Geophysical Research Abstracts,
Vol. 11, EGU2009-9506, 2009
EGU General Assembly 2009

Vegetation and water fluxes under Mediterranean mountain conditions. The Vallcebre research catchments (NE Spain)

P. LLORENS (1), R. POYATOS (2), A. MUZYLO (1), C.M. RUBIO (3,4), J. LATRON (1), J. DELGADO (1), and F. GALLART (1)

(1) Institute of Environmental Assessment and Water Research (IDÆA), CSIC, Spain (pllorens@ija.csic.es), (2) School of Biological and Biomedical Sciences, University of Durham, UK., (3) Dpt. Agri-Food Engineering and Biotechnology, UPC, Spain., (4) Lab-Ferrer Soils and Environmental Consulting, Spain.

The Vallcebre research catchments are located in a Mediterranean mountain area of the Pyrenean ranges (North Eastern Spain). These catchments were originally covered by Quercus pubescens but were deforested for agricultural use in the past. Nowadays they are covered by mesophyle grasses with spontaneous afforestation by Pinus sylvestris, covering 64% of the catchment area.

In this context, different investigations studying water fluxes in the soil-vegetation-atmosphere continuum have been performed. The main objective of these studies is the analysis of the role of vegetation cover on the catchment water balance in a framework of climate and land use changes. The dynamics of transpiration and rainfall interception by Pinus sylvestris and Quercus pubescens, are investigated in terms of their dependence on meteorological conditions, on soil moisture and water table depth. Furthermore, the role of vegetation on catchment water balance is analysed.

The results underline:
(a) The importance of rainfall interception losses, representing about 24% of the bulk rainfall by the Scots pine and between 6 and 24%, by the Pubescent oak (depending on phenology), and the high temporal variability of this flux.
(b) The effect of forest covers on soil moisture, which was apparent when comparing neighbouring soil moisture profiles under forest and meadows.
(c) The differences in transpiration between species. Transpiration by Scots pines represented twice the value found in the nearby Pubescent oak stand. Scots pines showed a strong reduction of transpiration during dry summer periods, even in the studied area where the annual rainfall slightly exceeds the reference evapotranspiration. On the contrary, Pubescent oak was less affected by soil moisture deficits.

Rainfall interception as well as trees transpiration processes have been modelled (Gash and Jarvis-type models respectively) at the plot scale with a twofold objective: the comprehension of each studied process and the analysis of the associated uncertainty. Finally, the comprehension of vegetation related hydrological processes has been used to develop the TOPBAL model, a TOPMODEL version developed for an improved simulation of the response of catchments with diverse vegetation types and high climatic seasonality. TOPBAL explicitly considers rainfall interception by vegetation and two-way exchanges between the root-unsaturated store and the phreatic store, allowing the modelling of semi-distributed soil moisture. Results indicate that for similar efficiency, TOPBAL improved the simulation of recession curves and provided a better simulation of the catchment water balance than TOPMODEL.