Analysis of snow cover variability over the Vercors mountains (French Prealps) using MODIS/Terra snow-cover products

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Satellite-derived snow cover maps are now operationally used into both climatic and hydrological models, especially for mountain area where ground observational networks are often sparse and provide more local condition information than regional scale patterns. Furthermore, the knowledge of distribution and chronology of snow cover is key information to understand ecological process and phenology.

Because of its high frequency temporal resolution (daily), the Moderate Resolution Imaging Spectroradiometer (MODIS) from NASA employed by the platform Terra provides useful snow data to study the spatiotemporal variability of snow cover. Snow covered areas, snow-free surfaces and cloud discrimination is based on the Normalized Difference Snow Index (NDSI) and on a "thermal" mask. The use of Normalized Difference Vegetation Index (NDVI) with the NDSI allows to detect better snow in forest zones. The 8-day composite snow cover products (MOD10A2, Maximum Snow Extent and Eight Day Snow Cover) are used to estimate and map Snow Cover Area (SCA) and Snow Cover Duration (SDC).

Snow cover is mapped at 500 m resolution for the snow cover period (November to May) from 2000 to 2010 over the Vercors Natural Park area (N 44°.50'/ E 05°.30'), a mid-elevation mountain range (1500 m asl) of the French Prealps characterized by a complex climate driven by Atlantic, Mediterranean and alpine influences.

The study then examines climate impact on the interannual and seasonal variability of SCA. Snow cover data are compared to snow depth measurements and climate parameters such as temperature, radiation and precipitation conditions. These data are collected from in situ meteorological instrumentation installed over the high plateaus (1620 m asl) since 2004 and national meteorological network.

Finally, the influences of topographic factors and vegetation cover on snow cover distribution are analyzed using GIS techniques. Elevation, slope and aspect are derived from a Digital Elevation Model (DEM) with a 75 m resolution. Vegetation cover is mostly represented by beech-fir forests for the mountain zones and a mosaic of Pinus Uncinata forests and grasslands in the subalpine zone.

The results show the important role playing by meteorological conditions and local factors (topographic features, vegetation cover) on the behaviour of snow cover, particularly at the beginning and the end of snow season.