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EDITORIAL

The present MAP Science Plan specifies the scientific questions and the related projects to be tackled within the framework of MAP, in particular during the Special Observing Period. Starting from the basic ideas written down in the MAP Design Proposal, first published in January 1995, later extended by the hydrology-related objectives in1996, and fully consistent with the U.S. MAP Overview Document (1996 and 1998), the general scientific objectives have been refined by several iterations in intensive discussion of the MAP Scientific Steering Committee and the MAP Coordination and Implementation Group. Finalization of the scientific projects and questions was achieved and agreed upon at the international MAP meeting in Boulder early this year (February 1998). The final version of the current document was accepted by the MAP committees at the MAP Meeting '98 in Chamonix Mont Blanc.

The development and progress of MAP is documented by the periodically published MAP Newsletter of which 8 issues appeared so far.

We are deeply indebted to the atmospheric scientists and hydrologists who shared their knowledge and contributed enthusiastically to finalize this document. Special thanks go to Andrea Rossa for editorial assistance as well as to Robert Benoit and Stéphane Chamberland who invested extra effort into the production of the target area figures in chapter 3.

This MAP Science Plan will be followed by the MAP Implementation Plan which will describe the experimental set-up and procedures of the Special Observing Period in detail.

June 1998

Philippe Bougeault
Peter Binder
Joachim Kuettner

Editors

1 Introduction

The primary scientific objectives of the Mesoscale Alpine Programme (MAP) were agreed upon during an international workshop held in Zurich in September 1994. The hydrological aspects were integrated during a dedicated workshop in April 1996. They have been published in the MAP Design Proposal (1996) as:

1a. To improve the understanding of orographically influenced precipitation events and related flooding episodes involving deep convection, frontal precipitation and runoff.

1b. To improve the numerical prediction of moist processes over and in the vicinity of complex topography, including interactions with land-surface processes.

2a. To improve the understanding and forecasting of the life-cycle of Foehn-related phenomena, including their three-dimensional structure and associated boundary layer processes.

2b. To improve the understanding of three-dimensional gravity wave breaking and associated wave drag in order to improve the parametrization of gravity wave drag effects in numerical weather prediction and climate models.

3. To provide data sets for the validation and improvement of high-resolution numerical weather prediction, hydrological and coupled models in mountainous terrain.

The field phase of MAP, scheduled 15 August-15 November 1999, will be a very large experimental effort over a mountain range of the size of the Alps. Thanks to the active international cooperation, a number of high technology atmospheric and hydrological probing facilities will be available, and their optimal use must be discussed and planned in advance, in relation to the potential weather situations and with a hierarchy of well-defined scientific objectives.

In order to facilitate this planning process, the SSC and CIG have decided to structure the numerous proposals of MAP scientists in eight broad projects (P1 to P8), presented in the following section.

Three of these projects come in direct support to the so-called “wet” part of MAP, i.e. the primary scientific objectives 1a and 1b. These are P1: Orographic precipitation mechanisms; P2: Incident upper tropospheric PV anomalies; P3: Hydrological measurements for flood forecasting.

Four projects come in direct support of the “dry” part of MAP, i.e. the primary scientific objectives 2a and 2b. These are P4: Dynamics of gap flow; P5: Unstationary aspects of Foehn in a large valley; P6: Three-dimensional gravity wave breaking; and P7: Potential vorticity banners.

Finally, project P8 on the planetary boundary layer structure, comes in support of both wet and dry scientific objectives.

There is a great synergy between the eight projects: the upper tropospheric PV anomalies (P2) are known to influence the intense rainfall location (P1) and vice versa; the PV-banners (P7) may also contribute to determining the location of intense rainfall (P1); the hydrological program (P3) will directly benefit from the rainfall measurements provided by (P1) and the surface evaporation measurements made under (P8); the dynamics of Foehn in a large valley (P5) have close a relationship to the gap flow (P4), and to the study of the planetary boundary layer (P8); 3D breaking gravity waves (P6) may be responsible for the generation of PV banners (P7); the PV banners (P7) influence the structure of the planetary boundary layer downstream (P8).

These projects and their observational requirements are described in detail in the next section. The subsequent section describes current plans for deployment of the surface

based facilities. Several target areas have been defined, and in most cases, the experimental objectives described under Section 2 have already been assigned to a specific target area. The capacities of the research aircraft requested for MAP are also briefly summarized in section 3, together with their assignment to specific projects. Finally, the plans concerning maximum data exploitation in the fields of NWP, Climatology, and Budget Studies are described under Section 4.