

## Atmospheric activities in the framework of BEYOND

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The research portfolio of BEYOND includes a cluster of activities related to the atmosphere. Ranging from the development of high quality ground-based remote sensing infrastructure for cal/val purposes to the assimilation of space-borne observations on atmospheric models, the activities focus on the development of high-quality services related to atmospheric hazards.

In this presentation, the following components of the atmospheric BEYOND cluster will be presented and discussed:

- (a) The LIVAS aerosol and cloud climatological archive developed and optimized based on 3D CALIPSO observations. The climatology covers a wide spectral range from UV to NIR, at 355 nm, 532 nm, 1064 nm, 1.57  $\mu\text{m}$  and 2.05  $\mu\text{m}$ . The optical properties at the different wavelengths are calculated from CALIPSO measurements at 532 nm and aerosol-type-dependent spectral conversion factors for backscatter and extinction derived from EARLINET ground-based measurements for the UV and scattering calculations for the IR wavelengths, using a combination of input data from AERONET, suitable aerosol models and recent literature. The LIVAS climatology is freely available under the BEYOND url: <http://ocean.space.noa.gr/BEYONDsite/index.php/atmospheric/3d-livas>, where the database is stored and exposed (Figure 1). The webpage provides the complete information on the methodological approaches and instructions on portal's usage. The data are provided in ASCII and netcdf formats, while brief statistics and quick-view charts are projected online.



Figure 1. The LIVAS web-portal.

- (b) The development of a sophisticated ground-based PollyXT lidar system and its operation on a 24/7 basis. The system will be installed in the station of Finokalia in Crete, aiming to monitor advection of air pollutants from remote sources (e.g. Sahara desert, forest fires and volcanic eruptions). This installation provides unique opportunities for effective aerosol characterization in the Eastern Mediterranean and cal/val activities related to European Sentinel and Earth Explorer missions.
- (c) Development of fire smoke and volcanic ash atmospheric dispersion models based on space-borne observations. The first version of wild fire smoke forecast service is installed in BEYOND and is operational since July 2014. Smoke dispersion is included in the integrated FireHub processing chain. Detailed ignition, duration and locations of the fire spots are obtained in five (5) minutes intervals from the MSG SEVIRI instrument. Smoke dispersion is

computed with the Lagrangian dispersion model FLEXPART driven by WRF-ARW meteorological fields at a resolution of 4x4 km over Greece. Hourly updated forecasts are available online: (<http://ocean.space.noa.gr/BEYONDsite/index.php/fires/fire-smoke-dispersion>).

(d) Development of a dust model coupled with real-time MSG-SEVIRI dust retrievals through advanced assimilation techniques. In this approach we attempt to derive dust fields from SEVIRI instrument (Figure 2a) and use it as initial conditions for the NMME dust forecasts (Figure 2b). This service is still under development and first results are evaluated towards the CHARADMExp campaign dust measurements in Crete, Greece. Dust model with and without assimilation of MSG-SEVIRI dust retrievals is used for the description of dust transportation towards Crete and the possible benefits of assimilation techniques are discussed based on lidar ground-truth data.

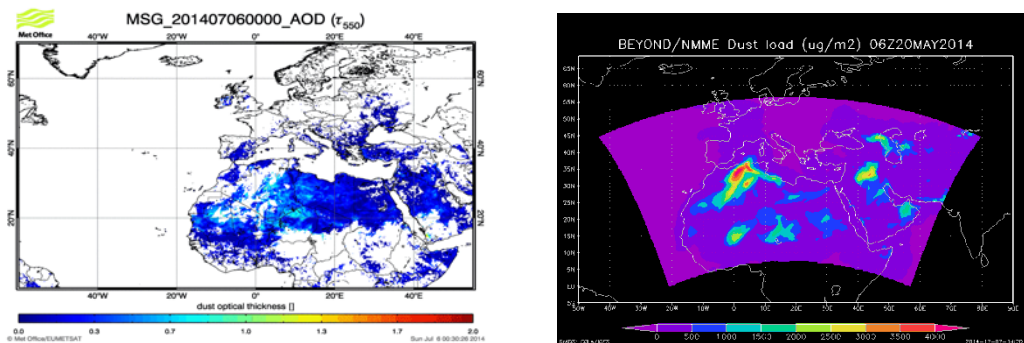


Figure 2. a) Example of dust optical thickness as provided by U.K. Met Office dust product on 6 July 2014. b) Example of BEYOND/NMME dust load forecast.

Finally, we present some synergistic applications incorporating several atmospheric BEYOND components. As seen in Figure 3, characterization of the observed aerosols during the CHARADMExp experimental campaign is provided from advanced lidar inversion algorithms and the origin of the particles is determined from detailed source-receptor analysis using WRF and FLEXPART models.

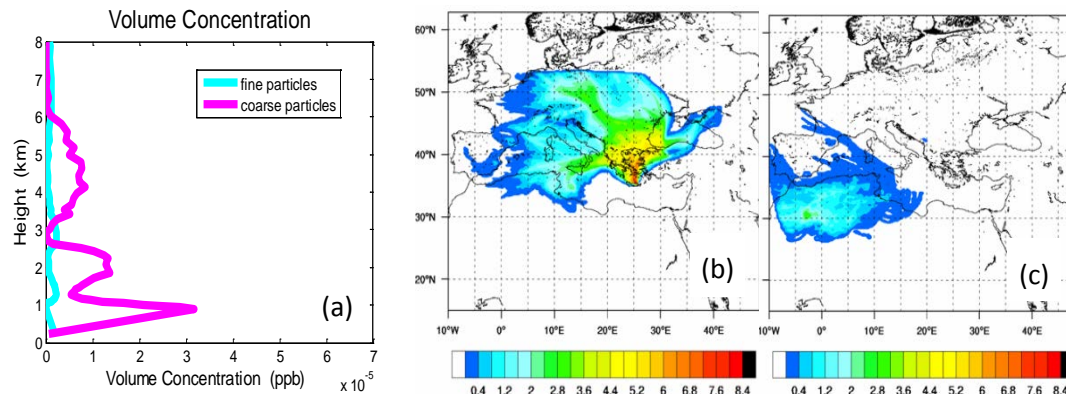


Figure 3. Aerosol particle characterization during the CHARADMExp campaign: (left) - Concentration profiles for fine and coarse particles derived with advanced lidar inversion algorithms and (right) – Origin of the particles in the profile for the layers 0-1 km and 3-6 km, respectively), derived with source receptor analysis modelling.