

ACTRIS

Aerosols, Clouds, and Trace gases Research Infrastructure Network

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Outline

- *Introduction*
- *Previous experience (EARLINET, EUSAAR)*
- *ACTRIS*
- *Global Scale*
- *National level*
- *Summary and remarks*



Aerosol observations for climate and air quality research

Aerosols are very difficult to handle in models

Aerosols are produced by many different processes, some sources are localized, others are distributed over large volumes

Aerosols interact dynamically in a nonlinear way (nucleation, condensation, coagulation, deposition)

Aerosols can be transported over large distances

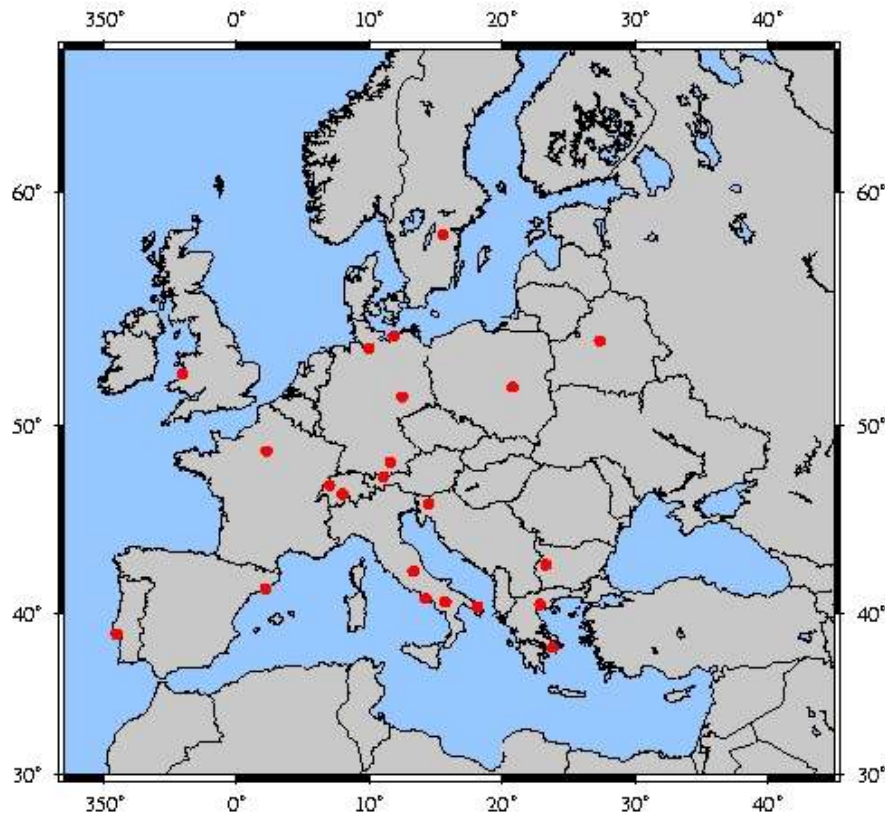
Measurements are needed to assess and improve understanding of aerosol processes and their treatment in models



EARLINET

European Aerosol Research Lidar NETwork

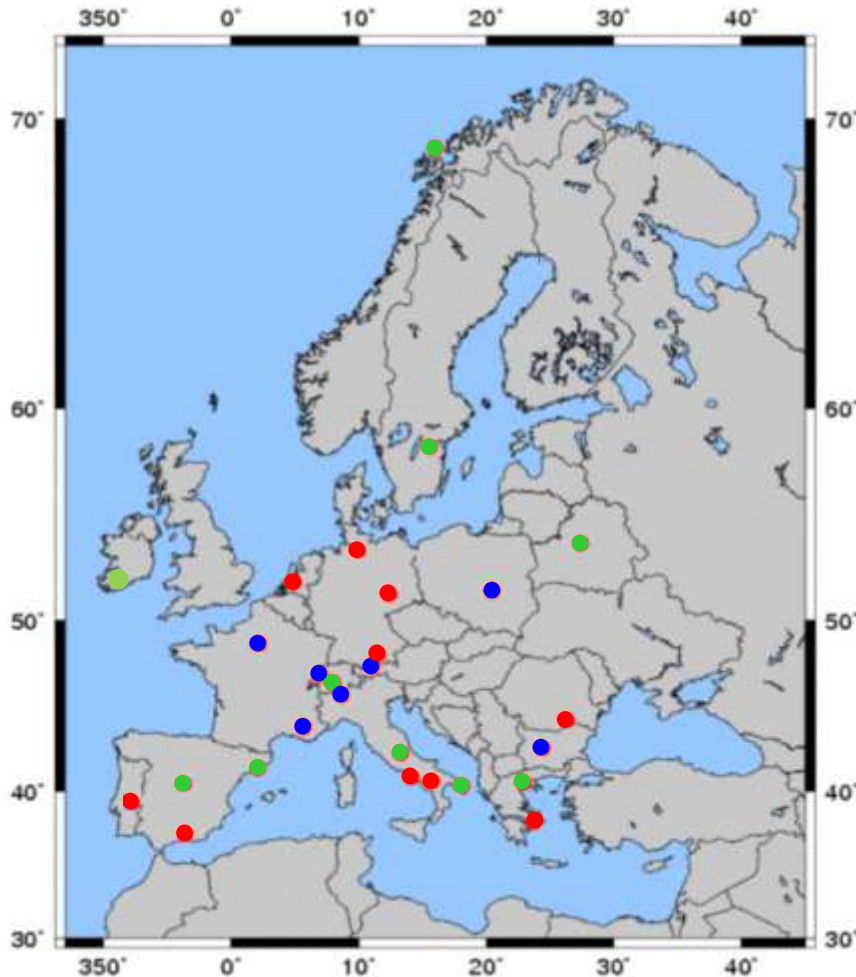
EARLINET was established in February, 2000 as a research project supported by the European Commission under the Fifth Framework Programme within the Energy, Environment and Sustainable Development Programme, contract No EVR1-CT-1999-40003.



- 22 lidar stations distributed over 14 European countries
- main objective: to establish a qualitatively and quantitatively significant database for the horizontal and vertical distributions of atmospheric aerosols over Europe
- 3 systematic regular aerosol lidar measurements per week
- special measurement campaigns to study special events (Saharan dust outbreaks, volcanic eruptions, forest fires)
- system level and retrieval algorithms intercomparisons



EARLINET 2010



- since 2000

- 27 lidar stations

- **10 multiwavelength Raman lidar stations**

- backscatter (355, 532 and 1064 nm) + extinction (355 and 532 nm) + depol ratio (532 nm)

- **10 Raman lidar stations**

- **7 single backscatter lidar stations**

- comprehensive, quantitative, and statistically significant data base

- Continental and long-term scale

- www.earlinet.org





EARLINET ASOS

European Aerosol Research Lidar Network: Advanced Sustainable Observation System

EC Infrastructure Project 1 March 2006 - 28 February 2011

The overall objectives are:

- To extend the development of the European Aerosol Research Lidar Network as a world-leading instrument for the observation of the 4-dimensional spatio-temporal distribution of aerosols on a continental scale, resulting in accurate, well-defined, and easily accessible data products for use in science and environmental services.
- To enhance the operation of this instrument to foster aerosol-related process studies, validation of satellite sensors, model development and validation, assimilation of aerosol data into operational models, and to build a comprehensive climatology of the aerosol distribution.
- To play a leading role in the development of a global observation network for the aerosol vertical distribution as a major innovative element of GEOSS, by setting the standards for instruments, methodology, and organization in this specific area.



Funded by EU under the infrastructure program (March 2006- Feb. 2011)

Coordination CNRS

Overall objective : Integration of atmospheric aerosol measurements performed in a distributed network of 20 high quality European ground-based stations. This integration contributes to a sustainable and reliable operational service in support of policy issues on air quality, long-range transport of pollutants and climate change.



The EUSAAR network



ACTRIS

Aerosols, Clouds, and Trace gases Research Infrastructure Network

Type of funding scheme: Combination of Collaborative Projects and Coordination and Support Actions for Integrating Activities

Work programme topics addressed: FP7-INFRASTRUCTURES-2010-1

Support to existing research infrastructures /Integrating Activities

INFRA-2010-1-1.1.16: Research Infrastructures for Atmospheric Research

Integrating the key ground-based facilities for long-term observation of aerosols, cloud-aerosol interactions, and trace gases in Europe

ACTRIS aims at integrating European ground-based stations equipped with advanced atmospheric probing instrumentation for **aerosols, clouds and short-lived gas-phase species**.

ACTRIS will have the essential role to support building of new knowledge as well as policy issues on climate change, air quality and long-range transport of pollutants.



The ACTRIS Consortium

28 partners, 13 third parties, 20 associated partners

Participant no.	Participant organisation name	Country
1	Consiglio Nazionale delle Ricerche (CNR)	Italy
2	Centre National de Recherche Scientifique (CNRS)	France
3	Norsk Institutt for Luftforskning (NILU)	Norway
4	Helsingin Yliopisto (UHEL)	Finland
5	Technische Universiteit Delft (TUD)	The Netherlands
6	Paul Scherrer Institut (PSI)	Switzerland
7	Leibniz Institut fuer Troposphaerenforschung e.V. (IFT)	Germany
8	Eidgenoessische Materialpruefungs- und Forschungsanstalt (EMPA)	Switzerland
9	University of Reading (UREAD)	United Kingdom
10	Universitat Politecnica de Catalunya (UPC)	Spain
11	Max-Planck-Institut für Meteorologie (MPG)	Germany
12	Lunds Universitet (ULUND)	Sweden
13	Agencia Estatal Consejo Superior De Investigaciones Cientificas (CSIC)	Spain
14	National University of Ireland, Galway (NUIG)	Ireland
15	Natural Environment Research Council (NERC)	United Kingdom
16	Foundation for Research and Technology (FORTH)	Greece
17	Commission of the European Communities - Directorate General Joint Research Centre (JRC)	Italy
18	Deutscher Wetterdienst (DWD)	Germany
19	B.I. Stepanov Institute of Physics, National Academy of Sciences of Belarus (IPNASB)	Belarus
20	Institute for Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences (BEO)	Bulgaria
21	Uniwersytet Warszawski (UWAR)	Poland
22	Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia (CNISM)	Italy
23	National Institute of Research and Development for Optoelectronics (INOE)	Romania
24	Ludwig-Maximilians-Universitaet Muenchen (LMU)	Germany
25	Czech Hydrometeorological Institute (CHMI)	Czech Republic
26	Pannon Egyetem (UPAC)	Hungary
27	Belgian Institute for Space Aeronomy (BIRA-IASB)	Belgium
28	Universidad de Valladolid (GOA-UVA)	Spain

4 years project
EC Contribution
7800 kEuro





The main objectives of ACTRIS are:

- To provide long-term **observational data relevant to climate and air quality research** on the regional scale produced with standardized or comparable procedures throughout the network
- To provide a coordinated framework to support trans-national **access to large infrastructures** strengthening high-quality collaboration in and outside the EU and access to **high-quality information and services** for the user communities (research, Environmental protection agencies, etc.)
- To develop **new integration tools** to fully exploit the use of multiple atmospheric techniques at ground-based stations, in particular for the calibration/validation/integration of satellite sensors and for the improvement of the parameterizations used in global and regional-scale climate and air quality models
- To enhance training of new scientists and new users in particular students, young scientists, and scientists from eastern European and non-EU developing countries in the field of atmospheric observation
- To promote development of new technologies for atmospheric observation of aerosols, clouds and trace gases through close partnership with EU SMEs





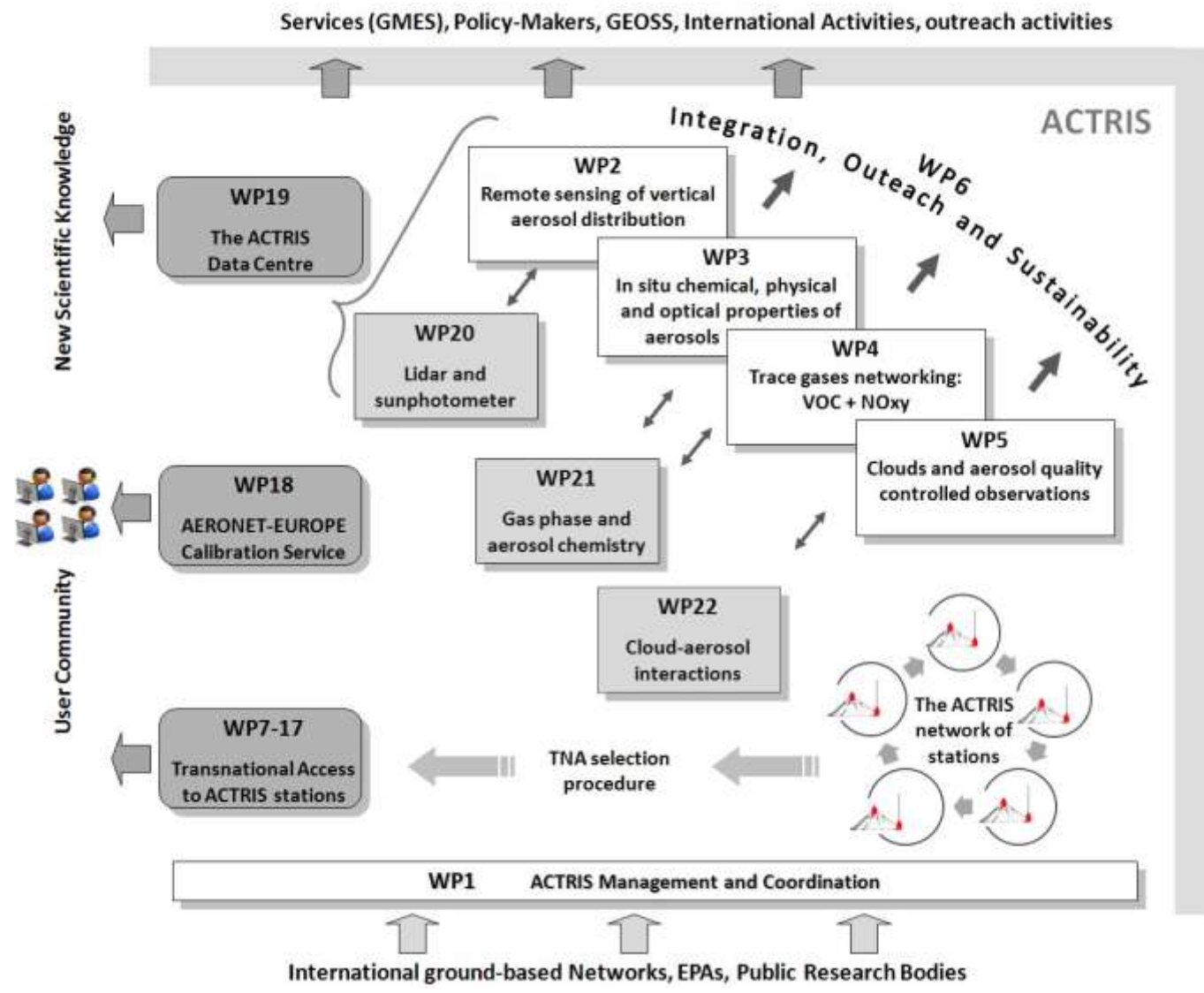
ACTRIS builds a new research infrastructure on the basis of a consortium joining existing networks/observatories that are already providing consistent datasets of observations and that are performed using state-of-the-art measurement technology and data processing.

In particular the ACTRIS consortium merges two existing research infrastructures funded by the European Commission under FP6: **EUSAAR** (European Supersites for Atmospheric Aerosol Research) and **EARLINET** (European Aerosol Research Lidar Network).

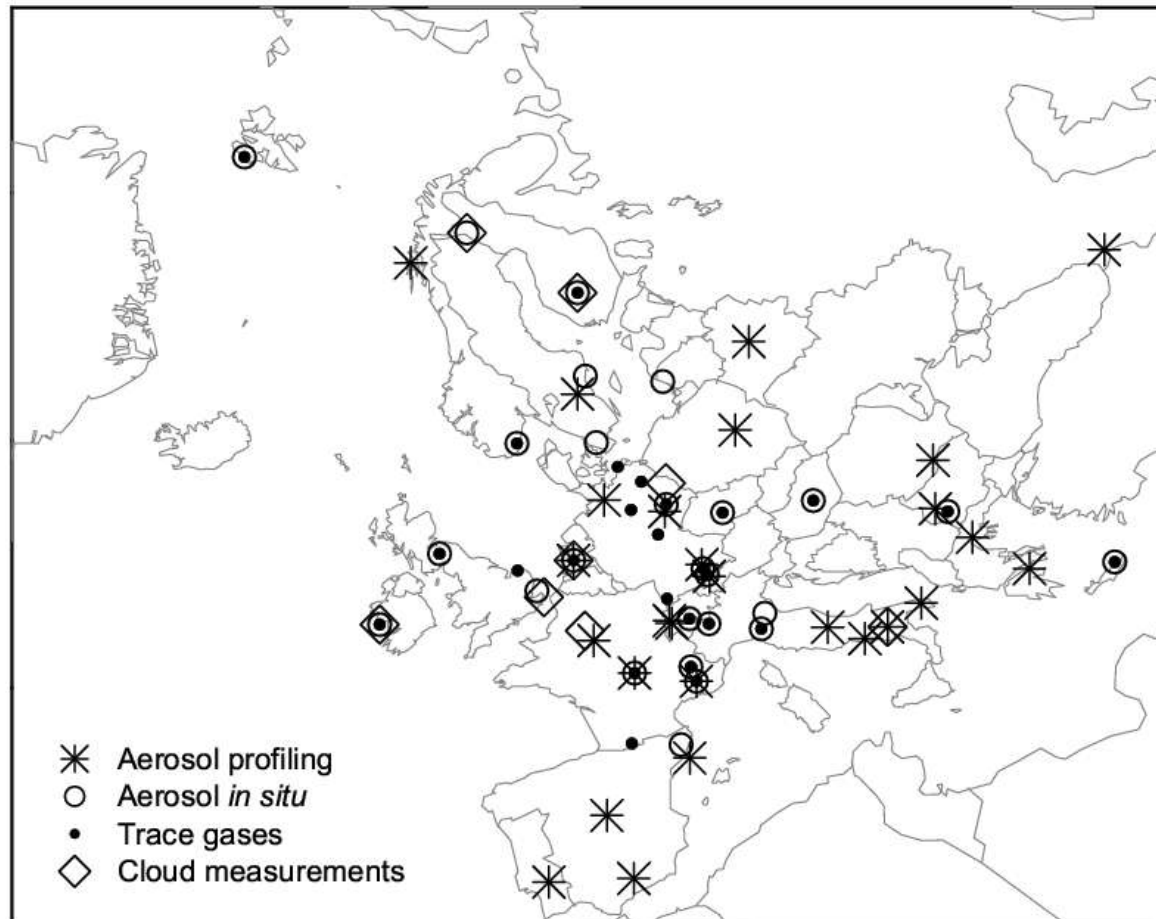
ACTRIS also includes the distributed infrastructure on aerosol – cloud interaction existing from a previous EU Research project **CLOUDNET** and by grouping the existing EU ground-based monitoring capacity for short-lived trace gases which is, at present, not coordinated at any level, besides **EMEP** (European Monitoring and Evaluation Programme) and **GAW** (Global Atmosphere Watch) caring for a few specific compounds.

ACTRIS represents an unprecedented effort towards **integration of a distributed network of ground-based stations**, covering most climatic regions of Europe, and responding to a strong demand from the atmospheric research community.





Map of measurement sites contributing to ACTRIS



CIAO: CNR-IMAA Atmospheric Observatory



Main instruments

- PEARL multi-wavelength Raman lidar (EARLINET)
- Mobile aerosol multi-wavelength Raman lidar (EARLINET QA reference system)
- Microwave profiler 12 channels (Radiometrics MP3014)
- 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, 1perielimeter)

Networks

- GRUAN (GCOS Reference Upper Air Network)
- EARLINET (European Aerosol Research Lidar NETwork)
- GALION (GAW Aerosol Lidar Observation Network)
- AERONET (Aerosol Robotic Network)
- Cloudnet (Development of a European pilot network of stations for observing cloud profiles)





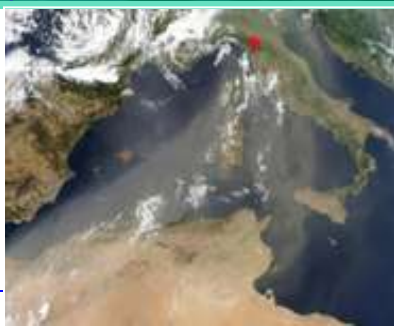
Mt. Cimone GAW-WMO Station "Ottavio Vittori" 2165 m EUSAAR (and ACTRIS) supersite

Contributo di: Bonasoni P., Cristofanelli P., Marinoni A., Duchi R., Bonafè U., Calzolari F.

- Libero orizzonte a 360° sulla vetta più elevata degli Appennini settentrionali
 - Normalmente al di sopra del PBL
 - Si trova sul bordo di due zone climaticamente differenti: l'Europa continentale ed il Bacino del Mediterraneo
 - Assenza di emissioni locali (uso esclusivo di energia elettrica)
 - Collegamento satellitare (Regione Emilia Romagna – Rete Lepida) che permette il controllo virtuale della strumentazione e dati in NRT
 - Accesso remoto garantito durante l'anno (4 laboratori, 1 terrazzo attrezzato, 6 posti letto)
 - Sito considerato rappresentativo delle condizioni di fondo della troposfera (Bonasoni et al., 2000; Fischer et al., 2003; Cristofanelli and Bonasoni; 2008)
 - Influenzato da masse d'aria inquinata provenienti dalla Pianura Padana e dall'Europa continentale (Bonasoni et al., 2000, Cristofanelli et al, 2003, 2009; Maione et al., 2008)
 - Influenzato da aerosol minerale proveniente dal Sahara (Bonasoni et al., 2004; Van Dingenen et al., 2004; Marinoni et al., 2007)
 - Influenzato da eventi di intrusione di masse d'aria di origine stratosferica (Buzzi et al., 1984, 1985; Bonasoni et al., 2000; Meloan et al., 2003; Cristofanelli et al., 2006, 2008)
- La stazione "O. Vittori" è ospitata presso le strutture del Servizio Meteo dell'Aeronautica Militare Italiana (CARM Mt. Cimone)*

Measurements
Surface ozone
Halogenated gases and VOC
CH ₄ , CO, N ₂ O, SF ₆
NO ₂ -O ₃ total+tropospheric column
Aerosol number concentration and size distribution
(10nm-20µm) Aerosol light absorption
Eq. black carbon Aerosol scattering
Chemical composition in PM ₁ -10 and PM ₁ size fractions
PM-10 (gravimetry)
7Be, 210Pb
Radon-222
Calculated from ...

Attività' di misura condotte con:
 Università di Urbino,
 Università di Bologna,
 ARPA-ER, ENEA



ENVIRONMENTAL GOALS

Le principali attività di ricerca riguardano:

- Global Changes
- Atmospheric Composition
- Air Quality
- Aerosol properties
- Transport processes
- Technological application



National level



- Lidar
- *in situ*
- ▲ Sun-photometers

National Road Map - MIUR



La rete osservativa del CNR per il supporto alle azioni del Dipartimento della Protezione Civile

- Osservazioni remote sensing ground-based (lidar, ceilometri, fotometri)
- Mezzi mobili
- Strumentazione da aereo
- Stazioni in situ in quota (Monte Cimone e Longobucco)

- Prodotti standard, nuovi prodotti, integrazione dati
- Gestione dati
- Individuazione nuovi siti e nuove tecnologie/metodologie



Summary and remarks

EARLINET, EUSAAR, ACTRIS link to all the other I3 and ESFRI

Sustainable observation system at European level

support is needed at national level

in some case Italian leadership (EARLINET, ACCENT, ACTRIS)

italian participation (EUSAAR, COPAL, EUFAR, ICOS, SIOS, LIFEWATCH ..)

Research infrastructure as core for scientific research and developments and also for more operational services (FPVIII, GMES)

At global scale WMO-GAW and WMO-GCOS

Future opportunities
ESFRI, GMES, FPVII and FPVIII, ESA

The role of CNR

Thanks

