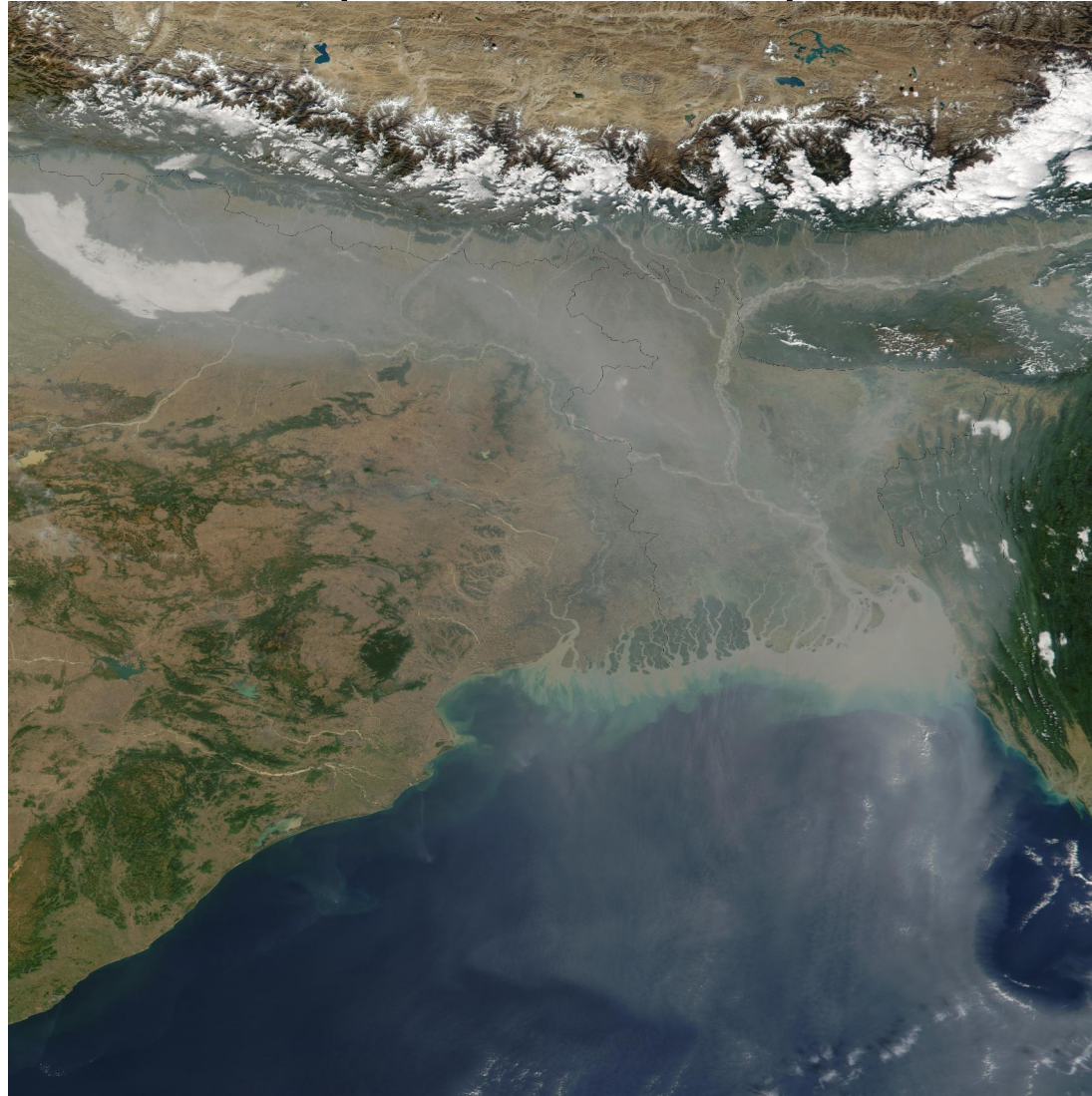


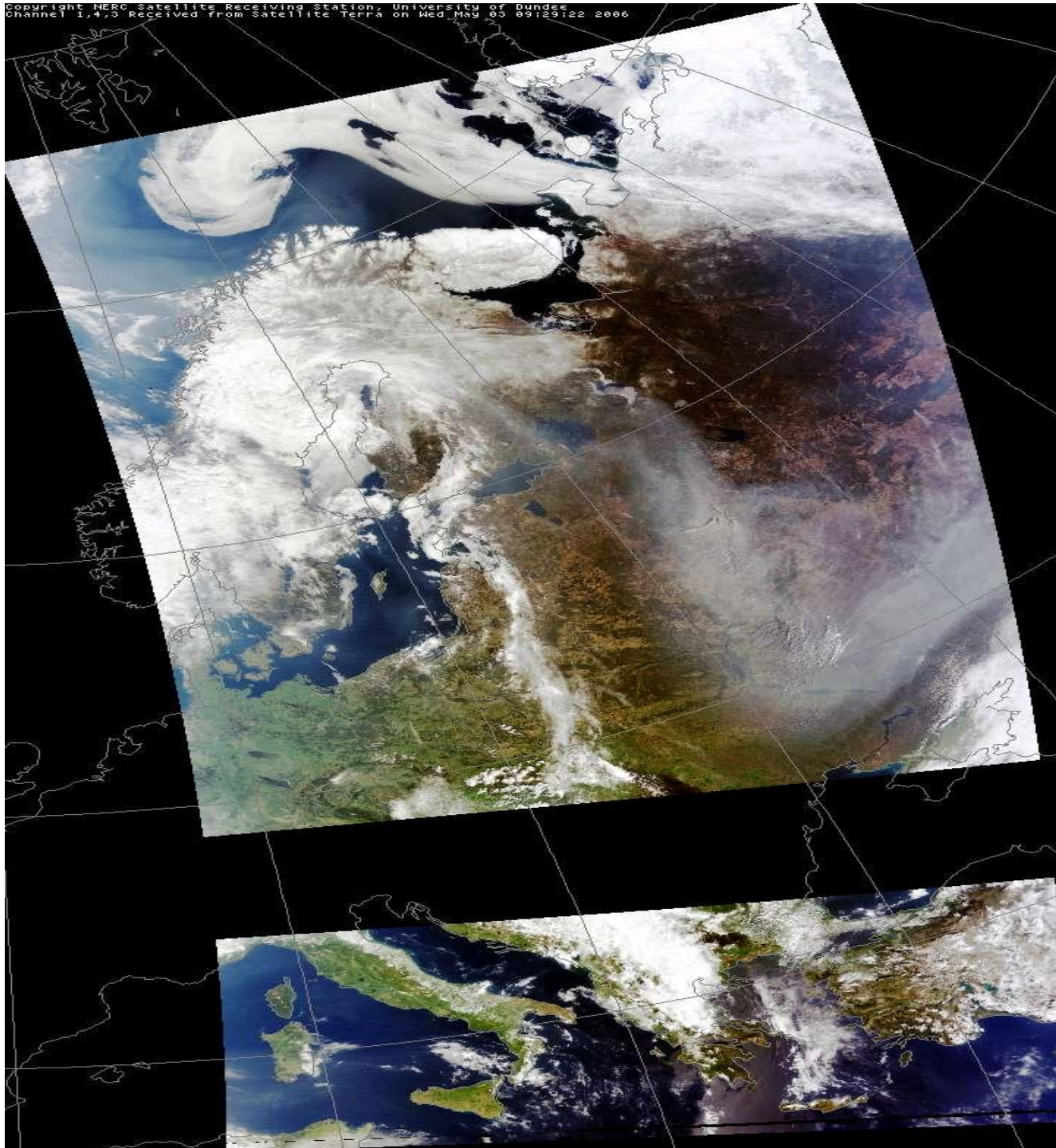
# Experiences from Nordic Centre of Excellence and associated graduate school

Markku Kulmala  
University of Helsinki  
Department of Physical Sciences  
Division of Atmospheric Sciences  
and  
BACCI and CBACCI

# Atmospheric Brown Cloud (Pollution)

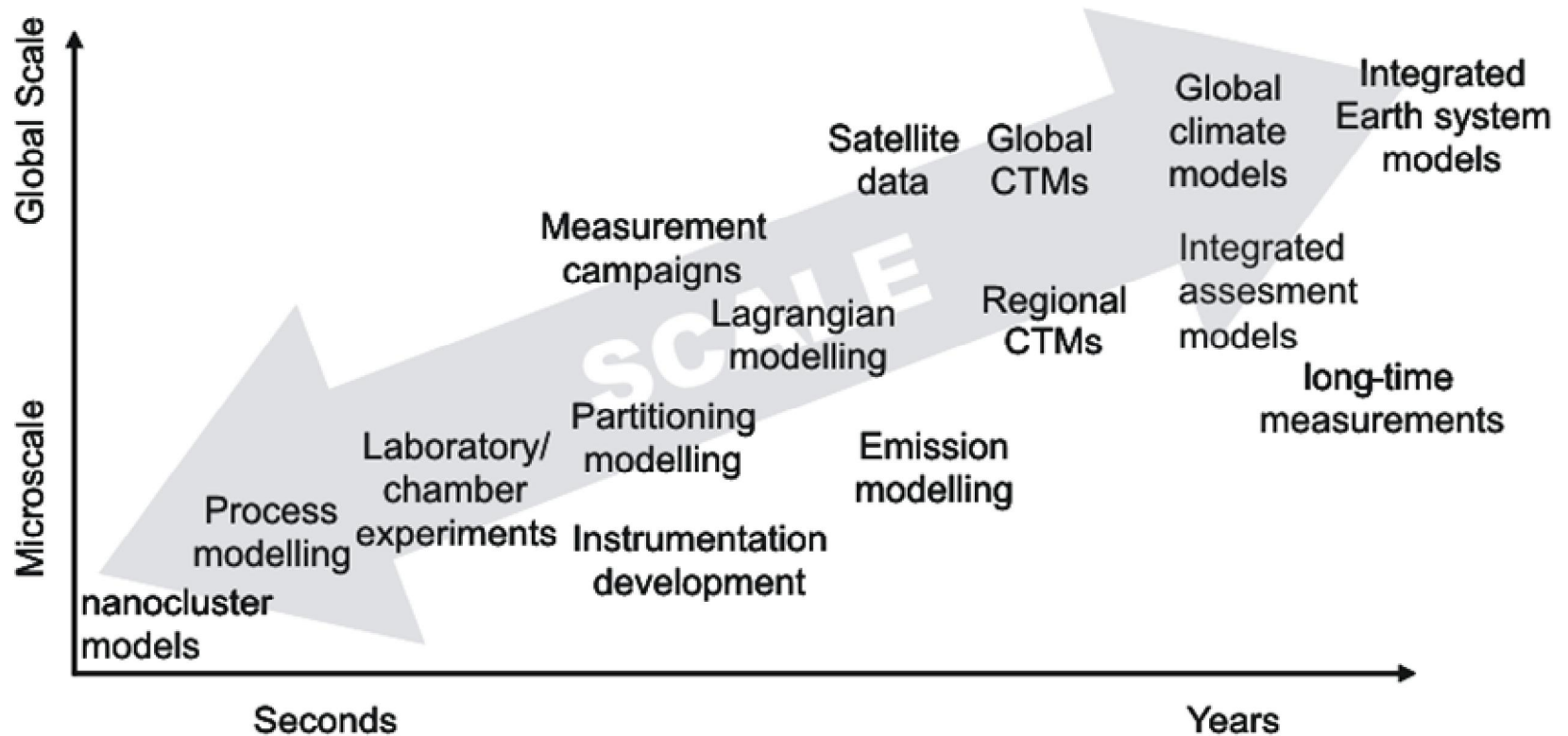


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Channel 1,4,3 Received from Satellite Terra on Wed May 03 09:29:22 2006



MODIS  
3.5.2006 09:29  
<http://www.sat.dundee.ac.uk/>

# Ambition



# Graduate School/CBACCI (Carbon-BACCI)

- The Graduate School consists of two Nordic Centres of Excellence:
  - NECC - Nordic Centre for Studies of Ecosystem Carbon Exchange and its Interactions with the Climate System
  - **BACCI – Biosphere-Aerosol-Cloud-Climate Interactions**
- Partners (in total 25) from
  - all five nordic countries, all BACCI and NECC partners
  - Baltic countries (Estonia, Lithuania)
  - Western Russia
- Open access

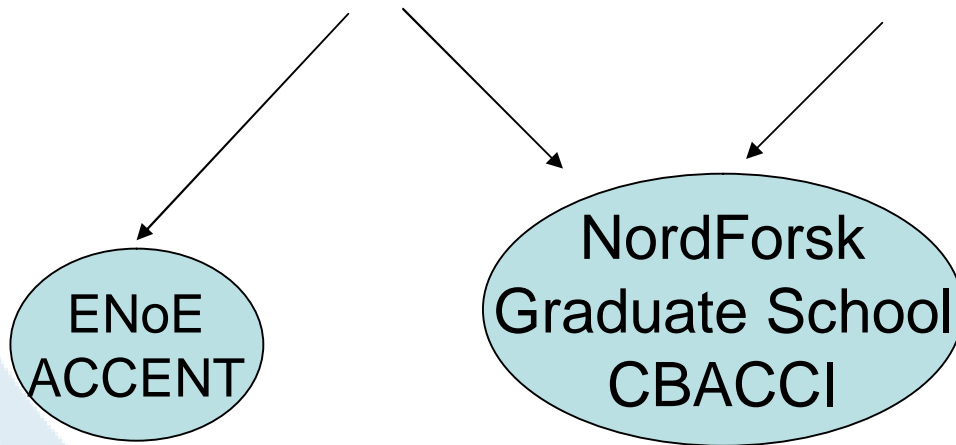
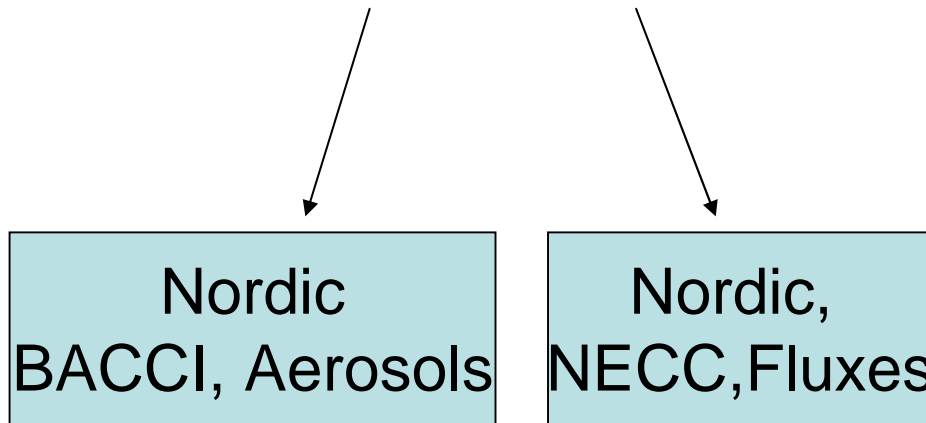
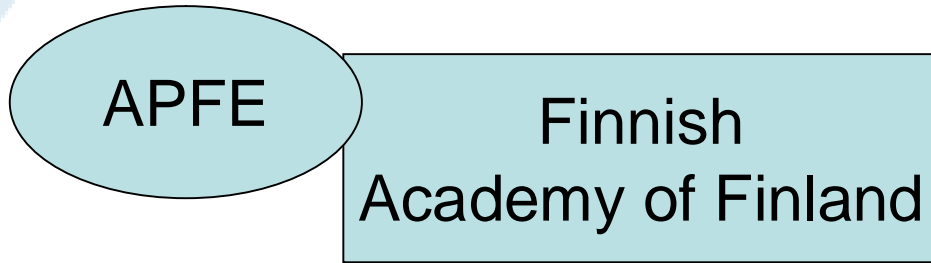
# CBACCI Education Structure

- International Master Program
  - Bologna requirements
  - Product of CBACCI
- International Ph.D. Program
  - core of CBACCI
  - future needs
- Post docs and teachers
  - Significant for scientific development

# Activities based on CoE

- BACCI and NECC (NCoEs)
- CBACCI (Nordic graduate school)
- iLEAPS/IGBP
- ABS (New Master Program)
- (EUSAAR)
- **EUCAARI**
  - European Integrated Project on Aerosol - Climate - Air Quality Interactions
  - 2007-2010; 48 partners

# Centers of Excellency



**EUCAARI, EUSAAR**

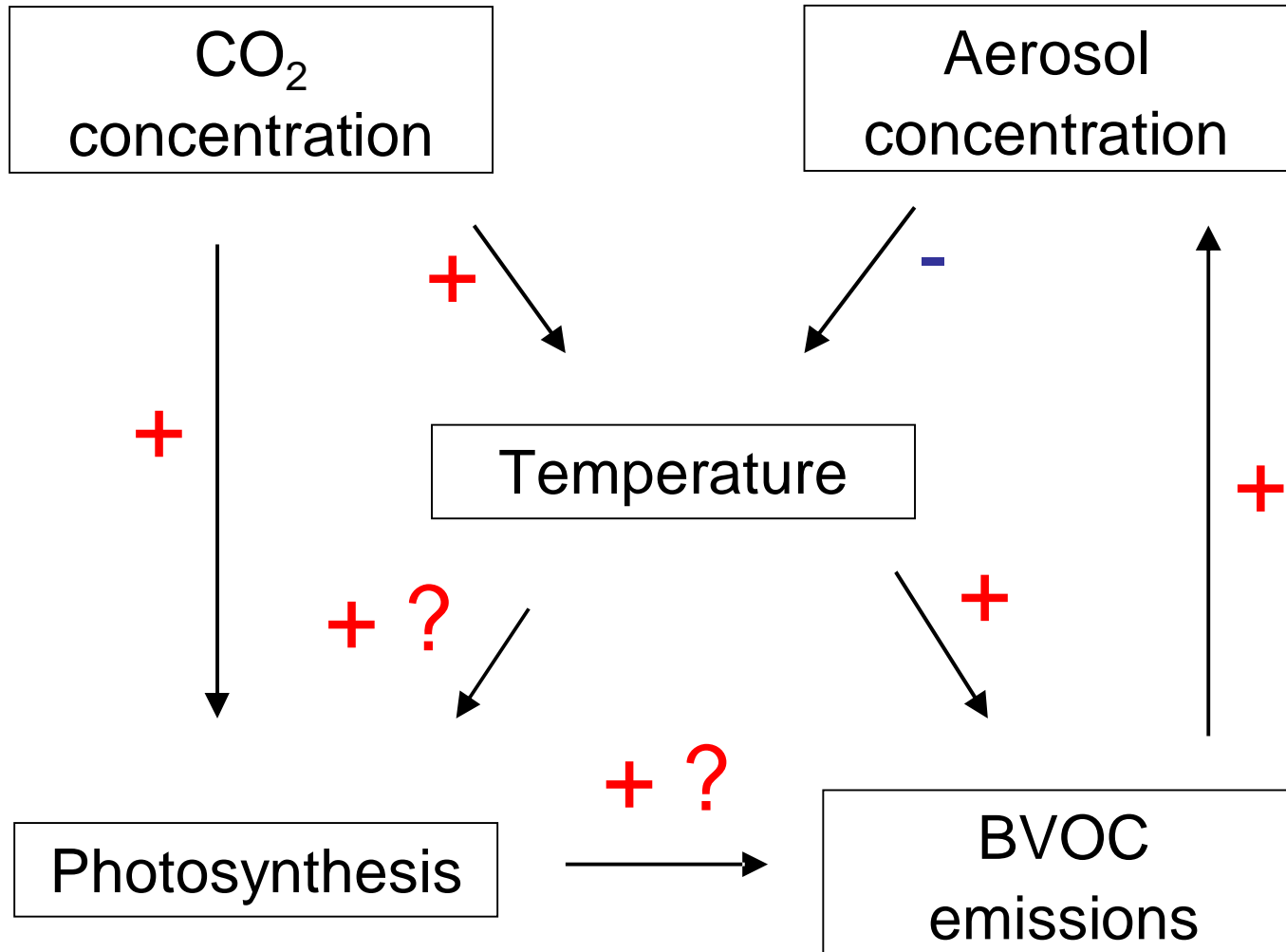
**CARBOEUROPE, NITROEUROPE**

**iLEAPS/  
IGBP**

# BACCI: Focus / Research Aims

- **formation and growth mechanisms of atmospheric aerosols, aerosol and air ion dynamics**
  - *Nature*, **404**, 66, 2000; *Science* **302**, 1000, 2003; *Science*, **307**, 698, 2005; *Science* **312**, 261, 2006
- **the effect of secondary biogenic aerosols on global aerosol load**
  - *Nature*, **416**, 497, 2002; *Nature*, **417**, 632, 2002; *Nature*, **433**, E13, 2005
- **aerosol-cloud-climate interaction**
  - *Nature* **388**, 336, 1997; *Science*, **292**, 2026, 2001.
- **the relationships between the atmosphere and different ecosystems, particularly Boreal Forest**
  - *Nature*, **404**, 861, 2000; *Nature*, **422**, 134, 2003, *Nature*, **437**, 529, 2005

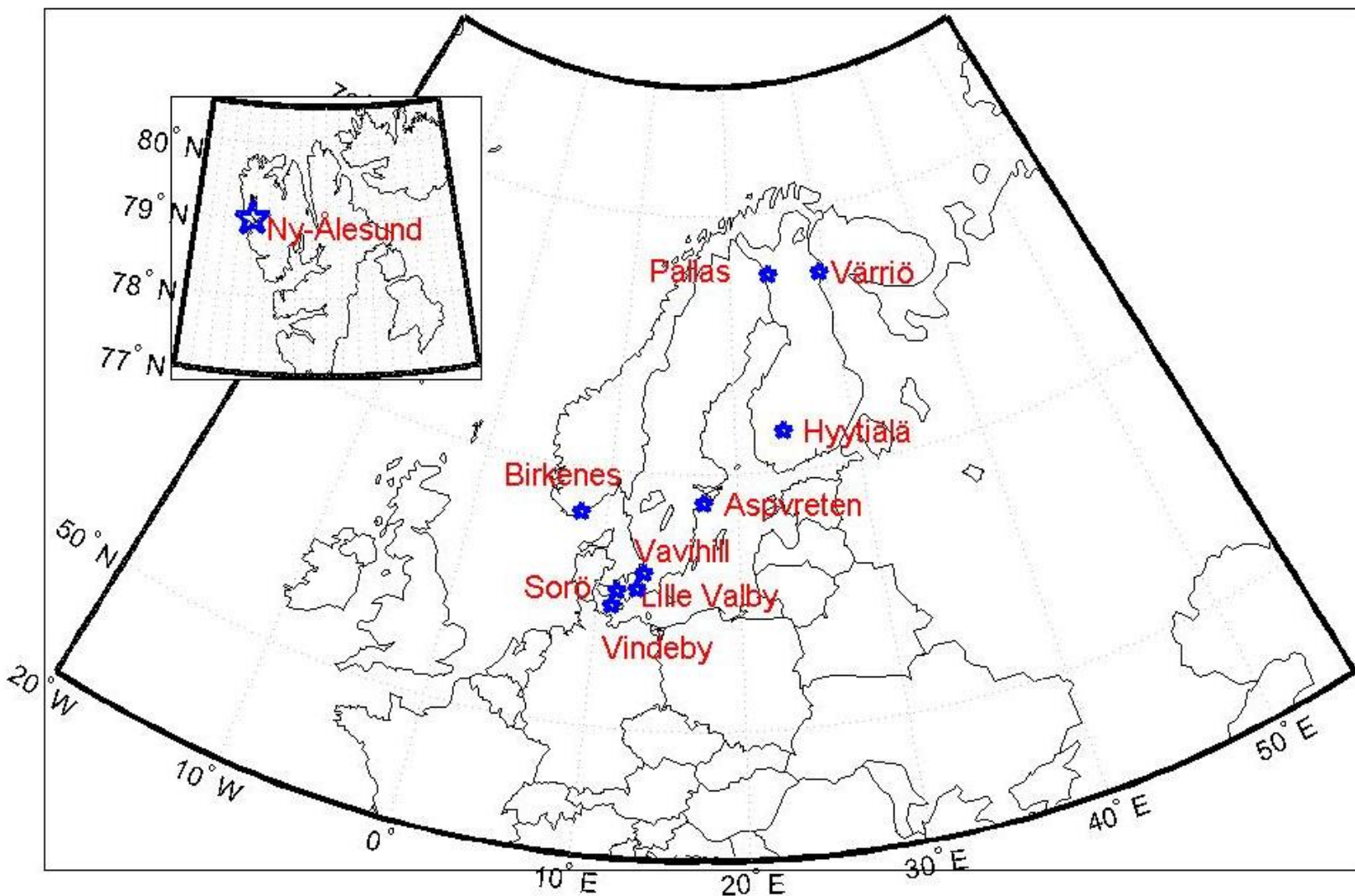
# Climate Change: One Feedback



# Approaches: how to answer our research questions

- experimental
  - laboratory
  - field (continuous and campaigns)
  - development of novel instrumental techniques
- theoretical
  - basic theories
  - simulations
  - model development
- Physics, Chemistry, Biology, Meteorology
- From molecular level to Global Scale
- BACCI/global networking and partnership

# Stations: Nordic Centre of excellence BACCI



# Continuous Measurements since January 1996

## SMEAR II

Station for measuring Forest Ecosystem - Atmosphere Relations  
University of Helsinki, Forestry Field Station, Hyytiälä

### TREE

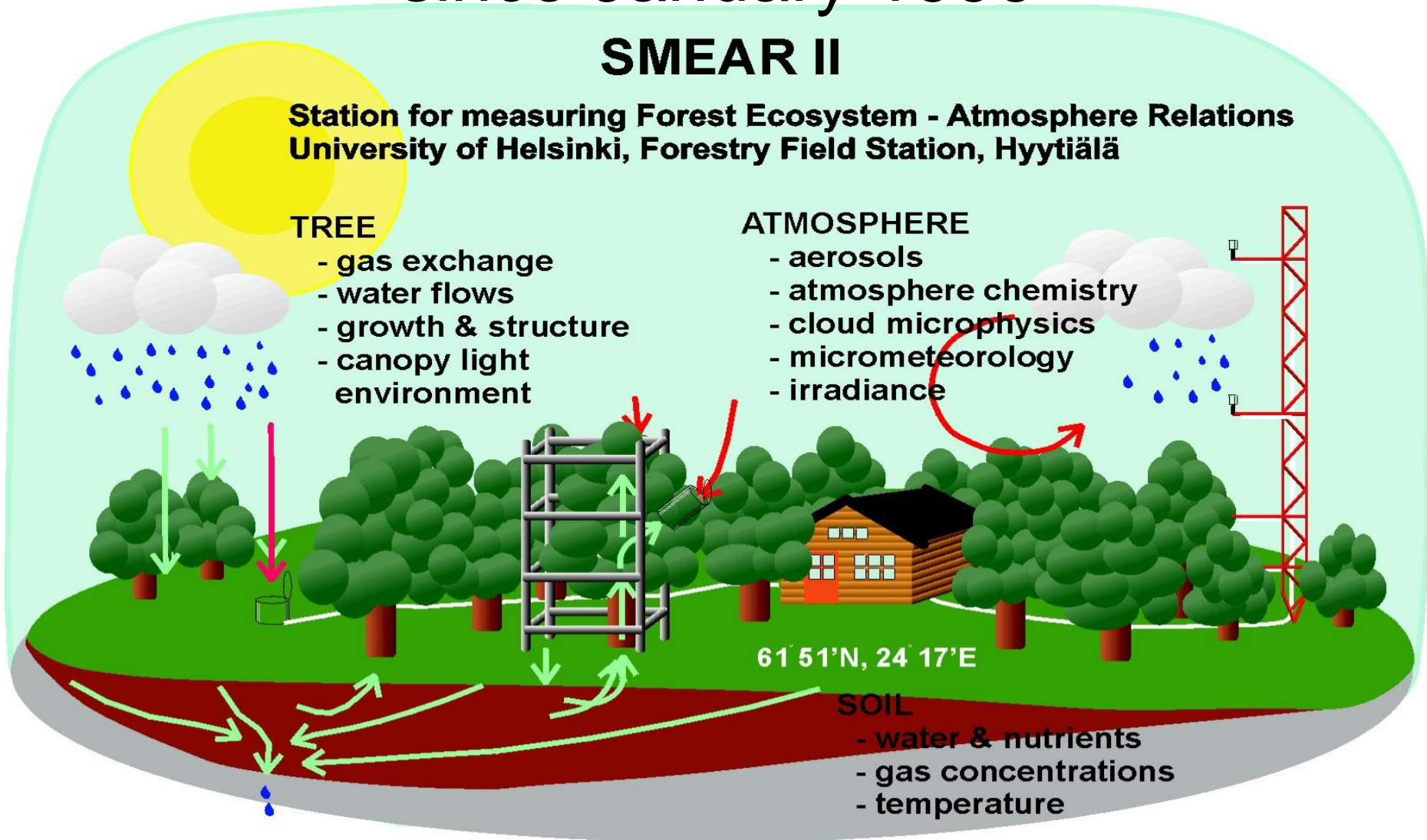
- gas exchange
- water flows
- growth & structure
- canopy light environment

### ATMOSPHERE

- aerosols
- atmosphere chemistry
- cloud microphysics
- micrometeorology
- irradiance

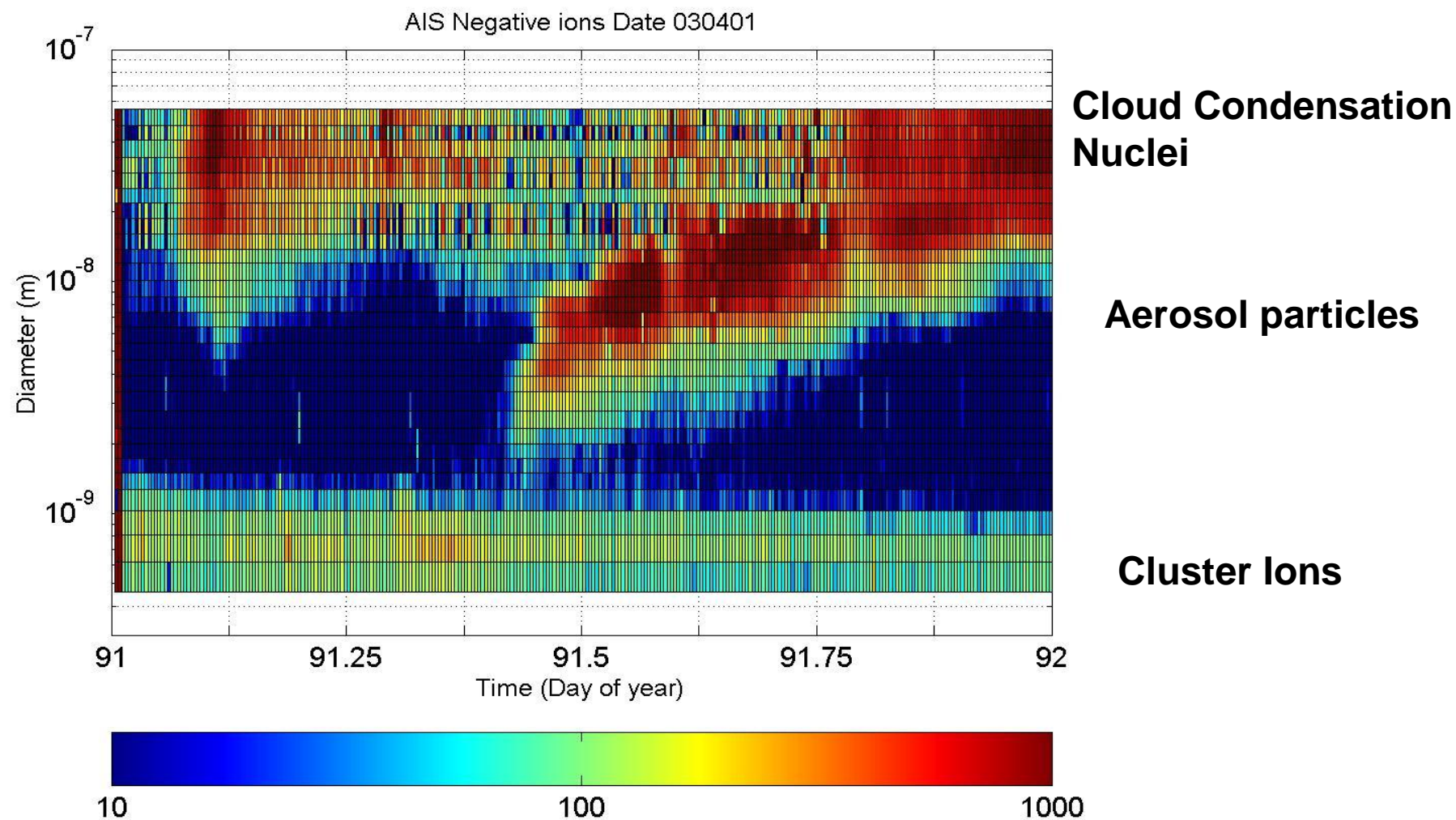
### SOIL

- water & nutrients
- gas concentrations
- temperature





# Observation of Nucleation Burst in Finland



# Recently we have shown:

- Continuous measurements are powerful
- Atmospheric particle formation has global importance
  - growth of new particles to cloud droplets
  - health effects of ultrafine particles
- Boreal forests act as aerosol sources
- Existence of neutral atmospheric clusters
  - Science Express 30.8. 2007
- Couple of connections between biosphere-atmosphere e.g. biology-physics – chemistry and meteorology of aerosol formation

# Why we are centre of excellence

- scientific ideas, innovative
- cross-, multi- and interdisciplinary
- wide and long ongoing co-operation
  - UHEL, UKU, FMI, Nordic partnership, European partnership etc.
- International reputation
- Group big enough, critical mass
- SMEAR, GAW and BACCI stations
- Results -> Scientific ranking
  - publications, Nature/Science
  - Thesis

# Significant

- Vision, ideas: what to do and why, own line, my/our way
  - goals
- Continuous and sustained work, to results and end products
- Co-operation
  - within our group and with others
    - encouraging, group spirit
  - benefit using the best possible knowledge
  - partnership and networking: BACCI, NECC, CBACCI
- Spirit of publication

# Why Nordic co-operation

- Research
  - Boreal, arctic
  - similar environmental problems and impacts
  - according to our experience: effective
- Science policy
  - traditions
  - joint nordic efforts
    - EU projects
    - global visibility
- Practise
  - short distances – personal meetings
  - common history, easy to understand each other
  - seminars, courses, workshops

# Future Challenges

- Science
  - molecular/nano to global scale
  - atmospheric nucleation
  - biosphere – atmosphere interactions
- Science policy
  - EUCAARI, iLEAPS, ECAR
  - Leading position in atmospheric research
  - How to use the whole capacity
- Education and Knowledge Transfer
  - International graduate schools and master programs
    - Utilizing CBACCI education structure
  - Continuation, Long periods needed