Geophysical Research Abstracts
Vol. 14, EGU2012-13225, 2012
EGU General Assembly 2012

Role of Biological Soil Crusts on hydrological cycle drivers of semiarid ecosystems

Y. Canton (1), S. Chamizo (1), E. Rodriguez-Caballero (1), I. Miralles (2), R. Lazaro (2), A. Sole-Benet (2), and F. Domingo (2)

(1) Dep. of Soil Science, University of Almeria, Almeria, Spain (ycanton@ual.es), (2) Experimental Station of Arid Zones, CSIC, Almeria, Spain

In arid and semiarid ecosystems, where plant cover is scarce, other surface components like soil crusts or stones acquire a very relevant role on local hydrologic regimes, controlling infiltration rates and they also affect erosion. The interplant spaces of these ecosystems are very often covered by biological soil crusts (BSCs), which are a community of microorganisms, including cyanobacteria, algae, fungi, lichens and mosses living in the soil surface. These BSCs regulate the horizontal and vertical fluxes of water, carbon, and nutrients into and from the soil and play crucial hydrological, geomorphological and ecological roles in these ecosystems. We analyse the role of BSCs on the different components of the water balance (infiltration-runoff, evaporation and soil moisture) in two representative semiarid ecosystems of SE Spain. The influence of BSCs on runoff-infiltration and erosion has been studied by rainfall simulations and with field plots under natural rainfall at different spatial scales, on BSCs in different stages of their development. Results show higher infiltration in BSCs than in physical crusts and different responses among BSCs depending on soil and rainfall properties and the considered spatial scale but, as a general trend, the greater the development of the BSCs, the greater the infiltration rate and the lower the sediment yield. In addition, given that BSCs modify many soil surface properties, such as surface stability, cohesiveness, cracking, porosity or micro-topography, which also affect runoff and erosion processes, we have examined the relative importance of BSCs features (cover, composition, roughness, water repellency, etc) on runoff and erosion and their direct and indirect relationships and how they interact with rainfall characteristics.
By using microlysimeters, similar evaporative losses were measured among crust types in late spring when ambient conditions were quite warm and all crust types lost water very quickly. However, monitoring of soil moisture during a whole year shows differences in soil moisture content and soil water loss between the types of BSCs depending on the moment of the year. Thus, during wet periods higher soil moisture and slower soil water losses were recorded in lichen-covered than in cyanobacteria-covered soils. While during dry periods, faster soil water depletion and lower soil moisture occurred under lichen than in soils covered by cyanobacterial BSCs. In conclusion, our results show the important roles of BSCs modulating the water cycle in semiarid ecosystems.