

How is the Arctic changing
because of climate change?
An overview on the main global
consequences and connections

Academy Professor

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Background: Scope of Global Grand Challenges

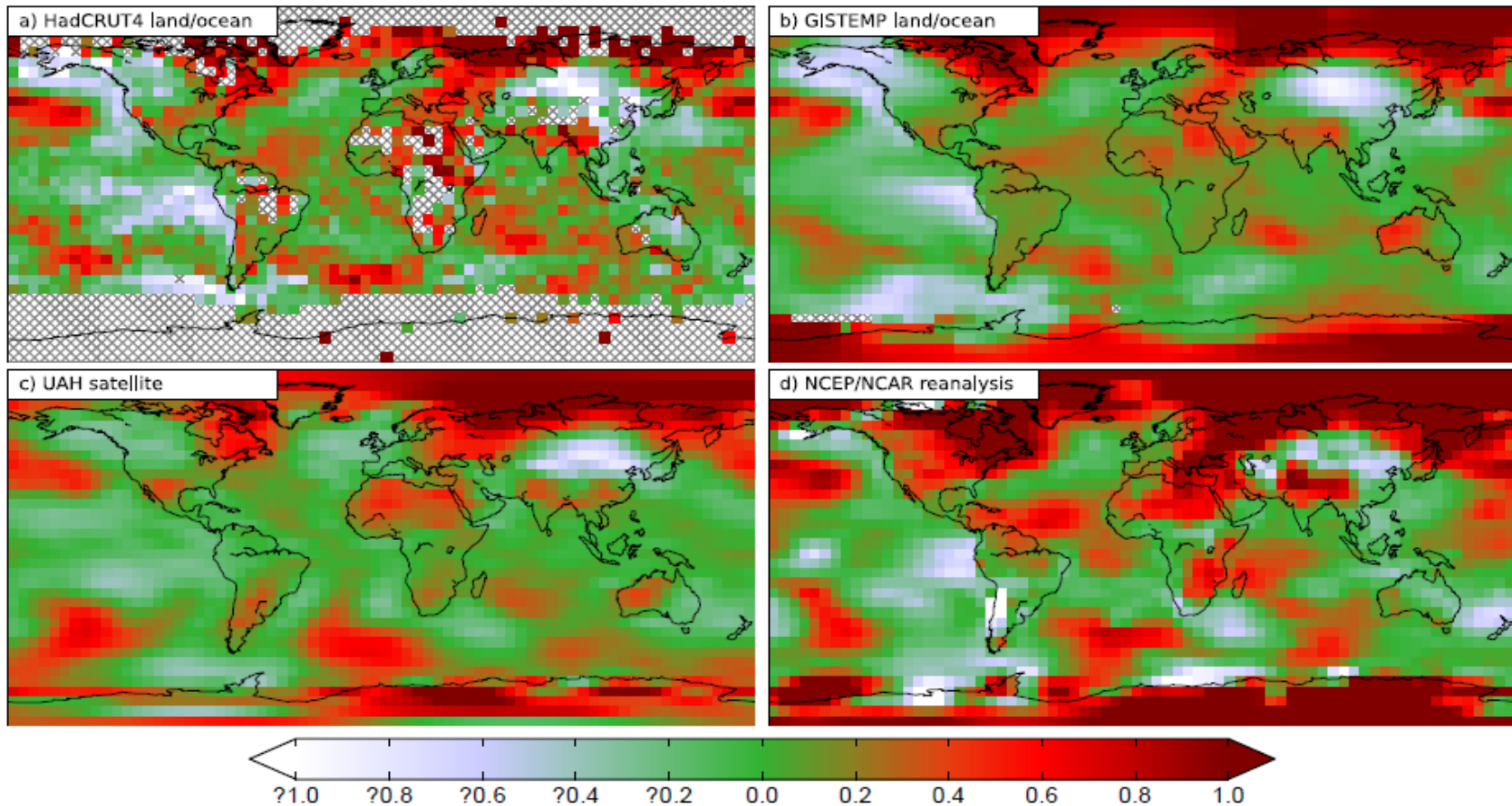


Background:

The Arctic is warming faster than any other place

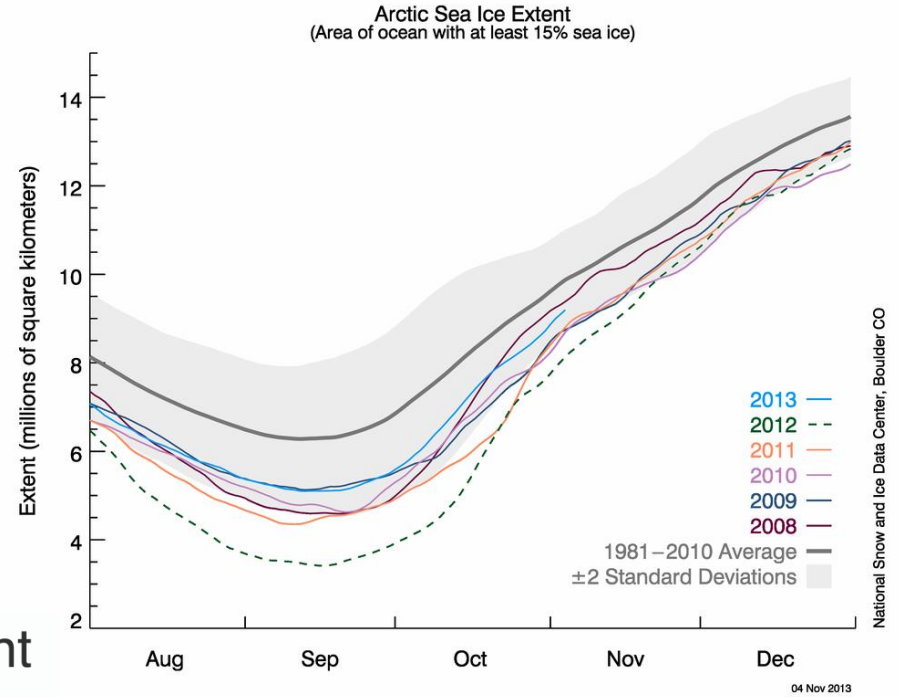
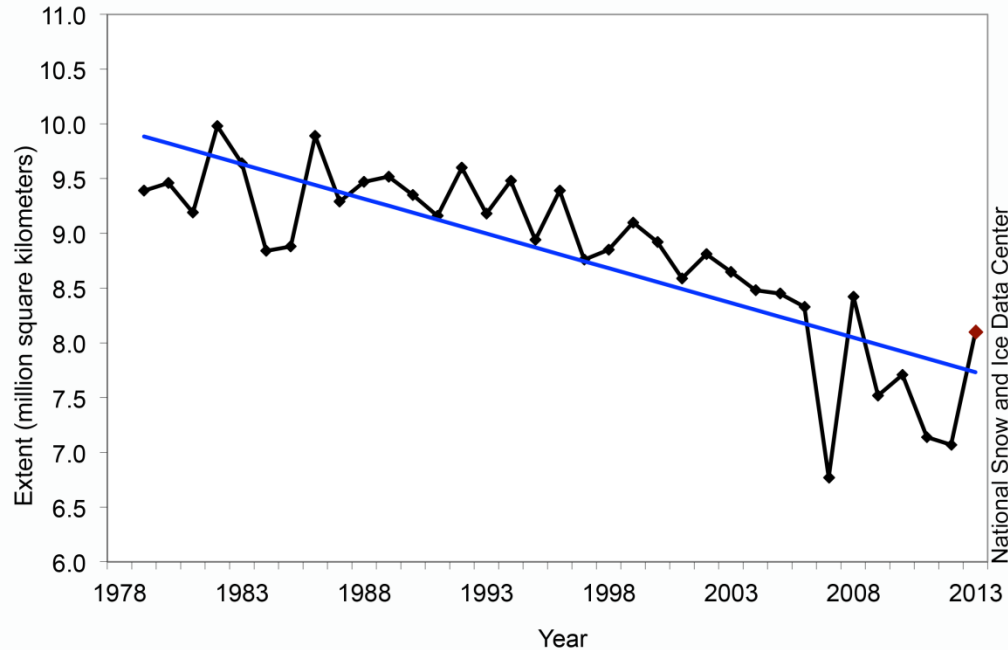
Underestimate of Arctic warming can probably explain artificial "pause" of global warming (Cowtan and Way, 2013)

Trend in deg/decade over the last 16 years

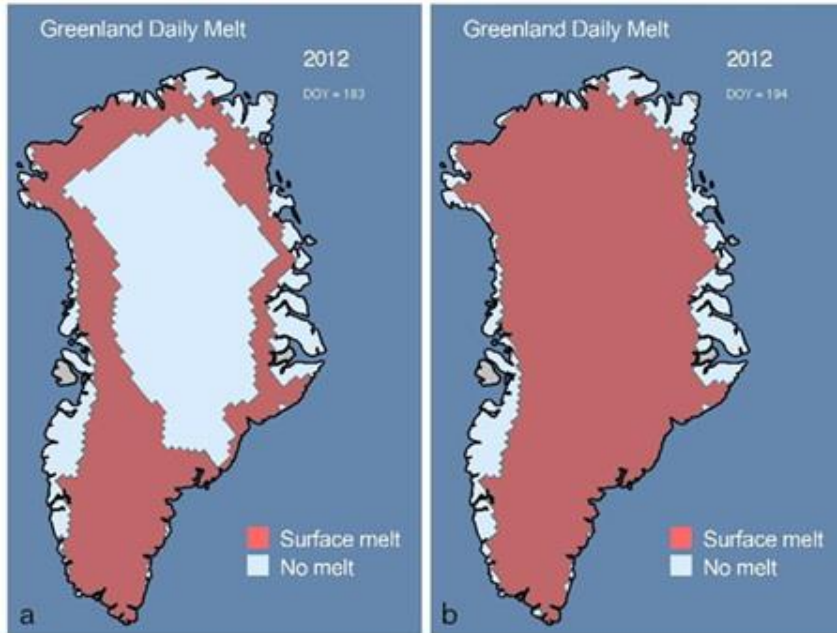


Sea ice loss

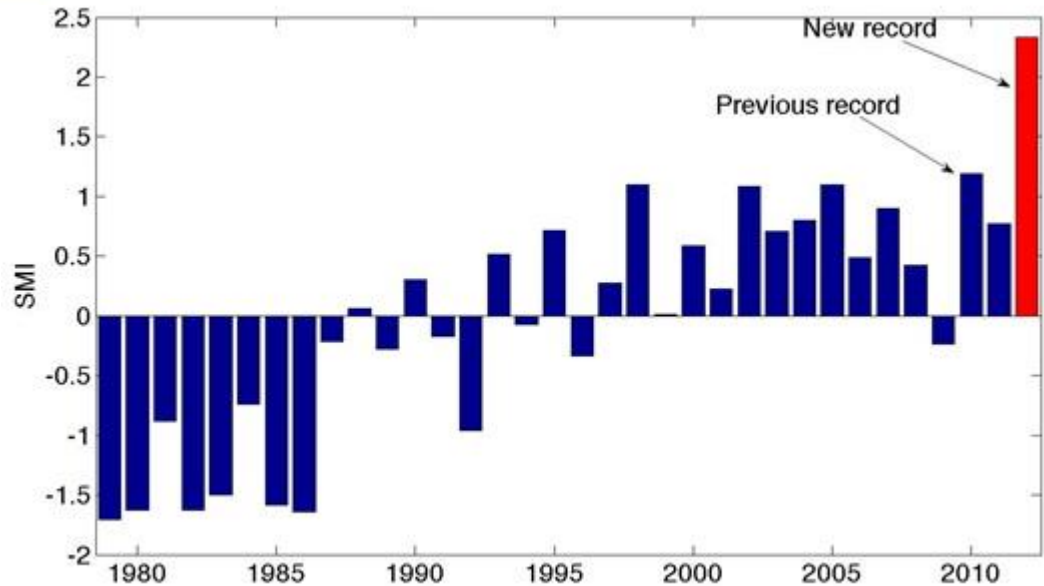
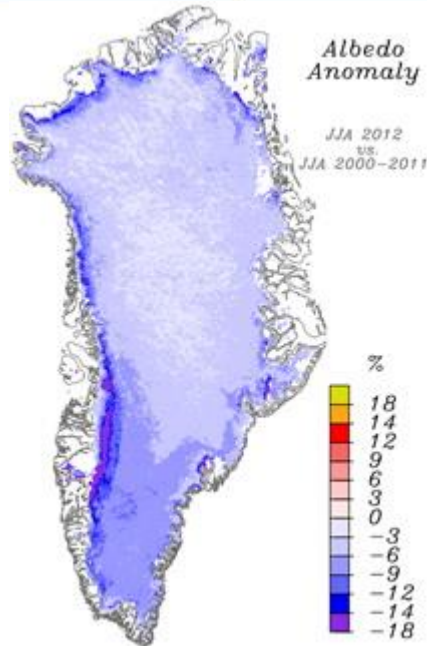
Average Monthly Arctic Sea Ice Extent October 1979 - 2013



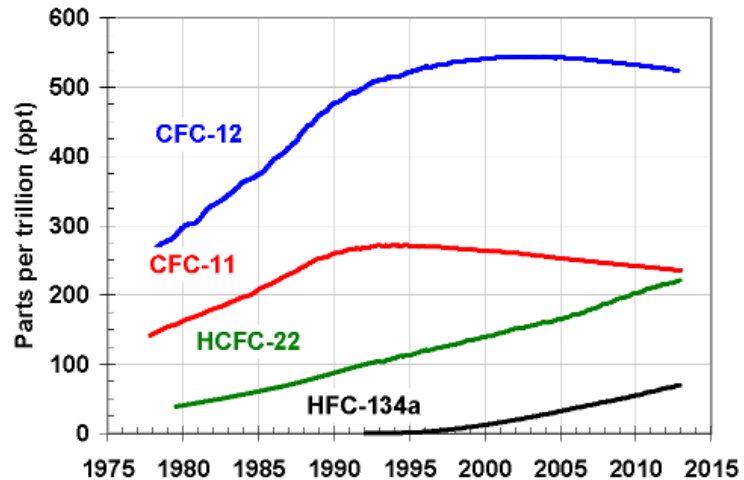
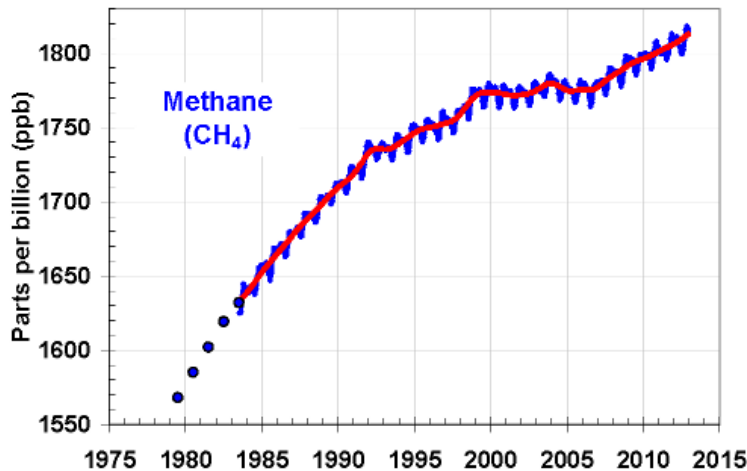
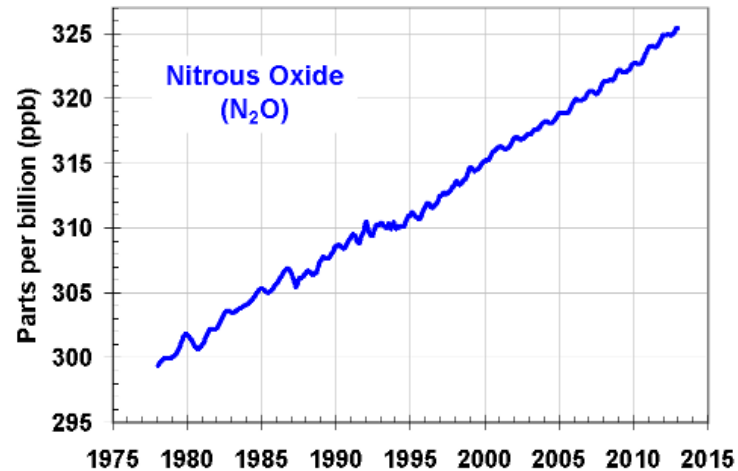
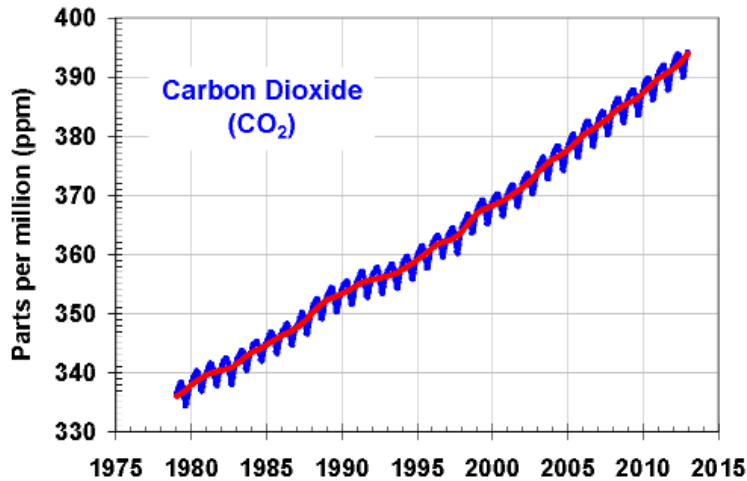
Ice sheet stability



Greenland melt index:
area-weighted number of days with melting



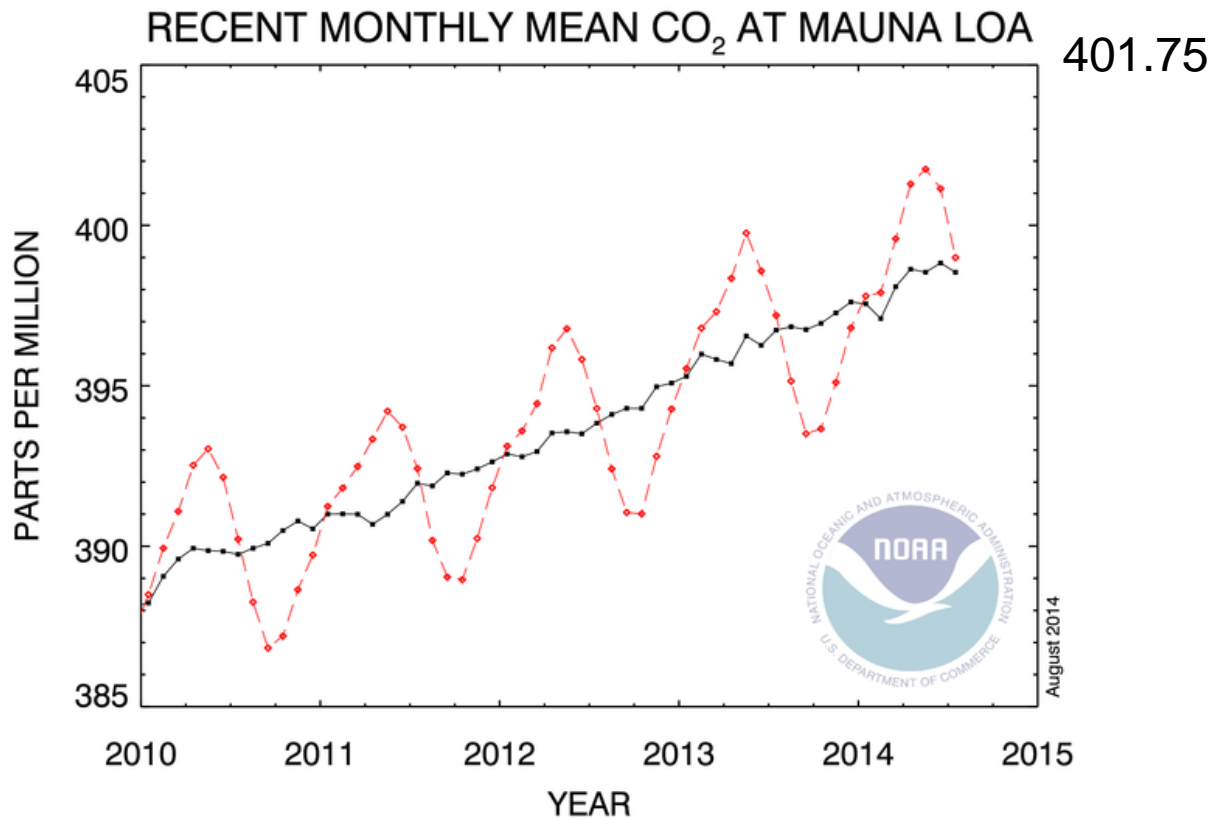
Increasing Greenhouse Gas Concentrations



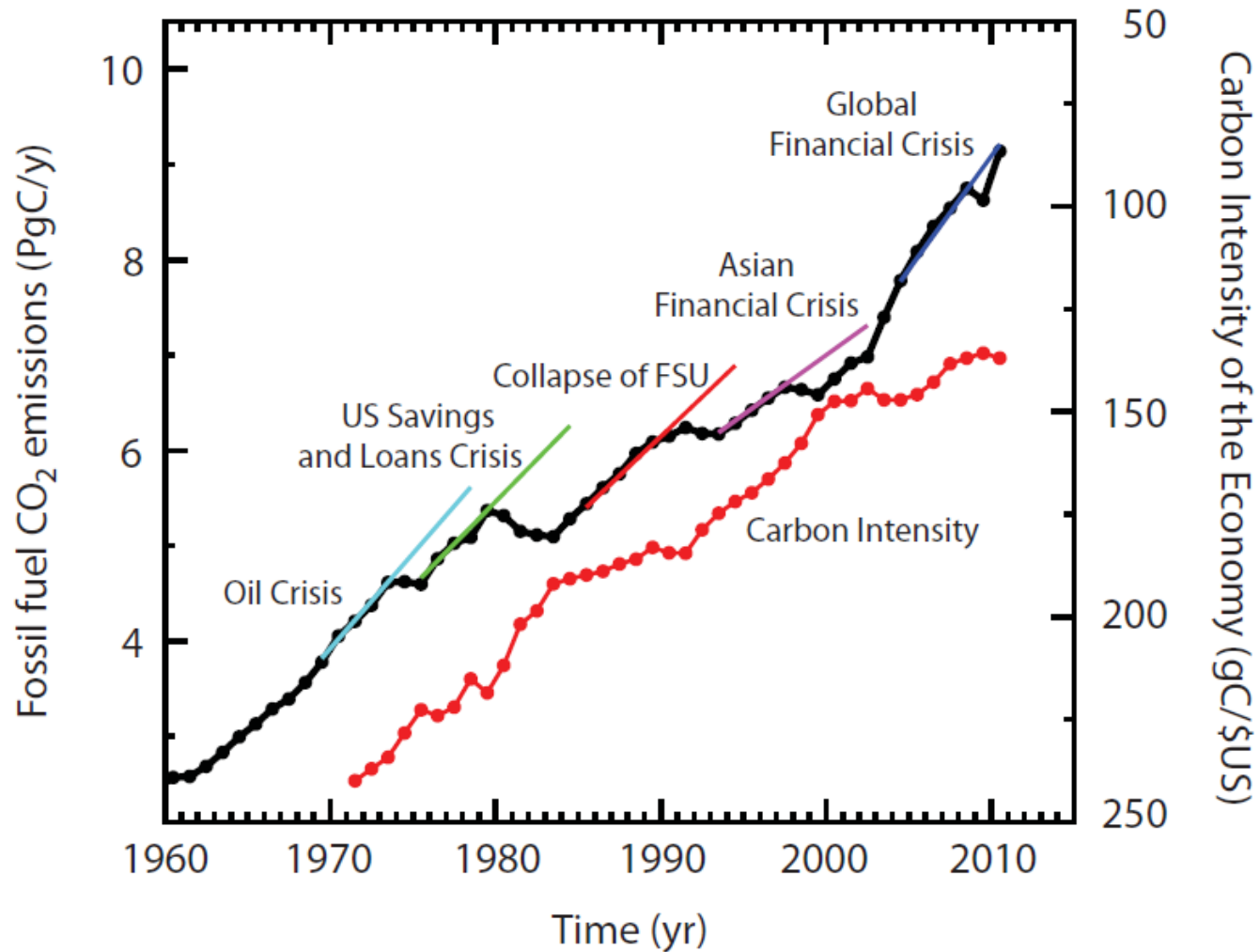
Boreal forests and woodlands store 30% of world's terrestrial carbon; possibly highly sensitive to warming, leading to feedback



Recent monthly mean CO₂ at Mauna Loa



Impacts of Economic Crises on C Emissions



BASELINE

“THE NORTHERN REGIONS (> 45°N) WILL UNDERGO SUBSTANTIAL CHANGES DURING THE NEXT 40 YEARS ” ref. L. Smith 2010

NORTHERN PAN-EURASIAN REGION

VERY IMPORTANT AREA

Crucial for global climate

Arctic, boreal

Albedo change

Carbon sink or source

Methane

Aerosol production
via BVOCs

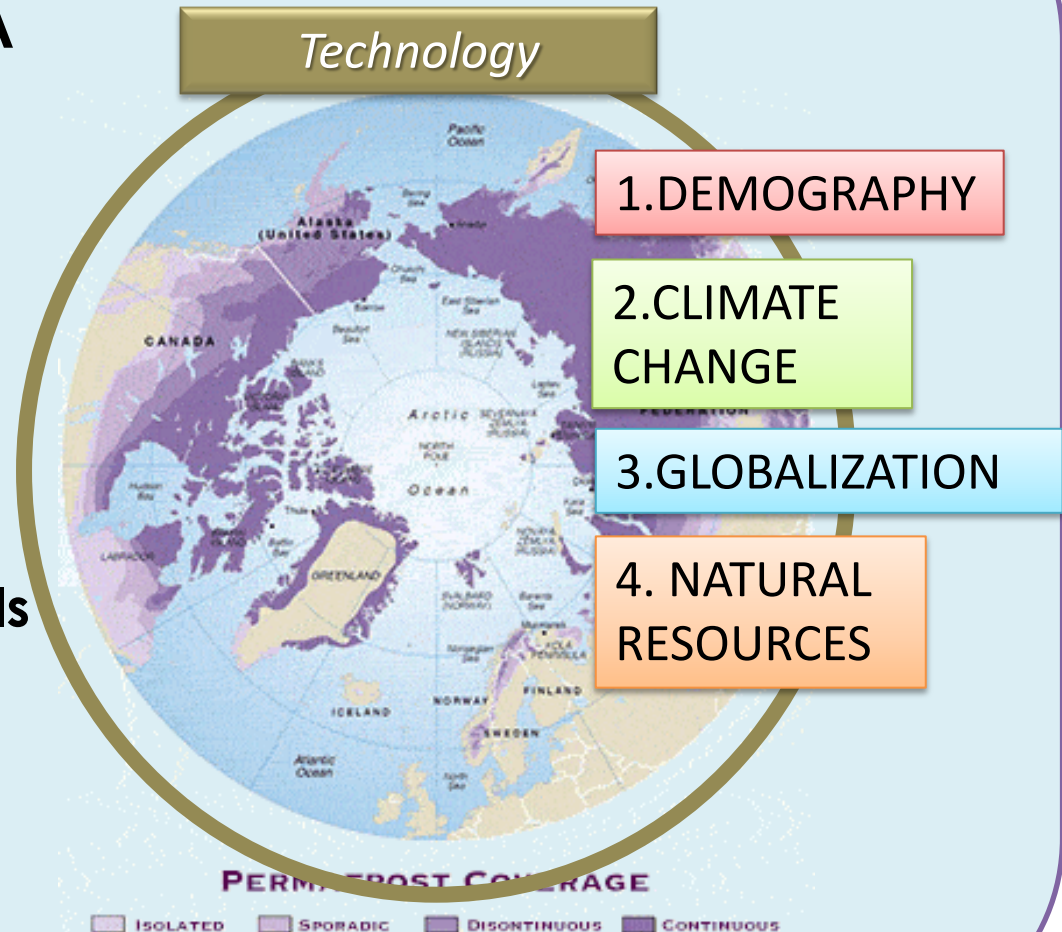
Air quality

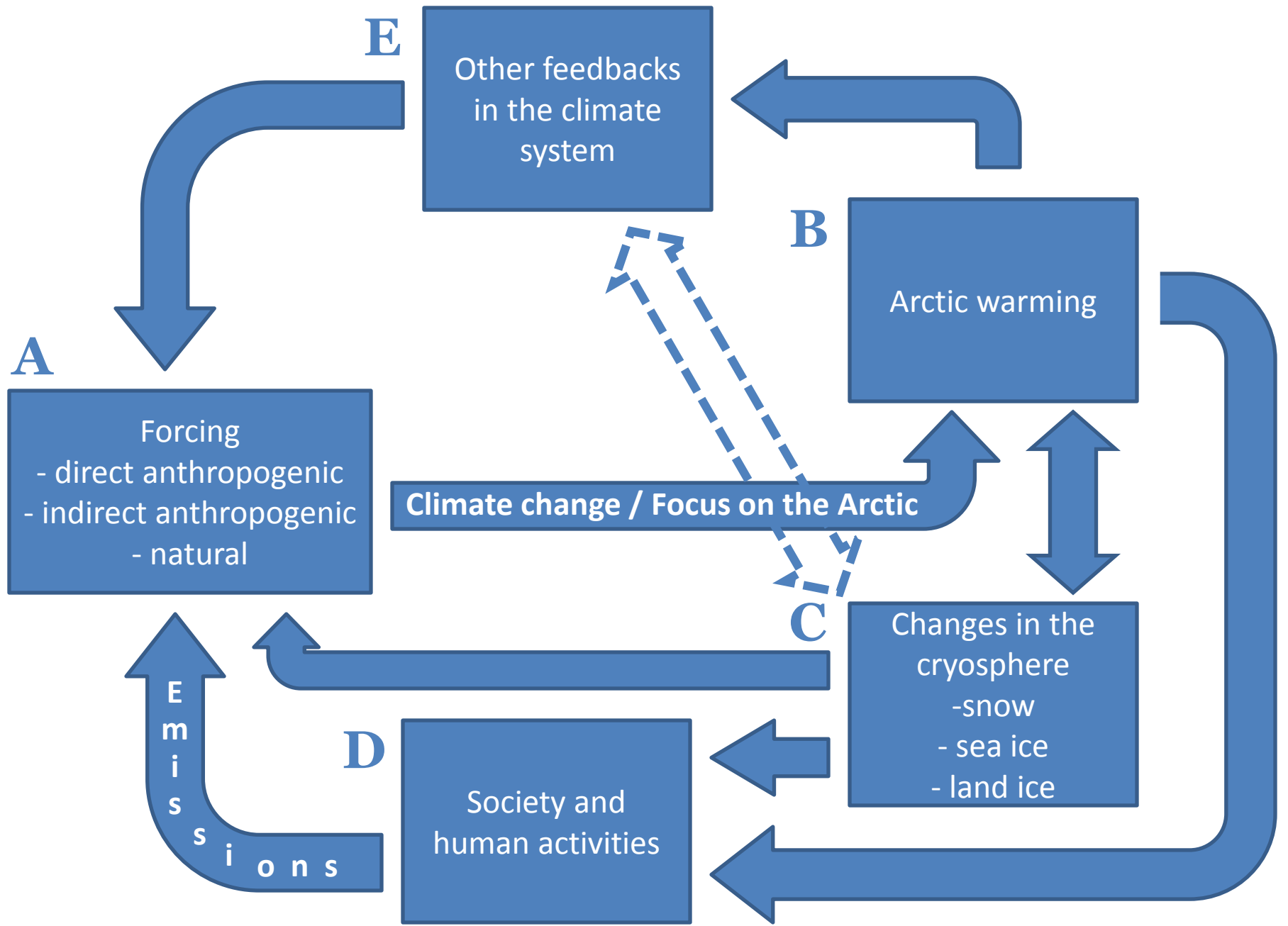
Energy production, minerals

Permafrost

Arctic Ocean

Socioetal issues

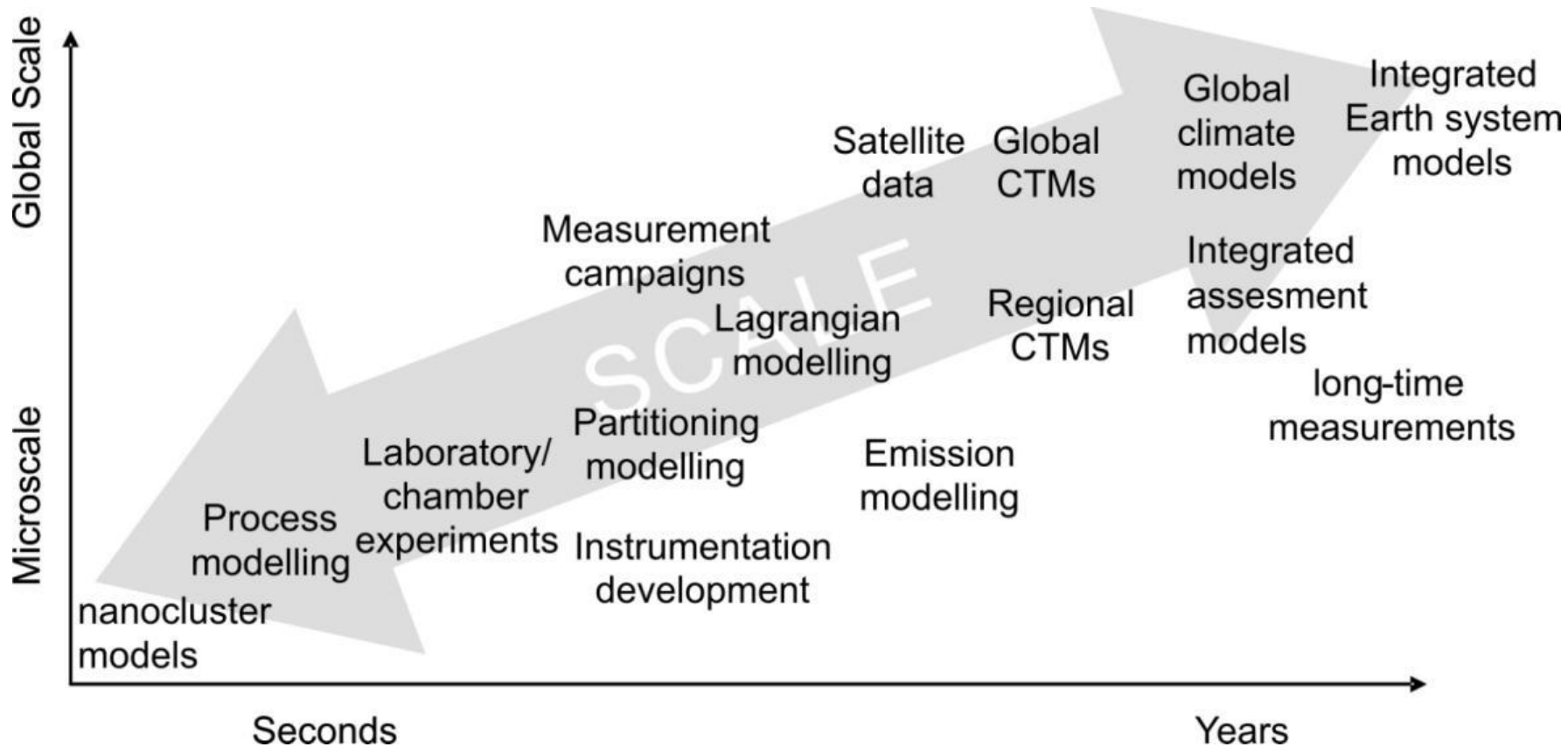




CRAICC feedback loop

Grand Challenges: Multiscale 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



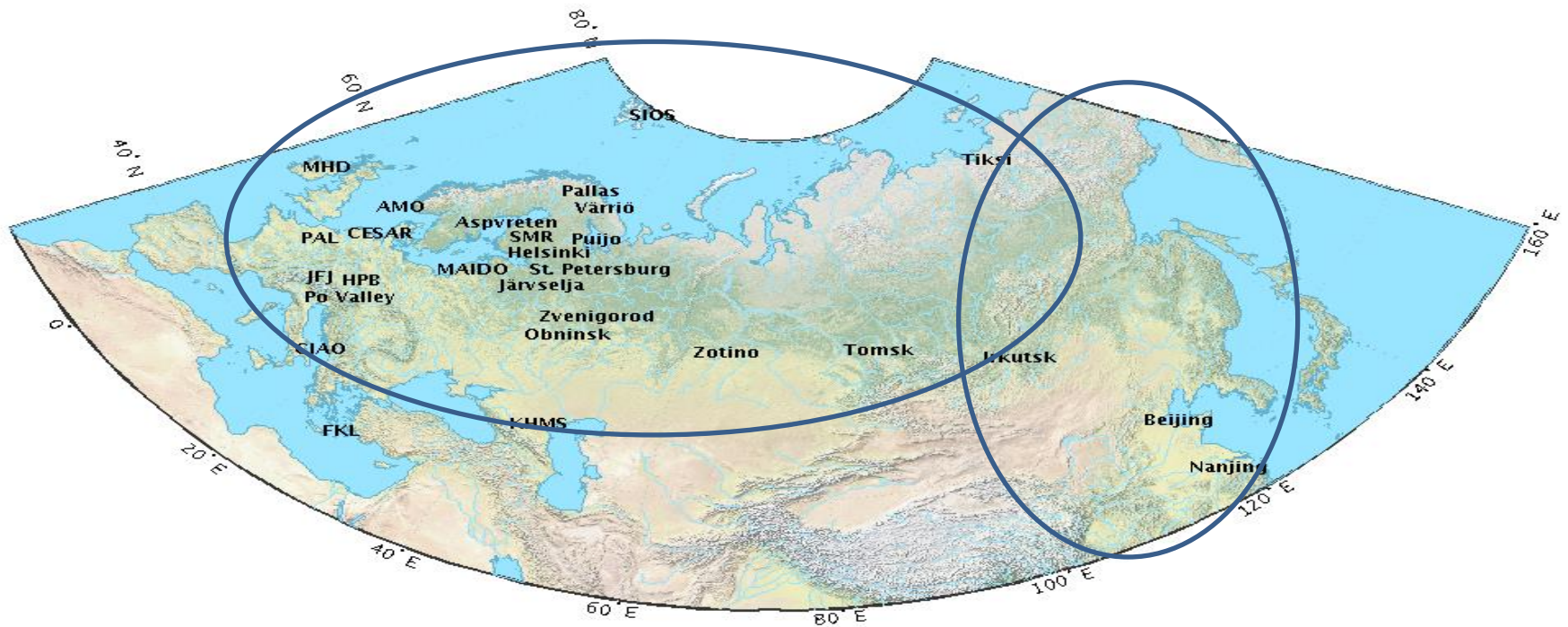


CRAICC field stations



1. Troll station, Antarctica
2. Vavihill, Sweden
3. Birkenes, Norway
4. Lille Valby, Denmark
5. Vindeby, Denmark
6. Sorø, Denmark
7. Aspveten, Sweden
8. SMEAR III, Finland
9. SMEAR II, Finland
10. SMEAR IV, Finland
11. Sodankylä, Finland
12. SMEAR I, Värriö, Finland
13. Abisko, Sweden
14. Reykjavik
15. Tiksi, Siberia
16. Kuopio, Finland
17. Aboa, Antarctica
18. Station Nord, Greenland
19. Ny-Ålesund, Spitzbergen
20. Pallas GAW station, Finland
21. Daneborg and Zackenberg, Greenland

PEEX (Pan Eurasian Experiment) 2013 - 2033 (-2100)



Station network, Marine, Airborne, remote sensing, multiscale modelling, Supradisciplinary

Tool to solve: PEEEX

