
INAR
INSTITUTE FOR ATMOSPHERIC AND EARTH SYSTEM RESEARCH
FOR THE ONLY PLANET WE HAVE
3.12.2019
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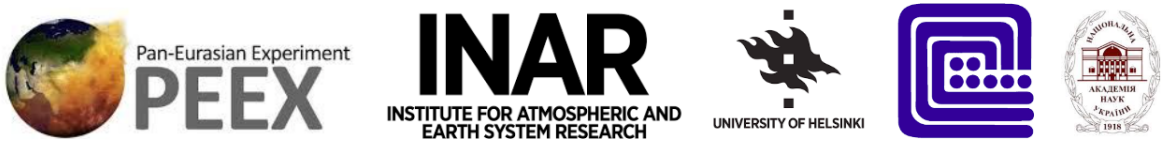
UNIVERSITY OF HELSINKI

PEEX Collaboration - Online Workshop



Institute for Atmospheric and Earth System Research, University of Helsinki &
Institute of Mathematical Machines and Systems Problems, National Academy of Sciences
(UHEL-INAR & IMMSP-NAS)

SMEAR (Station for Measuring Ecosystem–Atmosphere Relation) concept & measurements

Tuukka Petäjä and collaborators

6.6. 2024

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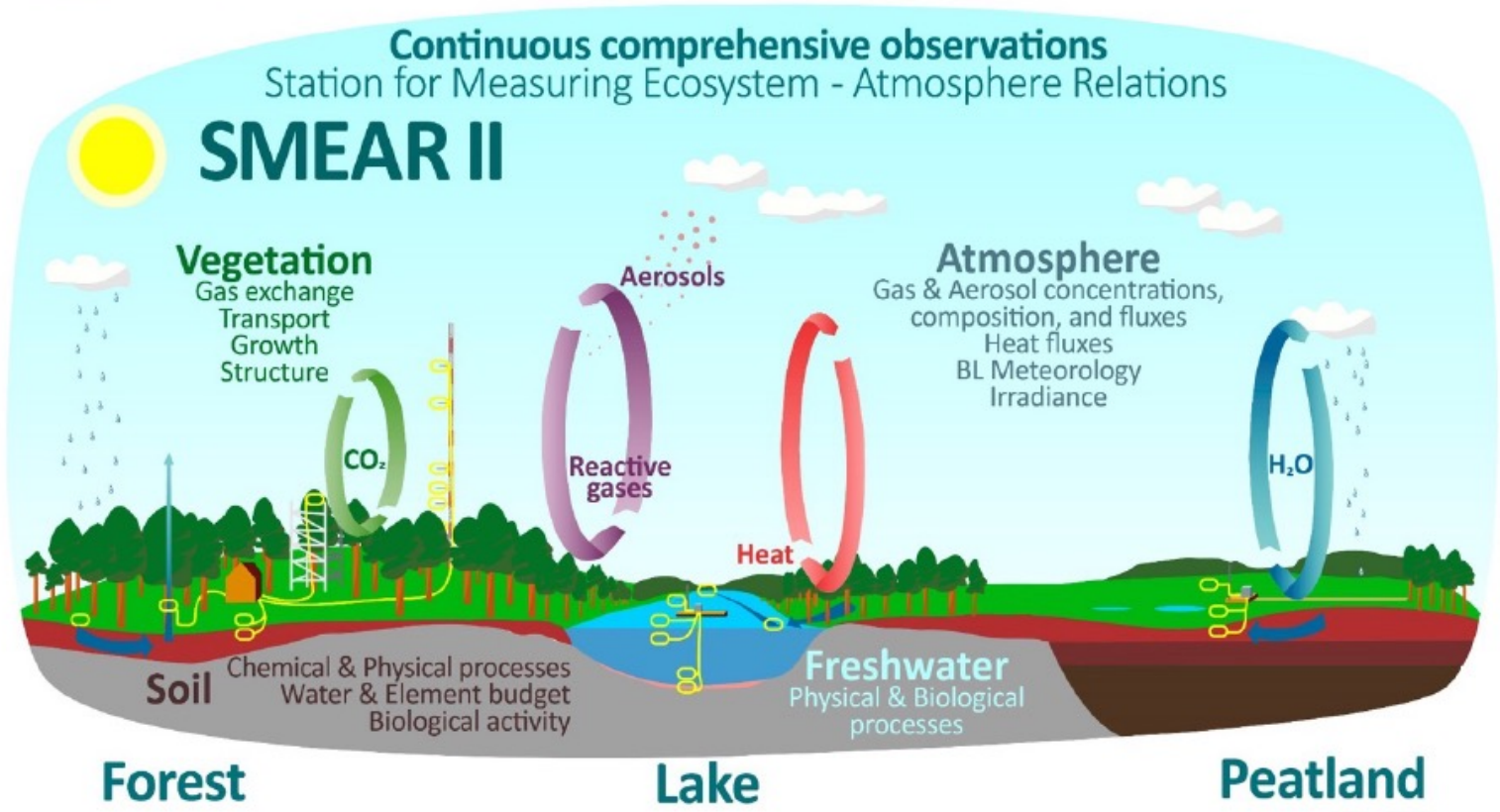
SMEAR II station in Hyytiälä, Finland

Over **1200** different variables



Flagship site for integration: combines all IPCC components.

Contributes to :

ACTRiS

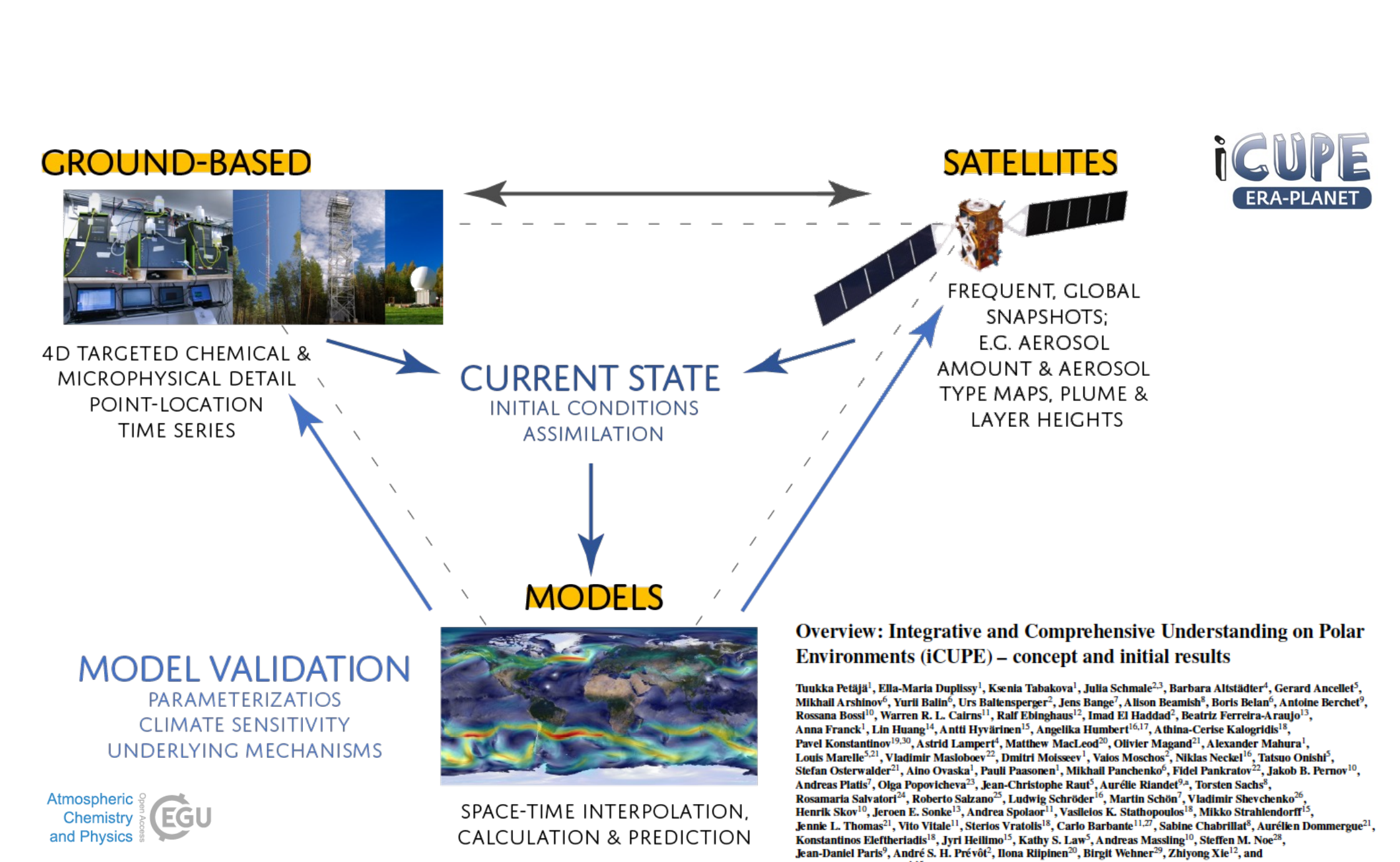
ICOS INTEGRATED CARBON OBSERVATION SYSTEM

AnaEE Analysis and Experimentation on Ecosystems

LTER europe

Pan-Eurasian Experiment PEEX

World Meteorological Organisation

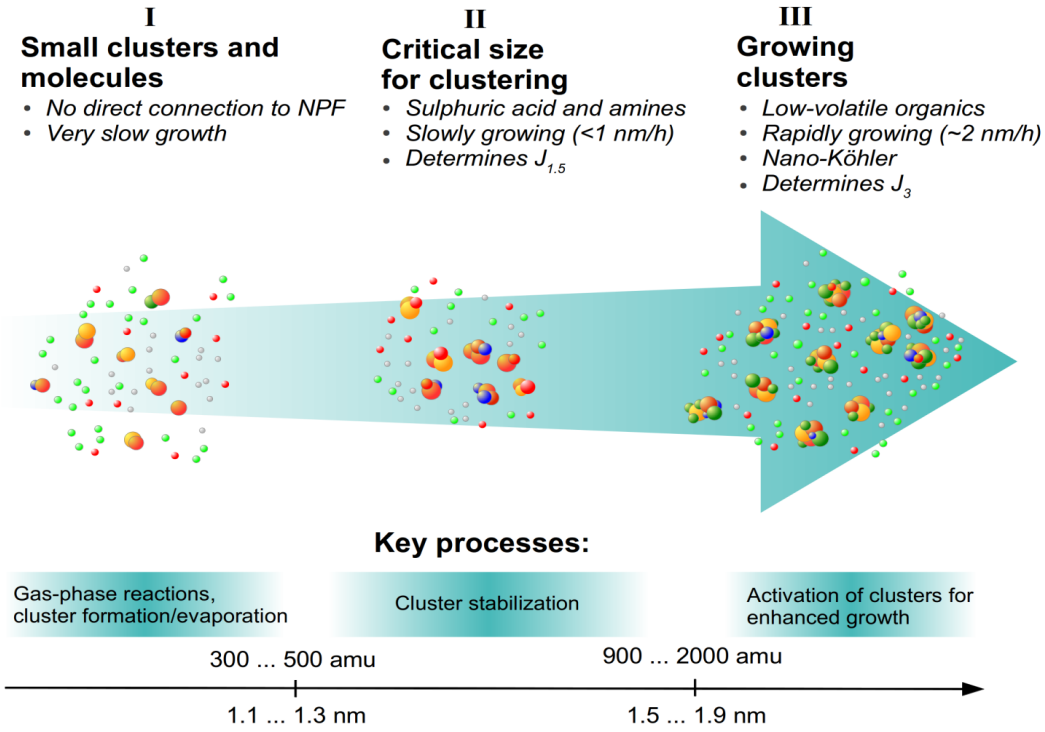


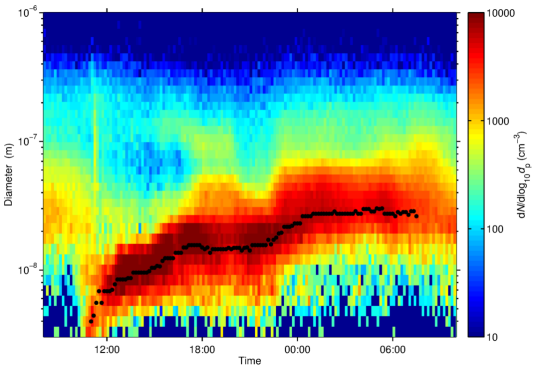
Atmospheric Chemistry and Physics Open Access EGU

Overview: Integrative and Comprehensive Understanding on Polar Environments (iCUPE) – concept and initial results

Tuukka Petäjä[1], Ella-Maria Duplissy[1], Ksenia Tabakova[1], Julia Schmale[2,3], Barbara Altstädter[4], Gerard Ancellet[5], Mikhail Arshinov[6], Yurii Balin[6], Urs Baltensperger[2], Jens Bange[7], Alison Beamish[8], Boris Belan[6], Antoine Berchet[9], Rossana Bossi[10], Warren R. L. Cairns[11], Ralf Ebinghaus[12], Imad El Haddad[2], Beatriz Ferreira-Araujo[13], Anna Franck[1], Lin Huang[14], Antti Hyvärinen[15], Angelika Humbert[16,17], Athina-Cerise Kalogridis[18], Pavel Konstantinov[19,30], Astrid Lampert[4], Matthew MacLeod[20], Olivier Magand[21], Alexander Mahura[1], Louis Marelle[5,21], Vladimir Masloboev[22], Dmitri Moisseev[1], Vaios Moschos[2], Niklas Neckel[16], Tatsuo Onishi[5], Stefan Osterwalder[21], Aino Ovaska[1], Pauli Paasonen[1], Mikhail Panchenko[6], Fidel Pankratov[22], Jakob B. Pernov[10], Andreas Platis[7], Olga Popovicheva[23], Jean-Christophe Raut[5], Aurélie Riandet[9,a], Torsten Sachs[8], Rosamaria Salvatori[24], Roberto Salzano[25], Ludwig Schröder[16], Martin Schön[7], Vladimir Shevchenko[26], Henrik Skov[10], Jeroen E. Sonke[13], Andrea Spolaor[11], Vasileios K. Stathopoulos[18], Mikko Strahlendorff[15], Jennie L. Thomas[21], Vito Vitale[11], Sterios Vratolis[18], Carlo Barbante[11,27], Sabine Chabrillat[8], Aurélien Dommergue[21], Konstantinos Eleftheriadis[18], Jyri Heilimo[15], Kathy S. Law[5], Andreas Massling[10], Steffen M. Noe[28], Jean-Daniel Paris[9], André S. H. Prévôt[2], Ilona Riipinen[20], Birgit Wehner[29], Zhiyong Xie[12], and Hanna K. Lappalainen[1,15]

Atmospheric nucleation / clustering processes





Kulmala et al., Science, 2013

Environmental Research Letters

Environ. Res. Lett. 13 (2018) 103003

TOPICAL REVIEW

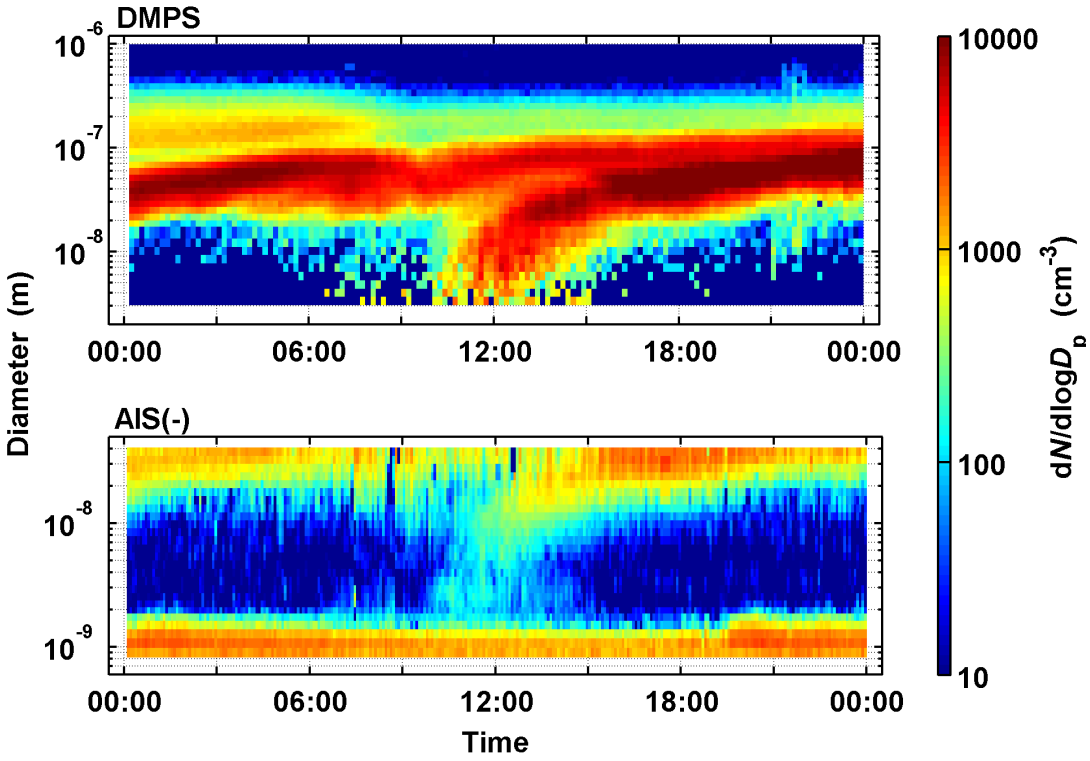
Atmospheric new particle formation and growth: review of field observations

Veli-Matti Kerminen[1], Xuemeng Chen[1], Ville Vakkari[2], Tuukka Petäjä[1], Markku Kulmala[1,3,4] and Federico Bianchi[1,3]

Atmospheric new particle formation in China

Biwu Chu[1], Veli-Matti Kerminen[1], Federico Bianchi[1,2], Chao Yan[1], Tuukka Petäjä[1,3], and Markku Kulmala[1,2]

Atmos. Chem. Phys., 19, 115–138, 2019



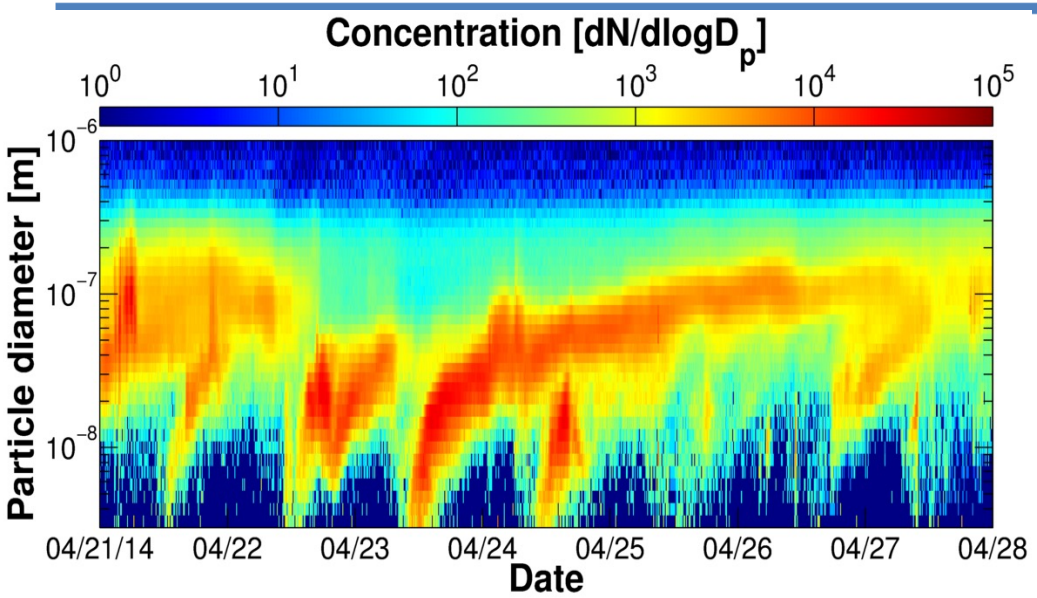
Key compounds for initial clustering

Sulfuric acid
Ammonia
Amines
Oxidized organics
Iodic acid (marine, Arctic)

Key compounds for the growth

Oxidized organics
MSA (marine)
+ other vapors above
Considerable variability from one location to another

Science Plan - Biogenic Aerosols- Effects on Clouds and Climate (BAECC)



1. From Emissions to Aerosols
2. From Aerosols to Clouds
3. From Clouds to Precipitation
4. Feedbacks and Interactions

- What is the role of newly formed particles in the cloud activation *in-situ*?
- Do they alter the cloud properties / precipitation?

Petäjä, T. (2013) Science Plan Biogenic Aerosols – Effects on Clouds and Climate (BAECC), US Department of Energy, Office of Science, DOE/SC-ARM-13-024.

ARM
CLIMATE RESEARCH FACILITY

The **Atmospheric Radiation Measurement (ARM) Climate Research Facility** is a U.S. Department of Energy scientific user facility, providing data from strategically located in situ and remote sensing observatories around the world.

ARM Mobile Facility 2 in Hyytiälä, Finland, February 2014 – September 2014

Goal: To understand the impact of biogenic aerosol formation on cloud properties and climate

Tools: Aerosol Observing system (AOS), Balloon-borne sounding system, laser distrometer, micropulse lidar, microwave radiometer, high spectral resolution lidar, Scanning W-band and Ka-band cloud radars (SWACR, M-WACKR, Ka-band zenith radar (KAZR)
Principal investigator: Tuukka Petäjä, UHEL

BAECC

A FIELD CAMPAIGN TO ELUCIDATE THE IMPACT OF BIOGENIC AEROSOLS ON CLOUDS AND CLIMATE

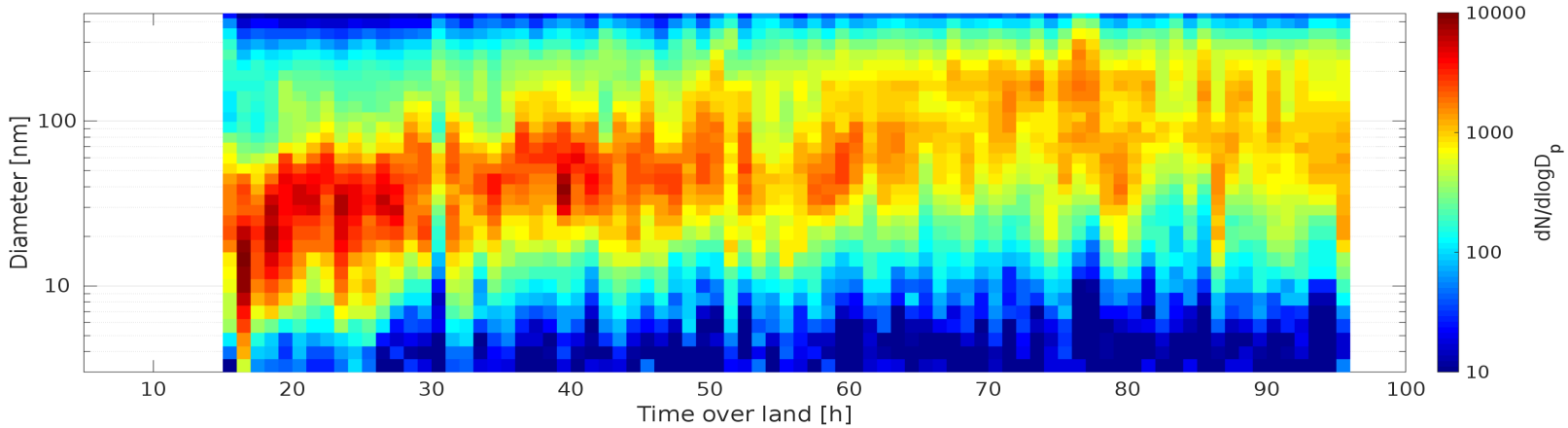
Petäjä et al. (2016) Bull. Am. Met. Soc. 97, 1909-1928, https://doi.org/10.1175/BAMS-D-14-00199.1

ARTICLES
https://doi.org/10.1038/s41561-021-00876-0
nature geoscience

Check for updates

Influence of biogenic emissions from boreal forests on aerosol–cloud interactions

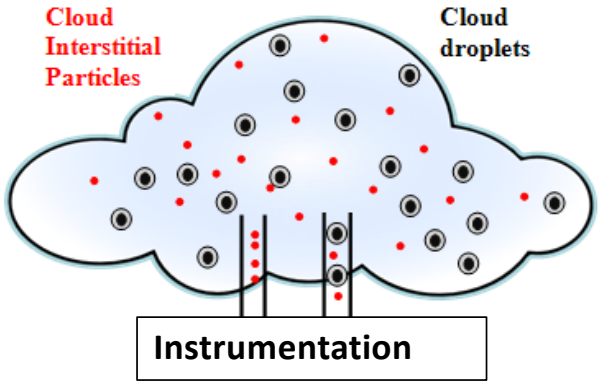
T. Petäjä[1,2]✉, K. Tabakova[1], A. Manninen[1,3], E. Ezhova[1], E. O'Connor[3,4], D. Moisseev[1,3], V. A. Sinclair[1], J. Backman[1,3], J. Levula[1], K. Luoma[1], A. Virkkula[1,2,3], M. Paramonov[1,3], M. Räty[1], M. Äijälä[1], L. Heikkinen[1], M. Ehn[1], M. Sipilä[1], T. Yli-Juuti[5], A. Virtanen[5], M. Ritsche[6], N. Hickmon[6], G. Pulik[7], D. Rosenfeld[7], D. R. Worsnop[1,8], J. Bäck[9], M. Kulmala[1,2,10,11] and V.-M. Kerminen[1]



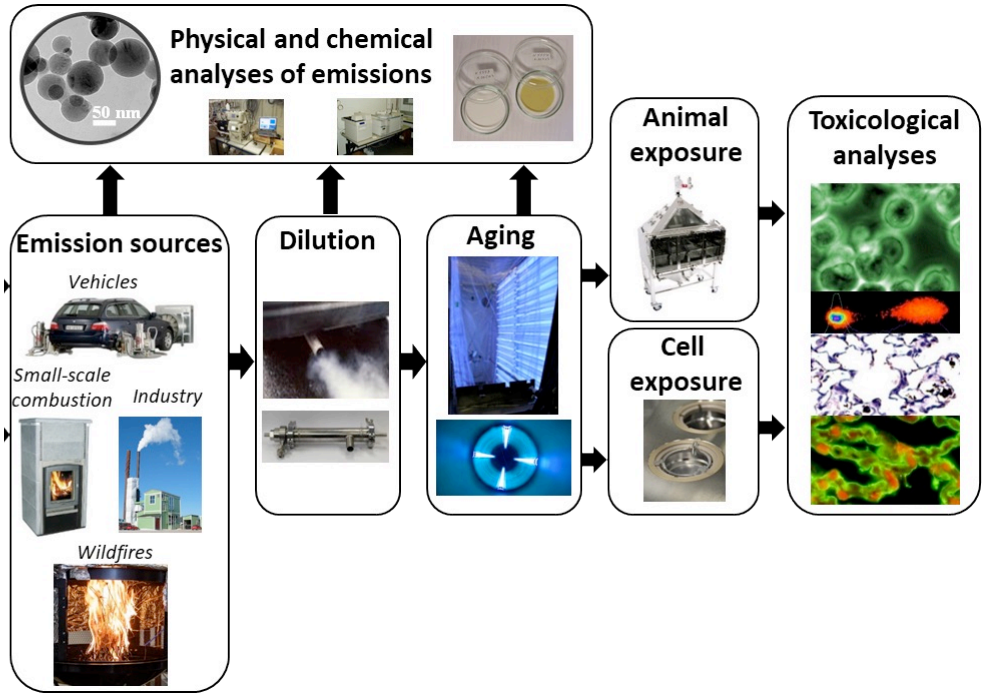
ACTRIS FACILITIES

UNIVERSITY OF EASTERN FINLAND

- Puijo SMEAR IV: Aerosol & Cloud in-situ: Aerosol in-situ entered to labelling phase



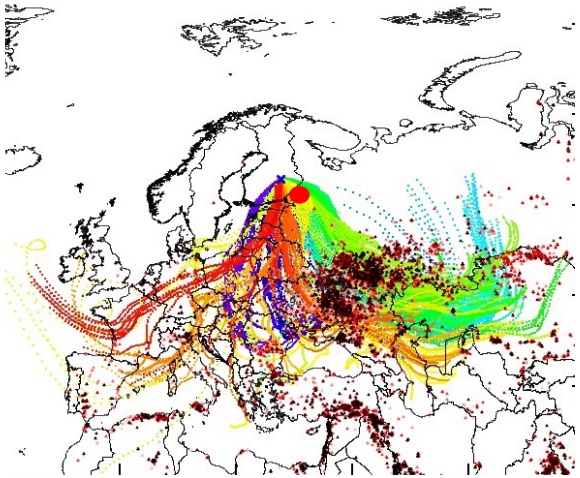
- Atmospheric simulation chambers KASC EUROCHAMP & ATMO-ACCESS
- 2 simulation chambers, ILMARI for comprehensive emission studies



Back trajectories – wildfire episode

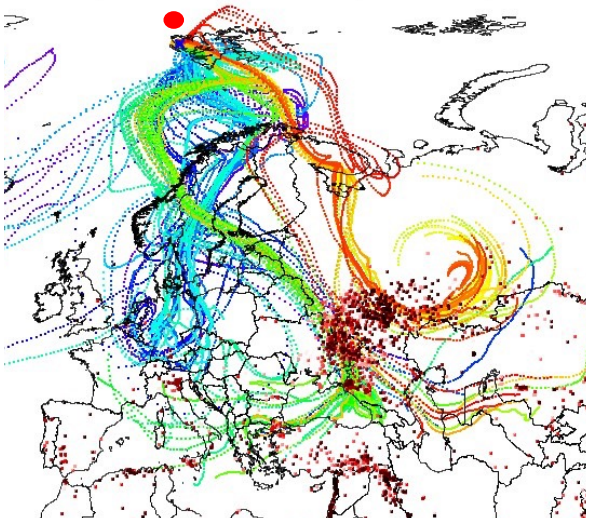
- Fires at South-Eastern Europe (mainly grass land fires)

SMEAR IV, Finland: plume age 2-3 days (5-day back trajectories)



23-09-2020 to 10-10-2020

Zeppelin Observatory, Svalbard, Arctic: plume age 3-5 days (10-day back trajectories)

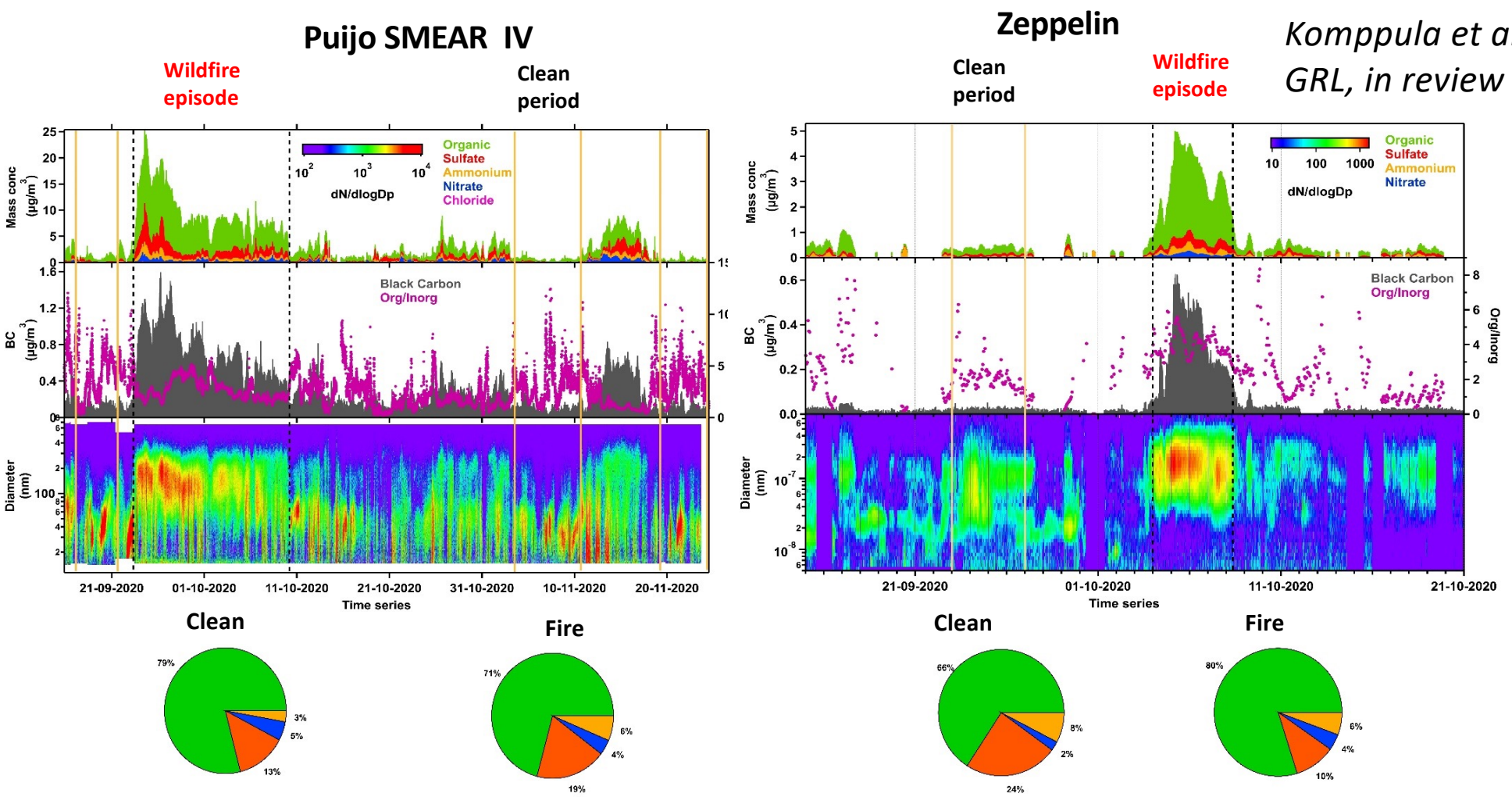


04-10-2020 to 09-10-2020

Komppula et al., GRL, in review

Long range transported wild fire plume observed at Puijo & Zeppelin

Komppula et al., GRL, in review

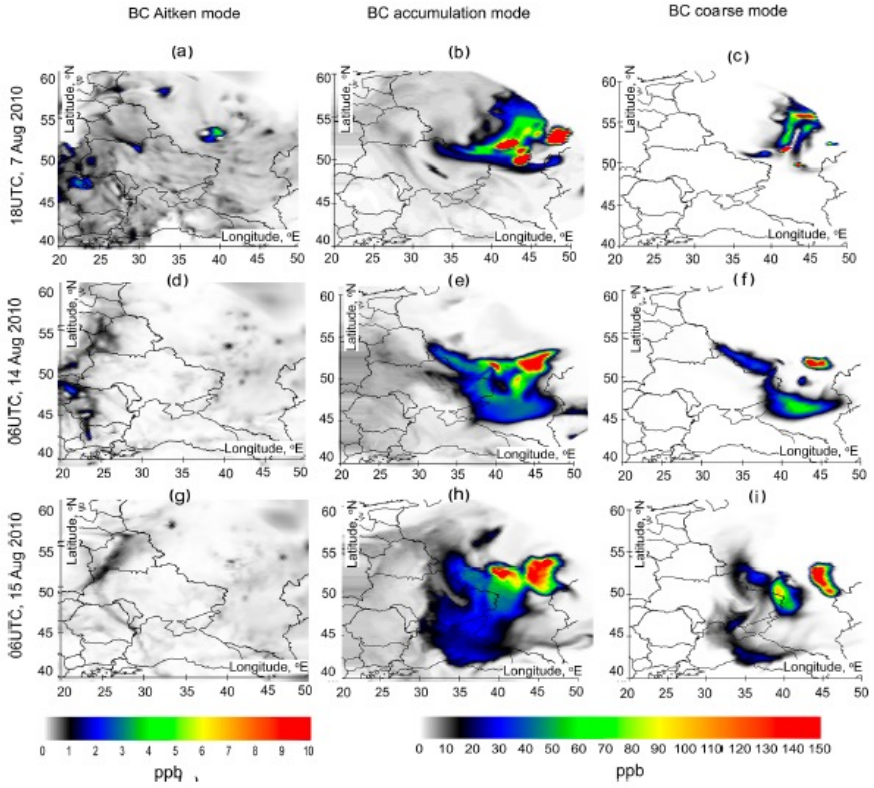


Fraction of Inorganics **increased** during Wildfire episode

Fraction of Inorganics **decreased** during Wildfire episode

Enviro-HIRLAM model estimates of elevated black carbon pollution over Ukraine resulted from forest fires

Mykhailo Savenets[1], Larysa Pysarenko[1], Svitlana Krakovska[1], Alexander Mahura[2], and Tuukka Petäjä[2]



Atmospheric Chemistry and Physics
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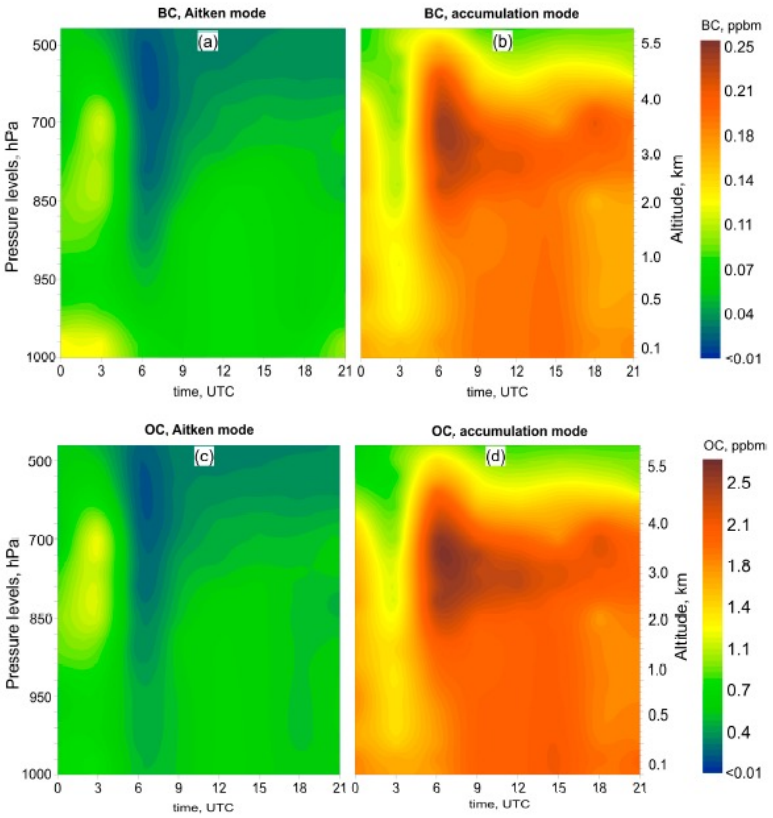
EGU

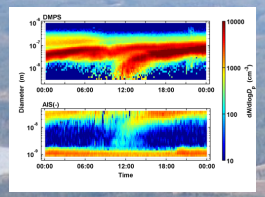
Article

Seamless Modeling of Direct and Indirect Aerosol Effects during April 2020 Wildfire Episode in Ukraine

Mykhailo Savenets [1,*], Valeriia Rybchynska [1,2], Alexander Mahura [3], Roman Nuterman [4], Alexander Baklanov [4,5], Markku Kulmala [3] and Tuukka Petäjä [3,*]



atmosphere
MDPI



SMEAR II station
(boreal) 1995 -

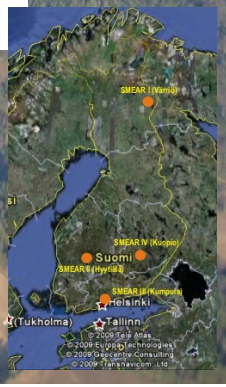
Main message:

1) **Commitment to comprehensive and continuous environmental observations**

2) **Continuous method development (instrumentation, models)**

3) **Active and open collaboration across various boundaries**

4) **Willingness to tackle and solve grand challenges together**



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RI URBANS

European Commission

ATMO ACCESS
Access to Atmospheric Research Facilities

Euroopan unioni
Euroopan aluekehitysrahasto

UIA URBAN INNOVATIVE ACTIONS

Teknologiateollisuuden 100-vuotissäätiö

J&AE
JANE JA AATOS ERKON SÄÄTIÖ

Support from University of Helsinki, Academy of Finland, European Commission, Regional Council of Lapland, Helsinki-Uusimaa Regional Council, Technology industries of Finland Centennial Foundation, Jane and Aatos Erkko foundation and Business Finland are gratefully acknowledged.