THE PROJECT FORALPS: CONTRIBUTIONS FOR A WISE MANAGEMENT OF WATER RESOURCES FROM METEOROLOGY AND CLIMATOLOGY

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Abstract: The paper presents an overview of the project FORALPS ("Meteo-hydrological Forecast and Observations for improved water Resource management in the ALPS"). The project aims at improving and integrating instruments to support the management of environmental resources in Alpine areas, in particular water. This goal is achieved by adopting innovative techniques for monitoring and reconstructing the time evolution of meteo-hydrological processes. Climatic databases of variables relevant for water resources availability are being collected and analyzed. Pilot activities at selected target areas are being performed, both through high resolution monitoring, such as in the implementation of new X-band micro-radars, and by means of the advanced numerical models of both meteorological and rainfall-runoff processes. An evaluation on selected case studies is being performed, to verify how improved meteo-hydrological information can support the adoption of best practices of sustainable planning and management of water resources.

Keywords: *climate change, meteorological radar, water resources, weather forecast, mountain weather, hydrology.*

1. INTRODUCTION

The Alpine meteorology and climatology display very peculiar features, which motivated specific international research projects, such as MAP (Bougeault et al., 2002). FORALPS aims at promoting the transfer of recent advances, gained from the above projects, into operational activities. FORALPS is supported by the European Union with the European Regional Development Funds (ERDF) under the initiative Interreg III B "Alpine Space". The project started at the beginning of 2005 and will come to its conclusion at the beginning of 2008.

2. STRUCTURE OF THE PROJECT

2.1 Partnership

The thirteen Partners of FORALPS come from three Alpine Countries, namely Austria, Italy, and Slovenia. The competence areas of the Partners cover rather uniformly the central-eastern Alps (Figure 1).

From Austria, four Regional Offices of the Central Office for Meteorology and Geodynamics (ZAMG), namely Tirol and Vorarlberg (ZAMG-I), Carinthia (ZAMG-K), Salzburg and Oberösterreich (ZAMG-S) and Vienna, Niederösterreich and Burgenland (ZAMG-W).

From Italy the National Agency for Environmental Protection and Technical Services (APAT), three Regional Environmental Agencies, respectively of Lombardia (ARPA-Lombardia), Veneto (ARPAV), Friuli-Venezia Giulia (Regional Meteorological Observatory, OSMER) and three Regional Meteorological Offices, namely of the Autonomous Provinces of Bolzano (PAB) and Trento (PAT) and of the Region Valle d'Aosta (RAVA).

From Slovenia the Environmental Agency of the Republic of Slovenia (EARS) and one University Department (see below).

The Lead partner is the Department of Civil and Environmental Engineering of the University of Trento through the Atmospheric Physics Group.

2.2 Work Package 5: assessment of climatic trends at regional scale

Precipitation, snow melting, drought are climatic factors affecting the Alpine hydrological cycle. Quantitative estimates of these factors on a climatological time scale including extreme events are a key basis for realistic planning, management and prevention of environmental risks.

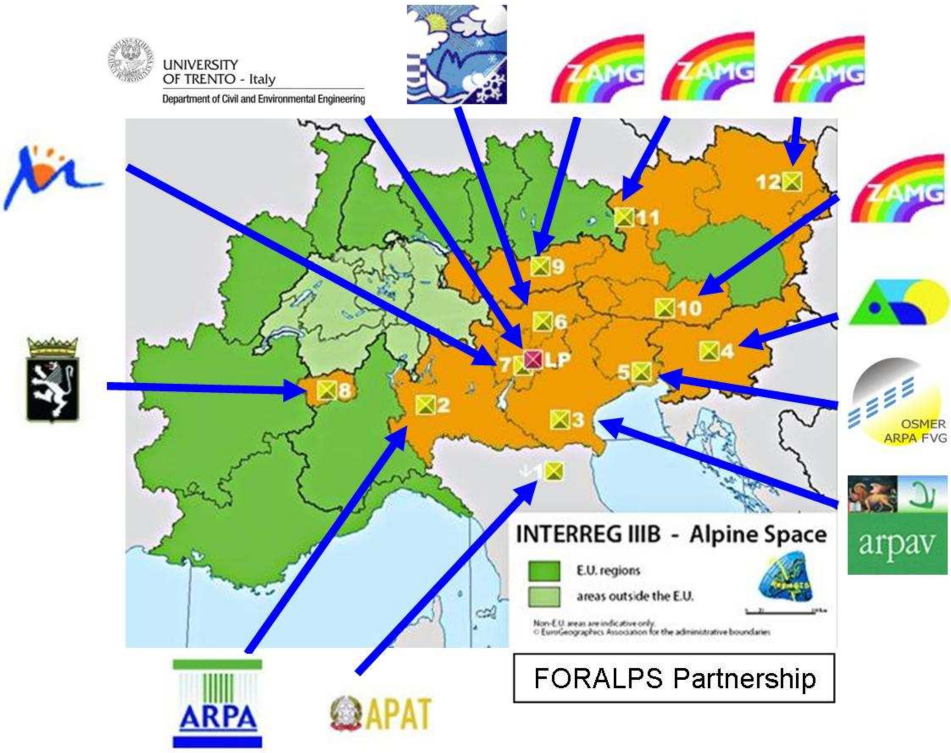

Figure 1: Map of the FORALPS partnership.

An accurate assessment of past and ongoing climate variations requires many and complete time series of hydro-meteorological variables. In FORALPS, series of daily precipitation, snow and temperature measurements available from national and regional services are being digitised, integrated with historical metadata, validated and homogenised, to create a rich and homogeneous climatological database. Part of the work within FORALPS is devoted to the study of the indexes of climate change, in particular in urban environments (Figure 2).

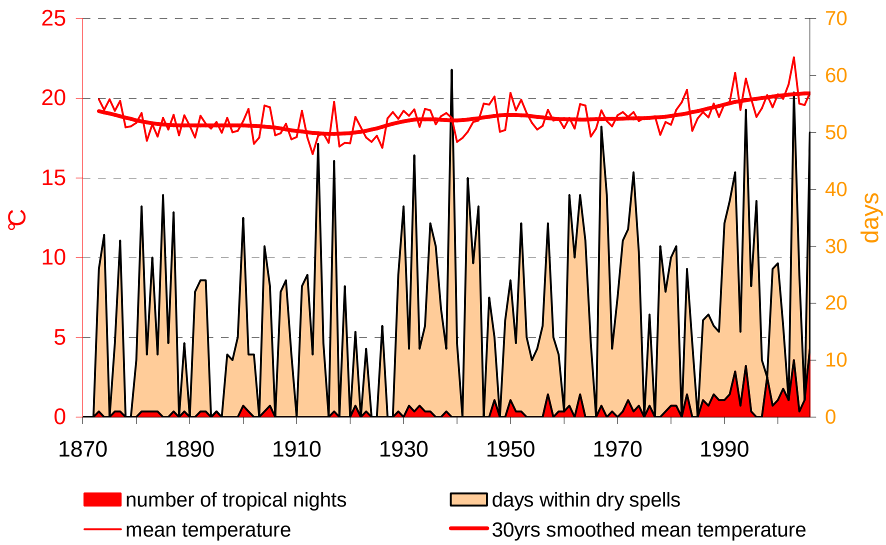

Figure 2: Climate variability at Wien Hohe Warte, in the flat north-eastern part of Austria in sub-urban environment (long. 16°21’23’’, lat. 48°14’55’’, alt. 198 m a. s. l.) for the summer season (June to August) 1873-2006. Time series of mean temperature, number of tropical nights (T_{min} > 20°C) and number of days within dry spells of at least 10 days. During the 20th century summer temperature has increased by more than 1°C, tropical nights show a remarkable increase since the 1970ies, and days within dry spells show a great variability but no trend (by I. Auer, ZAMG-W).

2.3 Work Package 6: innovative instruments for rainfall monitoring

Real time precipitation estimation is nowadays performed through long-range meteorological radars and raingauge networks. In the Alps, both suffer from severe limitations due to orographic factors (shadowing, clutter, etc.). FORALPS promotes pilot applications of innovative X-band microradar prototypes for high resolution monitoring of rainfall. These are being tested at selected target areas, usually affected by severe events such as hail and storms (producing severe impacts on agricultural activities, tourism, sports, etc.) in connection with existing long-range radars and ground based stations.

Figure 3: Left: X-band radar installed on the main tower of the medieval castle of Valeggio sul Mincio (Verona, Italy). Right: (high) the antenna of the radar and (low) view of the castle.

2.4 Work Package 7: weather and water resources availability forecasting

Numerical models are nowadays irreplaceable tools for medium range operational weather forecasting even in mountain areas (Richard et al., 2005). Use of such models can be revealing about the dynamics of uncommon weather events. However to be confident in using numerical forecasts, an assessment of model performance is required. FORALPS Partners are particularly concerned with the issue of model verification, and will define and adopt a common verification scheme, after a recognition of the many already available.

Figure 4: Views of the artificial basin of Speccheri (Vallarsa, Trento, Italy) for hydroelectric power production, adopted as a case study within FORALPS

2.5 Work Package 8: sustainable management of water resources

Sustainable management of environmental resources, and in particular water, can greatly benefit from innovative modelling tools. In particular, hydrological models have been recently developed to provide estimates of the water resource budget at river basin scale.

In FORALPS the coupling between meteorological models and hydrological models is being performed. Suitable models have been calibrated and tested on selected river basins, among which the Ridanna Valley basin (Vipiteno, Bolzano, Italy). In this typical Alpine basin, including glaciers and underground water, a quantitative estimation of the availability of water resources is being carried out, through the installation of instruments for continuous monitoring throughout the annual cycle and field measurements scheduled at selected seasons.

The impact of hydraulic works on surface runoff and water resource availability will be evaluated on test cases, among which the artificial basin for hydroelectric power production (Figure 4) of Speccheri (Vallarsa, Trento, Italy). A quantitative forecast of rainfall and discharge in the tributaries of the reservoir can be useful to plan dam operation with advance, minimizing the loss of water and energy resources. This knowledge also serves for planning a possible response to an extreme event.

2.6 Work Package 9: assessment of costs and benefits deriving from improved meteo-hydrological information

Successful planning and management of a wide range of activities are strongly affected by the weather. As a consequence, an accurate knowledge of meteorological and hydrological processes at various time scales, ranging from seasonal to real-time, can produce a positive impact on various economic activities, through suitable input to decision making processes.

FORALPS is working on an assessment of the managerial, economic and financial aspects deriving from the transfer of recent advances into technological applications (improvement in the environmental monitoring and modelling, development, setup and application of up-to-date instruments), procedures (e.g. environmental impact studies and assessment), and “best practices” (e.g. sustainable planning management of environmental and land resources) both while performing routine activities and managing emergency situations.

3. CONCLUSIONS

A short account has been provided of the ongoing project FORALPS, which is creating a network involving personnel of various institutions working in the fields of meteorology, climatology and hydrology, aiming at transferring the knowledge gained through previous and ongoing research activities into operational instruments and tools available to local authorities, decision makers, stakeholders and end users.

One of the strength of the project is the cooperation between research institutes, universities and public authorities in charge of operational weather forecast and water management, as well as various end users. The competence areas of the Partners cover uniformly the central-eastern Alps, where the territories of various countries and regions intertwine, thus requiring a transnational and interregional approach to issues faced by the project. The best practices experienced in FORALPS in typical Alpine cases will be easily transferable to other similar situations.

The next opportunity to disseminate results gained within FORALPS will be the Second FORALPS Conference to be held in Salzburg (Austria) on 28 November 2007.

Further details and news can be found in the project website www.foralps.net.

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