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



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

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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A satellite site (lidar remote sensing) also at C-STACC in Patras for regional airmass characterization.





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.



partners

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



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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



Sampling frequency 12-24h 570 l/min

- 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)



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

- Wet Annular Dednuder (EPFL/CSTACC), 1/week for determining NH₃, HNO₃, 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) EPFL

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



• CIMEL (LOA)













- WRF-multinested domain focused on Mt.Helmos
- Full microphysical package for mixed-phase clouds, including secondary ice processes (iceice 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 verticallyintegrated condensed water content (in kg m⁻²). From Georgakaki et al., ACPD, 2021.

CALISHTO communication/outreach

EGU Atmospheric Sci **Helmos Station** 1 4 Website (courtesy of A.Georgiou from NOA) 🙆 Αρχική σελίδα 101 Αρχική σελίδα https://calishto.panacea-ri.gr/ # Εξερευνήστε Ω Ειδοποιήσεις # Εξερευνήστε SA (EG ύματα Δ Ειδοποιήσεις Số CALISHTO ... 🖂 Home About ~ News δοδείκτες THE REAL EGU Atmospheric Sci Μηνύματα @EGU Atmos Σας ακολουθε M \square^+ Ακολουθείτε Organized by The research areas covered by the Atmospheric Sciences (A Revealing the secrets of extend from large-scale dynamical processes to chemical re Σελιδοδείκτες **Helmos Station** aerosol-cloud interactions 💿 Munich, Germany 🔗 as.egu.eu 🔠 Έγινε μέλος: Αύγο @MtHelmosSite Σας ακολουθεί 255 Ακολουθείτε 2.008 Ακόλουθοι Λίστες σσότερα Helmos Hellenic #Atmospheric #Aerosol and #Climate Change station (HAC2). 1 Oct - 30 Nov 2021 Ακολουθείται από τους χρήστες Helmos Station, Arindan C ST**acc** GAW Regional station established and operated by @NCSR_Demokritos. Athanasios Nenes Α Προφίλ Mt.Helmos, Pelloponese, Greece & calishto.panacea-ri.gr 4 Έγινε μέλος: Σεπτέμβριος 2021 Αρχική σελίδα 72 Ακολουθείτε 5 Ακόλουθοι \odot Περισσότερα 🙈 🤰 Ακολουθείται από τους χρήστες Swiss Climact, ERC_PyroTRACH και CSTACC_FORTH Hosted by NCSR Demokritos at the # Εξερευνήστε Helmos Hellenic Atmospheric Aerosol & Climate Change Station a PANACEA, ACTRIS, GAW facility PANACEA Ω Ειδοποιήσεις Γράψτε Tweet Πολυμέσα Tweet Tweet και απαντήσεις "Μου αρέσει" Μηνύματα Helmos Station @MtHelmosSite · 32 λ The Goal Website for #CALISHTO #aerosol-#cloud interaction campaign is up! Visit Σελιδοδείκτες Athanasios Nenes calishto.panacea-ri.gr for goals & site description, participants, @LAPLenfl The Cloud-AerosoL InteractionS in the Helmos background TropOsphere (CALISHTO-HELMOS Campaign) is a instrumentation, funding & results. Follow @MtHelmosSite on Twitter for Αίστες Professor @EPFL ,Scientist @FORTH_ITE @ synergy between the PANhellenic infrastructure for Atmospheric Composition and climatEchAnge (PANACEA) news. @PanaceaRI @LAPI_epfl @FORTH_ITE @cstacc #ERCfunded & Impacts on #Climate, #airpollution, #b Project focusing on WorkPackage 9 (WP9): Aerosol Cloud Interactions (ACI) and the European Research Council (ERC) @EPFL_en President Pyrogenic TRansformations Affecting Climate and Health (PyroTRACH) Project. 💄 Προφίλ Switzerland & Janl.epfl.ch The main goal of the CALISTHO Campaign is to provide a better understanding to the key processes involved in the aerosol-cloud interaction (TE formation and evolution of mixed-phase clouds, using a synergy of various in situ and remote sensing instrumentation 718 Ακολουθείτε 1.787 Ακόλουθοι 1 Oct - 30 Nov 2021 Περισσότερα located at a unique and optimal high-altitude location for targeted studies of aerosol-cloud interactions. Tweet και απαντήσεια Tweet Learn More Γράψτε Tweet PANALCEA ASTRIS 1] Káyars Retweet Helmos Station @MtHelmosSit Website for #CALISHTO #aero alishto.panacea-ri.gr for goals & s instrumentation, funding & results. news, @PanaceaRI @I API epfi @EPFL_en **Campaign Partners** aerosol-cloud interactions 1 Oct - 30 Nov 2021 TANKER ANTIN CO 1] 2 t, 1 Ο χρήστης Helmos Station έκανε Retweet USIALL Athanasios Nenes @LAPI epfl · 44 \ The #aerosol-#cloud interaction campaign #CALISHTO @MtHelmosSite k 🔊 🌒 🕇 organized with @NCSR_Demokritos & @ntua starts soon, with many groups Athanasios Nenes t] 2 contributing in-situ & remote sensing obs. Stay tuned for more! #ERCFunded @PanaceaRI @epfIENAC @cstacc @FORTH ITE @meteorologit @KITKarlsruhe

Twitter (Mt.Helmos, Partners and others)