EARLINET long-term aerosol observations for the evaluation, improvement and integration with satellite aerosol data

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European Aerosol Research Lidar Network

- 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

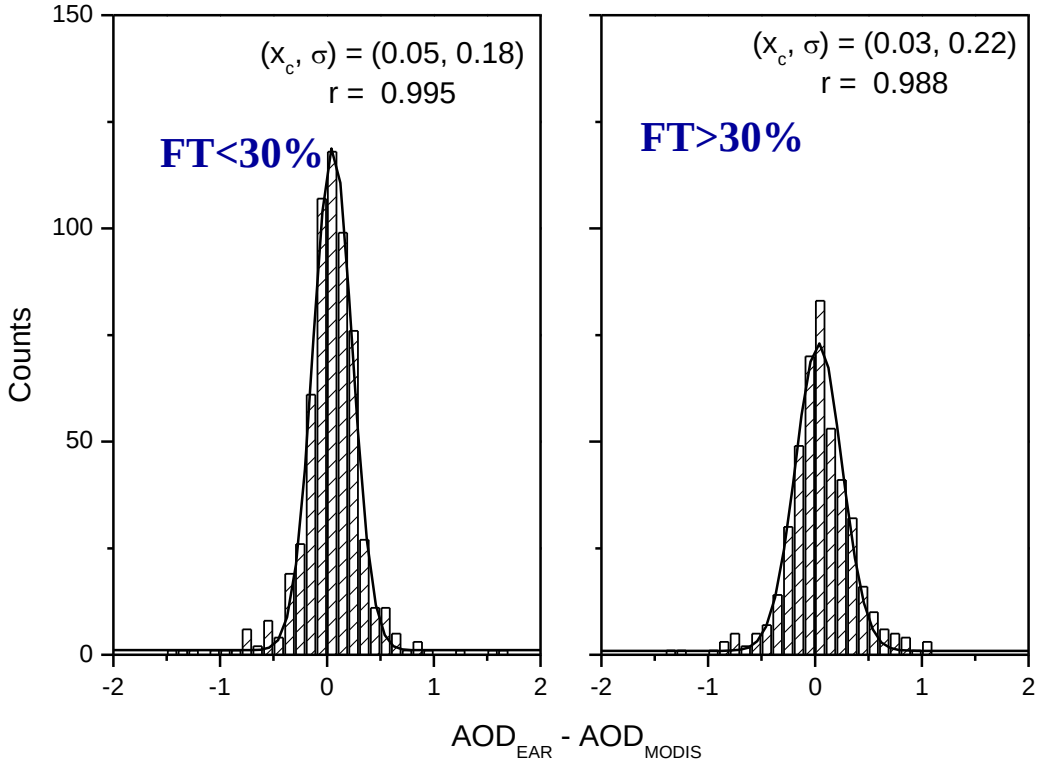
EARLINET-ASOS Sixth Framework Programme

ACTRiS Seventh Framework Programme

Satellite AOD validation: MODIS example

Differences between EARLINET and MODIS AOD measured on the same day are calculated for each station.

- **differences distribution approximated by a Gaussian distribution centered around 0.04 with a standard deviation of 0.2.**
- **No bias is evident.**



FT =Free Troposphere contribution to AOD

evaluated from EARLINET profiles

High FT contribution, which typically indicates large scale processes, differences between satellites 1° × 1° measurements and punctual measurements of the AOD are typically more spread than for small FT contributions

CALIPSO related efforts (1)

More than 15000 hours of correlative measurements have been performed and about 7500 correlative files have been uploaded into the EARLINET data base in the CALIPSO category.

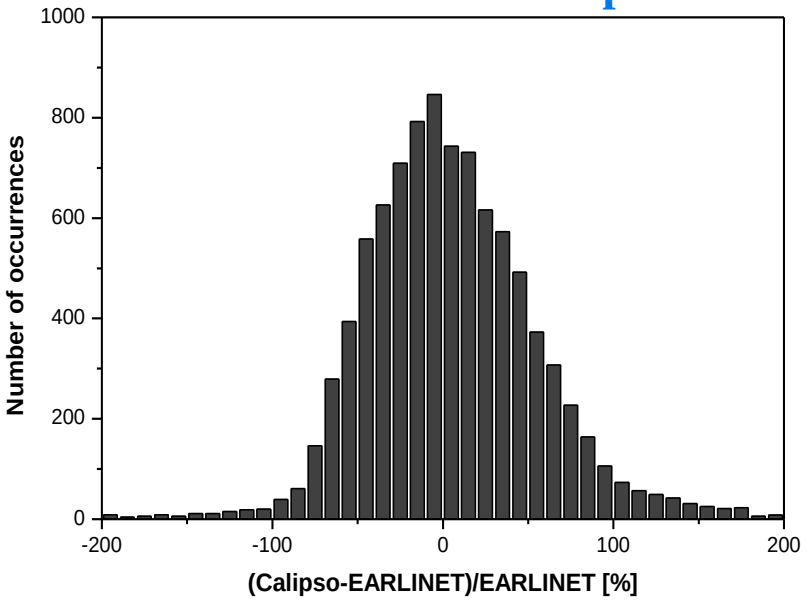
Level 1 data comparisons

A methodology was developed : a comparison without assumptions is possible f independent extinction and backscatter profiles are available, as possible with the elastic/Raman technique ***[Mona et al., 2009 ACP]***

A systematic comparison demonstrates the absence of biases and main problems in CALIPSO detected signals

Mean difference 4.6%,
standard deviation of 50%

[Pappalardo et al., 2009 ACP]



CALIPSO related efforts (2)

Level 2 data comparisons

CALIPSO extinction and backscatter profiles are generally available for identified features (i.e. profile segments) only and not as full profiles

Critical assumptions and needed improvements :

•cloud-aerosol discrimination is a critical issue

•Uncertainties and underestimation of aerosol load result from the CALIPSO layer approach (aerosol layers which are seen in L1 data do not appear in L2 products)

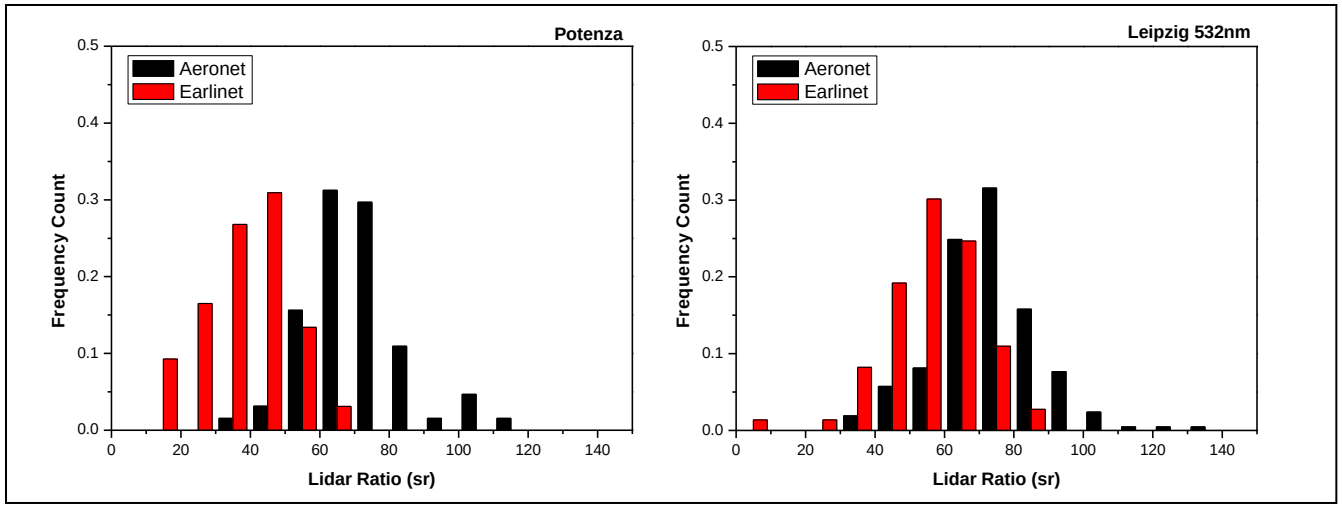
•Multiple scattering is important in case of aerosol below cirrus clouds and for large dust particles

Aerosol Typing

CALIPSO related efforts (4)

Lidar ratio values and aerosol typing

- assumption on lidar ratio values should be improved
- new aerosol typing could be added
- (e.g. over Europe not pure dust is observed but it is not the defined polluted dust of CAD algorithm)
- first analysis show an bias in CALIPSO lidar ratio value on average of -10 sr (location dependent)

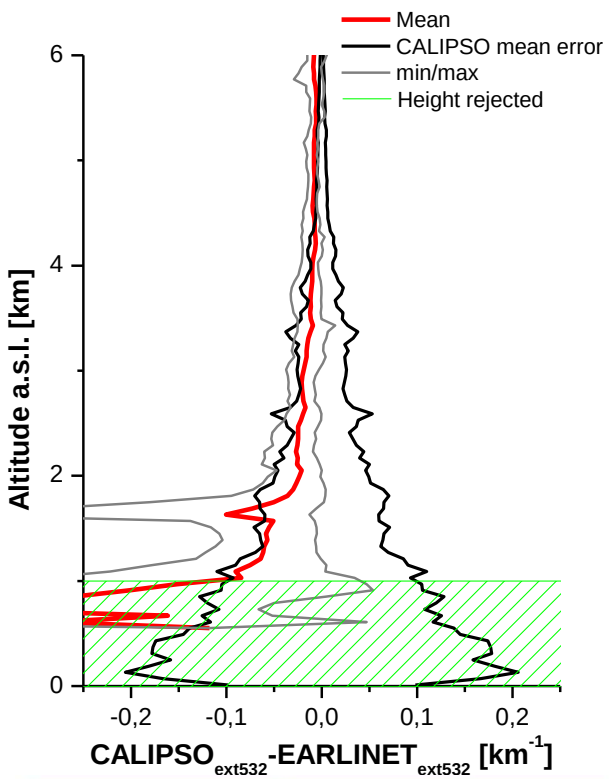


First EARLINET-AERONET comparisons show a disagreement between S. CALIPSO S assumptions are based on AERONET estimations a specific sites

CALIPSO related efforts (5)

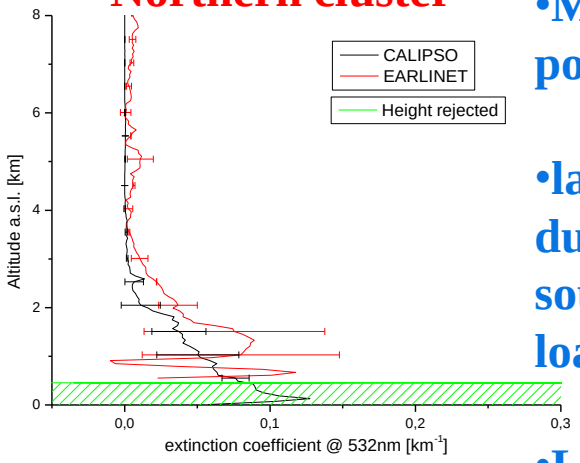
Level 3 data comparisons : first results

- CALIPSO Level 3 monthly mean profiles of aerosol extinction at 2°x5° grid
- EARLINET monthly averages evaluated considering only measurements performed in coincidence with CALIPSO overpass (within 100km).

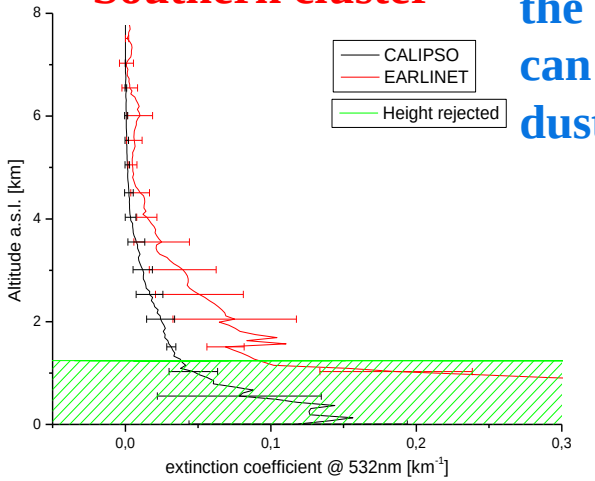


CALIPSO overpasses	EARLINET measurements
453	172

Northern cluster



Southern cluster



- Mainly dust and polluted dust for both
- larger contribution of dust particles to the south cluster aerosol load
- Larger discrepancy in the extinction coefficient can be related to larger dust cases on this cluster

Collaboration through AEROSAT

- **Aerosol typing**
- **validation , based on both case studies and statistical analysis**
- **retrieval improvements (e.g. CALIPSO, but also AERONET)**
- **next to come satellite space mission (e.g. EarthCare, and Sentinel)**

Interest / Expectations / Opportunities / Suggestions

- **Effective communication within AEROSAT community is essential for its purposes**
- **Facing with no-scientific users community is fundamental as well**
- **The AEROSAT group could act as interface between the pletora of scientists and the public**
- **AEROSAT should be constantly updated about improvement in satellite data and translate this info in messages/products for the general public**

View on the ToR draft

"Satellite aerosol retrieval if often undertaken by individual or small groups across the world.." retrieval is here limiting the field of interest "Satellite aerosol retrieval and data exploitation" is probably more complete.

Among AEROSAT goals providing information on the role of aerosol on climate climate change air quality and atmospheric processes. What about natural hazards?

It could be considered to combine AEROSAT meeting with other meetings for saving time and money, with AEROCOM, but not only (ACTRIS, international conferences)