Geophysical Research Abstracts
Vol. 16, EGU2014-13571, 2014
EGU General Assembly 2014

The soil water balance in a mosaic of clumped vegetation

Teresa Pizzolla (1), Salvatore Manfreda (1), Kelly Caylor (2), Andrea Gioia (3), and Vito Iacobellis (3)

(1) University of Basilicata, School of Engineering, Potenza, Italy (teresa.pizzolla@unibas.it), (2) Princeton University, NJ, (3) Polytechincal University of Bari, Italy

The spatio-temporal distribution of soil moisture influences the plant growth and the distribution of terrestrial vegetation. This effect is more evident in arid and semiarid ecosystems where the interaction between individuals and the water limited conditions play a fundamental role, providing environmental conditions which drive a variety of non-linear ecohydrological response functions (such as transpiration, photosynthesis, leakage). In this context, modeling vegetation patterns at multiple spatial aggregation scales is important to understand how different vegetation structures can modify the soil water distribution and the exchanged fluxes between soil and atmosphere.

In the present paper, the effect of different spatial vegetation patterns, under different climatic scenarios, is investigated in a patchy vegetation mosaic generated by a random process of individual tree canopies and their accompanying root system. Vegetation pattern are generated using the mathematical framework proposed by Caylor et al. (2006) characterized by a three dimensional stochastic vegetation structure, based on the density, dispersion, size distribution, and allometry of individuals within a landscape. A Poisson distribution is applied to generate different distribution of individuals paying particular attention on the role of clumping on water distribution dynamics. The soil water balance is evaluated using the analytical expression proposed by Laio et al. (2001) to explore the influence of climate and vegetation patterns on soil water balance steady-state components (such as the average rates of evaporation, the root water uptake and leakage) and on the stress-weighted plant water uptake. Results of numerical simulations show that clumping may be beneficial for water use efficiency at the landscape scale.

References

Caylor, Kelly K., P. D'Odorico and I. Rodriguez Iturbe: On the ecohydrology of structurally heterogeneous semiarid landscape. Water Resour. Res., 28, W07424, 2006.

Laio, F., A. Porporato, L., Ridolfi and I. Rodriguez Iturbe: Plants in water controlled ecosystems: Active role in hydrological processes and response to water stress, II. Probabilistic soil moisture dynamics, Adv. Water Resour., 24(7), 707-723,2001.