Geophysical Research Abstracts
Vol. 13, EGU2011-995, 2011
EGU General Assembly 2011

Intercomparison of two land surface schemes from a hydrological perspective

Min Chen, Garry Willgoose, and Patricia Saco
School of Engineering, Newcastle, NSW, Australia (m.chen@uon.edu.au)

Soil moisture is an important component of land surface schemes used in climate models and a major uncertainty in climate-change projections. In this paper we compared two widely accepted land surface models (HYDRUS-1D and IBIS) by simulating the daily soil moisture dynamics at one monitoring site in our Stanley field site. Surface 30cm soil moisture could be satisfactorily calibrated using HYDRUS and IBIS by tuning the soil and vegetation parameters. However, the models differed significantly in their simulations when the soil (fraction of sand, silt and clay) and vegetation parameters (leaf area index and root distribution) calibrated to HYDRUS were used in IBIS. This discrepancy could be significantly improved by imposing the same soil hydraulic properties, bypassing those that were originally derived from the soil separates using the pedotransfer function in IBIS which yields hydraulic parameters different from HYDRUS. With the same soil hydraulic properties and a free-drainage boundary condition, the evapotranspiration estimates were close but had a bias over the long term, while the surface runoffs were significantly different. Neither model was able to simulate the surface runoff observed in July 2007, while IBIS simulated runoffs over other periods for which they were not observed in the field. Differences in the mass balance of these three hydrological variables (i.e. surface runoff, evapotranspiration and drainage) accounted for the small differences between the soil moisture simulations of the two models. However, these differences were highly dependent on soil hydraulic properties. Using five other sets of soil hydraulic properties (from calibrations at our nearby S2, S3, S4, S5 and S7 sites), bottom flux and evapotranspiration generally behaved the same, apart from S3, which has a relatively low saturated hydraulic conductivity. The partitioning of water between drainage and evapotranspiration significantly varied with soil hydraulic properties. With these five parameter sets, IBIS was able to simulate the surface runoff during the July 2007 storm, while HYDRUS could only simulate that runoff when using the S3 and S4 soils (this was due to their low soil hydraulic conductivities). This indicates that the model performance on hydrology depends on soil hydraulic conductivity, with lower values making larger differences. At the catchment scale, both land surface models could give reasonable hydrological predictions on average provided the areal variability of soils is taken into account. Generally, with the same soil hydraulic properties and vegetation characteristics, IBIS simulated moister soil wetness conditions (for both surface 30cm and full-profile 90cm), with a lower latent heat flux than HYDRUS, which implies a different soil moisture-evapotranspiration feedback mechanism in the two models.