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Landsat TM versus Sentinel 2 as data sources for snow and vegetation covers in Mediterranean mountain regions: significant scales for hydrology applications in a monitoring site in Sierra Nevada (Spain).

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Available data from satellite platforms has allowed for large-scale analysis of different environment characteristics through the use of Geographic Information Systems during the last decades. These data sources are especially crucial in high mountain areas, where the frequent lack of in-situ measurements poses a constraint to high performance of models in general. In recent years, due to the increase of remote sensing sources with higher spatial/temporal resolution, the availability of data sets of different variables related to the water cycle offer a promising horizon for deriving long time series of snow cover area, functional vegetation covers, soil moisture, wet snow, etcetera. Nevertheless, for long term analysis we are still far from long time map series that combine high temporal and spatial resolution. Moreover, the wide range of different available sensors with different radiometric, spatial, spectral and temporal resolution require a not always direct pre-processing of different data sets by the final user, with potential mismanagement of the information.

The multi-band images taken by LANDSAT satellite constellation is, nowadays, the largest historical series of space-borne images of the Earth with time-continuity. On the other hand, SENTINEL 2 constellation provides space-borne images with higher radiometric, spatial and temporal resolution and a wide range of applications. This study compares retrieved snow-cover and vegetation-cover values from both data sources in a mountainous area in southern Spain, Sierra Nevada, where strong topographic gradients require small cell size grids to represent quick ablation processes. For this, results from image series from both LANDSAT and SENTINEL 2 from 2015-2017 have been compared, in terms of the statistical descriptors of both variables on both scales. Additionally, the effect of using each data source on hydrological modeling in the area has been assessed by comparing selected target variables in the energy-water balance (interception fraction, snowmelt/evaposublimation, runoff) for different periods. As a result, SENTINEL 2 images are able to represent detail process in a more accurate way, such as drag snow at leeward of rough elements, whereas in large-scale studies, the differences are not always significant, for example, on runoff. However, SENTINEL 2 allows for better calibration of processes on the sub-grid scale (e.g., the ablation process through depletion curves). Combining both data sources is key for multi-scale modeling and mitigation of scale issues on large scale performances.