Spatio-temporal variability of the snow cover in different Mediterranean mountain regions from in situ and remote sensing data

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The snow cover is an essential water resource in many regions with a Mediterranean climate. In the mountainous areas of these regions, in situ snow measurements are often too sparse to cover the range of spatial variability due to the topography. In contrast, satellite snow products are not sufficient to understand the processes governing the snowpack evolution. The combination of both data sources is useful to understand the effects of climate variability on the snow cover. Here we gathered the data of several high-elevation, snow-observing stations in the Pyrenees (Spain, Andorra), High-Atlas (Morocco), Sierra Nevada (Spain), Sierra Nevada (USA) and the Andes of Norte Chico (Chile) to run a point-scale snowpack energy-balance model. We extracted and gapfilled the MODIS snow product over 2000-2015 around each station to determine the mean snow cover duration as a function of elevation. The results of the energy-balance model highlight the importance of the snow sublimation, which amounts from 10% to 30% of the mean annual solid precipitation in these sites. The MODIS data indicate that the relationship between the snow cover duration and the elevation is almost entirely explained by the distance from of each site to the equator, which further indicates that radiation and humidity are important drivers of the snowpack dynamics. These factors should not be overlooked in the projections of the melt water contribution to runoff under future climate conditions.