



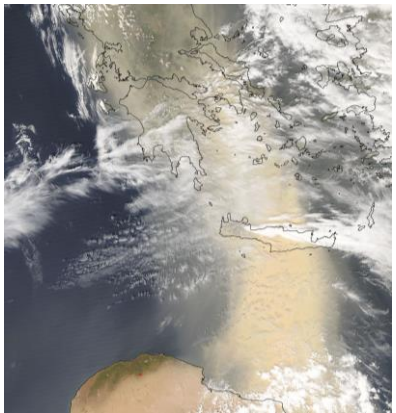
**Vassilis Amiridis**  
**BEYOND atmospheric services**  
IAASARS, National Observatory of Athens  
Greece

## Examples of systematic atmospheric hazards over Greece

Forest Fire Smoke



Saharan Dust



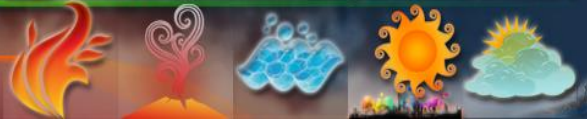


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Smoke dispersion

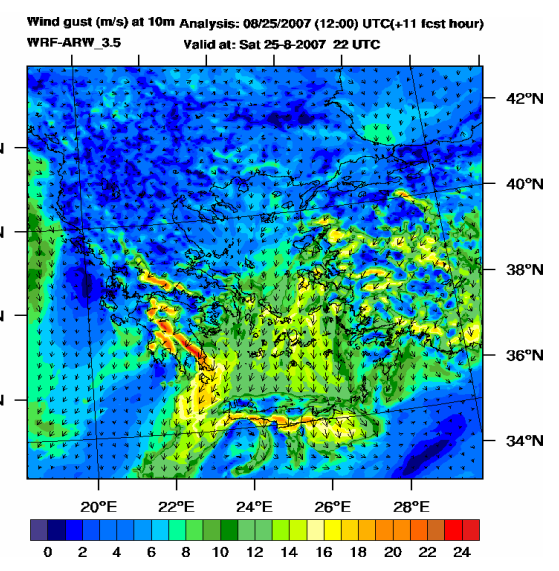
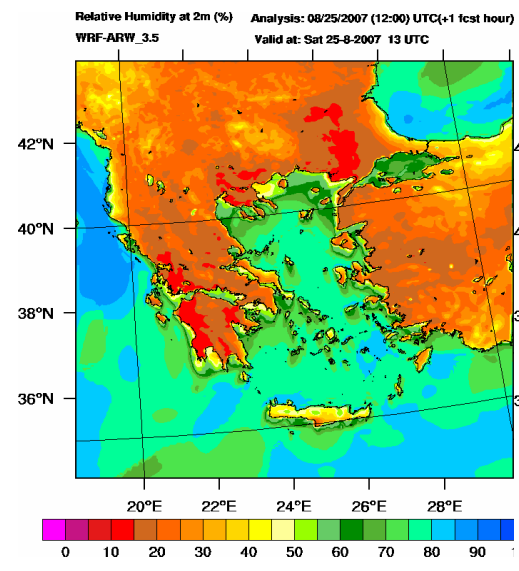
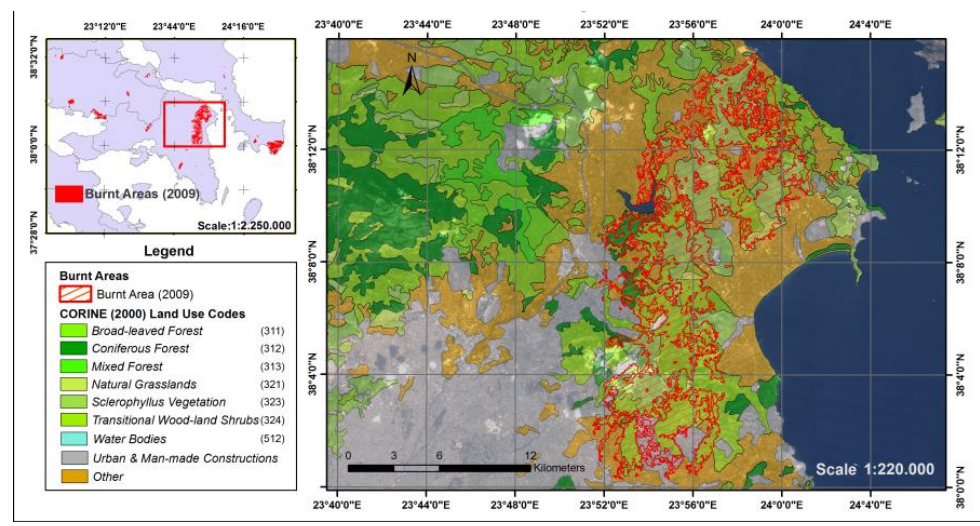


Remote sensing information:

Burnt area  
Fuel type  
Fire Radiative Power

+

Modeling:  
Meteorology





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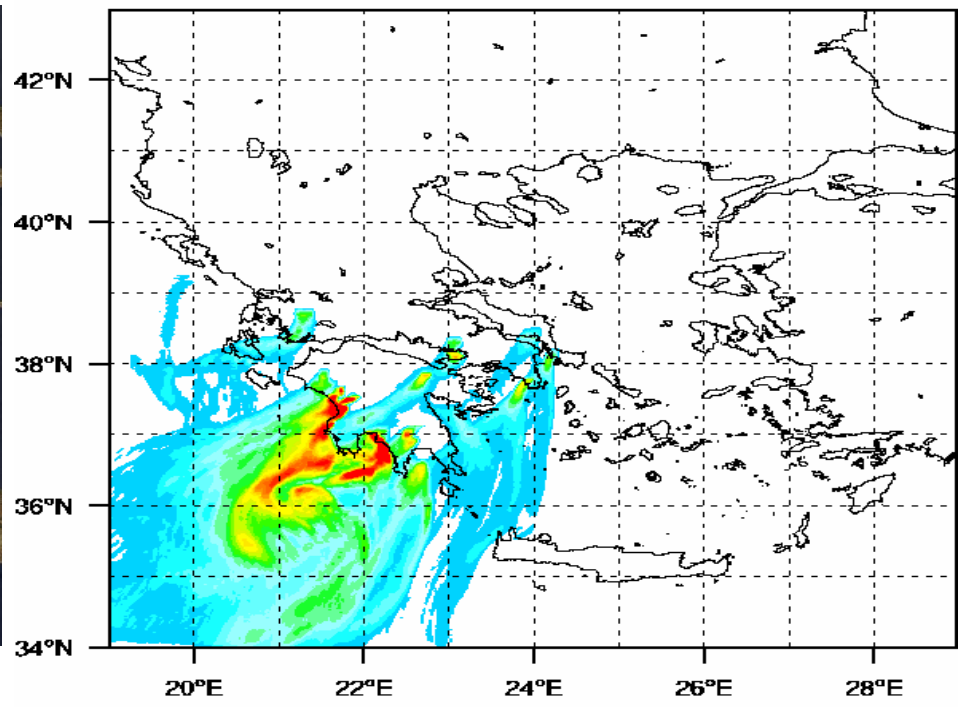
## Smoke dispersion



### FLEXPART - NOA Biomass Burning (Organic Carbon -OC)

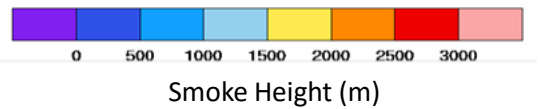
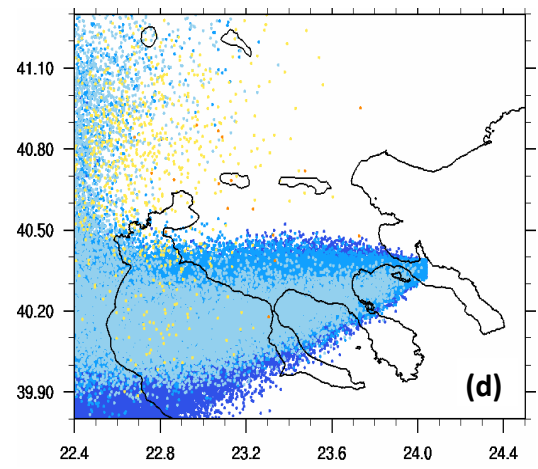
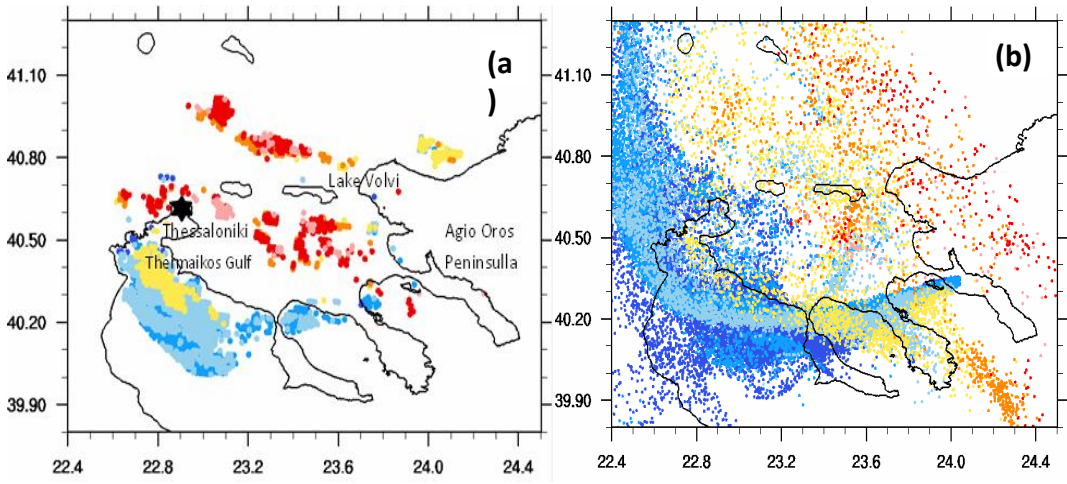
## Wild fire smoke dispersion

valid date:26-08-2007 0900UTC  
Model layer: Integrated Column (ng m<sup>-3</sup>)



Dispersion of smoke, MODIS 26 August 2007 09:30 UTC

## Smoke dispersion



The FLEXPART-NOA smoke dispersion modeling system is operational and provides 3D forecast fields in Greece.

The system is a part of the FireHub service and is utilized automatically from the fire detection online system.



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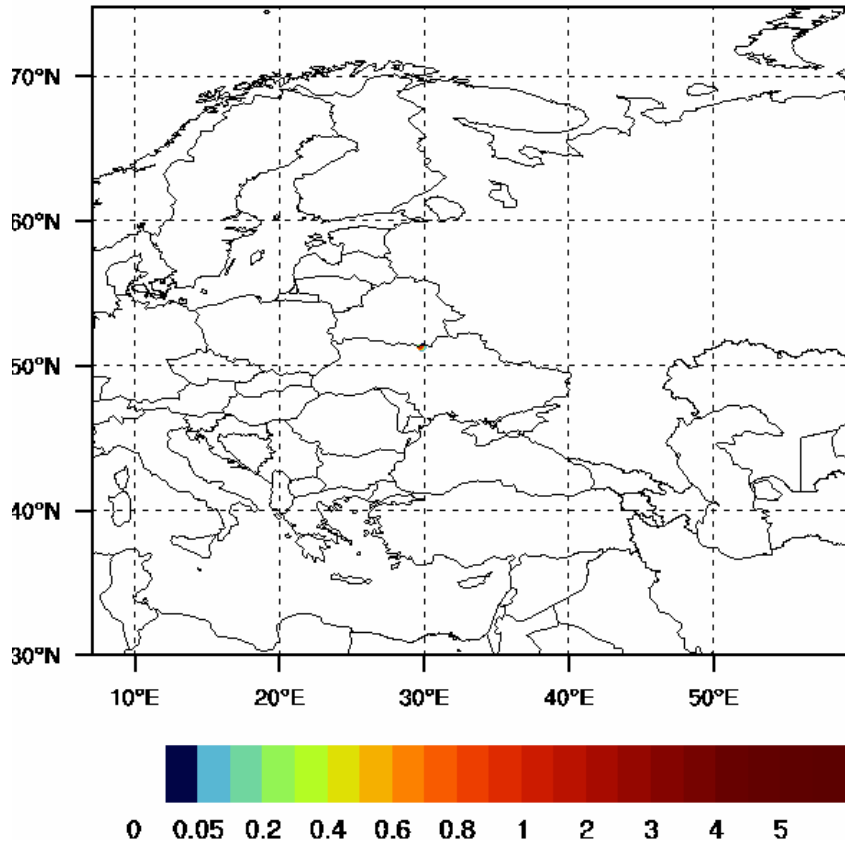
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## Industrial accident smoke dispersion



**BEYOND / NOA FLEXPART valid:29-04-2015 1500 UTC**  
**Smoke Aerosol Integrated Column (mg m<sup>-3</sup>)**



Early-warning system is stand by also for Europe. The example shows the simulation performed when we had a warning from our colleagues in Romania for the presence of biomass burning aerosols during the fires in Chernobyl – Ukraine in May 2015

*Collaboration with INOE and Doina Nicolae*

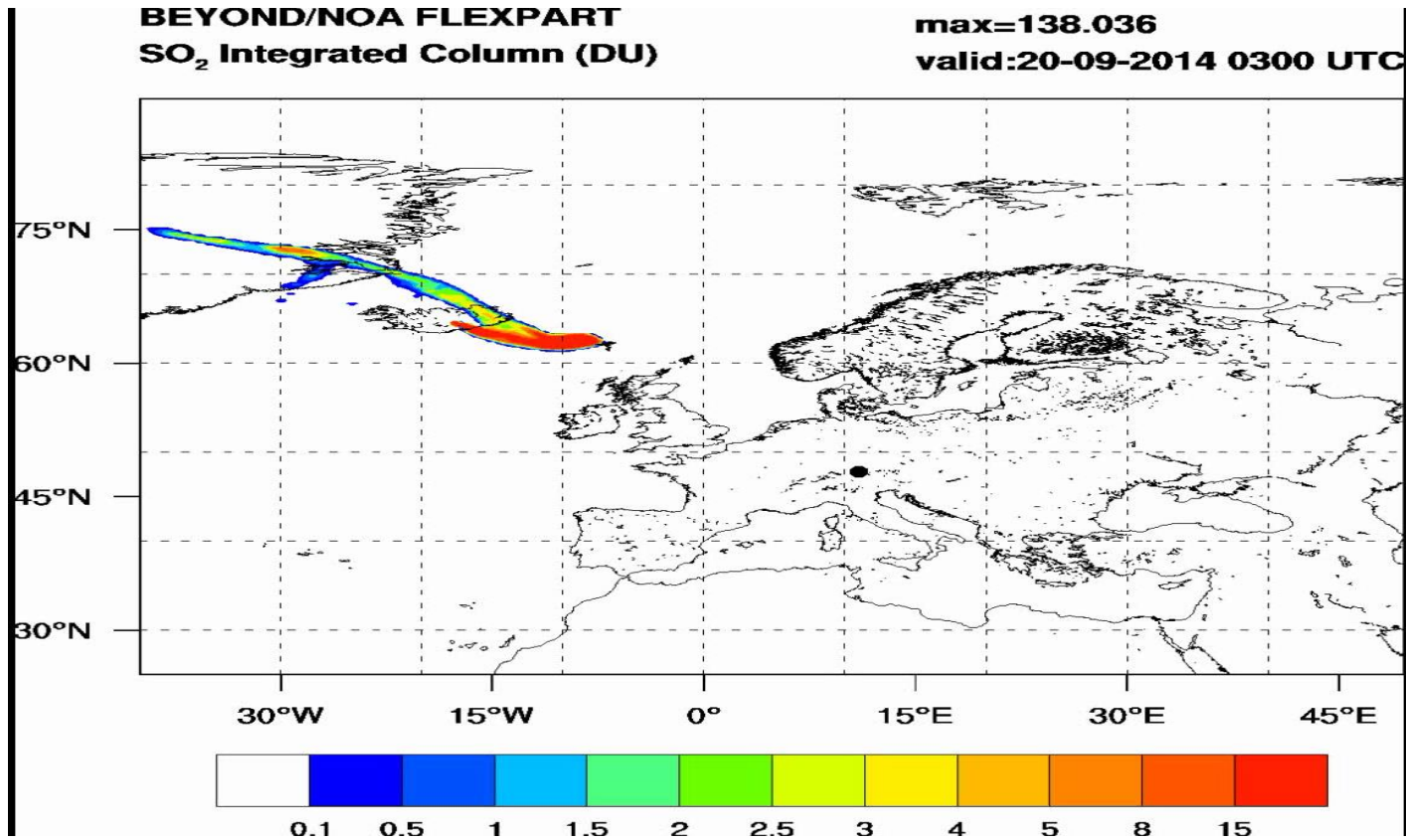


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## Volcanic ash dispersion



*Amiridis et al., 2015, ESA-ATMOS Conference*

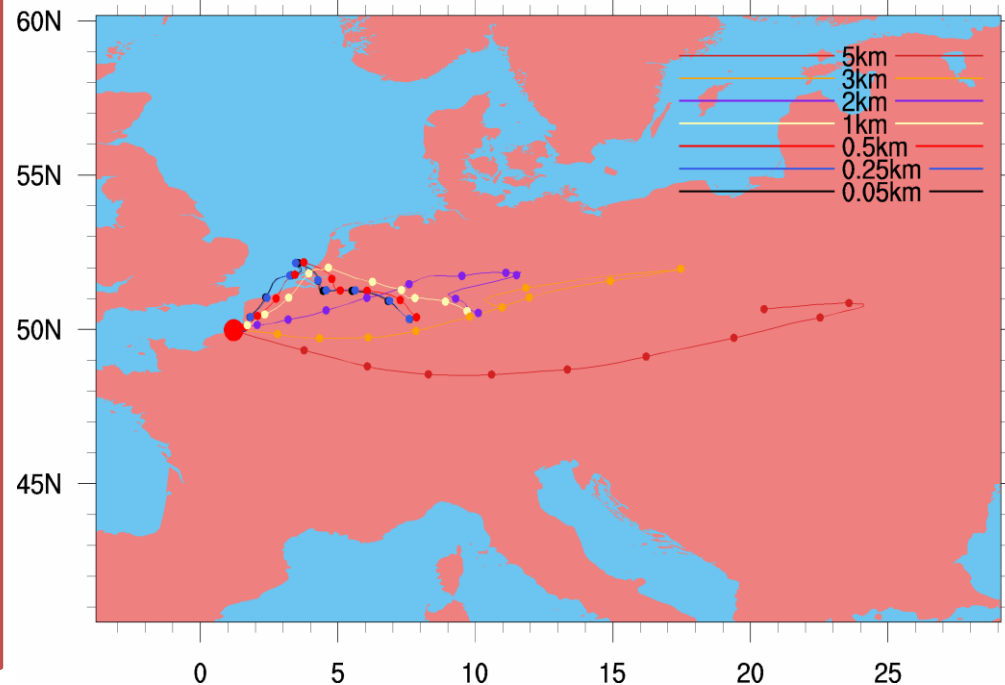
## Nuclear accident release

### BEYOND / NOAA Industry Accident Release (demo)

WRF / FLEXPART forward trajectories starting at: 20140824 120000 UTC

Markers every 6h - Colors denote trajectory height

- Prognostic forward trajectories for a conceptual scenario of nuclear accident over Europe.
- The big red dot indicates the location of the release.
- Different color lines indicate various height releases.
- When one knows the actual (observed) height of gas or particle releases the plume path is estimated from the corresponding trajectories.







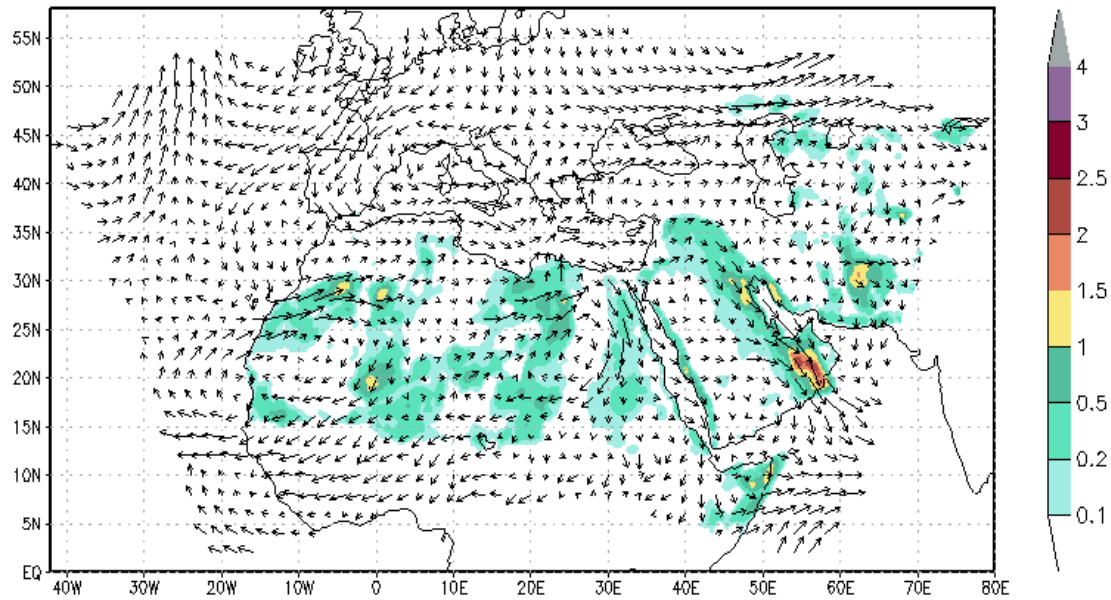
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## Desert dust modeling and forecasting

NMME/DREAM Charadmexp  
Dust Optical Depth (DOD) at 550nm and 2000m Wind  
Control Run 15JUN2014 12UTC



7



# BE OND

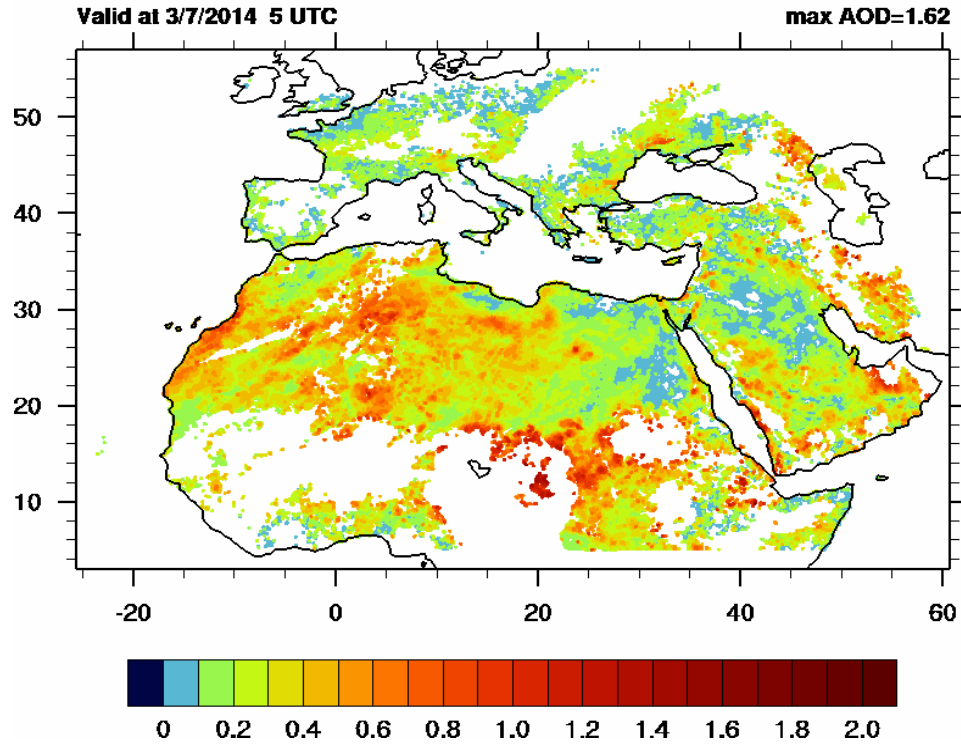
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## Desert dust modeling and forecasting



MSG SEVIRI Dust Optical Depth ( $\tau_{550}$ )



Dust Optical Depth from the UK Met Office SEVIRI retrieval algorithm  
(Data provided by Yash Pradhan for the CHARADMEExp campaign)



# BEYOND

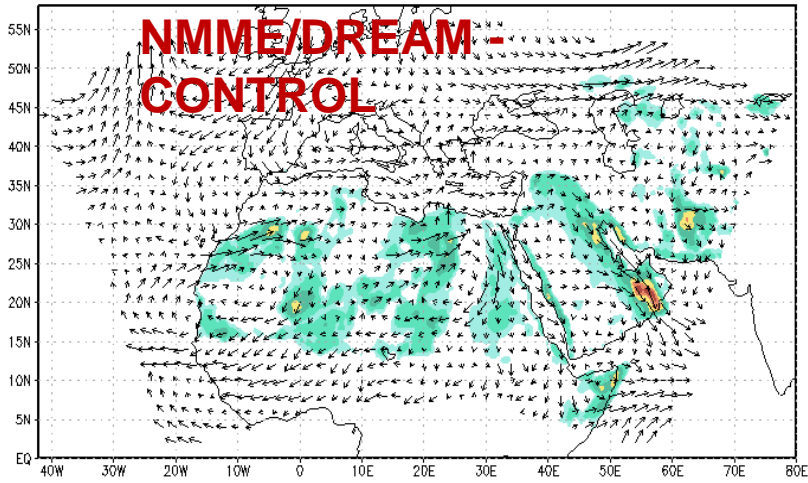
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## Desert dust modeling and forecasting

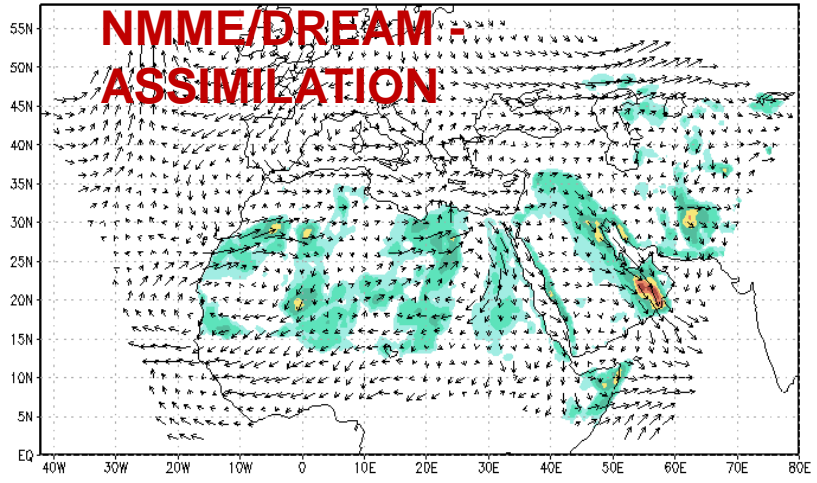


NMME/DREAM Charadmexp  
Dust Optical Depth (DOD) at 550nm and 2000m Wind  
Control Run 15JUN2014 12UTC



7

NMME/DREAM Charadmexp  
Dust Optical Depth (DOD) at 550nm and 2000m Wind  
SEVIRI Assimilation Run ( $k=5 \times 10^{-4}$ ) 15JUN2014 12UTC



7

GRADS: COLA/IGES

GRADS: COLA/IGES

### Assimilation Effects

- Cuts dust production over Arabian Peninsula
- Saharan dust sources are represented in finer detail
- Dust increases over Iberian Peninsula
- Sahel sources may be too strong



FP7-Regpot-2012-13-1



# BE OND

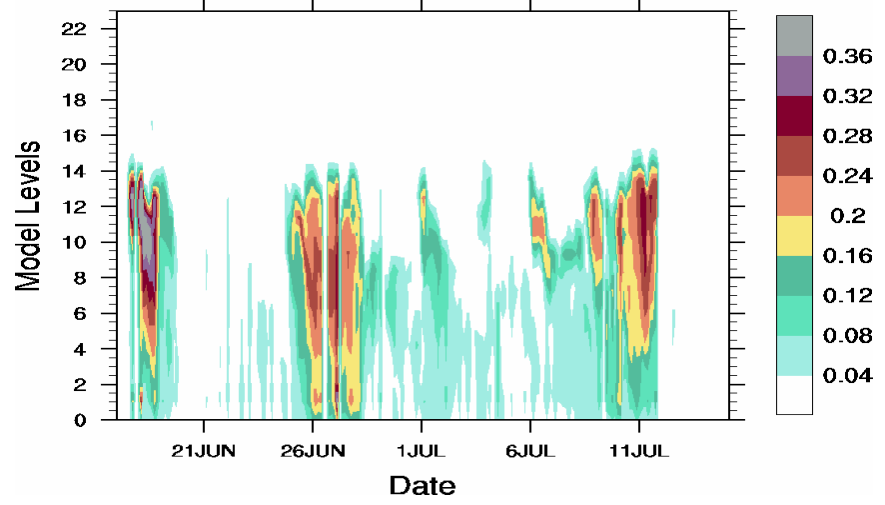
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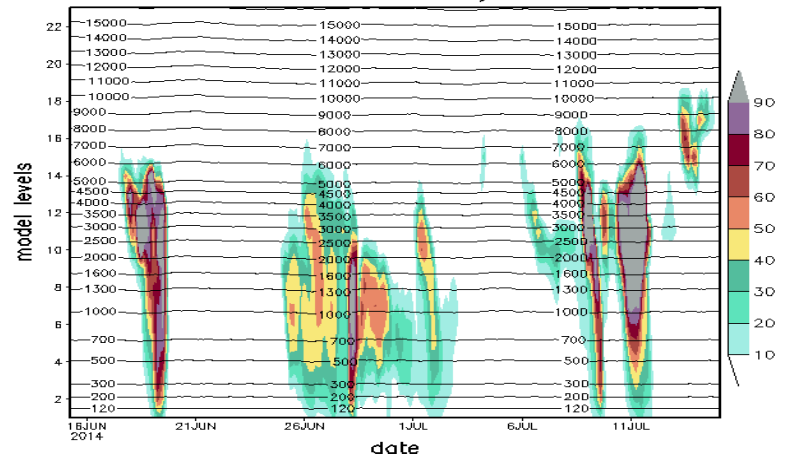
## Desert dust modeling and forecasting



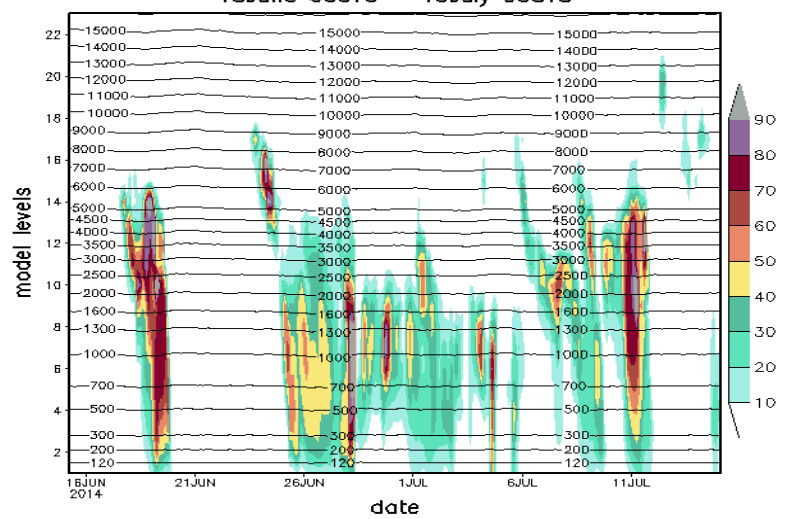
Volume depolarization ratio  
Pollyarielle, Finokalia, Crete, Greece  
17June2014 00UTC - 15July2014 03UTC



NMME/DREAM Charadmexp Control Run  
Total dust concentration [ $\mu\text{g}/\text{m}^3$ ] and geop. height (m)  
15June 06UTC - 15July 03UTC



NMME/DREAM Charadmexp MSG dust Assimilation Run  $k=5 \times 10^{-4}$   
Total dust concentration [ $\mu\text{g}/\text{m}^3$ ] and geop. height (m)  
15June 06UTC - 15July 03UTC

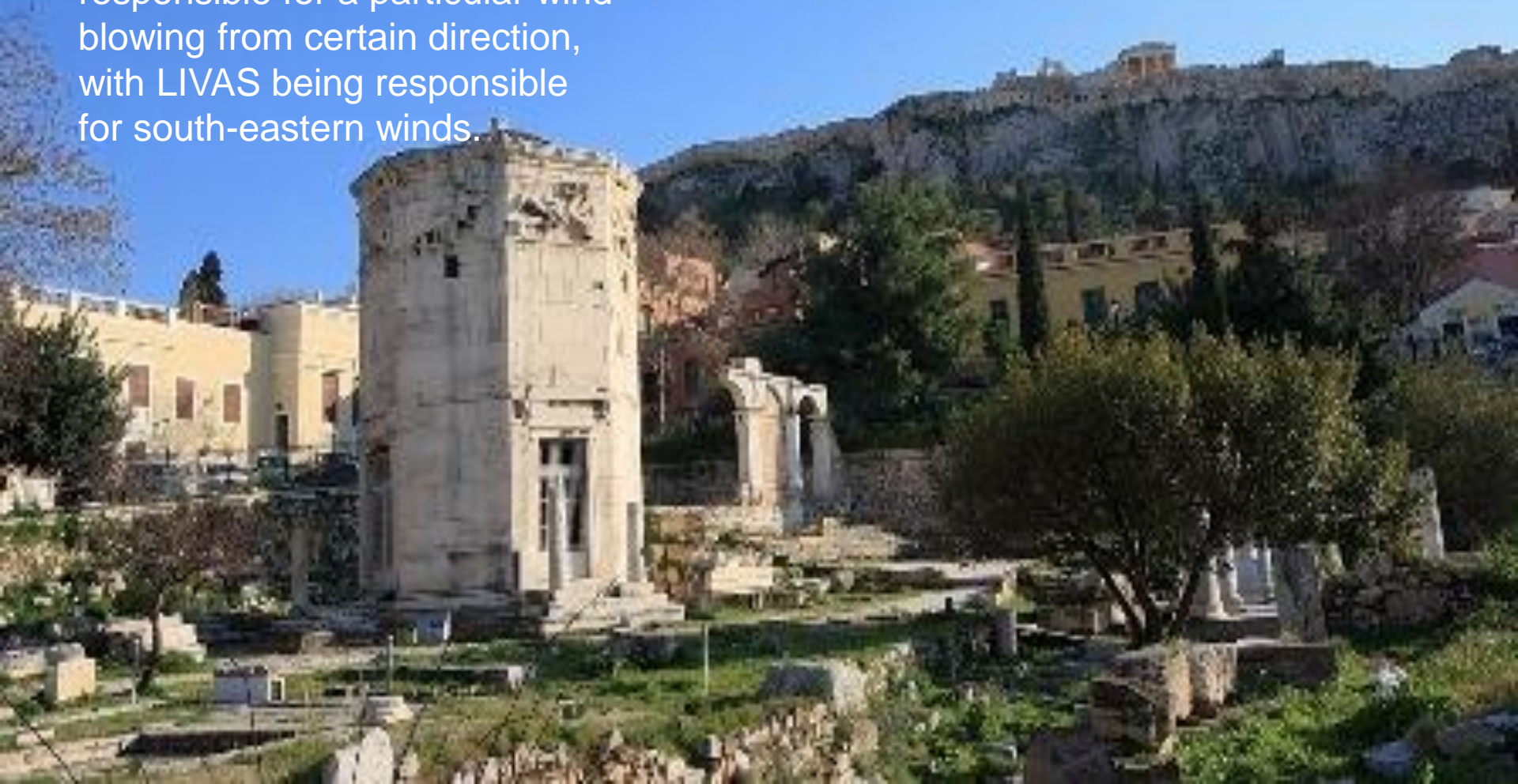


In collaboration with Slobodan Nickovic  
Nickovic et al., 2016 (in preparation)

# Aeolus and Livas

In Greek mythology, Aeolus was the 'keeper of the winds'.

Aeolus ruled over 8 gods, each responsible for a particular wind blowing from certain direction, with LIVAS being responsible for south-eastern winds.





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## LIVAS dust product

<http://lidar.space.noa.gr:8080/livas/>

[Home](#) [About](#)

### LIVAS

LIVAS Product  
Aerosol Extinction @532nm Per Type for cell with centroid: Lat= 44.5°, Lon= 11.5°

Height (km) vs Extinction Coefficient (km<sup>-1</sup>)

Number of Aerosol Observations vs Height (km)

General Statistics:			
Surface Elevation:			
Mean	0.0015	Min	0.001
Max	1.175		
Number of overpasses: 167			
Number of profiles examined: 3000			
Aerosol Statistics:			
Samples averaged (after filtering):			
Total	346425	Aerosol	31196
Clear Air	915333		
Aerosol subtype occurrence:			
CM	0	PC	0
CC	0	PD	0
S	12.4932	All	26.698
Aerosol Optical Depth at 532 nm:			
Mean	0.1221	Median	0.02793
StdDev	0.26102		

Category	Product	Wavelength	Partial Products
Aerosol	Extinction	355nm	Per Type
		532nm	
Cloud	Backscatter	1064nm	Per Season
		1570nm	
Stratospheric	Depolarization	2050nm	
		2050nm	

Save to ASCII    Save to NetCDF

Grid Selector

**Product Selector**

Navigate to the desired final product by hovering over the menu from left to right and then press in order to inspect charts and data.

**ABOUT**

NOA    > Regional and Seasonal Statistics    > About page

> Selected Scenes



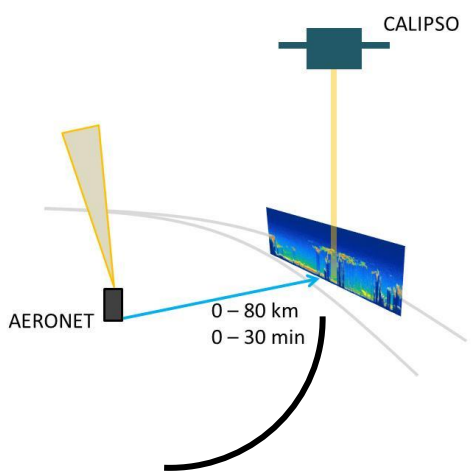
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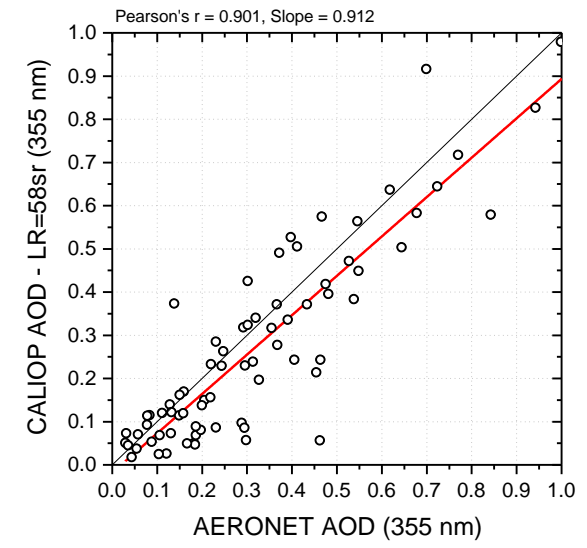
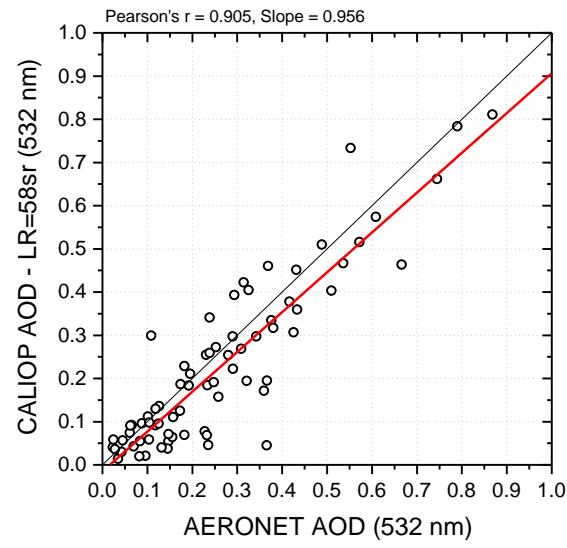
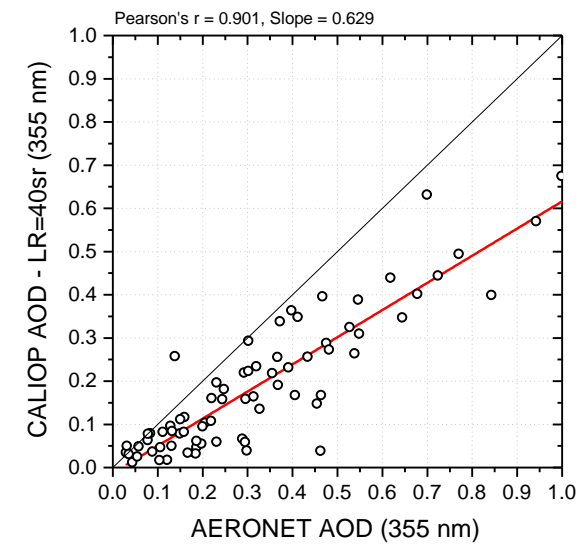
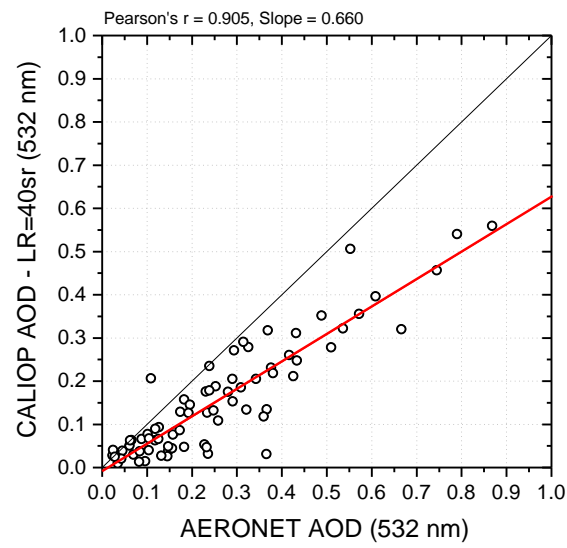


## LIVAS dust product

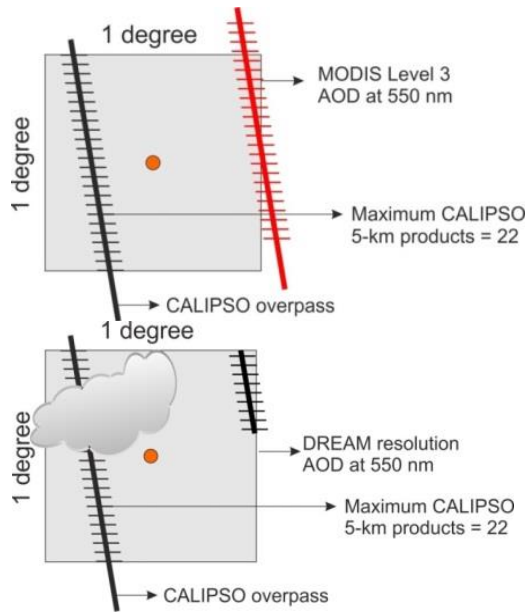
### CALIPSO-AERONET Collocation



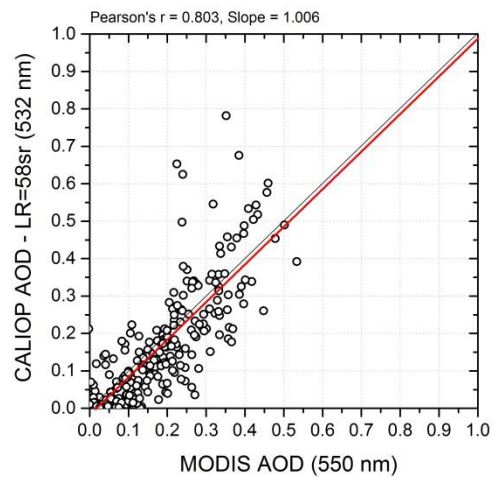
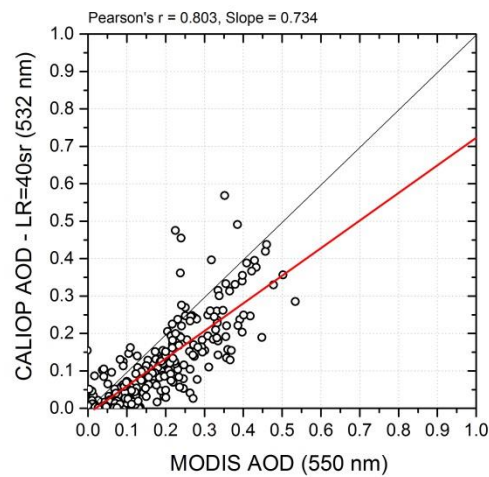
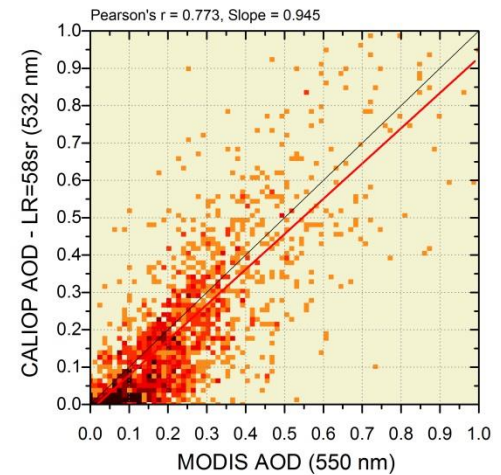
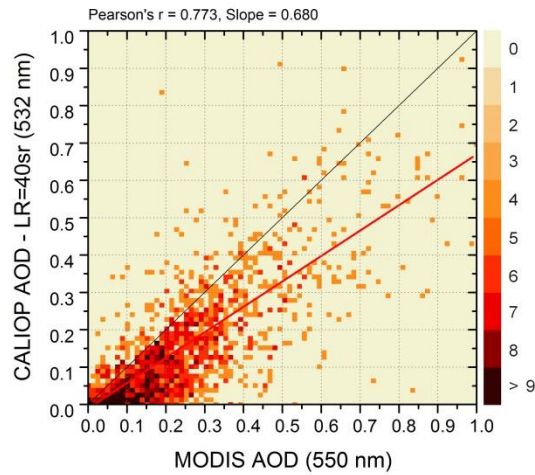
In pure Dust cases from CALIPSO typing



## CALIPSO-MODIS Collocation



Red overpasses rejected

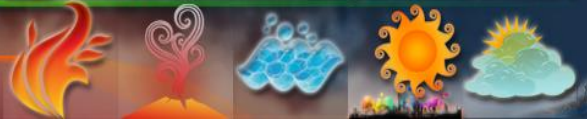




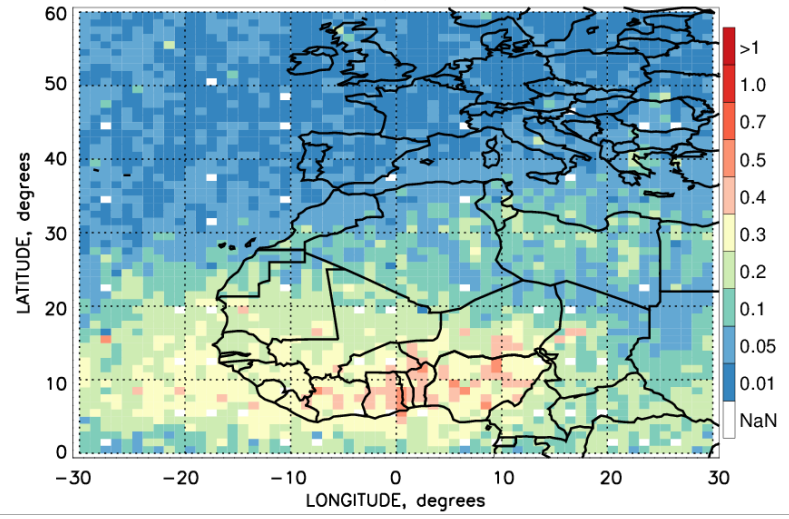


# BEYOND

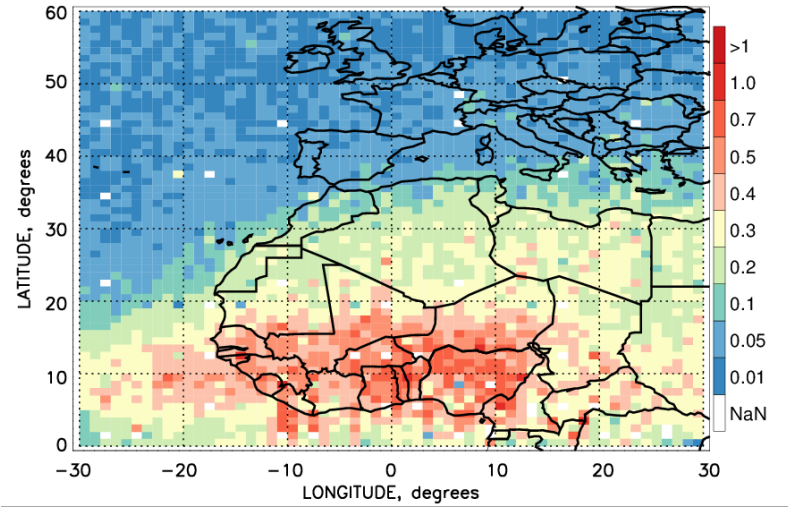
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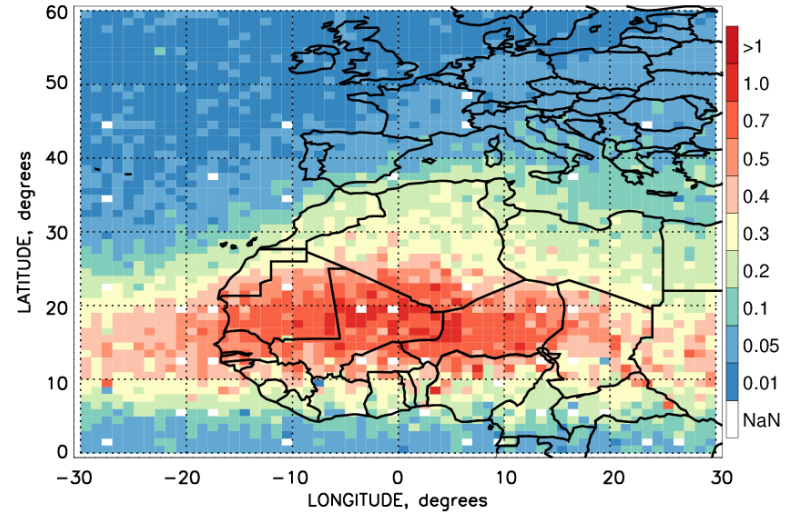
CALIPSO Mean Dust AOD, 2007-2013 D-J-F



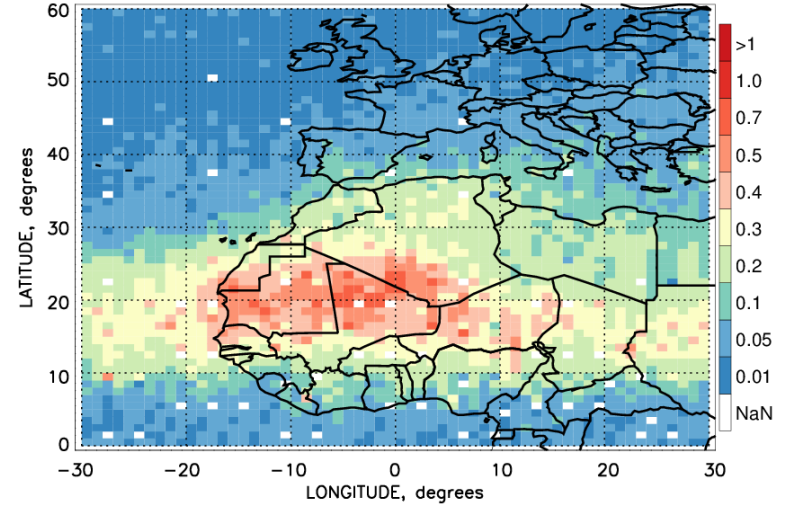
CALIPSO Mean Dust AOD, 2007-2013 M-A-M

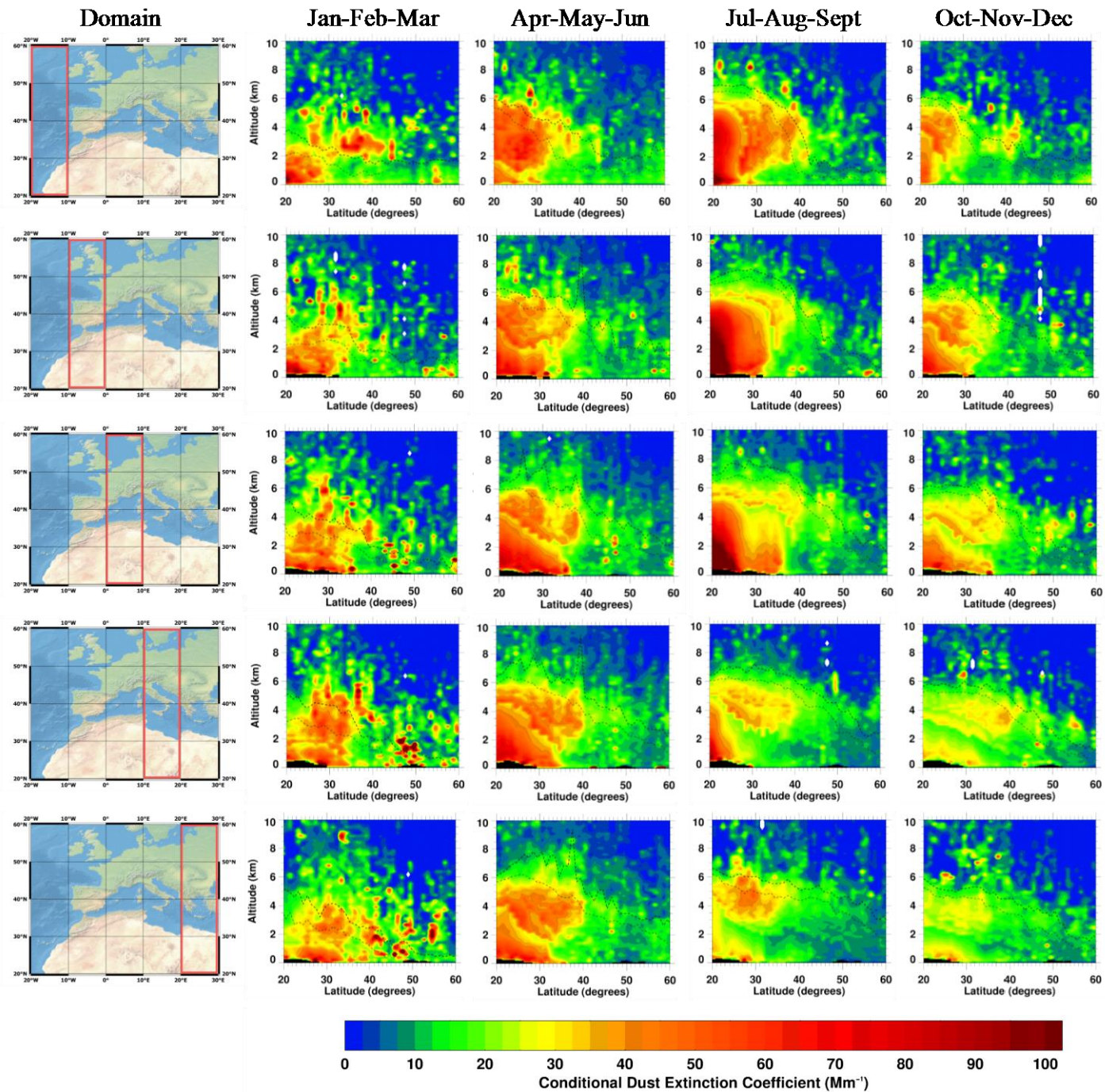


CALIPSO Mean Dust AOD, 2007-2013 J-J-A



CALIPSO Mean Dust AOD, 2007-2013 S-O-N

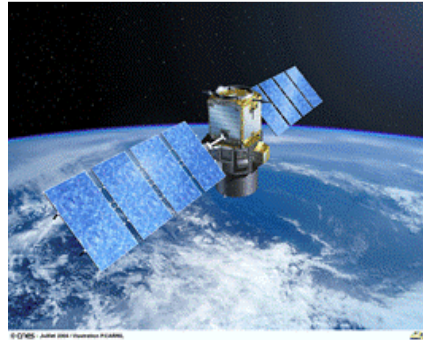




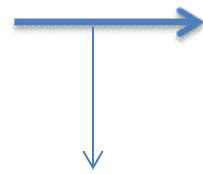


Starting from DUST and expanding to other aerosol types, the final BEYOND product in UV is envisioned to serve as the link between CALIPSO and EarthCARE, in order to bridge the missions for the provision of a multi-decadal harmonized climatic record.

**From CALIPSO**



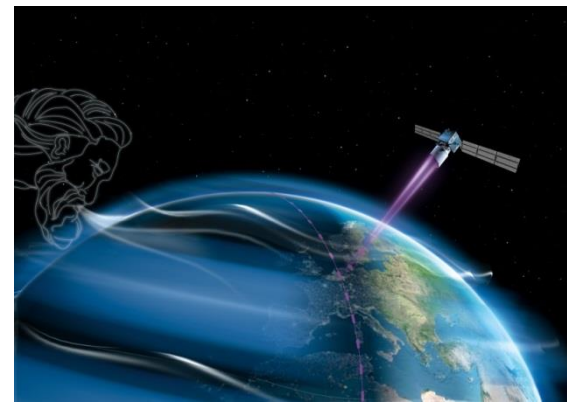
**EARLINET**



**To EarthCARE**



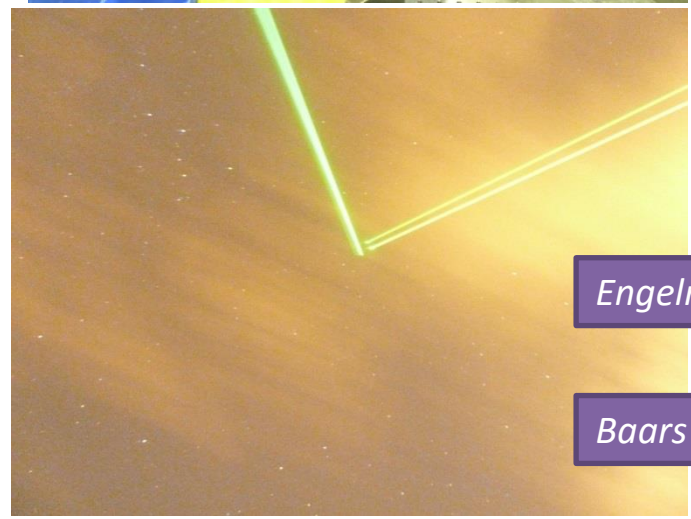
**ADM-Aeolus??**





# PollyXT Lidar System

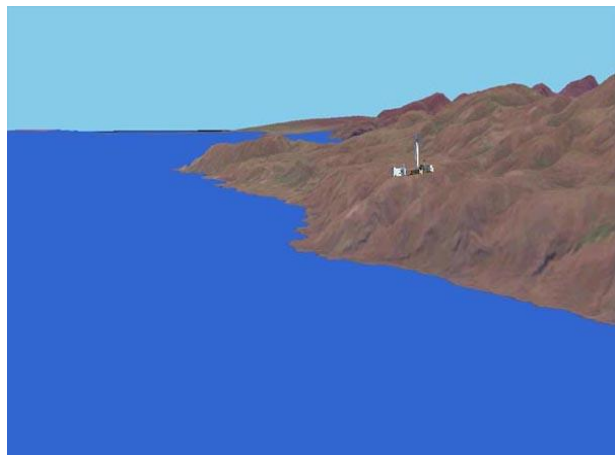
In BEYOND, we developed a sophisticated multi-wavelength backscatter/Raman/depolarization lidar in collaboration with TROPOS Institute in Leipzig, Germany, the so-called **PollyXT lidar**



*Engelmann et al., 2016, AMT*

*Baars et al., 2016, ACP*





Latitude = 35.34°N - Longitude = 25.67°E - Elevation = 252 a.s.l.



Thermo Environmental Instruments Inc.  
PM2.5 Analyzer

Thermo Environmental Instruments Inc.  
CO Analyzer

Magor Scientific  
Aethalometer™

ARI

Pfeiffer VACUUM TransPac

PILS

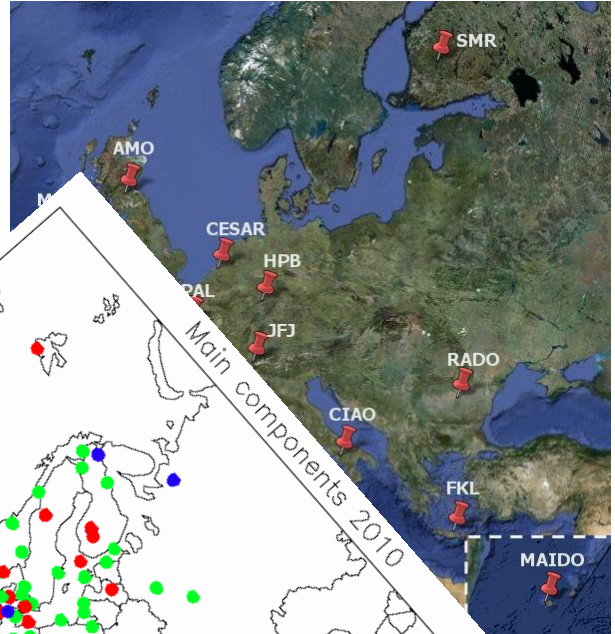
Thermo  
PM2.5

Radon-1

Main Menu  
Readings  
Data Average  
Report Pref

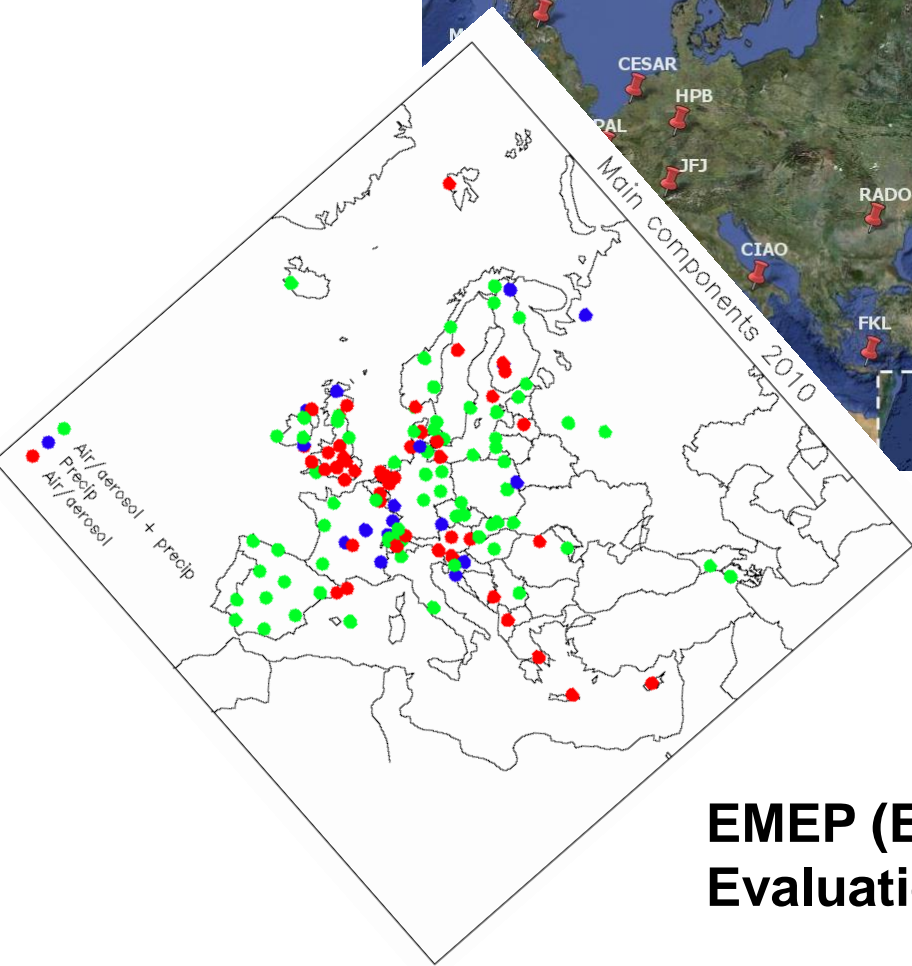


Finokalia station



**ACTRIS**

**ICOS (Integrated Carbon Observation System)**



**EMEP (European Monitoring and Evaluation Programme)**





## 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



# BEYOND

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## Scheduled future activities



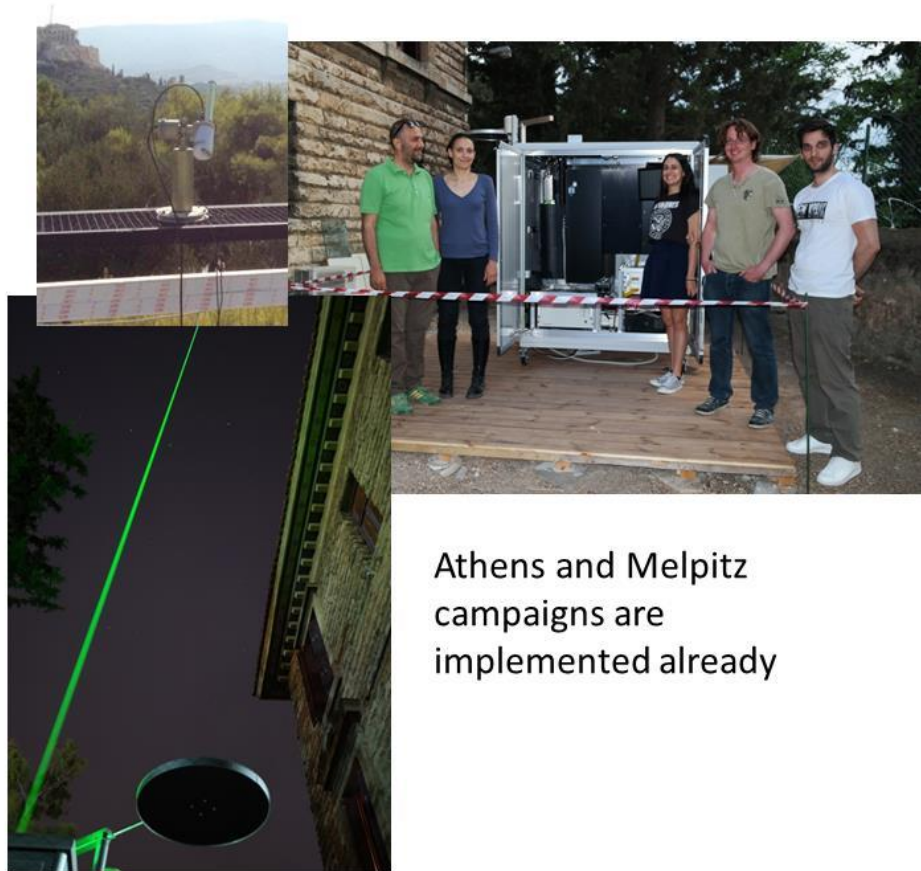
### ACTRIS-2 campaigns: NOA will organize 4 experimental campaigns @ Athens, Crete, Granada, Melpitz

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



CIMEL sunphotometer Polly<sup>XT</sup> OCEANET lidar

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



Athens and Melpitz campaigns are implemented already



## Large scale experimental campaign in Eastern Mediterranean – April 2017

**NOA:**  
Replicate LACROS  
@ Crete



**DLR:**  
50 flight-hours  
over East.Med.  
(ERC project A-LIFE)



**TROPOS:**  
LACROS @ Cyprus





## Conclusions

1. Langrangian atmospheric models (FLEXPART) utilized in the BEYOND in conjunction with RS data to provide smoke and volcanic ash dispersion forecasts.
2. Eulerian state-of-the-art models (NMME/DREAM) were utilized to simulate the atmospheric desert dust cycle. Assimilation of MSG dust retrievals showed to improve forecasts when compared to ground-based lidar profiles.
3. Assimilation of 3D fields from CALIPSO dust LIVAS product of BEYOND is under development. For this development we aim to use UV dust extinction wavelengths in order to be consistent with future ESA missions (ADM-Aeolus and EarthCARE).