# PROPOSAL FOR AN AUTO-UPDATING SNOWFALL MAP OF THE TRENTINE TERRITORY (EASTERN ALPS OF ITALY)

M.Fazzini[1], A.Cecili[2] M.Gaddo[3] & P.Billi[1]
[1]Dipartimento di Scienze della Terra – Ferrara University
[2] Dipartimento di Scienze Geologiche – Roma 3 University, Rome
[3] Provincia Autonoma di Trento – Ufficio Prevenzione e Previsione

**Abstract**: From the early 80s, the "Snow, Avalanches and Meteorology Office of Trento (Italy) Autonomous Province" ("Ufficio Neve,Valanghe e Meteorologia della Provincia Autonoma di Trento"), actually "Ufficio Previsione e Prevenzione" monitors the snowfall conditions and studies avalanches in the same territory; in particular, it manages a network of over 30 manual snow fields, plus about ten automatic measurement stations, added during the last 10 years, between 800 and 2750 meters (Fig. 1). Complete snow-meteorological measurements are daily performed (AINEVA-CAI Model 1) while automatic stations also measure the snow cover thickness, as well as classical meteorological parameters.

***Keywords****: snow data ,DEM, Webgis applications*

## 1. INTRODUCTION

During the 2002-2003 winter season, as a consequence of a provincial law on avalanche hazard assessment, a number of private snow fields have been installed in the ski stations usually affected by avalanches. Therefore, as of today, the territory is monitored in about 60 rather well distributed sites. The two different kinds of measurement **-** but from the next everyone will use the YETI - flow into the Snow Office's *workstation,* which maintains a constantly updated database. The simultaneous analysis of the synoptic situations that brought snow during the last 20 years and the average contribution recorded in each station, will provide a series of algorithms by multivariance analysis.

These will allow calculating, for each kind of synoptic situation, the snow contribution for the whole territory, also in areas with complete lack of data measurement.

Those elaborations will allow the production of an auto-updating snowfall map, drawn on a 20x20 meter or 10x10 meter DEM; the map will be useful in several socio-economic fields pertaining to the exploitation of snow as a natural resource.

The system, that will be installed in the snow office, will be able to store information in a G.I.S.; the information will be provided by monitoring stations spread throughout the territory, and will be organized in a personal geodatabase designed on purpose to acquire and convert the sensors' data formats into those compatible with the GIS-NEVE system.

This meteorological data acquisition and storage system will allow the fruition of the collected information and the spatial and geostatistical analyses typical of the integrated GIS system.

## 2. DATA ANALYSIS

- Requirement analysis will allow to ascertain what the system does, for whom it works and with what data, in order to describe the information useful to organize and develop GIS system (Allen, 1998).
- data analysis involves the collection of data from the stations or from the forthcoming Yeti system, according to criteria identified in the requirements analysis.

This procedure will allow filtering the necessary fundamental information needed for implementing the proposed system and the editing of the metadata; the latter will accurately characterize the information's typology, the source and reliability of the analyzed data.

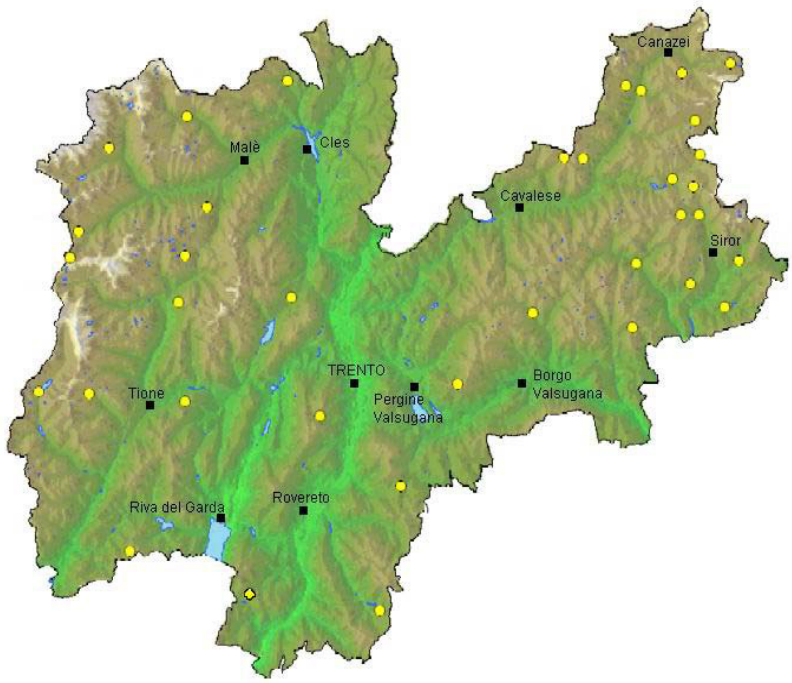


**Figure1.** Map of Provincia Autonoma di Trento with nivometric fields (yellow points)

- Conceptual modelling of the GIS-NEVE system - In this phase we will describe the conceptual modelling of the GIS-NEVE system, that is, how to use the information collected according to the requirements analysis, to realize the conceptual scheme of the activities and the processes the system will be able to carry out (Coughlan & Running, 1997).
- Logic modelling - Translation of the conceptual model into the data model according to the GIS software used. This project will use Arcgis data models as logical models; they will be realized through UML (Unified Modeling Language) diagrams, created by commercial CASE software; in the SGML case, by Microsoft Visio software:
- Physical modelling - Interpretation in Arcgis using the system tools to generate the system's physical model from UML diagrams, directly designing a Geodatabase; this will contain information from monitoring networks, according to relationships useful to generate the snowfall map (Cazorzi & Dalla Fontana G.,1996)

The major task is the creation of the WEB-GIS application. It must be able to display information from monitoring stations and the snow-cover mapping that varies in time. The proposed algorithms for data analysis, implemented in this system by model builder applications, allow the generation of maps in time. Furthermore, the interactive, restricted access WEB-GIS system will allow the remote data input for correcting and improving the analysis results and the subsequent mapping (Haefner et *al*, 1997). Fig.2 shows a graphic procedure of works

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