

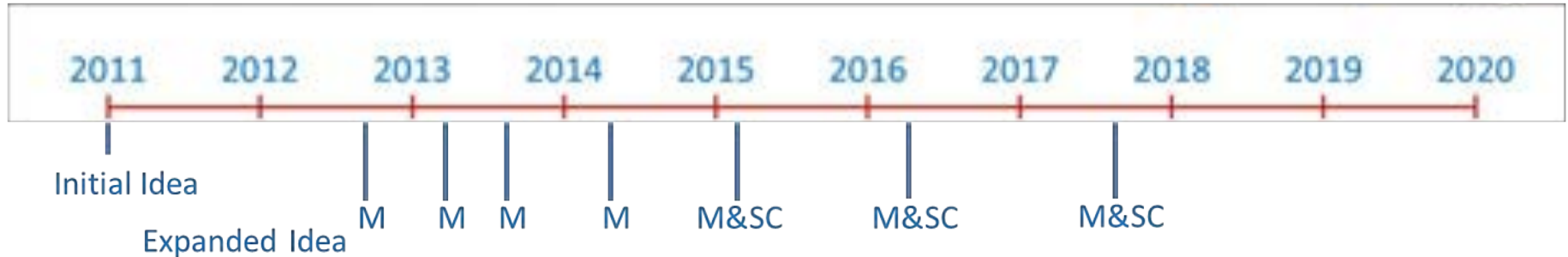


CLIMATE CHANGE & ARCTIC - BOREAL REGIONS FROM SCIENTIFIC UNDERSTANDING TO PRACTICAL SOLUTIONS

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PEEX PROGRAM www.atm.helsinki.fi/peex/



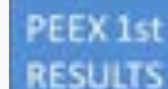
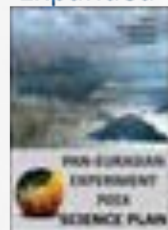
- network of 4000 researchers
- research communities from 20 different countries
- signed PEEX oriented MoUs with 30 universities and research institutes in Russia and 5 in China
 - www.atm.helsinki.fi/peex/index.php/mou
- Thematic Working Groups: Modelling-Platform, In situ stations, Socio-economics, Marine concept, Satellite





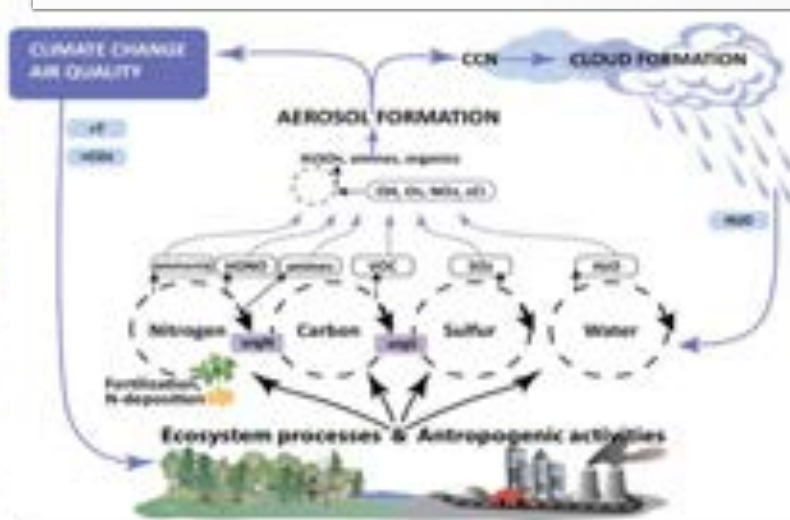
- 9-21th September.2017 in Moscow State University
- special issue in J. Geography, Environment and Sustainability
- 182 conference abstracts were submitted of which 123 were represented as orals

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
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Lappalainen et al 2016. ACP

Kulmala et al . 2015 ACP



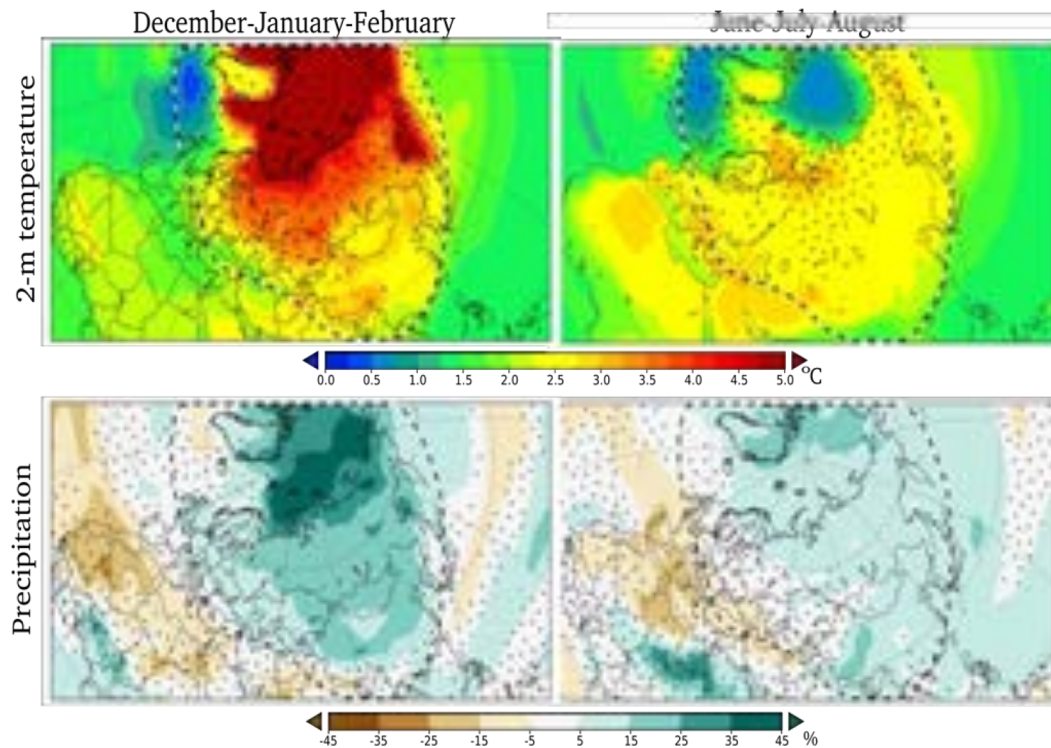
SYSTEM UNDERSTANDING OF THE NORTHERN EURASIAN REGION UNDER CHANGING CLIMATE (Lappalainen et al. ACP 2016)

- Process form PEEX Science Plan to 1st PEEX Result Overview
 - “State of the Art and the Key Gaps of the System and Future prospects” in 2019
- Climate scenarios over PEEX region
- PEEX research infrastructure concepts
 - In situ stations, PEEX station network, GlobalSMEAR
 - Marine
 - Satellites
 - Socio-economics
 - Modelling Platform
 - PEEX scientific results:
 - ACP PEEX Special Issue, PEEX projects
- Workshop in Helsinki 1-2.November 2018

Filling the
observational gaps in
the Northern Eurasian
region



PEEX CLIMATE SCENARIOS (Risto Makkonen et al.)



Changes in 2-meter temperature ($^{\circ}\text{C}$, upper panels) and precipitation (% , lower panels) during the 21st century. Present-day climatology is averaged over years 1981-2010 and end-of-century climatology over 2070-2099. Winter (left) and summer (right) are shown separately. Dotted areas indicate high variability in model ensemble (for temperature: standard deviation of 21st century change exceeds 1°C ; for precipitation: standard deviation of 21st century change exceeds 100% or present-day precipitation). The model results are from IPCC AR5, based on 42 individual models in CMIP5 experiments.

MARINE ARCTIC PEEEX (Vihma, Uotila et al. 2018)

State of the art & future needs

- integrated with the existing atmospheric, terrestrial, and socio-economic components of PEEEX.
- special attention to the linkage processes, such as atmospheric teleconnections and transports in and out of the Arctic, river discharge and related transports of dissolved and particulate matter, various coastal processes.
- need for integration of long-term monitoring, modelling, and process studies
- The SMEAR concept can be applied in coastal and archipelago stations, but in the Arctic Ocean it will probably be more cost-effective to further develop distributed marine observation networks.

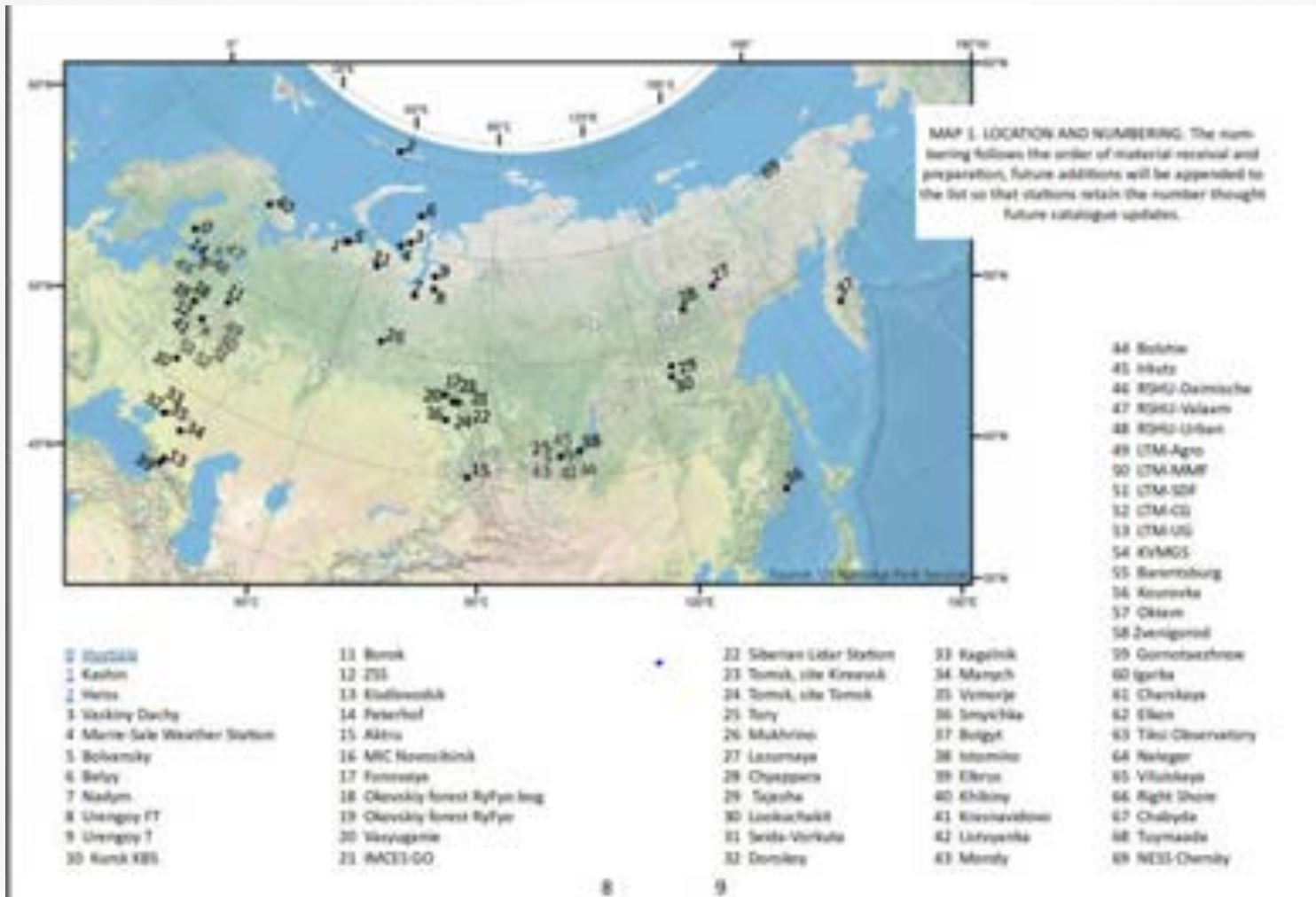


Distribution of buoys belonging to the International Arctic Buoys Programme on 16 October 2017.

HIERACIAL PEEX STATIONS NETWORK BASED ON EXISTING STATIONS

WG: I.Bashmakova, A.Borisova, N.Altimir, H.K. Lappalainen, S. Chalov, P. Kontantinov, T.Petäjä + several active stations in RU





How the station looks like:
Images of the site, surroundings, or stations
infrastructure.



JCN Integrated Carbon Observation System
 ANAS (Science and Supercomputing in Antarctica)
 J-ERA European Long Term Ecological Research
 WMO World Meteorological Organization
 JCM Japan, China, and France Joint Research Initiative
 IAGLR Interagency Antarctic Research in a Changing
 Climate



Pan-Eurasian Experiment

PEEX



Global observation network

- Refer to existing stations in Russia; THERE IS A NEED FOR ADVANCED IN SITU STATIONS IN THE NORTHERN EURASIA / PEEX REGION

**M. Kulmala: Nature Comment,
Nature 553, 21–23 4 Jan 2018)**

The answer is a global Earth observatory — 1,000 or more well-equipped ground stations around the world that track environments and key ecosystems fully and continuously

- Researchers could find new mechanisms and feedback loops in this coherent data set
- Policymakers could test policies and their impacts
- Companies could develop environmental services



An enclosure for measuring gas exchange between plants and the atmosphere at a station in Finland.

Build a global Earth observatory

Markku Kulmala calls for continuous, comprehensive monitoring of interactions between the planet's surface and atmosphere.

SMEAR II-station GlobalSMEAR - Flagship station Boreal forest, country side



Flagship station SMEARII

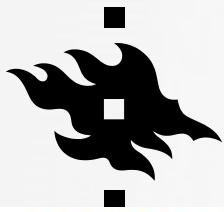
N 61° 50.845', E 24° 17.686', altitude 180 m a.s.l.

The SMEAR II (Station for Measuring Ecosystem - Atmosphere Relations) in [myyrylähti](#), Finland, represents the most advanced station of the SMEAR concept. SMEAR II station is carrying out measurements 24/7 on 1200 parameters on different ecosystems: boreal forest, wetland and lakes.

SMEAR II is contributing to several global Earth Observation systems and networks such as [WMO GLAS](#), [GEO-GLOSS](#), [Funchal](#), [AERONET](#) and [SOLRAD-net](#), and to the European Research Infrastructures such as [ICOS](#), [ACTRIS](#), [JAMSTEC](#) and [GLORIA](#).



* WMO Global World Meteorological Organization - The Global Atmosphere Watch - The Intergovernmental Group on Earth Observations (IGEO) - a Global Earth Observation System of Systems (GEOSS), ICOS (Integrated Carbon Observation System), ACTRIS (Atmospheric Composition, Clouds, and Trace gases Research Infrastructure), AERONET (Infrastructure for Analysis and Experimentation on Aerosols), ACTRIS (Integrated Air Quality Long-term Research)



Pan-Eurasian Experiment

PEEX



SMEAR Measurement Concept Business / Upscaling Plan

- PEEX promoting the SMEAR II flagship station - concept based on SMEAR blocks in Russia and in China

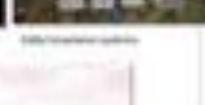


Flagship station SMEAR II

N 62° 50.845', E 24° 17.086', altitude 160 m a.s.l.

The SMEAR II (Station for Measuring Emissions—Atmospheric Relations) in Rybinsk, Finland, represents the most advanced station of the SMEAR concept. SMEAR II station is carrying out measurements (NET or GPP) performed on different ecosystems: spruce forest, wetland and peat.

SMEAR II is contributing to several global land observation systems and datasets such as: GPP4000, GPP40000, Fluxnet, AICHOSS and Inland Flux, and to the European Research Infrastructure with: EURIS, ACTRIS, Eurolux and: e-Flux.



COMPONENTS

Instrumentation The station is equipped with a wide range of instruments for measuring various atmospheric parameters. The instruments are arranged in a way that allows for simultaneous measurements of different parameters. The instruments are also arranged in a way that allows for measurements of different parameters at different heights.

Infrastructure The station is equipped with a wide range of infrastructure for supporting the measurements. The infrastructure includes a power supply system, a data acquisition system, and a communication system. The infrastructure is also arranged in a way that allows for measurements of different parameters at different heights.

Quality assurance The station is equipped with a wide range of quality assurance measures to ensure the accuracy and reliability of the measurements. The quality assurance measures include regular calibration of the instruments, regular maintenance of the infrastructure, and regular quality control of the measurements.

Documentation The station is equipped with a wide range of documentation measures to ensure the accuracy and reliability of the measurements. The documentation measures include regular documentation of the measurements, regular documentation of the infrastructure, and regular documentation of the quality assurance measures.

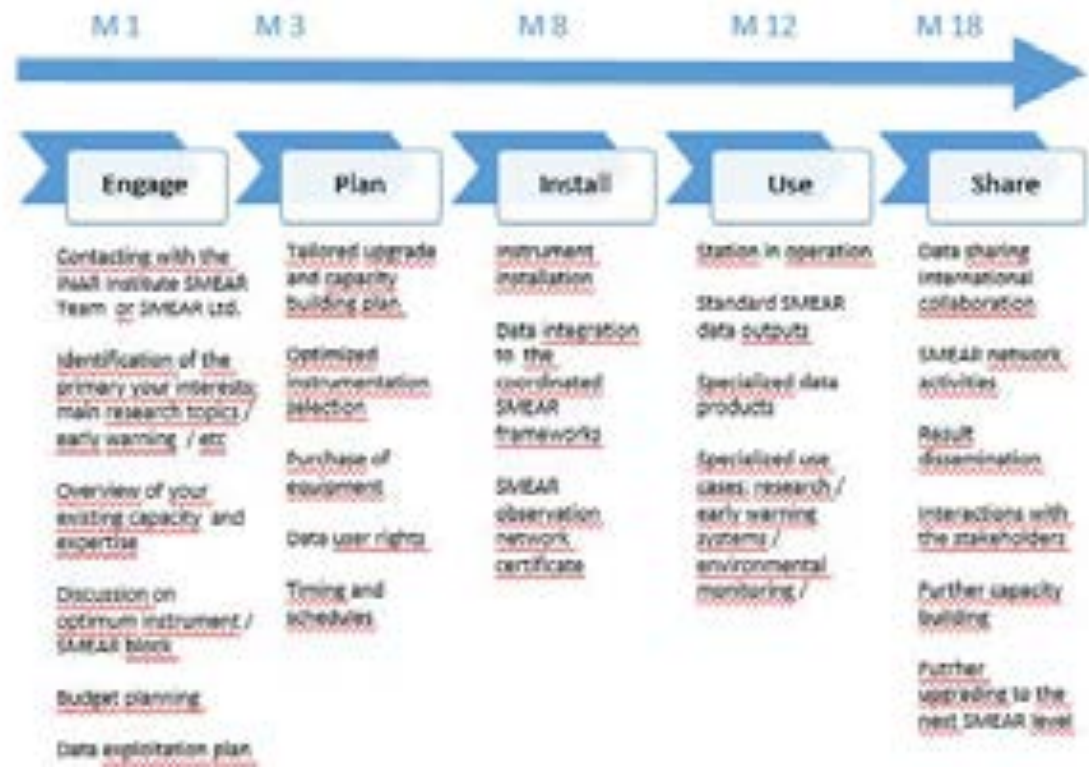
Training The station is equipped with a wide range of training measures to ensure the accuracy and reliability of the measurements. The training measures include regular training of the staff, regular training of the students, and regular training of the researchers.

Dissemination and communication The station is equipped with a wide range of dissemination and communication measures to ensure the accuracy and reliability of the measurements. The dissemination and communication measures include regular dissemination of the measurements, regular communication of the infrastructure, and regular communication of the quality assurance measures.

- instrument blocks
Prices from
380.000 euro to
1.000.000 euro



SMEAR Measurement Concept Business Plan



Supersites based on SMEAR concept across northern Eurasian region



PEEX is promoting the flagship station concept based on SMEAR blocks in Russia and China

An aerial photograph of a vast, dense green forest. In the middle ground, a small cluster of buildings, possibly a village or farmstead, is visible near a calm body of water. The background shows rolling hills under a clear sky.

WELCOME TO SMEAR II!

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