Cloud-AerosoL InteractionS in the Helmos background TropOsphere
(CALISHTO-HELMOS the **PANACEA & PyroTRACH** *Campaign*)

DEMOKRITOS

C·STACC
Center for the Study of Air Quality & Climate Change

EPFL

European Union
European Regional Development Fund

HELLENIC REPUBLIC
MINISTRY OF ECONOMY & DEVELOPMENT
SPECIAL SECRETARY FOR ERDF & CF
MANAGING AUTHORITY OF EPAnEK

EPAnEK 2014–2020
OPERATIONAL PROGRAMME
COMPETITIVENESS ENTREPRENEURSHIP INNOVATION

ΕΣΠΑ 2014-2020
ανάπτυξη - εργασία - αλληλεγγύη
Partnership Agreement 2014 - 2020

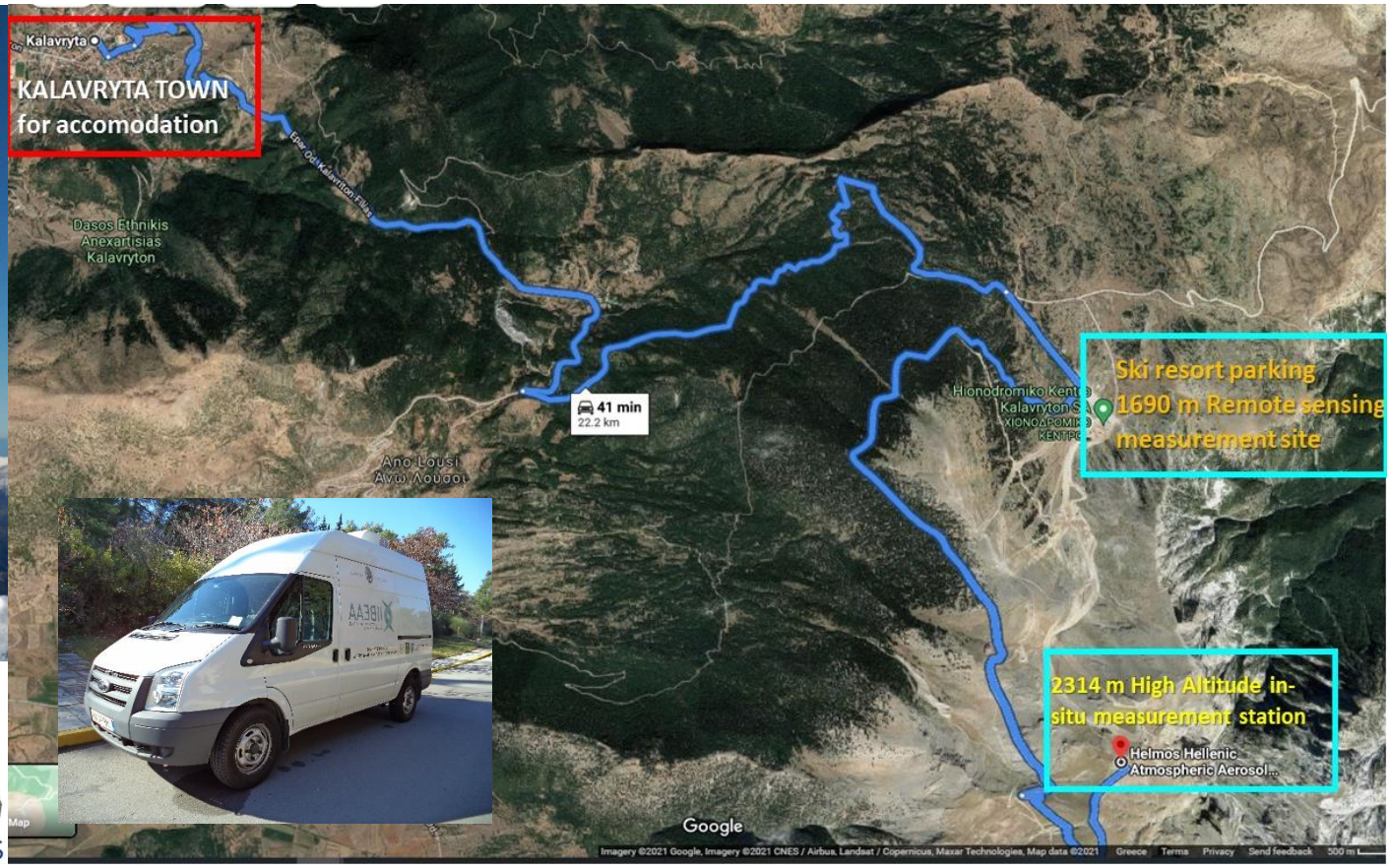
Co-financed by Greece and the European Union

erc
European Research Council
Established by the European Commission

Hosted by NCSR Demokritos at the Helmos Hellenic Atmospheric Aerosol & Climate Change Station (HAC²), a PANACEA, ACTRIS, GAW facility

Two sites: in-situ mainly at HAC², and remote-sensing (Kalavrita Ski Resort)

A satellite site (lidar remote sensing) will be at the C-STACC center in Patras for airmass characterization.



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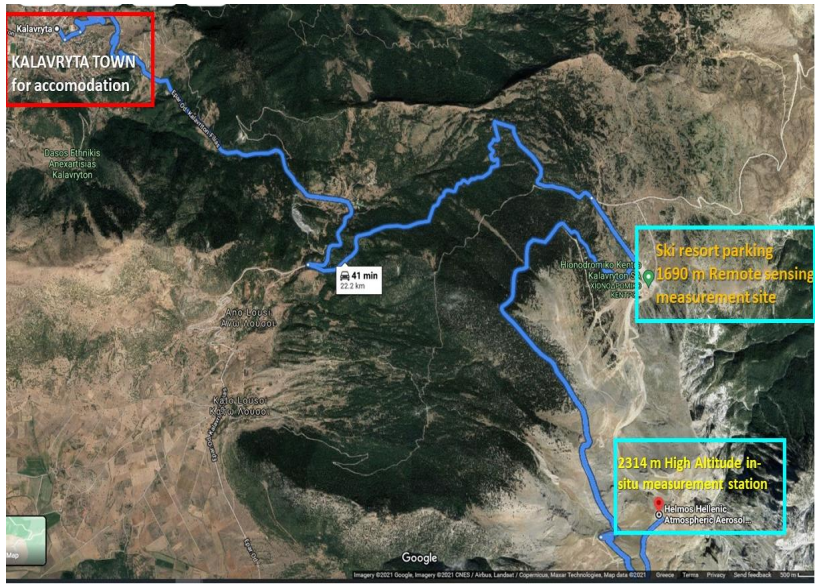

Scientific Objectives

- Study aerosol-cloud interactions for orographic mixed-phase clouds in the E.Med region using synergy of remote sensing & in situ instrumentation.
- Improve remote sensing algorithms to retrieve cloud microphysical properties (e.g. cloud droplet number concentrations).

Observations will characterize:

- Dynamics of the air masses that drive cloud formation
- Understanding the sources and drivers of the aerosol population (new particle formation, secondary organic aerosol formation and long-range transport) that form cloud droplets and ice crystals.
- Cloud microphysical (droplet and ice size distributions) & optical properties.

Process-level and larger-scale modeling will synthesize the observations and provide a higher-level understanding of the processes controlling cloud formation in the region.

The PANACEA partners

Website (created by NOA Amiridis team)
https://calishto.panacea-ri.gr/

DEMOKRITOS — K. Eleftheriadis

ITE, FORTH, C-STACC Center for the Study of Air Quality & Climate Change — A. Nenes, S. Pandis

ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ UNIVERSITY OF CRETE — N. Mihalopoulos

A. Papayannis

Technical University of Crete — M. Lazaridis

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D. Balis

S. Misios

E. Giannakaki

The ACTRiS /International partners

Institute of Meteorology and Climate Research, Atmospheric Aerosol Research (IMK-AAF) (in-situ)

Laboratoire d'Optique Atmosphérique (LOA), Lille, France (remote sensing)

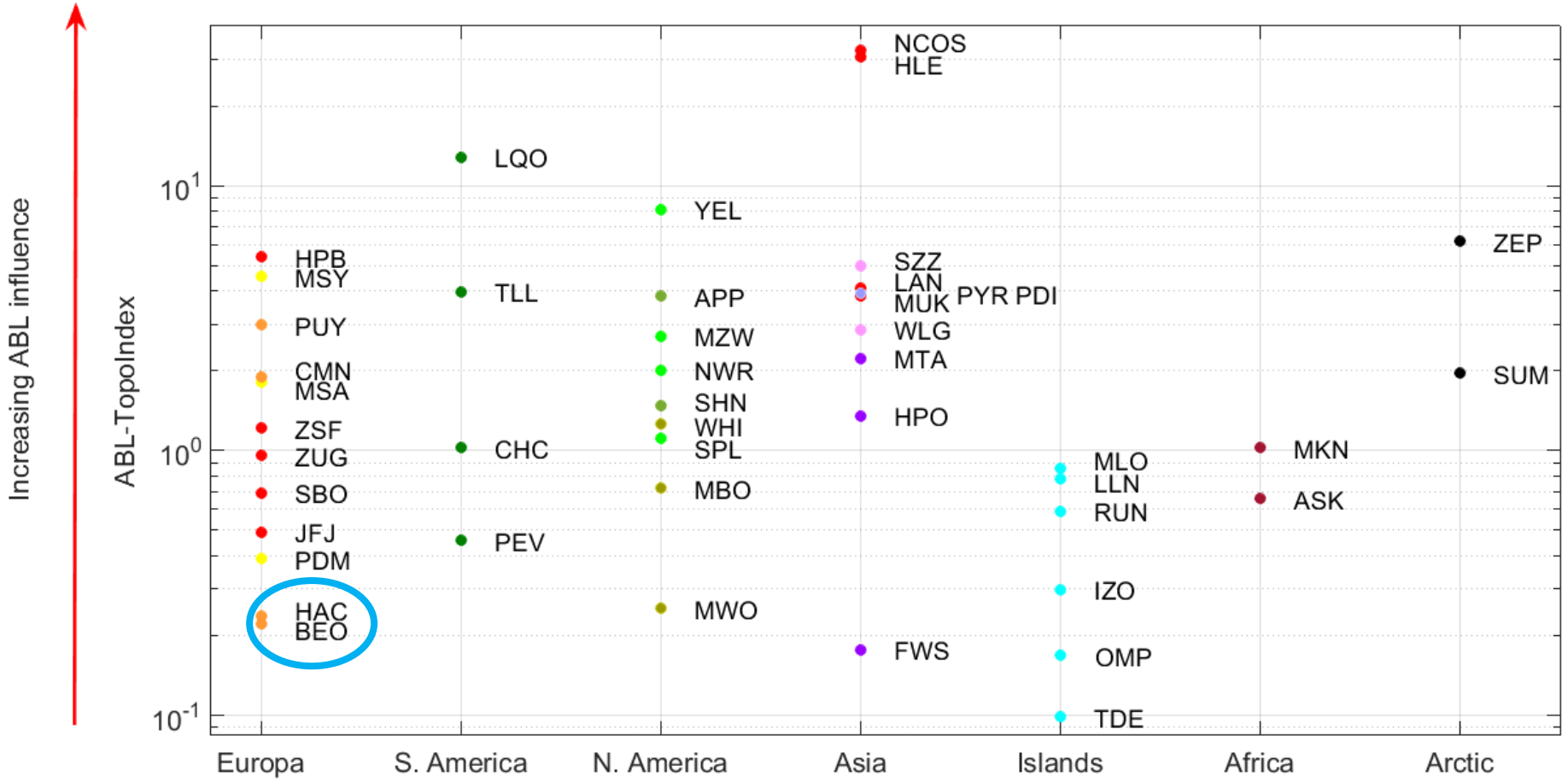
Finnish Meteorological Institute (remote sensing)

École Polytechnique Fédérale de Lausanne (A.Nenes – in-situ instrumentation A.Berne - cloud remote sensing)

University of Birmingham School of Geography, Earth and Environmental Sciences, Birmingham, UK (in-situ)

The relative influence of Boundary layer air with respect to other stations

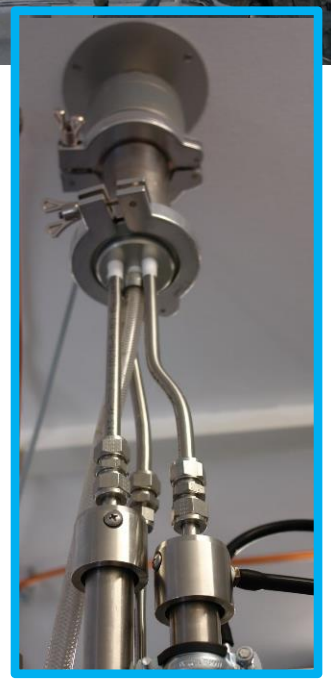
Excellent location for Free Troposphere Research ranked very suitable according to the ABL-TopoIndex



Helmos Mt (HAC)

Reported

Continuous data



- Number size distribution (SMPS and OPC spectrometers)
- Scattering & Back Scat. coefficient (3λ) TSI Nephelometer
- EBC + Abs (Aethalometer AE31 7λ)

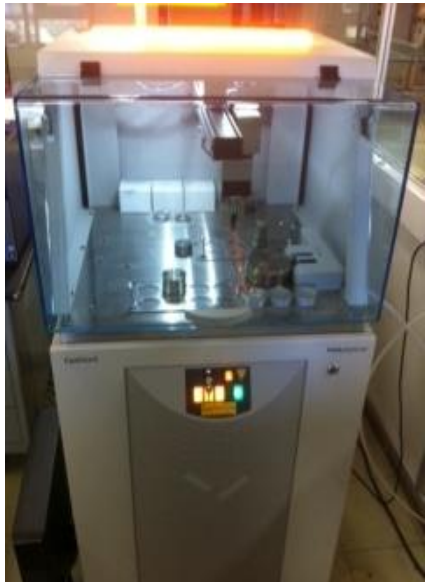
PICARRO G2401CRDS Analyzer
CO2 + CO + CH4 + H2O
Ozone monitor (Thermo)

- Meteorological parameters (T, RH, W Speed & Dir (sonic)

Analysis programme for Hi-Vol Quartz filters @ ERL NCSR Demokritos

Sampling frequency 12-24h
570 l/min

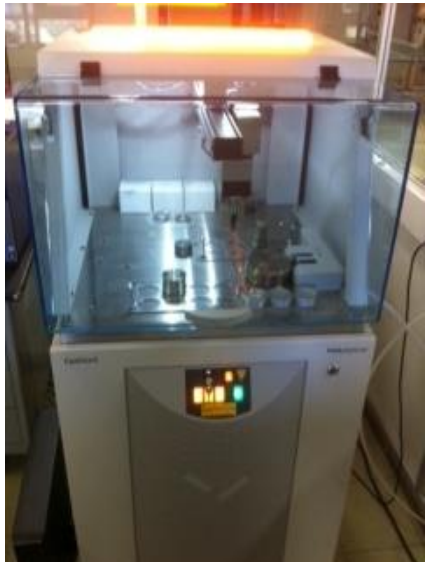
- EC/OC Thermo-optical Sunset Lab
- XRF Spectrometry for Majour & trace metals (Panalytical E5)
- γ (Gamma) Spectrometry for Radionuclide Tracers (well type HpGe)



Analysis programme for Hi-Vol Quartz filters @ EPFL, CSTACC, UoC, NOA

- IC analysis (EPFL/CSTACC) for hygroscopicity and pH calculations
- Offline AMS (CSTACC) for PMF analysis of sources & OC composition
- ATR-FTIR analysis (EPFL) for OC Analysis
- BrC/OP and soluble metals (Fe, Cu, Mn) with ICP-MS (CSTACC/EPFL)
- Phospholipids analysis for bioaerosol content characterization (EPFL)
- Sugars, polysaccharides (NOA/UoC)

Sampling frequency 12-24h
570 l/min



In-situ measurements (EPFL, CSTACC, KIT, UB)

- Wet Annular Dednuder (EPFL/CSTACC), 1/week for determining NH_3, HNO_3, etc. for pH
- WIBS-Neo (EPFL) for measuring Fluorescent PBAPs (continuous)
- PINE (KIT) for measuring IN at specific temperatures (continuous)
- Filter-based IN measurements (KIT) for measuring T-spectra of immersion mode IN (1/day)
- APS (KIT) for measuring supermicron aerosol size distribution
- Aerosol size distribution with SMPS (CSTACC)
- Cloud Condensation Nuclei with a DMT counter (EPFL/U.Birmingham)
- Gerber probe for cloud water content (Demokritos)
- Bioaerosol sampling/analysis with molecular biology tools (TUoC) 1-2/month
- Lightning/atmospheric electricity measurements (DU, NOA)

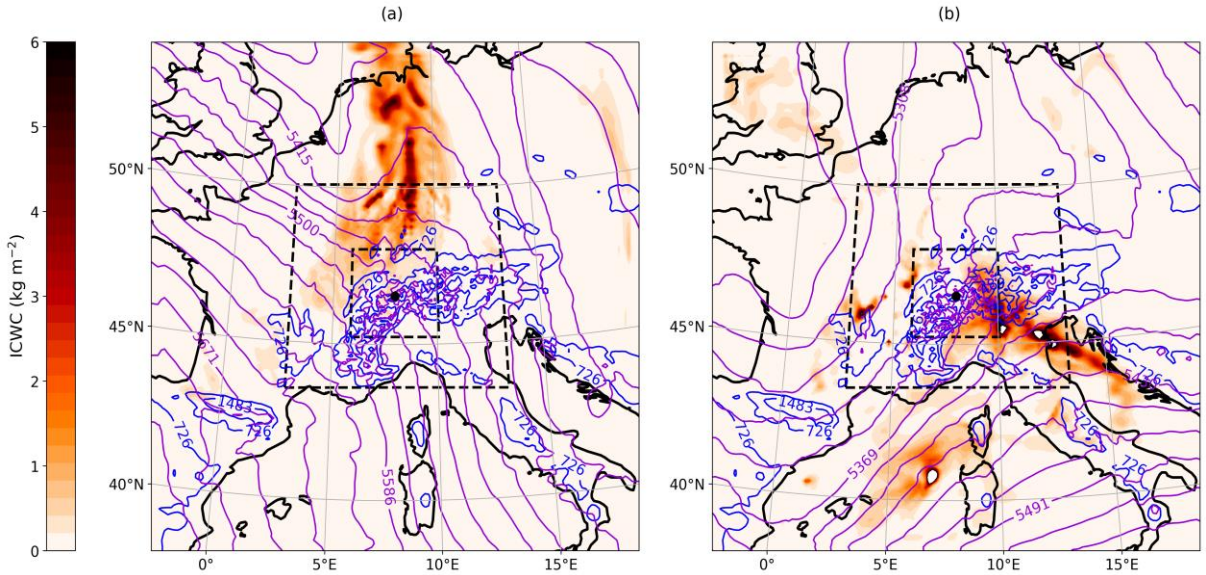
Check CALISHTO website for full description of instruments and analysis techniques.

Remote Sensing observations (NTUA, EPFL, FMI, UoL)

- Cloud radars (EPFL/NTUA) (continuous)
- Cloud profiler (HALO) for vertical velocity measurements (FMI/NTUA)
- Aerosol lidars (NTUA)
- MAX-DOAS (AUTH)
- CIMEL (LOA)

Modeling analysis (EPFL, CSTACC)

- WRF-multinested domain focused on Mt.Helmos
- Full microphysical package for mixed-phase clouds, including secondary ice processes (ice-ice collisions, Hallet-Mossop, droplet shattering and sublimation splintering) following the work of G.Sotiropoulou (CSTACC/EPFL) and P.Georgakaki (EPFL)
- Aerosol fields can be obtained from PMCAMx (-UF) for CCN, IN fields.



Map of WRF setup for cloud formation at the Jungfraujoch station, Switzerland (black dot) with computational domains. Outer domain is 12km, with two embedded domains at 3km and 1km-resolution, respectively. Maps show synoptic conditions around JFJ station at (a) 00:00 UTC, 26 January 2014 and (b) 00:00 UTC, 30 January 2014. The purple (blue) contours show the 500 hPa geopotential height in m (the terrain heights in m). The color shading shows the vertically-integrated condensed water content (in kg m^{-2}). From Georgakaki et al., ACPD, 2021.

CALISHTO communication/outreach

Website (courtesy of A.Georgiou from NOA)

https://calishto.panacea-ri.gr/

Twitter (Mt.Helmos, Partners and others)