# EARLINET correlative measurements for CALIPSO

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# **Correlative measurements**

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EARLINET, the European Aerosal Research Lidar Network, offers a unique opportunity for the validation and full exploitation of the CALPSO mission because of its geographic coverage and the deployment of advanced Rama nerosal lidars. EARLINET provides long-term, quality-assured aerosal data, which allows us to investigate a large variety of different aerosal situations with respect to layering, aerosal type, mixing state, and properties both in the free troposphere and the local planetary boundary layer. EARLINET started correlative measurements for CALPSO since 14 June 2006, at the beginning of the operativity of CALLOP. A strategy for correlative measurements has been defined on the base of the analysis of the ground track data provided by INASA. Based on the experience of the first 18 months of correlative observations, the strategy of correlative measurements has been consolidated in the frame of a dedicated ESA study aiming at a long-term aerosal and cloud data base from ground-based and satellite-borne lidars. Within this study, correlative measurements have been intensified especially taking into account the geographical distribution of participating stations. EARLINET correlative measurements en still in progress. After about 3 years of correlative observations, more than 6500 hours of correlative measurements have been performed and about 3100 correlative files are available for comparisons. A number of modelling tools is used for the aerosol type and source identification in addition to the information derived from the multi-wavelength lidar observations. The first results in terms of comparisons between EARLINET and available CALIPSO products (both level 1 and level 2 data) are presented.



EARLINET

25 lidar stations 9 multiwavelength Raman next future idar stations 3ß (backscatter) + 2a  $(extinction) + \delta$ - Ireland (depolarization ratio) (●) - Portugal 9 Raman lidar stations 7 single backscatter lidar

The validation strategy foresees the following mandatory measurements: • Case A measurements - CALIPSO overpass within 100 km Case B measurements - more stations of the same cluster perform simultaneous measurements
Case C measurements - interesting additional cases like Saharan dust intrusions and forest fires



Four clusters have been identified for studying the aerosol/cloud fields on European continent: Central European (hh - Hamburg, ca - Cabauw, le - Leipzig, mu - Munich), Western Mediterranean (ba - Barcellona, ma - Madrid, gr -Granada), Central Mediterranean (la - l'Aquila, na - Napoli, po -Potenza, Ic - Lecce) and Eastern Mediterranean (sf - Sofia, th - Thessaloniki, at - Athens). Each one of identified cluster includes at least one multiwavelength Raman lidar station,

CALIPSO

Comparison EARLINET – CALIPSO (lev1)

Comparison with CALIPSO level 1 data: attenuated backscatte

taneous and independent measurements of aerosol backscatter and extinction profiles measured by EARLINE possible to calculate without any assumptions the CALIPSO-like attenuated backscatter (CLAB) profile at 55 ob e compared to CALIPSO use! I data (Mana et al., 2009).



observed, because of imperfect spatial coicindence and high variability in the



Comparison EARLINET – CALIPSO (lev2)

stations (O)

Following the measurement strategy established for the ESA-CALIPSO study, horizontal distance between CALIPSO and EARLINET selected stations covers a large interval:

This allows us to investigate the horizontal variability on different scales, from regional

to continental one. The temporal variability of aerosol/clouds fields can be investigated with the 150 minutes lasting records of measurements (centered around the overpass)

> Comparison with CALIPSO level 2 data: aerosol backscatter and extinction coefficient 30 May 2008

> > Reference

Saharan dust

0-100 km for Case A (almost 60% of the cases within 500 km)
120-750 km for Case B (almost 70% of the cases within 500 km)
also larger distances for Case C measurements

Cross section of the total attenuated backscatter The purple box highlights the overpass at Potenza





Temporal evolution of the lidar range-corrected signal at 1064 nm measured

Aerosol backscatter (left panel) and extinction (right and Naples (NA) EARLINET stations and obtained from CALIPSO observations at different horizontal distance from Potenza lidar station for the 29-30 May 2008 night-time case.

Good agreement for Potenza aerosol backscattering measurements on 29 May (107 km distance).

No similar agreement for the aerosol extinction measurements probably due to CALIPSO assumptions on

- x0 < 10min - x0 < 30 min - 30 min < x2 < 60 min

aerosol backscatter coefficient at 532 nm for space-borne vs groundbased lidar horizontal distances lower than 100 km and 10 minutes for maximum time shift between the two observations



For time shifts larger than 30 minutes the two observations are not correlated. This implies that on a spatial scale of 100 km the aerosol time variability for this event is of the order of 30 minutes



The observational period of **26-31 May 2008** has been chosen for a first correlation analysis for both single and multiple point observations as a period with a large number of

In fact, during messe days to case A, 7 additional case binectal energy and to demonstrate Case C measurements were performed because of the Saharan dust alert distributed to the EARLINET station At the moment, **420 EARLINET files** are on the database for



catter Coefficient @ 532 nm [km<sup>-1</sup> sr<sup>-1</sup>]

Comparisons within 10 minutes and different



#### Conclusions and outlook

The development of cloud and aerosol-type classification schemes and of conversion algorithms to relate space-borne lidar observations made with different instruments onboard the CALIPSO, ADM-Aeolus, and EarthCARE missions is an important task to establish a harmonized dong-term, global, -4 dimensional aerosol and cloud data set. This task requires the long-term, ground-based support of space-borne missions with multiwavelength lidar instruments at different locations in order to build up a comprehensive database of ground-truth information. EARLINET as a continential lidar observation networks and ground-truth set and the Consequently. EAS and EARLINET have initiated a contained table and a corresponding long-term aerosol and cloud database. There is a strong need to continue such kind d actio Observation thevendy will allow us to be strett the ground-based observations from the continential to the network GALRON (Global Amosphere Vatch Argoso Lidar Observation Network) will allow us to be strett the ground-based observations from the continential to the network GALRON (Global Amosphere Vatch Argoso Lidar Observation Network) will allow us to be strett the ground-based observations from the continential to the network GALRON. global scale and to improve our understanding of the variety of natural and anthropogenic aerosol sources.



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horizontal distances

backscatter counts distributions for time shifts lower than 10 minutes reported as a function of the maximum considered horizontal distances between the two bservations













Count distributions of EARLINET and CALIPSO measured values of

