Geophysical Research Abstracts,
Vol. 11, EGU2009-8703, 2009
EGU General Assembly 2009

Monitoring the spatio-temporal evolution of the snow cover in the eastern Alps from MODIS data

P. Cianfarra (1), F. Salvini (1), and M. Valt (2)

(1) Università Roma Tre, Roma, Italy, Dip. Scienze Geologiche, Roma, Italy (cianfarr@uniroma3.it), (2) ARPA Veneto - Centro Valanghe Arabba, Italy

Estimating the snow cover extent in mountain ranges is important for a wide variety purposes including of scientific studies, environmental and meteo-climatic applications, as well as predicting water availability for energy resource and agriculture. Moreover, the monitoring of the spatio-temporal variation of the snow cover thickness, coupled with ground data from weather stations, allows to identify avalanche risk areas after heavy snowfall.

The aim of this study is to test an automatic procedure to identify and map the snow coverage for different altitude interval in the eastern part of the Alpine range.

There has been much progress since 1966 when the first operational snow mapping was done by NOAA with spaceborne sensors that provide daily, global observations to monitor the variability in space and time in the extent of snow cover.

MODIS sensors offer increased improvements relative to the AVHRR that has been operational for many years on the NOAA Polar Operational Environmental Satellite System.

In this context the MODIS provides observations at a nominal spatial resolution of 500 m versus the 1.1 km spatial resolution of the AVHRR and continuously available (spatially and temporally), spectral band observation that span the visible and short-wave infrared wavelengths, including those useful for recognize snow cover.

The other advantage of using MODIS data is its availability and cost by the NASA's server. In this work we used MOD02 (L1B) data providing calibrated radiance values at the sensor (without atmospheric correction).

Snow cover map production included the following steps: selection of the images with clear sky conditions, geometric correction and georeferencing to UTM zone 32 ,WSG 84 ellipsoid, to eliminate the distortion of and the typical bow-tie effect that produces the observed not alignment of the scan lines in the row image; spatial sub setting to produce an image covering an area of about 200 x 120 km; identification of the snow cover was done by computing the Normalised Difference Snow Index (NDSI) knowing that snow reflectance is higher in the visible (0.5-0.7 mm) wavelengths and has lower reflectance in the short wave infrared (1-4 mm) wavelengths. This allowed to separate snow from clouds and other non-snow-covered pixels. The NDSI for MODIS images is defined as the difference of reflectances observed in the visible band 4 (0.555 mm) and the short wave infrared band 6 (1.640 mm) divided by the sum of the two reflectances:

$NDSI=(B4 – B6)/ (B4 + B6)$

This approach allowed to reduce (yet not totally eliminate) the influence of the atmospheric effects and lighting conditions.

A series of thresholds were tested to the ratio image to establish the best value for snow cover identification.

Eventually, the snow cover extent was computed for 6 altitude intervals. Results from the different processed images were compared and statistically analysed.

A complete set of ground truth of these preliminary results is still missing; yet we are confident that once the tuning of the processing will be completed, the automated processing of MODIS data will provide low cost, near real-time estimates of the snow cover distribution over the eastern Alps. This product would be a valuable tool for public administrations and authorities for environmental protection, control and risk management.