Multi-instrument platforms for investigating the aerosol-cloud-dynamic interaction in Eastern Mediterranean

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In the context of the EXCELSIOR project, the ERATOSTHENES Centre of Excellence (ECoE) has acquired a research infrastructure for the observation of clouds and aerosol in Cyprus. The Atmospheric Cluster of the Department of Climate and Environment of the ECoE coordinates the Cyprus Atmospheric Remote Sensing Observatory (CARO). CARO is a national facility for atmospheric research and consists of a state-of-the-art dual field of view Polly^{XT} Raman lidar (since October 2020), a Doppler wind lidar (since February 2023), a ceilometer and a disdrometer-Parsival2 model (since January 2024), a 35 GHZ cloud-radar and microwave radiometer (since July 2024). Meanwhile, long-term aerosol observations have also been provided by the CUT-TEPAK AERONET sunphotomer, since 2010. CARO is located at Limassol, a coastal city of Cyprus (34.677°N, 33.0375°E, 2.8 m above sea level) and is planned to become the reference observatory in the East Mediterranean, north Africa and the Middle East (EMMENA region). The CARO is in unique geographical location as the air masses affecting the site originate from the surrounding areas of EMMENA, as well as from south-eastern Europe. CARO is part of the ACTRIS-ERIC aerosol and cloud remote sensing observational platform, EARLINET (European Aerosol Research Lidar Network), and the PollyNET (Network of automated Raman-polarization lidars). Furthermore, CARO actively participates in the EarthCARE stallite validation through the project CORAL (Cyprus Observation for EarthCARE validation), providing ground- truthing observation of the atmosphere's vertical structure. The CARO ground-based high-quality infrastructures with the addition of the new knowledge on modelling related and satellite based atmospheric research through the ATARRI project (ATmospheric and solAR Research and Innovation in the Eastern Mediterranean), will allow a measurement– modelling synergistic approach dealing with major environmental and atmospheric research and innovation aspects.

This multi-instrument platform is unique with the latest modern standard that is only available in few regions globally. CARO aerosol and cloud observational platform gives the advantage of investigation the complex impact of different aerosol mixtures on cloud formation, in addition to studying the direct and indirect effects of aerosols on radiative transfer and dynamic precipitation generation. A lidar–radar methodology can be used to investigate the role and impact of aerosol particles on ice formation in atmospheric clouds and on subsequent precipitation processes and present valuable closure studies.

Keywords: EXCELSIOR project, ERATOSTHENES Centre of Excellence (ECoE), Cyprus Atmospheric Remote Sensing Observatory (CARO), Multi-instrument observatory, aerosol-cloud-dynamic interaction.

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