EMS Annual Meeting Abstracts,
Vol. 6, EMS2009-508, 2009
9th EMS / 9th ECAM
© Author(s) 2009

9th EMS Annual Meeting
9th European Conference on Applications of Meteorology
High resolution meteorology
- applications and services

Groundwater influence on soil moisture dynamics and land surface fluxes over the Iberian Peninsula

L. Gestal-Souto and G. Miguez-Macho

Non-linear physics group, Universidade de Santiago de Compostela, Santiago de Compostela, Galicia, Spain
(lucia@fmares.usc.es, gonzalo@fmares.usc.es)

We investigate the influence of groundwater on land surface fluxes over the Iberian Peninsula with LEAFHYDRO, a comprehensive land surface model including water table dynamics. We first calculate a high resolution (9 arcsec) climatology water table depth as the position of the water table where lateral flow divergence compensates an estimated mean climatology recharge. We use several estimates of recharge and compare results with more than 3000 observations over Spain and Portugal, which we analyze in detail. The result is a smooth, undulating surface beneath land topography, occasionally appearing at the land surface as wetlands, rivers, and lakes. We find that in many areas, even in semiarid climates of the Iberian Peninsula, the water table depth is shallow due to lateral convergence or poor drainage, lying within 10 m of the land surface.
We perform next two simulations with the LEAFHYDRO model spanning several years, forced by atmospheric conditions from ERA-Interim and precipitation values from an analysis of thousands of observations over Spain. One of the experiments includes water table dynamics and uses the previously calculated climatology water table depth as the initial condition. The second simulation has a gravitational drainage approach at the bottom of soil columns. We find that groundwater increases notably the persistence of soil moisture conditions in areas where the water table is shallow. The pattern of root-zone soil moisture mimics that of the water table, wetter soils where the water table is shallow and drier soils where it is deeper. Through their influence on soil moisture, shallow water tables have an important effect on land surface fluxes in semiarid climates, where evapotranspiration is largely limited by soil moisture availability rather than atmospheric demand. This groundwater-land surface fluxes interactions may have significant implications for climate that have not been previously considered.