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Snow cover monitoring over French Alps based on Spot-Vegetation S-10 products. Application to the Vercors area for the time period 1998-2008.

S. BIGOT (1), JP. DEDIEU (2), and S. ROME (1)

(1) Université Joseph Fourier, Institut de Géographie Alpine, Grenoble, France, (2) Laboratoire LTHE - UMR 5564 CNRS, Grenoble, France

Sylvain.bigot@ujf-grenoble.fr
Jean-pierre.dedieu@hmg.inpg.fr
Sandra.rome@ujf-grenoble.fr

Estimation of the Snow Covered Area (SCA) is an important issue for meteorological application and hydrological modeling of runoff. With spectral bands in the visible, near and middle infrared, the SPOT-4 and -5 VEGETATION sensors are used to detect snow cover because of large differences between reflectance from snow covered and snow free surfaces. At the same time, it allows separation between snow and clouds. Moreover, the sensor provides a daily coverage of large areas.

However, as the pixel size is 1km x 1km, a VGT pixel may be partially covered by snow, particularly in Alpine areas, where snow may not be present in valleys lying at lower altitudes. Also, variation of reflectance due to differential sunlit effects as a function of slope and aspect, as well as bidirectional effects may be present in images. Nevertheless, it is possible to estimate snow cover at the sub-pixel level with a relatively good accuracy and with very good results if the sub-pixel estimations are integrated for a few pixels relative to an entire watershed.

Application of this approach in the French Alps is presented over the Vercors Natural Park area (N 44°.50' / E 05°.30'), based on 10-day Synthetic products for the 1998-2008 time period, and using the NDSII (Normalized Difference Snow/Ice Index) as numerical threshold. This work performs an analysis of climate impact on snow cover spatial and temporal variability, at mid-elevation mountain range (1500 m asl) under temperate climate conditions.

The results indicates (i) a increasing temporal and spatial variability of snow coverage, and (ii) a high sensitivity to low variation of air temperature, often close to 1° C. This is the case in particular for the beginning and the end of the winter season. The regional snow cover depletion is both influenced by thermal positives anomalies (e.g. 2000 and 2006), and the general trend of rising atmospheric temperatures since the late 1980s.