The Mesoscale Alpine Programme

newsletter

MAP

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Editors

Dr. Georg Mayr
Institut für Meteorologie und Geophysik
Universität Innsbruck
Innrain 52, A-6020 Innsbruck
Austria

Phone	+43-512-507 54 59
Secretary	+43-512-507 54 51
Fax	+43-512-507 29 24
e-mail	Georg.Mayr@uibk.ac.at

Dr. Andrea Rossa
MeteoSwiss
Krähbühlstrasse 58, CH-8044 Zürich
Switzerland

Phone	+41-1-256 95 39
Secretary	+41-1-256 91 11
Fax	+41-1-256 92 78
e-mail	andrea.rossa@meteoswiss.ch

Publisher

MAP newsletter
c/o MeteoSwiss
Krähbühlstrasse 58, CH-8044 Zürich
Switzerland

Programme Office
Secretary

Dr. Andrea Rossa
MeteoSwiss
Krähbühlstrasse 58, CH-8044 Zürich
Switzerland

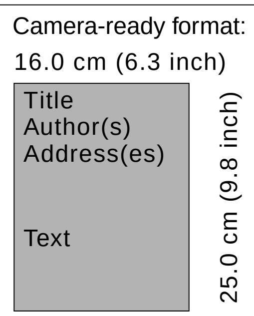
Phone	+41-1-256 95 39
Secretary	+41-1-256 91 11
Fax	+41-1-256 92 78
e-mail	map@meteoswiss.ch

MAP Data Centre

Internet (WWW) http://www.map.ethz.ch

The MAP newsletter invites short articles on MAP-related topics. **Contributions** to the MAP newsletter should be sent to the Editor Andrea Rossa. **Please deliver your text (graphs included) in a camera-ready format** (see templates at the MAP Data Centre), and be sure that figures are suitable for black and white reproduction.

Your contribution must not exceed 2 pages!



Deadline for contributions to the MAP newsletter No. 14: February 19, 2001 (to appear in March 2001)

Deadline for contributions to the MAP newsletter No. 15: May 8, 2001 (to appear in June 2001)

Editorial

This newsletter follows what must have been a frenetic few months for the MAP community. Three highly successful conferences have taken place since the last issue: the Mesoscale Alpine Programme meeting in Bohinjska Bistrica, Slovenia, 24-26 May 2000; the American Meteorological Society's (AMS) Ninth Conference on Mountain Meteorology in Snowmass Village, Aspen, Colorado, 7-11 August, 2000; and the 26th International Conference on Alpine Meteorology (ICAM), Innsbruck, Austria, 11-15 September 2000. All conferences provided the early opportunities for researchers to present their preliminary results and discuss their findings. The overwhelming outcome was the potential importance of the data collected during the MAP Special Observing Period.

The key note speeches at the conferences, and indeed the previous MAP newsletter editorials, have been presented by some of the most respected scientists in the field of mountain meteorology. Joachim Kuettner's paper at the AMS on 'How the Lee Wave was Discovered' was inspirational. Similarly, overviews and insights into the various aspects of MAP research have been presented by Ronald Smith, Christoph Schär, Reinhold Steinacker and Ignaz Vergeiner, to name but a few. The contribution that I would like to add, therefore, is to give a view of MAP from the perspective of the less established scientists of the group.

One of the outstanding qualities of the MAP research initiative is its interaction between scientists from all participating institutes. Citing the Gap-Flow group as an example, researchers investigating Foehn in the Wipptal consist of participants from ten institutions based in six countries. Within this group, and other research groups within the community, collaborations have been forged that I am sure will extend far beyond the MAP project. This will be of great benefit to the individual scientist and provide excellent opportunities for the advancement of atmospheric science as a whole.

The operational phase of MAP presented the possibility of working with researchers from various fields of expertise. Invaluable skills and 'hands-on' experience were gained. The diversity of the instrumentation deployed during MAP permitted everyone to gain a greater understanding of the measurement facilities available for meteorological research. More importantly, however, it generated an appreciation of the potential requirements for the daily operation of specialized instruments, the advantages and disadvantages of each method, and the difficulties involved in the analyses of such data.

As the complexities of research increase it is becoming, or has already become, impossible for any one person to master all. Collaborative projects such as MAP allow the best aspects of current science to be brought together. Each scientist is able to excel in his/her own area of expertise as well as gaining invaluable knowledge from the overall experience. As we have, and are continuing to see, this holds the potential for outstanding results!

On that note, I would like to wish everyone much success in their continued data analyses. Looking forward to more discussions and results at the next MAP meeting in Schliersee, Germany, 14-16 May, 2001.

Samantha Arnold
University of Leeds, UK.

Summary of the Committee Meetings

Andrea Rossa, MeteoSwiss, 8044 Zurich, Switzerland

The MAP committees CIG, SSC, and IGP met 22 and 23 May 2000, as usually, in the framework of the annual MAP Meeting, held in Bohinjska Bistrica, Slovenia. The EUMETNET MAP-NWS Board met jointly with the IGP. After the successful field phase (see MAP newsletter 12 for extended reports) all organisational efforts are now devoted to the spinup of Phase III of MAP, the Evaluation Phase.

Availability of and easy access to the SOP data is critical at this stage of MAP, highlighting the importance of the MDC. It soon became evident that the lack of manpower at the MDC was bottlenecking the process of making SOP data available. The MAP Committees therefore decided, in the framework of the MAP Meeting 2000, that the MDC staff should be upgraded by two additional persons for one year. A respective proposal was submitted, and accepted by the MAP-NWS Board. As of today, besides the DB manager Hans Hirter and his assistant Esther Häller, two additional persons are working (80% and 50%) possibly until the end of 2001.

The MDC and the PO made a substantial contribution to the MAP Field Catalog (see Fig. 1), a 4-CD set containing a complete description of the SOP in terms of operation summaries and reports, quick look data, and a selection of meteorological products that were available at the MAP Forecasting Office during the SOP. The information is well organised and allows for efficient overviewing of individual Intensive Observing Periods (IOPs). The Field Catalog has been produced in collaboration with the Joint Office of Science Support, UCAR, USA, and is planned to be available in November, in Europe via the MDC. An online version of the Field Catalog is available at the MDC under www.map.ethz.ch.

Two spin-off projects of MAP are currently being developed from the MAP Working Groups of routine observational networks, climatology, and forecasters, geared to solving very practical issues in operational meteorology and climatology. The first of the two projects, the Mesoscale Alpine Climatology (MAC), is a combination of and builds upon the work of WG-ROUND and WG-Pclim, the climatology working group which was launched to establish an Alpine-wide data pool for climatological data sets with high spatial resolution. This idea, although initially part of the MAP scientific objectives, received only secondary attention due to the pressing needs of the MAP field experiment. However, MAC can perfectly profit from the tremendous work accomplished during MAP and the personal relationships developed. Contact person for MAC are Christian Häberli, MeteoSwiss, and Carlo Cacciamani, ARPA-SMR, Italy.

The second project, FACT (Forecasting in Alpine and Complex Terrain), is to be the continuation of the work of the Forecasters' Working Group. Three fields of main interest have been identified. Firstly, the scientific results of MAP need to be transferred to applications that are useful in the forecaster's daily business, i.e. in improving forecasts. This encompasses establishing relations between PV-streamers, heavy precipitation and hydrological impacts, gravity wave activity and aircraft safety, and to assess the significance of PV-banners for weather elements. Secondly, the fruitful international cooperation that started during MAP needs to be continued, especially the trans-border exchange of information on extreme events. In particular, alerts for severe weather is a topic of interest, while case studies and further exchange of special operational products are envisaged as well. Thirdly, FACT plans to develop schemes for education and training of Alpine forecasters, starting from workshops and summer schools, and entertains the idea of establishing a school for Alpine weather forecasting.

As to the overall structure of MAP, some changes will be introduced by the time of the MAP Meeting 2001. Firstly, it is felt that the Coordination and Implementation Group (CIG) and the Scientific Steering Committee (SSC) had their distinct part to play in the preparation of the field experiment, but that now a merger of these two bodies is reasonable. Secondly, in order to increase the visibility of MAP results, plans are being made to attach the annual MAP Meeting to other conferences, i.e. to the AMS Conference on Mountain Meteorology and the International Conference on Alpine Meteorology (ICAM). Finally, the new chairman of the MAP-NWS Board is Jacques Ambühl, member of the directorial board and head of the weather department of MeteoSwiss, replacing Thomas Gutermann who retired as director of MeteoSwiss at the end of 1999. Thomas Gutermann, however, has been confirmed chairman of the MAP's International Governing Panel (IGP) until 2001.

The next MAP Committee Meetings will take place 17-18 May 2001 in the framework of and right after the MAP Meeting 2001, 14-16 May 2001 in Schliersee, Germany, a picturesque village at the northern edge of the Bavarian Alps. More and updated information is available under http://www.map.ethz.ch.

Figure 1. Figure Caption for the Field Catalog PR: The MAP Field Catalog, a four-CD volume containing a complete set of operation reports and summaries, quick look data, and a selection of meteorological products that were available at the MAP Forecasting Office during the SOP. The Field Catalog will be available in November. For Europe the distribution is via the MDC (http://www.map.ethz.ch), where the online version is already installed. Photographs on CDs are CNRS Ronsard radar operation by night (CD1, courtesy of P. Tabary, CETP, France), NCAR Electra flight over the Po Valley (CD2, courtesy of M.-P. Lefevre, CNRM, France), Foehn clouds over the Rhine Valley target area (CD3, courtesy of H. Berger, MeteoSwiss, Switzerland), and gravity wave clouds over the Mont Blanc massive (CD4, courtesy of A. S. Broad, The Met. Office, UK).

Reports from MAP working groups

Note from the editors

Working groups have been a key element to propel MAP forward during its phase I and to prepare for phase II, the field measurement campaign in fall of 1999. Now, in phase III, people are so busy working with the SOP data that there might not be enough time nor an immediately seen reason to keep on with the working groups. However, working groups will again become crucial for the coordinated and comprehensive exploitation of the SOP data set. This need was recognized in the latest CIG/SSC meeting and further action will be taken. In the meantime a big thank you to all working group members and their chairpersons! The following list gives the *current* status of the working groups.

- WG-Numerical Modelling (see Benoit et al. on page 10)
- WG-Hydrological Modelling: currently inactive
- WG-ROUND (see Groehn et al. on page 5)
- WG-AIRCRAFT: Terminated
- WG-Radar: Active
- WG-Forecasters: Has put together a new proposal for Forecasting in Alpine and Complex Terrain (FACT). More details will appear in the next MAP newsletter.
- WG-PBL (see Rotach and Emeis, this page)
- WG-Precipitation Climatology: Will merge with WG-ROUND to start a new project: Mesoscale Alpine Climatology (MAC). More details about MAC will be given in the next MAP newsletter.
- WG-Upper-tropospheric PV-anomalies: Active
- WG-Lidar: Active

Two new working groups have formed resulting from the need to coordinate measurements and their interpretation in the target areas Rhine Valley and Brenner:

- WG-FORM
- WG-GAP

MAP Working Group on Planetary Boundary Layers in Complex Terrain

Mathias Rotach, Institute for Climate Research, ETH, 8057 Zurich, Switzerland, and
Stefan Emeis, Fraunhofer Institut, 82467Garmisch, Germany (co-chairmen)

The MAP Working Group on Planetary Boundary Layer in Complex Terrain, WG-PBL has first seen the light of this world after the MAP meeting in Bad Tölz in 1995. It quickly grew to a respectable size and soon became instrumental in introducing the concerns of boundary layer issues into the MAP community. While ‘boundary layer’ was merely some sort of abstract term referring to boundary conditions within MAP before its appearance, MAP WG-PBL greatly helped to identify important research tasks and possible approaches for the problem of understanding boundary layer processes over complex terrain. Consequently, it saw its very raison d’être being introduced as one of the eight research objectives of MAP in the Science Plan.

During the later stages of its life, MAP WG-PBL concentrated on transposing its ideas into concrete research projects, resulting in three major (field) activities during the MAP Special Observing Period (SOP) in fall 1999. One, associated to 'Dry MAP' focused on the boundary layer processes in connection with Foehn events in the Rhine valley and also to the gap flow phenomenon in the Wipptal. A second project concentrated on the investigation of the boundary layer structure in the Po valley, i.e. the 'upwind region' of the Alps for southerly flow potentially leading to heavy precipitation events in the Alps. Also associated to 'Wet MAP' and thus the Lago Maggiore target area was the MAP-Riviera project conducted in the valley of the same name in southern Switzerland. Here, the research focus was on the investigation of the turbulence structure in an (example) valley and the turbulent exchange processes within a valley as well as between the valley boundary layer and the free atmosphere above. Having brought the interested researchers together and having helped to work out the relevant research topics with respect to boundary layer issues in MAP, MAP WG-PBL has more than fulfilled the task of its life. All its friends and supporters will always keep it in good memory! In the meantime other national and international research programmes have included boundary layer topics in their agendae and will continue to do so. The topic is of refreshing actuality, especially in applied meteorology.

Short Report from the Working Group of Routine Network Data (WG-ROUND)

Inga Groehn, Christian Häberli, and Reinhold Steinacker, Department of Meteorology and Geophysics, University of Vienna, 1190 Vienna, Austria

On Tuesday, 23rd of May 2000 before the official start of the MAP-Meeting in Bohinjska Bistrica – the 4th meeting of WG-ROUND was held. 12 persons from 9 institutions in 4 countries participated.

This meeting was devoted to three different topics:

- New Way of Presentation of DAQUAMAP Results: From now on the results of DAQUAMAP are distributed via internet. That means that the very important information about sensor problems, systematic or gross errors is available for every MAP data user on the internet! First, the data providers had to check the DAQUAMAP results and to agree to their publication. In special cases it also meant to write some comments about reasons of special behaviour of single stations. This information is then also available on the web. DAQUAMAP homepage incl. results of reduced pressure, potential temperature and humidity:
  http://www.map.ethz.ch/mm-doc/daquamap/daquamain.html
  (you will be asked for your MAP password)

- MAC (Mesoscale Alpine Climatology): After an introduction of the background, of the basic ideas, and of the goals of MAC the following discussion yielded that MAC might be a possible future work of WG-ROUND. This means that the future organisational structure of MAC must also be open to data holders who are not national weather services (i.e. regional weather services in Italy, hydrographic offices in other countries etc.). But there are still some MAP duties to be finished before starting something new ...

- Status of the Alpine station inventory and data delivery to MDC and the post-SOP actions of the WG (data collection): After a short overview of the amount of data available at the MDC it was discussed what the next post-SOP actions will be. WG-ROUND makes several recommendations concerning data from routine networks. This includes the performance of the data collection after the SOP. According to the decision of the Chamonix meeting, the 'offline data' (if delivered) will in many cases finally replace the 'real-time' data. But also the special treatment of precipitation was discussed in detail.

- For more information see: http://www.univie.ac.at/IMG-Wien/daquamap/MinutesSlow.htm (Minutes of the WG-ROUND Meeting in Bohinjska Bistrica, Slovenia), http://www.univie.ac.at/IMG-Wien/daquamap/wgroundmain.html (WG-ROUND homepage)

Data Quality Control of MAP (DAQUAMAP)

Inga Groehn, Reinhold Steinacker, Christian Häberli, Wolfgang Pöttschacher, Manfred Dorninger, Department of Meteorology and Geophysics, University of Vienna, 1190 Wien, Austria

Introduction

Before evaluating meteorological data a quality control should be carried out. For example, observational errors may have a serious impact on objective analyses. Before conducting an objective analysis, i.e. interpolating irregularly spaced observations to a uniform grid, the data should be checked up on errors carefully.

But also when using data from different data providers, it is advisable to check the data with a uniform method in order to get a more homogeneous data set irrespective of e.g. state borders. The stations of MAP are operated by several dozens of institutions. So some variety in measuring and processing procedures as well as in quality control efforts have to be expected.

For this purpose a mathematical method of quality control has been developed and continually improved during the last years at the Department for Meteorology and Geophysics (University of Vienna) in the project of DAQUAMAP in order to get a more homogeneous data set for the whole Alpine region.

Method (short overview)

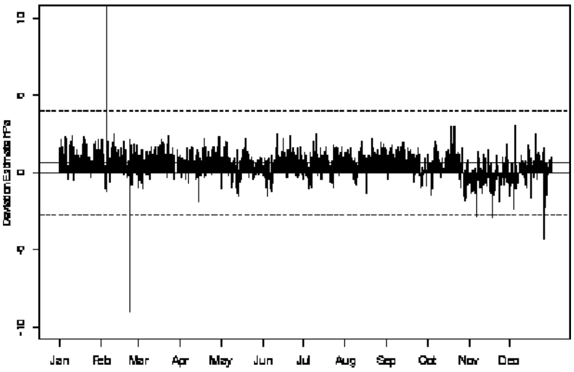
The method includes a piecewise functional fitting approach which is based on a variational algorithm. Like for thin-plate splines, an integral of squares of second spatial derivatives is minimised. The second derivatives are obtained from overlapping finite elements using a polynomial approach (Steinacker et al. 2000). The basic advantages of this method are that neither a first guess or (prognostic) model field is necessary nor a priori knowledge about structure or weighting functions is required.

Implementation

The results (in terms of deviation estimates) of the year 1999 are now available on the web (as soon as the results have been approved by the respective data provider):

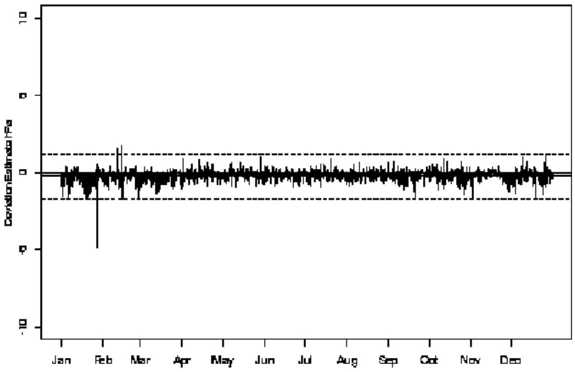
- http://www.map.ethz.ch/mm-doc/daquamap/daquamain.html

(You will be asked for your MAP password).
At the moment the parameters mean sea level pressure, potential temperature, and humidity of GTS-stations below 750 msl were calculated. An extension to the non-GTS surface stations of the participating institutions is under way.



obs	n	PGE	median	IQR	mean	sdev
all	2144	0.23	0.67	0.96	0.62	0.88
00	288	0	0.64	0.97	0.64	0.69
06	337	0.3	0.9	0.88	0.75	0.82
12	338	0.3	0.54	0.96	0.49	0.93
18	348	0.57	0.56	0.9	0.49	0.79

Figure 1. Time series of deviation estimate (reduced pressure) and statistical evaluation of station 1 (n denotes number of observations, PGE the percentage of gross errors, and IQR the interquartile range).



obs	n	PGE	median	IQR	mean	sdev
all	2611	0.27	-0.21	0.41	-0.24	0.37
00	353	0	-0.3	0.45	-0.32	0.36
06	347	0	-0.28	0.44	-0.3	0.34
12	350	0.86	-0.16	0.37	-0.18	0.35
18	349	0.57	-0.08	0.3	-0.12	0.3

Figure 2. Time series of deviation estimate (reduced pressure) and statistical evaluation of station 2.

Results

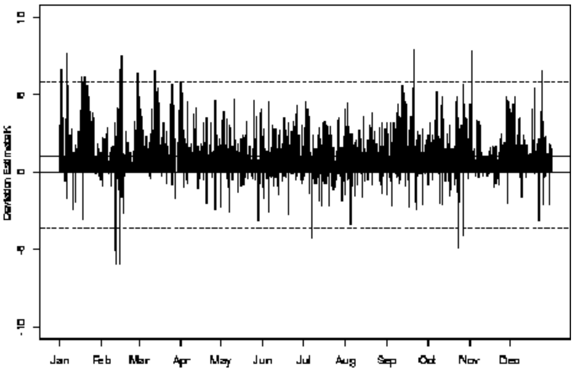
General comments: A positive (negative) deviation means that the measured value of the station is higher (lower) than predicted from the surrounding stations. If it persists and does not show any correlation with the diurnal or seasonal cycle or with a synoptic setting, it may be caused by sensor problems (systematic errors) and can give some hints on the representativity of the stations with respect to the scale which can be resolved by the local/regional station density.

Example for reduced pressure: In Fig. 1 there is a light positive deviation with the median (dashed line) of 0.67 for nearly all observations until middle/end of October. At that time it looks as if the barometer was changed. The two strong deviations concentrated at the beginning of the year indicate most probably gross errors caused by instrumental misreading, miscoding etc.

In comparison Fig. 2 shows very small deviations (compare also tables with their statistics). Only at the beginning and at the end there are some 'stronger' deviations due to meteorological forcing. At the end of January you also find a single gross error.

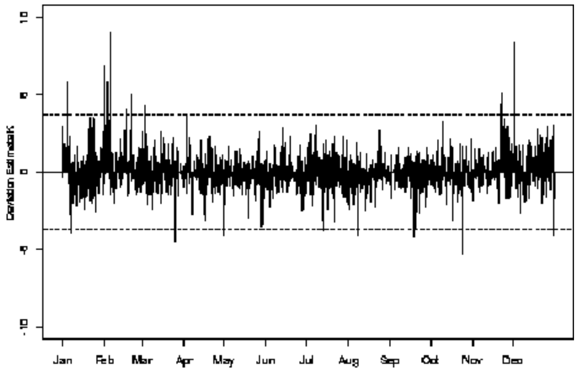
Example for potential temperature: A station higher than the surrounding stations will show a natural tendency for positive deviation because the annual mean potential temperature is increasing with height (approximately 0.4K/100 m). But also in the case of two nearby stations with differences in height: This can lead to deviations with opposite sign especially during the cold season when one station is situated above the temperature inversion while the other one stays in the cold air pool. Also heat island effects of big cities (Fig. 3) are represented in temperature measurements.

In comparison Fig. 4 shows very clear meteorological forcing and the diurnal cycles (compare median values).



obs	n	PGE	median	IQR	mean	sdev
all	2611	0.92	1.05	1.35	1.27	1.39
00	353	0.57	1.62	1.72	1.8	1.51
06	347	0	1.37	1.52	1.59	1.33
12	350	2	0.67	1.08	0.8	1.14
18	349	2.01	0.79	0.97	0.86	1.1

Figure 3. Time series of deviation estimate (potential temperature) and statistical evaluation of station 3.



obs	n	PGE	median	IQR	mean	sdev
all	2641	0.8	-0.02	1.06	0.05	1.06
00	356	0.84	-0.14	1	-0.05	1.08
06	355	0.85	-0.06	1.08	-0.03	1.09
12	356	0.84	0.11	1.11	0.2	1.07
18	345	0.58	0.05	1.07	0.1	1.03

Figure 4. Time series of deviation estimate (potential temperature) and statistical evaluation of station 4.

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Steinacker R., C. Häberli, and W. Pöttschacher, 2000: A transparent method for the analysis and quality evaluation of irregularly distributed and noisy observational data. *Mon. Wea. Rev.*, **128**, 2303-2316.

Acknowledgements

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MAP newsletter #15

Note from the editors

After a year with several conferences hosting sessions on MAP, the only major MAP-related conference in 2001 will be the MAP Meeting itself. The extended abstracts in the MAP newsletter will therefore be the only written documentation of the progress of MAP for the MAP community, the larger scientific community, and funding agencies. The MAP newsletter will accommodate by:

- urging all presenters at the MAP meeting 2001 to submit an extended abstract;
- easing the previous 2-page limit to 4 pages per contribution;
- being in your mailboxes before the summer holidays.

As a compromise between having your very latest results in the abstracts and distributing the newsletter very soon after the conference, the deadline for receipt of the extended abstracts will be May 8, 2001, in the week before the MAP meeting.

Ongoing Activities and Future Events

Activities within MAP

date	event
March 8-9, 2001	16th CIG meeting in Zurich, Switzerland
May 14-16, 2001	MAP Meeting 2001, Schliersee, Germany (http://www.map.ethz.ch)

Future events related to MAP

date	event
December 4-8, 2000	Fifth international symposium on tropospheric profiling: needs and technologies, Snowmass, CO, USA
December 4-6, 2000	International SRNWP Workshop Statistical Adaptation, Vienna, Austria (www.zamg.ac.at/~SWSA2000)
January 14-19, 2001	Precipitation Extremes: Prediction, impacts, and responses (AMS), Albuquerque, New Mexico, USA
March 25-30, 2001	EGS 26th General Assembly, Nice, France (http://www.copernicus.org/EGS/EGS.html)
April 23-24, 2001	International SRNWP Workshop on Verification, de Bilt, The Netherlands
July 10-18, 2001	8th Scientific Assembly of IAMAS, Innsbruck, Austria (http://meteo.uibk.ac.at/IAMAS2001)
July 19-25, 2001	30th AMS Conference on Radar Meteorology, Munich, Germany
July 30-August 2, 2001	18th AMS Conference on Weather Analysis and Forecasting, and 14th Conference on Numerical Weather Prediction, Fort Lauderdale, FL, USA
July 30-August 2, 2001	Ninth AMS Conference on Mesoscale Processes, Fort Lauderdale, FL, USA
September 18-21, 2001	DACH-MT: Deutsch-Oesterreichisch-Schweizerische Meteorologen-Tagung, Wien, Oesterreich (http://www.zamg.ac.at/~DACH2001)
September 24-25, 2001	International SRNWP Workshop on Nonhydrostatic Modelling, Bad Orb, Germany
September 2-6, 2002	International Conference on Quantitative Precipitation Forecast (QPF), Reading, UK

First look at the MC2 performance for fine scale forecasting during the MAP SOP

R. Benoit[(1)], H. Davies[(2)], C. Schär[(3)], P. Binder[(4)], S. Chamberland[(1)], M. Desgagné[(1)], C. Girard[(1)], D. Lüthi[(2)], D. Maric[(5)], E. Müller[(4)], P. Pellerin[(1)], J. Schmidli[(2)], F. Schubiger[(4)], M. Sprenger[(2)], S. Willemse[(4)], W. Yu[(1)], E. Zala[(4)]

[(1)] Recherche en Prévision Numérique (RPN), Environment Canada, Dorval
[(2)] Institute of Atmospheric Science of ETH (LAPETH), Zürich
[(3)] Geographical Institute of ETH (GIETH), Zürich
[(4)] MeteoSwiss, Zürich
[(5)] Swiss Center for Scientific Computing (SCSC), Manno

Introduction

The configuration of the MC2 model for MAP, featuring a 3-km window over the entire Alps, described in (Benoit et al., MAP NL 11, 1999), has been run successfully during MAP to provide special guidance to the research aircrafts, to test the explicit convection modelling, and to establish a database for mesoscale process studies over the Alps. A website was established to record the day-by-day analysis of the model forecasts by the MC2 desk crew (RPN, ETHZ and MeteoSwiss) at the MOC in Innsbruck: now at http://www.geo.umnw.ethz.ch/research/map_mc2/.

From Sep. 7, 1999 until Nov. 15 1999, the model was run on a continuous basis on *gottardo*, the NEC SX-4 supercomputer at the Swiss Centre for Super Computing (SCSC/CSCS); results were archived for all days and all graphical products (about 1000 images per day) are online at the MAP Data Centre. The full 27 h 3-km simulation takes 4.5 h CPU time in a dedicated mode on 10 processors at a sustained speed of approximately 10 Gflops (50% of peak theoretical performance). During the MAP field phase, this computation represents the largest computational task that was conducted in Switzerland on a daily basis.

The full suite consisted of 14-3-1 km nested runs, with the 1-km targeting (~150 km moveable domain) a crucial (mostly for the GWB project, P6) aircraft mission to take place the next morning.

A first look at the results

The topography chosen for the 3-km model (Fig. 1), rather smooth, ensured un-noisy and reliable runs (not a single failure during the period): very subtle features (e.g. detailed timings of the foehn or gapflow onset) have been be simulated. The explicit modelling of convection with 3-km instead of 2-km as initially planned, appears to have been able to catch properly only the heavy precipitation zones, while underestimating the smaller amounts, resulting in a quite large areal bias. A comprehensive evaluation of the MC2 precipitation is being carried out in collaboration with MeteoSwiss, as part of an overview paper (Benoit et al., 2000); Fig. 2 compares the mean hourly precipitation at all ANETZ stations (over Switzerland) with that of the MC2 corresponding points. The timing of the precipitation was well predicted, with some underestimation of the precipitation intensity. The planned hydrologic realtime simulations (driven by the MC2 rain) really took place with the collaboration of Nick Kouwen (Waterloo, Canada): Fig. 3 shows the hydrograph for the Toce-Ticino during the SOP. There were three significant events during the MAP SOP: September 20 during IOP-02, September 26 during IOP-03 and October 21 during IOP-08. The first rainfall event that resulted in a very good flood forecast. The second rainfall was centred on the Ticino river above Bellinzona and was not predicted by MC2 for the Ticino River. The third event was a snowfall event with precipitation amounts that would have produced significant flows if it were rain instead of snow.

It took the 1-km final MC2 adaptation to fully capture the full amplitude of the intense gravity waves, such as shown on Fig. 4, for the IOP15. The model predicted approximately the right wave amplitudes (with peak values of 4.2 and 3.6 m/s, respectively). Apart from IOP 2b, no GWB false alarms were raised by the MC2.

Outlook

A complete MC2-MAP archive (1 TeraByte) has now been established at RPN that contains all of the MC2 gridded output as well as the driving boundary files: scientists interested in using parts of this MAP data are invited to enquire to the author. The adequacy of 3-km for explicit convection will be further examined, as well as the question of the proper terrain definition.

A second MC2 suite, at 14 km, with 75 levels and a higher lid at 35 km, out to T+72h, driven by the ECMWF model, was also run on a DLR SX-4 machine and is not described here.

References

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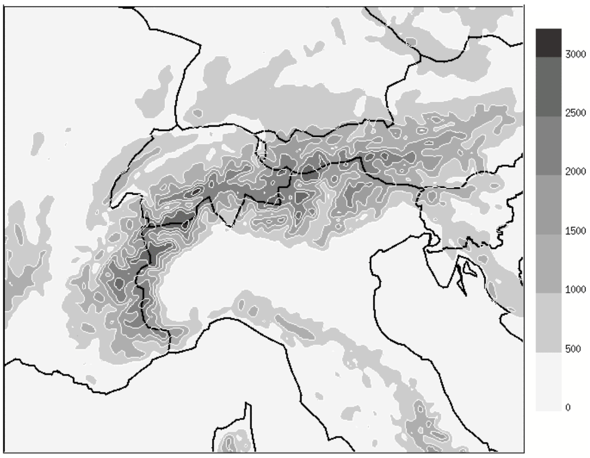

Figure 1: Topography used in MC2-3km

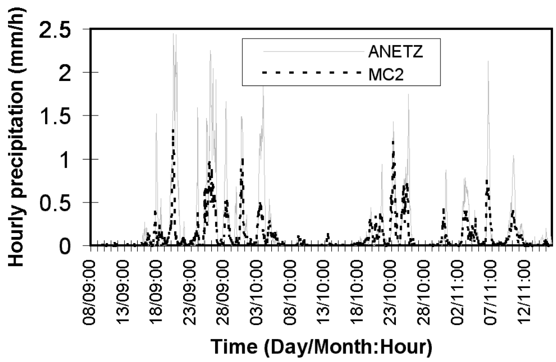

Figure 2: Hourly precipitation predicted by MC2 and observed by ANETZ stations.

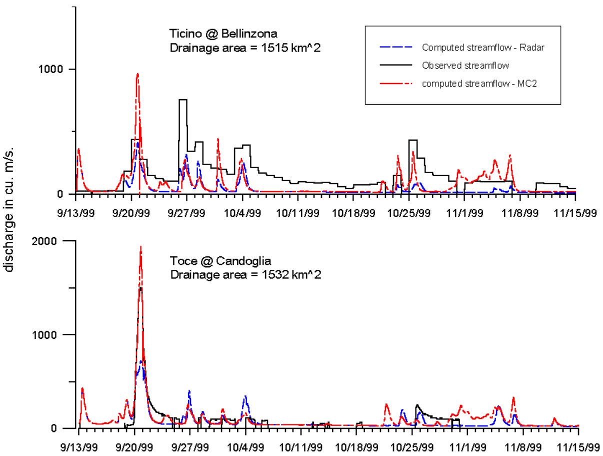

Figure 3: Observed and computed streamflow for the MAP – SOP for the Toce and Ticino Rivers.

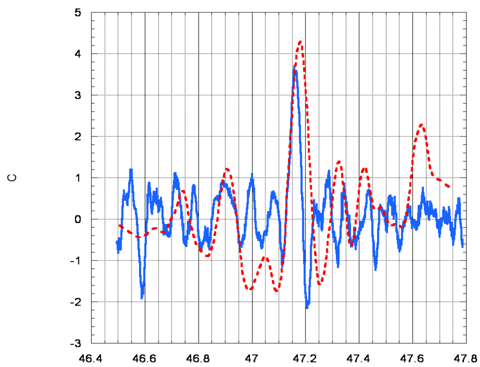

Figure 4: Vertical velocity observed by Electra (in solid line) at altitude of 6400 m ASL, and simulated by MC2-1km (in dashed line) at an altitude of 6500 m ASL for IOP 15. Abscissa is latitude of flight track.

Extended Abstracts from the MAP Meeting 2000, Bohinjska Bistrica, Slovenia

SESSION P1 Orographic precipitation mechanisms

SESSION P3: Hydrometeorological measurements and flood forecasting

SESSION P4 Dynamic of gap flow

SESSION P5 Unstationary aspects of Foehn in a large valley

SESSION P6 Three-dimensional gravity wave breaking

SESSION P7 Potential vorticity banners

SESSION P8 Structure of planetary boundary layer over steep topography