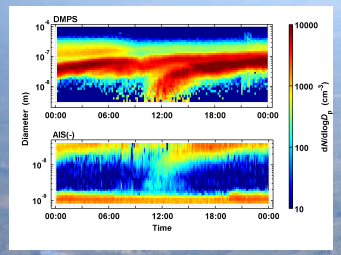

SMEAR

Ilmanlaatututkimuksesta kv.-näkökulma

Prof. Tuukka Petäjä
Institute of Atmospheric and Earth System Research INAR / Physics
Faculty of Science, University of Helsinki
Finland



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**

SMEAR II station
(boreal) 1995-

Global grand challenges

Climate change

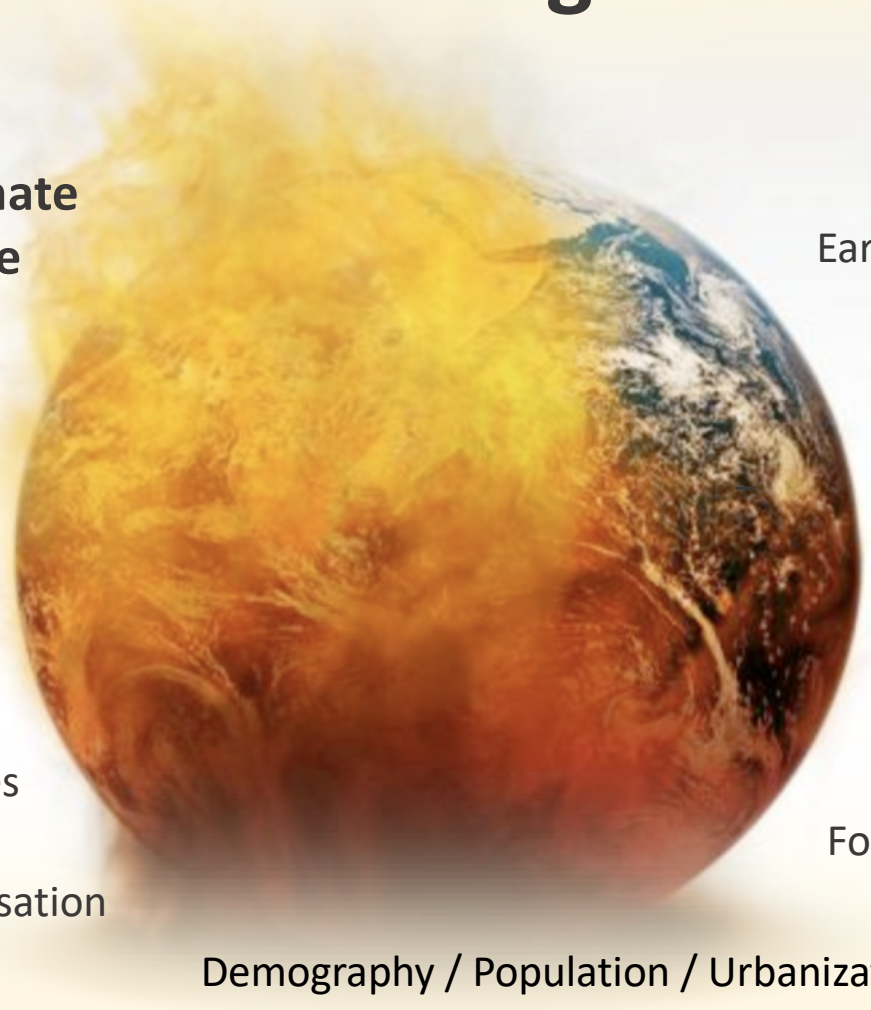
Volcanoes

Energy

Biodiversity loss

Epidemic diseases

Chemicalisation



Earthquakes

Air quality

Fresh water

Ocean acidification

Deforestation

Food supplies

Demography / Population / Urbanization

AIM:

TO TACKLE AND SOLVE GLOBAL GRAND CHALLENGES

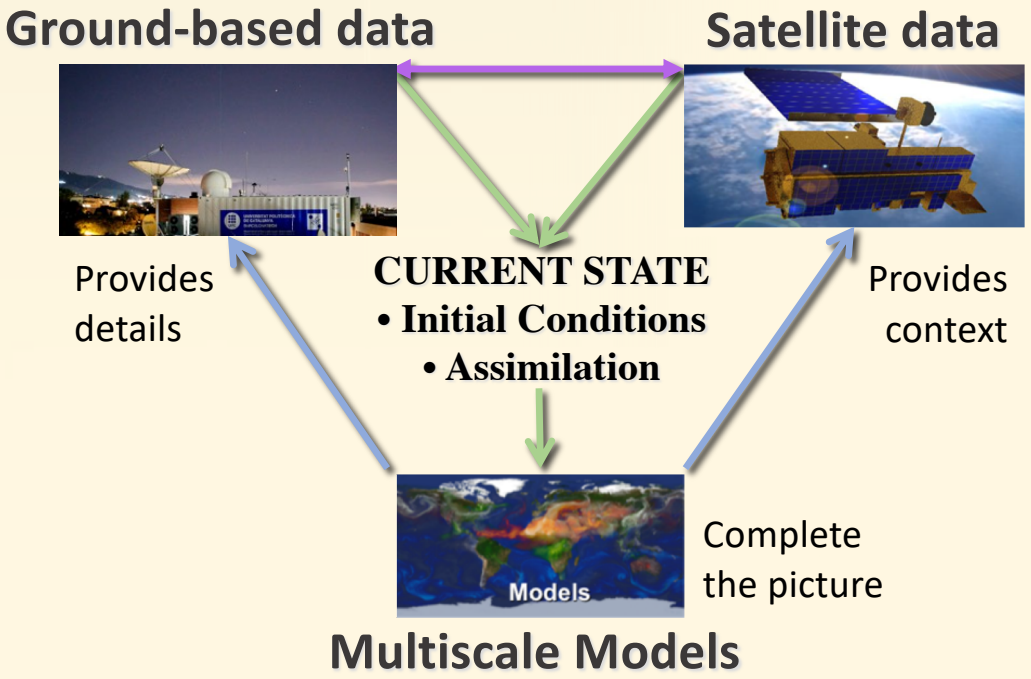
with comprehensive observation network and data synthesis

MULTIDIMENSIONAL, MULTIDISCIPLINARY, MULTISCALE APPROACH TO ANSWER GRAND CHALLENGES

Clear and ambitious vision / from deep understanding to practical solutions

Empirical measurements and modelling / from observations to new theories

From research to innovations / economic growth and human wellbeing



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.

Nature Comment (2018), Nature 553, 21–23

Many developing countries, such as Mongolia, have rural economies, so projects that can provide farmers with up-to-date agricultural information are crucial.

Steps to the digital Silk Road

Sharing big data from satellite imagery and other Earth observations across Asia, the Middle East and east Africa is key to sustainability, urges **Guo Huadong**.

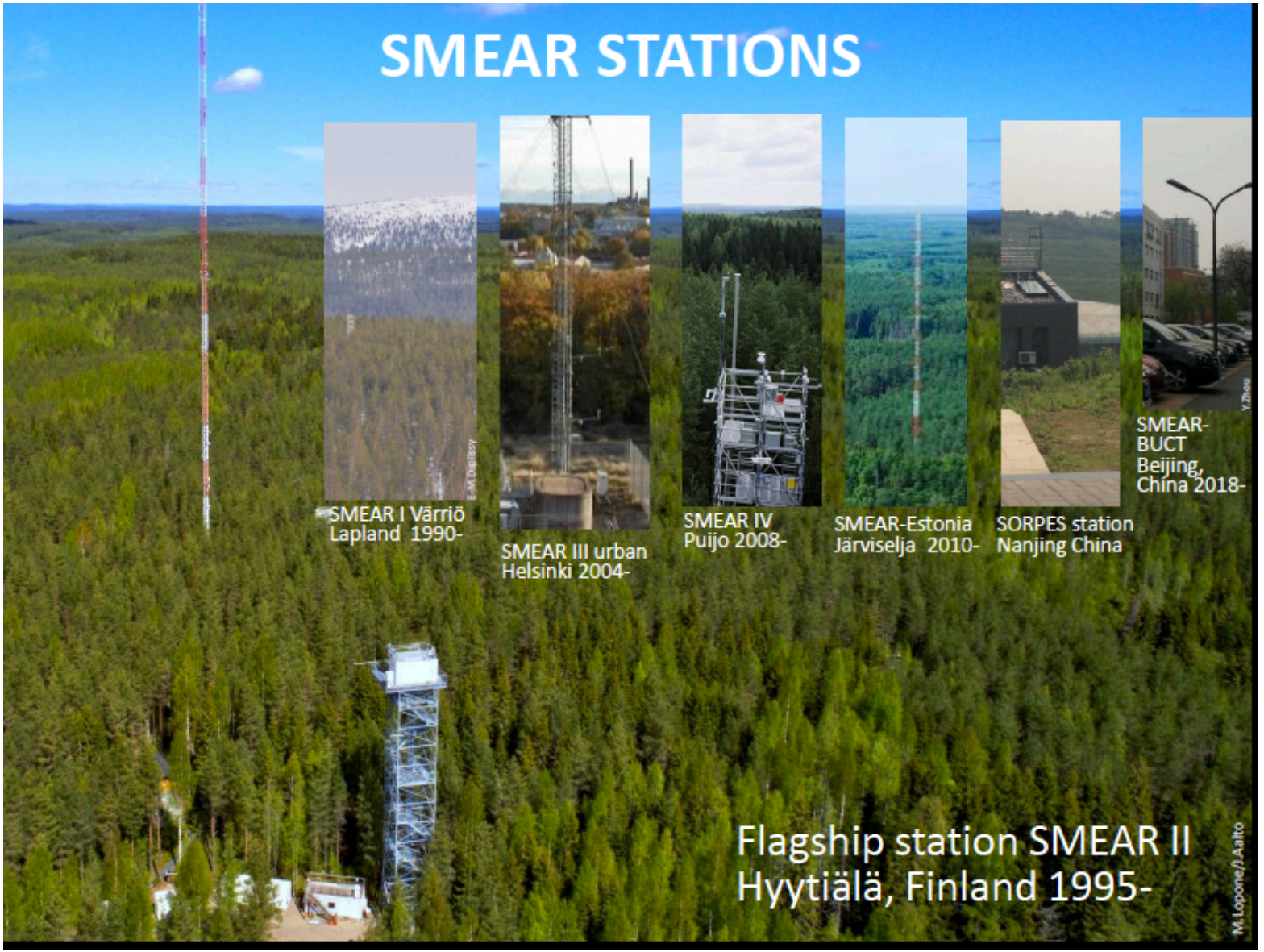
Nature Comment (2018), Nature 554, 25-27

Sharing big data from satellite imagery and other Earth observations

Global SMEAR and Digital Belt & Road - DBAR

Academician, Academy Professor **Markku Kulmala**
University of Helsinki, Faculty of Science
Institute for Atmospheric and Earth System Research
markku.kulmala@helsinki.fi

Academician, Professor **Guo Huadong**
Chair of DBAR
The Institute of Remote Sensing and Digital Earth
Chinese Academy of Sciences
guohd@radi.ac.cn


SMEAR STATIONS
SMEAR I Värriö
Lapland 1990-
SMEAR III urban
Helsinki 2004-
SMEAR IV
Puijo 2008-
SMEAR-Estonia
Järviselja 2010-
SORPES station
Nanjing China
SMEAR-
BUCT
Beijing,
China 2018-
Flagship station SMEAR II
Hyytiälä, Finland 1995-

acve
→ ATMOSPHERIC COMPOSITION VALIDATION AND EVOLUTION

ACTRIS

ACTRIS, the Aerosol, Clouds, and Trace gases Research Infrastructure, is the European Research Infrastructure for the observation of Aerosol, Clouds, and Trace gases.

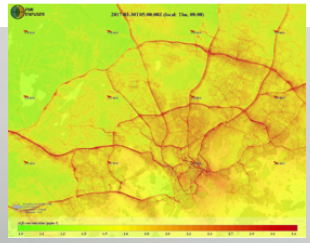
ACTRIS started in 2011 merging existing networks for establishing a sustainable network of coordinated long-term atmospheric observations in Europe

ACTRIS is composed of observing stations, exploratory platforms, instruments calibration centres, and a data centre.

ACTRIS HQ will be established in Helsinki as an independent legal entity (ERIC) in 2021.

Nanjing Air Quality Testbed (NAQT)
Vision: 3D pollutant measurement

- 20 pcs of Vaisala AQT420 Air quality sensors and 10 pcs of WXT536 Multi-weather sensors installed around Nanjing area
- Vaisala CL51 Ceilometers and a prototype lidars for vertical boundary layer monitoring
- High-end data from SORPES and Mobile SORPES stations
- FMI-ENFUSER model to study the effects of various components
- SW platform and applications for improved forecasting and alerting capabilities in Nanjing area



Based on Helsinki Air Quality Testbed (HAQT)

Uudenmaan liitto
Nylands förbund

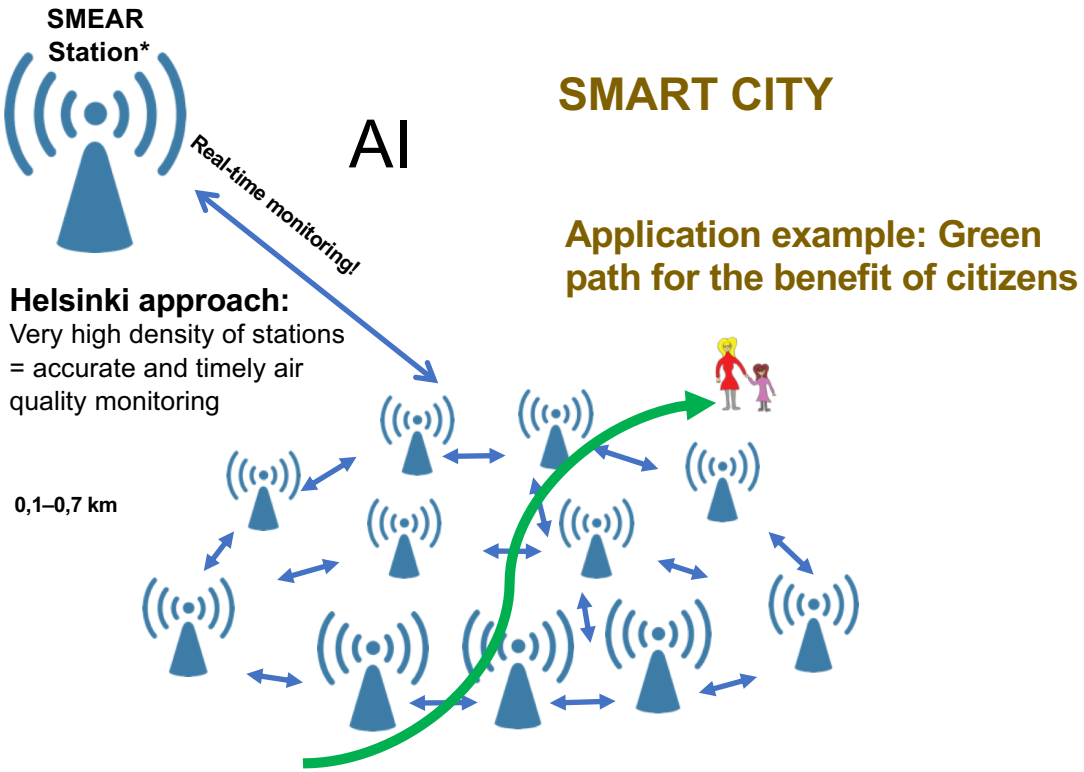
HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

HIGH DENSITY OF MEASUREMENT STATIONS & AUTOMATICALLY CALIBRATED SENSORS PROVIDING REAL-TIME MEASUREMENT DATA

- Low cost mini- & micro-sensors and base stations across the environment supported by 4G NB-IOT network leading to a viable 5G service
- Field calibration by highly accurate atmospheric science SMEAR Station

Enables multiple applications:

- City planning, health and wellbeing, wearable and fitness devices, vehicular technology, mobile apps, HD-maps
- High quality maps and calibration technique that takes into account correlations across environments.



Monitoring stations in urban and rural areas. Multiple ways to use sensors.

SMEAR* = Station for Measuring Earth Surface-Atmosphere Relations (SMEAR)
https://www.atm.helsinki.fi/SMEAR/

Air quality research in Beijing: Lab construction and facilities

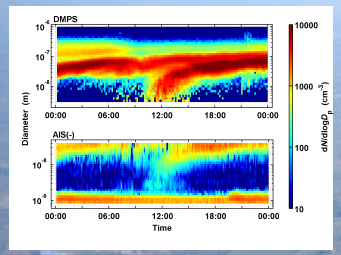
- May 2017, the lab was a chemistry lab for education;

Lab construction and facilities

- May 2017, the lab was a chemistry lab for education;
- Nov 2017, the lab was demolished for refurbishment

Lab construction and facilities

- May 2017, the lab was a chemistry lab for education;
- Nov 2017, the lab was destructed for refurbishment
- Feb 2018, the lab is well equipped with start-of-the-art instruments



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**

SMEAR II station
(boreal) 1995 -

Contact:
Prof. Tuukka Petäjä, University of Helsinki
tuukka.petaja@helsinki.fi
+358 50 41 55 278

Vipuvoimaa EU:lta 2014–2020

Euroopan unioni
Euroopan aluekehitysrahasto

Support from Academy of Finland, European Commission, Regional Council of Lapland, Helsinki-Uusimaa Regional Council, and Business Finland are gratefully acknowledged.