Potenza Atmospheric Observatory Vincenzo Cuomo and Gelsomina Pappalardo















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1° GRUAN Implementation-Coordination Meeting (ICM-1), Norman, Oklahoma, USA 2-4 March 2009



Potenza, italy

Potenza site



The Potenza atmospheric observatory operative at the CNR-IMAA is located in Southern Italy on the Apennine mountains (40.60N, 15.72E, 760 m a.s.l.), less than 150 km from the

West, South and East coasts.

The site is in a valley surrounded by low mountains (<1100 m a.s.l.)

- Different kinds of weather and climate regimes.
- Typical mountain weather strongly influenced by Mediterranean atmospheric circulation, resulting in generally dry, hot summers and cold winters.
- Orographic effects on cloud formation
- Dust and volcanic aerosols outbreaks
- Measurements of aerosol and clouds within a continental boundary layer.



IMAA ground based facility for Earth Observation

PEARL multi-wavelength Raman lidar (EARLINET)
Mobile aerosol multi-wavelength Raman lidar (EARLINET QA reference system)

Microwave profiler 12 channels (Radiometrics MP3014)

- \triangleright Radiosounding systems (P,T, RH, O₃ and wind) RS92-Vaisala
- CIMEL sunphotometer (AERONET)
- > Cloud-radar (METEK MIRA-36)
- > Ceilometer (Jenoptik CHM15k)
- Ceilometer (VAISALA CT25K)
- > Automatic surface radiation station
- (2Pyranometers, 1pyrgeometer, 1perieliometer)



Potenza EArlinet Raman Lidar (PEARL)

LASER: ND: YAG (Continuum Powerlite Precision II 9050)

Max. pulse energy : 1200mJ @1064nm 600mJ @532nm 350mJ @355nm Max. repetition rate 50Hz Beam divergence 0.25 mrad

(beam expander 2X with remixing)

RECEIVER: Cassegrain Telescope

Diameter of the primary mirror 0.5 m Combined focal length Nighttime field of view Achromatic lens Ø=2" f=50cm

1 mrad

5 m

CHANNEL SELECTION

Interference filters (FI), bandwidth 0.5 nm Polarizer beam splitter (BK7) a 532 nm (POL) Dichroic mirrors (DM e HT) Selection of high and low altitude channels

ACQUISITION

Fotomultipliers (PMT) THORN EMI 9202QA 532, 532L, 532II, 607 nm 9893/350B 355, 386 nm EG&G MCS - PCI (100ns min dwell time, 150MHz photon counting) APD 1064 nm Licel Transient recorder (12bit 20 MHz analogic, 250 MHz photoncounting)

Operational since 2000 (upgrade in 2005 of a pre-existing lidar system)







Potenza, Italy, (40.60%, 15.73°E), 26 June 2006, 0 0:56:07 - 01:26:24 UTC



MP3014 Microwave profiler





K-band channels = 22.235, 23.0335, 23.835, 26.235, 30 GHz V-band channels = 51.250, 52.280, 53.850, 54.940, 56.660, 57.290, 58.800 GHz <u>Rate</u>: > 12 s <u>Accuracy</u>: 0.5 K <u>Resolution</u>: 0.25 K

Output products (Neural network retrieval) Temperature, water vapour, relative

humidity and cloud liquid water profiles up to 10 km above the ground

Operational since February 2004



Radiosoudings

AS 13 Autosonde system (October 2004)
MW 21 manual system (July 2004)
PP15 manual system (January 1994)







CT25K ceilometer



CHM15K ceilometer





MIRA-36 Cloud-radar



Surface Radiation Station



CIMEL-CE318

Main involvements

Networks

-EARLINET (European Aerosol Research LIdar NETwork)

-AERONET (Aerosol Robotic Network)

-Cloudnet (Development of a European pilot network of stations for observing cloud profiles)

EC projects

- EARLINET-ASOS (Advanced Sustainable Observation System) 2006-2011
- GEOMON (Global Earth Observation and Monitoring of the atmosphere) 2007-2011

ESA projects

- ESA-ESTEC "Aerosols and Clouds: Long Term Database from Spaceborne Lidar Measurements" (2008-2010)

- ESA-ESRIN VALID "MULTI-MISSION QUALITY ANALYSIS BY LIDAR" (2008-2013)

- ESA-ESRIN CEOS (Committee on Earth Observation Satellites) intercalibration of groundbased spectrometers and lidar (2008 - 2013)

CAL/VAL programs

- ENVISAT
- CALIPSO
- Next: ADM-Aeolus and EarthCARE

WMO

- GAW-GALION (Global Atmospheric Watch LIdar Observation Network)
- WMO Sand and Dust Storm Warning System (SDSWS)

Special Measurement Campaigns: ICARTT, EAQUATE, LAUNCH-2005, COPS-2007, LUAMI-



EARLINET: European Aerosol Research Lldar NETwork

Systematic observations since 2000 to establish a qualitatively and quantitatively significant database for the horizontal and vertical distributions of atmospheric aerosols over Europe



25 lidar stations

- 8 multiwavelength Raman lidar stations $3\beta + 2\alpha + \delta$ (=)
- 9 Raman lidar stations ()
- 8 single backscatter lidar stations ()

• 3 systematic regular aerosol lidar measurements per week

• special measurement campaigns to study special events (Saharan dust outbreaks, volcanic eruptions, forest fires)

• Data quality has been assured by instrument intercomparisons using the available transportable systems. The quality assurance also includes the intercomparison of the retrieval algorithms for both backscatter and Raman lidar data. Moreover, tools for the continuous quality check of the instruments and algorithms used have been developed.



1a) What is the site status with respect to the requirements outlined in GCOS-121 and GCOS-112 (priority 1 and 2)?

Priority1

-<u>Standard surface variables</u> (pressure, temperature, humidity and wind) MILOS520 AWS (including PW and Rain Gauge)

- <u>balloon-based observations of temperature</u>, <u>water vapour and</u> <u>winds</u> (including pressure and GPS/radar height on balloons)

AS 13 VAISALA autosonde+2manual systems (GPS availlable)

-Ground-based GPS receivers to measure total column water vapour

Trimble GPS receiver available



1a) What is the site status with respect to the requirements outlined in GCOS-121 and GCOS-112 (priority 1 and 2)? *Priority 2* Surface radiation instruments as currently deployed for the Baseline Surface Radiation Network: BSRN-like station (Kipp and Zonen) available but need "certification"

Microwave radiometer: Radiometrics Mp3014 microwave profiler available

Sunphotometers: CIMEL Sunphotometer (AERONET) available

<u>Cloud geometrical properties</u>: METEK MIRA-36 cloud-radar Jenoptik CHM15k and VAISALA CT25k ceilometers+Heimann IRT available

<u>Lidar</u>: Multi- λ Raman lidar for water vapor and aerosol and cloud properties available

Integrated trace gas measurements: could be implemented by the end of 2010

<u>Multi-channel infrared radiometer, such as an AERI</u>: AERI (could be available by the end of 2010)



1b) Which guidelines/manuals do you use when taking measurements, if any?

> EARLINET guidelines for aerosol and clouds lidar measurements

- AERONET guidelines
- For commercial instruments: manuals and guidelines provided by the manufacterer
- Radiosoudings, MWP and Raman lidar integration for water vapor measurements

Additional information: >GPS time server for syncronization



1c) What is your data dissemination practice?

> EARLINET data policy for aerosol and clouds lidar data (data accessible through the EARLINET database)

> AERONET data available through AERONET

Dedicated website at IMAA for quicklooks visualization (end of 2010)

> The access to the data is based on the request of the data to the instrument PI or to the coordinator of the experimental field

No restrictions beyond 1-yr

Data are available in netcdf format



2. What do you need from the Lead Centre / working group / secretariat?

- Data storage
- Data dissemination, in particular for real and/or near real time data
- > Metadata
- Working groups for the develoment of methodologies for the QA/QC
- "Fast response" support about the network operations

- Clarifications are needed regarding time schedule, procedures and the whole process
- Actions to gain support from national funding agencies



3) Are there any scientific or organizational developments we should be aware of?

Scientific and organizational developments in the definition of QA programs including instruments inter-comparison campaigns and algorithm inter-comparisons (EARLINET, GALION, Cloudnet, CEOS, ISO)

> Development of algorithms for the integration of lidar and microwave measurements for cloud profiling

> Measurement campaigns involving the full exploitation of the synergy between active and passive sensors

> Evaluation of the performance of numerical weather prediction models using lidar and radiometry (Cloudnet)



Satellite Validation: CALIPSO

Starting from June 2006 we are performing measurements following the EARLINET strategy for Calipso validation purposes



PEARL - Aerosol Backscatter @ 1064 nm

Saharan dust layer extends between 2 and 9 km a.s.l.

CALIPSO - Attenuated Backscatter @ 532 nm

532 nm Total Attenuated Backscatter, /km /sr Begin UTC: 2006-06-26 01:06:11.5882 End UTC: 2006-06-26 01:19:30.5652 Version: 1.05 Image Date: 09/06/2006





1° GRU

LIDAR: Water vapor

Water Vapor profiles characteristics

Night time measurements 60 m – 12000 m a.s.l. 15-150 m vertical resolution 10 minutes temporal resolution



Daytime measurements 90 m – 5000 m a.s.l. 15-300 m vertical resolution 10 minutes temporal resolution





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LIDAR: Water vapor



• Routine comparisons with NWPMs (CloudNET)

- Long time series of measurements (campaigns, special events)
- Improvement of parameterization



Clouds



• Mixed-phase

• Thin clouds



Lidar+microwave profiler: Kalman filter



Perspective : integration multi-wavelength Raman LIDAR + MWP+Cloud-Radar

