Geophysical Research Abstracts
Vol. 18, EGU2016-15030, 2016
EGU General Assembly 2016

Water and energy balance in a Mediterranean snowpack: the importance of evaposublimation

Javier Herrero (1), Rafael Pimentel (2), Pérez-Palazón María José (2), and Polo María José (2)

(1) Andalusian Institute for Earth System Research, University of Granada, Granada, Spain (herrero@ugr.es), (2) Andalusian Institute for Earth System Research, University of Córdoba, Córdoba, Spain

In low-latitude snowpacks or those located in semiarid regions, snow dynamics becomes an essential driver of the hydrological cycle, as well as an important support for a number of ecosystem services with an influence over the economy and the ecology of the whole region. Therefore, it is crucial to understand the processes that are taking place in the snowpack and the relative importance and timing of the different mass and energy fluxes.

Sierra Nevada is a linear mountain range parallel to the Mediterranean coastline of southern Spain at 37ºN. It reaches up to 3479 m.a.s.l. in approximately 40 km from the sea. Despite the semiarid climatic conditions that surround the high mountain area, it presents a regular snow cover above 2500 m.a.s.l. during the winter season. Previous studies have shown at this site that this snowpack is very exposed to high insolation rates and strong winds, and, like in other low-latitude areas, the radiative and evaposublimation (combination of the sublimation of ice and the evaporation of the water drops melted on the surface of the snow) fluxes may have a significant and prominent value in the coupled balance.

In this work, we study the evaposublimation fraction in the annual water and energy balance over the snowpack in Sierra Nevada. For this, we apply a one-layer mass and energy balance snow model developed in previous works, which has proven to adequately simulate the shallow snowpacks of Sierra Nevada during the year. High evaposublimation rates were simulated and subsequently measured during several field campaigns. Evaposublimation fractions were found to range from 24 to 33% of the total annual ablation at this site. This ratio is very changeable between years, like the local meteorology itself, even though there was not a direct relationship between this rate and the dry or humid nature of each particular year. In fact, it is the particular distribution of the rainfall throughout the year what defines the dynamics of the snopack (specifically, the evaposublimation rates), its cover area and persistence, and, ultimately, its relative importance on the hydrological budget. This behaviour is also representative for all those snowpacks at low latitudes where meteorology shows high inter-annual variability and involves intense energy inputs to the accumulated snow.