CIAO (CNR-IMAA Atmospheric Observatory)

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Potenza site

The ground-based 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.

Potenza GRUAN site

The Potenza site, run by the Istituto di Metodologie per l'Analisi Ambientale (IMAA) of the Italian National Research Council (CNR), has been formally established as an advanced atmospheric observatory, named CIAO (CNR-IMAA Atmospheric Observatory).

At the end of 2009, the Italian Met Service and the Permanent Representative of Italy with WMO, on the basis of the invitation of the GCOS secretariat, has expressed to the president of the National Research Council (CNR) his positive opinion to the formal request of including the CNR-IMAA Atmospheric Observatory in the GRUAN global monitoring network. This allows the IMAA to formal participate in GRUAN.

The equipment of the facility is currently fully operational. Respect to the status of the facility at the time of the ICM-1 meeting, new automatic quality check procedures for providing quality-controlled data on the vertical profiles of clouds, humidity, temperature and aerosols are under implementation. Moreover, the writing of the instrument manuals/handbook is in progress and their publications on the CIAO website, along with the near-real time quicklooks of all the instruments of the observatory, is expect for the mid 2010.

CIAO ground based facility for Earth Observation

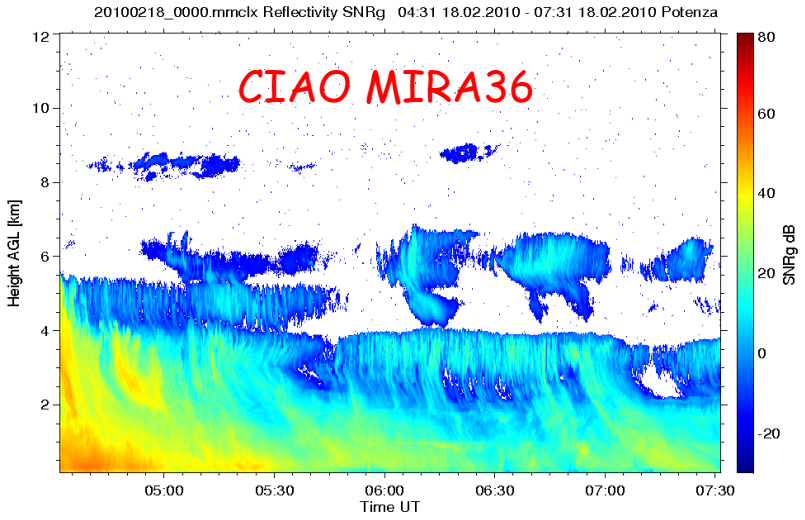
- PEARL muliwavelenght Raman lidar (EARLINET)
- Microwave profiler 12 channels (Radiometrics MP3014) + IR thermometer
- PP15 and MW21 manual radiosounding systems (P,T, RH, O_3 and wind) RS92-Vaisala
- Autosonde AS13 (P,T, RH and wind) RS92-Vaisala
- CIMEL sunphotometer (AERONET)
- Cloud-radar (METEK MIRA-36)
- Ceilometer (Jenoptik CHM15k)
- Ceilometer (VAISALA CT25K)
- Automatic surface radiation station (2Pyranometers, 1pyrgeometer, 1perieliometer - Kipp&Zonen)
- GPS receiver (Trimble)
- MUSA (Multiwavelenght System for aerosol) lidar – Intercomparison reference system for EARLINET/CEOS/NASA/ESA

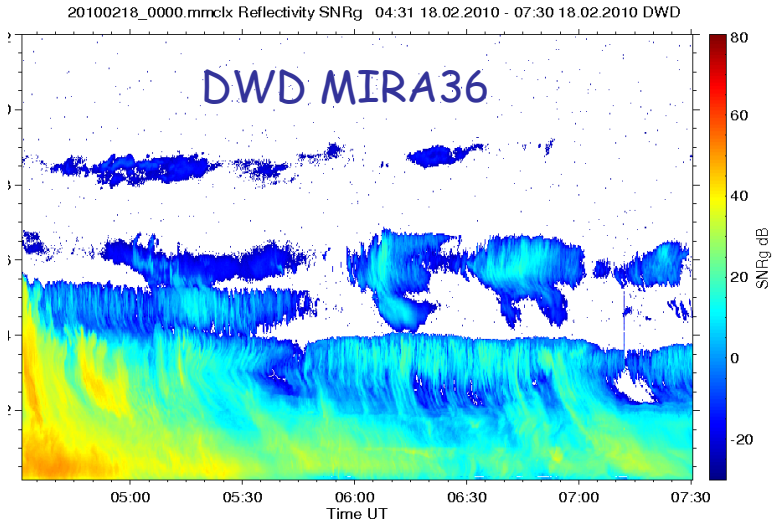
Site news: Ka-band cloud radar

The acquisition of new instruments is planned with particular interest for the acquisition of a FTIR and devices for trace gases monitoring, as well as the acquisition of a new GPS receiver.

A new scanning unit of the 36 GHz radar, already operational in the zenith pointing mode, is expected for the end of March 2010. The description of the whole equipment of the facility is available on the CNR-IMAA website (www.imaa.cnr.it). A updated website for CIAO will be soon available.

Radar co-located measurements





Courtesy of Uli Gorsdorf (MOL-RAO DWD)

1. Which of your existing radiosonde launches already meet the mandatory requirements (GCOS-121: once weekly best production quality radiosonde, once monthly stratospheric water vapour; recommended twice daily), and which additional launches need to be instigated or augmented?

- Radiosoundings performed at CIAO were usually performed once per week contemporaneously with the Raman lidar regular night time measurements.
- In the frame of the priority phase 1 of GRUAN, in order to match the GCOS mandatory requirements and to instigate additional launches respect to the past activities, the following launch schedule is proposed:
- a. once weekly best production quality radiosonde (autosonde launcher)
- b. once monthly stratospheric water vapour (manual and simultaneous with the autosonde launch)

The stratospheric water vapour launch will be performed using the devices and the techniques suggested by the GRUAN expert community.

2. Which ground based measurements can you provide in addition to the mandatory GPS total water vapour column (microwave, FTIR, lidar, …) and how can you use these additional observations to make sure that measurement uncertainty estimates will be consistent?

The observatory is already equipped with a Trimble GPS receiver. The data are freely accessible but the implementation of the suitable algorithms, in cooperation with experts in this field, is needed.
A support from the GRUAN community is expected for establishing the GPS data processing.

CIAO is also able to provide continuous measurements of water vapour provided by a microwave profiler and a sun photometer, as well as the Raman lidar measurements operated on a systematic basis.

3. Do you have any limitations regarding the development of GRUAN launch protocols for routine and reference sonde launches (e.g. the use of autosonde launchers)?

- No limitation for the development at the site of the GRUAN launch protocols. These three systems allow to perform multiple radiosoudings.

- In the past, several tests with multiple balloon launches using different radiosonde types, like RS-80, RS-90 and RS-92 (SGP, K, KL) have been performed to assess and diagnose instrument failure and characterize instrument biases.

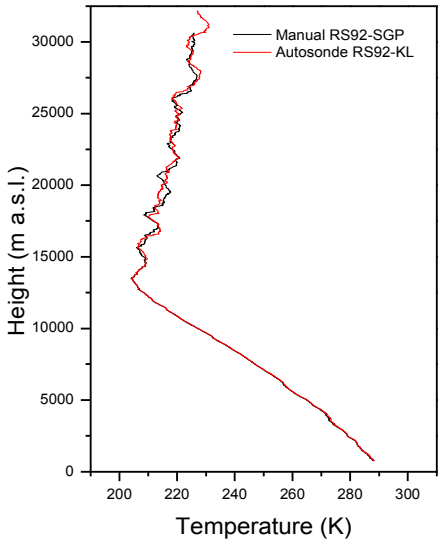
- The autosonde system has been recently upgraded and recalibrated by the manufacturer.

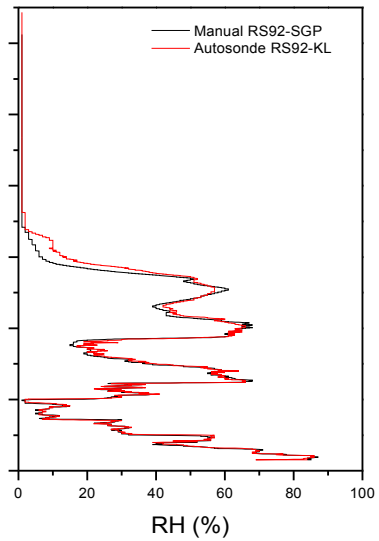
- CIAO proposal for developing the GRUAN protocols is to perform routine launches using the autosonde launcher and to perform stratospheric water vapour or other additional launches using the manual system.

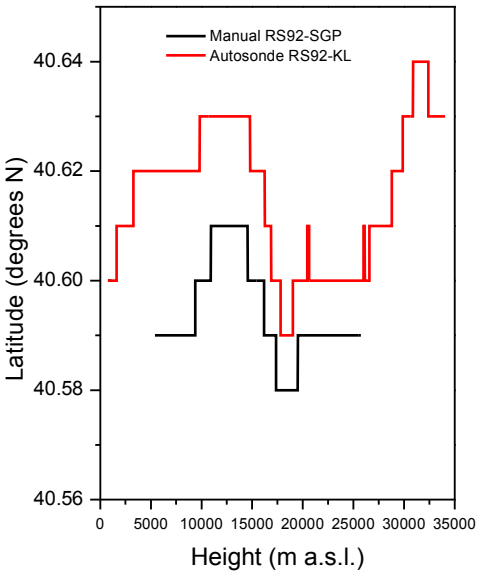
Autosonde launcher + manual

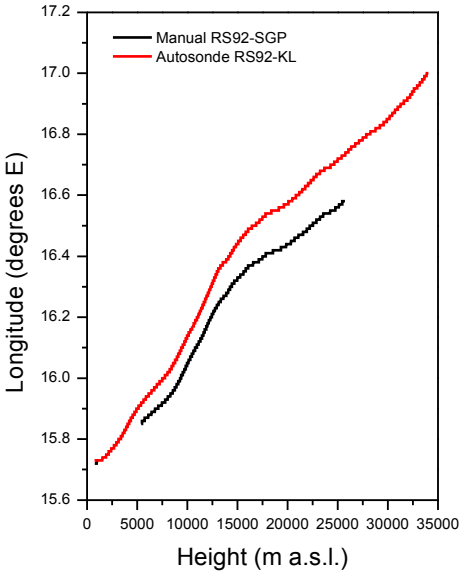
- Comparison between RS92-KL (autosonde launcher) and RS92-SGP.
- Distance between the two systems: about 50 m
- Start time difference: 10 seconds
- Very good agreement for temperature
- RH differences lower than 3 % up to 6 km, and less than 5 % between 6 and 13 km above the station

Tito Scalo (Potenza), Italy, (40.60°N, 15.73°E), 18 October 2004, 1613 UTC









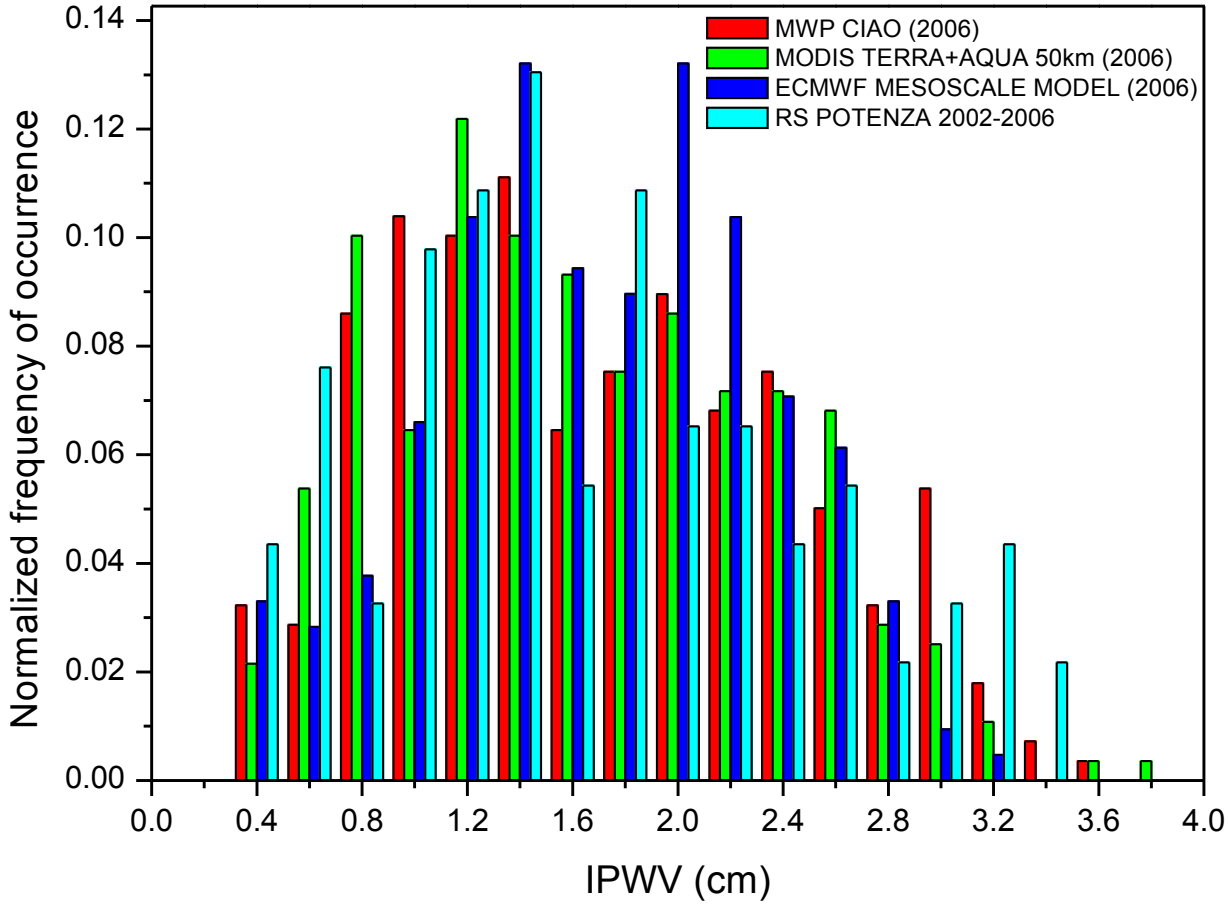
4. Do you have any limitations regarding the development of uniform GRUAN data processing schemes for remote sensing observations?

- There are no limitation for the development of GRUAN data processing schemes for remote sensing. Actually we could build on the expertise already gained in other networks (EARLINET, Cloudnet, etc.)

5. What local analysis can you provide to assure that measurements uncertainties will be consistent across the network (analysis of redundant observations either dual sonde launches or sonde + remote sensing observations)?

- CIAO archive contains several example of dual sonde launches (manual-automatic) as well as co-located and contemporaneous radiosoundings and remote sensing measurements
- This redundant dataset allow us redundant analysis for ensuring the consistency of the measurements uncertainties with the rest of the network
- Preliminary radiosounding representativeness study
- Within GRUAN: monthly stratospheric water vapour (manually) performed contemporaneously to the weekly autosonde launch to increase the dataset redundancy and to assess possible limitations in the routine use of the autosonde launchers

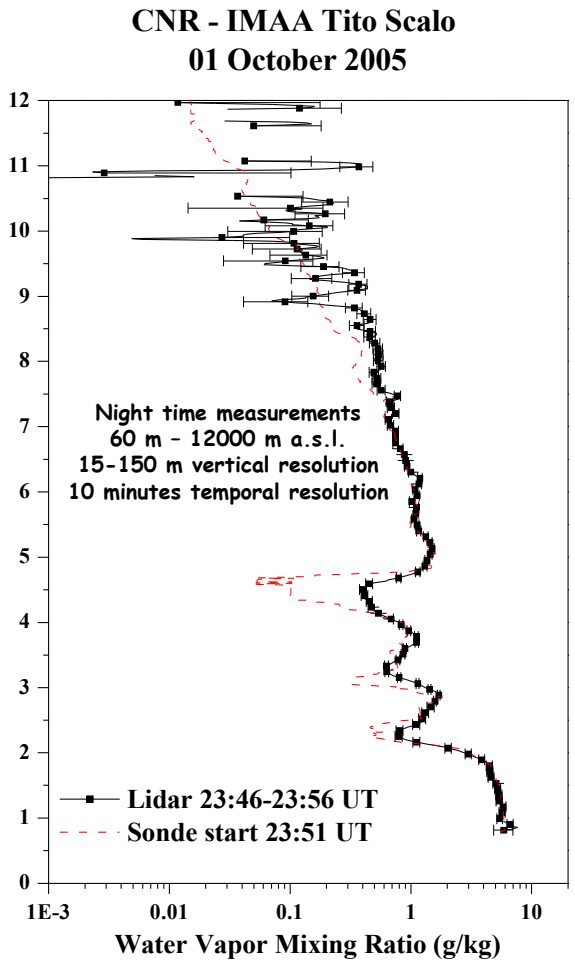
Representativeness

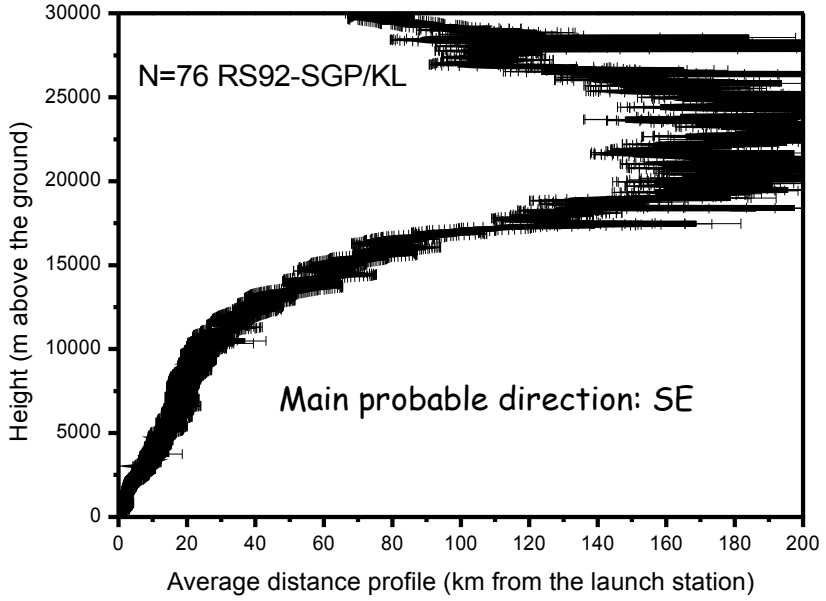


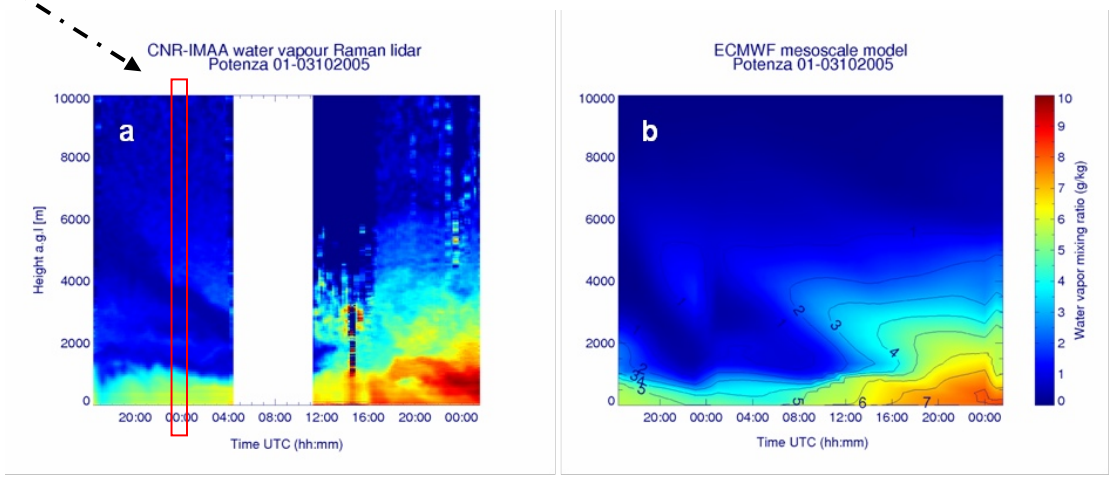
2006 cumulative distribution of MWP+MODIS+ECMWF vs 2002-2006 RS distribution

Next: Study of representativeness on a larger spatial domain.

Representativeness



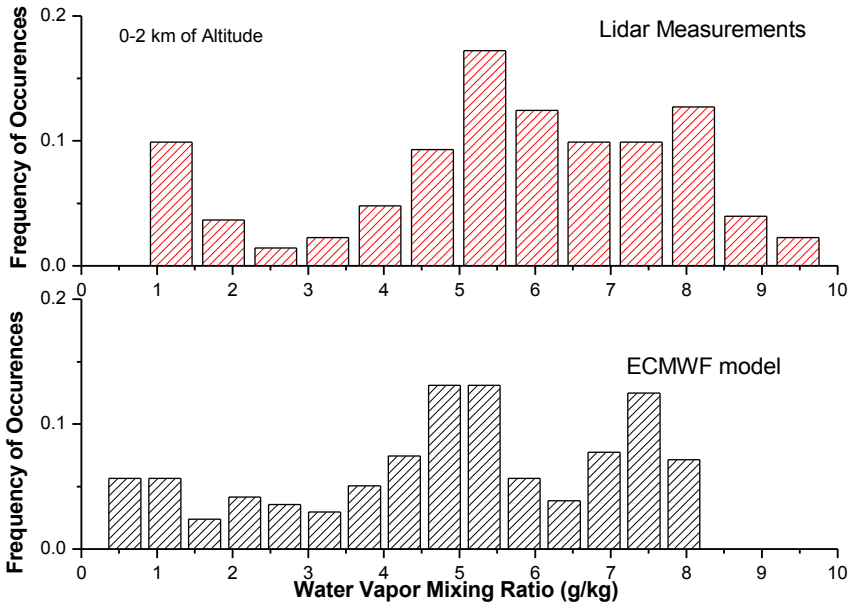




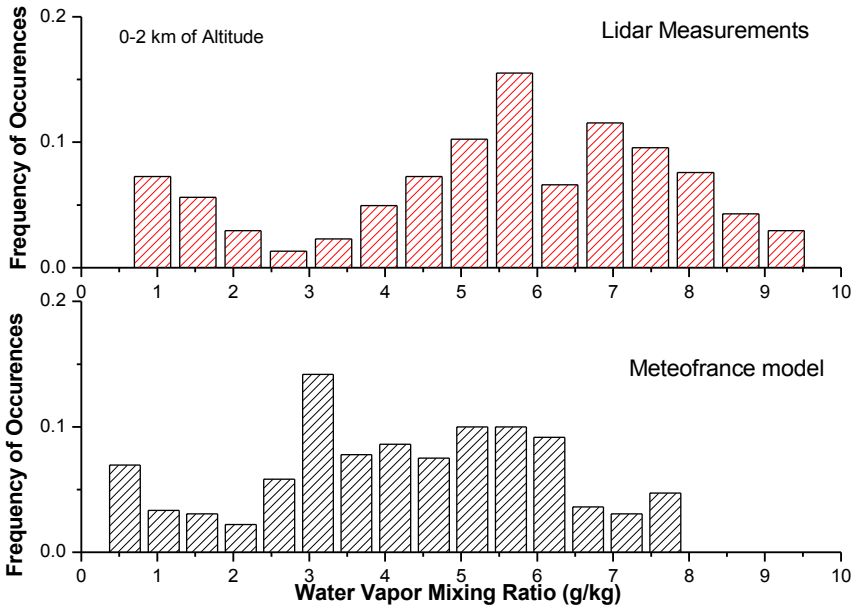
SYSTEMATIC LIDAR – MODEL COMPARISON

Quantitative OBSERVATION-MODEL comparisons can be carried out in terms of the probability density function (pdf) calculated for both lidar and models data reduced at models resolutions in different altitude ranges.

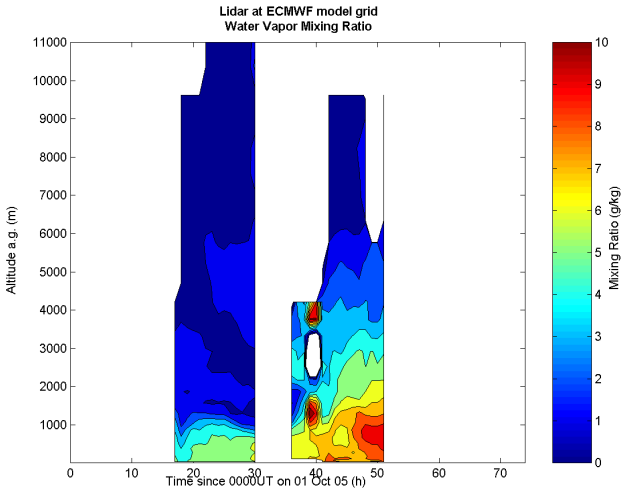
ECMWF model



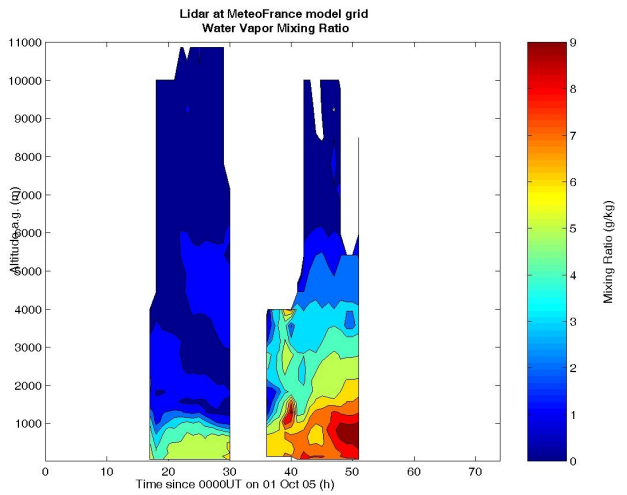
MeteoFrance model



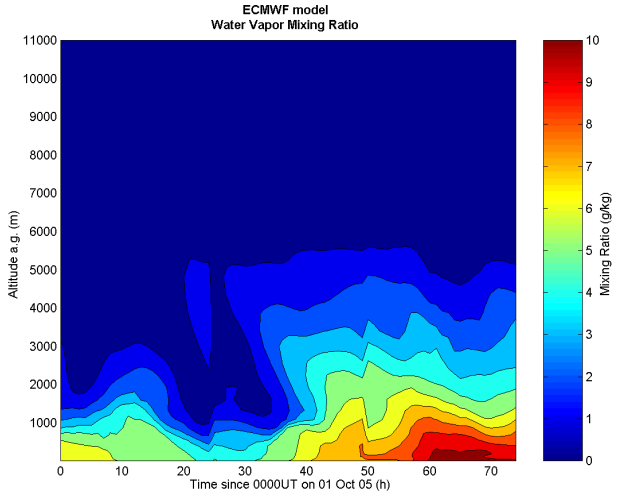
Lidar at ECMWF model grid



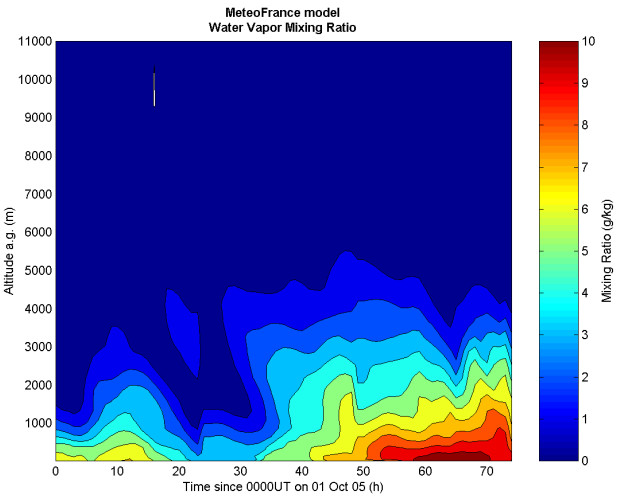
Lidar at MeteoFrance model grid



ECMWF model data



MeteoFrance model data



6. For sonde observations: Can you provide all raw data for central archiving?

- For sonde observations, CIAO can provide all raw data for central archiving. No restrictions exists regarding the transfer of the data to a central collection unit; the raw data will be also stored in the CIAO central archive as well.

7. For remote sensing observations: Will you be able to archive all raw data for possible future reanalysis and reprocessing?

- Clarify if "Raw data" is lv0 or lv1?
- CIAO observatory has an archive that is already operative and routinely collects all the lv1 (e.g. radiances) raw data and processed data provided by in situ and remote sensing instruments operated at the observatory.
- For most of the devices also the lv0 (e.g. electrical signals) data are routinely stored in the data archive.
- Some techniques (e.g. radar), lv0 data are represented by the single spectrum collected with an high temporal resolution that requires huge storage capacity. In this case, the option to consider the lv1 as the raw data is probably the most appropriate.

8. What help do you need from the Lead Centre/WGARO/ GCOS Secretariat in moving forwards?

- "Fast response" support in case of questions about the network operation and about news on actions to gain support from the scientific community, sponsors, funding agencies, call for applications.

- Support for the GPS data processing. possible links with GPS experts for starting the data processing and gain the preliminary information for running and critically using the routine for the data processing.

- Lead Centre/working groups support regarding the methodologies to apply for the instrument calibration/intercomparison/validation and for the protocols for data dissemination.

9. Will you be able so host local intercomparison campaigns (yet to be scheduled)?

CIAO is an infrastructure particularly suitable for performing intercomparison campaign.

•The facility is design to host these experiments and it can also an archive facility for the data storage and a guesthouse.

•The infrastructure already hosted measurements campaign (EAQUATE, Zhou et al. 2006, BAMS) as well as special experiments performed by manufacturer (e.g VAISALA) for the optimization of the data collection and processing using radiosoundings.

•Moreover, in the next future possible funding could be available for such measurement campaings from the transnational access activities of EU FP7 proposals that are currently under evaluation.

Ongoing activities and perspectives

CIAO operation: next future

- Scanning radar (3D) + FTIR + trace gases
- GPS new receiver
- Integration LIDAR(3β+2α+δ)+MWP+Cloud-Radar
- Completing representativess study and extending it to RAOB operational stations next to Potenza (Pratica di Mare and Brindisi)

Ongoing……

- CAL/VAL strategy for current and future mission
- Mesoscale model evaluation

Perspectives for GRUAN

CIAO operation in the frame of GRUAN

- Ready for the phase 1 using both manual and automatic launcher
- Preparation of reference intercomparison experiment (CFH)
- GPS receiver already operational: request for scientific support
- Surface data ok
- Development of integration approaches for the prority
  phase 2: water vapour and clouds

Possible contribution to GRUAN

-Extending representativess study (RS+remote sensing+model+satellite) to other sites

- GRUAN strategy for using RS and remote sensing data for CAL/VAL and model evaluation