

Synergistic Use of Lidar and In Situ aerosol measurements over a high altitude site (1800-2300 m): Highlights from the CALISPHTO Campaign at the Helmos Mountain (Autumn 2021)

Alexandros Papayannis^(1,2), Maria Cristina Papanikolaou⁽¹⁾, Dimitra Anagnou⁽¹⁾, Romanos Foskinis^(1,3), Athanasia Moutafidou⁽⁴⁾, Andreas Aktypis⁽⁴⁾, Konstantinos Eleftheriadis⁽³⁾, Athanasios Nenes^(2,4), Maria Gini⁽³⁾, Prodromos Fefatzis⁽³⁾, Marilena Gidarakou⁽¹⁾, Konstantinos Granakis⁽³⁾, Olga Zografou⁽³⁾, Christina Spitieri⁽³⁾, Evangelia Diapouli⁽³⁾, Maria Mylonaki⁽¹⁾, Panagiotis Kokkalis⁽⁵⁾, Ourania Soupiona⁽¹⁾, Stavros Solomos⁽⁶⁾, Thierry Podvin⁽⁷⁾, Phillipe Goloub⁽⁷⁾

⁽¹⁾ *Laser Remote Sensing Unit, Department of Physics, National and Technical University of Athens, 15780 Zografou, Greece, E-mail: demi.anagnou@gmail.com; marilena.98@hotmail.com; papanikolaouca@mail.ntua.gr; foskinis@mail.ntua.gr; apdlidar@mail.ntua.gr; mylonakimari@mail.ntua.gr; raniaphd@mail.ntua.gr*

⁽²⁾ *Laboratory of Atmospheric Processes and their Impacts, École Polytechnique Fédérale de Lausanne, Lausanne, CH-1015, Switzerland, Email: athanasios.nenes@epfl.ch*

⁽³⁾ *Environmental Radioactivity Laboratory, Institute of Nuclear & Radiological Sciences & Technology, Energy and Safety, National Centre of Scientific Research "Demokritos", 15310 Attiki, Greece, E-mail: foskinis@mail.ntua.gr; elefther@ipta.demokritos.gr; k.granakis@ipta.demokritos.gr; gini@ipta.demokritos.gr; p_fefatzis@yahoo.gr; o.zografou@ipta.demokritos.gr; ldiapouli@ipta.demokritos.gr; Spitieri@ipta.demokritos.gr*

⁽⁴⁾ *Center for Studies of Air Quality and Climate Change, Institute of Chemical Engineering Sciences, Foundation for Research and Technology Hellas, Patras 26504, Greece, Email: up1060031@upnet.gr; aktypis97@gmail.com*

⁽⁵⁾ *Physics Department, Kuwait University, 5969, Safat 13060, Kuwait, Email: panagiotis.kokkalis@ku.edu.kw*

⁽⁷⁾ *Research Centre for Atmospheric Physics and Climatology, Academy of Athens, 10680 Athens, Greece, Email: ssolomos@academyofathens.gr*

⁽⁸⁾ *Laboratoire d'Optique Atmosphérique, University of Lille, CNRS, UMR8518, 59000 Lille, France, Email: thierry.podvin@univ-lille.fr; philippe.goloub@univ-lille1.fr*

The experimental campaign CALISHTO-HELMOS, took place in Greece (Helmos mountain: 38.006° N, 22.198° E, 1800 m a.s.l.), as a synergetic action, implementing the PANhellenic infrastructure for Atmospheric Composition and climatEchAnge (PANACEA) and the European Research Council Pyrogenic TRansformations Affecting Climate and Health (PyroTRACH) Projects. The main goal of the campaign is to gain a better understanding of the processes involved in the formation and evolution of mixed-phase clouds under pristine environmental conditions, with an additional goal to study the properties of long-range transported Saharan dust particles, as well as their role in cloud formation, over the remote high-altitude site. In this paper we present a highlight of selected case studies of tropospheric aerosol transport (between 2–7 km a.s.l.), over a high altitude measuring site (1800-2300 m) of a mixture of Saharan, biomass burning and volcanic particles, as measured by the backscatter/depolarization Aerosol Lidar System (AIAS) at 532 nm, a wind/depolarization lidar (HALO system) at 1550 nm, a CIMEL UV-VIS-NIR sun photometer (CE318-T) and various *in situ* instrumentation, measuring the aerosol size distribution, the cloud condensation nuclei and the aerosol composition.