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Editorial

Intense weather over major mountain ranges, such as the European Alps, brings a high cost to society in the form of floods, windstorms and threats to aviation. The Mesoscale Alpine Programme (MAP) is a measured response of the international atmospheric and hydrologic community to the challenge of improving the understanding and prediction of intense weather in mountainous areas. While several important programmes in mountain meteorology have occurred during the last decade (PYREX, COAST, IPEX, etc.), MAP is essentially a heritage of the Alpine Experiment, ALPEX, which was conducted over the European Alps in 1982. A future South Föhn Project was first mentioned in the February 1990 issue of the ALPEX Regional Bulletin, and the first occurrence of the acronym MAP can be found in its February 1993 issue. The concept of MAP was forged during a workshop at ETH, Zurich, in November 1994, and outlined in the MAP Design Proposal (Binder and Schär 1996). In 1997, MAP became the first Research and Development Project of the new WMO World Weather Research Program. A Science Plan was then assembled (Bougeault *et al.* 1998). The main field experiment, called the Special Observing Period, or MAP SOP, took place from 7 September to 15 November 1999, and involved about 500 participants from 14 countries (Bougeault *et al.* 2001).

While several articles on MAP results are already published and more will soon follow, this special issue of the *Quarterly Journal of the Royal Meteorological Society* comprises a comprehensive set of scientific results, directly based on the MAP SOP field experiment. The editorial line was to invite relatively short original contributions discussing:

(i) special observations of the MAP SOP, their significance and their theoretical interpretation;
(ii) results from numerical simulations of actual SOP meteorological events (idealized simulations were welcome only if clearly related to a case observed during the SOP);
(iii) evaluation of the forecasting and measurement systems deployed during the SOP.

The response of the MAP community was overwhelming, and the selection process was difficult. Consistent with the spirit of the SOP, the authorship of this issue offers a healthy mix of junior and senior scientists, constituting a powerful combination of experience and enthusiasm. We are also happy that the final choice of papers does respect quite well the general balance of the scientific projects and nations engaged in MAP.

This volume is organized to highlight the subdivision of MAP into eight scientific projects.

Under Project 1, ‘Orographic precipitation mechanisms’, we study the dynamical and microphysical processes leading to the enhancement and organization of precipitation close to major mountain ranges. Medina and Houze propose conceptual models of orographic rain enhancement in two representative flow regimes, well in line with the subsequent dynamical analysis by Rotunno and Ferretti. Bousquet and Smull explore further dynamical consequences of the upstream blocking mechanism. Steiner *et al.* reveal the nature of down-valley flow under conditions of precipitation, and discuss the dynamical influence of snow melting. Smith *et al.* compute the precipitation efficiency in a detailed budget study. Yuter and Houze unravel the microphysical modes of orographic precipitation growth, while Hagen and Yuter revisit the rainfall–reflectivity relationships using disdrometer measurements. Georgis *et al.* draw a three-dimensional picture of the flow within convective systems at the Alpine foothills, while Seity *et al.* portray lightning and electrical fluxes. Richard *et al.* successfully model a severe convection episode, and Asencio *et al.* model the strongest rain event of the SOP. The real-time forecasts of MM5 are evaluated by Ferretti *et al.*

In Project 2, ‘Incident upper-tropospheric anomalies’, together with their modification over the Alps, are studied. Hoinka *et al.* examine the three-dimensional structure of a large potential-vorticity (PV) ‘streamer’ and its simulation by a mesoscale model. Liniger and Davies explore the fine-scale structure of the same phenomenon with the help of a Lagrangian forward-projection technique.

Project 3, ‘Hydrological measurements for flood forecasting’, attempts to predict floods in real time through coupled atmospheric and hydrological models. Ranzi *et al.* report on these experiments and describe the measurements deployed in support of this project. Jasper and Kaufmann present an extensive evaluation of the capacity of two atmospheric models for hydrological forecasting.

Project 4, ‘Dynamics of gap flow’, investigates the three-dimensional distribution of the wind at the Brenner Pass and within the Wipp Valley. Durran *et al.* present a detailed inter-comparison of the wind measurements by an *in situ* aircraft and a ground-based lidar, while Reitebuch *et al.* compare the very first measurements by the airborne WIND lidar to conventional data and model simulations.

Project 5 is dedicated to the ‘Unstationary aspects of föhn in the Rhine Valley’. Drobinski *et al.* analyse lidar and model results and propose conceptual models of the complex föhn flow near the splitting point between the Rhine and Seez Valleys. Jaubert and Stein assess the capacity of a mesoscale model to simulate in detail the history of a föhn episode.

Project 6 is devoted to ‘Three-dimensional gravity waves’. Volkert *et al.* and Doyle and Smith explore the capacity of mesoscale models to simulate the detailed three-dimensional structure of mountain lee waves in two different cases, by making ample use of aircraft and remote-sensing data.

In Project 7, ‘Potential-vorticity banners’, the structure of the Alpine wake is further explored. Schär *et al.* examine the fine-scale vorticity structure of the primary PV banner generated by the western tip of the Alps, and argue that the influence of individual peaks is still visible far downstream. Jiang *et al.* come to similar conclusions in a comprehensive study of the well-known mistral wind.

Finally, under Project 8, ‘Structure of the planetary boundary layer over steep orography’, Matzinger *et al.* document the influence of partial sky view in detailed radiation measurements at several altitudes along a slope.

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this volume. A special mention is due for copy editors Suzanne Bevan and Ralph Hardy, and also to Alison Hunter and Mary Spence at the QJ Office in Reading who managed to go through all difficulties of the enterprise with professionalism and timeliness.

While MAP has benefited from the enthusiasm of many colleagues, two individuals have probably done more than anyone else to make it a reality: Joachim Kuettner, distinguished Chair for International Programs at UCAR, and Thomas Gutermann, former Director of MeteoSwiss. We are proud to dedicate this volume to them, as a tribute to their inspiring leadership.

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