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Strategic positioning of the ERATOSTHENES Research Centre for dust-related field studies in the center of the African-Asian dust belt

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The deserts in northern Africa and in the Middle East are major dust sources and have a strong impact on air quality and aerosol conditions in the Eastern Mediterranean/Middle East (EMME) region. Emissions from arid (non-desert) and semi-arid regions and from areas with strong agricultural activities contribute as well. For a proper consideration of mineral dust in climate, dust outbreak, and air quality modeling, vertical profiling of dust with the potential to distinguish between fine and coarse dust as well as to separate dust from marine and anthropogenic aerosol contributions is required (Solomos et al. 2017). Fine and coarse dust particles influence the Earth's radiation budget, cloud processes, and environmental conditions in different ways. 20–40% of the dust optical depth is caused by fine dust according to Aerosol Robotic Network (AERONET) sun/sky photometer observations. Coarse dust particles are favorable cloud condensation nuclei and ice-nucleating particles, whereas fine dust particles can significantly affect air quality and may sometimes dominate PM1.0 (particles with diameters < 1.0 μm) levels in the EMME region.

Cyprus, in the center of the African-Asian dust belt, can be regarded as an ideal natural laboratory for advanced and comprehensive field studies of dust and aerosol pollution and the complex aerosol impact on weather, climate, clouds, and precipitation formation. The island is almost continuously influenced by Middle East and Saharan dust outbreaks. Modern atmospheric and environmental research (dealing with process understanding and improvement of forecasts) is based on a close link between atmospheric modeling and state-of-the-art observations (for model validation and data assimilation, Binietoglou et al. 2015). However, a super site equipped with state-of-the-art remote sensing technique for continuous aerosol, cloud, and precipitation profiling does not exist in the entire EMME region, a key region of climate change and strongly increasing urbanization and associated pollution levels.

The ERATOSTHENES Research Centre (ERC) of the Cyprus University of Technology (CUT) with the vision to become a Centre of Excellence for Earth Surveillance and Space-Based Monitoring of the Environment (in the framework of phase 2 of the EXCELSIOR H2020 Teaming Project) wants to close this important gap on climate and environmental research. In close collaboration with the German Leibniz Institute for Tropospheric Research (TROPOS), we plan to build up a remote sensing ACTRIS (EARLINET/AERONET/ Cloudnet) supersite equipped with an advanced aerosol lidar, cloud radar, wind Doppler lidar, microwave radiometer, disdrometer and a radiative flux measurement unit. The ERATOSTHENES Research Centre is already a member of the European Aerosol Research Lidar Network (EARLINET) and of the worldwide Aerosol Robotic Network (AERONET). To demonstrate the usefulness of a remote sensing supersite at Cyprus, the Leipzig Aerosol and Cloud Remote Observation System (LACROS, a mobile Cloudnet station) was deployed at Limassol, Cyprus in October 2016, within a pioneering pilot study, and continuously

performed measurements until the end of March 2018. In this way two rain seasons (November to March) were covered and 17 months of dust profiles were collected in the framework of CyCARE (Cyprus – Clouds Aerosol and pRecipitation Experiment). In our presentation we will show case studies of dust layering up to the tropopause and cloud formation (mixed-phase altocumulus and cirrus clouds) embedded in aerosol layers composed of dust and anthropogenic pollution (urban haze, biomass burning smoke etc.). These examples and the 17-month campaign clearly corroborates that an atmospheric monitoring super site is highly demanded in this important region of the world.

The EXCELSIOR project is a team effort between CUT (acting as the coordinator), the German Aerospace Centre (DLR), the Institute for Astronomy and Astrophysics Space Applications and Remote Sensing of the National Observatory of Athens (NOA), the TROPOS and the Cyprus' Department of Electronic Communications of the Ministry of Transport, Communications and Works (DEC-MTCW). These institutions will work together to improve the network structures significantly, so that Cyprus will become a cornerstone of the European atmospheric networking infrastructure organized in the framework of ACTRIS (Aerosols, Clouds, and Trace Gases Research InfraStructure).

Keywords: dust, profiling, remote sensing, Middle East dust, Saharan dust

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