The key role of terrestrial imagery in semiarid mountainous areas: The snow monitoring system in Sierra Nevada (Spain)

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Snow resources play a key role in the hydrological regime in mountain areas in Mediterranean regions. However, the high variability of snow over these areas (i.e. the several accumulation-melting cycles throughout the year, with very different duration; the wide range of snow depth states, close to the order of magnitude of the surrounding micro-relief (1-1000m); and the particular patched snow distribution, ranging from one to hundreds of square meters) makes necessary accurate monitoring system that cover all these particularities. On one hand, the correct representation of precipitation, partially solved with the installation of more dense precipitation network at high elevation, but still with problems related with the discrimination between rain and snowfall. On the other hand, the need of high resolution snow cover maps, highly improved with a recent increasing number of high resolution satellite missions launched and the development of fusion algorithm that combines them with traditional ones, but without standardized ground-truth datasets to verify that algorithms and validate the new products

This work presents terrestrial imagery as part of the snow monitoring network in Sierra Nevada (Spain) highlighting its value as complementary measurements of the traditional monitoring instrumentation and as ground-truth data source for the retrieving and validation of snow maps algorithms. Selected locations were chosen for the installation of several time-lapse cameras on different spatial scales above 1200 m a.s.l. with different purposes. On the point scale, as complementary sensor installed in some of the meteorological stations (Refugio Porqueira, Cortijuela), they allow discriminating possible errors in precipitation observations (i.e. undercatch and rain on snow events). On the detail scale (Refugio Poqueira), they facilitate the generation 30x30m sub daily times series of snow cover area and snow depth are derived for the modelling of the snow processes on the subgrid scale (i.e. the definition of adapted depletion curves for semiarid environment). On the slope scale, (El Caballo hillslope) they provided a 2x2 km reference maps to validate fractional snow cover maps from different algorithms/satellite sensors sources; and replicates of these scales on different points throughout the study area (i.e. the direct validation of NDSI and spectral mixture models for retrieving of snow maps from Landsat).

Thus, snow variable times series derived from terrestrial photography constitute a validated reference data set to test the accuracy of snow products algorithms in complex environments. Besides its use as raw observation datasets to calibrate and validate models' results, terrestrial photography constitutes valuable information to complement weather stations observations.