

## **A multi-scale observation dataset of the snow cover in the Pyrenees**

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Snow melt from the Pyrenees is extensively used for hydropower generation and crop irrigation. However, the ground measurement networks are deemed insufficient to capture its spatial variability. We present an ongoing effort to build a collection of snow products from satellite imagery in the Pyrenees to complement in situ observations.

1. The NASA Aqua and Terra MODIS snow products were extracted to generate a daily gap-free climatology of the snow cover area for the period 2000-2016 at 500 m resolution. The MODIS snow product accuracy was assessed using in situ daily snow depth (SD) and snow water equivalent (SWE) observations at 19 stations. We estimated the values of the SD and SWE best detection thresholds to 150 mm and 40 mm w.e., respectively.
2. We developed a processor for an operational snow product from Landsat-8 and Sentinel-2 level-2 data. The algorithm is similar to the one used for the MODIS snow products but will allow the production of snow cover area maps at the scale of the Pyrenees mountain range with much higher spatial resolution (20 m) without sacrificing the temporal resolution thanks to the high revisit capacity of Sentinel-2 (5 days).
3. We used very-high-resolution optical stereo images (Pleiades) to generate snow depth maps at 2 m resolution near the date of the accumulation peak in 2015 and 2016. The comparison of the first map (2015-03-11) with 451 snow-probe measurements showed a decimetric accuracy and precision in the Pléiades-derived snow depths. The method was also assessed using an independent photogrammetric drone campaign. These data will help us to further study the effect of land cover and topography on the snow cover. In this perspective we currently maintain two standard snow-observing meteorological stations in the same area. One is under a deciduous forest canopy whereas the other is located in open terrain.

We strive to make these in situ and remote sensing data available to everyone. The entire meteorological dataset without quality check can already be downloaded from the CESBIO website. The Sentinel-2 and Landsat-8 snow maps will be distributed via the French Theia data centre. The MODIS snow climatology and Pléiades snow depth maps will be updated every year and are available upon request.