

Misure LIDAR di aerosol e trasporto da sorgenti remote

Gelsomina Pappalardo
CNR-IMAA

Outline

- *Introduction*
- *EARLINET*
- *EARLINET database*
- *Long range transport*
- *EARLINET-ASOS*
- *Summary and perspectives*

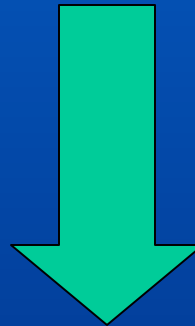
Aerosol profiling for climate and air quality research

Lidar measurements

Long term measurements

Distributed measurements

Advanced lidar systems for microphysical properties

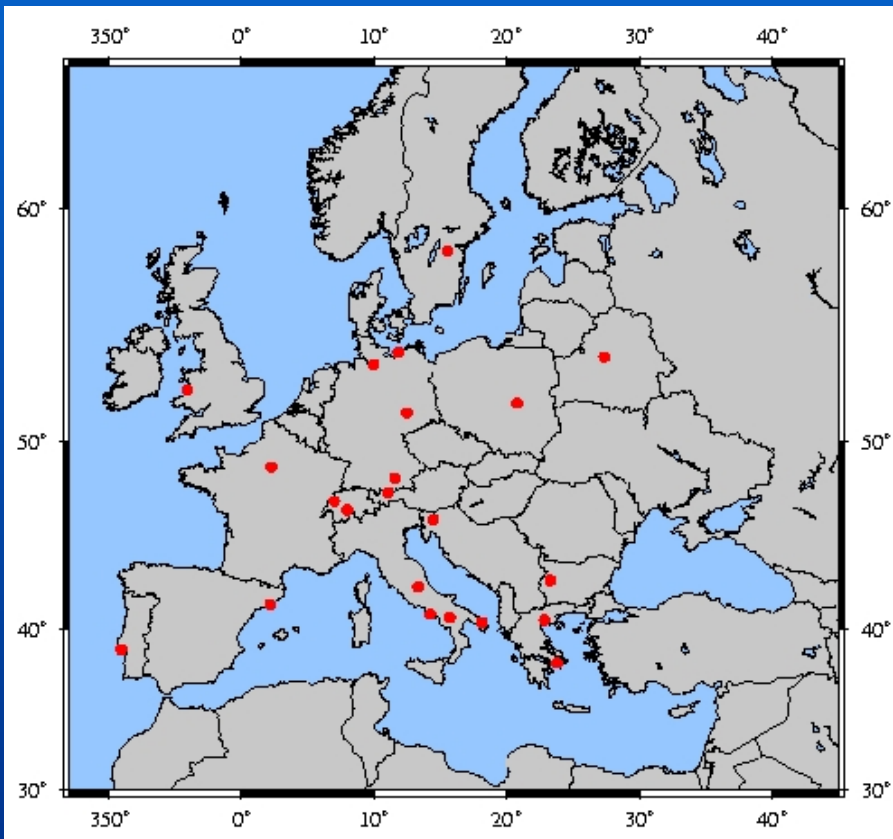


EARLINET

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 measurements started in May 2000

The EARLINET database represents the largest database for the aerosol distribution on a continental scale

All the files are divided in different categories related to regular and special conditions:

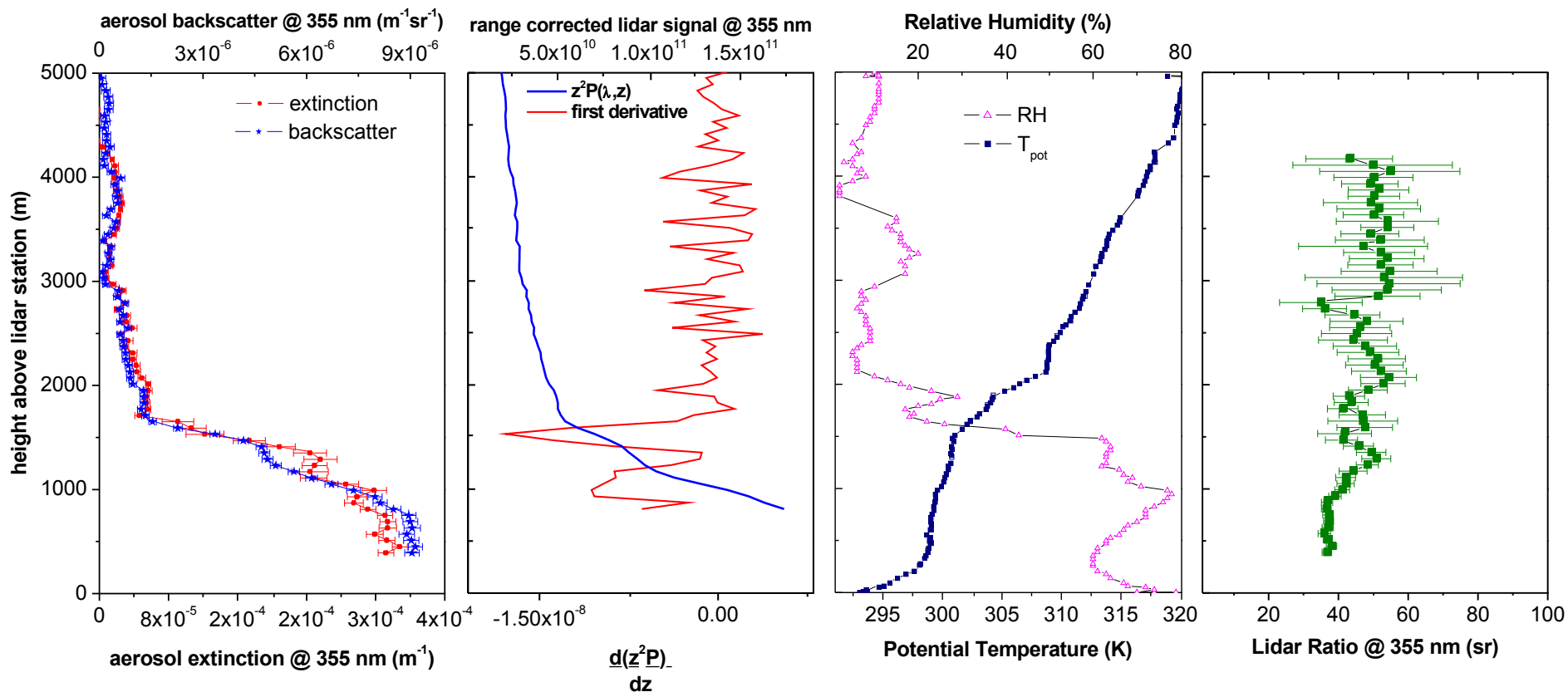
- *Climatology*
- *Cirrus*
- *Diurnal cycles*
- *Volcanic eruptions*
- *Forest Fires*
- *Photosmog*
- *Rural/urban*
- *Saharan dust*
- *Stratosphere*

Lidar ratio data retrieved from simultaneous and independent lidar measurements of aerosol extinction and backscatter

Lidar typical profiles

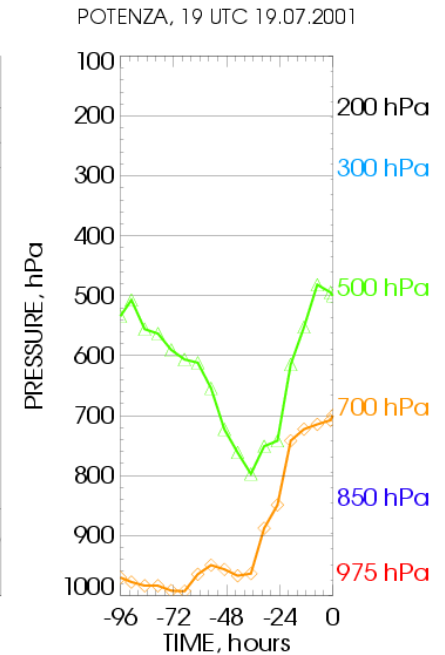
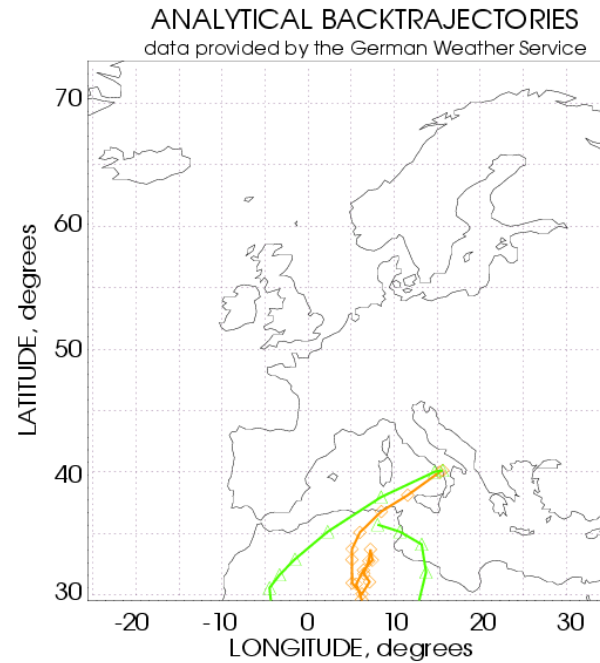
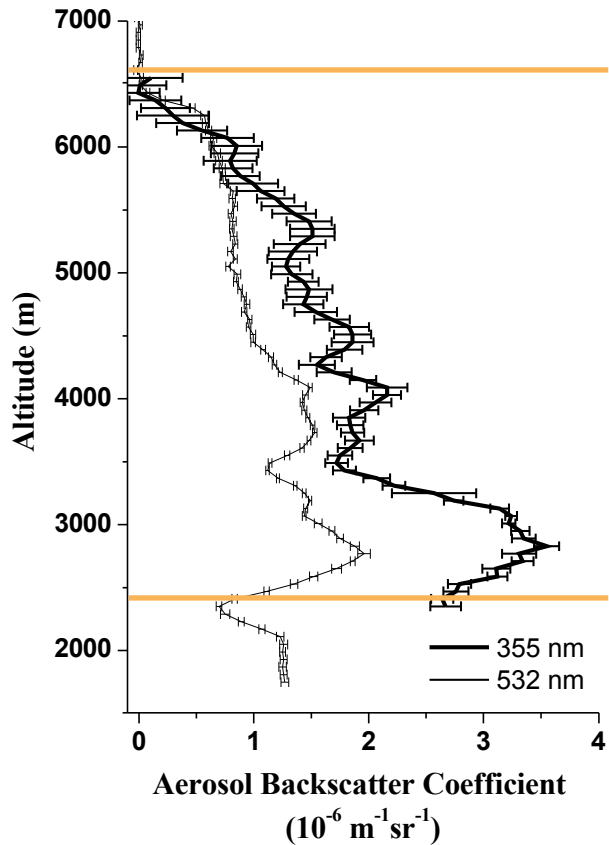
Potenza (40°36'4.32" N 15°43'25.3" E, 760 m a.s.l.)

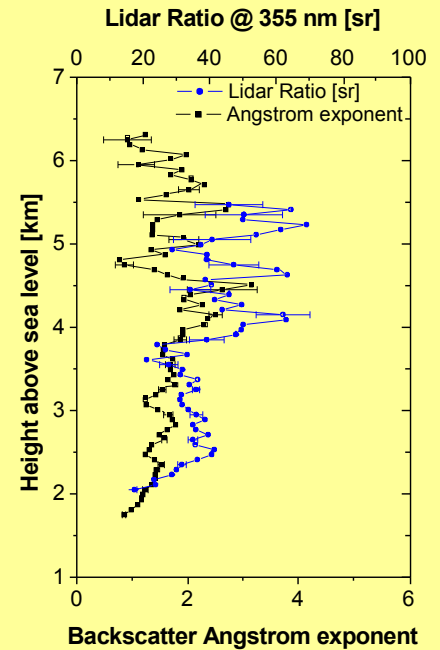
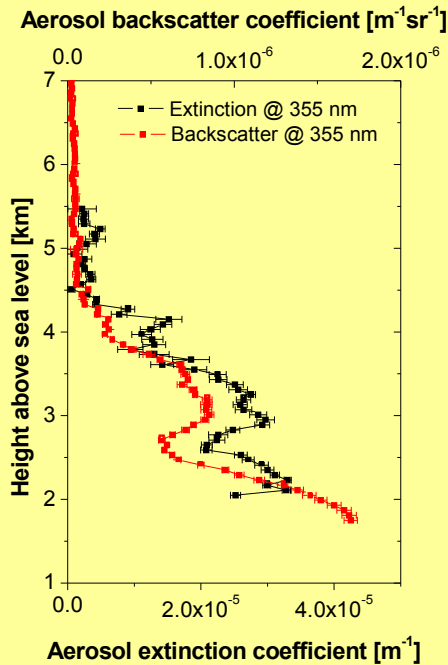
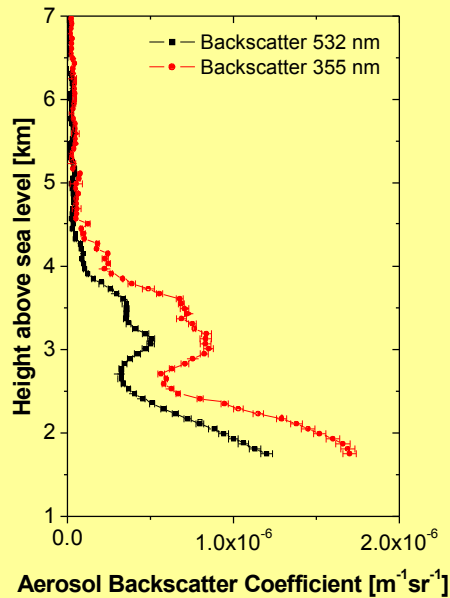
18 September 2002, 20:30-20:45 UTC



Saharan Dust Event

Potenza, July 19, 2001 - 20:30-21:00 UTC



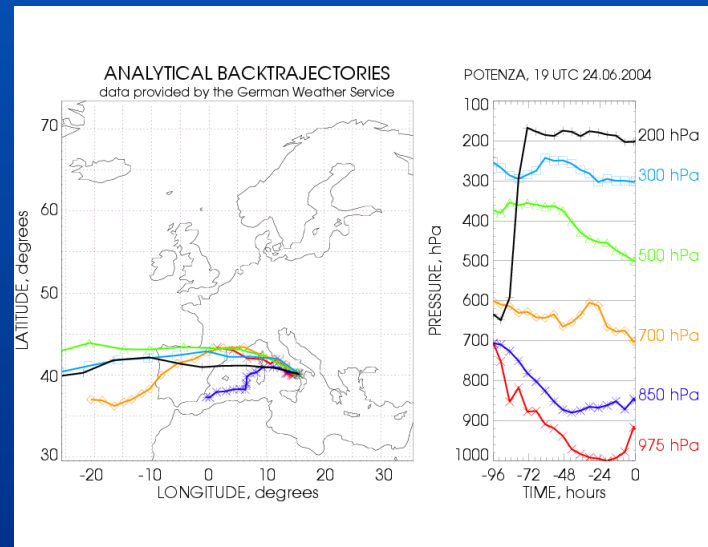


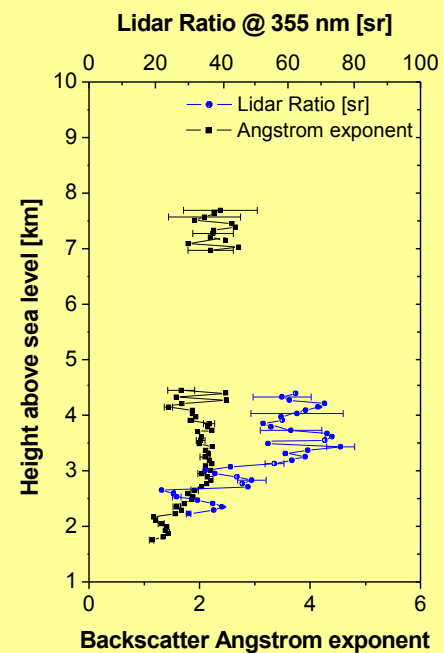
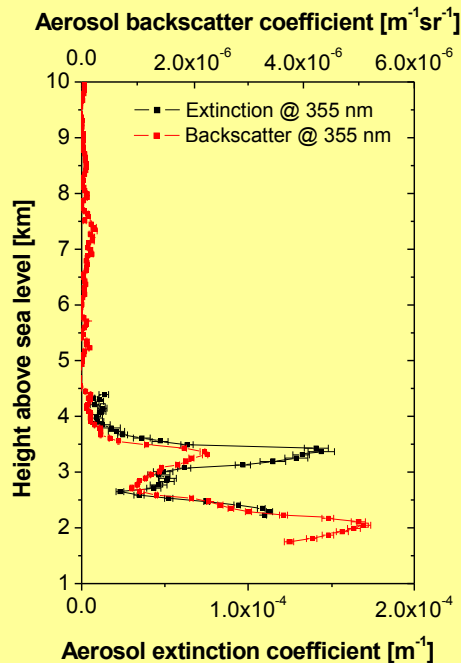
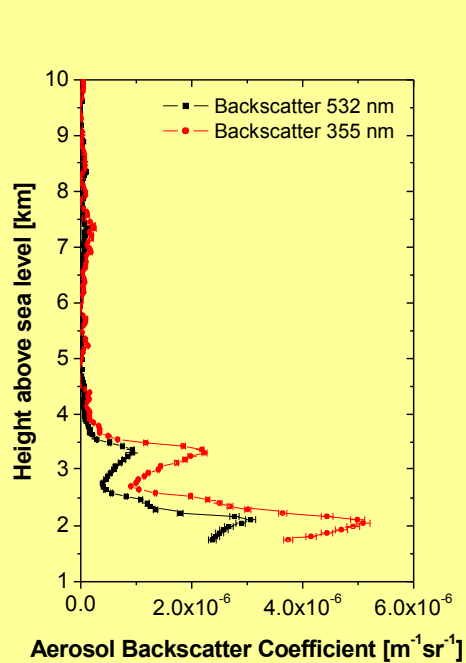
June 24, 2004

*Presence of pollution of anthropogenic
North American origin*

Lidar measurement:

19:20-19:50 UT



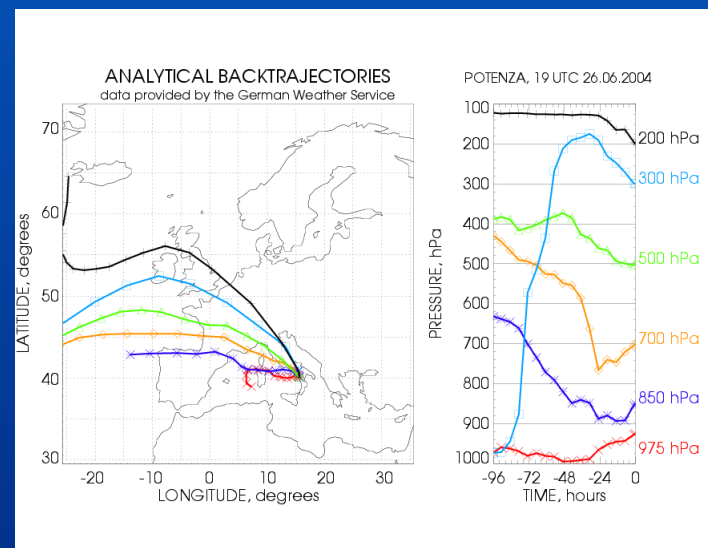


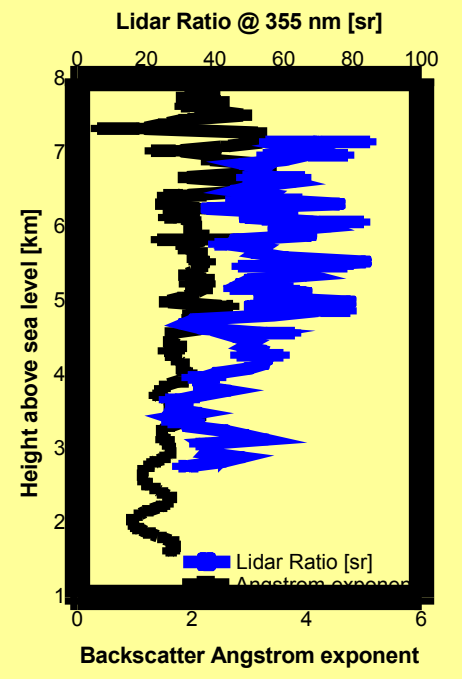
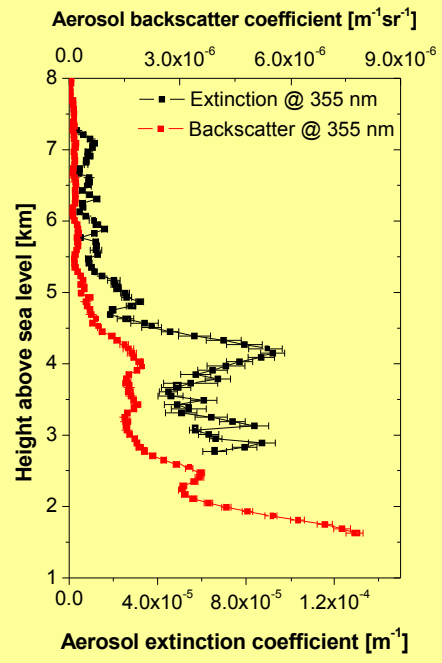
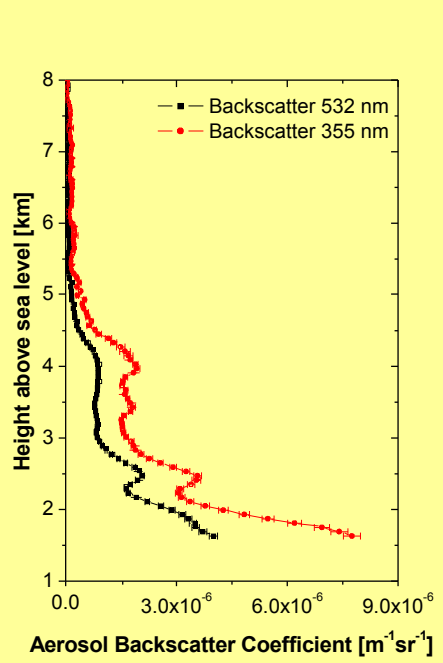
June 26, 2004

*Presence of pollution of anthropogenic
North American origin*

Lidar measurement:

20:00-21:00 UT

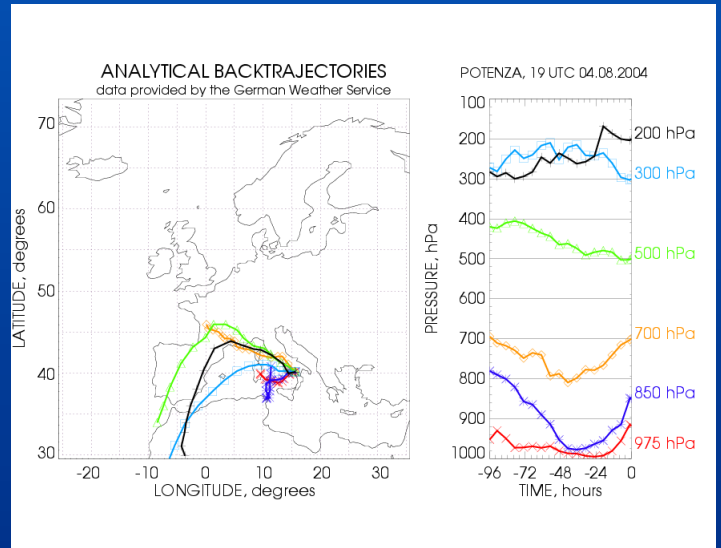




August 04, 2004

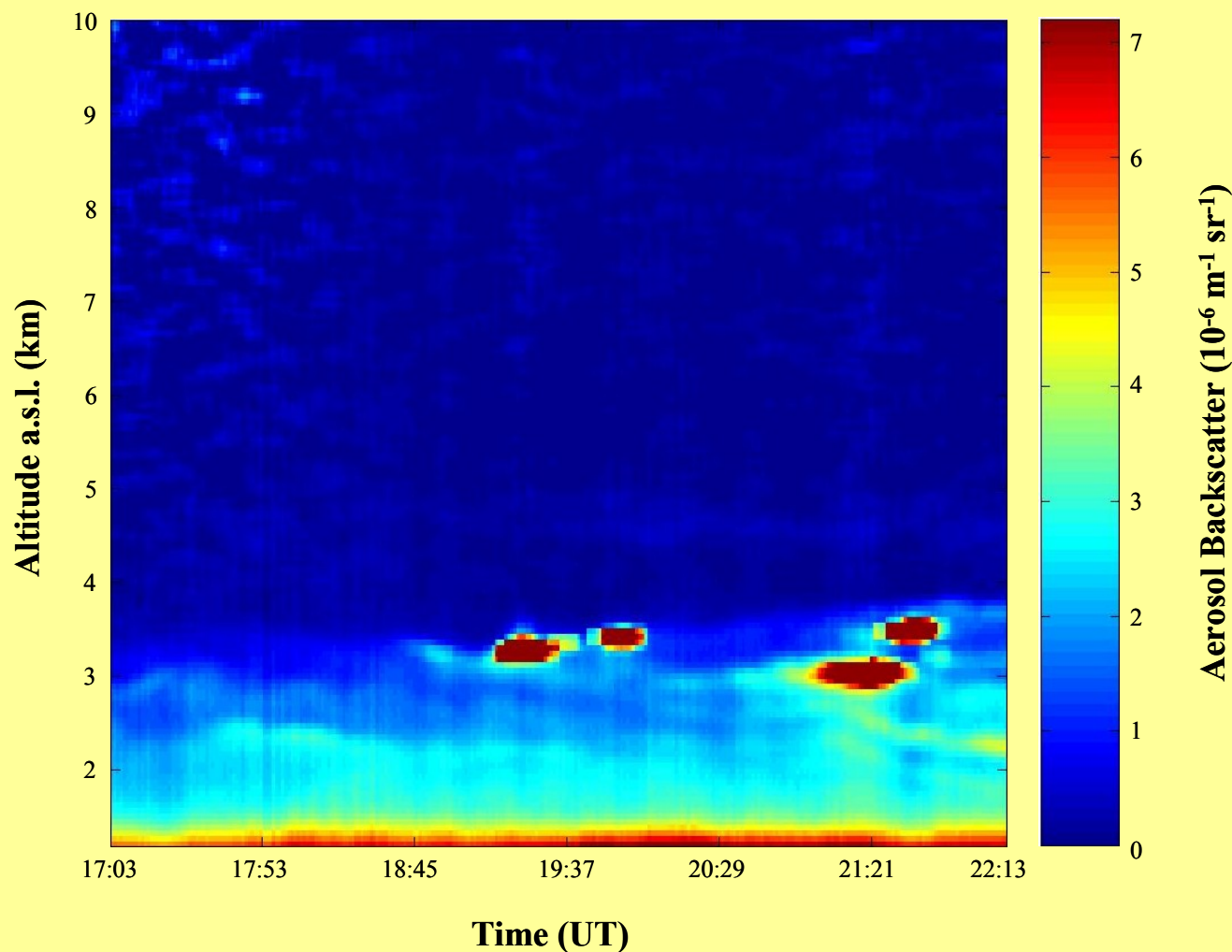
Presence of pollution of anthropogenic North American origin and Saharan dust

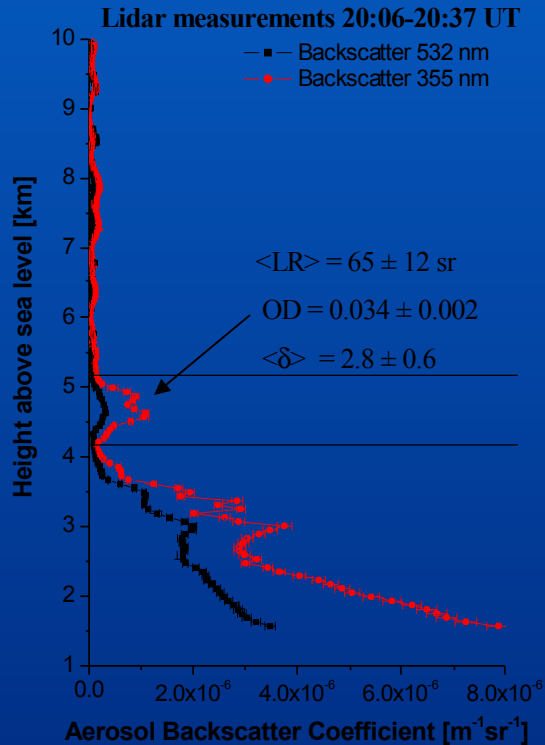
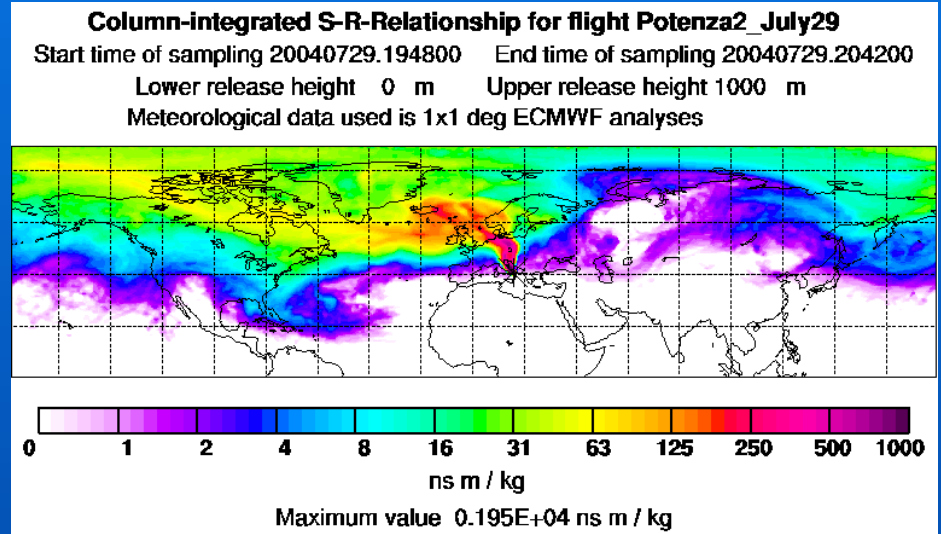
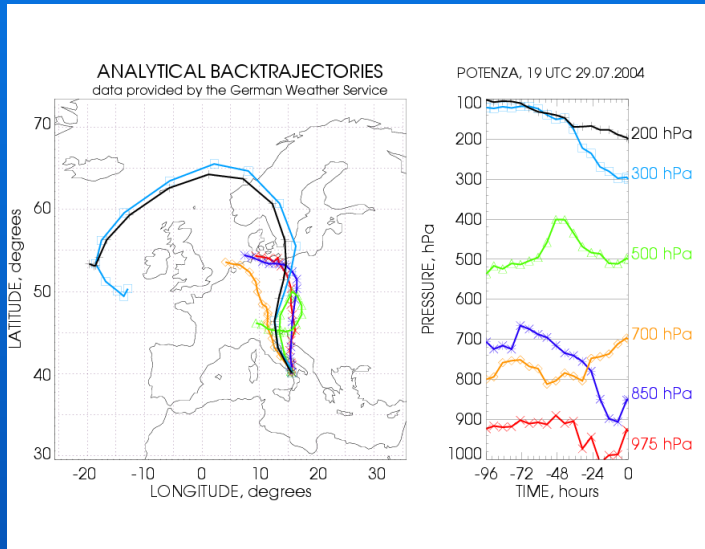
*Lidar measurement:
19:00-19:30 UT*

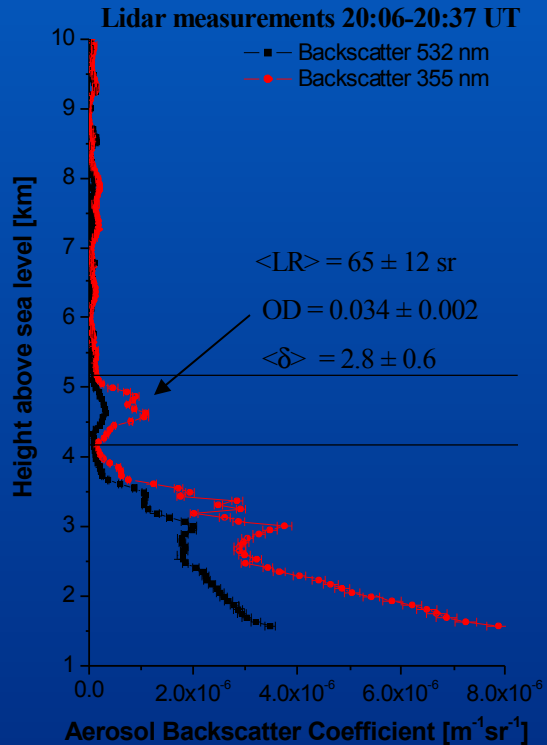
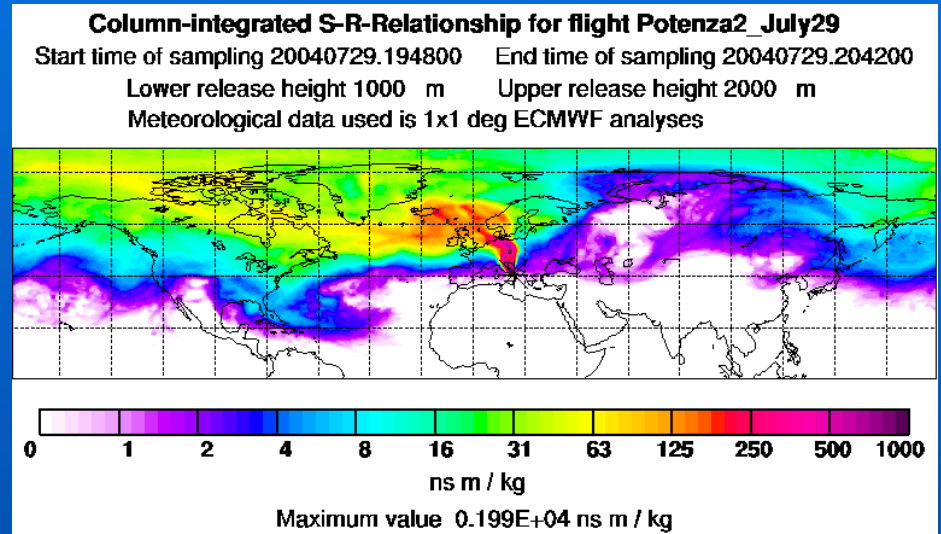
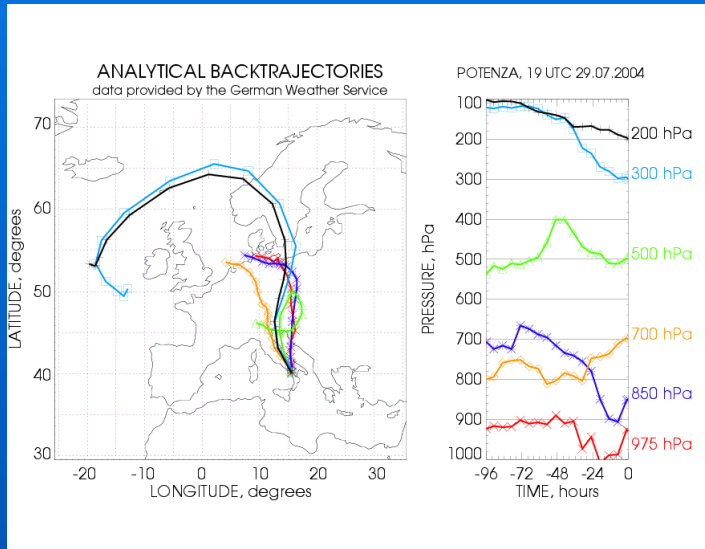


Forest fires smoke transported from Alaska and Canada observed over Tito Scalo

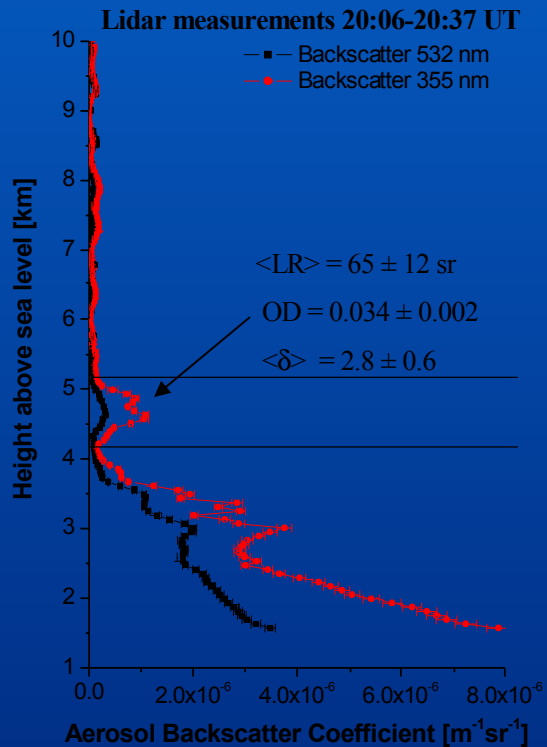
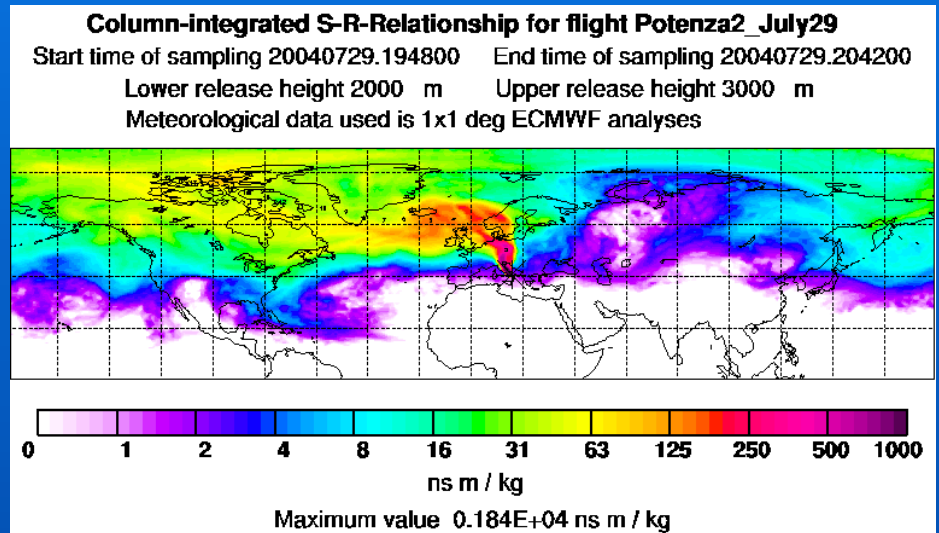
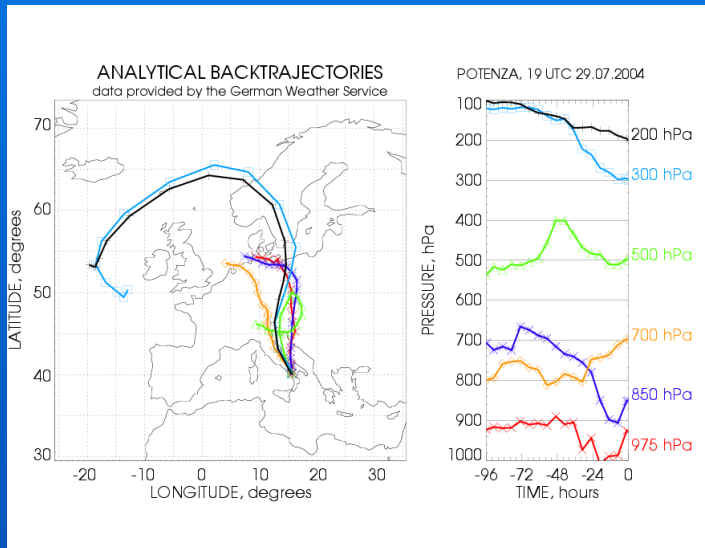
July 29, 2004
IMAA-CNR Tito Scalo
Aerosol Backscatter @ 532nm

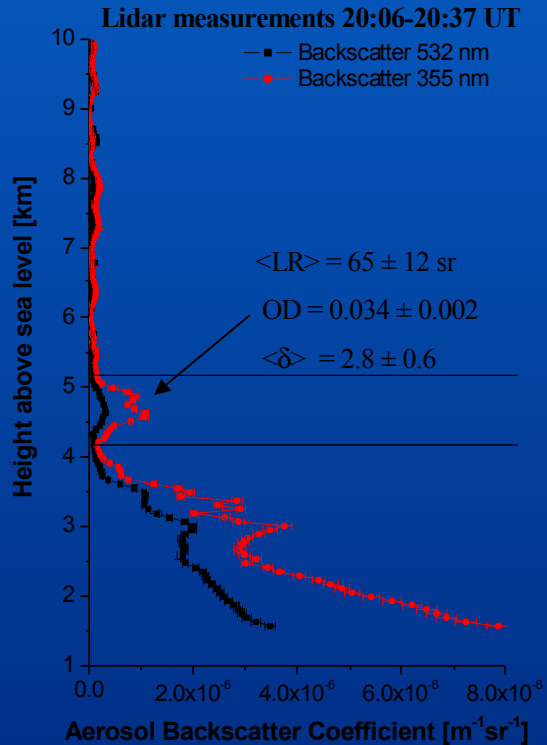
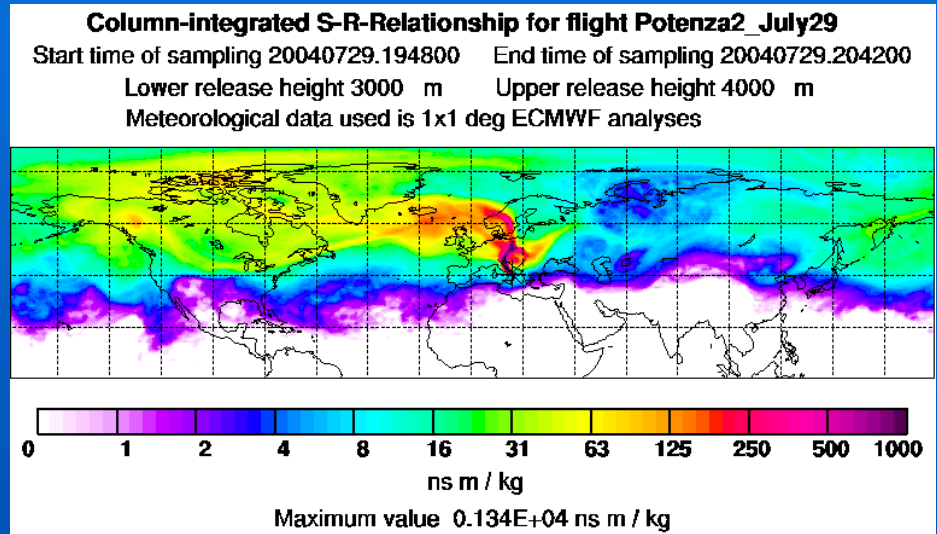
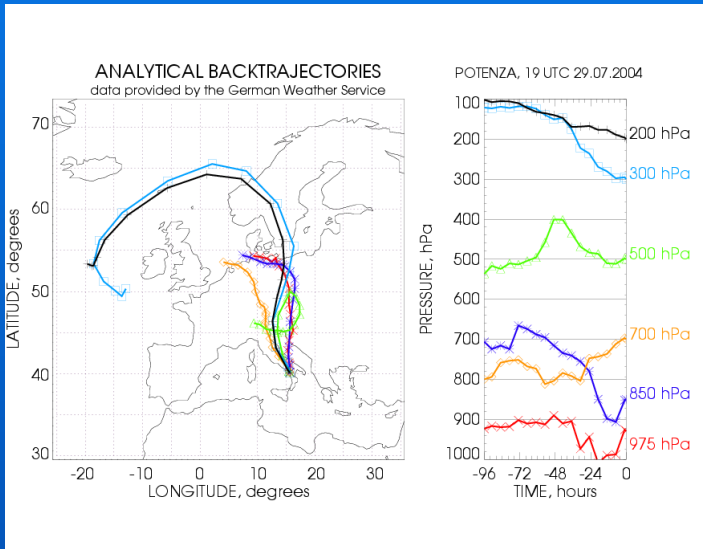




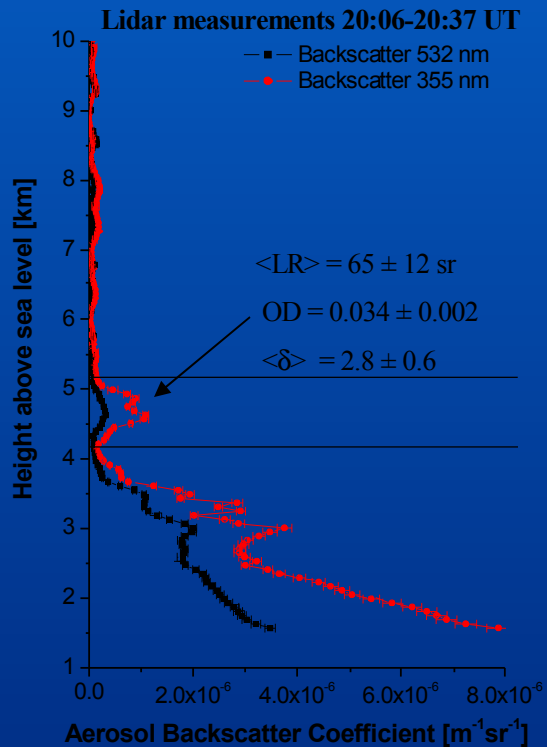
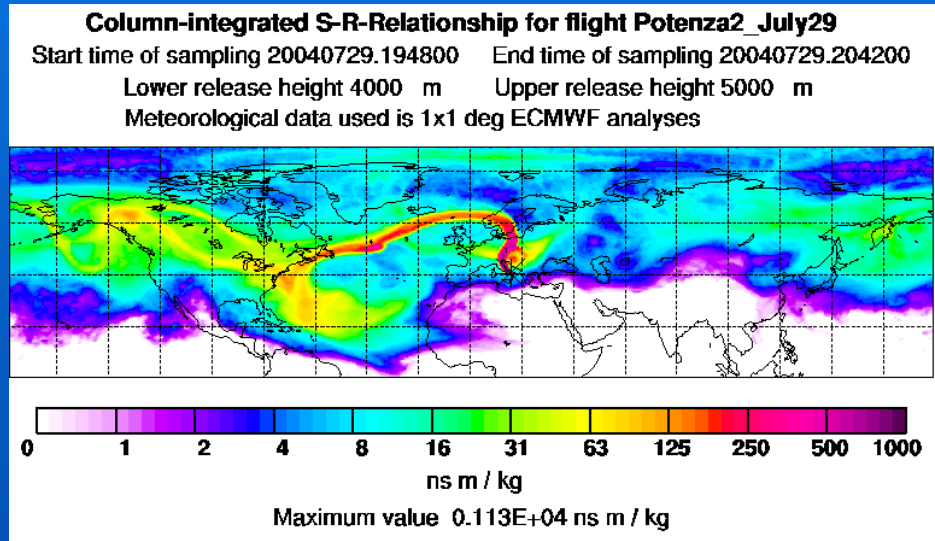
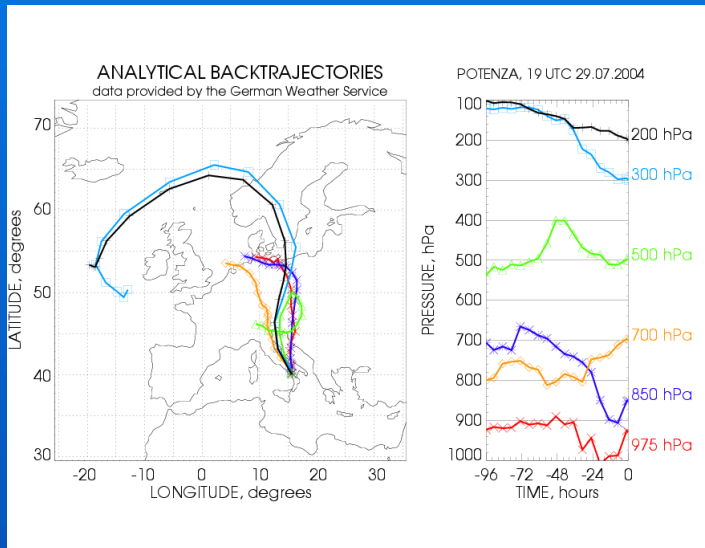


G. Pappalardo, Misure LIDAR di aerosol e trasporto da sorgenti remote - ISAC Bologna, 19 ottobre 2006



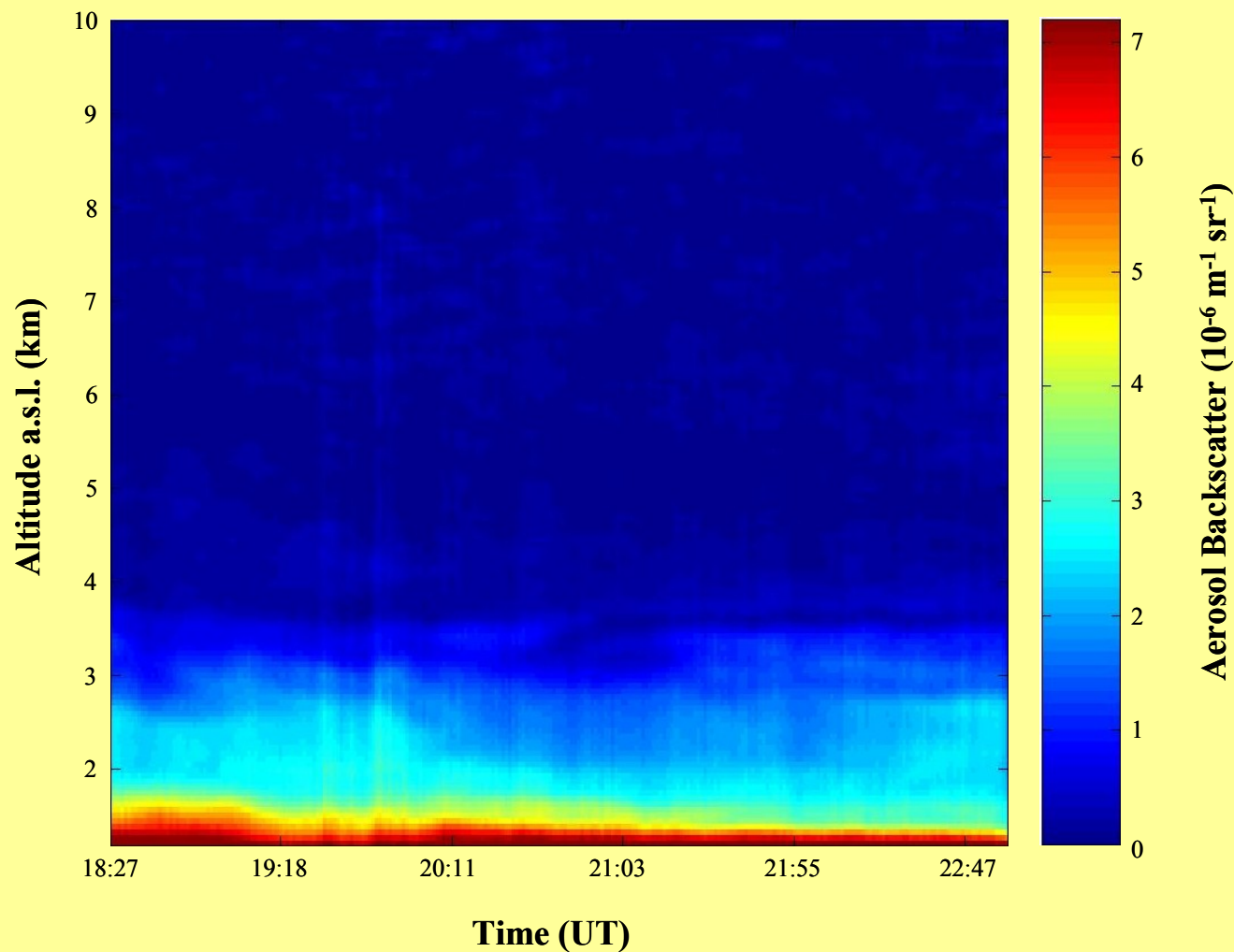


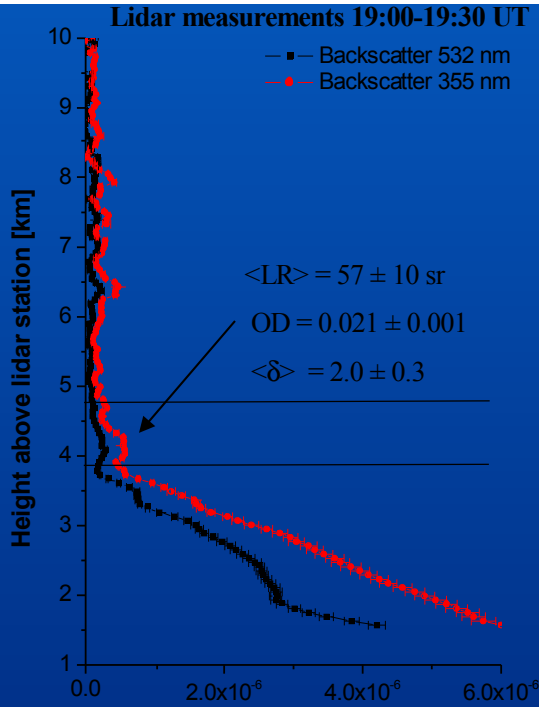
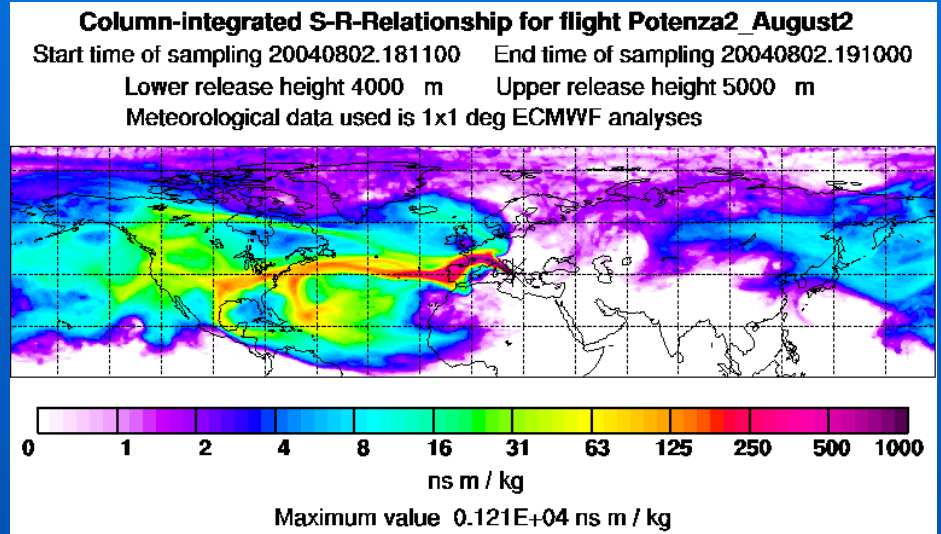
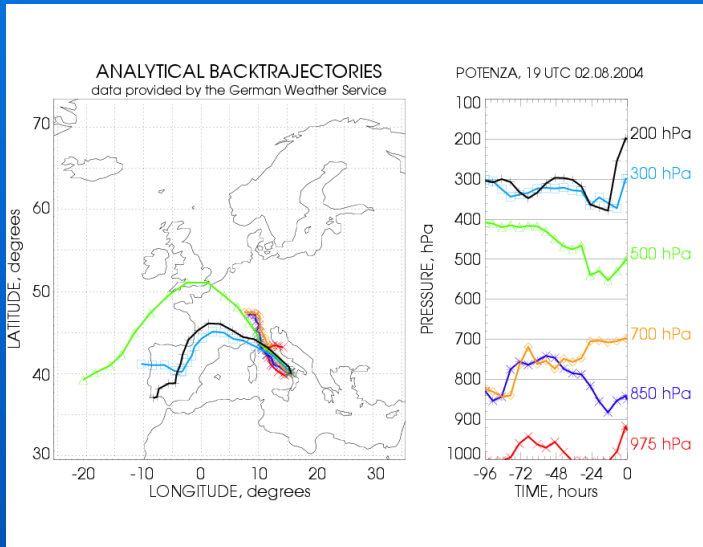
G. Pappalardo, Misure LIDAR di aerosol e trasporto da sorgenti remote - ISAC Bologna, 19 ottobre 2006



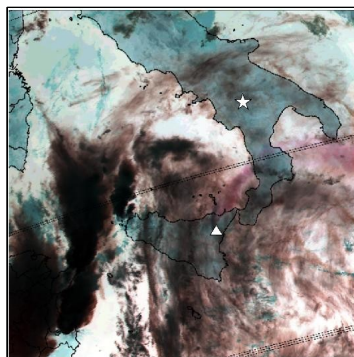
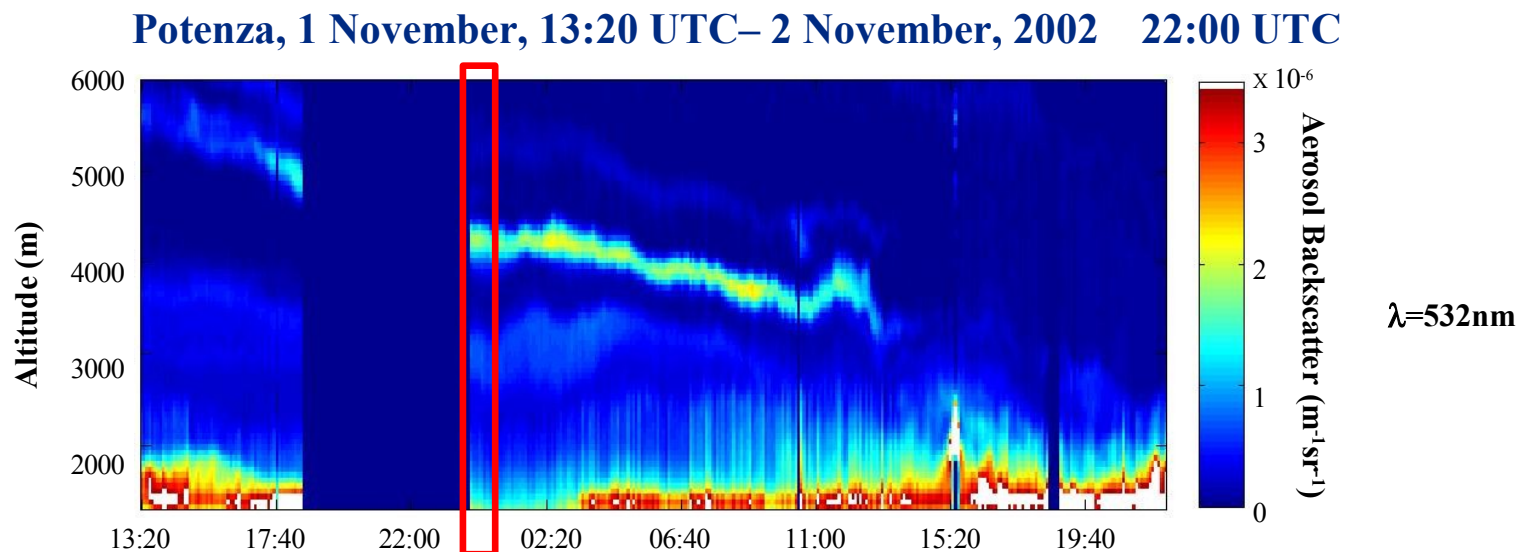
Forest fires smoke transported from Alaska and Canada observed over Tito Scalo

August 02, 2004
IMAA-CNR Tito Scalo
Aerosol Backscatter @ 532nm

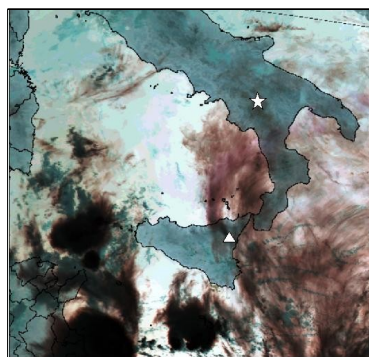




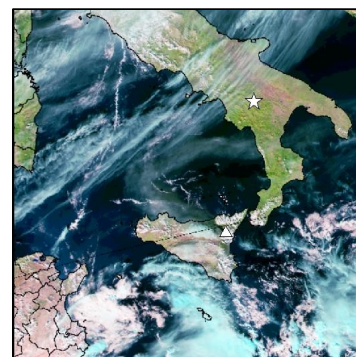
Evolution of Volcanic Aerosol Layer



1 Nov. 16:58 UT



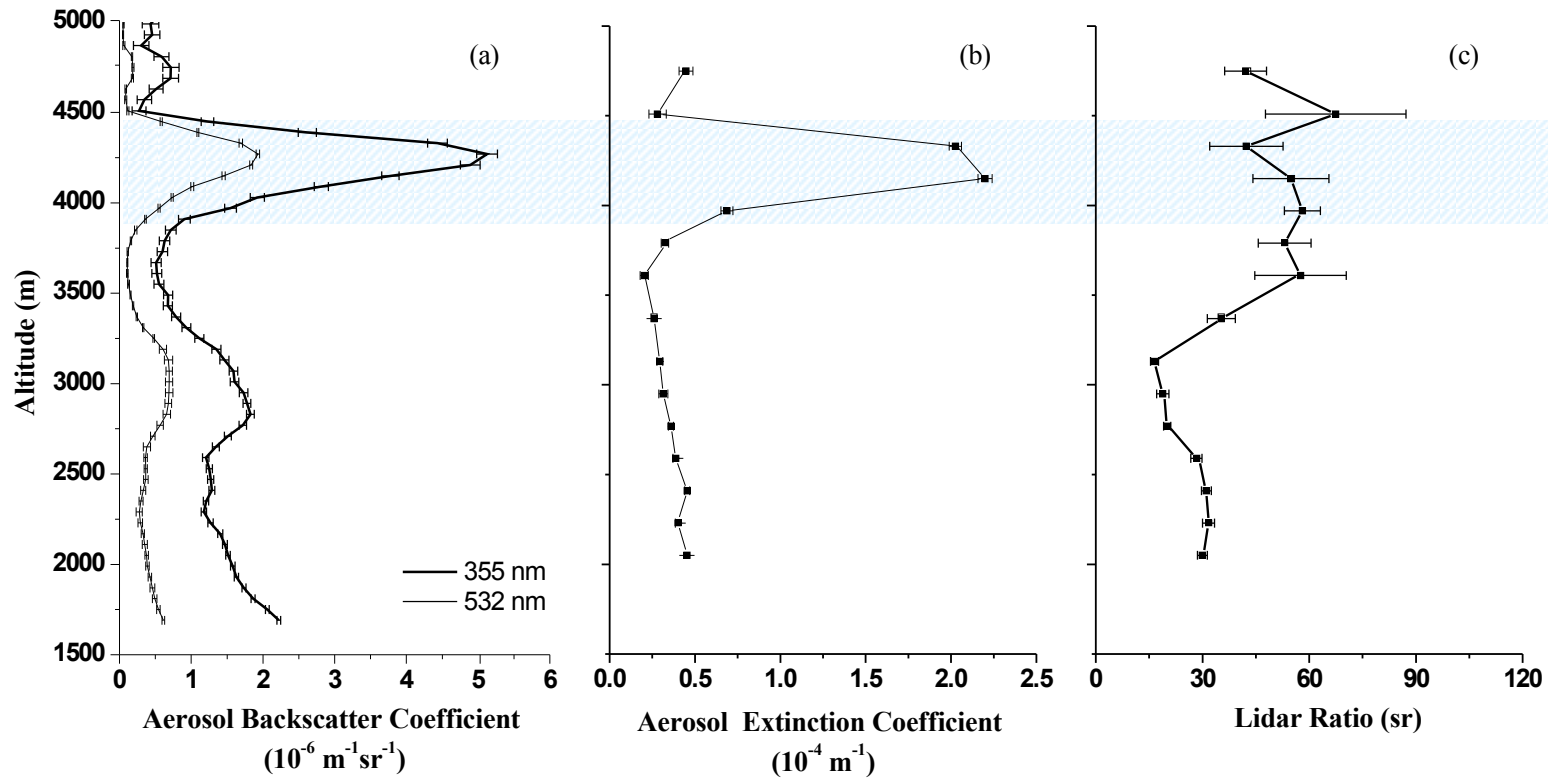
2 Nov. 00:50 UT



2 Nov. 12:16 UT

AVHRR images

Potenza, 1 November 2002, 23:20-23:50 UT



$\delta \sim 2.4$

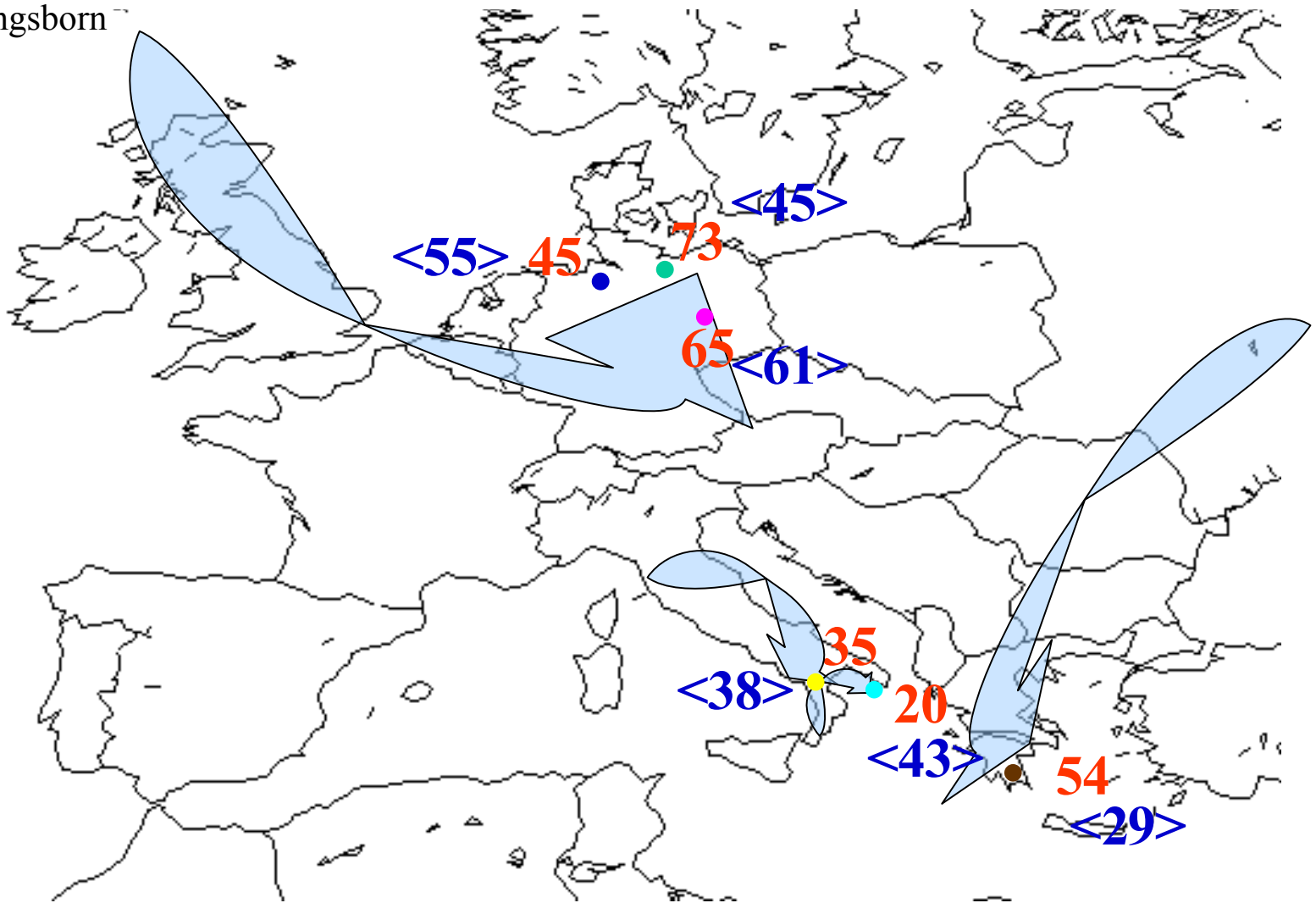
OD=0.09

$\langle \text{LR} \rangle = 55 \pm 4 \text{ sr}$

Pappalardo et al., GRL 2004

14 JUNE 2001

- Athens
- Hamburg
- Kuehlungsborn
- Lecce
- Leipzig
- Potenza





EARLINET ASOS

European Aerosol Research Lidar Network: Advanced Sustainable Observation System

EC Infrastructure Project Started on 1st March 2006

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.

NA1 - Management of CA

Management will comprise the areas of communication with the Commission for all contractual and administrative matters, organization of annual and special reports, organization of consortium meetings, monitoring the progress of work based on milestones and deliverables.

NA1
Management
Coordinator
Deputy Coordinator

NA2 - Exchange of expertise

- organized flow of information both between the participants and between the participants and the external scientific community.
- cooperation and coordination with the relevant observation and user communities

NA2
Exchange of expertise

NA3
Quality Assurance

NA4
Optimization of instruments

NA5
Optimization of data processing

NA6
Data base construction and operation

NA3 - Quality assurance

To establish a common European standard for routine quality assurance of lidar instruments and algorithms

NA4 - Optimisation of instruments

To improve the observation system on the basis of well defined subsystems and system integration by selection of the optimal approach from various solutions existing at individual stations.

NA5 - Optimisation of data processing

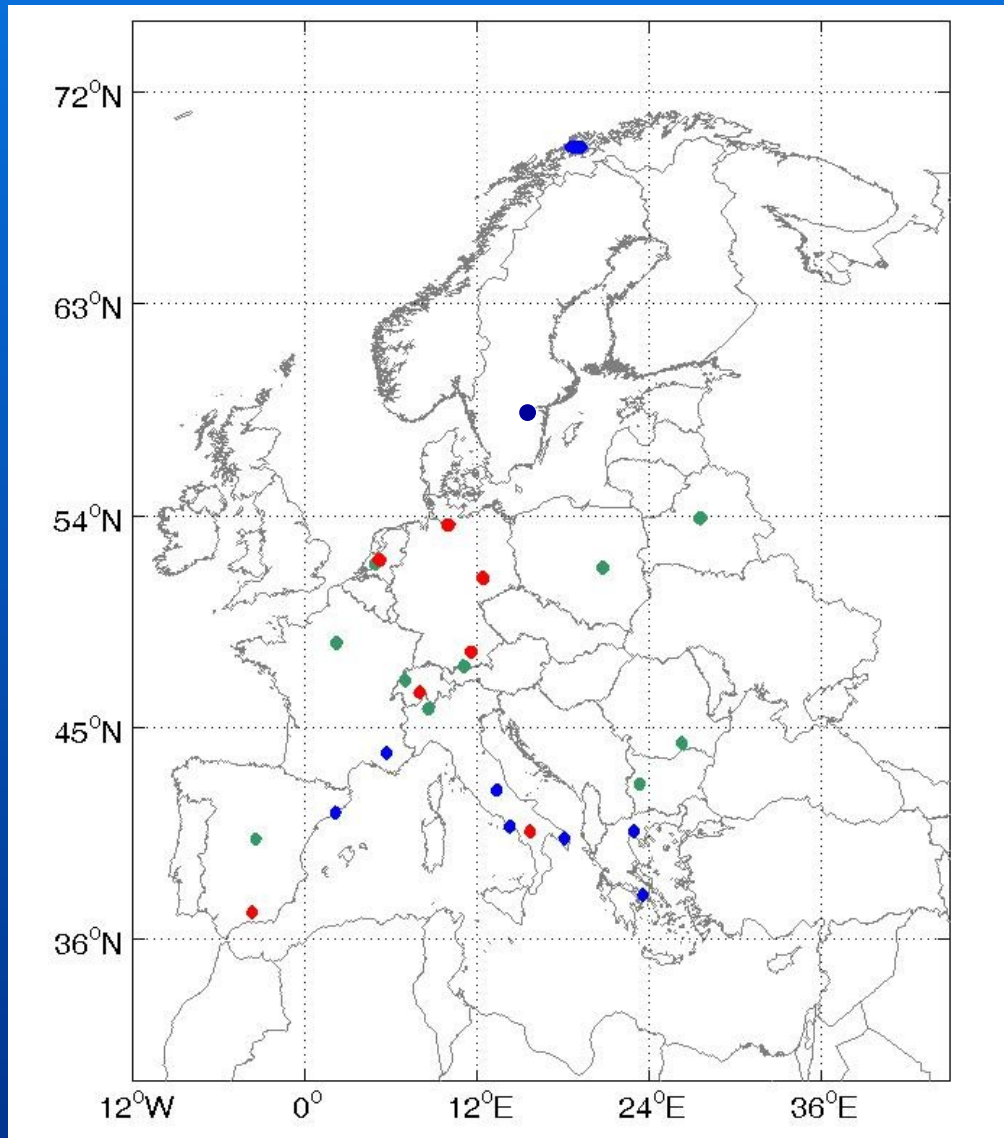
Optimisation of data processing to retrieve aerosol optical properties and microphysical properties.

Common single chain data processing procedure for the automatic retrieval of aerosol properties.

NA6 - Data base construction and operation

The establishment of the EARLINET-ASOS database and the development of a web-based interface to provide easy access to the data products for internal and external users.

EARLINET 2006



24 lidar stations

- 7 multiwavelength Raman lidar stations (●)

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

- 7 UV Raman lidar stations (●)

- 10 single backscatter lidar stations (●)

Summary and perspectives

- *EARLINET database is still growing*
- *more stations are going to join the network*
- *Raman and multiwavelength Raman lidar*
- *EARLINET-ASOS will enhance the operation of the network*
 - QA
 - *improvement of the instruments and data analysis*
 - *improvement of the temporal coverage*
 - *fast and easy access to the data base for both internal and external users*
 - *establish a platform for cooperation and coordination with the relevant observation and user communities, and serve as a nucleus for a world-wide aerosol lidar network*

EARLINET and transport models

- Long range transport at European scale
- Long range transport at larger scale
- Identification of sources
- Integration with satellite data (CALIPSO)
- Gaps in the observations

- Max-Planck-Institut für Meteorologie, Hamburg, Germany
- Aristotleleo Panepistimio Thessalonikis, Greece
- Universitat Politecnica de Catalunya, Barcelona
- Consiglio Nazionale delle Ricerche - Istituto di Metodologie per l'Analisi Ambientale, Potenza, Italy
- Meteorologisches Institut der Ludwig-Maximilians-Universität, Munich, Germany
- Institut für Troposphärenforschung, Leipzig, Germany
- National Institute for Public Health and the Environment, Bilthoven, The Netherlands
- Grupo de Fisica de la Atmósfera, Departamento de Fisica Aplicada, Universidad de Granada, Granada, Spain
- Zentrum für Dynamik komplexer Systeme, Universität Potsdam, Potsdam, Germany
- Institute of Physics National Academy of Sciences, Minsk, Bjelarus
- Norwegian Institute for Air Research, Tromsø, Norway
- Observatory of Neuchatel, Neuchatel, Switzerland
- INOE National Institute of R&D for Optoelectronics, Bucharest, Romania
- Ethnikon Metsovion Polytechnion Athinon, Athens, Greece
- University of Lecce, Italy
- CIEMAT, Madrid, Spain
- JRC Institute for Environment and Sustainability, Ispra, Italy
- Institute Pierre Simon Laplace, Paris, France
- Universita degli Studi L'Aquila, Italy
- Ecole Polytechnique Federale de Lausanne, Switzerland
- Institute of Geophysics, Polish Academy of Sciences, Belsk, Poland
- Istituto Nazionale per la Fisica della Materia, Napoli, Italy
- Institute of Electronics, BAS, Sofia, Bulgaria
- Forschungszentrum Karlsruhe, IMK-IFU, Garmisch-Partenkirchen, Germany

www.earlinet.org