Hardware and software infrastructure for long-term environmental monitoring at the IDPA-CNR Col Margherita atmospheric observatory


CNR-IDPA
CNR-ISAC

14 marzo 2018
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Col Margherita in the frame of GMOS
   Characteristics of the site
      2012-2015

Upgrade of the Station

Conclusions
From 2010 to 2015 (http://www.gmos.eu)

- global impact of Hg
- consequences for the environment and for the human health
- over 35 remote global monitoring stations
- oceanographic campaigns
- airplane studies
Falcade (BL)

- 2543 amsl
- 46.36683 N
- 11.79192 E

Ideal position, representative of the region

- absence of local influences for most of the year
- Föehn e Stau & cross-border transport
1 Col Margherita in GMOS Site

Period of activity

2 New infrastructure
Automation
Weather
Upgrade
Cloud
Web page
Remote Control
Data analysis

3 Conclusions

▶ http://colmargherita.dsa.unive.it
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Figure 1. Coverage and consistency (%), on monthly basis, of GEM data collected at some of the ongoing GMOS secondary stations during the period 2011–2015.
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Col Margherita in the frame of GMOS

Upgrade of the Station
  HW & SW development
  Weather sensors
  New sensors
  Cloud storage
  Real-time data
  OpenVPN for remote management
  Real-time data analysis

Conclusions
OpenWrt: Linux distribution for embedded devices
AWS sensors

- CR800 Series Datalogger
- 05108-45 Wind Speed & Direction Sensor
- CS215 Temperature & Relative Humidity Sensor
- CS106 Barometric Pressure Sensor
- 109 Temperature Probe
Collaboration between IDPA-CNR and ISAC-CNR start at the begin of 2017

- Ozone analyzer
- 4-Component Net Radiometer
- OPC
- nephelometer
- SR50A Sonic Ranging Sensor
- SI-111 Precision Infrared Radiometer
- CR1000 Campbell datalogger
- Aerosol bulk/wet deposition chemistry
Scalable system!
- Analog & Digital I/O
- ADC 16 bit
- Fast acquisition rate (~ 100 kHz)
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colmargherita@unive.it

Router 3G
Rete UMTS TIM
20 GB/month

Rclone (rsync)

Sharing
1 Col Margherita in GMOS

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colmargherita@unive.it
Server & backup
Rclone
Kiosk screen
Chromium directed to website
Virtual machine
http://colmargherita.dsa.unive.it/mrg
http://shiny.bo.isac.cnr.it:3838/idpa_cnr_colmargherita
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ANALYSIS
ITERATIVE / INTERACTIVE
SERVER & backup

OUTPUT
DATA
DOCUMENT

Ubuntu

REPRODUCIBLE
Guidelines

EBAS atmospheric database, Co-operating frameworks and projects include:

- Convention on Long-Range Transboundary Air Pollution - EMEP
- WMO Global Atmosphere Watch Programme
- Arctic Monitoring and Assessment Programme (AMAP)
- EU-project Aerosols, Clouds, and Trace gases Research InfraStructure Network (ACTRIS)
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Col Margherita in the frame of GMOS

Upgrade of the Station

Conclusions
Conclusions

- Remote control and management
- Real-time data available (open mode)
- Improve the infrastructure
- Automatic report
- Interoperability (e.g. Unive - Atmos. Aerosol, Arabba Avalanche Center - Snow metamorphism, ...)

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Thank you!

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Institute for the Dynamics of Environmental Processes (IDPA)
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3 Conclusions

<table>
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<th>WC (°C)</th>
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Air Temperature & Wind Chill

Air Temperature & Wind Chill

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TIME

T (°C)

T

WC

Air Temperature & Wind Chill
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### Air Temperature

![Air Temperature Chart]

**T (°C)**

- November 2017 to February 2018
  - Average temperature varies significantly between months.
  - Highest temperature observed in February 2018.
  - Lowest temperature observed in November 2017.

**Seasonal Analysis**

- Winter months (November to February) show lower temperatures.
- Spring months (March) show a slight increase in temperatures.

**Conclusion**

The data analysis indicates that the temperature variations are largely due to seasonal changes rather than infrastructure or technology upgrades.

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Wind Speed

![Box plot of wind speed](image)