7 Forecasting Support

as of 15 July 1999

7.1 Forecasting Office

A. Situation

The Forecast Office (FO) is part of the MAP Operations Centre (MOC). It is situated within the rooms of the Austrian Aviation Weather Service (ACG) at Innsbruck Airport, in the vicinity of the civil Austrian weather service (ZAMG). The FO on the ground floor has about 46 m^2 (cf. plan of the FO in chapter 10).

B. Technical equipment

3 SUN workstations, 4 PC's, 2 printers, phone, fax.

C. Network

The Forecasters will dispose of both the large set of data especially designed for MAP-SOP and of the routine analysis and forecast tools from the Austrian national weather services. This means that the forecasters at MOC will have access to the operational network of the national weather services ACG and ZAMG. They can use the visualisation-tools of the NWS's, which are not available outside of the NWS-network. Due to reasons of security it was necessary to install two independent networks in the FO: One is part of the NWS-network, the other network distributes all data especially tailored for MAP (MOC - network). The latter one is open to the MAP community on the intranet, and all data there have to meet a common format which is compatible to Internet browsers. So the majority of data in the FO are delivered by two different ways, giving high security and reliability. The MOC network is schematically shown in Fig. 7-1.

7.2 Staff

All MOC-forecasters coming from different parts of the Alps, from the U.S. and Canada are members of the Forecasters Working Group. Founded in 1996 this group did a lot of work to be well prepared for the MAP-SOP. About 25 forecasters will do their shifts in the MOC-FO. Additionally they will be supported by operations staff (Section), and if necessary, also by the local staff of the NWS's.

7.2.1 The training exercises of the Forecasters Working Group

As the members of the Forecaster Working Group come from different countries and weather services it was necessary to develop procedures of cooperation, to initiate an exchange of know-how and to share operational forecasting methods adapted to MAP-related meteorological phenomena. Therefore a joint activity for monitoring and documenting MAP relevant meteorological situations occurring during the extended MAP season (June to November, 1996 to 1998) was initiated. Since fall 1998 the Forecaster Working Group was authorized to suggest test runs of the MAP experimental NWP MC2 and of Meteosat 6 - rapid scans by EUMETSAT.

7.2.2 Meteorological handbook and checklist

In order to ensure a uniformly high standard of forecasting knowledge and skills for the entire MAP area a meteorological handbook was compiled on the basis of contributions from forecasters with excellent knowledge of MAP phenomena relevant for their area of experience. These contributions are distilled into a checklist which will serve as meteorological guidelines for the work during MAP-SOP. Additionally this handbook will become a unique collection of meteorological knowledge and experience for different parts of the Alpine region.

7.2.3 Forecaster shifts at MOC Innsbruck

as of 15 July 1999

The Forecasting Office will be open from 03:00 to 19:00 UTC, extension will be possible on request. A shift of 4 forecasters was established with 3 forecasters on duty every day (Table 7-1 and Fig. 7-2):

- **E**(arly shift) 03:00 - 11:00 UTC
- **D**(ay shift) 04:00 - 12:00 UTC
- **L**(ate shift) 11:00 - 19:00 UTC

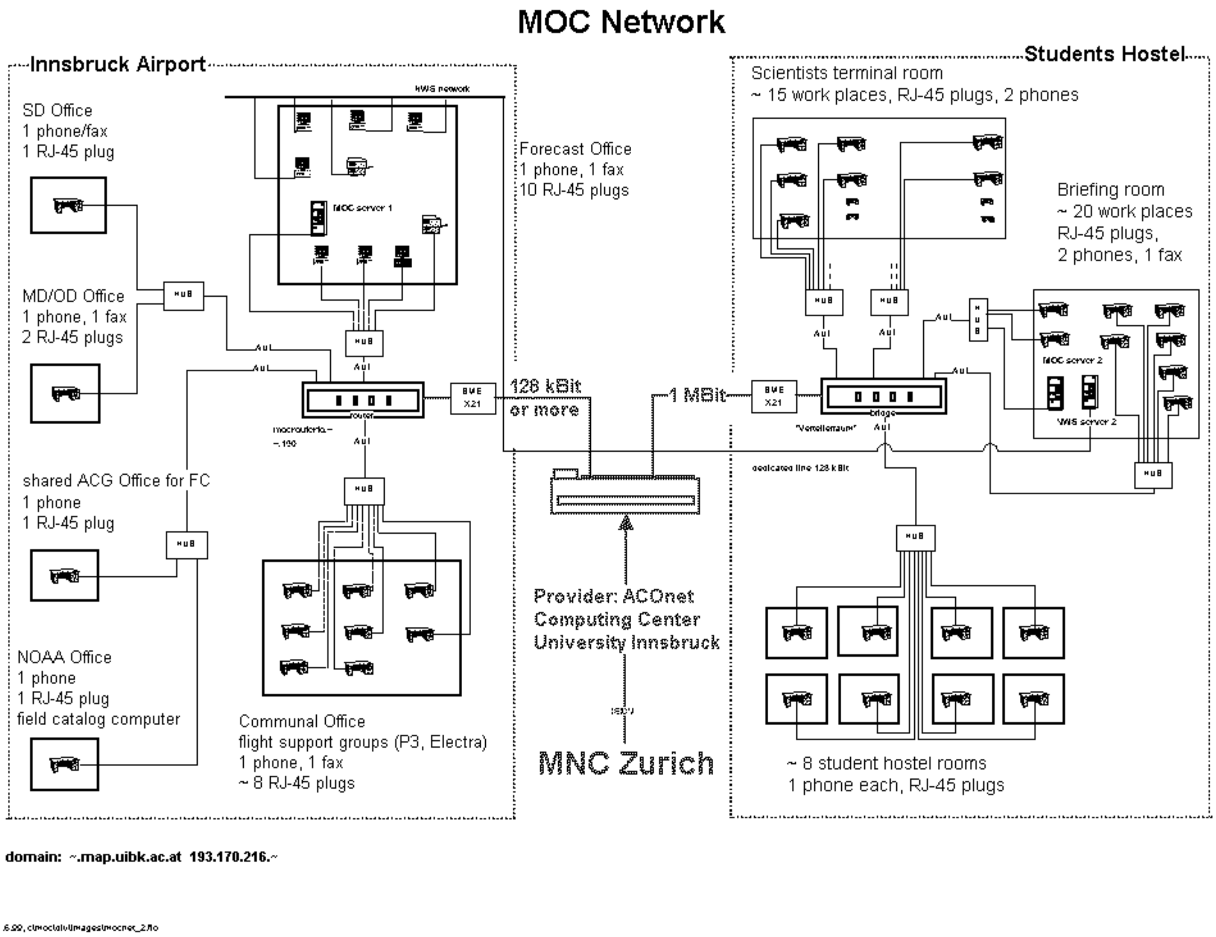


FIGURE 7-1. Schematic of the network at MOC Innsbruck (MOC-net + NWS-net)

TABLE 7-1. Shift plan (state of July 1999).

Date								
5.9	L	Front ero	D	Snyd er	F	Velka vrh	E	Thale r
6.9	F		E		D		L	
7.9	D	Frontero 1a	L	Snyder 1b	E	Velkavrh 1c	F	Thaler 1d
8.9	E		F		L		D	
9.9	L		D		F		E	
10.9	F		E		D		L	
11.9	D	Frontero 2a	L	Snyder 2b	E	Velkavr h 2c	F	Willemse 2d
12.9	E		F		L		D	
13.9	L		D		F		E	
14.9	F		E		D		L	
15.9	D	Frontero 3a	L	Snyder 3b	E	Velkavrh 3c	F	Selvini 3d
16.9	E		F		L		D	
17.9	L		D		F		E	
18.9	F		E		D		L	
19.9	D	Alessio 4a	L	Cremo- nini 4b	E	Willemse 4c	F	Selvini 4d
20.9	E		F		L		D	
21.9	L		D		F		E	
22.9	F		E		D		L	
23.9	D	Alessio 5a	L	Cremo- nini 5b	E	Willemse 5c	F	Selvini 5d
24.9	E		F		L		D	
25.9	L		D		F		E	
26.9	F		E		D		L	
27.9	D	Alessio 6a	L	Cremo- nini 6b	E	Willemse 6c	F	Ivancan-Picek 6d
28.9	E		F		L		D	
29.9	L		D		F		E	
30.9	F		E		D		L	
1.10	D	Vile 7a	L	Tentler 7b	E	Mahringer 7c	F	Ivancan-Picek 7d
2.10	E		F		L		D	
3.10	L		D		F		E	
4.10	F		E		D		L	
5.10	D	Vile 8a	L	Wolz 8b	E	Mahringer 8c	F	Ivancan-Picek 8d
6.10	E		F		L		D	
7.10	L		D		F		E	
8.10	F		E		D		L	
9.10	D	Vile 9a	L	Wolz 9b	E	Mahringer 9c	F	Ruffie 9d
10.10	E		F		L		D	
11.10	L		D		F		E	
12.10	F		E		D		L	
13.10	D	Roulet 10a	L	Trimmel 10b	E	Poredos 10c	F	Lefort 10d
14.10	E		F		L		D	
15.10	L		D		F		E	
16.10	F		E		D		L	
17.10	D	Roulet 11a	L	Trimmel 11b	E	Poredos 11c	F	Lefort 11d
18.10	E		F		L		D	
19.10	L		D		F		E	
20.10	F		E		D		L	
21.10	D	Muller 12a	L	Trimmel 12b	E	Poredos 12c	F	Lefort 12d
22.10	E		F		L		D	
23.10	L		D		F		E	
24.10	F		E		D		L	
25.10	D	Muller 13a	L	Lombroso 13b	E	Lanzinger/ Colman 13c	F	Tescaro 13d
26.10	E		F		L		D	
27.10	L		D		F		E	
28.10	F		E		D		L	
29.10	D	Muller 14a	L	Lombroso 14b	E	Lanzinger/ Colman 14c	F	Tescaro 14d
30.10	E		F		L		D	
31.10	L		D		F		E	
1.11	F		E		D		L	
2.11	D	Seidl 15a	L	Lombroso 15b	E	Lanzinger/ Colman 15c	F	Tescaro 15d
3.11	E		F		L		D	
4.11	L		D		F		E	
5.11	F		E		D		L	
6.11	D	Seidl 16a	L	Tuts 16b	E	Neururer 16c	F	Buchauer 16d
7.11	E		F		L		D	
8.11	L		D		F		E	
9.11	F		E		D		L	
10.11	D	Thaler 17a	L	Tuts 17b	E	Neururer 17c	F	Buchauer/Zi ngerle
11.11	E		F		L		D	
12.11	L		D		F		E	
13.11	F		E		D		L	
14.11	D	[illegible] r 18a	L	Tuts 18b	E	[illegible] urer 18c	F	[illegible] rle 18d
15.11	E		F		L		D	

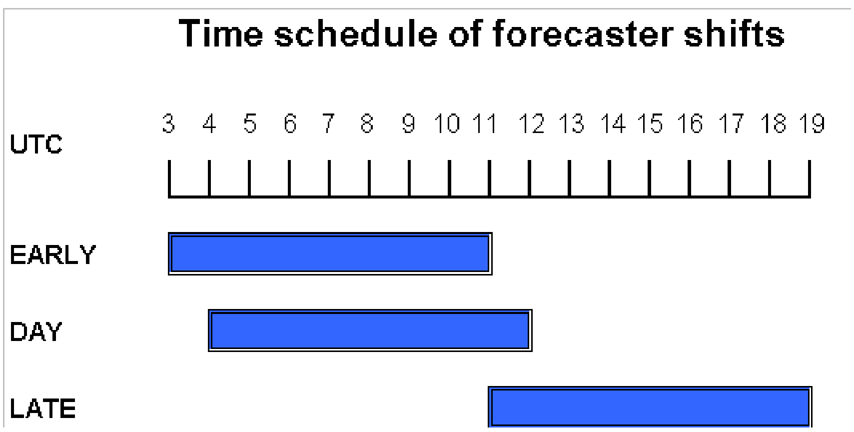


FIGURE 7-2. Forecaster shift scheme.

- **F**(ree)

Shift rotations are D-E-L-F or L-F-D-E or E-L-F-D or F-D-E-L. The off-duty forecaster has to be available for supplementary duties during IOPs.

During IOPs:

- Shifts may be extended when necessary.
- The shift "Free" may be called in to supplement Early, Day or Late.
- Auxiliary forecasting support will be available (MOC team, local staff, MOC forecasters on extension).
- Student assistants serve as additional staff.

post-IOP periods:

For days when no operations are planned after an IOP, time-off in lieu will be granted to the forecasters. Only a minimum weather survey will be provided (check-up of weather outlook).

The work at MOC puts high demand on the forecasters. The working schedule tries to coordinate the requests from scientists and aircraft crews with the limitations of a small group.

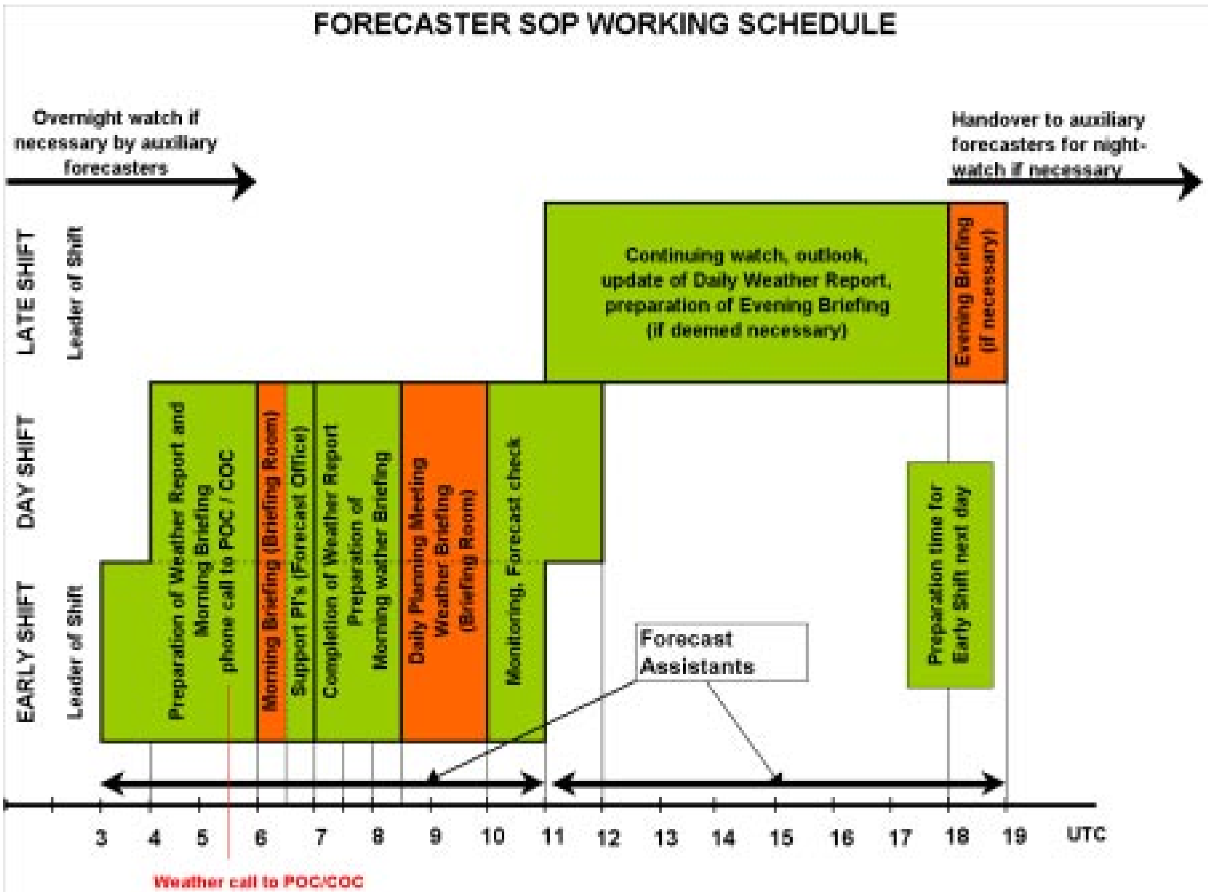


FIGURE 7-3. Forecaster SOP working schedule

7.3 Forecasting / Nowcasting support at the POC

7.4 Support to scientists

The basic requirement to be satisfied by the forecasters is to give support for mission planning and decision making by covering all forecast ranges from medium range (48 - 120h), short range (24 - 48h), very short range (6 - 24h) to nowcasting (0 - 6h), and real-time mission support. During missions a team formed by a forecaster and a ground-based mission scientist shall provide real-time guidance to the aircraft and radar teams.

Only a restricted number of persons will have access to the Forecasting Office. After the core briefing, which will be held in the briefing room, a limited group with the scientific director, operations director, principle investigators, MOC-personnel and forecasters can continue in-depth weather discussions in the Forecast Office. The main briefing will take place in the Student Hostel. This 'briefing room' is also intended to be a general information- and communication centre. Therefore one of the forecasters / student assistants will be available in the briefing room during fixed hours.

7.4.1 Structure of Daily Forecast Reports

as of 1 September 1999

At least once a day the forecasters will provide a written weather forecast which will be included in the MAP Field Catalogue. At approximately 9 UTC the daily forecast report will be available over internet. The report contains the following main features:

i) Matrix of expected potential for MAP-relevant weather phenomena

For each forecast day from D1 to D3 every important weather event (heavy precipitation south of Alps, South Foehn, North Foehn) is assigned to one of four subjective probability classes: **nil, possible, likely, certain**. It expresses the likelihood of an event belonging to one of the 8 scientific projects. The indices depend primarily on criteria and thresholds outlined in the meteorological checklists and on the personal experience of the forecaster.

TABLE 7-2. Probability Matrix for MAP scientific projects. Indices: nil, possible, likely, certain

Weather event	Target area	D1=today	D2	D3
heavy precipitation south of the Alps	Lago Maggiore	certain	possible	nil
	NE-Italy / Slovenia	nil	likely	certain
South Foehn	Rhine Valley	certain	likely	nil
	Wipp Valley	certain	certain	possible
North Foehn	Po Valley	nil	nil	possible
strong westerly flow (gravity wave activity)	western Alps	nil	nil	nil

ii) General Overview (D1 - D6)

- synoptic development
- continuity check of models
- ensemble forecasts
- general overview of possibility of occurrence of different scientific objectives, structured

by forecast ranges D1, D2, D3, D4 - D6 (D0 is initial time of the ECMWF 12 UTC run).

iii) Description

For every important weather event whose probability index is at least 'possible' a detailed description of the decision finding process will be given. Arguments for and against the scientific projects P1 - P8, locations within target areas, intensities, etc. This description will be structured by the weather events and forecast times:

- heavy precipitation south of the Alps: HP-NW, HP-NE; P1-P3, P8
- South Foehn in the Rhine Valley and / or Wipp Valley: SF-RV, SF-GAP; P4-P8
- North Foehn: NF-PV; P7
- strong westerly flow over the western Alps: GWA; P6

where

- P1 orographic precipitation mechanisms
- P2 incident upper-tropospheric PV anomalies
- P3 hydrological measurements for flood forecasting
- P4 dynamics of gap flow
- P5 unstationary aspects of Foehn in a large valley
- P6 three-dimensional gravity wave breaking
- P7 potential vorticity banners
- P8 structure of the PBL over steep orography

iv) Discussion

Comments and suggestions coming from discussions during briefings will be mentioned here.

v) Review of the daily forecast report and finalizing for documentation

7.4.2 Summarised Overview of Forecast Criteria

as of 15 July 1999

TABLE 7-3. Abbreviations: GM: Global NWP model (ECMWF, also EPS products, DWD); LAM: Limited Area Model (Aladin LACE, Swiss Model, LM 7.5 (DWD) and experimental model MC2); TA: Target Area

South Western Alps Heavy Precipitation Target Area: Lago Maggiore Projects: P1, P2, P3, P8	**South Eastern Alps Heavy Precipitation Mission Areas: Friuli and Slovenia Projects: P1, P2**	**North Foehn over Northern Italy Projects: P6, P7**	**South Foehn (deep or shallow) Target Areas: Rhine Valley, Wipptal (Brenner pass) Projects: P2, P4, P5, P6, P8**
General features, synoptic situation & development D6 – D3			
Deep trough over W Mediterranean with strong S – SW flow over the target area Trough axis: position and movement, especially stationary situations Cyclogenesis over Genova or N – Adriatic Sea Passage of Cold front No cut off	Deep upper trough over W Mediterranean with strong S-SW flow over MA, especially stationary situations Cyclogenesis over Gulf of Genova or N Adriatic Sea No cut off Passage of frontal system Orographic effects often underestimated	Deep trough over Central Europe with N - S oriented axis over the Alps Direction of Jet NNW over Alpine ridge	Deep trough over the W Mediterranean, Cyclone over the Atlantic or over the North sea especially slow moving or stationary systems cold fronts slowly approaching from west
Criteria & thresholds for D 3			
• Evaluation based on GM's • $\underline{v}_h$ 700 – 300 hPa > 20 ms^{-1} SSW • $\underline{v}_h$ 850/925 hPa > 10 ms^{-1} ESE • w 700/500 hPa > 5 cms^{-1} • Φ 1000 hPa: A over Balkan • large gradients in height of 2 PVU increasing S – flow • Tropopause anomaly • Origin of trajectories over Mediterranean • Cross-sections: θe + RH • Tot.precip > 40 mm / 24 h, > 25 mm / 12 h • Stability indices: Whiting > 25 Showalter < 0: intensification KO ≤ -5	• Evaluation based on GM's • $\underline{v}_h$ 700 & 500 hPa > 15/ 20 ms^{-1} S - SW • $\underline{v}_h$ 850 hPa > 10/15 ms^{-1} SE - S for W Friuli, S - SW for E Friuli and W Slovenia • $\underline{v}_h$ 925 hPa & 10 m E-S, scirocco before the front • Trajectories 500 to 850 hPa: typical pattern shifting from 260° towards 190° • Stability index: SSI (0: convective intensification • Height of 2 PVU: details of trough axis, conv. intensif. • RH 850 & 700 hPa > 80%	• Direction of $\underline{v}_h$ 500 hPa between 300° and 360° • Φ 850 hPa: δT/δt ≤ -8 K (over W Alps) • "Foehn nose", Δp between North and South > 12hPa	• Use of GM's • Position of ridge axis east of Alps: deep foehn, over Alps: shallow foehn • Direction of $\underline{v}_h$ 500 hPa: 150° - 250°: **+** 120° - 150°, 250° - 280°: **?** 280° - 120°: **-** • Direction of $\underline{v}_h$ 700 hPa: S - SW: deep Foehn W or weak: shallow Foehn Surface pressure: "Foehn nose": **+** weak gradient: **?** p (North) > p (South): **-** • T 850 hPa: Po valley < North of Alps: **+** No difference: **?** North of Alps cooler: **-**
General features, synoptic situation and development D2 & D1			
• Evaluation based on LAM's, consistency of GM's, retardation or speed up, secondary cyclogenesis over Gulf of Genova, scirocco over the Adriatic Sea, low level SE flow over Po valley, unstable air mass, position of cold front, A over Balkan area	• Compare fields of GM's (especially Φ 1000 & 500 hPa, RH, precipitation) • Be suspicious in the case of retardation or acceleration of trough movement • unstable air mass gives additional convective precipitation (stationary-like Cb's over Adriatic) • N - Mediterranean cyclogenesis, passing fronts		• Consistency check, evaluation based also on LAM's • Position of fronts: Cold front/Occlusion approaching from W - S: **+** Front moving slowly: **+** Warm front approaching from S: **?**

TABLE 7-3. Abbreviations: GM: Global NWP model (ECMWF, also EPS products, DWD); LAM: Limited Area Model (Aladin LACE, Swiss Model, LM 7.5 (DWD) and experimental model MC2); TA: Target Area

South Western Alps Heavy Precipitation Target Area: Lago Maggiore Projects: P1, P2, P3, P8	**South Eastern Alps Heavy Precipitation Mission Areas: Friuli and Slovenia Projects: P1, P2**	**North Foehn over Northern Italy Projects: P6, P7**	**South Foehn (deep or shallow) Target Areas: Rhine Valley, Wipptal (Brenner pass) Projects: P2, P4, P5, P6, P8**
Criteria & thresholds for D2 & D1			
• $\underline{v}_h$ 700 – 300 hPa SSW, front side of trough no cut off • $\underline{v}_h$ 850 hPa SSE for Piedmont, SSW for Lombardy/ Lago Maggiore • w 500 hPa > 5 cms^{-1} ? • w 700 hPa > 3 cms^{-1} ? • $\underline{v}_h$ 500 hPa > 20 ms^{-1} SSW • $\underline{v}_h$ 700 hPa > 15 ms^{-1} SSW • $\underline{v}_h$ 850 hPa > 10 ms^{-1} SSE • $\underline{v}_h$ 925 hPa > 10 ms^{-1} SE • $\underline{v}_h$ 10 m > 5 ms^{-1} ESE • p (TA) < -10 hPa/24 h • RH 850 – 700 hPa > 80% • evidence of low level moisture convergence • Stability indices: Showalter<0, Whiting>25, KO ≤ -5, CAPE>900 J/Kg • RR in 24/12/6 h: GM: >40/>25/>20 mm LAM: >100/>60 />40 mm • Prob. RR>40 mm/ 24 h>75% based on EPS • Timing and intensity: Meteograms, Time-Height-Sections, Vertical Cross-Sections	• $\underline{v}_h$ 700 – 300 hPa SW, front side of trough, no cutoff $\underline{v}_h$ 850 hPa SE - S for W Friuli, S - SW for E Friuli and W Slovenia • $\underline{v}_h$ 500 & 700 hPa > 15/ 20 ms^{-1} S - SW • $\underline{v}_h$ 850 & 925 hPa > 10/ 15 ms^{-1} SE - S for W Friuli, S - SW for E Friuli & W Slovenia • $\underline{v}_h$ 10m 5/8 ms^{-1} S - SE • RH 850 – 700 hPa > 80% • Stability index: SSI ≤ 0: attention on coastal values • RR amount: 40 (GM) -.100 (LAM) mm / 24h • RR type: convective / stratiform? • Trajectories typical pattern 500 hPa: 260° - 230° 850 hPa: 230° - 190° • Low level convergence fields over Mediterranean • Meteograms & Time-Height-Sections: Teolo, Udine, Pula, Ljubljana • Vertical cross-sections: Corsica-Trieste-Vienna, St. Gotthard - Zagreb • satellite & radar images, lightning for detecting of rapid developments and intrusion of dry air	• LAM forecasts: $\underline{v}_h$ 10 m > 8 ms^{-1} W - NNE (W part of Po valley) $\underline{v}_h$ 700 hPa > 10 ms^{-1} & $\underline{v}_h$ 10 m > 4 ms^{-1} NNW - NNE (E part of Po valley and Foehn valleys) • Surface Temp. and RH field: strong warming and drying • Δp > 4 K, ΔRH < -40% in the Po valley • Analysis at D1: Surface Pressure: δp/δt (North of Alps) > δp/δt (Po valley) • Compare observed soundings with pseudo soundings over Northern Italy (air masses) • Evaluation of potential energy of the cold and humid airmass at 700 hPa • Evaluation of instability generated by north foehn and of maximum kinetic energy available (for turbulent and gusty surface winds)	• LAM forecasts: • Gridpoints: $\underline{v}_h$ 700 hPa > 7 ms^{-1}, $\underline{v}_h$ 500 hPa > $\underline{v}_h$ 700 hPa, Warming & drying effects at 850 hPa & 700 hPa, • Cross-Sections along the Wipptal, Time - Height - Sections north and south of the Alps: θ_e+RH, θ_e+θ, • $\underline{v}$, ω • hint for GWB: stable layer 2500 - 3000 m, unstable above with decrease of windspeed • Observations: Temps Milano, Verona, Vipiteno, Innsbruck, München, high resolution data for GWB Windprofiler Innsbruck, Julier Pass • Synops: Gütsch, Säntis, Feldberg, Galzig, Warth, Ischgl, Pitztaler Gletscher, Zugspitze, Patscherkofel, Brenner, Ehrenbachhöhe, Wendelstein, Altdorf, Chur, Vaduz, Feldkirch, Oberstdorf, Kempten, Reutte non-synop stations: Sattelberg, Igls, Hafelekar Olympisches Dorf, Bahnhof • Satellite images - Foehn wall

Of course these meteorological checklists are not more than useful guidelines. In many cases some of the criteria will not be satisfied, and additionally the criteria are not independent from each other. Therefore they need to be evaluated by the experienced forecaster, who adds substantial subjective aspects to the forecast

7.5 Availability of data and products

as of 20 May 1999

In principle all data and products offered to the forecasters in their office are available for scientists in the briefing room. The data of both networks (MOC-net and NWS-net) will be represented in the briefing room. The MOC-net is accessed via the MOC data server II, which is a mirror of MOC data server I, and the data of the NWS-net are visualised by a software created by ZAMG (MAVIS). In addition, the MOC-data servers will be connected to the MAP Data Centre (MDC) in Zurich and to the Project Operation Centre in Milano.

7.5.1 Observational data from meteorological services

A. NWS-network:

- Standard GTS data: SYNOPs, TEMPs, metars, forecasts
- Visualisation tools:
    - surface data (MAVIS)
    - radiosoundings GTS-format (TLOGP, METWATCH, RAOB)
    - radiosoundings high resolution (MAP software)
    - radars 2 dimensional images (Austrian Network & European Composite, VIIS)
    - Austrian Lightning Detecting System (MAVIS)
    - objective analysis: 2- and 3 dimensional (VERA)Alpine Composite of lightning detection (project)

B. MOC-network:

- Format: Internet browser compatible
- real-time hourly surface data from automatic stations: (A, CH, D, F, I, SI)
  (The operations staff will be in charge of producing graphical products from the observational data bases as needed)
- radiosonde data GTS format & high-resolution data from selected stations
- Windprofiler (CWINDE-99)
- radar-images (A, CH, D, F, I)

7.5.2 NWP products

A. NWS-Network:

Operational model output of ECMWF, DWD, ALADIN/LACE

B. MOC-network:

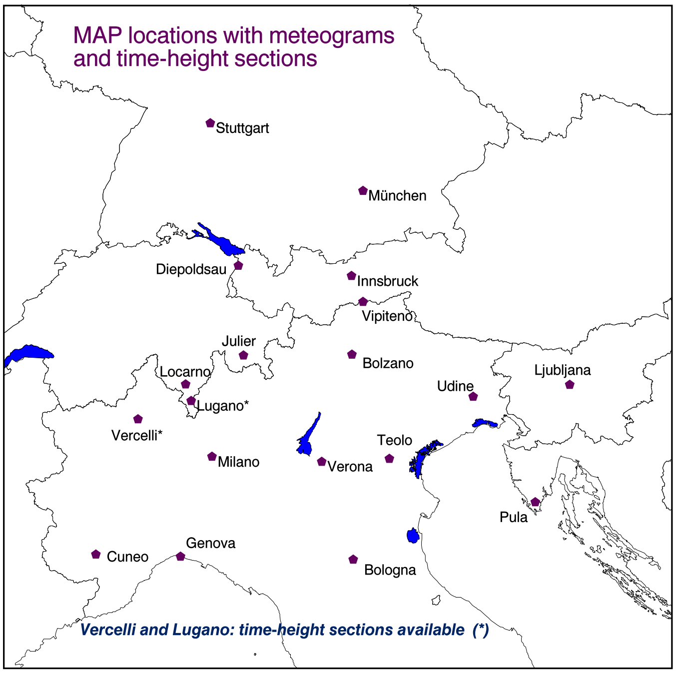
A large number of forecast charts were designed especially for MAP. The list of meteorological parameters, the time steps, the location of vertical sections etc. have been discussed exhaustively by scientists and forecasters. As no interactive use of the NWP products is possible, a large number of potentially interesting charts will be produced every day (about 800 charts per model run). Besides the global model ECMWF, the following LAM's are in preparation for MAP-SOP: Swiss Model, Local Model of DWD, ALADIN/LACE (see Table 7-4 and Table 7-5). A special support for forecasters and scientists will be given by the output of the MC2 model, the experimental NWP of MAP (see Section 7.7)

TABLE 7-4. NWP products of the ECMWF model for the MOC Forecasting Office.

level	products	remarks
horizontal sections **t_0=00, 12UTC; range:+ 60h by Δt=6h, +120h by Δt=12h,** **domain: 15˚W – 30˚E, 35˚N – 60˚N**		
300hPa	Φ + |v| (jets); ζ_{shear}, ζ_{curv} (complementary)	v + ζ_a, for comparison with regional models
400hPa	Φ + RH	
500hPa	Φ + T, v + VA (pos. ζ-advection)	
700hPa	Φ + T; RH; ω	
850hPa	Φ + T; Φ +RH; ω	
850-500hPa	humidity (integrated), TFP	TFP: thermal front parameter
1000-500	relative topography	
surface	p_{msl}+ topography (1000, 2000m); RR_{tot}, RR_{conv}, RR_{strati},	
100hPa	Φ + |v|, T	add. products for gravity wave-breaking objectives
300hPa	T	
~315K	isentropic PV	add. products fro the ULF objectives
2pvu (tropopause)	pressure height	
vertical profiles up to 15km (raso, model)		
trajectories (p-level)		
ECMWF Ensemble Prediction System (EPS) products		
500hPa	ensemble mean and spread: Φ; clusters for area “C”-SW Europe	
850hPa	ensemble mean and spread: T	
probability maps	24h precipitation for thresholds 1mm/10mm for days +3/+4/+5 (cf. ECMWF Tech. Mem. #248)	
“plumes”	time series of spread: T850, Φ500, RR	at meteogram locations
tubing		special product from Meteo France

TABLE 7-5. Products of LAMs (SM, ALADIN/LACE) for the MOC Forecasting Office.

level	**products**	**remarks**
horizontal sections Δt=6 h, t_0=00, 12 UTC + 48 h, domain: 2-19°E, 42-50°N		
300 hPa	$\Phi + \lvert\underline{v}\rvert$, $\underline{v}$ + AV, div, T	AV: absolute vorticity
400 hPa	Φ + RH	
500 hPa	$\Phi + \omega$, T + RH, $\underline{v}$ + AV	
700 hPa	$\Phi + \omega$, T + RH, $\underline{v} + \lvert\underline{v}\rvert$	
850 hPa	Φ + T, Φ + RH, $\theta_w + \underline{v}$, PV + $\underline{v}$, helicity	
925 hPa	div($q\underline{v}$)	moisture convergence
500 m.a.g.	$\underline{v} + \lvert\underline{v}\rvert$	on model level
surface	p_{msl}+ topography (1000, 2000 m), T_{2m}, TFP, RH_{2m}, $\underline{v}$	TFP: thermal front parameter
tropopause	height of 2 pvu	
stability	CAPE, $\Delta\theta_w$ (500-850 hPa), (CIN)	CIN: convective inhibition
precipitation	RR, strat. RR, conv. RR, snow level	
cloudiness	TCC, C_l, C_m, C_h	TCC: total cloud cover
100 hPa	$\Phi + \lvert\underline{v}\rvert$, T	small contour intervals for T to allow for detection of gravity waves
300 hPa	T	
vertical cross sections Δt=6 h, t_0=00, 12 UTC + 24 h, vertical axis: height		
zonal at 44, 46, 48 N; meridional at 11 E, others[a] (up to 15 km)	θ_e + RH, θ + PV, $v_n + \underline{v}(v_n, w)$, $v_p + \underline{v}(v_p, w)$	v_n: normal to section; v_p: parallel to section
meteograms (representation according to the available operational product)		
time-height sections at sounding locations T + RH, $\theta_e + \theta$, $\underline{v} + \lvert\underline{v}\rvert$		



a) Freiburg (48.0N, 7.850E)–Zagreb (45.817N, 16.033E); Calvi (42.533N, 8.80E) - Wien (48.235N, 16.352E); along Gotthard

TABLE 7-6. Products of HR LAMs (MC2, LM, MM5, COAMPS, etc.)

level	products	remarks
horizontal sections Δt=6h, t_0=00, 12UTC + 48h, domain: 2-19˚E, 42-50˚N		
100hPa	Φ + $\lvert \underline{v} \rvert$, T, Ri	small contour intervals for T to allow for detection of gravity waves
300hPa	Φ + $\lvert \underline{v} \rvert$, T, Ri	
400hPa	Φ + RH	
500hPa	Φ+ ω, T + RH, $\underline{v}$	
700hPa	Φ + ω, T + RH, $\underline{v}$ + $\lvert \underline{v} \rvert$	
850hPa	Φ + T, Φ + RH, θ_w + $\underline{v}$, PV + $\underline{v}$, AV	
500m.a.g.	$\underline{v}$ + $\lvert \underline{v} \rvert$	on model level
surface	p_{msl}+ topography (1000, 2000m), T_{2m}, RH_{2m}, $\underline{v}$	
precipitation	RR, snow level	
cloudiness	TCC, C_l, C_m, C_h, vertically integrated non-precipitating condensed water (total could water, all species)	TCC: total cloud cover
vertical cross sections, time-height sections and meteograms as for LAMs		

7.5.3 Satellite products

The following satellite imagery will be available in real time in the Forecast Office and in the briefing room:

A. NWS-net:

- all METEOSAT 7 products (IR, WV, VIS)

B. MOC-net:

- all METEOSAT 7 products (IR,VIS: half-hourly; WV: hourly)
- NOAA IR / VIS images (2 times per day)
- EUMETSAT will provide rapid scans from METEOSAT 6, see Section 2.8.

7.6 Domestic meteorological information at the POC

as of 20 May 1999

In addition to all the data and products available over the MNC (which is equivalent to the MOC-net) CMR, as regional meteorological centre, has its own facilities which are also available to the POC forecaster.

General meteorological information at the POC: is locally available via POC server and POCLAN. The Oracle DB is namely kept updated by MNC with the required frequency at MOC and POC. Therefore, all the meteorological information operationally acquired by the MAP community is also available in real or quasi real time at POC (see above). Further, CMRLAN feeds the POC server with the operational meteorological information normally available at CMR for the normal operational routine (GTS, ICAO, ECMWF, EUMETSAT, etc:

see Table 7-7). CMR Forecasters will also independently provide normal briefings to pilots and crews on request.

TABLE 7-7. General meteorological information locally available on POCLAN via CMRLAN/CNMCA (independent from MNC/MOC/POC link)

Met. Reports	Model Maps	Satellite Pictures	Radar Pictures
SYNOP	ECMWF 00 UTC:	Meteosat 7 VIS	Treviso Istrana
TEMP/PILOT	AU/AS	" 7 IR	Pisa
GRIB/GRID	FU/FS/P+72 h	" 7 WV	It.Met.Ser. Comp.
RADOB	PS+T850	NOAA 13	Spino d'Adda
SATOB	H700+p.W.	" 14	Bric della Croce
SFLOC	H500+w700	Nephoanalysis	S.P. Capofiume
METAR	ECMWF 12 UTC:		Teolo
AIREP/PIREPS	AU/AS		Fossalon
SIGMET	FU/FS/P+168 h		
AIRMET	PS+T850		
Mesonets (Italy)	H700+p.W.		
HR radiosound.	H500+w700		
	ILAM[a)] 00+12 UTC *		
	AU/AS		
	FU/FS/P+72		

a) ILAM: Italian Local Area Model

Local meteorological information at the POC: a lot of surface and radar observations are originated in Northern Italy. Therefore, POC is also intended to be the collector of such information, which is to be made operationally available to the MAP community at POC and MOC. In particular, a number of automatic weather station (AWS) and of operational radars will be provided to POC in real or quasi real time from regional and local Italian agencies (see Section 4.5.2 and Section 6.4). High resolution radio soundings are also regularly available in real time at CMR from the local station 16080 – Milano Linate, from 16044 Udine Rivolto and from Cagliari 16560.

7.7 MC2 experimental forecasts

as of 20 May 1999

In addition to the operational global and limited-area NWP models mentioned in Section 7.5.2 as available for MAP, the Canadian non-hydrostatic research LAM known as MC2 will produce ultrafine experimental forecasts during the MAP SOP. The MC2 is nested within the Swiss Model (SM) and does not perform any further data assimilation: it takes its initial and lateral hourly boundary conditions from the latest run of the SM. The definition of the surface physiography is taken from high-resolution digital elevation models (~200 m) and soil/vegetation database (~1km). For MAP, MC2 is run on the NEC-SX/4 computer at the CSCS (Centro Svizzero di Calcolo Scientifico) in Manno (Canton Ticino, Switzerland). The SM data is transmitted to Manno from the computing centre of ETH in Zurich, where the SM is run. This MC2 activity is known as MC2opr4MAP.

FIGURE 7-4. Targeted domain of the MC2 for MAP. Model topography is shown with a 1000 m contour interval.

Work is still going on to finalize all aspects of the model runs. The latest information is accessible at the MC2opr4MAP web site, http://www.cmc.ec.gc.ca/rpn/map/. The content of this web site is expected to evolve until the end of the SOP.

Currently, the target configuration of MC2 for MAP is as follows:

- Grid: 350 x 300 x 50 levels. Meshsize = 3km. Polar stereographic projection, true at 60° N, central meridian = 10° E. Navigational parameters are given on the MC2opr4MAP web site. Domain shown on Fig. 7-4.
- Timestep: 30 s.
- Model top: 25km, as dictated by the SM nesting.
- Nesting: latest 12 UTC SM run.
- Forecast period: at least 24 h free of spin-up, total up to 30 h.
- Forecast window: [00 UTC - 00 UTC] excluding the spin-up.
- CPU time: about 5 h on 10 concurrent SX-4 processors. Dedicated mode.
- Raw output files: post-processing is interleaved with the MC2 run. Terminates at about same time as the model run.

The following wallclock schedule is expected:

- SM-run on ETH Cray: Start at 14:30 UTC, results available at ~16 UTC, as in current operational schedule.
- MC2-run on CSCS NEC SX/4: Start of integration at 22:00 LT, run terminates shortly before 03:00 LT.

This implies that results would become available at 1:00 UTC (summer time, first part of experiment) and 2:00 UTC (second part of the experiment), respectively. Since take off of research aircraft is not before 6:00 LT, this two-hour lapse appears well sufficient for the operational constraints of mission planning.

7.8 Summary of operational support by Weather Services

as of 1 September 1999

Requested data and products for MOC-POC.

TABLE 7-8. Real-time product providers for the MOC-FO

providing Met. Service	fore-casters	extra raso	high-res surf. networks	radar	NWP	other
ZAMG	4	72	TAWES	*CERAD*	ECMWF Aladin-LACE	METEOSAT
ACG	3	102		*A-Composite*		ALDIS (lightning)
Aeron. Militare	2	36		*North Italian stations*		
SMI	2	72	ANETZ, ENET	*CH-Composite*	SM	METEOSAT, NOAA
Météo France	4	336	*1h SYNOP*	*F- Composite*		METE-ORAGE
DWD	2	144	*1h SYNOP*	*D-Composite*	LM 7 km	
C.S.I.M. Teolo			autom. stations	SINA-Composite		
ital. SMR	7	144	autom. stations	yes		
RPN/CAN	1				MC2 3km	
CRO	2	72	*1h SYNOP*			
SI	2	102	*1h SYNOP*			
INM		72	1h SYNOP			
SMC		yes	1h SYNOP			
COST-76 (UKMO)						CWINDE+MAP
DLR				Alpine Composite		

Data and products are delivered to the MAP network either directly via ftp or over the GTS. The GTS-hub for the MAP network is SMI in Zurich. The data and products delivered over the GTS are printed in *italic* in Table 7-8. Most radiosounding messages are fed into the MAP network over the GTS as well.