GLASS WORKSHOP ON THE PILPS CARBON EXPERIMENT

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The first workshop of the Project for Intercomparison of Land-surface Parameterization Schemes (PILPS)-Carbon project was held from 6–7 May 2003 on the Centre National de la Recherche Scientifique (CNRS) campus in Gif-sur-Yvette, France. The aim of the workshop was to discuss the results of the first phase of the PILPS carbon project. As described in Viovy (2002) the goal of this project was to compare net CO_2, sensible and latent heat fluxes simulated by several land surface models (LSM) with *in situ* data. The site chosen for this experiment was Loobos, a temperate coniferous forest located in The Netherlands. For this site 2 years (1997–1998) of half-hourly fluxes and meteorological data are available. This forest was planted 80 years ago on sand. This means that at plantation, the soil contained less than 1 percent of the current carbon contant and thus simplifying the initial conditions for these numerical experiments.

Moreover, it was possible to reconstruct a 100-year time series of meteorological data using measurements of a nearby station. Two simulations were performed. For the first one, named "free-equilibrium," the models were run to equilibrium of state variables (e.g., carbon and water pools) looping through the two years of data (1997 and 1998). For the second simulation, named "free-100 years," the participants were asked to simulate the growth of the forest from its plantation to 1998 starting without any carbon in the soils and without vegetation. For the two simulations only the forcing data were given to the participants without any calibration or adaptation done for the site.

Several analyses have been performed to compare model output. These include systematic and non-systematic root mean square error and index of agreement (Willmott 81). For the 100-year run the annual net CO_2 flux simulated by the models has been compared between models and to observations for the last two years. The evolution of several parameters (i.e., assimilation, productivity, net CO_2 flux, soil carbon and vegetation biomass) simulated by the different models during the 100 years of simulation have been compared.

The results show first that most of the models underestimate the higher fluxes for latent heat and net CO_2 (NEE=Net Ecosystem Exchange). The greatest dispersion is observed for sensible heat flux. One would have expected a higher dispersion for the NEE because LSMs have only introduced its parameterizations recently. All models seem to overestimate night flux. Some models tend to overestimate this flux all the time (the heat flux is biased but the correlation with observation is good) whereas the others models have correct fluxes during the day (and then the slope of the fit between model and observation is lower than 1). All the models tend to underestimate CO_2 net fluxes.

The decomposition of Root Mean Square Error (RMSE) between systematic and not systematic contributions indicate that for equivalent total RMSE models show very different behavior since some have a good correlation with data but with high dispersion, whereas others show a systematic bias but with low dispersion.

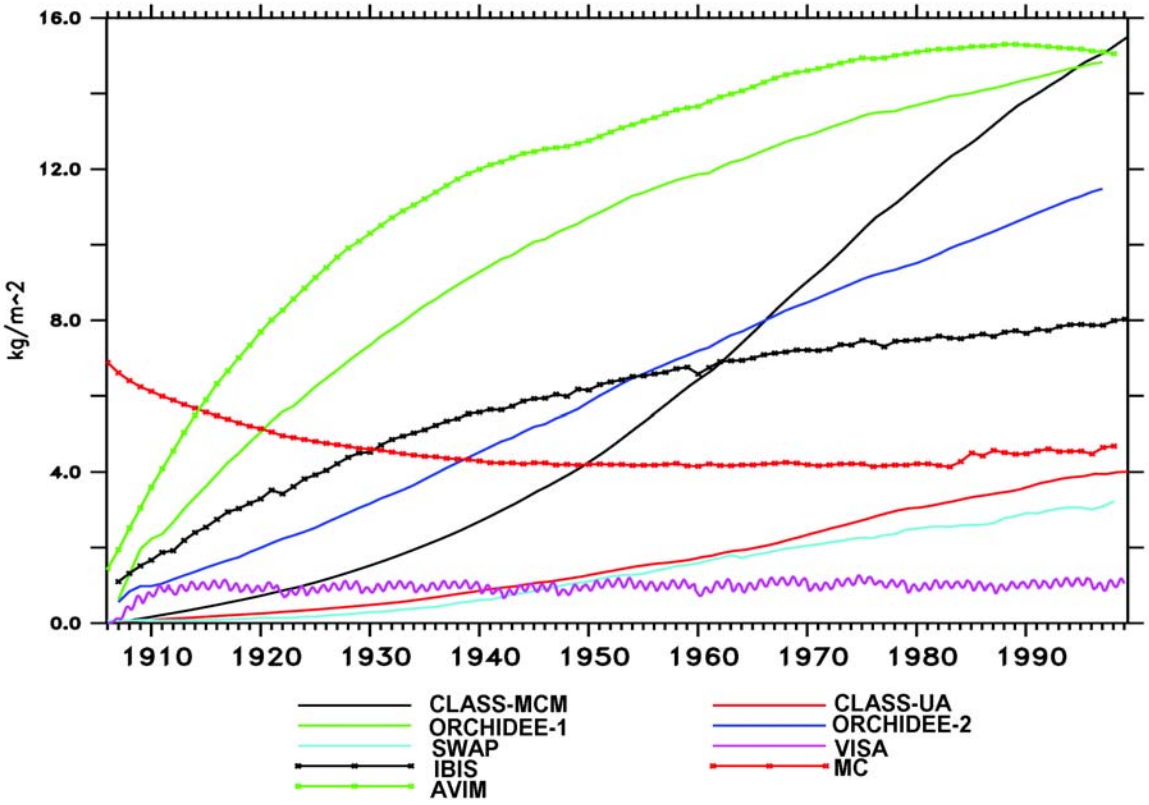
In the century long runs, all models simulate a net sink as observed. Most of the models are also able to reproduce the increase of the net sink for year 1998 compared to 1997. However, most of the models underestimate this sink. If models converge around relatively similar annual NEE at the end of the run, the evolution of the simulated total living biomass and soil carbon are very different from one model to the other. The total living biomass can vary for instance from 1 kg to 16 kg of carbon in the vegetation and from 1 kg to 10 kg of carbon in the soil. However, for soil carbon where data are available for Loobos, several models are close to the 7 kg of carbon per square meter observed (see the figures on the next page).

The preliminary analysis has already shown that LSMs do not perform worse for the net CO_2 flux than they do for the energy fluxes. On the other hand the long-term evolution of the carbon pools can be very different from one LSM to another and reminds of the discrepencies found in previous PILPS for soil moisture. To conclude this first phase of the project a new set of simulations will be performed by the participants. These numerical experiments will be the same as previously, except that ancillary information on the surface properties will be provided to the participants so that the models can be calibrated for this site. New participants are welcome to participate in these new sets of simulations.

All of the results and the full report can be found at http://www.pilpsc1.cnrs-gif.fr.

References: www.gewex.org/refs.htm

GLASS WORKSHOP ON PILPS CARBON EXPERIMENT SHOWS WIDE DISPERSION DUE TO DIFFERENT LAND SURFACE MODELS
(However, several are close to observed soil carbon)



Trajectories of total biomass (above) and total soil carbon (below) simulated by the different model during growth of the forest.