Geophysical Research Abstracts
Vol. 12, EGU2010-10462, 2010
EGU General Assembly 2010

The role of the vegetation on the water balance in Water-limited Mediterranean ecosystem

CLORINDA CORTIS and NICOLA MONTALDO
Università degli studi di Cagliari, Dipartimento di Ingegneria del Territorio, Cagliari, Italy (ccortis@unica.it)

Mediterranean ecosystems are heterogeneous with contrasting plant functional types (PFTs, grass, shrubs and trees) that compete for the water use and are characterized by strong interannual variability of rainfall that affects the dynamics of the PFTs.
To develop an appropriate water management, it is necessary to measure and model accurately the energy flows on the surface, soil moisture and vegetation dynamics for a long period that includes years with different hydro-meteorological conditions.
The complexity of the Mediterranean areas requires very detailed models able to explain the relationship between the evapotranspiration and the strategies that different species of plants develop under water stress conditions.
To understand this issue a model of soil water balance based on the Richard equations (MISR)he MISR is coupled with two Vegetation dynamic models (VDMs) for each of the different species considered (shrubs and grass). In particular the water extraction (sink) term is considered as the root water uptake. Two VDMs predict vegetation dynamics, including spatial and temporal distribution/evolution of the root systems in the soil of two competing species (grass and woody vegetation). An innovative method for solving the unlinear system of predicting equations is proposed.
The model is tested for the Orroli case study, situated in the mid-west of Sardinia within the Flumendosa river watershed. The site landscape is a mixture of Mediterranean patchy vegetation types, in particular two contrasting plant functional types (grass and woody vegetation) have been included.
The model well predict the soil moisture and vegetation dynamics for the case study, and significantly different root potentials are predicted for the two PFTs, highlighting the root competition for the water use.
The soil depth is low in the case study, while the Flumendosa basin is characterized by soils of different type and depth (more silty and deep nearly the river valley), such as typical in Mediterranean basins. A sensitivity analysis to the soil depth and soil type is performed for investigating their influences on the PFT dynamics and soil water balance.
The results show an increase of the average soil moisture in the root zone with increasing soil depths especially during the dry period.
Varying the soil type from a sand to a loam soil type the soil moisture content increases. In particular for the Sand and Sandy-Loam soil types the water content is between the wilting point and the limit value, therefore the evapotranspiration is strongly influenced by water content.
The LAI (Leaf Area Index) of the Grass in the case of sandy soil is kept constant, while there is a change in the case of Sandy-Loam and Silt-Loam soils, in both cases, there is an increase in LAI with increasing depth.
Results show that the plant compete differently according to site soil characteristics (depth and type), and the impact of vegetation dynamics on the soil water balance terms is significant and cannot be neglected in current hydrological approaches.