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Simulation of soil moisture over the state of Illinois, by the land surface model ORCHIDEE using NLDAS forcing data : comparison with observations

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The aim of this study is to check the ability of the Land Surface Model (LSM) ORCHIDEE (ORganising Carbon and Hydrology In Dynamic EcosystEms) to simulate the seasonal variation of soil moisture. The model is forced by NLDAS (North American Land Data Assimilation System) data which has a 1/8 degree resolution. The study is focused on the state of Illinois over which measurements of soil moisture have been performed (Hollinger & Isard, 1994; A. Robock, 2000). We compared the Soil Wetness Index (SWI) simulated by the LSM to the observations, during the period 1997-1999. We compare first the results over C3 crops vegetation which has a large fraction of coverage for ORCHIDEE and which corresponds to the grass over the stations. The comparison points out the weakness of ORCHIDEE to simulate the seasonal variation of soil moisture over this cover. Some parameters were changed to improve this simulation. The one which has the largest impact is the root density profile which allows the simulated evaporation to increase during summer and the SWI to decrease substantially. One the other hand, the Leaf Area Index (LAI) and the height of vegetation have no significant impact through evaporation on soil moisture. Furthermore, an improvement in the computation of the bare soil evaporation under vegetable cover has also induced a better agreement of the SWI with observations. The results being very responsive to the input of precipitations data, we substitute the forcing precipitations by the observed ones only on the pixels including stations. It results a good

improvement of the soil drying and soil moisture is very close to the observations during summer and autumn. A study of standard deviation shows in many stations a variability of the SWI given by the model close to the observed one. However, as we get a good agreement with observations in global mean, some results on some specific pixels are not always satisfying. The soil moisture is overestimated during the recharge of the soil that may be due to the simple computation of the drainage/runoff in the model.