Vassilis Amiridis

BEYOND ground-based remote sensing and cal/val activities

IAASARS, National Observatory of Athens
Greece

ONE step BEYOND workshop, 15 October 2015
ESA - Frascati, Italy

SEVENTH FRAMEWORK PROGRAMME
FP7-Regpot-2012-23-1

BEYOND Infrastructure

1. One UV-MFR radiometer and one CIMEL sunphotometer, part of the NASA global network AERONET (http://aeronet.gsfc.nasa.gov/)

2. The ESA-EMORAL mobile lidar system: IAASARS is responsible for the operation of this system.

3. Development of a sophisticated multi-wavelength lidar system (PollyXT) for systematic operation in Crete. Join EARLINET, ACTRIS

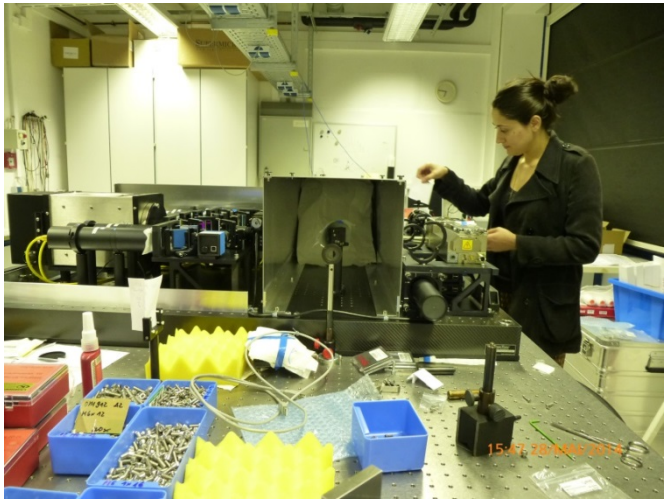
Mobile Lidar Station

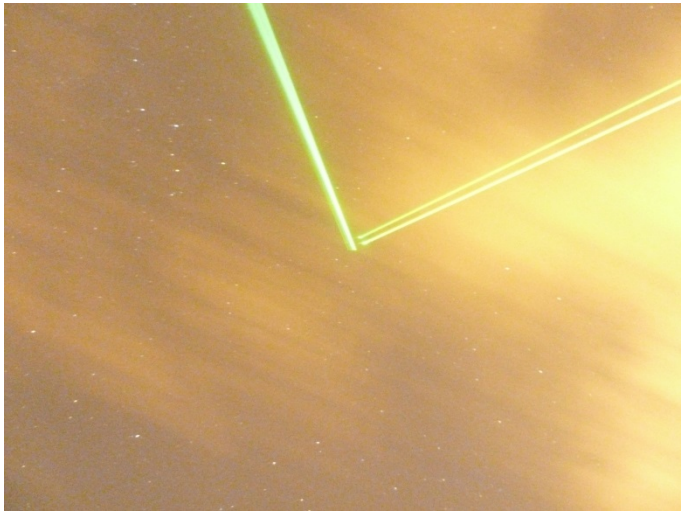
The **EMORAL mobile lidar station** is a combined backcatter/Raman lidar, which is a property of ESA. Through BEYOND, NOA operates the system which is deployed for dedicated experimental campaigns of ESA.

BEYOND
Building a Centre of Excellence for EO-based monitoring of Natural Disasters

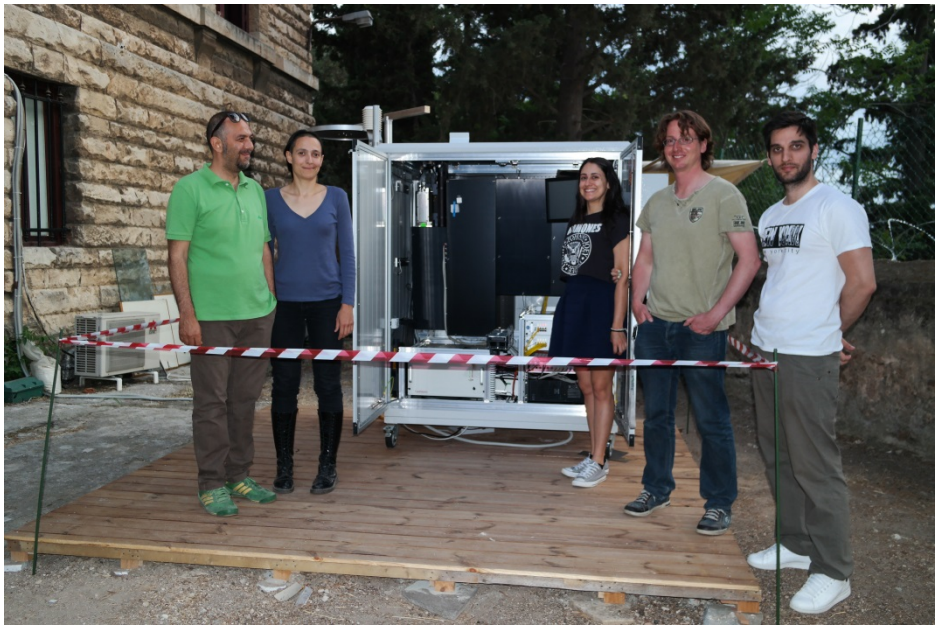
PollyXT Lidar System

In BEYOND, we developed a sophisticated multi-wavelength backscatter/Raman/depolarization lidar in collaboration with TROPOS Institute in Leipzig, Germany, the so-called **PollyXT lidar**





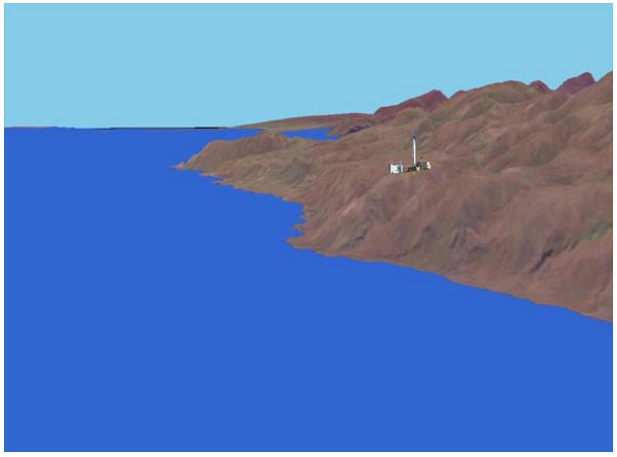
PollyXT Lidar System



The system operates currently in the NOA premises in Thiseion (Athens center), collocated to the sunphotometric station.

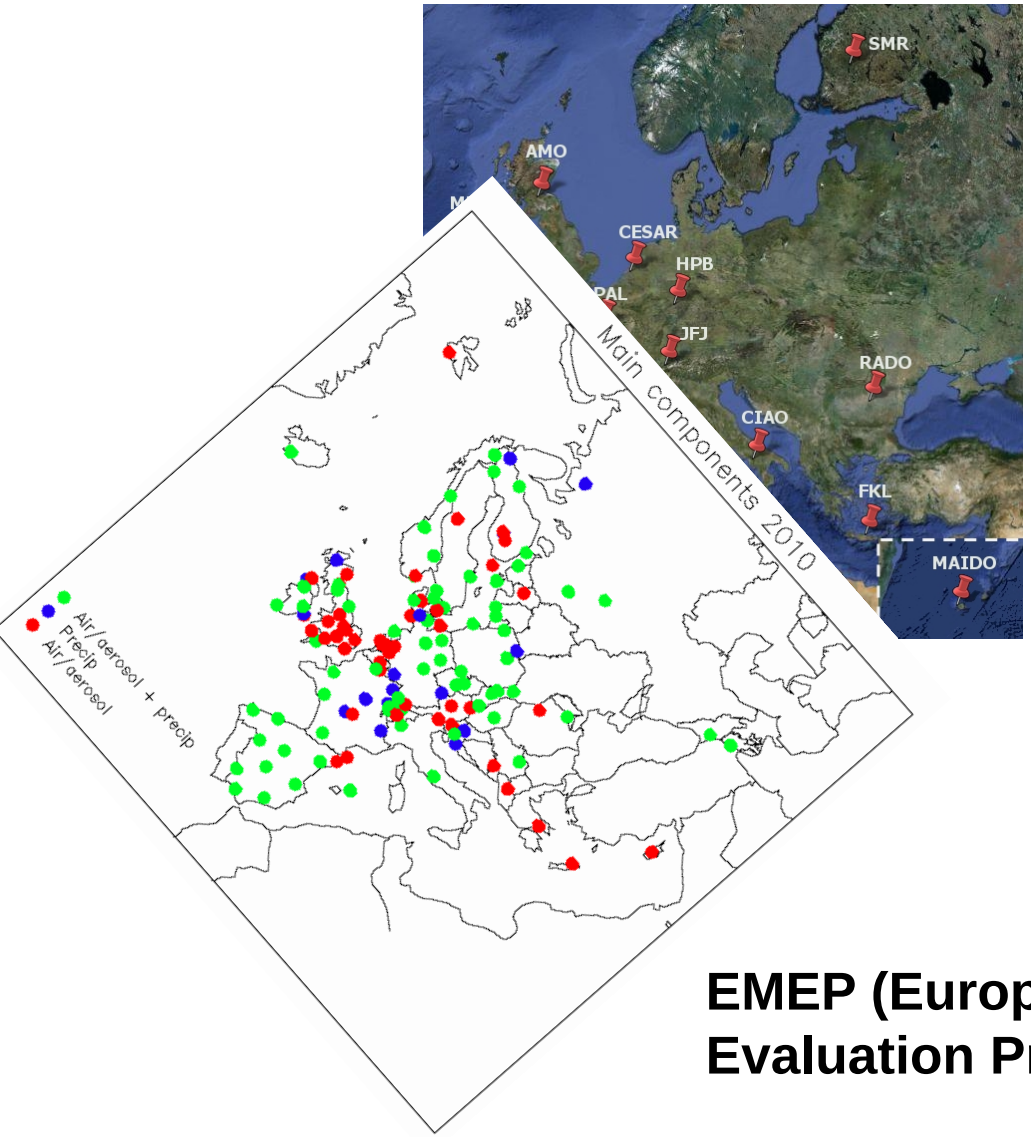
This is a test mode operation, where we perform consistency and quality assurance tests for the 24/7 system operation and calibration.

Finokalia station



Latitude = 35.34^{0}N - Longitude = 25.67^{0}E - Elevation = 252 a.s.l.


Magee Scientific
Aethalometer™
PILS
PFEIFFER VACUUM
HiPace
Thermo Environmental Instruments Inc.



ACTRIS

ICOS (Integrated Carbon Observation System)

EMEP (European Monitoring and Evaluation Programme)

http://charadmexp.gr/

- 3 backscatter channels (355, 532, 1064 nm)
- 2 extinction Raman channels (387, 607 nm)
- 2 depolarization channels (355, 532 nm)
- 1 water vapor channel (407 nm)
- 1 near-range channel (532, 607 nm)

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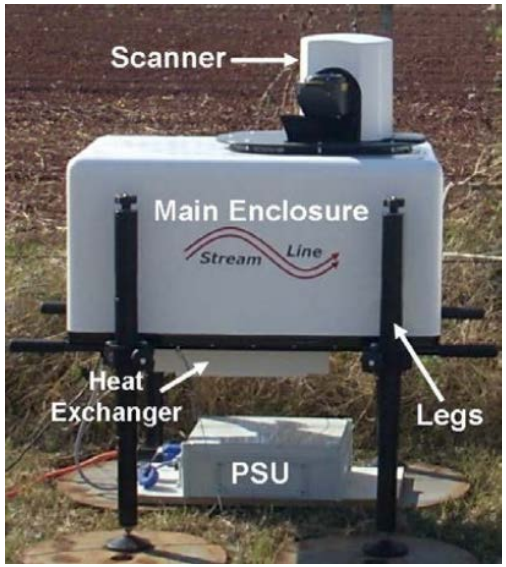
- 1 extinction Raman channel (387 nm)
- 2 depolarization channels (355, 532 nm)



- 1 backscatter channel (1.5 μm)
- Doppler lidar capable of providing wind speed and direction and turbulence

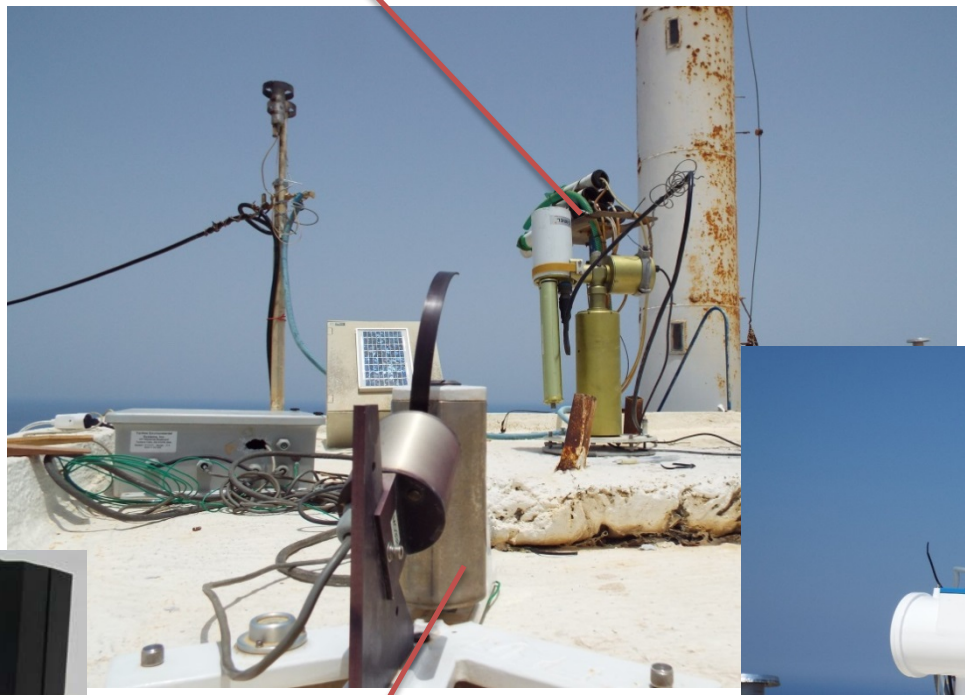
MicroWave Radiometer HATPRO

Measures the brightness temperatures in the range between 2.7K (cosmic background) and ambient temperature

Capable of providing:

1. Liquid Water Path (LWP)
2. Integrated Water Vapor (IWV)
3. Temperature and RH profiles within the PBL (for CHARADMexp, the synergy with the lidars will be utilized to derive WV profiles)

AERONET-CIMEL



PSR

Microtops II

UV-MFR

Ground Control Unit

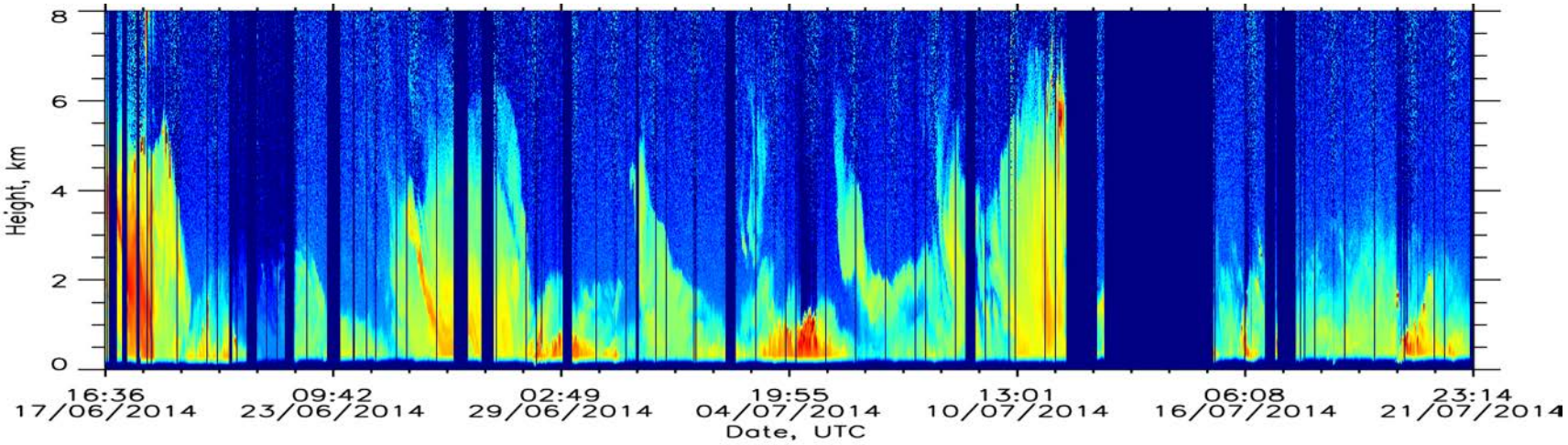
Black carbon (aethalometer)

Ozone (UV absorption)

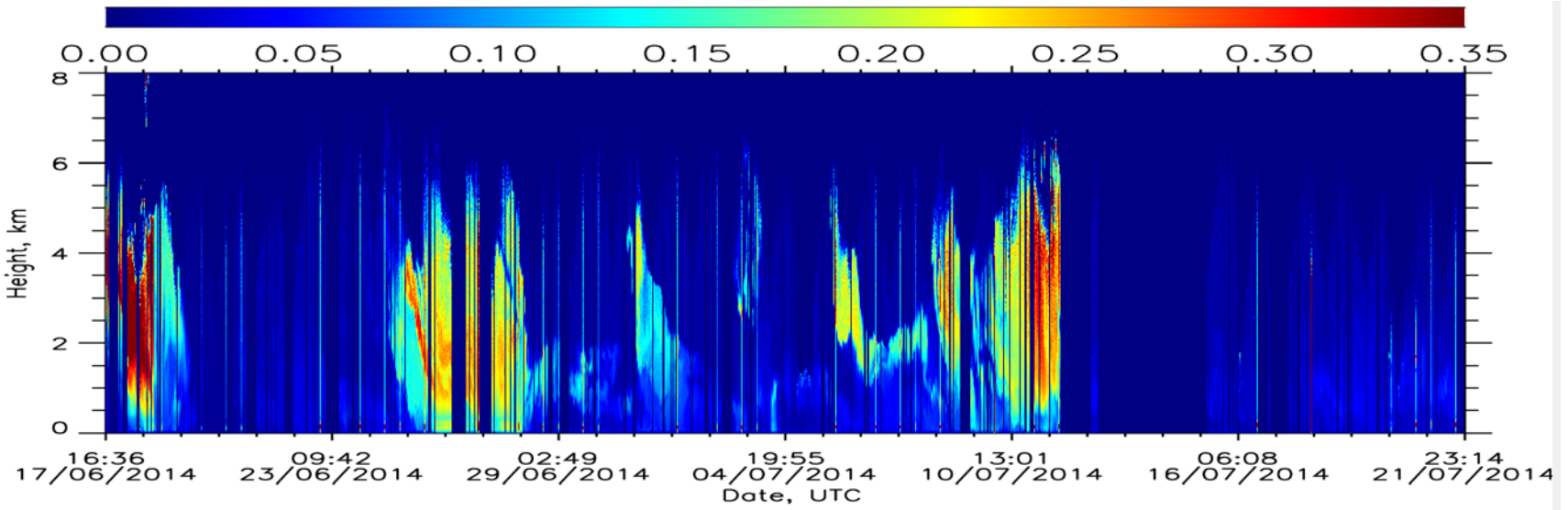
Condensation Particle Counter (CP

Retrieval examples

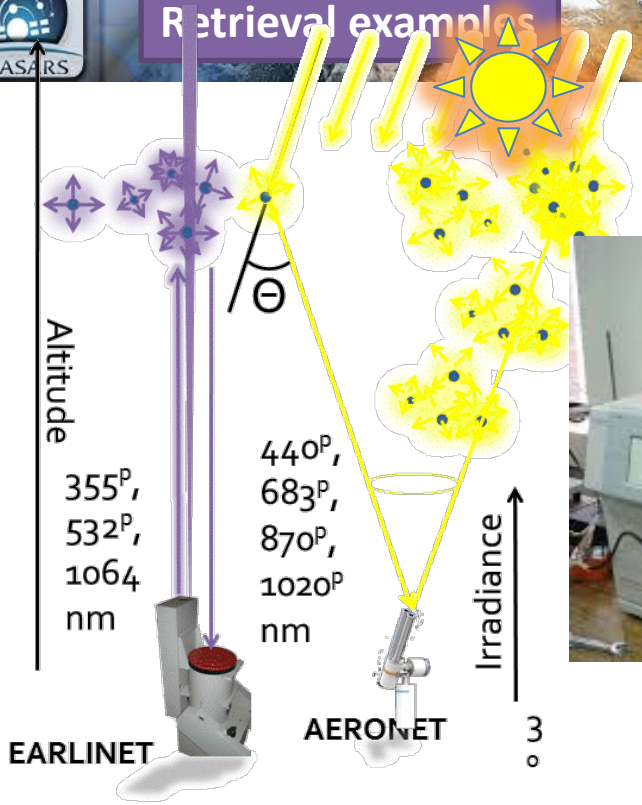
Range corrected signal at 1064nm

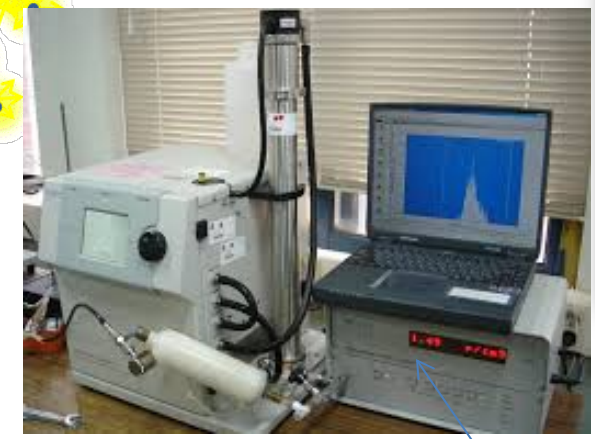


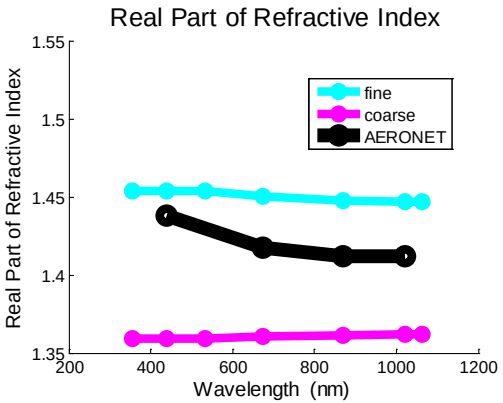
Depolarization: cross/total @532nm

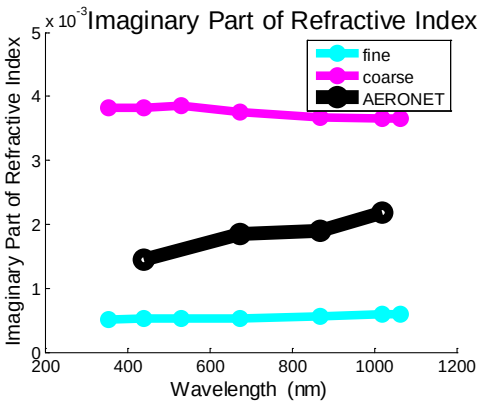


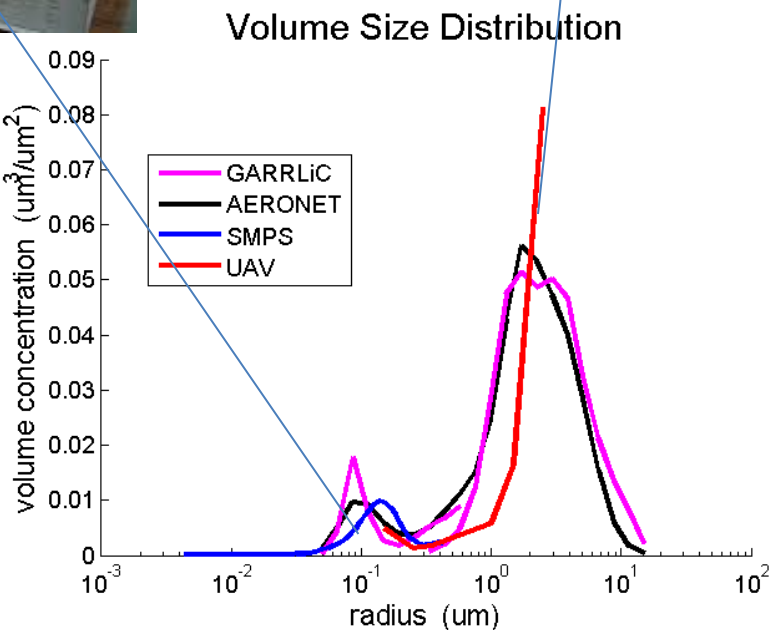
Retrieval examples











EMORAL (Esa's Mobile RAman Lidar)

Products:

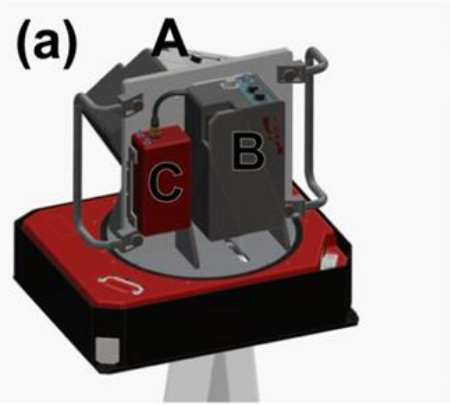
- Aerosol Extinction Profile, at 355 nm and 532 nm
- Aerosol Backscatter Profile, at 355 nm and 532 nm
- Linear particle depolarization ratio, at 355 nm

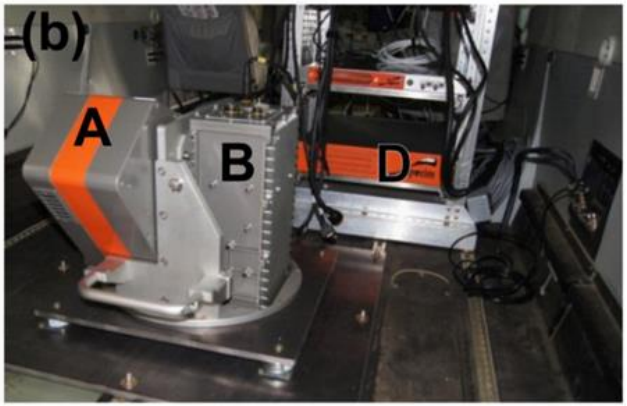
Utilization of EMORAL lidar during HYFLEX campaign, for the evaluation of atmospheric correction and sun-induced fluorescence retrieval methods

HYFLEX campaign

OBJECTIVES:

1. operate and verify the new HyPlant sensor through airborne measurement activities over agricultural and forest areas.
2. calculate maps of sun-induced fluorescence using the proposed approaches of the space-borne FLEX mission and to validate these maps by ground based measurements of top-of-canopy sun-induced fluorescence.
3. compare airborne fluorescence estimates over agricultural and forest areas to ground measurements and model simulations.





05 and 09 September 2012

Clean aerosol days: models succeed to make atmospheric corrections

High aerosol days: the implementation of EMORAL'S aerosol extinction profiles into models was necessary for successful atmospheric corrections

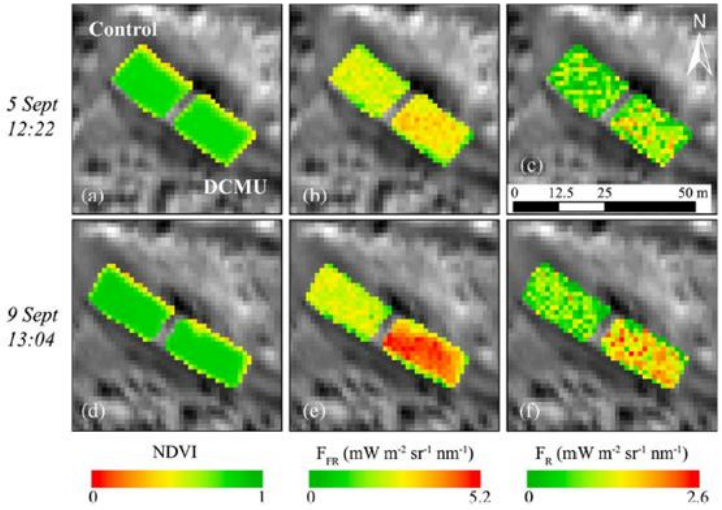
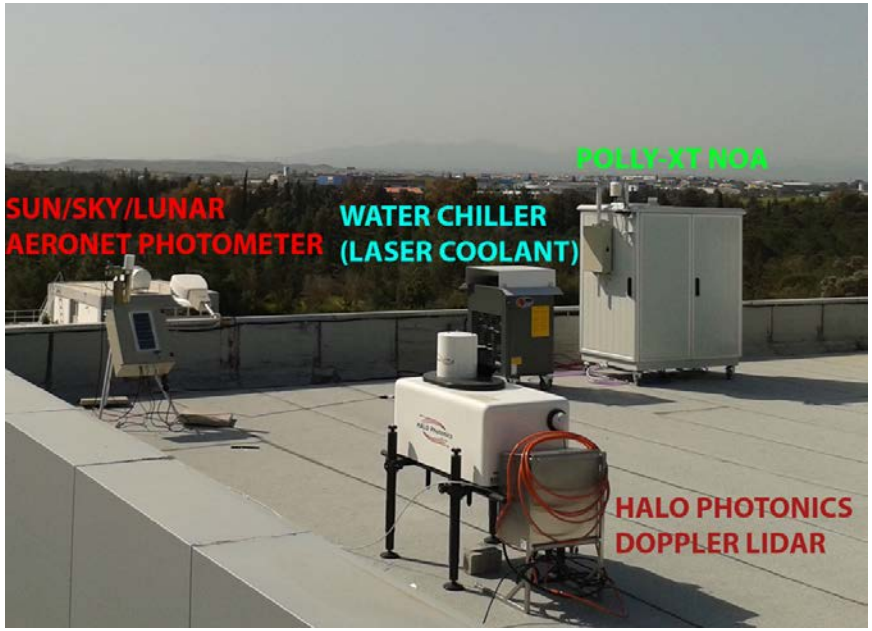


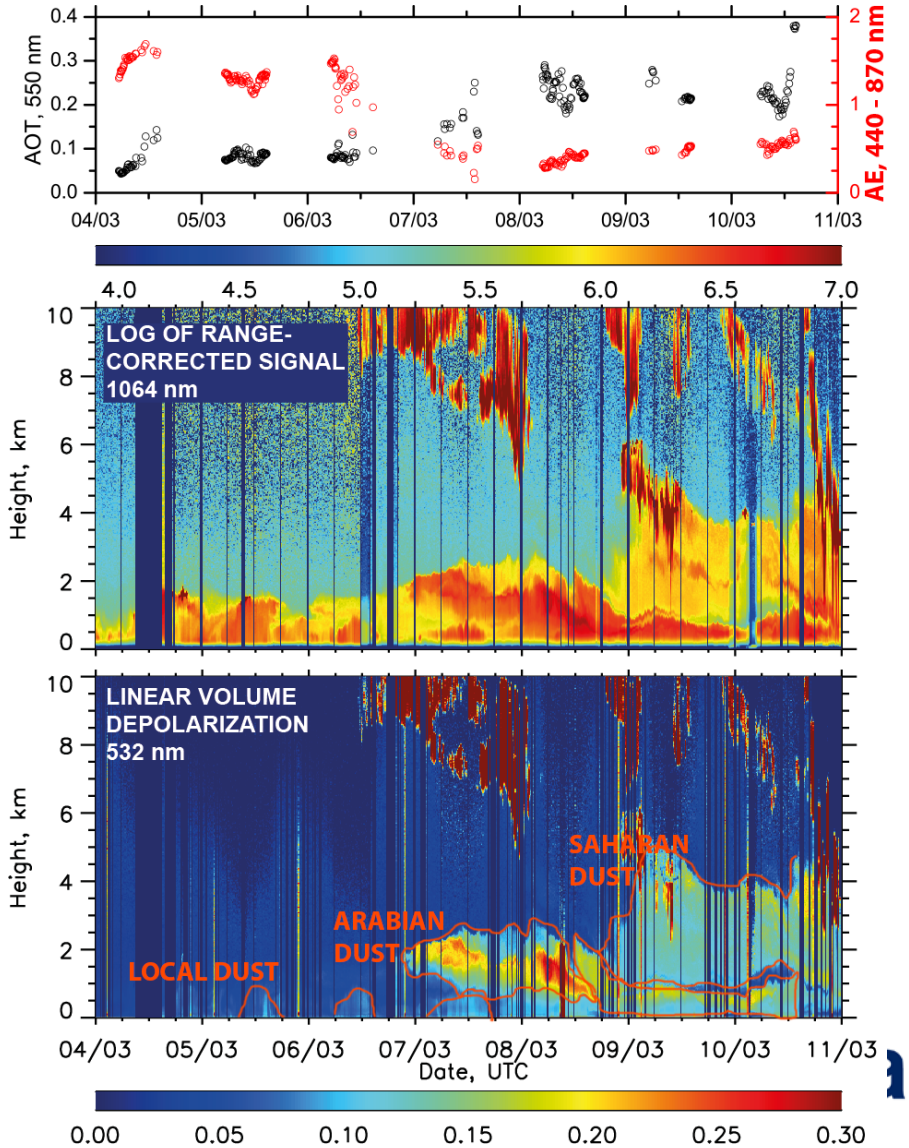
Figure 2. Control (left) and DCMU-treated (right) grass plots in airborne images. (a, d) Normalized difference vegetation index (NDVI). (b, e) Far red chlorophyll fluorescence (F_{FR}). (c, f) Red chlorophyll fluorescence emission (F_R). The dates and hours (CEST) on the left indicate the data acquisition time.

** Rossini et al., Red and far red Sun-induced chlorophyll fluorescence as a measure of plant photosynthesis, Geophysical Research Letters, 10.1002/2014GL062943, 2014*

Scheduled future activities

Campaign performed in Cyprus by TROPOS, NOA and CyI for adding information on Arabian dust properties.
(already presented by Ms. Mamouri)





Large scale experimental campaign in Eastern Mediterranean – April 2017

NOA:
Replicate LACROS
@ Crete

TROPOS:
LACROS @ Cyprus

Scheduled future activities

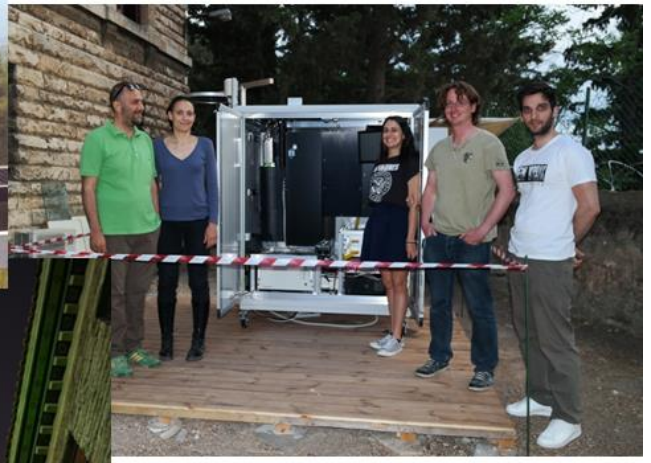
ACTRIS-2 campaigns: NOA will organize 4 experimental campaigns @ Athens, Crete, Granada, Melpitz

Night-time retrievals with sun/lunar/star photometer and Raman lidar

CIMEL sunphotometer

Polly^{XT} OCEANET lidar

In-situ measurements with Unmanned Aerial Vehicles (UAVs) and/or tethered balloons



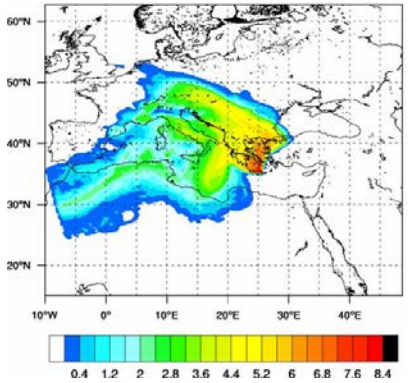
Athens and Melpitz campaigns are implemented already

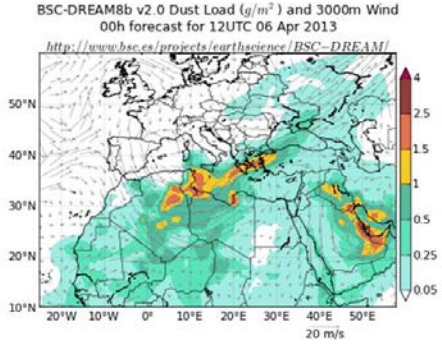
Proposal to ESA:
VADAM: Validation of ADM-Aeolus L2 aerosol and cloud product employing advanced ground-based lidar measurements

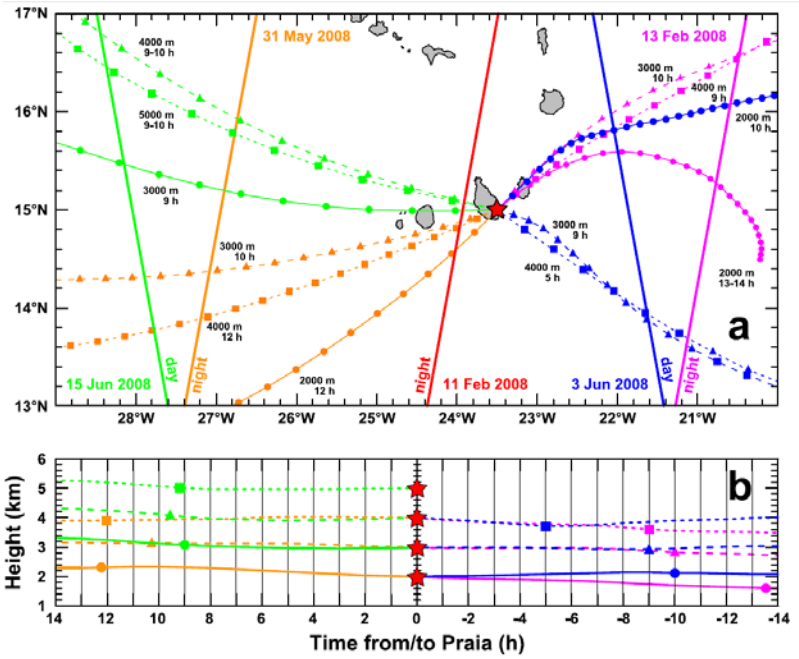
Scheduled future activities

BEYOND and twining partners (TROPOS, FMI) became members of the Aeolus Product Validation and Evolution Team (APVET)

VADAM cal/val approach







ADM in space

VADAM Start

Lev. 0, 1 Data

VADAM Stop

Lev. 2 & Final Report

L Date

+3.5m

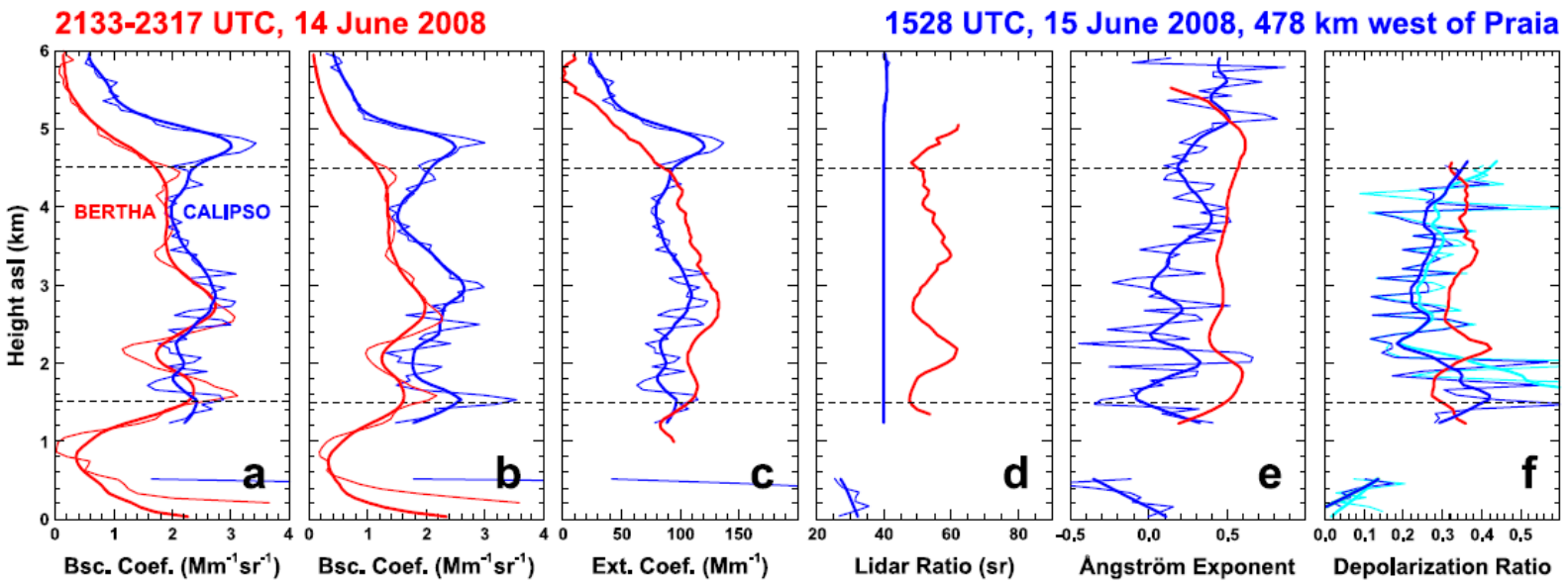
+1m

+9.5m

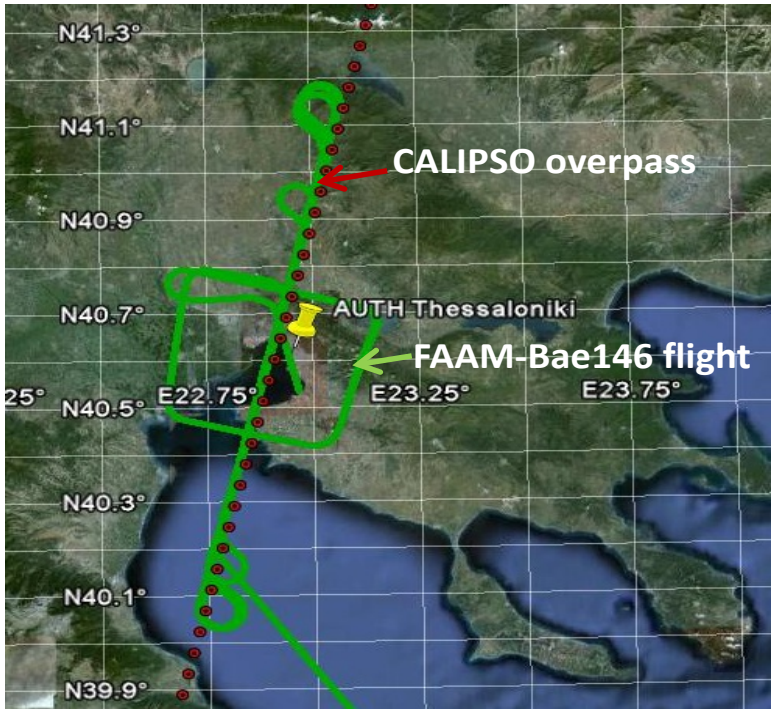
+16m

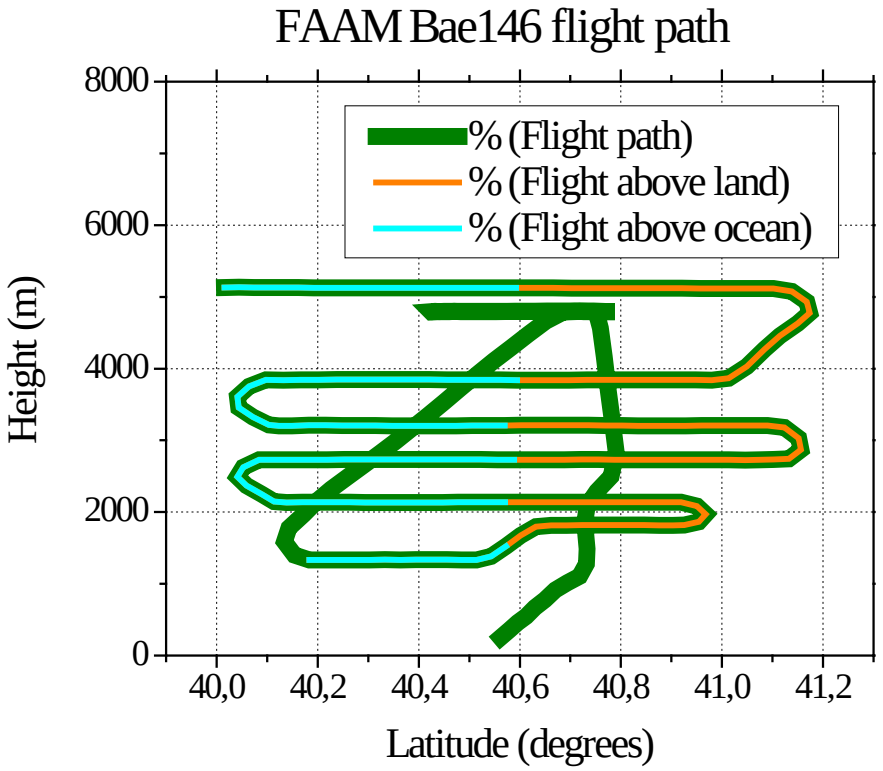
Evaluation examples (CALIPSO case)

Tesche et al., Ground-based validation of CALIPSO observations of dust and smoke in the Cape Verde region, JGR, 118, 2889-2902,doi:10.1002/jgrd.50248, 2013



Evaluation examples (CALIPSO case)





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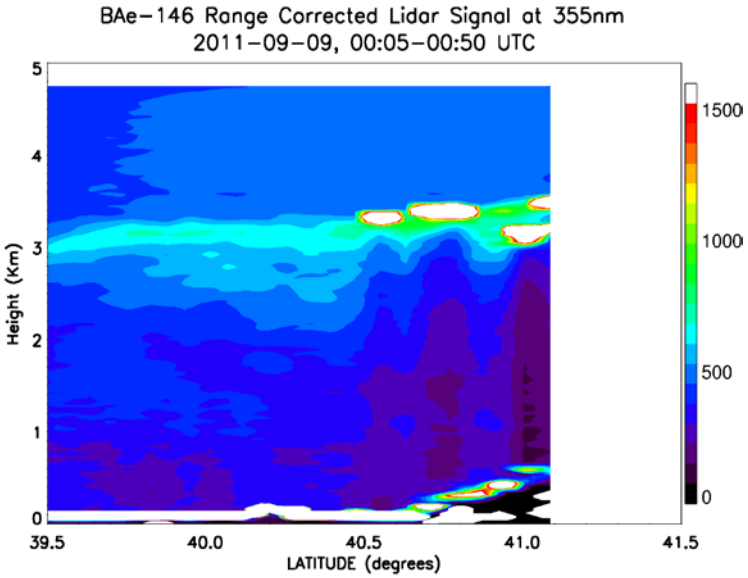
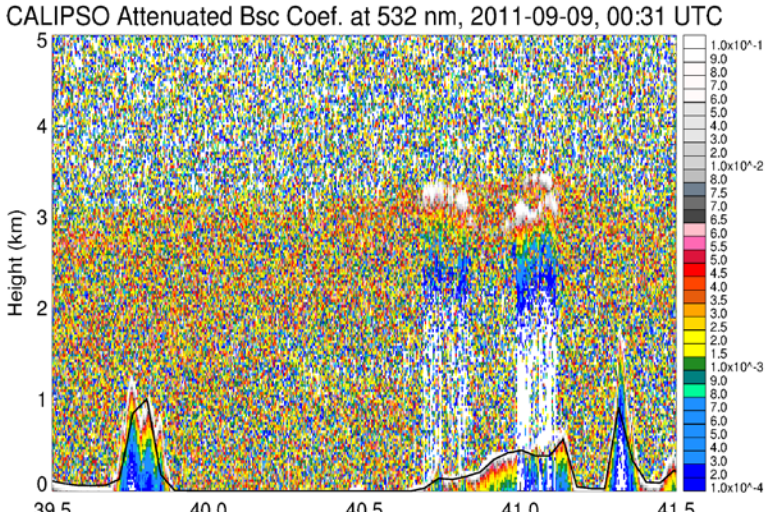
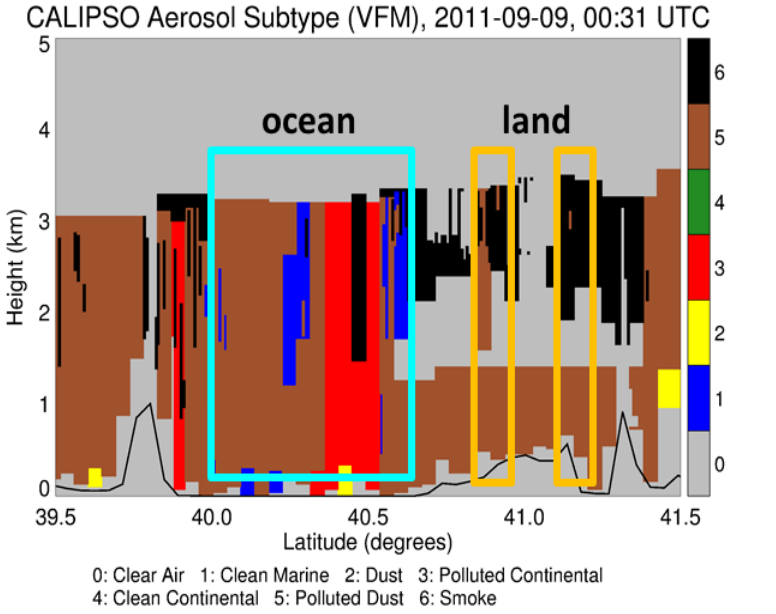
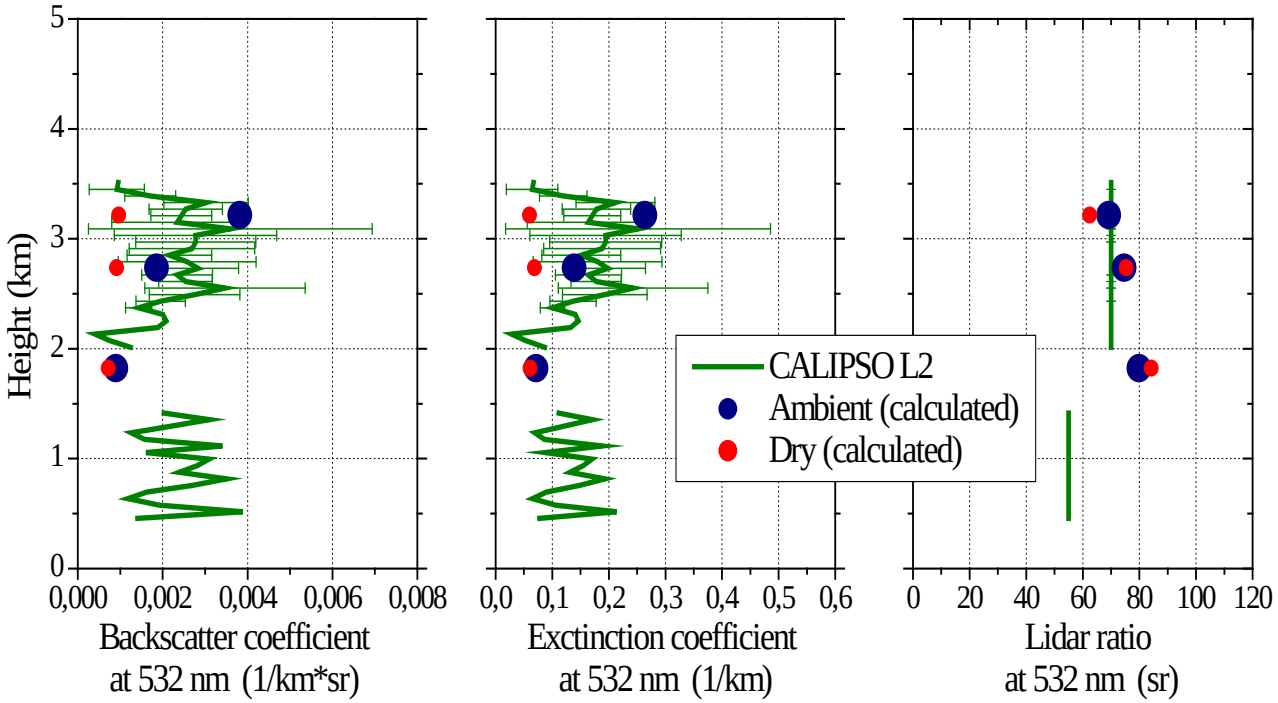






Tsekeri et al., CALIPSO validation using airborne and ground-based measurements over Mediterranean in the framework of the ACEMED campaign, (under review, AMT)



Conclusions

1. Through BEYOND, NOA has acquired sophisticated ground-based instrumentation
2. NOA has already integrated in European Networks like ACTRIS and EARLINET
3. NOA will coordinate 4 experimental campaigns in the framework of ACTRIS.
4. BEYOND participates in large-scale campaigns scheduled for the next 3 years, collaborating with UK MetOffice, ESA, NASA and other highly esteemed Institutions/Agencies (***Namibia-2017, Kuwait-2017, United Arab Emirates-2016, Eastern Mediterranean-2017***).
5. BEYOND aims to utilize the large ground-based dataset from the campaigns for cal/val activities targeting future ESA missions (Sentinels and Earth Explorers).