ABSTRACT

SNOW MAPS OF TRENTINO WITH CRIOPAT
Automated generation and analysis of data and statistics on snow coverage through remotely gathered multispectral images

L. Bruzzone, C. Marin, M. Santoni, F. Bovolo, A. Trenti, W. Beozzo

This paper presents the CRIOPAT project, resulting from the cooperation between the Forecasting and Planning Office of the Autonomous Province of Trento and the Remote Sensing Laboratory of the Department of Information Engineering and Computer Science of the University of Trento. CRIOPAT is an integrated analysis system that is able to gather daily important information about snow coverage on the Trentino region through satellite images. In detail, the system can automatically access the data acquired by the NASA MODIS sensor and generate snow coverage maps, monthly snow persistence maps and statistics on the evolutionary trend of snow and the altitude limits of snow presence on the Trentino region.

The data generated from the system are accessible by users via friendly web interfaces that allow authenticated users to carry out dedicated analyses on the snow evolutionary trends for homogeneous areas. The results obtained through the analysis of remotely gathered images as from February 2000 are in line with the historical data processed by the weather forecasting office of the province of Trento. This underlines the operational effectiveness of the CRIOPAT system.

MODELLING OF SNOWPACK DYNAMICS IN ALTA VALTELLINA

F. Avanzi, C. De Michele, A. Ghezzi, F. Bondiolotti, G. Della Vedova

Melting of seasonal snowpacks is an important component of the hydrological balance of mountain watersheds.

For example, alpine areas contribute more than 50% of the total annual flows of the Po river basin. In this context, the Valtellina valley (Lombardia, Northern Italy) represents an important case study, for the fact of having many hydroelectric power plants, important winter tourism resorts, and intensive agricultural production.

Because of the influence of climate variations on snow accumulation and melting dynamics, the prediction of future scenarios of water availability in this area is strategic for the economic and social future of the whole country.

The article deals with the implementation of a snowpack dynamic model to three different measuring sites located in Alta Valtellina. The model predicts the dynamics of snow water equivalent at a site through combined analysis of snow depth and its average snow density. Predictions are then compared with data from three experimental sites located in western Val Grosina valley (Malghera), eastern Val Grosina valley (Eita) and in the Cancano valley (Val Cancano). These results show that the proposed model can be an important tool for the evaluation of snowpack accumulation and melting dynamics in the Italian Alps.

SnowMaps: drawing up of snowfall maps to support avalanche forecasting

M. Dall'Amico, F. Zambon, A. Cagnati, A. Crepaz, S. Endrizzi

Snow is a fundamental resource in the mountain: in addition to being a tourist attraction for winter sport lovers, it is also a precious water supply during snow melting. However, snow can also represent a danger, for example due to possible avalanche realease, causing obstacles on roads, and sudden floods in case of rapid snow melting caused by temperature rises. Quantifying snow height and snow water equivalent therefore allows experts to optimise snow management in the tourism, energy, hydrologic and civil defence sectors, which are strategic in the mountain areas. This article illustrates an innovative snow monitoring system called SnowMaps, which allows for quantification of snow height on a regional scale through a physically-based approach.

The article also proposes a case study in the mountain area of Veneto region and in-depth analysis of the implementation of this tool as a support for avalanche forecasting.

Snow water equivalent monitoring from MODIS data: the case study of the upper Piave river basin (eastern Italian Alps)

P. Cianfarra, M. Valt

Monitoring the snow water equivalent (SWE) in mountain regions is of utmost importance for water budget assessment and for hydro-geological risk management. This work presents a methodology to estimate SWE based on the analysis of both multispectral data (MODIS satellite images) and field measurements.

The study area is the headwater of the Piave river basin in the Eastern part of the Italian Alps during the melting season of the 2010-2014 period. SWE was determined by taking into account the variability of the snow covered area and of snow density.

Obtained results are promising and the developed methodology could be successfully used to highlight the climatic trends of the last 15 years of the entire Italian Alps thanks to the availability of historical time series and satellite images.

THE MOUNTAIN RISK RESEARCH TEAM

Research to support management of wet and glide-snow avalanches in Valle d'Aosta

B. Frigo, B. Chiaia, V. De Biagi, L. ublanc, M. Freppaz, D. Godone, M. Maggioni, D. iglietti, E. Ceaglio, P. Della vedova, D. Franco, A. Godio, H. Grosjacques, A. Prola, F. Torretta, A. Welf, D. Tosi

The Mountain Risk Research Team - MRR Team (established in the framework of the "Call for the creation and development of Research Units" - DGR n. 1988 dated 26/08/2011) is a multidisciplinary research unit with a scientific-technical core, integrated with the legal and social aspects, in the field of natural hazards in mountain environment. In particular, the MRR Team, which includes universities, research institutes and a ski enterprise of Aosta Valley is developing the Operational Project "RRI - Risk, Research and Innovation". In this framework, the wet and glide-snow avalanches are studied. These avalanches are highly dangerous because of the large possible involved volume of snow and the difficulty of forecasting their release. Before the '60s, these phenomena have only partially attracted the scientific interest but afterwards the knowledge on formation and processes related to wet-snow and glide-snow avalanches has grown significantly. Particularly, the role of free water at the snow/soil interface has been analyzed as key factor responsible of the gliding rate and the acceleration of the gliding snowpack. The scientific and technological objectives pursued in this project by the MRR Team are (1) to develop tools for monitoring and prediction of wet-snow and glide-snow avalanches and (2) to define a procedure (best practice) of risk management in terms of safety and cost reduction in the Alpine ski-resort Monterosa Ski. The experimental approach on the analysis of formation of wet and glide-snow avalanches is based on the set-up of four test sites within the Monterosa Ski resort in Aosta Valley (NW Italian Alps) during summer 2013. The paper describes the objectives, the activities and the test sites with some preliminary data and results.