SMEAR = STATION FOR MEASURING ECOSYSTEM-ATMOSPHERE RELATIONS

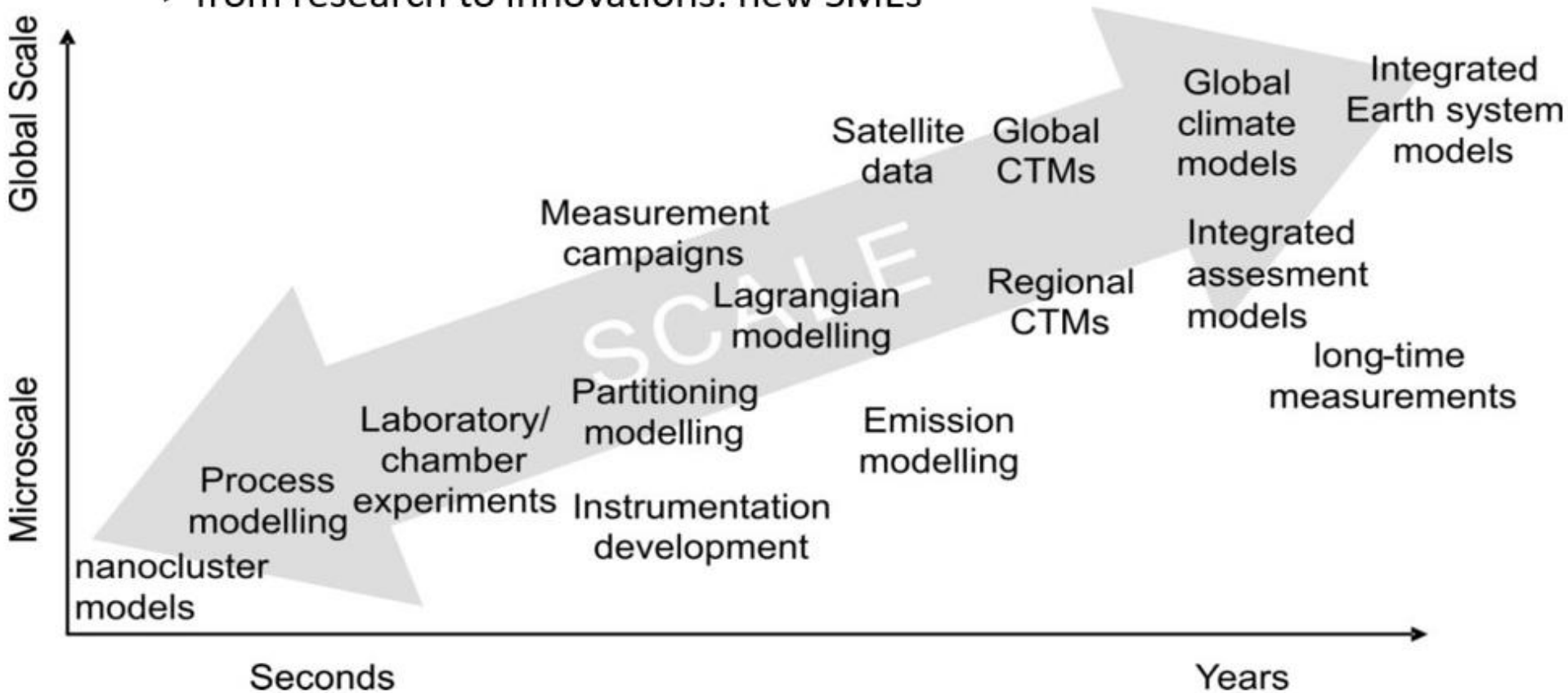
https://www.atm.helsinki.fi/SMEAR/

GLOBAL CHALLENGE

HUMANITY FACES A MULTITUDE OF SEVERE GLOBAL ENVIRONMENTAL CHANGES SUCH AS CLIMATE CHANGE, AIR POLLUTION AND DISTURBANCES TO FOOD AND WATER SUPPLIES. THESE GRAND CHALLENGES ARE INCREASINGLY SEVERE AND WILL NOT WAIT LONG FOR SOLUTIONS.

Grand Challenges:
Multi-scale way to answer

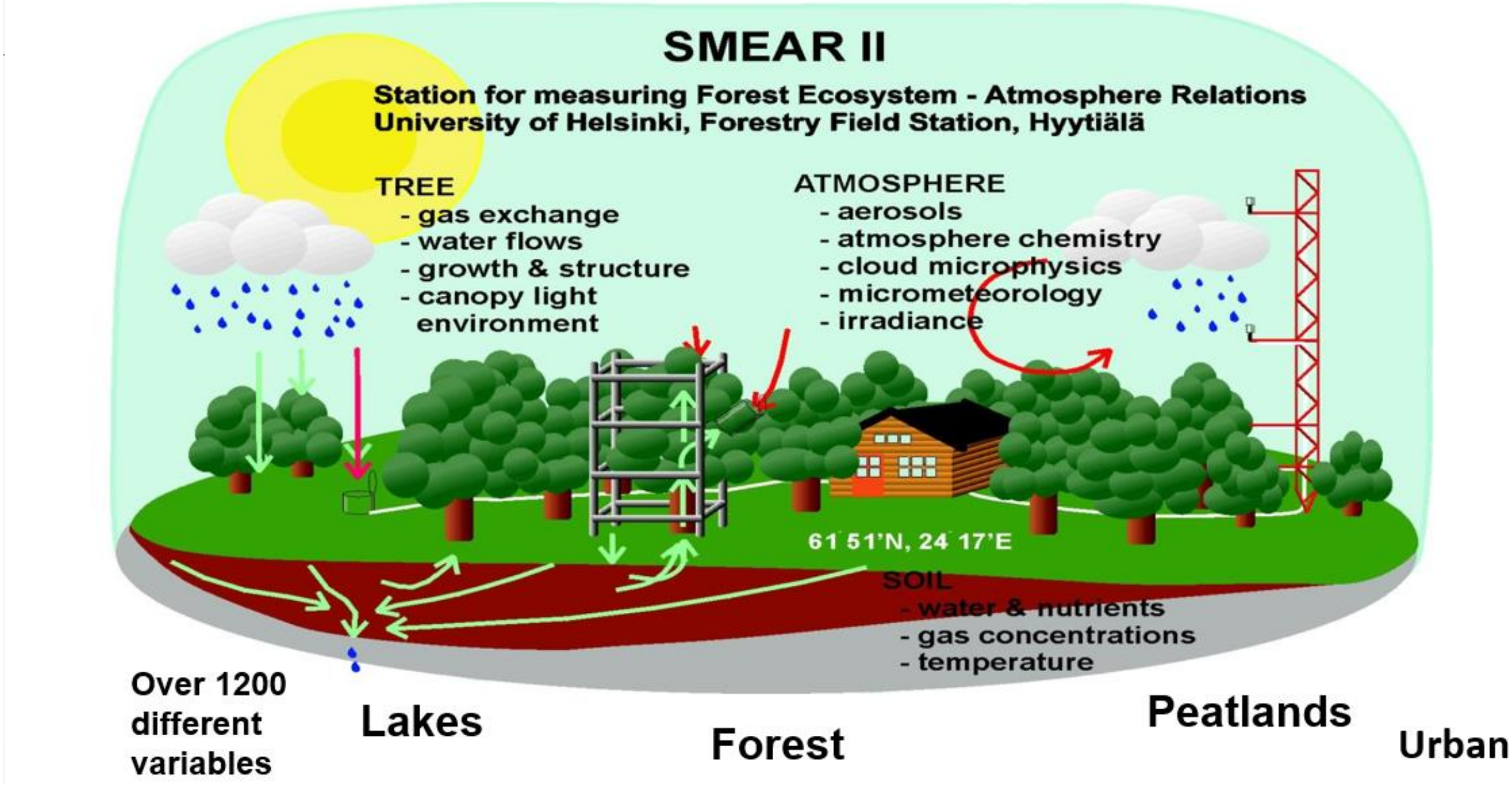
- ✓ clear and ambitious vision
- ✓ empirical and experimental (laboratory, field, instrument developing...)
- ✓ theoretical (basic theories, simulations, model development..)
- ✓ multidisciplinary (physics, chemistry, biology, meteorology, etc)
- ✓ from research to innovations: new SMEs



SMEAR CONCEPT

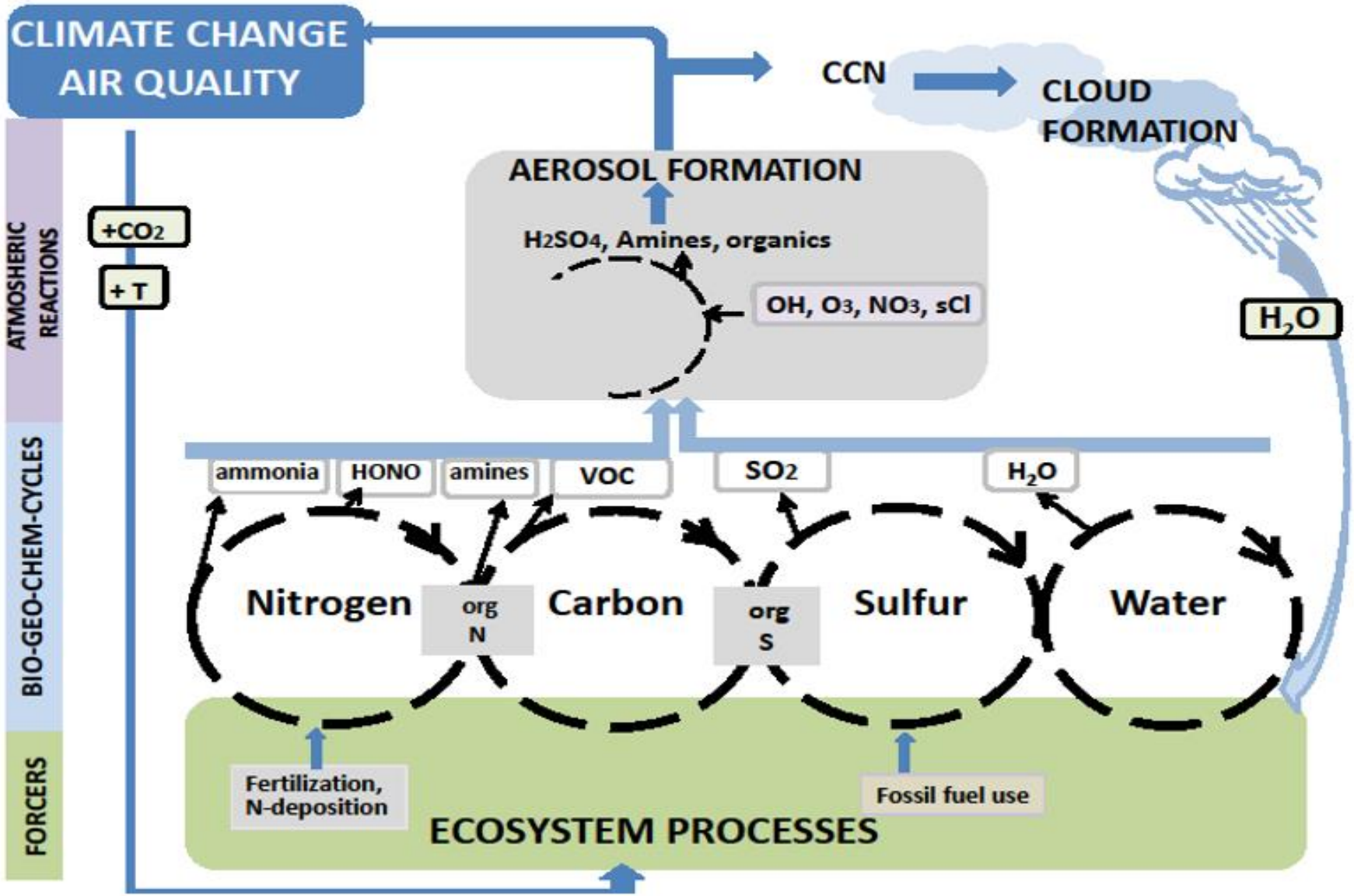
Comprehensive, continuous observation

- Atmosphere – Earth Surface – Biosphere
  - Forest, lakes, peatland, urban
  - Concentrations, fluxes, processes
    - 130m tower in Hyytiälä
  - Feedbacks
- Measurements (observations / experiments):
  - **Meteorology:** temperature, humidity, wind, precipitation, radiation
  - **Atmospheric composition + fluxes:** aerosols, clouds, atmospheric chemistry, greenhouse gases
  - **Ecosystems:** photosyntesis, soil dynamics
- In-situ observations, ground base remote sensing
- Open access, open data, data flows
- Contributions to several European Strategy Forum for Research Infrastructures (ESFRI)
- Crucial component in: ICOS, ACTRIS, LTER/ANAEE



HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

INTERLINKED PROCESSES AND FEEDBACKS



DEVELOPER OF SMEAR

Academician Markku Kulmala
Academy Professor, Academy of Finland
Director of INAR Institute, University of Helsinki
Foreign Academician / Member of CAS
Citation over 40000, H-index =101
ISI No. 1 Citation in Geoscience (Since 2011)

GLOBAL SMEAR NETWORK

- Development and use of observations around the world, currently in Finland, Estonia, Russia, China, South Africa
- Flag-ship stations monitor all aspects of land-atmosphere interactions
- Similar hierarchy and flag-ship stations should be deployed in all ecosystems to observe the atmospheric, terrestial, hydrospheric, cryospheric, marine, and urban components of the Earth
- Together they can form a world-class integrated network of research infrastructures

INTEGRATED APPROACH:
THE GLOBAL EARTH OBSERVATORY / GLOBAL SMEAR

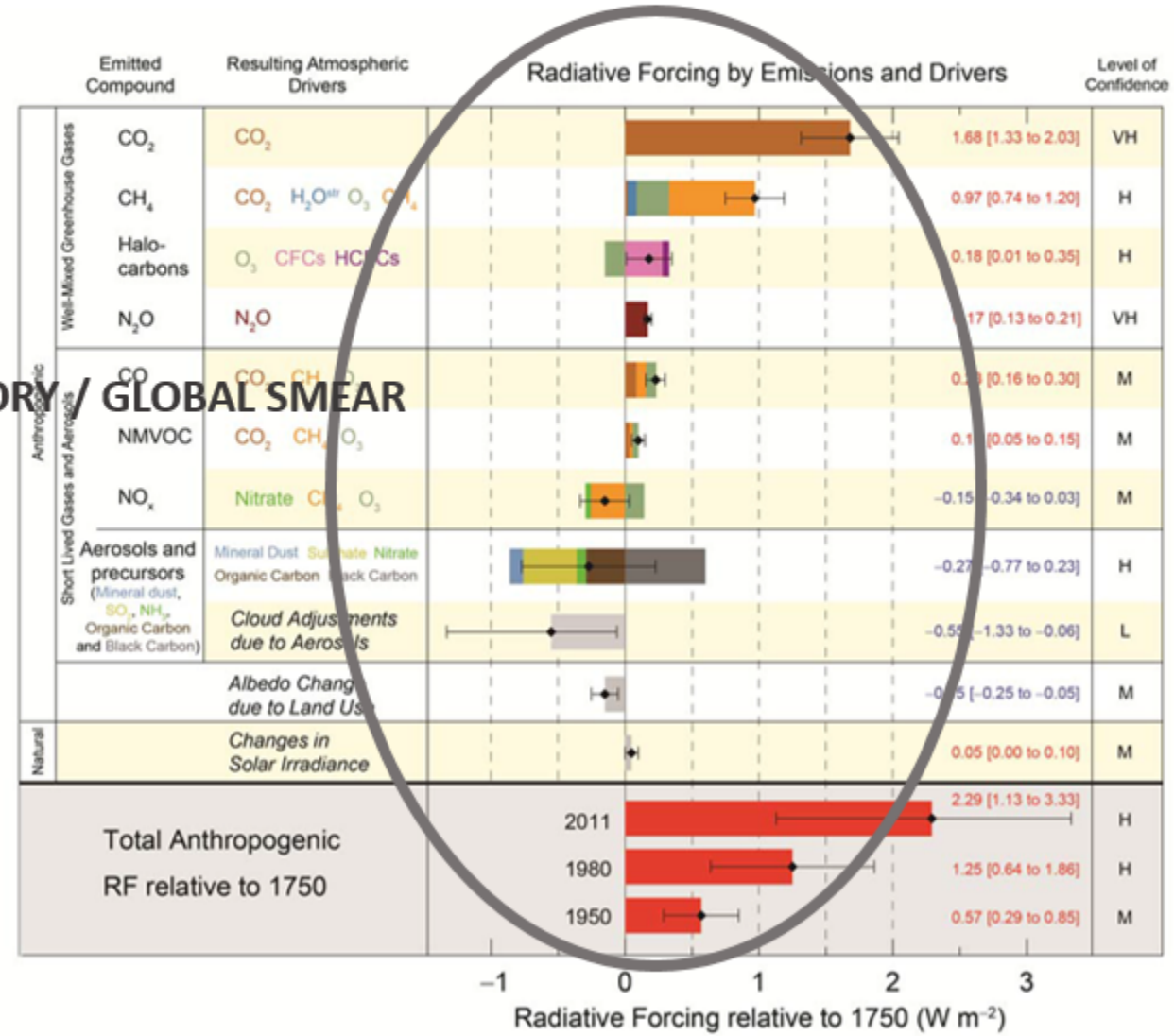
Current observations (see IPCC 2013) are fragmented:

1) Greenhouse gases
2) Aerosols
3) Air quality
4) Ecosystems
5) Climate
6) …

Future aspiration: **Integrated approach**

- **To understand feedbacks**
- **To reduce uncertainties**
- **To mitigate and adapt effectively**

INTEGRATED APPROACH:
THE GLOBAL EARTH OBSERVATORY / GLOBAL SMEAR



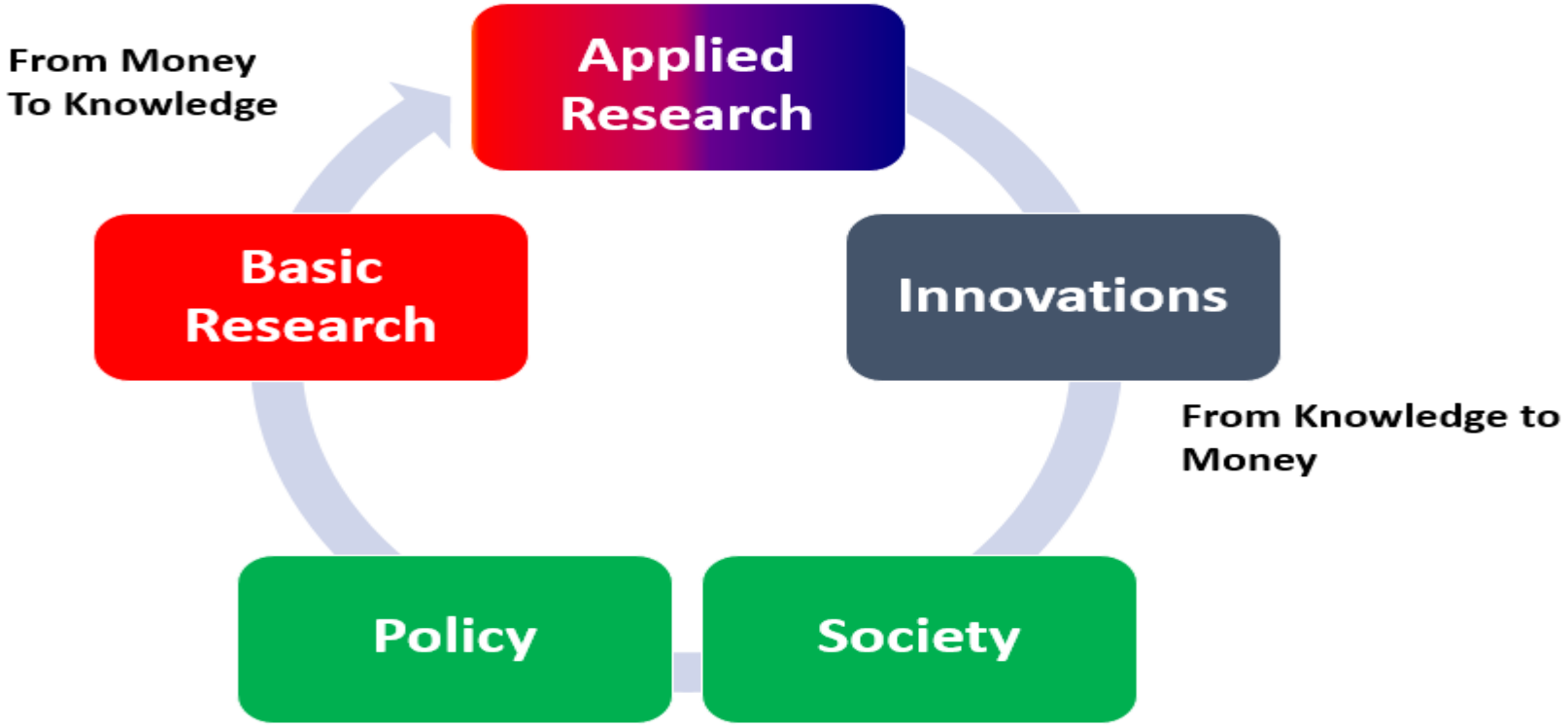
THE GLOBAL DREAM

A network of measuring stations meeting the SMEAR standards and extending from Russia to the Amazon and Africa will produce globally comprehensive and coherent data.

Politicians will receive up-to-date information on the progression of climate change as well as locally relevant information on, e.g., variation in air quality.

Our understanding of climate change feedback will increase. By constructing a network of compatible measuring stations, the impact of climate research will reach a whole new level.

SCIENCE TO SOCIETY



SMEAR PILOTS MEGASENSE: INTELLIGENT AIR QUALITY MONITORING. ENVIRONMENTAL SENSING BASED ON SMEAR

We do not understand the effects of air chemistry on our health.
Measurement of PM 2.5 is a good start but we need more. We need SMEAR.
The finest particles and gases are the deadliest, and these are not measured
MegaSense can provide affordable micro-sensoring based on series of high level scientific air quality measurement

MEGASENSE IN A NUTSHELL