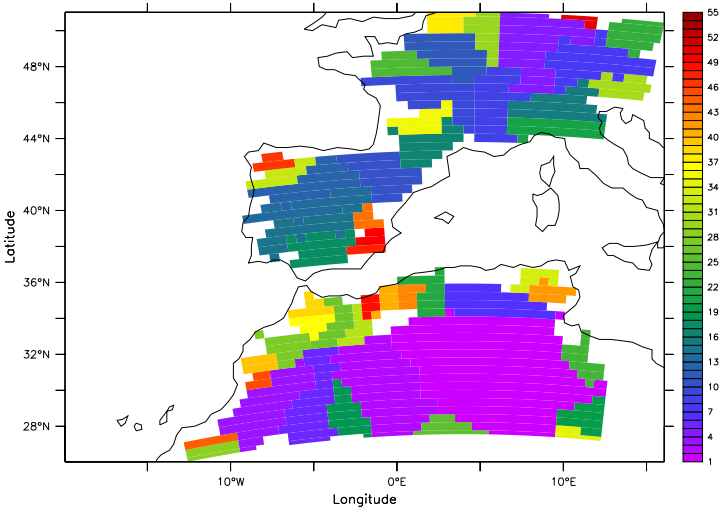
Mean annual LAI simulated (m2/m2)



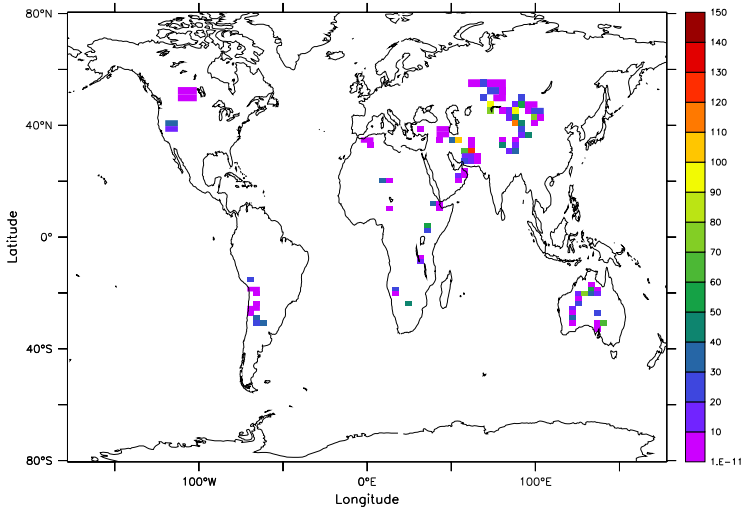
The river routing within ORCHIDEE

The original idea of this routing scheme is to fully integrate it into the land-surface model and to resolve the conflicting resolution issue by having sub-grid basins.

The dominant basin in each grid-box (for the PROMES model)



Basins which do not flow into the oceans (at the LMD6 resolution)



Implementation of ORCHIDEE

This new land-surface model has a modern and flexible implementation :

- The interface to the atmosphere follows the guidelines of the PILPS-4c project. This provides a great flexibility in its use :

  1. The same code can be used coupled and off-line.
  2. ORCHIDEE can be applied at all scales and over all regions of the globe.
  3. Allows to couple ORCHIDEE to a number of atmospheric models.

- The modules of ORCHIDEE are independent and exchangeable. Each module has only one entry point and manages its own prognostic variables.

The use and validation of ORCHIDEE has greatly been simplified by this implementation.

Planed evolutions

A number of processes are currently represented in a very crude way and need improvements :

- The surface flux formulation need to evolve from the bulk formula to a Penman-Monteith approach. This is needed to make potential evaporation and surface parameters comparable to observations.
- Soil freezing and thawing need to be included with their impact on soil hydrology and plant functioning (In collaboration with LGGE and DMI).
- Physical and biological processes over wetlands and lakes need to be modeled.
- The phenology model needs to be improved and the nutrients included.
- A model for land-use will need to be included.
- Including the role of glaciers in the water cycle will need to be considered.

Planed applications of ORCHIDEE

This new land-surface model will open a wide range of applications :

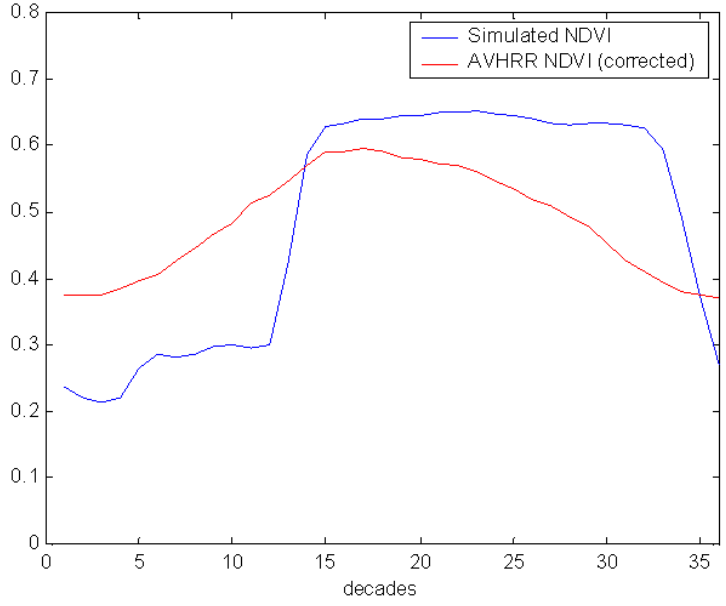
- As with previous land-surface parameterizations this model can be used for land-atmosphere interaction studies. But some new and original topics are made possible :
  1. The role of the vegetation dynamic in climate variability (LMD/LSCE).
  2. The impact of natural and artificial irrigation in tropical areas (LMD).
  3. The evolution of vegetation as a carbon sink in a changed climate (LMD/LSCE)
- ORCHIDEE can and will be used as an impact model. It will provide information of the impact of climate change on surface processes and provide feedback to the coupled model (LMD).
- ORCHIDEE will be used as a monitoring tool for the carbon uptake by continental surfaces (LSCE).
- The number of processes and feedbacks now included in ORCHIDEE will allow us to consider its application for data assimilation. This will enable us to monitor and predict the state of the surface as well as estimate surface parameters at continental to global scales (LMD/LSCE).

First steps towards data assimilation

1. A radiation scheme is being implemented into ORCHIDEE to compute the surface L-band brightness temperature. It provides information on the upper soil moisture content (LMD)

2. Assimilating NDVI in ORCHIDEE (LMD, LSCE and CESBIO)

The NDVI was diagnosed from ORCHIDEE using the PROSPECTS and SAIL models :



Assimilation corrects the LAI simulated by ORCHIDEE :