

PAN-EURASIAN EXPERIMENT (PEEX) PROGRAM

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PEEX / GlobalSMEAR Secretary General
Institute for Atmospheric and Earth System Research (INAR)
University of Helsinki, FINLAND

ACCC IMPACT WEEK 11.APRIL.2024

Global grand challenges



KEY QUESTION

Why understanding of Atmosphere – Earth Surface – Biosphere is important for Climate Change ?

- New feedback mechanism / interactions / processes
- More time to act: Mitigate & Adapt



Pan-Eurasian Experiment
PEEX



TOOLS for understanding of Atmosphere – Earth Surface – Biosphere interaction, feedbacks

- Pan-Eurasian Experiment (PEEX) Program for understanding the Atmosphere – Earth Surface – Biosphere in the Arctic – boreal context / Northern Eurasia / Silk Road Region (2012 ->)
- GlobalSMEAR (Stations Measuring Earth Surface Atmosphere Relations) Initiative for Global Earth Observatory for filling the observational gap of the atmospheric – ecosystem in situ data (2015 - >



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Pan-Eurasian Experiment
PEEX



PEEX Program GlobalSMear Initiative



Prof. Tuukka Petäjä,
INAR, Univ.Helsinki



Prof. Alexander
Baklanov
Univ.Copenhagen



Dr. Alexander Mahura,
INAR, Univ.Helsinki



Academician
Markku Kulmala
Director of INAR Institute,
University of Helsinki, FI
Citation over 40000
H-index >100
ISI No. 1 Citation in
Geoscience (2011-2018)



Professor
Sergej Zilitinkevich (1936-2021)
Finnish Meteorological Institute
EU/ERC-Advanced, Russian-
Mega +
other major grants



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Hanna K. Lappalainen
Markku Kulmala
Sergej Zilitinkevich
Editors

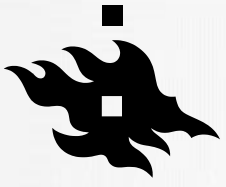


**PAN-EURASIAN
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PEEX
SCIENCE PLAN**

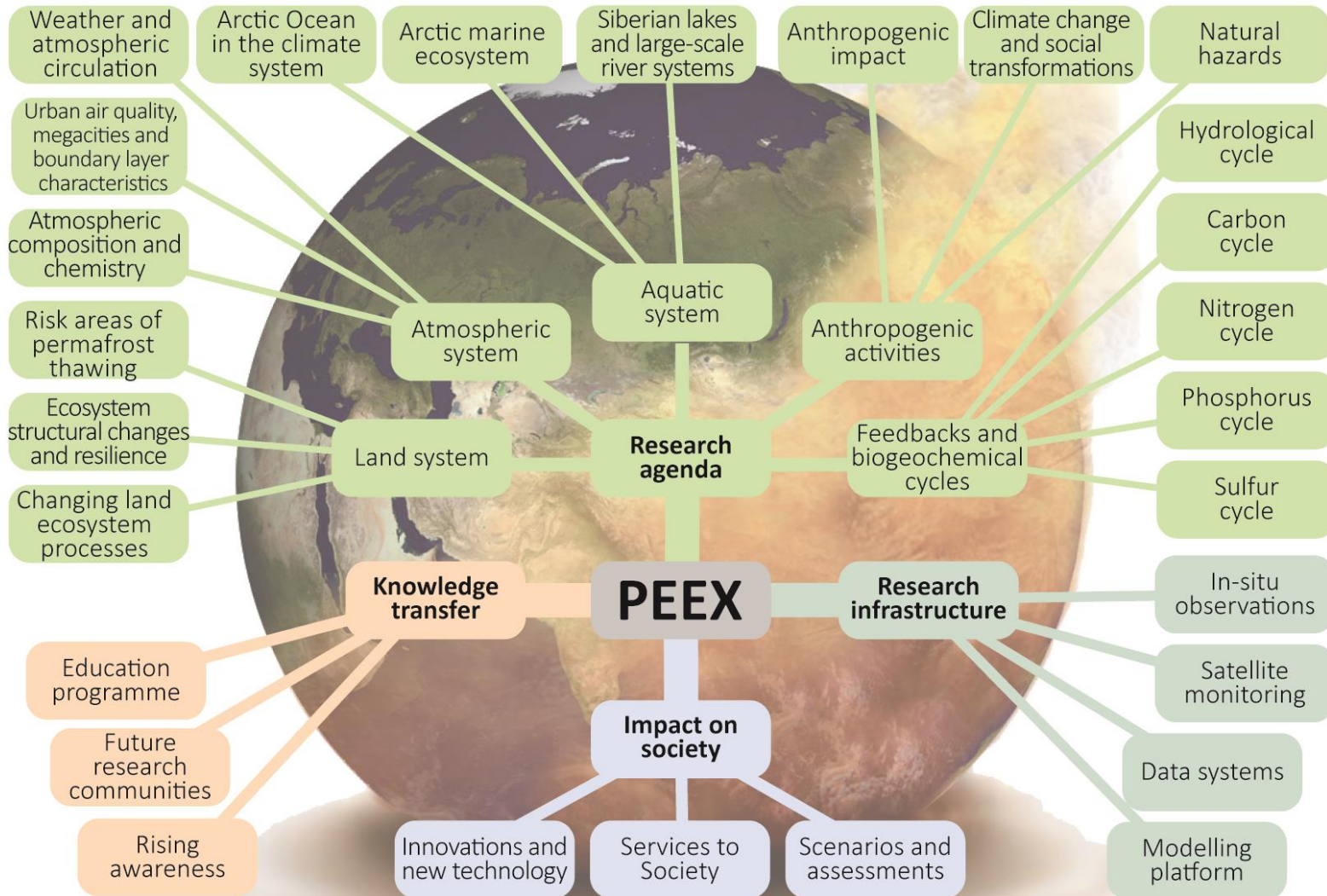
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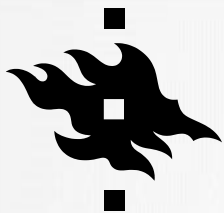
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PEEX PROGRAM STRUCTURE





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PEEX PROGRAM

RECENT NEWS / ACTIVITIES

<https://www.atm.helsinki.fi/peex/>

Latest news



PEEX signed new MoU with Kyiv Academic University

The new Memorandum of Understanding was signed with the Kyiv Academic University, Ukraine. The MoU is a bilateral document to encourage the development of the PEEX program in Pan-Eurasia and China regions. [\[Read more\]](#)

Summer School Application of AI/ML techniques in Atmospheric Science



Summer School on Application of AI/ML techniques in Atmospheric Science

The Lahti University Campus, the University of Helsinki (UH), Institute for Atmospheric and Earth System Research (INAR) and the Lappeenranta-Lahti University of Technology (LUT), Department of Computational Engineering are pleased to announce the summer school [\[Read more\]](#)



PEEX-related

Earth Data

The following... recently in the... Sogacheva, Ti... Sundström, Pe... Sofiev, Hanna... (2024)Two dec



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News

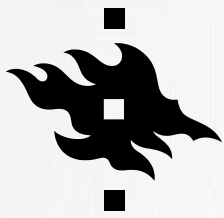
ACCC-FASN Science Conference
21-22 Nov 2023
Kuopio, Finland



CLUVEX at ACCC-FASN Conference During 21-22 November 2023 the [Atmosphere and Climate Competence Center \(ACCC\)](#) and [Finnish Atmospheric Science Network \(FASN\) Science Conference](#) took place in Kuopio, Finland. The Erasmus+ CLUVEX project was promoted at the Conference as overview oral and poster presentations. [Read more.](#)



Sergej Zilitinkevich Memorial Award 2024
Call open: Sergej Zilitinkevich Memorial



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PEEX PROGRAM Newsletter

- 4 issues per year
- a forum to advertise your activities etc.
- For contact:
Editor Alla Borisova
Alla.borisova@helsinki.fi
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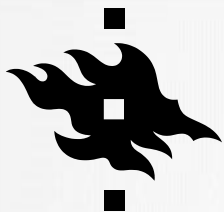
News



CLUVEX at ACCC-FASN Conference
During 21-22 November 2023 the
[Atmosphere and Climate Competence Center \(ACCC\)](#) and [Finnish Atmospheric Science Network \(FASN\)](#) Science Conference took place in Kuopio, Finland. The Erasmus+ CLUVEX project was promoted at the Conference as overview oral and poster presentations. [Read more](#).



Sergej Zilitinkevich Memorial Award 2024
Call open: Sergej Zilitinkevich Memorial Award Nominations are accepted 01 December 2023 – 29 February 2024. [Read more](#)



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PEEX PROGRAM COMMUNICATION

PEEX Newsletter & Blog

PEEX NEWSLETTER

Welcome to the PEEEX Arctic-Boreal Hub Community!
Please provide your email address to receive PEEEX news and our quarterly e-newsletter.

Thank you for joining us!

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Institute

Materials

PEEX NEWSLETTER

PEEX Arctic-Boreal Hub Newsletter

In this issue:

- News
- PEEX Blog
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News

The 2022 International Forum on Big Data for SDGs

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these terms.

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PEEX Blog brings you news from our international community at PEEEX and UArctic Boreal-Hub Network.

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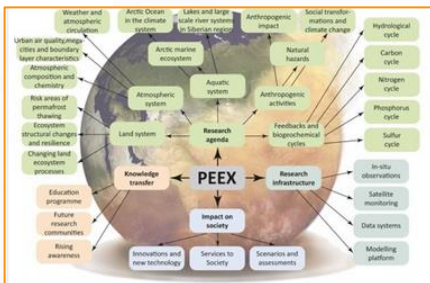
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Events



Projects & Subprograms

PEEX PROGRAM COLLABORATION

Helsinki HQ

PEEX Memorandum of Understanding (MoU)

Welcome
new Partners
signed & in
signing stage
the PEEK
MoU
(seminar
11.Apr.24)

- YSU - Yerevan State University
- ChNU - Chernivtsi National University
- BTNAU - Bila Tserkva National Agrarian University
- KNUBA - Kyiv National University of Building and Architecture
- UT - University of Tartu
- LU - Latvia University
- UiT - The Arctic University of Tromso
- KAU - Kyiv Academic University
- YU - Yarmouk University
- UCPH - University of Copenhagen
- KazNU - Al-Farabi Kazakh National University
- UHMS – Ukrainian Hydrological and Meteorological Society
- IMMSP - Institute of Mathematical Machines and Systems Problems
- UoB – University of Belgrade

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PEEX RESEARCH



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Pan-Eurasian Experiment (PEEX) – Part II

Editor(s): ACP co-editors | Coordinators: Dominick Spracklen and Paul Zieger | Co-organizers: Veli-Matti Kerminen, Martin Heimann, and Tuomas Laurila

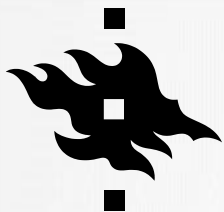
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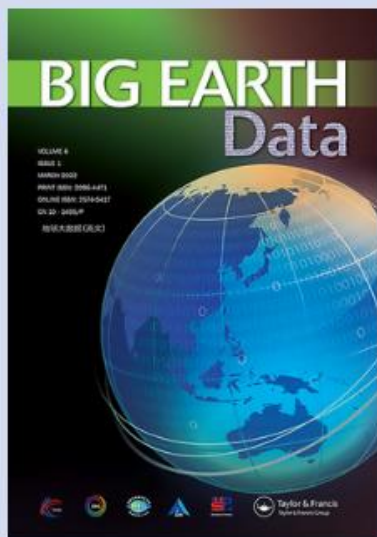
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PEEX RESEARCH

Submit a Manuscript to the Journal
Big Earth Data

For a Special Issue on
High-quality environmental information and analysis for the Arctic boreal
region and High Mountain Asia

Manuscript deadline
28 February 2023



Special Issue Editor(s)

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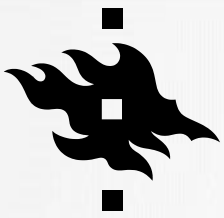
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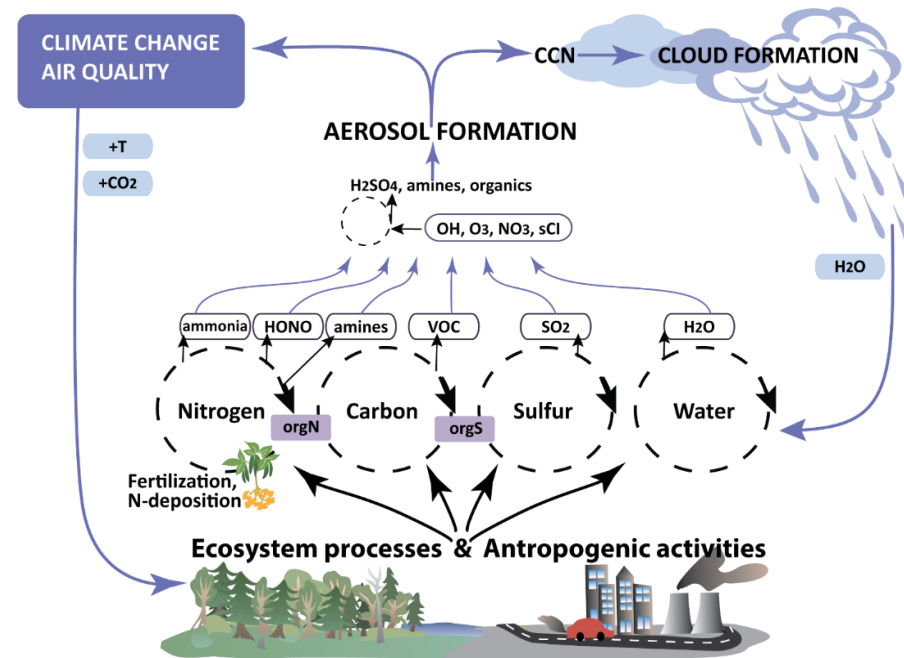
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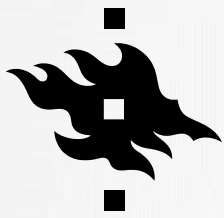
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Research approach from process studies towards understanding & quantification of feedbacks

- system specific topics are basically related to process understanding
- individual process understanding enables to quantification of biogeochemical cycles
- via biogeochemical cycles the energy and matter flows linked to a wider system context enabling us to analyze the feedback phenomena
- feedbacks are essential components towards (climate) system understanding

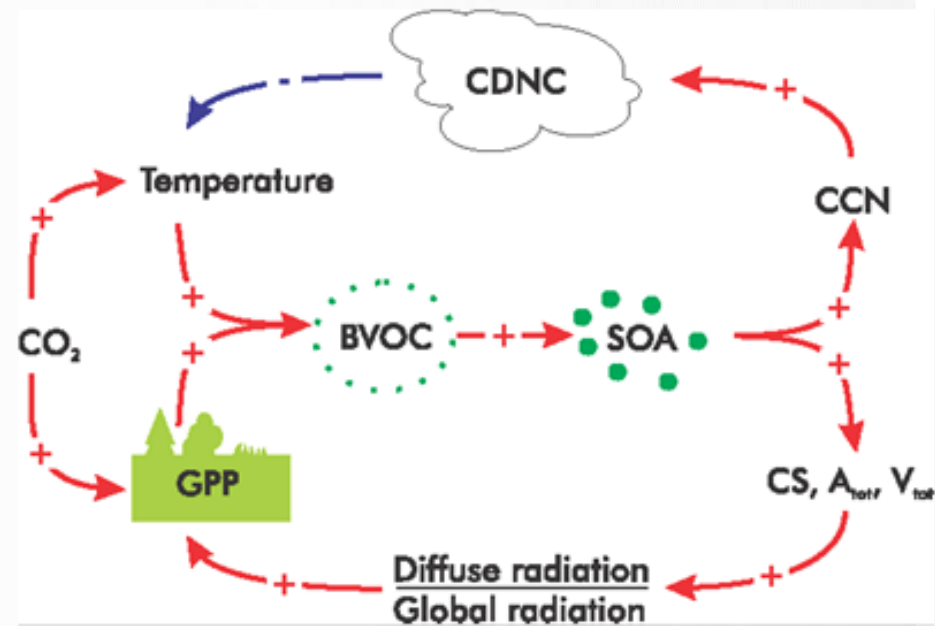




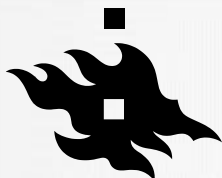
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A FEEDBACK LOOP RELEVANT TO ARCTIC-BOREAL REGIONS: COBACC (CContinental Biosphere-Aerosol-Cloud-Climate)

FEEDBACK LOOP has two major overlapping feedback loops. The focal points of these two loops are ambient temperature and plant gross primary production (GPP). The loops are closely tied with aerosol-cloud interactions and with the atmospheric carbon sink, and both tend to act toward suppressing global warming (Kulmala et al. 2014, Paasonen et al. 2013, PEEEX Science Plan)



BVOC=biogenic volatile organic compounds
SOA=secondary organic aerosol
CS=the condensation sink
A_{tot}=total aerosol surface area
V_{tot}=total aerosol volume
CCN=cloud condensation nuclei
CDNC=cloud droplet number concentration
GPP=Gross Primary Productivity



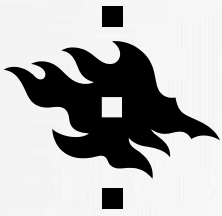
Atmos. Chem. Phys., 22, 4413–4469, 2022
<https://doi.org/10.5194/acp-22-4413-2022>
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Atmospheric
Chemistry
and Physics
Open Access


Overview: Recent advances in the understanding of the northern Eurasian environments and of the urban air quality in China – a Pan-Eurasian Experiment (PEEX) programme perspective

Hanna K. Lappalainen^{1,36}, Tuukka Petäjä¹, Timo Vihma², Jouni Räisänen¹, Alexander Baklanov³, Sergey Chalov⁴, Igor Esau^{5,44}, Ekaterina Ezhova¹, Matti Leppäranta¹, Dmitry Pozdnyakov^{6,23}, Jukka Pumpanen⁷, Meirrat O. Andreae^{8,41,42}, Mikhail Arshinov⁹, Eija Asmi², Jianhui Bai¹⁰, Igor Bashmachnikov⁶, Boris Belan⁹, Federico Bianchi¹, Boris Biskaborn¹¹, Michael Boy¹, Jaana Bäck¹², Bin Cheng², Natalia Chubarova⁴, Jonathan Duplissy^{1,43}, Egor Dyukarev¹³, Konstantinos Eleftheriadis¹⁴, Martin Forsius¹⁵, Martin Heimann¹⁶, Sirkku Jubola¹⁹, Vladimir Konovalov¹⁷, Igor Konovalov¹⁸, Pavel Konstantinov^{4,32}, Kajar Küster¹², Elena Lapshina²⁰, Anna Lintunen^{1,12}, Alexander Mahura¹, Risto Makkonen², Svetlana Malkhazova⁴, Ivan Mammarella¹, Stefano Mammola^{21,22}, Stephany Buenrostro Mazon¹, Outi Meinander², Eugene Mikhailov^{23,24}, Victoria Miles¹, Stanislav Myslenkov⁴, Dmitry Orlov⁴, Jean-Daniel Paris²⁵, Roberta Pirazzini², Olga Popovicheva²⁶, Jouni Pulliainen², Kimmo Rautiainen², Torsten Sachs²⁷, Vladimir Shevchenko²⁸, Andrey Skorokhod²⁹, Andreas Stohl³⁰, Elli Suhonen¹, Erik S. Thomson³¹, Marina Tsidilina³², Veli-Pekka Tynkkynen³³, Petteri Uotila¹, Aki Virkkula², Nadezhda Voropay³⁴, Tobias Wolf⁵, Sayaka Yasunaka³⁵, Jiahua Zhang³⁶, Yubao Qiu³⁶, Aijun Ding³⁷, Huadong Guo³⁶, Valery Bondur³⁸, Nikolay Kasimov⁴, Sergej Zilitinkevich^{1,2,45,†}, Veli-Matti Kerminen¹, and Markku Kulmala^{1,39,40}



Prof. Risto Makkonen Finnish Meteorological Inst. team

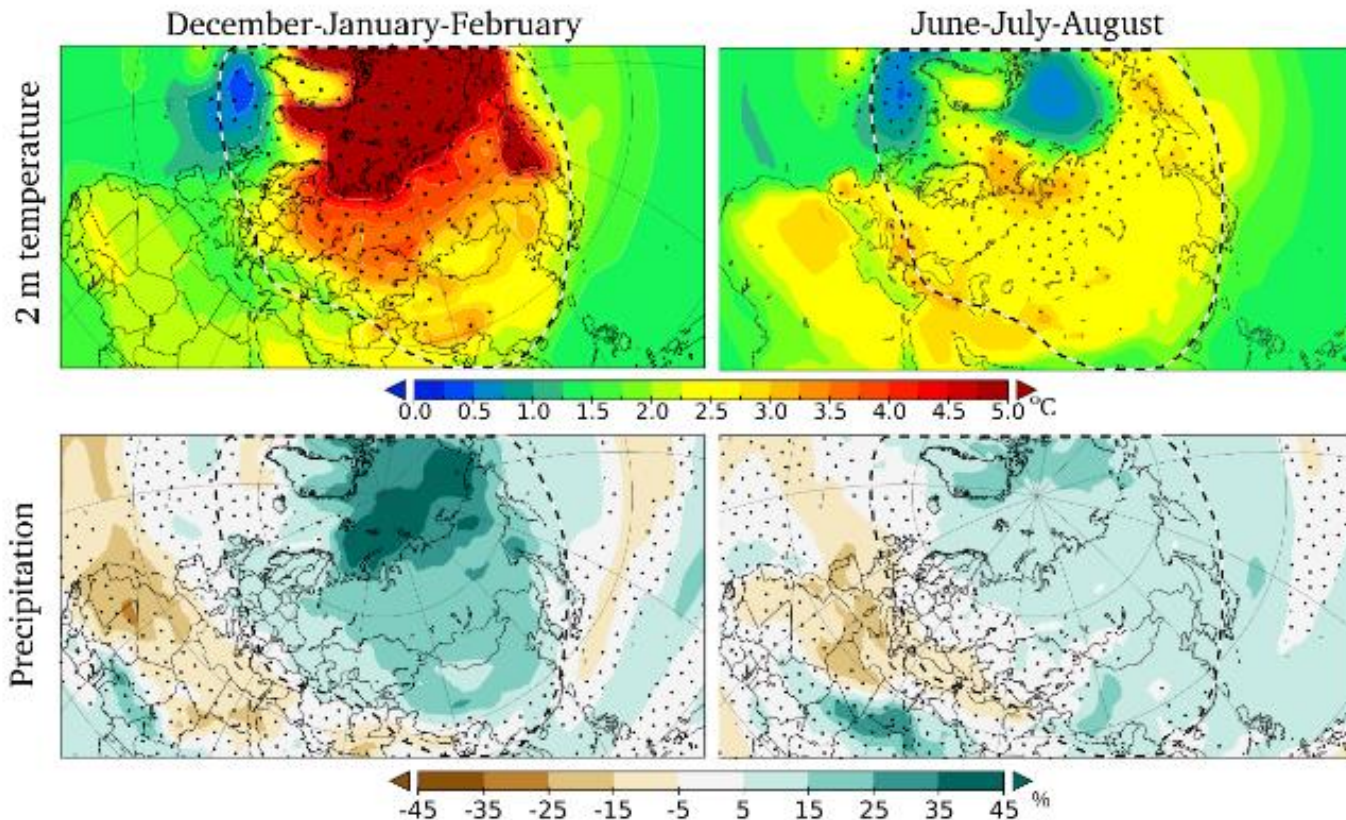
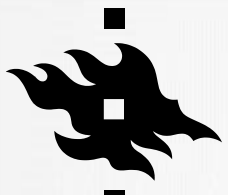
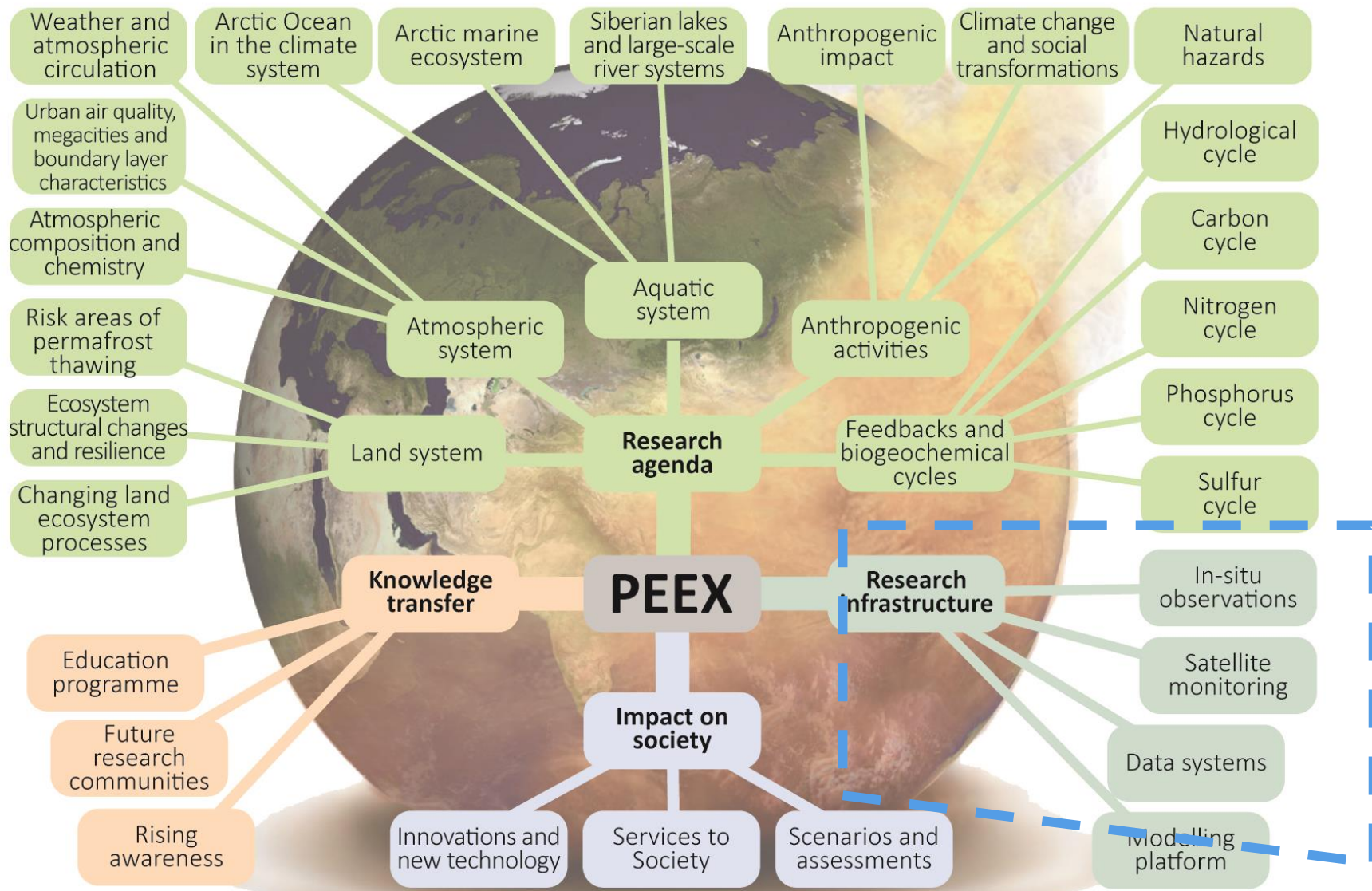
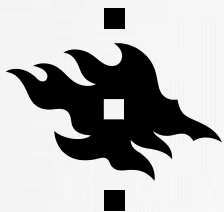


Figure 9. Changes in 2 m temperature (°C, upper panels) and precipitation (% , lower panels) during the 21st century. Present-day climatology is averaged over the years 1981–2010 and end-of-century climatology over 2070–2099. Winter (left) and summer (right) are shown separately. Dotted areas indicate high variability in the 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 under the RCP4.5 scenario.



RESEARCH INFRASTRUCTURE





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Pan-Eurasian Experiment

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Vision: Global observation network

THERE IS A NEED FOR ADVANCED IN SITU STATIONS IN

**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 in Hyytiälä, FINLAND

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 Hyytiälä, 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 GAW, GEO-GEOS, FluxNet, AERONET and SolRad-Net, and to the European Research Infrastructures such as ICOS, ACTRIS, AnaEE and ELTER.



Instrument cottage



Instruments on mast and towers to measure at different heights



Eddy Covariance systems



Aerosols



Shoot-level flux chamber



Lake raft housing instruments



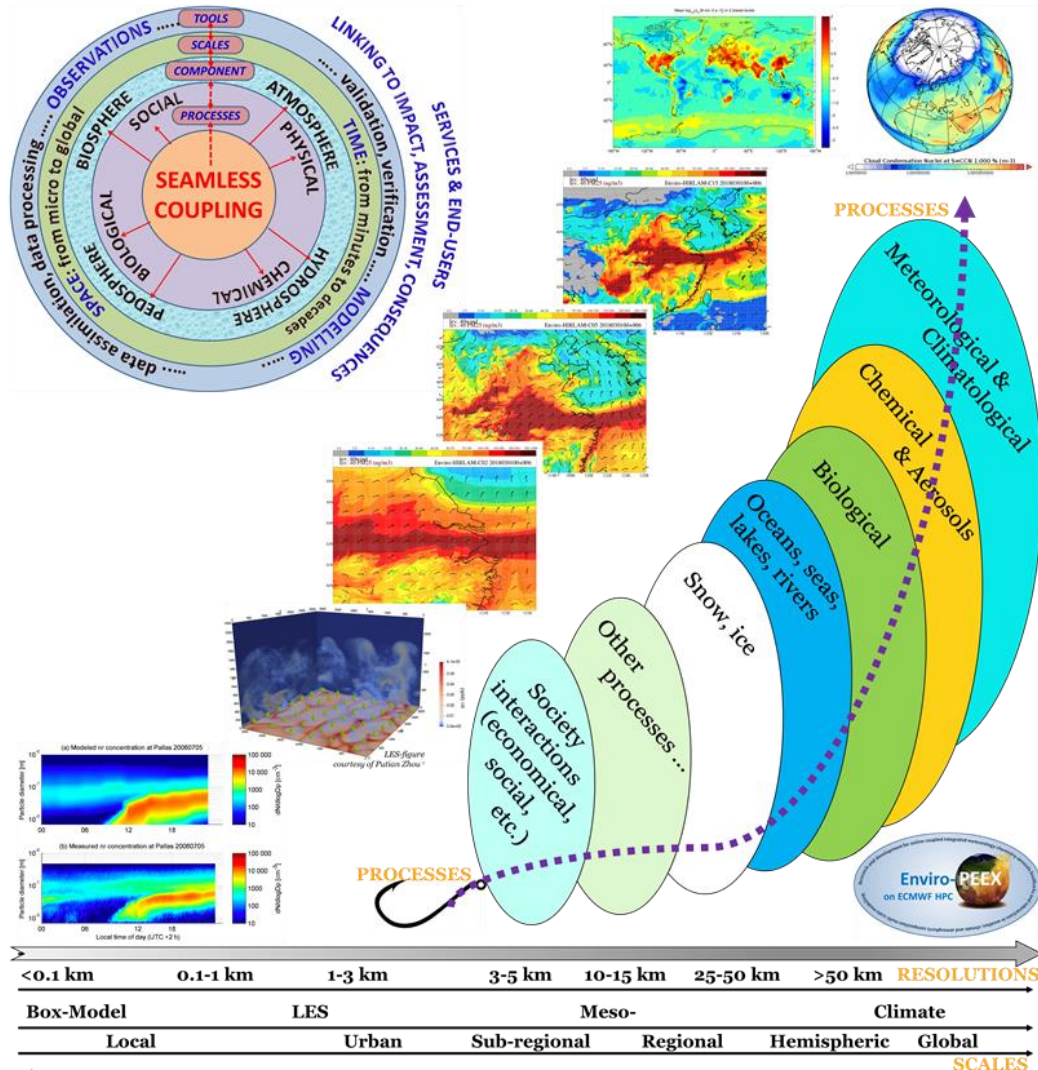
Biosphere

Pedosphere

Hydrosphere

Atmosphere

* WMO GAW World Meteorological Organization - The Global Atmosphere Watch, The Intergovernmental Group on Earth Observations (GEO) - a Global Earth Observation System of Systems (GEOS), ICOS (Integrated Carbon Observation System), ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure), AnaEE (Infrastructure for Analysis and Experimentation on Ecosystems), ELTER (Integrated European Long-term Ecosystem)



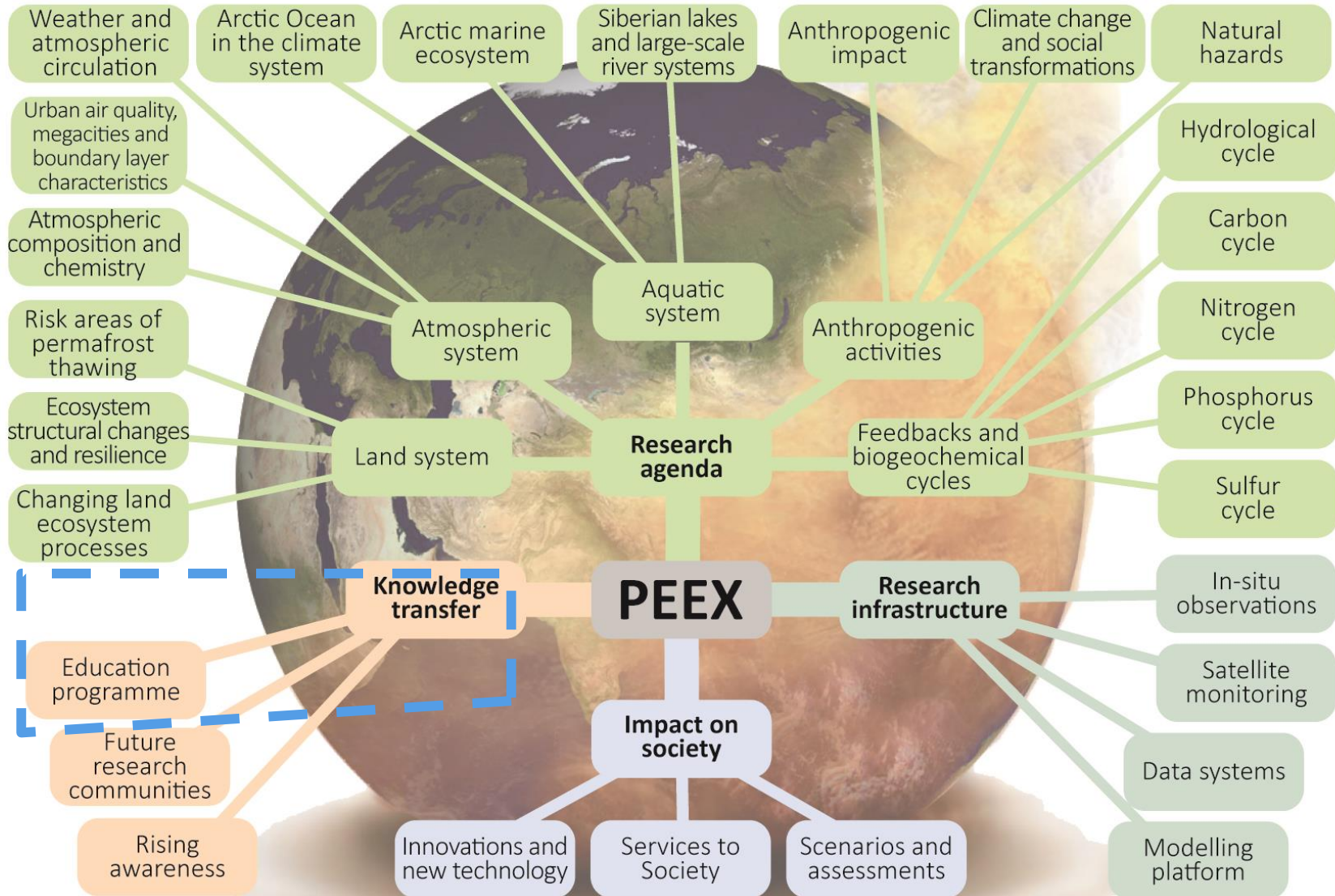
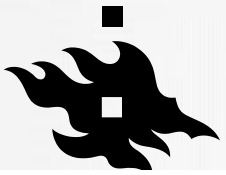
“PEEX-MP research and development for online coupled integrated meteorology-chemistry-aerosols feedbacks & interactions in weather, climate & atmospheric composition multi-scale modelling”

(2018-2020, 2021/2023, 2024-)

www.atm.helsinki.fi/peex/index.php/enviro

Objectives:

- to analyze importance of meteorology-chemistry-aerosols interactions & feedbacks;
- to provide a way for development of efficient techniques for on-line coupling of NWP and ACT via process-oriented parameterizations and feedback algorithms.





Pan-Eurasian Experiment

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EDUCATION

European Union Erasmus+ Programme Virtual Exchange(s) projects in 2023-2027



CLimate **U**niversity for **V**irtual **EX**changes

– **CLUVEX** –

EU Programme Erasmus+



Funded by the European Union



Una Europa - **V**irtual **EX**changes for **S**ustainability

– **UnaVEx** –

EU Programme Erasmus+



Funded by the European Union

una
europa

- to engage students with climate competences and green agenda together with interdisciplinary, green and soft skills
- to educate 500 students in 1 Virtual Exchange (VE) Week (2x5 VE Weeks in total)
- to educate altogether 5000 students as Climate Messengers in 3 years
- Projects coordinated by INAR, University of Helsinki



Pan-Eurasian Experiment

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EDUCATION

<https://www.atm.helsinki.fi/peex/index.php/education/>



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PEEX BENCHMARKED COURSES



INAR Climate University MOOCs



Pan-Eurasian Experiment

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For contact Dr. Laura.riuttanen@helsinki.fi

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35 ECTS in total
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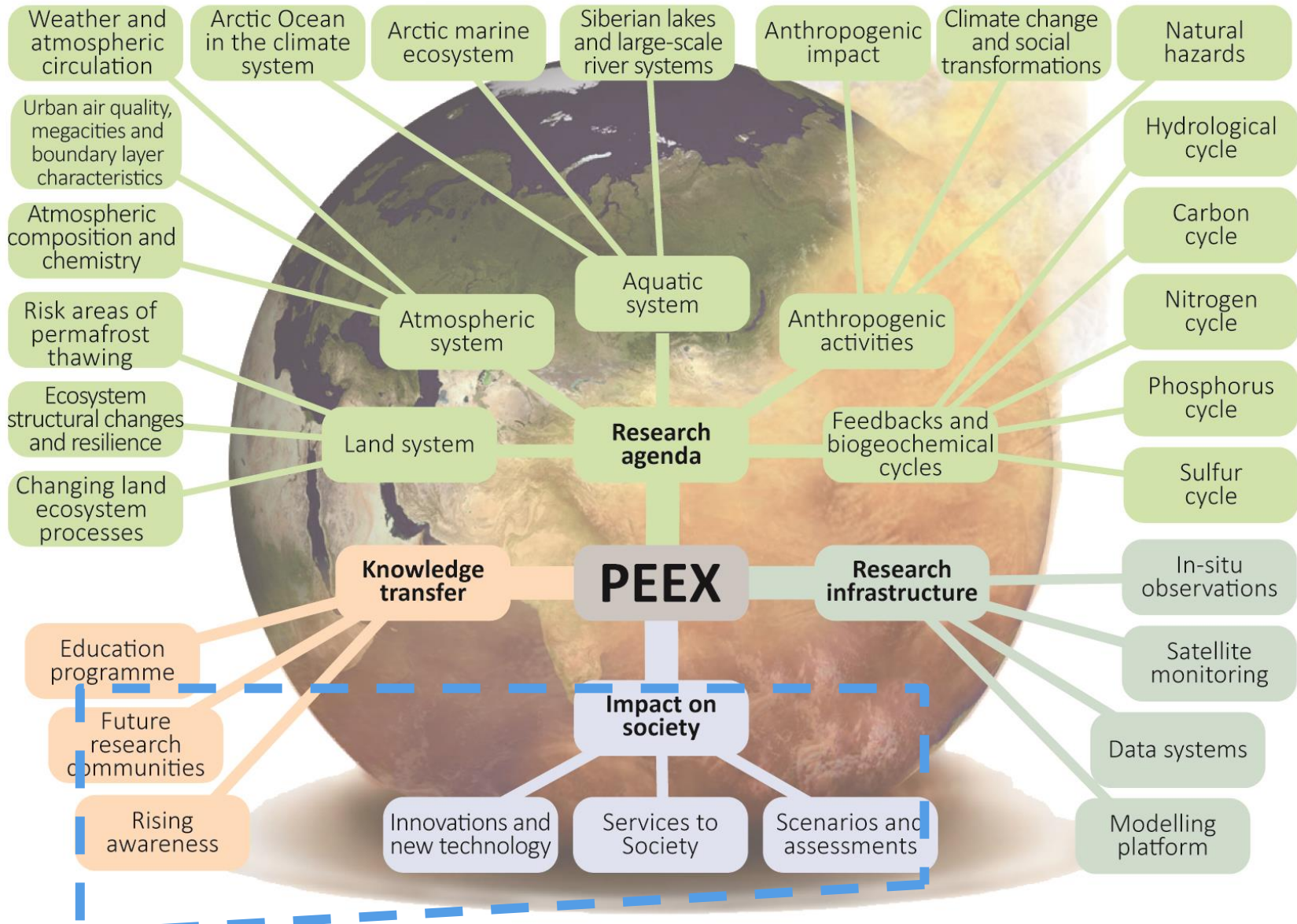
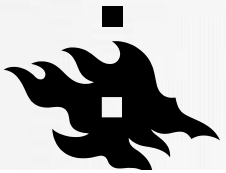


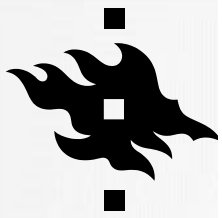
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LUKIOLAISEN ILMASTO.NYT







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PEEX SCIENCE DIPLOMACY /IMPACT ON SOCIETY

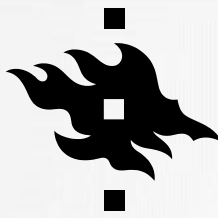
Gap analysis of the existing Arctic Science Co-Operations (AASCO)

HSH Prince Albert II of Monaco visited Värriö Research Station (SMEAR I) on 6 June 2023



In figure in front, from left; Olivier Wenden, Hanna Lappalainen, Mikko Sipilä, HSH Prince Albert, Erkki Parkkinen, Bernard Fautrier together with station staff, Riikka Karppinen and Jaana Bäck.





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