

APPENDIX A: KEY CONTACT ADDRESSES*as of 1 September 1999*

TABLE A-1. Key contacts at the MOC

Function	desk phone	handy	email	fax
MOC Director	+43-512-17034660	+43-676-5074681	herbert.puempel@ austrocontrol.at	+43-512-17034646
Media Coordinator	+43-512-17034660	+43-699-10451623	herbert.puempel@ austrocontrol.at	+43-512-17034646
Science Director	+43-512-277137	+43-676-5074685	scidir@ mocfo1.map.uibk.ac.at	-
Operations Director	+43-512-17034663	+43-676-6157140	opsdir@ mocfo1.map.uibk.ac.at	+43-512-282273
Facility Status Coordinator	+43-512-282273	+43-676-6157141	fsc@ mocfo1.map.uibk.ac.at	+43-512-282273
Aircraft Operations Support Manager	+43-512-17034609	+43-676-5074686	aosm@ mocfo1.map.uibk.ac.at	+43-512-17036656
Forecasting Office	+43-512-292383	+43-699-10451643	forecaster@ mocfo1.map.uibk.ac.at	+43-512-292774
MAP SOP-Status (passive)	-	+43-699-10451623	-	-

TABLE A-2. Key contacts at the POC

Function	desk phone	handy	email	fax
POC Director	+39 0273904600	0348 7800177	frustaci@ meteolin.mi.infn.it	+39 0273904605
Media Coordinator	+39 0273904600	0348 7800177	frustaci@ meteolin.mi.infn.it	+39 0273904605
Science Coordinator	+39 0273904590	?	mst@meteolin.mi.infn.it	-
Operations Coordinator	+39 0273904591	?	ops@meteolin.mi.infn.it	+39 0273904599
Aircraft Coordinator	+39 0273904592	-	-	-
Forecasting Office	+39 0273904593 +39 0273904623	?	nwc@meteolin.mi.infn.it	-

TABLE A-3. Key contacts at the COC

Telephone general (24 hours)	+41 81 302 35 31 from outside Switzerland 081 302 35 31 from within Switzerland
Telephone Coordination	+41 81 ### ## ## from outside Switzerland 081 ### ## ## from within Switzerland
Fax	+41 81 ### ## ## from outside Switzerland 081 ### ## ## from within Switzerland
email	coc@atmos.umnw.ethz.ch
The status information of the activities in the COC	
Telephone (answering machine)	+41 81 ### ## ## from outside Switzerland 081 ### ## ## from within Switzerland
http://www.map.#####	

as of 1 September 1999

APPENDIX B: AIRCRAFT INSTRUMENTATION

Ground-based instrument tables

J-1: NOAA P-3 Instrumentation

TABLE A-4. NOAA/AOC WP-3 Instrumentation.

Parameter	Instrumentation	Method	Response	Accuracy	Resolution
Meteorological					
Free air temperature	Rosemount Platinum Resistance Thermometer	Immersion	1 s	0.5 C (clear air)	0.03 C
Dew point temperature	General Eastern Cooled Mirror	Air intake	~3 s	0.5 C (clear air)	0.03 C
Static pressure	Rosemount transducer	Pressure sensor	40 Hz	1 mb	0.1 mb
Horizontal wind (computed)	Inertial Navigation & true air speed	computed	40 Hz	1%	0.5 m/s
Vertical wind (computed)	High-resolution angle of attack, pitch angle, vertical acceleration	computed	1 s	-	-
True Air Speed	Temperature, aircraft attitude, & dynamic press.	computed	40 Hz	0.5 m/s	0.1 m/s
Aircraft Attitude					
Ground Speed	Northrop/Delco Inertial Navigation Equipment	Integration of horizontal acceleration	40 Hz	0.5 m/s	0.06 m/s
Track Angle	Northrop/Delco Inertial Navigation Equipment	Integration of horizontal acceleration	40 Hz	0.2°	0.005°
Heading Angle	Northrop/Delco Inertial Navigation Equipment	-	40 Hz	0.1°	0.005°
Pitch Angle	Northrop/Delco Inertial Navigation Equipment	-	40 Hz	0.06°	0.005°
Roll Angle	Northrop/Delco Inertial Navigation Equipment	-	40 Hz	0.06°	0.005°
Dynamic pressure	Rosemount transducer	Pressure sensor	40 Hz	0.5 mb	0.1 mb
Attack pressure (angle)	Rosemount transducer	Pressure sensor	40 Hz	1%	0.1 mb
Sideslip pressure (angle)	Rosemount transducer	Pressure sensor	40 Hz	1%	0.1 mb
Cloud Physics					
Small cloud droplet spectrum	FSSP forward scattering probe	-	-	-	-
Cloud droplet spectrum	PMS Knollenberg 2-D grey probe	-	-	-	-
Hydrometeor size spectrum	PMS Knollenberg 2-D grey probe	-	-	-	-
Cloud liquid water	Johnson-Williams	Hot-Wire	1 s	0.2%	0.1 g m ⁻³
Icing rate	Rosemount	-	-	-	-
Total Water Content	"King" probe (experimental)	Hot-Wire	-	-	-
Radiation					
Sea surface temperature	AOC modified Barnes PRT-5	Infrared radiometer (9.5 - 11 um)	1 s	0.5 C (altitude dependent)	0.1 C
CO ₂ , air temperature	AOC modified Barnes PRT-5	Infrared radiometer (14-16 um)	1 s	0.5 C	0.1 C
Long wave radiation	Eppley radiometers	-	-	-	-

TABLE A-4. NOAA/AOC WP-3 Instrumentation.

Parameter	Instrumentation	Method	Response	Accuracy	Resolution
Short wave radiation	Eppley radiometers	-	-	-	-
Radar					
Radar reflectivity	C-band PPI lower-fuselage (LF)	360 degree scan (horizontal) fan beam	-	-	-
Radar reflectivity	X-band RHI tail (TA), ^{a)}	360 degree scan (vertical)	-	-	-
Radial velocity	Doppler X-band RHI tail (TA)	360 degree (vertical)	-	-	-
Navigational					
Position, ground speed	Northrop/Delco Inertial Navigation Eq., LORAN and GPS (Military Precision)	Integration of horizontal acceleration, satellite	40 Hz	1.5 km (after post processing)	8.3×10^8 km
Radar Altitude	Stewart-Warner (APN-59)	-	1 s	0.01%	1 m
Cloud and Sky Imagery (daylight)					
Side and Nose photography	Video Cameras, video tape	Both sides, forward, bottom	-	-	-

a) Note: LF radar data normally recorded every other scan unless a different rate is requested. TA radar recorded every scan.

TABLE A-5. NOAA P-3 radar characteristics.

Parameter	Tail Radar	LF-Radar
Scanning Method:	RHI, Fore/Aft Scanning	PPI
Wavelength:	3.22 cm (X-band)	5.59 cm (C-band)
<u>Beamwidth:</u> Steerable antenna: - Horizontal - Vertical CRPE flat plate antenna: - Horizontal - Vertical	Steerable antenna: - Horizontal: 1.35° - Vertical: 1.90° CRPE flat plate antenna: - Horizontal: aft: 2.04°, fore: 2.10° - Vertical: aft: 2.10°, fore: 2.10°	Steerable antenna: - Horizontal: 1.1° - Vertical: 4.1°
<u>Polarization (along sweep axis):</u> - Steerable antenna: - CRPE flat plate antenna:	- Steerable antenna: Linear vertical - CRPE flat plate antenna: linear horizontal	Linear-Horizontal
<u>Sidelobes:</u> Steerable antenna: - Horizontal: - Vertical: CRPE flat plate antenna: - Horizontal: - Vertical:	Steerable antenna: - Horizontal: -23.0 dB - Vertical: -23.0 dB CRPE flat plate antenna: - Horizontal: aft: -57.6 dB, fore: -55.6 dB - Vertical: aft: -41.5 dB, fore: -41.8 dB	Steerable antenna: - Horizontal: -23.0 dB
<u>Gain:</u> - Steerable antenna - CRPE flat plate antenna	- Steerable antenna: 40.0 dB - CRPE flat plate antenna: aft: 34.85 dB, fore: 35.9 dB	- Steerable antenna 37.5 dB
<u>Antenna Rotation Rate:</u>	Variable up to 10 RPM	Variable up to 4 RPM
<u>Fore/Aft Tilt:</u> - Steerable antenna - CRPE flat plate antenna	- Steerable antenna: Variable up to $\pm 25^\circ$ - CRPE flat plate antenna: aft: -19.48, fore: 19.25 dB	± 10 horizontal stabilization
Pulse Repetition Frequency	Variable up to 3200 s^{-1}	200 s^{-1}
Pulses Averaged per Radial	32	32
<u>Nyquist Interval:</u> - Radial Velocity - Range	- Radial Velocity: Selectable via staggered PRF - Range: scheme up to ~ 71 m/s. Selectable from base PRF from ~ 46 - 82 km.	- Radial Velocity: Selectable via staggered PRF: - - Range: scheme up to: 371 km
Pulse Width:	0.25, 0.375, or 0.5 usec	6.0 usec

APPENDIX C: NCAR ELECTRA INSTRUMENTATION

J-2: Data Acquisition

- Airborne Data System II (Motorola 69040 based), consisting of two Distributed Sampling Modules (DSMōs), located at the RAF system operators station.
- SunSPARC 5, PowerVideo interface, 16" High Resolution Color Monitor, Sun EXP-2 Disk Drive, Exabyte Model 8505XLS Tape Drives (2 units), Diamond Trackball, HP 3630 PaintJet Printer, APC 600 Uninterruptable Power Supply, located at the RAF system operators station.
- Sony XC-999 VHS Color Camera, JVC Model HR-4700U VHS Video Recorder, Horita GPS Video Titler. Cameras are mounted forward and right side facing.

J-3: User Displays

- Sun BriteLite with 9" Flat Panel Display, Diamond Trackball, located at the observer station in the cockpit.
- Sun SPARCstation IPC, 16" High Resolution Color Monitor, Diamond Trackball, HP 3630 PaintJet Printer, ELDORA 2 channel 15" High Resolution Color Monitor, and 2 Observer Seats, located in the forward cabin.
- Sun SPARCstation IPC, 16" High Resolution Color Monitor, Diamond Trackball, HP 3630 PaintJet Printer, ELDORA 2 channel 15" High Resolution Color Monitor, and 2 Observer Seats, located in the centre cabin, right hand side.
- SunSPARC 5, 16" High Resolution Color Monitor, Diamond Trackball, HP 3630 PaintJet Printer, ELDORA 2 channel 15" High Resolution Color Monitor, and 2 Observer Seats, located in the centre cabin, left hand side.
- Sun SPARCstation IPC, 16" High Resolution Color Monitor, Diamond Trackball, HP 3630 PaintJet Printer, ELDORA 2 channel 15" High Resolution Color Monitor, and 2 Observer Seats, located in the centre cabin, left hand side.

J-4: Aircraft Position, Velocity and Attitude

- Honeywell Model HG1095-AC03 Laseref SM Inertial Reference System.
- Trimble TANS III Global Positioning System (GPS).

J-5: Static Pressures

- Rosemount Model 1501 Digital Pressure Transducer (PSFD) - Fuselage Port
- Rosemount Model 1201F1 (PSW) - Left Wing Tip
- Rosemount Model 1201F1 (PCAB) - Centre Cabin

J-6: Dynamic Pressures

- Rosemount Model 1221F1VL (QCW) - Left Wing Tip
- Rosemount Model 1221F1VL (QCF) - Nose
- Rosemount Model 1221F1VL (QCR) - Radome

J-7: Temperatures

- Rosemount Type 102 Non-deiced Sensor, Rosemount Model 510BF Amplifier (TTRL) Left Radome Port
- Rosemount Type 102 Non-deiced Sensor, Rosemount Model 510BF Amplifier (TTRR)

Right Radome Port

- Rosemount Type 102 Deiced Sensor, Rosemount Model 510BH Amplifier (TTFH) Forward Cabin Left Fuselage Port

J-8: Flow Angle Sensors

- Attack - Rosemount Model 1221F1VL Differential Pressure Transducer (ADIFR) Radome
- Sideslip - Rosemount Model 1221F1VL Differential Pressure Transducer (BDIFR) Radome

J-9: Dew Point and Humidity

- General Eastern Model 1011B Dew Point Hygrometer (DPT) - Forward Cabin Top Right Fuselage Port
- General Eastern Model 1011B Dew Point Hygrometer (DPB) - Forward Cabin Bottom Right Fuselage Port
- NCAR Model LA-3 Lyman-Alpha Hygrometer (VLA)- Left Radome Mount
- NCAR Model Crossflow Lyman-Alpha Hygrometer - (VLA1) - Right Radome Mount

J-10: Radiation Fluxes

- Visible Radiation: RAF Modified Eppley Model PSP Pyranometers - Upward looking (SWT), Downward Looking (SWB) - Centreline Mid-Fuselage
- Infrared Radiation: RAF Modified Eppley Model PIR Pyrgeometers - Upward looking (IRT), Downward looking (IRB) - Centreline Mid-Fuselage
- Ultraviolet Radiation: RAF Modified Eppley Model TUVR Pyranometers - Upward looking (UVT), Downward looking (UVB) - Centreline Mid-Fuselage
- Remote Surface Temperature: RAF Modified, Temperature Controlled, Heimann Model KT19.85 Infrared Radiation Thermometer (RSTB) & (RSTB1) - Forward Baggage Compartment, Downward looking

J-11: Geometric Altitude

- 0 - 762 m: Sperry Model AA-200 Radio Altimeter (HGM) - Aft Baggage Compartment
- 60 - 10,000 m: Stewart-Warner AN/APN-159 Radar Altimeter (HGME) - Aft Baggage Compartment

J-12: Cloud Physics

- Liquid Water Content: PMS (CSIRO-King) Hot Wire Liquid Water Sensor (PLWC) - Left Pylon
- Liquid Water Content: PMS (CSIRO-King) Hot Wire Liquid Water Sensor (PLWC1) - Right Wing Tip
- Icing Rate: Rosemount Model 871FA Icing Rate Detector (RICE) - Right Pylon
- Cloud Drop Spectrum: Particle Measuring Systems Model 260X - 40-620mm (260X) - Right Pylon
- Cloud Drop Spectrum: Particle Measuring Systems Model FSSP-100 - Selectable Ranges. 6-47mm (FSSP 100) - Left Pylon
- Cloud Drop Spectrum: Particle Measuring Systems Model 2DC - 25-800mm (2DC) Right Wing Tip
- Hydrometeor Spectrum: Particle Measuring Systems Model 2DP - 200-6400mm (2DP) Left Wing Tip

J-13: Chemistry

- Ozone: RAF Modified TECO Ozone Monitor (TEO3)

J-14: Other NCAR/ATD Facilities

- ELDORA - Left Centre Cabin/Tail
- PIRAQ: PC Integrated Radar Acquisition System - Right Side Forward Cabin

S

NCAR ELDORA/ASTRAIA radar characteristic

Parameter	Value
Wavelength	3.2 cm
transmitted frequency	9.2-9.8 GHz
Beam width	1.8 deg
antenna gain	40 dB
polarization	horizontal
sidelobes	-35 dB
Beam tilt angle	+15-19 deg
antenna spin axis parallel to	heading
antenna rotation rate	5-144 deg/sec
dwel time	7-50 ms
rotational sampling rate	1-2 deg
peak transmit power	35-50 kW
minimum detectable signal at 10km	-12 dBZ
receiver bandwidth	0.5-8 MHz
pulse repetition frequency	2000-5000 /sec
unambiguous range	20-90 km
unambiguous velocity	13-110 m/s (dual-PRF)
number of transmitted frequency	4
pulse chip length	0.1-3 microsec
along track beam spacing	>0.3 km
range resolution	0.0375-1.2 km

APPENDIX D: DLR FALCON INSTRUMENTATION CHARACTERISTICS

J-15: Falcon 20-E5 Performance Data:

- Initial climb altitude FL 385 = 11.73 km
- Max. certified altitude FL 450 = 13.71 km
- Min. flight altitude 500 ft AGL = 152 m AGL
- Max. operational range 2,200 NM = 4,075 km
- Max. operational endurance 5.5 h
- Max. cruise Mach number 0.83 Mach
- Max. payload 1,000 kg
- Electrical mission power 15 kW (28 Volt)

J-16: Falcon 20-E5 Modifications and Systems

1. Nose boom, length 1,8 m made of CFK for carrying measuring probes (e.g. five hole probes for turbulence measurements)
2. coverable photo windows in the bottom and 1 on top of the fuselage with a diameter of 520 mm each.
3. Opening with a size of 250 x 570 mm at the left fuselage side for optical or IR-equipment.
4. 5 hardpoint stations (2 under each wing, 1 under the bottom of the fuselage) to carry loads up to 250 kg each.
5. 4 openings with a diameter of 80 mm on top of the fuselage.
6. EFIS-cockpit with GNS-X Flight Management Systems (incl. GPS, VLF-Omega, Loran-C, VPU, Honeywell laser reference system, 2 VHF, 1 HF/SELCAL, 1 UHF, 2 VOR/DME/ILS/GP, 2 ADF, 1 TACAN, 2 XPDR).

J-17: Falcon 20-E5 Basic Sensor Systems

Temperature	<ul style="list-style-type: none"> • fast / slow Rosemount PT500 / PT100-probes • OAT / TAT via air-data-computer
Radiation	<ul style="list-style-type: none"> • Radiometer Barnes PRT-6 (downward) • Pyrometer Eppley PSP (up- and downward) • Pyranometer Eppley PIR (up- and downward)
Humidity	<ul style="list-style-type: none"> • thermoelectrically cooled dew point sensor • dielectric sensor (relative humidity) • Lyman-alpha (absolute humidity) • dew-point sensor, cryogenically cooled (optional)
Pressure and wind	<ul style="list-style-type: none"> • flow angle sensor (nose boom) for 3D-turbulence and wind measurements • absolute and differential pressure sensors • barometric altitude (air data computer)
Navigational data	<ul style="list-style-type: none"> • aircraft position (GPS, Loran-C, VLF, Omega, VPU, IRS) • motion data (IRS, Attitude Reference System (AHRS)) • GPS-Time • track, heading, radar altitude, etc.

J-18: Falcon 20-E5 Optional Sensor Systems

Cloud Physics	<ul style="list-style-type: none">• several optional wing mounted droplet-speedometers / PMS-probes (OAP-230X, OAP 2D2-C, OAP 2D2-P, PCASP-100X, FSSP-100)• liquid water content sensors (Jingoism-Wiliness CT-10, PMS CSIRO- King)
Remote Sensing	<ul style="list-style-type: none">• LIDAR systems (DLR-Ladders ALEX / OLEX) to measure the backscatter signals of aerosols or cloud particles and the differential absorption of water vapour etc.• multispectral scanner Daedalus AADS 1268• imaging spectrometer ROSIS• metric Zeiss camera RMKA 30/23
Air Chemistry	<ul style="list-style-type: none">• ozone sensors (surface (dye) chemiluminescence detector, UV-absorption ozone photometer)• NO-detector• NO2-detector• air sampling• additional sensors on request

J-19: Falcon 20-E5 Data Acquisition System

Specification:

- up to 400 Data channels
- up to 100 Hz sampling rate
- several interfaces to connect user acquisition systems
- inflight data online processing
- online graphic quicklook system
- separate storage of raw and online processed physical data

APPENDIX E: MERLIN IV

The French Met Office Aviation Centre (CAM) operates a Merlin IV aircraft which is equipped to make a wide variety of atmospheric observations. As can be seen from its appearance, the nose has been modified for this role. It is now one of the most sophisticated light aircraft 'flying laboratory' for atmospheric research in the world.

The radome allows sensitive instruments to make measurements of turbulence, in a region the most in front of the influence of the aircraft itself. The belly has been modified to carry radar antenna. The callsign of this aircraft is **F-GMTO**.

Merlin flight characteristics

Max. endurance	3 up to 5 h (with IFR reserves)
Max. range	2.200 km at 8.000 m alt. (1200 NM)
Initial climb	22.000 ft (6.700 m)
Max. altitude	28.000 ft (8.500 m)
Min. altitude	150 ft over water (46 m) 300 ft over land (91 m)
Speed	75 - 135 m/s
Max. payload	500 kg
Crew	2 aircrew + 1 technician up to 2 scientists

Merlin IV Basic Sensor Systems

Temperature	<ul style="list-style-type: none"> fast / slow Rosemount PT50 / PT100-probes fast response thin wire sonic thermometer Reverse flow (NCAR) OAT / TAT via computer
Humidity	<ul style="list-style-type: none"> 2 thermoelectrically mirror cooled dew point sensor 2 dielectric sensor (relative humidity) 2 Lyman-alpha Refractometer (CETP) dew-point sensor, cryogenically cooled (optional)
Pressure and wind	<ul style="list-style-type: none"> flow angle sensor (five holes radome and vane) for 3D-turbulence and wind measurements absolute and differential pressure sensors barometric altitude (computer) sonic airspeed measurement fast response variometer
Radiation	<ul style="list-style-type: none"> Radiometer Barnes PRT-5 (downward, optionally upward) Pyrgometer Eppley PIR (upward and downward) Red and Visible Pyranometer Eppley PSP (upward and downward) UV radiometer
Navigational data	<ul style="list-style-type: none"> aircraft position (GPS, INS) motion data (INS, GPS, Doppler radar) GPS-Time Radar altitude up to 15.000 ft
Video	<ul style="list-style-type: none"> CCD camera SVHS recorder with data encrusting

Merlin Optional Sensor Systems

Cloud Physics	<ul style="list-style-type: none"> • 4 droplet-spectrometer probes such as Fast FSSP, OAP-230Y, OAP-2DC, FSSP-100 • 3 liquid water content sensors (Johnson-Williams, King KLWC-5, Gerber PVM-100)
Remote Sensing	<ul style="list-style-type: none"> • Scatterometer RESSAC for sea surface observation; waves and wind.
Chemistry	<ul style="list-style-type: none"> • Inlet gas sampling for: • Ozone • Nitrogen oxides • Carbon monoxide • Water sampling for postponed analysis • Aerosols • Air sampling for postponed analysis

Merlin Data Acquisition System

Specifications	<ul style="list-style-type: none"> • Analog Data channels • Filtered Analog Data channels • Remote-controlled Filtered Analog data channels, 1553 link • 25, 50, 100, 200 Hz sampling rate, possibly up to 800 • Arinc channels • Serial • inflight data online processing • online graphic quicklook system • 2 work stations
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For further information contact the CAM:

[Michel Andre](#)

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APPENDIX F: INSU FOKKER-27 ARAT CHARACTERISTICS

J-20: ARAT - features

Type of aircraft: FOKKER 27-MK 700, pressurized, Twin turboprop

Wingspan: 29 m

Length: 23.5 m

Height: 8.5 m

Cabin length: 9.40 m

Cabin width: 2.10 m to 2.55 m

Cabin height: 2.02 m

Max. takeoff weight: 17 t

Empty weight 11.5 t

Scientific payload*: 1.6 t to 2.6 t

Takeoff runway length: 1,400 m

Cruising speed at 5800 m: 350 km/h (190 kt)

Min. speed for work: 240 km/h (130 kt)

Optimum altitude: 5,800 m

Service altitude: 5,800 m

Flight autonomy*: 3 to 4.5 h

Flight potential: 5,000 h

Time-basis for scientific use: 300 h per year

Pilots: 2

Navigator: 1

Scientific director: 1

Computer engineer: 1

Sensor and electronics engineer: 1

Scientific passengers: Maximum 4

* The autonomy depends on the scientific payload and mission profile.

J-21: ARAT Modifications and Systems

- 1 removable nose probe which stretches some 5 m in front of the aircraft, to isolate the sensors from disturbances created by the aircraft itself.
- 1 ring with 6 attachment points behind the cockpit, in front of the propeller rotation plane, away from any possible disturbance from the engines.
- 8 load carrying points under the wings, underneath and on top of the fuselage.
- 1 sighting window in the upper part of the fuselage, for the LEANDRE Lidar beam.
- 2 photographic camera stations with optical windows protected by electrically-operated traps.

- 1 opening through the left side of the cockpit, for a navigation sight, for controlling the cameras and assisting in navigation.
- 1 removable radome under the fuselage to house the SAR antenna for the VARAN-S radar during remote sensing operations.

ARAT - Atmospheric Sensors

Pressure, wind	Static Pitot tube, transducer, wind vane, accelerometers, hot-film anemometer, inertial navigation system, Doppler Radar navigation
Temperature	Probes: Rosemount, reverse flow, high-speed temperature probe
Humidity	Dew point, humidity fluctuation, relative humidity sensors
Liquid water content	Johnson-William sensor, CSIRO probe
Inside clouds measurements	Icing detector
Remote sensing sensors (not available in the STAAARTE program)	PUSHBROOM - 4-band spectrometer, scanning principal identical to SPOT). POLDER - telecentric instrument for observing the reflectivity and polarisation of the Earth-atmosphere system.
Microphysics	5 1-D and one 2-D size distribution sensors
Radiation measurements	Pyranometers: 2 visual, 2 infrared, 2 ultraviolet and 2 visual red.
Air sampling	100 m3 sample, continuous measurement duct
Ozone measurements	Model 49 thermoelectric sensor ALTO Lidar (ozone profile)
Measurement of Nitrogen Compounds	NO, NOx, NOy
Precipitation collection	National weather system
Cryogenic sampling	To be defined
Aerosols	Integrating nephelometer for measuring light diffusion coefficient. Leandre 1 Lidar (aerosol profile)
Condensation nuclei	Nucleus counter, from 0.02 to 1
Aircraft position	Inertial navigation system, navigation Doppler radar, inertial system / GPS position transfer, ground video camera.
Ancillary instrument	Radio altimeter probe (up to 500 m altitude), video cameras filming forward and groundward
Electric generator	20 kVA, three phases, 115 V / 400 Hz and 28 VDC
On board computer systems	HP 1000 A900, recordings on high-capacity digital video cassette, 2 EXABYTE 2.5 GByte recorders.

J-22: ARAT - Data Acquisition and Processing

The various sensors measure 150 different parameters at rates of 4 to 256 points per second, i.e. about 160384 octets per second. The purpose of the acquisition system is to provide data that can be analysed immediately after the flight by any computer centre, but more especially by the "Volotheque", the aircraft's own database. These data are recorded in the form of unprocessed signals representing basic physical quantities.

Immediate data processing enables the measure parameters to be visualized on screens during flight so that the flight plan and the running of experiments can be adapted in accordance with the data already acquired. Spot checks can also be made regularly during experiments.

APPENDIX G: ECO-DIMONA HB-2335

TABLE A-6. Measured parameters on board of MetAir's aircraft "ECO-Dimona HB-2335" for MAP-Riviera and MAP Rheintal Foehn.

parameter	instrument/method	range from...to	resolution/ parameter/ time	precision/accuracy	calibration or checks
air temperature	Meteolabor thermocouple	-50..50° C	0.1° C/10 Hz	0.1/0.5° C	ice-water/mercury
dewpoint	Meteolabor dewpoint mirror	50..50° C	0.1° C/2 s	0.1/ 0.5° C	psychrometer
5 pressures (1 absolute, 4 diff.) for	capacitive sensors from Keller Druckmesstechnik	300..1300; 0..50 hPa	0.02 hPa/10 Hz	0.1/0.5 hPa	factory calibrated
flow angles	differences of pairs (left/right, top/bottom)	-20..20°	0.1°/0.1s	0.1°/0.5°	wind residuals
true airspeed,	calculated (p, T, u)	10..70 m/s	0.1 m/s/10 Hz	0.2/0.5 m/s	wind residuals
and pressure altitude	integrated (p, T, u)	0..7000 mMSL	1 m/4 s	3/10 m	mountaintops
height above ground	radar altimeter TERRA	15..780 m	1 m/ 1s	1 /5 m	against pressure altitude
position (x,y,z)	Trimble TANS Vector	worldwide	7 m/1 s	20 /100 m *	fixpoints from map
ground speed (vx, vy)		do.	0.1 m/s/ 1 Hz	0.1 /0.5 m/s	statically at ground
attitude angles (azimuth, pitch, and roll)		do.	0.1°/3..10 Hz	0.1 /0.5°	statically at ground
3-d-wind (x,y,z)	post flight processing from parameters above	0.5..30 m/s	0.5 m/s/ 3 Hz	0.5/ 1.0 m/s	wind during maneuvers
aerosols (>0.3 and >0.5 µm)	MetOne Laser Particle Counter	0..200 n/ cm ³	1 n/ 3 cm ³ / 1 s	1 /10 n/cm ³	factory calibration
O ₃ (slow)	PSI/ UV absorption	2 ppb..1 ppm	1 ppb/ 4 s	1 / 2 ppb	calibration gas ⁺
NO ₂ , Ox ⁺⁺	6-channel Luminol-detector with converters	0.5..500 ppb	0.1 ppb/ 1.5 s	0.5 ppb/ 20 %	NO ₂ calibration gas

* depending on operation mode (SA) of the satellites; eventually we will have dGPS for better accuracy

++ The signals of the two monitors are combined to get both fast and stable measurements, overlapping in the range between about 30, and 600 seconds

The following operational guidelines apply to the MetAir Dimona motorglider:

- MetAir's ECO-Dimona HB-2335 is a motorglider according to JAR-22/utility with special certifications for overweight (MTOW 930 kg), and underwind pods. We can enter airspaces "C" or higher ("A" is excluded, but, is not existing in Switzerland). More details about VFR in Switzerland can be found in the "VFR-guide" available from the Office for Civil Aviation.
- The turbo-charged piston engine (Rotax 914) is fuelled preferably with unleaded automobile fuel (95 octane or higher). When frequently using 100LL, maintenance intervals are reduced to 50 h. On any airfield under discussion for MAP, 100LL is available, but, we will usually organize fuelling by our canisters (unleaded car fuel). We need less than 20 litres per hour of flight. Maximum capacity is 110 litres.
- Minimum height above ground between take-off and landing is 300 m over populated areas, 150 m above rural areas, and 60 m above slopes. In principle, we could apply for a

special permission for 50 m minimum altitude above suitable places. However, this is not necessary, and not foreseen for flights during MAP. Over terrain, where an emergency landing within the glide slope would not be possible, these minima are increased by the pilot by safety reasons although the engine has double ignition and is also certified for regular single engined aircraft (e.g. "Katana").

- Minimum speed for save operation is 110km/h, maximum speed for levelled flight is 200km/h (260km/h during descents). However, a maximum speed of 180km/h (100 kts) is chosen when the endurance has to be more than 3 hours (5 hours when flying between 150, and 180km/h). In heavy turbulence (e.g. Foehn), the minimum speed has to be set to at least 120km/h, and the maximum speed according to the aircraft manual is then 210km/h. However, a lower maximum might be chosen for the comfort of the crew (120 to 150km/h in heavy turbulence). Maximum climb rate below 3000 m is between 3, and 4 m/s (depending MTOW). A maximum descent rate of 5 m/s is chosen in order to limit pressure changes (hysteresis and other instrumental problems). Due to the turbo-charged engine, the ceiling height is very high (11'800 m were flown by the manufacturer). However, without oxygen, we would not climb above 4000 mMSL. With oxygen masks (not foreseen during MAP), we would also set a limit at 7000 mMSL.
- Since communication is limited to one-channel VHF (no HF, no second VHF) we can switch fast between main, and stand-by-frequency. For urgent messages, we could also receive SMS via GSM (short notes via cellular phone, "NATEL" in Switzerland) in case this is legal (has to be found out first).

APPENDIX H: P-3 AIRCRAFT SCIENTIST FORMS

**MESOSCALE ALPINE PROGRAMME (MAP)
P-3 CHIEF SCIENTIST CHECKLIST**

Flight Number: _

Date:

Aircraft ID: NOAA42RF

Proposed T/O Time (UTC):

Base of Operations:

Primary Mission:

Alternate Mission:

Aircraft Crew:Scientific CrewFlight Crew

Chief Sci:

AC Commander:

Co-Chief Sci.:_

Pilot:

Doppler Sci.:_

Flight Engineer:

Doppler Sci:

Flight Director:_

Cloud Phys Sci.:

Navigator:

Sonde Sci.:

Sys Engineer:

Observer:

Data Tech.:

Observer:

Radio Op.:

Observer:

Sonde Op.:_

Other Flight/Scientific Crew, Observers, and Visitors:

NameFunctionNameFunction**Mission Briefing (including proposed flight patterns):****Mission Summary:**

Takeoff Time (UTC):

Landing Time (UTC):

Location:

Official Mission Duration:

hr (from Flight Director)

Tapes/disks Collected:

Data Sys.: Radar: _ Cloud Phys.: Video:_ Dropsonde:

Number of Sondes Dropped: Sonde Failures:

MESOSCALE ALPINE PROGRAMME (MAP) P-3 CLOUD PHYSICS SCIENTIST CHECKLIST

Flight Number:

Date:

Aircraft ID: NOAA42RF

Cloud Physics Scientist:

Equipment status prior to takeoff:

Brief description of problems encountered during flight:

Cloud Physics Data System Tape Log

Tape #	Time On (UTC)	Time Off (UTC)	Comments
---------------	------------------------------	---------------------------	-----------------

MESOSCALE ALPINE PROGRAMME (MAP) P-3 DROPSONDE SCIENTIST LOG

Flight Number:

Date:

Aircraft ID: NOAA42RF

Dropsonde Scientist:

Dropsonde Operator:

Dropsonde Operator:

Equipment status prior to takeoff:

Brief description of problems encountered during flight:

Sonde System Log

Drop #	Drop Time (UTC)	Location LatLon	Altitude (m)	Comments
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MESOSCALE ALPINE PROGRAMME (MAP) P-3 RADAR SCIENTIST CHECKLIST

Flight Number:

Date:

Aircraft ID: NOAA42RF

Radar Scientist:

Radar Engineer:

Radar Operator(s):

INE Number:

Confirm:

Proper radar setup file, LF:

Proper radar setup file, TA:

Proper thresholding (dBm) :

Proper sample size (≥ 32):

Equipment status prior to takeoff:

**brief description of problems encountered during flight:*

MESOSCALE ALPINE PROGRAMME (MAP)

P-3 RADAR SCIENTIST LOG

Flight Number: Page of

Date: Aircraft ID: NOAA42RF

Operator(s):

Radar Data System Log

Tape No.	Time UTC	Mode	Sect Cntr	Hdg (H) Trk (T)	Comment s
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APPENDIX I: MAP DATA ARCHIVE DESCRIPTION

J-23: Characteristics of MDC Archive

The success of data ingestion into the MDC archive will be based on the following principles:

- There will be few entry requirements for data providers. Input format is restricted for online data only (see MDC Archive formats). MDC will not decode any data to store in the database. Input media will not be restricted, although a few recommendations will be made in order to minimise the entry work.
- Data transmission to MDC will be done directly via anonymous FTP over Internet or through an external media. We prefer CD-ROM's, but we will accept tapes in common format as well. For raw data, we will not have any restriction, but we will accept only data with a full format description and if necessary with corresponding decoder programs.

J-24: MDC Archive format

All MAP data are stored in a relational database at the MDC (MAP Data Centre), with the exception of images. Thus the MAP database is table based. In order to insert data into the database most efficiently, we have designed the following format recommendations for table-based data and images. If you consider to use an alternative format, please first contact the MDC for finding the best solution to copy your data into the MAP database.

i) Table based data

Table-based data you sent to MDC must be in an ASCII file format with the structure described below or in a Microsoft Excel (see Exceptions) format. The data must be in absolute values and not in a coded format. If any quality control marks for the meteorological data are available, they should be declared clearly. Geographic positions must be included as well.

Declaration of Contents, general Structure

1. Each file contains at least one header row, with a clear description of the contents and the creation date of the file itself. The first character of each header line is always a "#".
2. Each file contains a complete description of the contents or a reference to a text file, which contains this information (giving the description within the file itself is preferred).
 - Name, address and email of the responsible person.
 - Caption of the data row with declaration of data source, unit, precision, ...
3. If it is only possible to identify the data by the file name, you must send an extra file with the information of points 1 and 2 as well.
4. The maximum file name length is 32 characters. The following ASCII-characters are allowed: A...Z, a...z, 0...9, _, - , . and space.
5. The row length is limited to 64 kBytes.
6. The file length is not limited.
7. Dummy values of a variable are -99.9 or -999.9 depending on the format of the variable.

Format and Character

1. The MDC accepts only ASCII files (US ASCII 8-Bit) with line structure (no binary data files!).

2. Apart from "tab", "line feed" and "carriage return", do not use characters of the ASCII collating sequence with an ordinal number below 032. Thus the complete ASCII character set for the MDC is: 009, 010, 013, 032...255.
3. The data columns are free formatted or fixed, according to the declaration in the header of the data file.
4. The data columns (formatted free or fixed) must be separated by "tab", ";" or "blanks(spaces)". At least one separator must be inserted between two columns.
5. The following compression methods of your data files are accepted:
 - Compression with gzip filename.gz
 - Compression with tar and gzip filename.tar.gz
 - Compression with pkzip filename.zipFor all other compression methods contact MDC first.
6. ASCII files written under UNIX terminate lines with a "line feed". PCs, however, terminate text lines with two characters: a "carriage return" and a "line feed". Therefore, be cautious: if you send ASCII files produced on a PC to the MDC via a UNIX platform, you may have to do some reformatting!

Data exchange

The standard Data exchange procedure is by FTP. If you do not dispose of a FTP- connection to the MDC, send your data on a 3.5" DOS formatted diskette to the MDC. For all other data carrier or a direct database link, please contact the MDC.

1. The anonymous FTP address of the MDC is map.ethz.ch (129.132.77.123). To login use "anonymous" as username and your email address as password. Put the data in the directory "/pub/mapinput/" and send an email to the MDC (map@atmos.umnw.ethz.ch) that the data have been transmitted (do not worry if you do not see your transmitted file anymore; the "mapinput" directory has write only access for anonymous FTP users. You must type dir and the full filename to see if your file transfer was successful).

Units

1. In general, we use the SI-Units and the common units in meteorology.
2. The time must be given in UTC. If the time in your data file is not in UTC, then you must declare the difference between the time of your data and UTC in the header of the file.
3. Geographic positions: longitude (°.dec), latitude (°.dec) (Minutes and Seconds in decimal degrees) and height (m above sea-level or gpm).
4. Pressure: (hPa)
5. Temperature: (°C)
6. rel. Humidity: (%)
7. Wind direction: (°) (decimal degrees)
8. Wind speed: (m/s)
9. Precipitation: (mm/h or mm/day) (for daily precipitation give the exact sampling period, e.g. 06 UTC to 06 UTC).

Exceptions

Microsoft Excel files (Version 3 to 7) are accepted as well, if the information described under point 1.2 is included. If it is impossible to send the data in the format described above, please send a complete description of the data structure as well as the decoding procedure for the data.

Examples**Wind data of some surface stations**

```
# Wind data (u,v) from MAP Case 5 27.6.96
# H. Hirter, LAPETH, CH-8093 Zuerich, hirter@atmos.umnw.ethz.ch
#
# Date period: 9.11.95 0h until 14.11.95 0h (UTC)
# N      : Station number
# TIME   : hours since 9.11.95 0h (UTC)      (h.dec)
# U      : hourly mean value east component of wind (m/s)
# V      : hourly mean value north component of wind (m/s)
#
# Stations:
# Number Name      short form long(°) lat.(°) height(m)
# 4  Wynau        WYN    7.78 47.25 422
# 6  Vaduz        VAD    9.25 47.15 460
# 14 Altdorf      ALT    8.63 46.86 449
# 33 Guetsch     GUE    8.61 46.65 2282
# 53 Bern-Liebefeld BER 7.41 46.93 565
#
# N  TIME   U   V
4  0.67  0.1  0.2
4  1.67  0.3  0.2
4  2.67  0.1  0.1
4  3.67  0.2  0.5
6  0.67  1.7 -1.9
6  1.67  1.6 -1.1
6  2.67  1.9 -1.5
6  3.67  2.7 -1.8
....
```

6.2 Radiosonde file

```
# METEOROLOGICAL SONDE DATA Payerne 17.4.96
# H. Hirter, LAPETH, CH-8093 Zuerich, hirter@atmos.umnw.ethz.ch
#
# Date : 2.7.95 23:03 (UTC)
# Station: Payerne 06610 SPAY 6.95 46.82 491
# HE: Height (m)
# PR: Pressure (hPa)
# TD: Temperature (°C)
# HR: rel. Humidity (%)
# DT: Seconds since launch (s)
# U: east component of wind (m/s)
# V: north component of wind (m/s)
#
#
# HE  PR  TD  HR  DT  U  V
0 949.00 17.50 84.00 0 -0.5 0.0
6 948.37 19.05 76.50 1 -999.9 -999.9
32 945.47 19.45 68.50 6 -999.9 -999.9
41 944.46 19.79 68.25 8 -999.9 -999.9
46 943.95 19.90 68.13 9 -999.9 -999.9
67 941.69 19.83 66.88 13 -999.9 -999.9
```

84	939.82	20.54	65.75	16	-999.9	-999.9
90	939.20	20.56	65.38	17	-999.9	-999.9
110	937.00	20.88	63.71	21	-999.9	-999.9
119	936.06	20.87	62.86	23	-999.9	-999.9
123	935.59	20.91	62.43	24	-999.9	-999.9
147	933.04	20.65	61.00	29	-999.9	-999.9
157	931.91	20.61	60.50	31	-999.9	-999.9
162	931.34	20.56	60.25	32	-5.6	-3.5

ii) Image Based data

In general all image-based data at MDC are in GIF-Format. GIF format is a widely used compression format, which can easily be displayed by all known WWW browsers. Postscript files readable by ghostview are also accepted. But MDC will convert these files to GIF format to allow for a preview on the WWW.

- The MDC accepts files in **GIF format or Postscript**.

Remarks:

If you have a format, which is not listed above, please contact the MDC. We are sure to find a solution to put the data in the MAP database by reformatting the data.

J-25: Large data volumes: NWP fields

as of 29 March 1999

Numerous products originating from different operational and research NWP models will be available in real time at or through the MDC during the MAP SOP. These products represent a huge data volume and only the most useful fraction of it can be stored at the MDC. Until the re-analysis will be available, the real-time analysis will be of prime need for many modelling groups. It is therefore proposed to store progressively at the MDC the IOPs' analyses of the ECMWF, ARPEGE, DM/SM and LM7 models. This analysis data set will cover the so-called large scale MAP domain and will include all the different fields necessary to initialize and govern limited area models:

- orography
- land/sea mask
- surface and deep soil temperature
- surface and deep soil moisture
- surface pressure
- horizontal winds
- temperature,
- humidity
- cloud water

The data will be provided in GRIB format, on model levels and on the original grid (or Gaussian grid in case of spectral models) for all the models. Simultaneously, a catalogue of some selected basic fields plotted in the same format will be made available at the MDC allowing a quick assessment of the agreement/disagreement between the different analysis.

The volume of forecast data originating from operational models (ALADIN/LACE, SM, LM7, ...) or high-resolution research models (MC2,...) is too large to envisage a similar storing procedure at the MDC. The forecast raw data will be archived only at their site of origin, in

their usual format, but they should be made available on request. However for documentation purposes, all the .gif images that will be routinely produced during the MAP SOP will be kept at the MDC.

J-1: Large data volumes: Radar data

J-2: Large data volumes: Satellite data

as of 9 March.1999

The satellite coverage of the SOP will be ensured by two METEOSAT spacecraft, METEOSAT 7 (operational meteorological mission, 0° N, 0° E) and METEOSAT 6 (back-up satellite, 0° N, 10° W). METEOSAT 7, the last mission of the METEOSAT Transition Programme (MTP), will perform the half-hourly full-disk scans for regular dissemination to the meteorological community and to MAP SOP. METEOSAT 6 acting as replacement satellite in case of failure of METEOSAT 7 will be on stand-by for the rapid scan strategy of the SOP area during the IOPs. A concept of acquisition and archival of satellite data has to include binary data and imagery from both satellites. The numbers given below need necessarily be considered as a guess for sizing the amount of disk space at the MDC. They are based on a number of assumptions that still need some verification, but no large changes of the overall amounts are expected.

C. METEOSAT 7

The satellite will support forecasts, planning and operations at MOC and POC and, at the same time, provide data for later studies by satellite meteorologists. The data format that suites both applications is the B-format that EUMETSAT uses for dissemination to the European NWS via Primary Data User Station (PDUS) installations. This format covers the area from the Sahel to Scandinavia (included) and mid-Atlantic to Turkey (included).

Figure 1-17a) shows the geographical area covered by the B-format and Fig. 1-17b) an example of imagery in the IR band.

The on-line archive will store imagery in Graphics Interchange Format (GIF) to be readily used during daily operations. A typical midday image like the one shown in Figure 1-17 has the following size in the three spectral bands

- 600 Kbytes VIS
- 500 Kbytes IR
- 450 Kbytes WV

If we take into account that VIS imagery is restricted to slot 10 to 39 (30 slots, 15 hours), the total storage per day of B-format GIF imagery will be 63.6 Mbytes. Considering around 60 days for the whole SOP, the total storage for the campaign will then be of the order of 4 Gbytes. Note that these calculations refer to an overall maximum, which does not take into account the eclipse of the satellite during the SOP. During the eclipse a few slots around midnight are lacking every day and the above numbers can be considered to be on the safe side. For real-time use the B-format area is bigger than necessary and a sub-area in the centre of the image will equally serve the purpose. In this case the amount of data to be stored lowers accordingly.

High-resolution data corresponding to B-format imagery should also be archived at MDC for later use by the community. Their archival, though, need not be on-line and a delayed transmission to MDC by the receiving institution can be conceived. The high-resolution data corresponding to the GIF imagery described above amounts to 781'250 bytes for all three channels VIS, IR and WV for a total of 2.4 Mbytes every slot. Again considering the VIS data

as of 9 March.1999

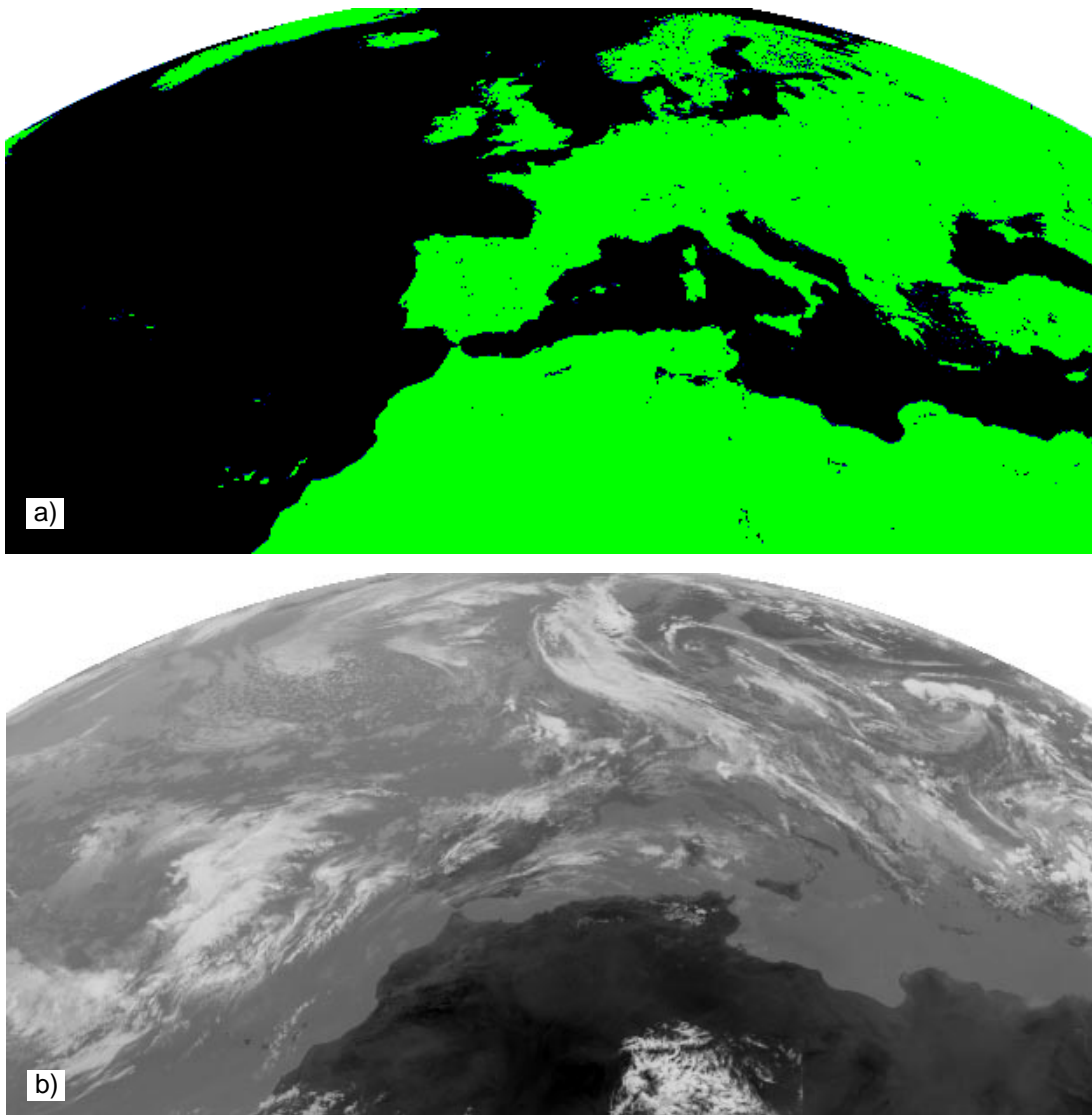


FIGURE 1-17. Panel a): Sea-land mask of METEOSAT B-format imagery. The image is 1250 pixel wide and 625 pixel high. The image in the figure has been resampled to 625 x 312 pixels for publishing reason. Panel b): METEOSAT 7 IR image in B-format. Refer to the upper panel for size and geo-location.

transmission from slot 10 to 39 the total storage for the three channels requires 98.5 Mbytes per day. The whole SOP (60 days) will then see about 6 Gbytes of B-format high-resolution data.

D. METEOSAT 6

From the first tests of rapid scans performed by EUMETSAT it appears that the sensor will scan 228 lines every 5 minutes. These are unrectified lines and the rectification procedure lowers their number to 170. It is then conceivable to count on rapid scan images 2500 pixels wide (full Earth disc width) and 170 lines high. The area covered by the rapid scan image is shown in Fig. 1-18.



FIGURE 1-18. Sea-land mask relative to the proposed METEOSAT 6 rapid scan window for the MAP IOPs. The image is 2500 pixels wide and 170 pixels high. In the figure the image has been degraded to 1250 x 85 pixels for publishing reasons.

The rapid scan procedure comprises 18 hours of continuous operation followed by a few hours of normal scanning procedure for satellite stabilization and calibration of the sensor.

The total amount of images for a single rapid scan period will be 216 in each channel VIS, IR and WV. A single 2500x170 pixel GIF image in the IR corresponds to about 60 Kbytes, which makes it 180 Kbytes for a single rapid scan in the three channels. 216 rapid scans during a single session produce GIF files for an amount of about 40 Mbytes. Considering an hypothetical number of 10 rapid scans for the whole SOP, the total disk space required for the rapid scan GIF imagery is 400 Mbytes.

The file format for image archival that EUMETSAT will use for the delivery of rapid scan imagery to MDC is the OpenMTP format regularly used for image archival at EUMETSAT's Meteorological Archive and Retrieval Facility (MARF). Files in OpenMTP format have the following characteristics:

- VIS full resolution 5000 x 5000 pixels 25'354'344 bytes
- IR 2500x2500 pixels 6'475'860 bytes
- WV 2500x2500 pixels 6'475'860 bytes

A single VIS OpenMTP file can contain $29 \times 2 = 58$ VIS rapid scan images while the IR and WV files can host only 14. The following files will be necessary to entirely cover a single 18-hour rapid scan

- VIS 4 files x 25'354'344 bytes = 101'417'376 bytes = 102 Mbytes
- IR 16 files x 6'475'860 bytes = 103'613'760 bytes = 104 Mbytes
- WV 16 files x 6'475'860 bytes = 103'613'760 bytes = 104 Mbytes

A single rapid scan will occupy in the end around 310 Mbytes of disk space. If we consider again the hypothetical number of 10 rapid scans for the whole SOP, the total disk space required for the high-resolution rapid scan imagery will slightly exceed the 3 Gbytes storage amount.

APPENDIX J: POC DAILY SCHEDULE

Table 1:

Type of Event	Staff*	00-06 UTC	06-12 UTC	12-18 UTC	18-24 UTC
NonIOP down day	PCD	off	off	off	off
	PSC	off	off	off	off
	POCOC	off	off	off	off
	PAC	off	off	off	off
	PES	off	off	off	off
	PRS	off	off	off	off

*PCD—POC Center Director
 PSC—POC Science Coordinator
 POCOC—POC Operations Coordinator
 PAC—POC Aircraft Coordinator
 PES—POC Radar Engineers
 PRS—POC Radar Scientists



Table 2:

Type of Event	Staff*	00-06 UTC	06-12 UTC	12-18 UTC	18-24 UTC
Dry MAP-IOP, no Wet-MAP alert	PCD	off	Chair weather and facility briefing (0800-0845). Available for questions and problems related to the POC activities.	Available for questions and problems related to the POC activities.	off
	PSC	off	Review current weather. Assist POCOC to coordinate Dry MAP aircraft	Monitoring and analysis of data collected so far by S-Pol, RONSARD, Mt. Lema, DOW, and OPRA (reflectivity, radial velocity, particle types). If this is first non-IOP day following the conclusion of a W-IOP, conduct a W-IOP debrief of all the wet MAP personnel at the POC with the MOC wet MAP scientists participating by phone.	off
	POCOC	off	Act as PAC. See below.	same as 6-12	Same as 12-18 till end of flight
	PAC	off	Communicate with and help to coordinate Dry MAP aircraft	same as 6-12	Same as 12-18 till end of flight
	PES	off	Monitor data flow from radar sites (Monte Lema and Italian operational radars). Monitor computing and communications equipment	Same as 06-12.	Same as 12-18 till end of flight
	PRS	off	off	off	off

*PCD—POC Center Director
PSC—POC Science Coordinator
POCOC—POC Operations Coordinator
PAC—POC Aircraft Coordinator
PES—POC Radar Engineers
PRS—POC Radar Scientists

Table 3:

Type of Event	Staff*	00-06 UTC	06-12 UTC	12-18 UTC	18-24 UTC
Wet MAP alert	PDCD	off	Chair weather and facility briefing (0800-0845). Available for questions and problems related to the POC activities. Put nowcasting support on alert as needed.	Available for questions and problems related to the POC activities. Put nowcasting support on alert as needed.	off
No IOP going on	PSC	off	0600-0800: Review current weather and project status. 0800-0845: Attend weather and facility briefing. 0845-0900: Call MOC Science Director for preliminary discussion of today's activities. 0900-1030: Lead POC participants in preparation of today's Wet MAP science proposal. Consult via video or phone with PI's at MOC in this preparation. Proposal should recommend: (1) If a W-IOP will start in the next 24 h. (2) If so when & where DOW deployed, (3) when S-Pol and RONSARD begin ops and which scan strategies they should employ, and (4) what aircraft flights would be useful.	Participate in Mission Selection Team decision regarding use of aircraft in next day. Otherwise: Check on S-Pol, RONSARD, Mt. Lema, DOW, and OPRA data (reflectivity, radial velocity, particle types). Recommend changes in S-Pol and RONSARD scan strategies as weather and operational conditions warrant. If this is first non-IOP day following the conclusion of a W-IOP, co-chair (with POCOC) a W-IOP debrief of all the wet MAP personnel at the POC with the MOC wet MAP scientists participating by phone. 1700-1800: Participate in final update meeting for the day.	off
	POCOC	off	0600-0800: Review facility status. 0800-0845: Attend weather and facility briefing. 1030-1130: Chair POC daily meeting. In first half of meeting lead POC discussion to review project status and activate DOW, S-Pol and RONSARD if called for in today's Wet MAP proposal. At 1100 join with MOC meeting via phone to discuss aircraft proposals.	If W-IOP has been declared activate DOW, S-Pol, and RONSARD at the appropriate times. If this is first non-IOP day following the conclusion of a W-IOP, co-chair (with PSC) a W-IOP debrief of all the wet MAP personnel at the POC with the MOC wet MAP scientists participating by phone. 1700-1800: Conduct in final update meeting for the day.	off
	PAC	NA	NA	NA	NA
	PES	automatic radar data recording	Monitor data flow from radar sites. Monitor computing and communications equipment.	Same as 06-12.	automatic radar data recording
	PRS	off	Check over night weather data for precip occurrence. If precip has started, alert the POCOC and begin making MIZebra-based hourly regional radar composites and entering them on JOSS catalogue	Continue making and JOSS-cataloguing half hourly regional composites. Download OPRA data and show them to PSC.	off

*PCD—POC Center Director
PSC—POC Science Coordinator
POCOC—POC Operations Coordinator
PAC—POC Aircraft Coordinator
PES—POC Radar Engineers
PRS—POC Radar Scientists

Table 4:

Type of Event	Staff*	00-06 UTC	06-12 UTC	12-18 UTC	18-24 UTC
Wet-MAP alert	PCD	off	Chair weather and facility briefing (0800-0845). Available for questions and problems related to the POC activities. Put nowcasting support on alert as needed.	Available for questions and problems related to the POC activities. Put nowcasting support on alert as needed.	off
with Dry MAP-IOP going on.	PSC	off	0600-0800: Review current weather and project status. 0800-0845: Attend weather and facility briefing. 0845-0900: Call MOC Science Director for preliminary discussion of today's activities. 0900-1030: Lead POC participants in preparation of today's Wet MAP science proposal. Consult via video or phone with PI's at MOC in this preparation. Proposal should recommend: (1) If a W-IOP will start in the next 24 h. (2) If so when & where DOW deployed, (3) when S-Pol and RONSARD begin ops and which scan strategies they should employ, and (4) what aircraft flights would be useful. 1030-1130: Chair POC daily meeting if POCOC not available because of dry MAP flights. Assist POCOC to coordinate Dry MAP aircraft.	Participate in Mission Selection Team decision regarding use of aircraft in next day. Otherwise... Assist POCOC to coordinate Dry MAP aircraft Check on S-Pol, RONSARD, Mt. Lema, DOW, and OPRA data (reflectivity, radial velocity, particle types). Recommend changes in S-Pol and RONSARD scan strategies as weather and operational conditions warrant. If this is first non-IOP day following the conclusion of a W-IOP, conduct a W-IOP debrief of all the wet MAP personnel at the POC with the MOC wet MAP scientists participating by phone	off
	POCO	off	Act as PAC, otherwise: 0600-0800: Review facility status. 0800-0845: Attend weather and facility briefing. 1030-1130: Chair POC daily meeting. In first half of meeting lead POC discussion to review project status and activate DOW, S-Pol and RONSARD if called for in today's Wet MAP proposal. At 1100 join with MOC meeting via phone to discuss aircraft proposals.	If W-IOP has been declared activate DOW, S-Pol, and RONSARD at the appropriate times. Act as PAC.	Act as PAC till end of flight, then off
	PAC	off	Communicate with and help to coordinate Dry MAP aircraft	same as 6-12	Same as 12-18 till end of flight
	PES	off	Monitor data flow from radar sites. Monitor computing and communications equipment	same as 6-12	Same as 12-18 till end of flight
	PRS	off	Check over night weather data for precip occurrence. If precip has started, alert the POCOC and begin making MtZebra-based hourly regional radar composites and entering them on JOSS catalogue. Enter real-time aircraft positions in MtZebra.	Enter real-time aircraft positions in MtZebra. Obtain final flight tracks from airborne mission scientists and ingest them in MtZebra. Prepare IOP summary with final aircraft tracks, terrain, and precipitation (if present).	off

*PCD—POC Center Director
PSC—POC Science Coordinator
POCOC—POC Operations Coordinator
PAC—POC Aircraft Coordinator
PES—POC Radar Engineers
PRS—POC Radar Scientists

Table 5:

Type of Event	Staff*	00-06 UTC	06-12 UTC	12-18 UTC	18-24 UTC
W-IOP no A/C	PCD	off	Chair weather and facility briefing (0800-0845). Available for questions and problems related to the POC activities. Coordinate nowcasting support.	Available for questions and problems related to the POC activities. Coordinate nowcasting.	off
	PSC	off	0600-0800: Review current weather and project status. 0800-0845: Attend weather and facility briefing. 0845-0900: Call MOC Science Director for preliminary discussion of today's activities. 0900-1030: Lead POC participants in preparation of today's Wet MAP science proposal. Consult via video or phone with PI's at MOC in this preparation. Proposal should recommend: (1) If a W-IOP will start in the next 24 h. (2) If so when & where DOW deployed, (3) when S-Pol and RONSARD begin ops and which scan strategies they should employ, and (4) what aircraft flights would be useful.	Participate in Mission Selection Team decision regarding use of aircraft in next day. Otherwise: Check on S-Pol, RONSARD, Mt. Lema, DOW, and OPRA data (reflectivity, radial velocity, particle types). Recommend changes in S-Pol and RONSARD scan strategies as weather and operational conditions warrant. Prepare data for IOP summary of this W-IOP.	off
	POCOC	off	0600-0800: Review facility status. 0800-0845: Attend weather and facility briefing. 1030-1130: Chair POC daily meeting. In first half of meeting lead POC discussion to review project status and activate DOW, S-Pol and RONSARD if called for in today's Wet MAP proposal. At 1100 join with MOC meeting via phone to discuss aircraft proposals.	If W-IOP has been continued re-deploy DOW and notify S-Pol and RONSARD that they will be continuing operations and what scan strategies they will employ.	off
	PAC	NA	NA	NA	NA
	PES	automatic radar data recording	Monitor data flow from radar sites. Monitor computing and communications equipment. Make sure a/c track data is being entered into real time MZeBra as long as aircraft is up.	Same as 06-12.	off
	PRS	off	Make MZeBra-based hourly regional radar composites for night-time hours and enter them on JOSS catalogue. Gather information on status of all radars (S-Pol, RONSARD, Mt. Lema, DOW, OPRA, ETH, KMRR, Italian radars) and report to POCOC before 0700. Continue making and JOSS-cataloguing half hourly regional composites. Include aircraft tracks.	Continue making and JOSS-cataloguing half hourly regional composites. Download OPRA data, create OPRA time-height plots of reflectivity, and report findings to PSC. Start constructing IOP summary of this W-IOP. Include OPRA data in IOP summary. 1700-1800: Participate in final update meeting for the day.	off

*PCD—POC Center Director
PSC—POC Science Coordinator
POCOC—POC Operations Coordinator
PAC—POC Aircraft Coordinator
PES—POC Radar Engineers
PRS—POC Radar Scientists

Table 6:

Type of Event	Staff*	00-06 UTC	06-12 UTC	12-18 UTC	18-24 UTC
W-IOP with A/C	PCD	off	Chair weather and facility briefing (0800-0845). Available for questions and problems related to the POC activities. Coordinate nowcasting.	Available for questions and problems related to the POC activities. Coordinate nowcasting.	off
	PSC	Participate in decisions regarding takeoff times of Wet MAP aircraft as required.	Participate in decisions regarding takeoff times of Wet MAP aircraft as required. Otherwise... 0600-0800: Review current weather and project status. 0800-0845: Attend weather and facility briefing. 0845-0900: Call MOC Science Director for preliminary discussion of today's activities. 0900-1030: Lead POC participants in preparation of today's Wet MAP science proposal. Consult via video or phone with PI's at MOC in this preparation. Proposal should recommend: (1) If a W-IOP will start in the next 24 h. (2) If so when & where DOW deployed. (3) when S-Pol and RONSARD begin ops and which scan strategies they should employ, and (4) what aircraft flights would be useful.	Participate in decisions regarding takeoff times of Wet MAP aircraft as required. Otherwise: Check on S-Pol, RONSARD, Mt. Lema, DOW, and OPRA data (reflectivity, radial velocity, particle types). Recommend changes in S-Pol and RONSARD scan strategies as weather and operational conditions warrant. Prepare data for IOP summary of this W-IOP. 1700-1800: Participate in final update meeting for the day	off
	POCOC	off	0600-0800: Review facility status. 0800-0845: Attend weather and facility briefing. 0845-10:30 Substitute for PSC as needed. 1030-1130: Chair POC daily meeting. In first half of meeting lead POC discussion to review project status and activate DOW, S-Pol and RONSARD if called for in today's Wet MAP proposal. At 1100 join with MOC meeting via phone to discuss aircraft proposals.	If W-IOP has been declared activate DOW, S-Pol, and RONSARD at the appropriate times. 1700-1800: Conduct final update meeting for the day	off
	PAC	NA	Communicate with aircraft.	Same as 06-12	Same as 12-18 till end of flight
	PES	automatic radar data recording	Monitor data flow from radar sites. Monitor computing and communications equipment	Same as 06-12. 1700-1800: Participate in final update meeting for the day	Same as 12-18 till end of a/c flight, then automatic radar data recording
	PRS	off	Enter real-time flight tracks into MtZebra. Make MtZebra-based hourly regional radar composites for nighttime hours and enter them on JOSS catalogue. Gather information on status of all radars (S-Pol, RONSARD, Mt. Lema, DOW, OPRA, ETH, KMRR, Italian radars) and report to POCOC before 0700. Continue making and JOSS-cataloguing half hourly regional composites. Include aircraft tracks.	Continue making and JOSS-cataloguing half hourly regional composites. Download OPRA data, create OPRA time-height plots of reflectivity, and report findings to PSC. Start constructing IOP summary of this W-IOP. Obtain final flight tracks from a/c scientists and ingest them into MtZebra. Include flight tracks and OPRA data in IOP summary. 1700-1800: Participate in final update meeting for the day	Same as 12-18 till end of a/c flight, then off

Abbreviations see other tables

LIST OF ACRONYMS

ACG	Austrocontrol
AGL	above ground level
AMDAR	Aircraft Meteorological Data Reporting
ANETZ	Swiss network of automatic meteorological stations
AOC	Aircraft Operation Center (NOAA)
ASL	above sea level
ATC	Air Traffic Control
CIG	Coordination and Implementation Group
CAT	Clear air turbulence
CETP	Centre d'Étude Terrestres et Planétaires
CLB	Constant level balloon
CMR	Centro Meteorologico Regionale
CNES	Centre National d'Études Spatiales
CNMCA	Centro Nazionale di Meteorologia e Climatologia Aeronautica
CNR	Consiglio Nazionale delle Ricerche
CNRM	Centre National de la Recherches Météorologiques
CNRS/UPS	Centre National de Recherche Scientifique/ Université Paul Sabatier
COAMPS	Coupled Ocean and Atmosphere Prediction System, US Navy
CWINDE	COST Wind Initiative for a Network Demonstration in Europe
DFG	Deutsche Forschungsgemeinschaft
DIAL	Differential absorption lidar
DLR	Deutsches Zentrum für Luft und Raumfahrt
DWD	Deutscher Wetterdienst
ECMWF	European Centre for Medium-Range Weather Forecasts
EC-RPN	Environment Canada, Recherche en Prévision Numérique
EdF	Électricité de France
ELDORA	airborne Doppler radar system
ENEL	Ente Nazionale Energia Elettrica
EPFL	Ecole polytechnique fédéral de Lausanne

ETH	Swiss Federal Institute of Technology
EUCOS	European Composite Observing System (an optimization exercise of EUMETNET)
EUMETNET	Network of the European Meteorological Services
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FISBAT-CNR	Istituto per lo Studio dei Fenomeni Fisici e Chimici della Bassa e Alta Atmosfera, Bologna
FIR	Flight Information Region
FORM	Foehn in the Rhine Valley during MAP
GIETH	Institute of Geography, ETH
GOES	Geostationary Operational Environmental Satellite
GOP	General Observing Period
GPS	Global Positioning System
GTS	Global Telecommunication System
GWB	gravity wave breaking
HNMS	Hellenic National Meteorological Service
IAF	Italian Air Force
ICG-CNR	Istituto di Cosmo-Geofisica, CNR, Torino
IFA-CNR	Istituto di Fisica dell'Atmosfera, CNR, Roma
IGP	International Governing Panel
IMK	Institut für Meteorologie und Klimaforschung (joint institute of University and Forschungszentrum Karlsruhe)
INDOEX	Indian Ocean Experiment
INM	Instituto Nacional de Meteorologia
INSU	Institut National des Sciences de l'Univers
IOP	Intensive Observational Period
IPA-DLR	Institut für Physik der Atmosphäre, DLR-Oberpfaffenhofen
IROE-CNR	Istituto di Ricerca sulle Onde Elettromagnetiche, Firenze
ISAO-CNR	Istituto di Scienze dell'Atmosfera e dell'Oceano
ISIATA-CNR	Istituto per lo Studio dell'Inquinamento Atmosferico e l'Agrometeorologia, CNR, Lecce
JRC	Joint Research Centre, Ispra

LA	Laboratoire d'Aérodologie, Toulouse
LaMP	Laboratoire de Météorologie Physique, Clermont-Ferrand
LAPETH	Institute for Atmospheric Sciences, ETH
LMD	Laboratoire de Météorologie Dynamique
LSEET	Laboratoire de Sondage Électromagnétique de l'Environnement Terrestre, Toulon
MADD	Module d'Acquisition De Données (automatic weather station, supplied by solar cells)
MAP	Mesoscale Alpine Programme
MDC	MAP Data Centre
METAIR	Swiss private company
METEOSAT	Meteorological Satellite, EUMETSAT
MF	Météo France
MHRDD	MAP High Resolution Data Domain
MOC	MAP Operation Centre
MST	Mission Selection Team
NASA	U. S. National Aeronautics and Space Administration
NCAR	U. S. National Center for Atmospheric Research
NCEP	National Center for Environmental Prediction
NOAA	U. S. National Oceanic and Atmospheric Administration
NRL	Naval Research Laboratory
NSF	National Science Foundation
NSSL	National Severe Storm Laboratory
NWP	Numerical Weather Prediction
OD	Operations Director
PBL	Planetary Boundary Layer
PO	Programme Office
POC	Project Operation Centre
PSC	POC Science Coordinator
PTU	Pressure, temperature, humidity sounding
PV	Potential Vorticity
RAF	Research Aircraft Facility (NCAR)

RASS	Radio Acoustic Sounding System
RONCARD	French Doppler radar
SABL	Scanning Aerosol Backscatter Lidar
SD	Science Director
SHMU	Slovak Hydro-Meteorological Institute
SMI	Swiss Meteorological Institute
SMI-AER	Aerological and remote sensing section, SMI
SMI-ENV	Environmental meteorology section, SMI
SOP	Special Observing Period
SQL	Search and Query Language
SSC	Scientific Steering Committee
SYNOP	report of a surface observation of a land station
TA	target area
UCAR	University Corporation for Atmospheric Research
UGM	Ufficio Generale per la Meteorologia
UKMO	United Kingdom Meteorological Office
ULF	Upper Level Feature
VMC	visual meteorological conditions
WIND	Wind Infrared Doppler Lidar
WMO	World Meteorological Organization
WP	Wind Profiler
ZAMG	Zentralanstalt für Meteorologie und Geodynamik, Austria