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METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE

# Finnish Meteorological Institute: National and International Partnerships

**Prof. Petteri Taalas**  
**Director General**  
**Finnish Meteorological Institute**

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# PETTERI TAALAS?

- Born 1961 in Helsinki
- **PhD in Meteorology**, Univ. Helsinki 1993, Docent Univ. Kuopio 1997
- **Management training**: Helsinki Univ. Economics, Leonardo da Vinci Univ., Paris
- Naval Academy 1981, National Defense Course 2003
- Weather technician 1983-86 at several airports
- Scientist 1986- Air Quality Dept: dispersion modelling, tropospheric chemistry
- Senior scientist at Weather Dept 1989-: stratospheric ozone and UV research
- Head of research, Meteorological Res. Dept 1996-: leader of ozone research unit
- **Research professor** 2001-: Remote sensing (satellites)
- **Director General** of FMI 2002-
- University of Eastern Finland, Chairman of the Board 2009-
- Science Academy of Finland, Member 2009-
- **Director of WMO** Development and Regional Activities Dept, 2005-2007, Member of WMO Executive Council 2007-
- Chairman of EUMETNET Council 2003-5; Vice-chairman of EUMETSAT Council 2007-, member 2002-; Member of ECMWF Council 2002-; Delegate and chairman of national committee to IPCC; Vice-chairman of European Commission atm. science committee 1995-2003,
- **Leader and partner in several international and national R & D projects** funded by EU, EUMETSAT, ESA, NASA, Finnish Academy & Tech. Dev. Centre
- **Author of ~50 peer-reviewed papers** on satellite technology, global change, climate & atmospheric chemistry, dozens of other publications & presentations



# Helsinki University Magnetic-Meteorological Observatory 1838-

- Motivation: theory on connections between magnetic field and weather variations  
=> weather services & military advantages
- Academic basis with service function
- Institute with highest budget of the University



**J.J. Nervander 1805-1848**





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# FMI staff and budget

- 621 man-years
  - services 300
  - research 286
  - other 45 my
- 60 % academic, 19 % PhD
- 62 M€ 2009
  - 65 % government
  - 35 % from commercial or research activities
- 50 % of research activities externally funded
  - EC, ESA, EUMETSAT, Finnish Academy & Technology Development Centre

## DIRECTOR GENERAL AND DIRECTOR GENERAL'S OFFICE

### WEATHER AND SAFETY

Weather and Safety Centre

Commercial Services

Development of Services

ICT Management Services

Observation Services

### RESEARCH AND DEVELOPMENT

Climate Change

Air Quality

Meteorology

Marine Research

Earth Observation

Arctic Research

Kuopio Unit

Consulting Services

## ADMINISTRATION



## **FMI management**

- ✓ **Organization for a 3-year period, rotation encouraged**
- ✓ **All manager positions vacant every third year**
- ✓ **Limited international employment favored**
- ✓ **Visiting professors (now 3 US, 1 NL & 1 RU)**
- ✓ **30 % of salary performance dependent**
- ✓ **Productivity, innovation & modernization as targets**
- ✓ **Partnership strategy: win-win with high-level partners**
- ✓ **Management training, expert academy, secretary academy**
- ✓ **Electronic accounting and billing systems**





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# FMI HELSINKI HQ AT KUMPULA CAMPUS



- Alltogether 1000 experts on atmosphere, space, marine & earth systems
- Centres for excellence
- Private enterprises

- Shared professors
- EU & national projects
- Regional offices: Tampere, Kuopio & Rovaniemi
- Arctic Research Centre at Sodankylä/Lapland





# RANGE OF SERVICES AND KNOW-HOW FOR THE BENEFIT OF THE WHOLE COUNTRY: CASE FINLAND

## Ministry of the interior

- Hazardous releases
- Natural disasters
- Rescue authorities
- Forest fires

## Ministry of defence

- Operational services
- Methodology development

## Ministry of social affairs and health

- Nuclear safety
- Health effects of pollutants and weather

## General public

- Warnings and safety
- TV, Radio, www, mobile
- Sea, road, pedestrian safety
- Press releases & education



## Ministry of transport and communications

- Road, air, rail & sea traffic safety
- Route maintenance
- Efficiency of traffic
- Emissions from traffic and their impacts



## Ministry for education

- University partnerships
- Shared professors, projects

## Ministry of the environment

- Climate change
- Air quality

## Ministry for industry and labour

- Technology development
- Mobile service development
- Know-how for private sector
- Wind, solar & hydropower

## Ministry for foreign affairs

- Development co-operation
- Climate policy
- Technology export

## Ministry of agriculture and forestry

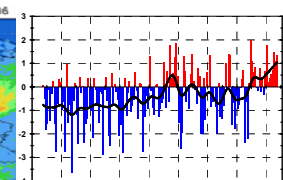
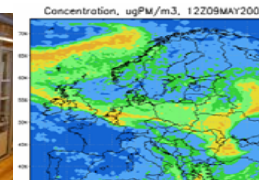
- Climate change adaptation
- Flash flooding
- Agriculture & forest services

## Special services

- Private enterprises
- Tailor made services, golf, skiing, fishing,...

## International responsibilities

- WMO, IPCC
- ECMWF, EUMETSAT, EUMETNET
- ESA PB-EO, GMES, GEO





## BENEFIT IN FINLAND 2007

	Benefit (M€)
Road transportation	13 – 18
Pedestians & cyclists	80 – 100
Railway transportation	1
Shipping and boating	32 – 50
Aviation	54 – 55
Logistics	Tens of millions
Building construction and maintenance	15 – 30
Energy sector	10
Agriculture	34
Total benefit	> 239 – 298

**FMI budget 50 M€ in 2007**





## RESULTS 2008

- ✓ **Accuracy of forecasts 83-90 %**
- ✓ **Observations availability 99.8 %**
- ✓ **Product availability 99.8 %**
- ✓ **Customer satisfaction 4.1/5.0 commercial, 3.9 public**
- ✓ **Staff satisfaction 3.5/5.0**
- ✓ **External funding 17.9 M€, 37 % of total FMI budget**
- ✓ **R & D external funding share 53 % of total R & D budget**
- ✓ **Publications 248 peer-reviewed**
- ✓ **Productivity growth + 9,1%**
- ✓ **Staff education level 12 PhD thesis**



## OTHER NUMERICAL INDICATORS

- FMI www pages fourth most visited in Finland (1. Google, 2. Helsinki library, 3. Helsinki area public transport service, 4. FMI), 1 million visitors a week (5.3 M in Finland)
- FMI number one public sector organization in Finland 2007, 08 & 09 (2002-2009 between 1 and 2), out of 32
- FMI second as most favoured public sector organization for employment in 2007
- Climate change expertise of FMI was honoured by the president of Finland: 2008 nature price



# WEATHER SERVICES



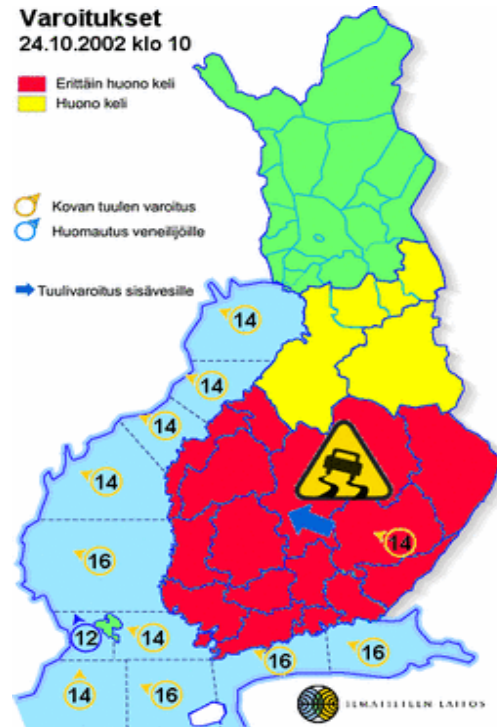


# Weather Services

## Commercial Services



## Basic Services







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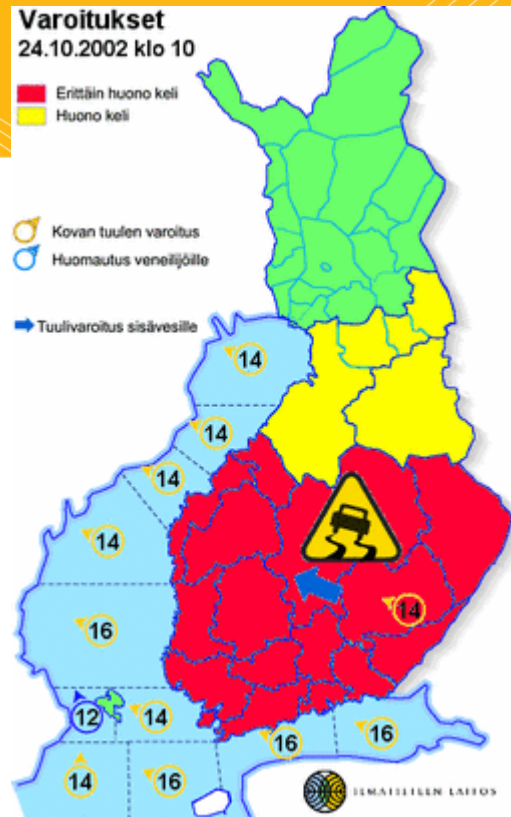
# PUBLIC SAFETY SERVICES

## EARLY WARNINGS

- Storms
- Flooding, snowstorms, hail, icing
- Drought
- Heat waves
- Air quality, forest fires, etc.

## TO WHOM and HOW?

- Authorities: rescue & disaster, road, aviation, shipping, ...
- Companies: Electricity, transport, agriculture
- Public
- E-mails, mobile phones, customer portals, www & TV/radio





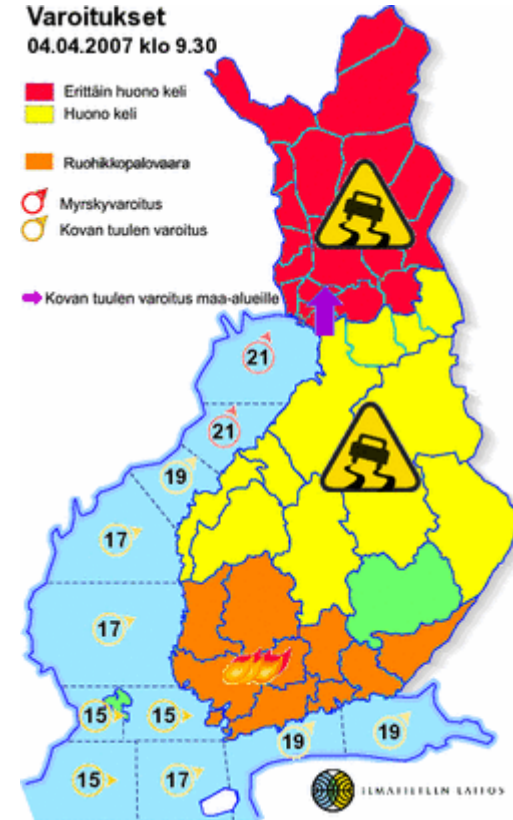
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## 24/7 services

- Warnings and forecasts for radio, TV, and web
- High-impact weather messages for authorities
- **DANGER- bulletin system**
  - Includes also analysis of the impacts (traffic, electricity distribution, infrastructure damage, falling trees etc.)
  - Combines the use of e-mail-web-TETRA-networks
- Press releases
- [www.fmi.fi](http://www.fmi.fi) infobox
- High-impact natural phenomena for governmental situation awareness system

Varoitukset  
04.04.2007 klo 9.30

- Erittäin huono keli
- Huono keli
- Ruuhkipalovaara
- ⚡ Myrskyvaroitus
- ⚡ Kovan tuulen varoitus
- ➔ Kovan tuulen varoitus maa-alueille



21.1.2009 9.30

Ajokeli on suuressa osassa maata huono lumisateen pölyävän lumen ja lumisten teiden vuoksi. Katso voimassa olevat varoitukset»



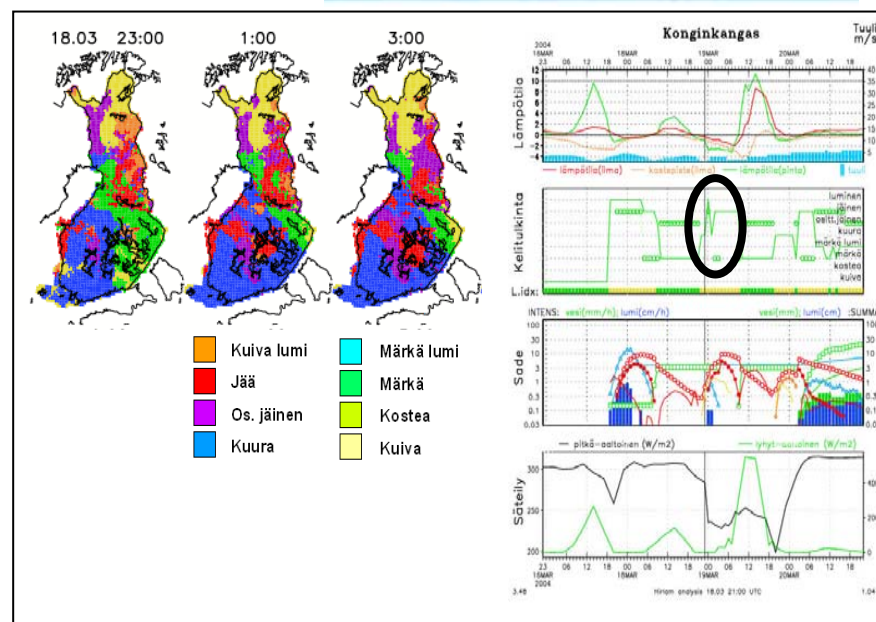
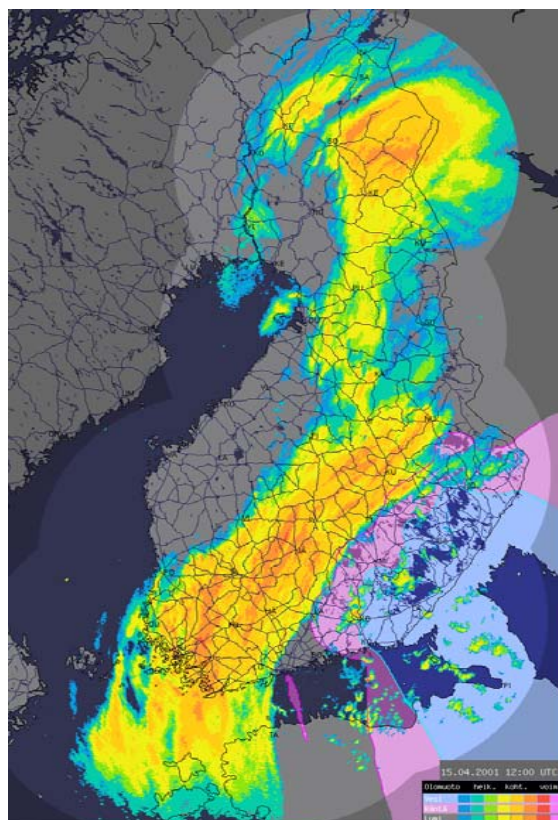


# CIVIL AVIATION





# WINTER ROAD MAINTENANCE







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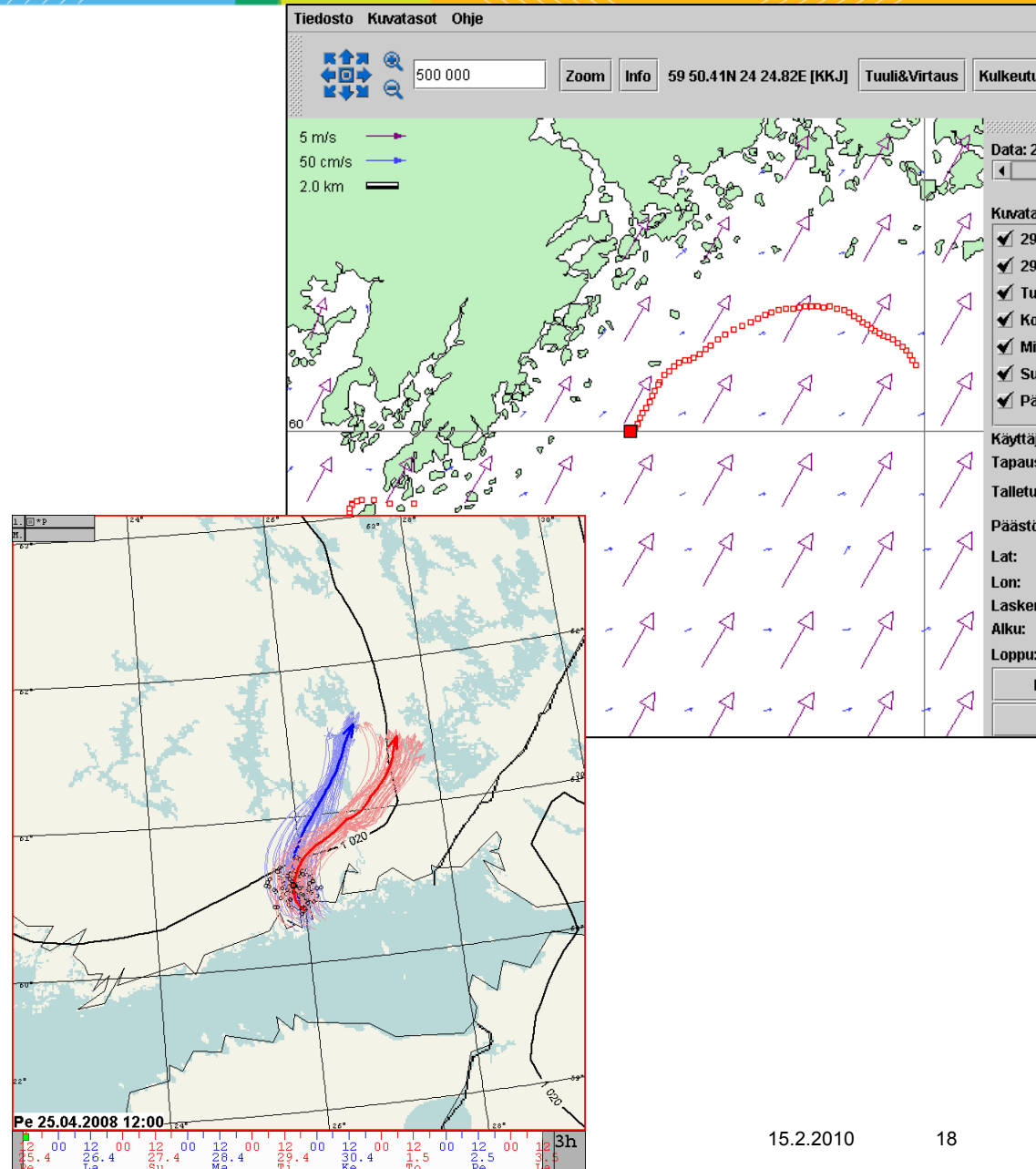
# MILITARY SERVICES





# SPECIAL EVENTS

- Nuclear accidents
- Forest fires
- Oil accidents, sea rescue
- Hazardous materials, terrorism





# Observation Systems



**Automatic surface stations**



**Weather radars**



**Lightning detection**



**MIRACLE network**



**Marine stations**



**Air quality monitoring stations**





## Technological progress in the West

Aker Arctic



USCG "Healy"

IB "Otso" and "Kontio"



RIB "Aurora Australis"



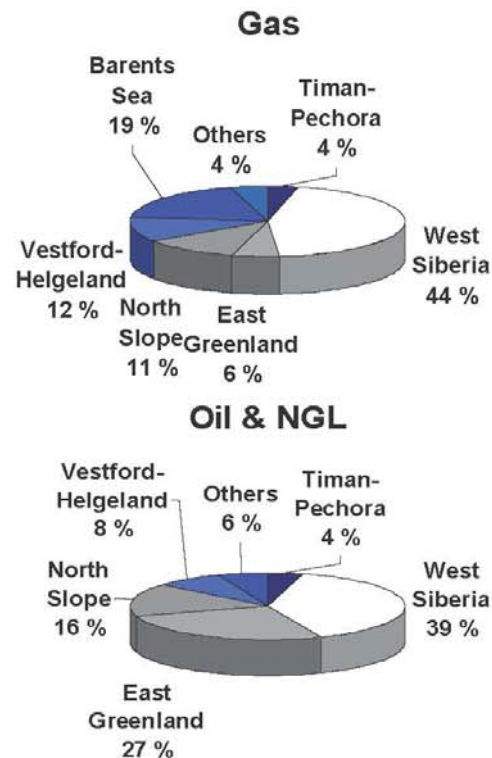
RIB "Sir James Clark Ross"





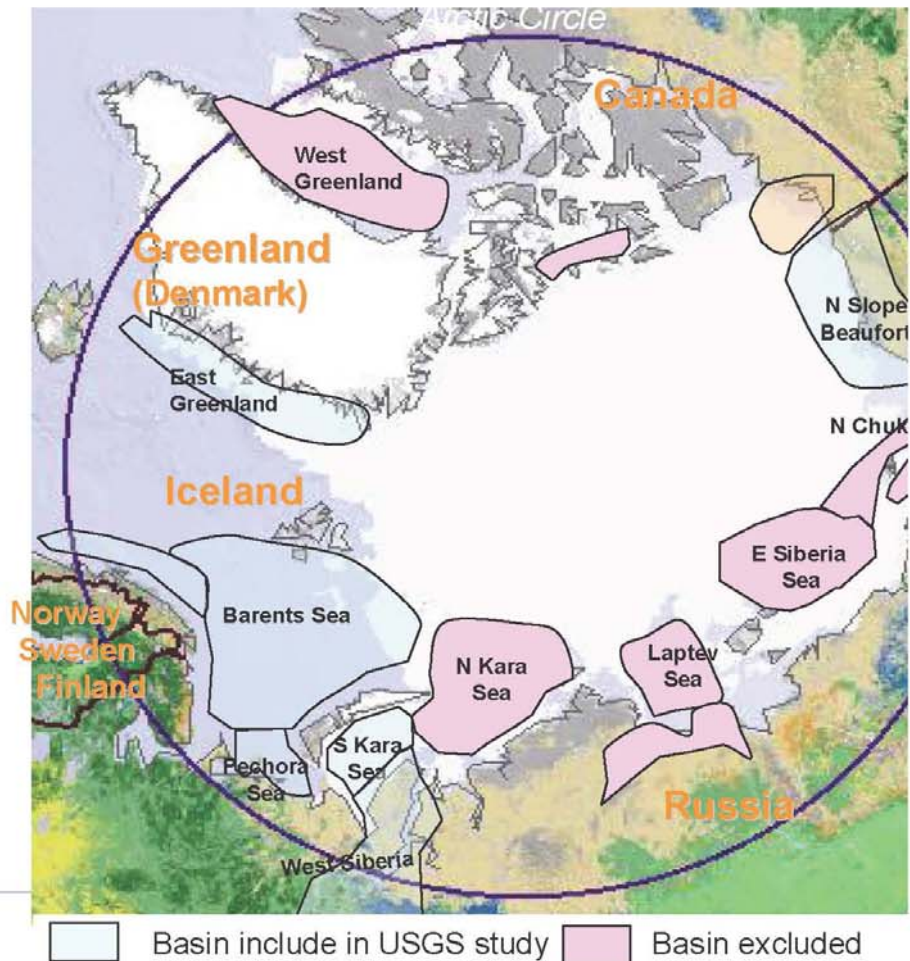
Today's drivers for us are oil and gas - 25% of world's undiscovered resources are in the Arctic

\*USGS study



The Ice Technology Partner

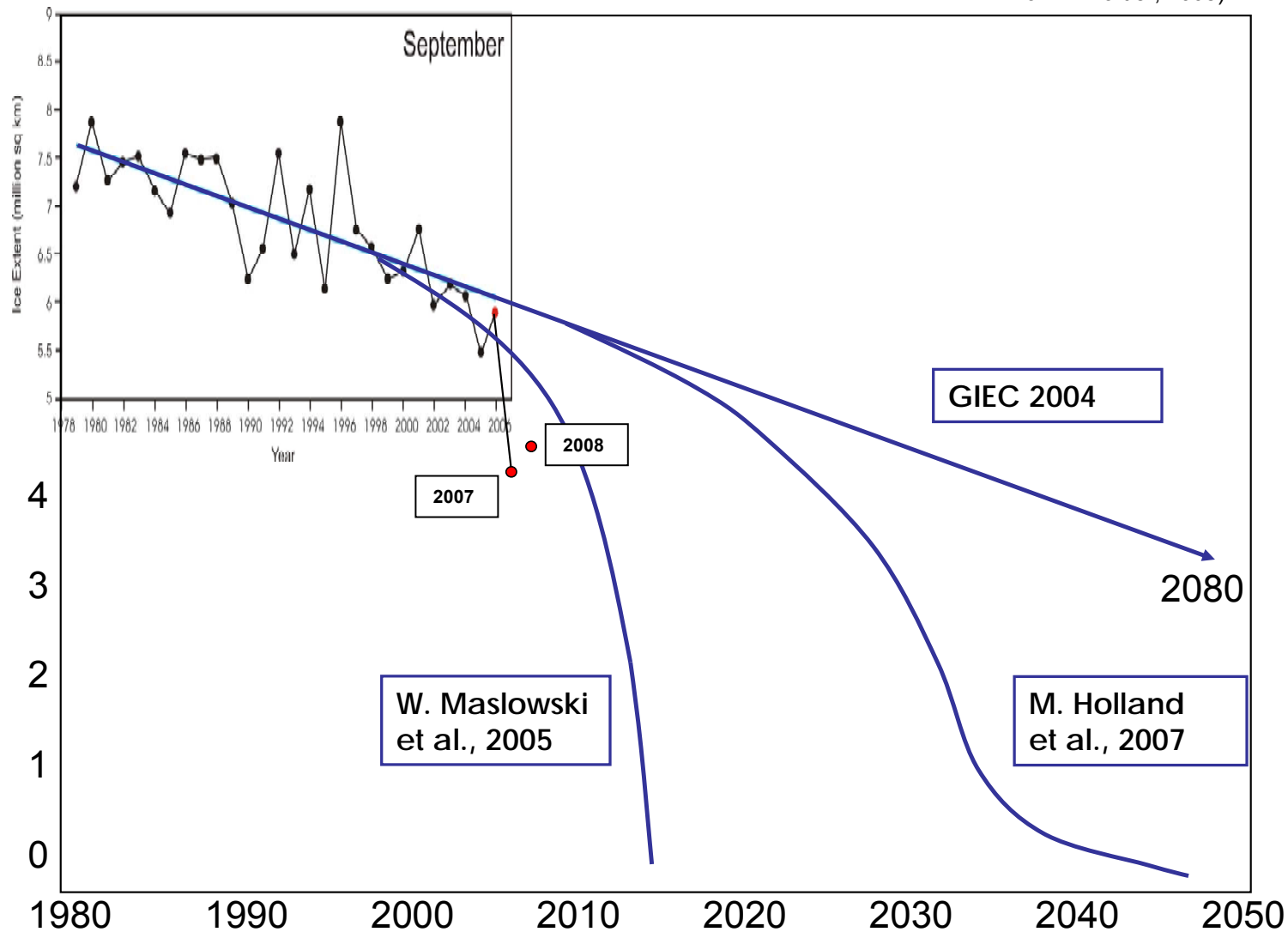
© 2006 Aker Yards





# Arctic sea ice evolution?

From L. Fortier, 2008)





# MOBILE PHONES FOR SERVICE DELIVERY







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# SUPPORT TO ENVIRONMENT/CLIMATE POLICY

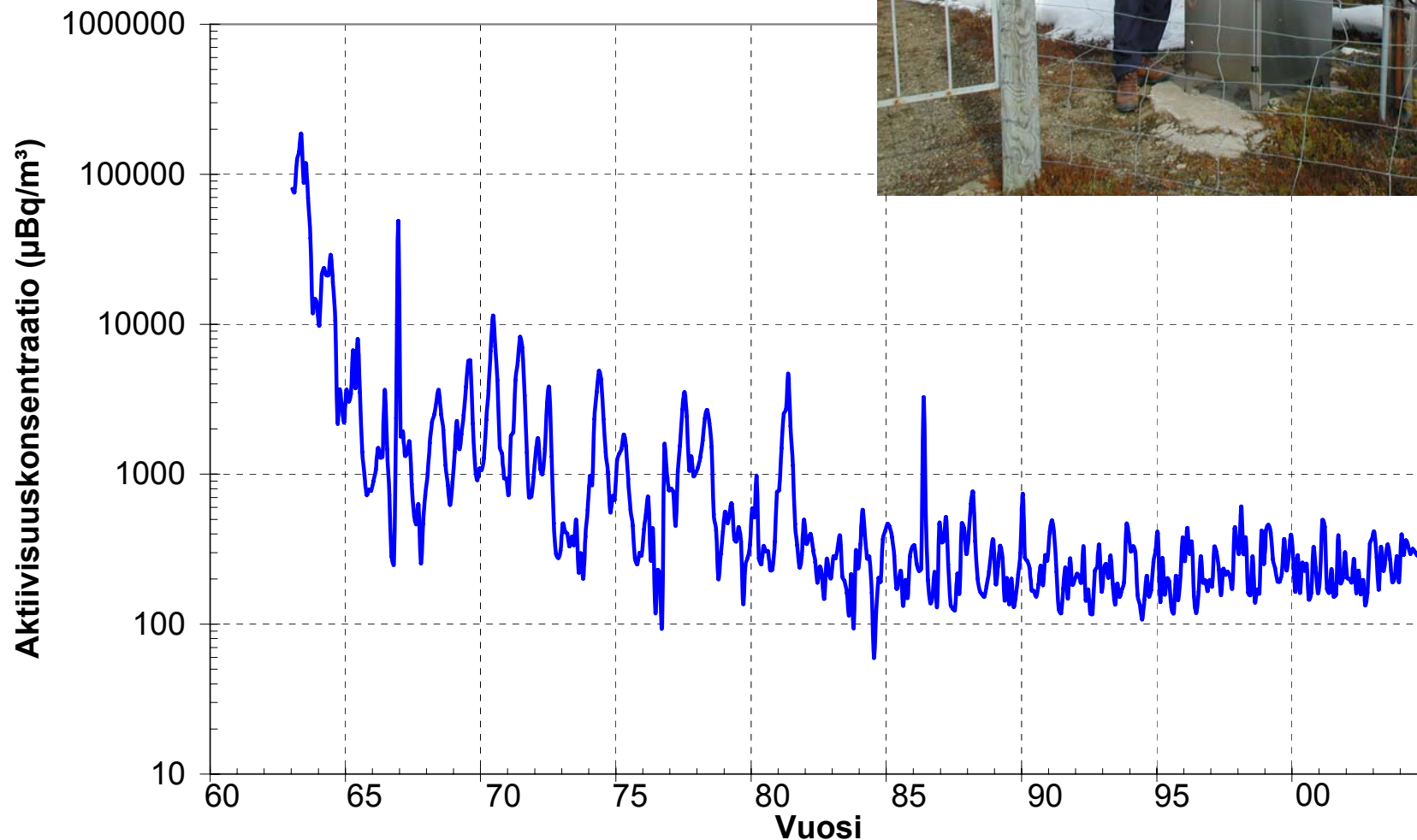






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## Beta activity at Sodankylä, 67 N

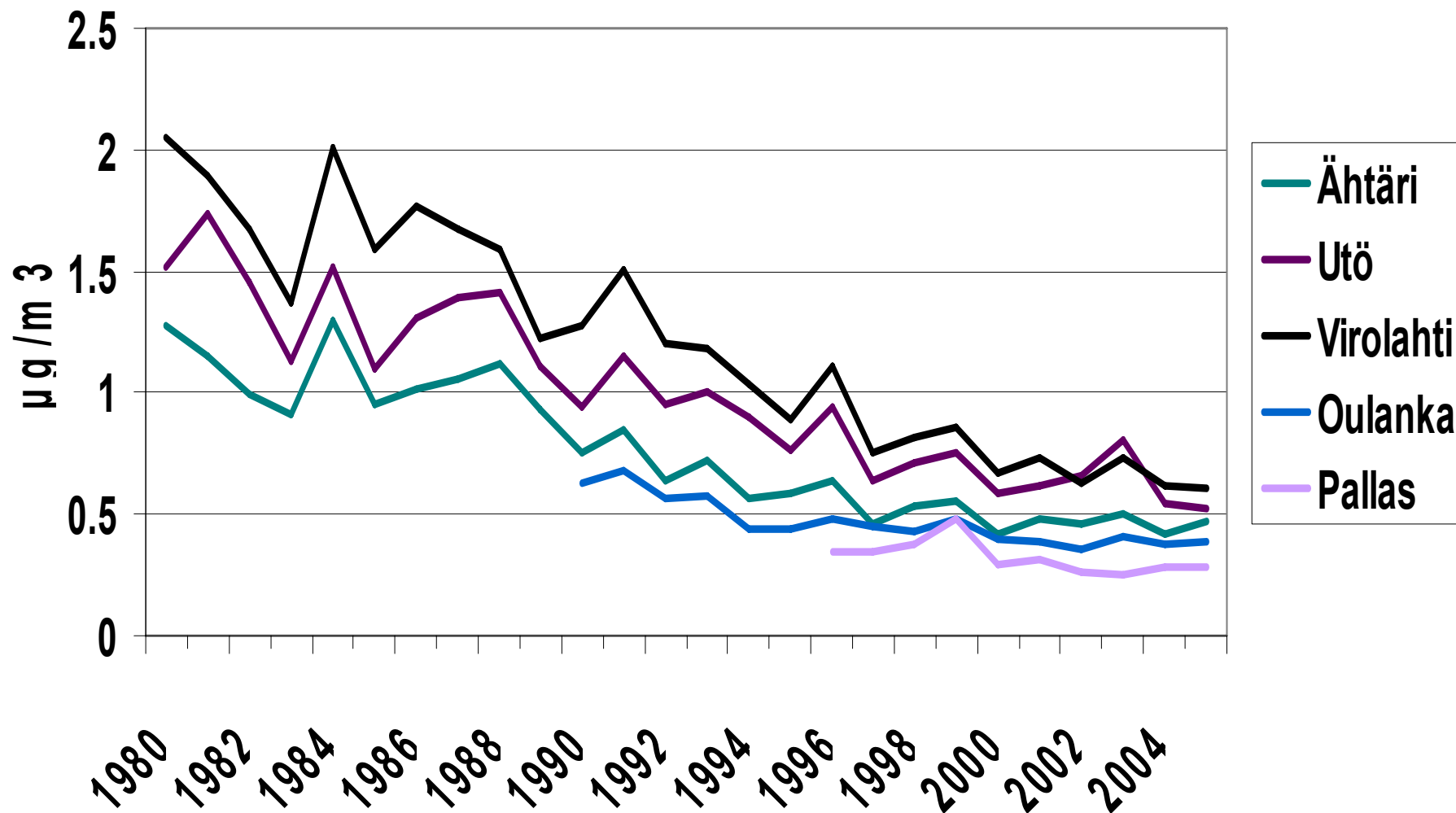




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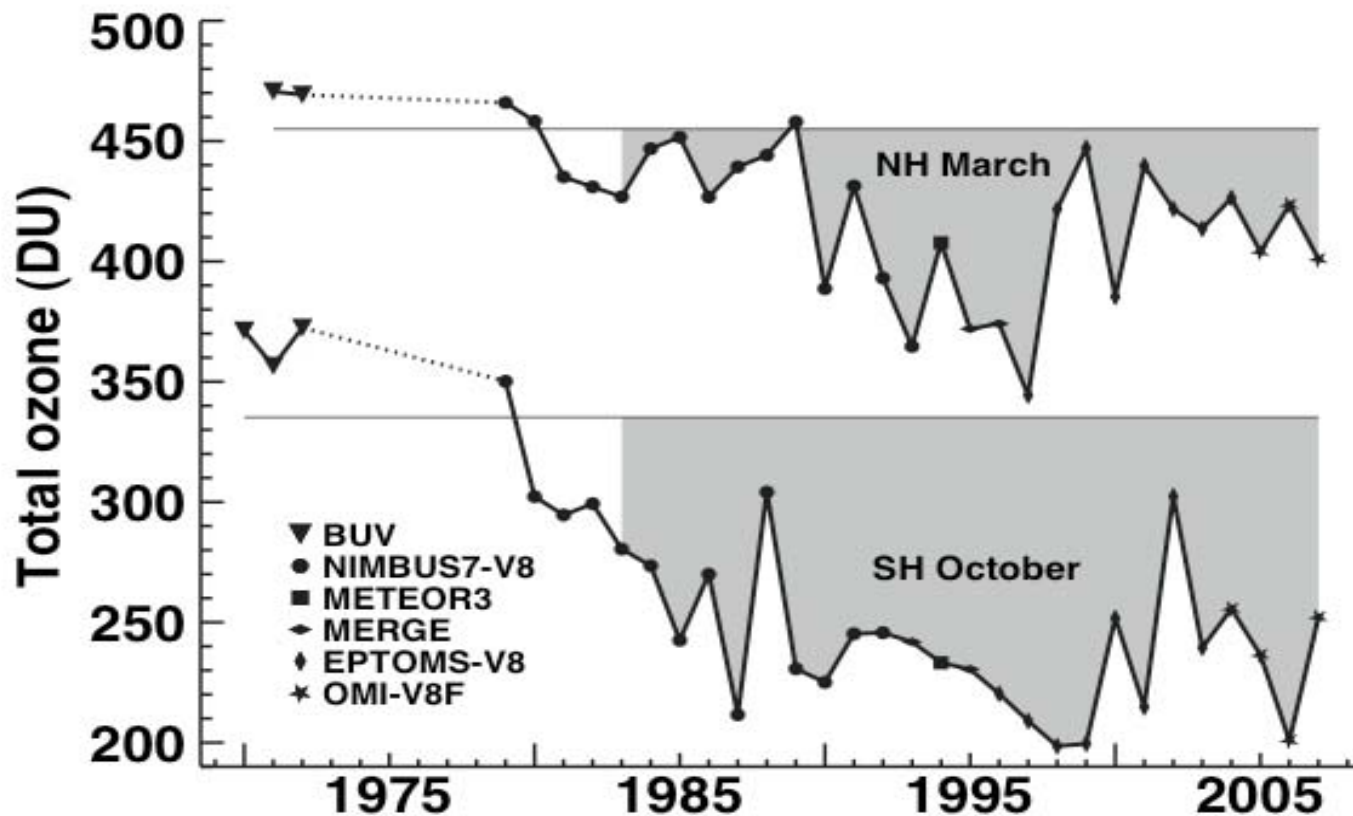
# ACIDIFICATION

## SO<sub>4</sub>-S time series





# Arctic & Antarctic Ozone

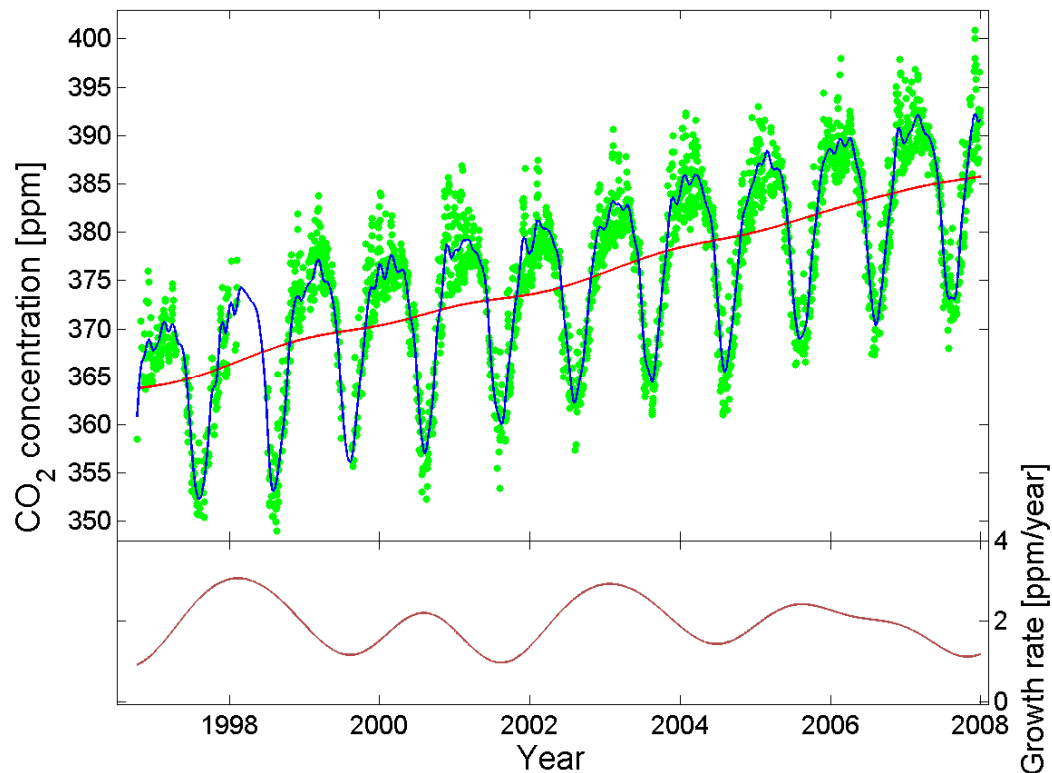




CO<sub>2</sub>

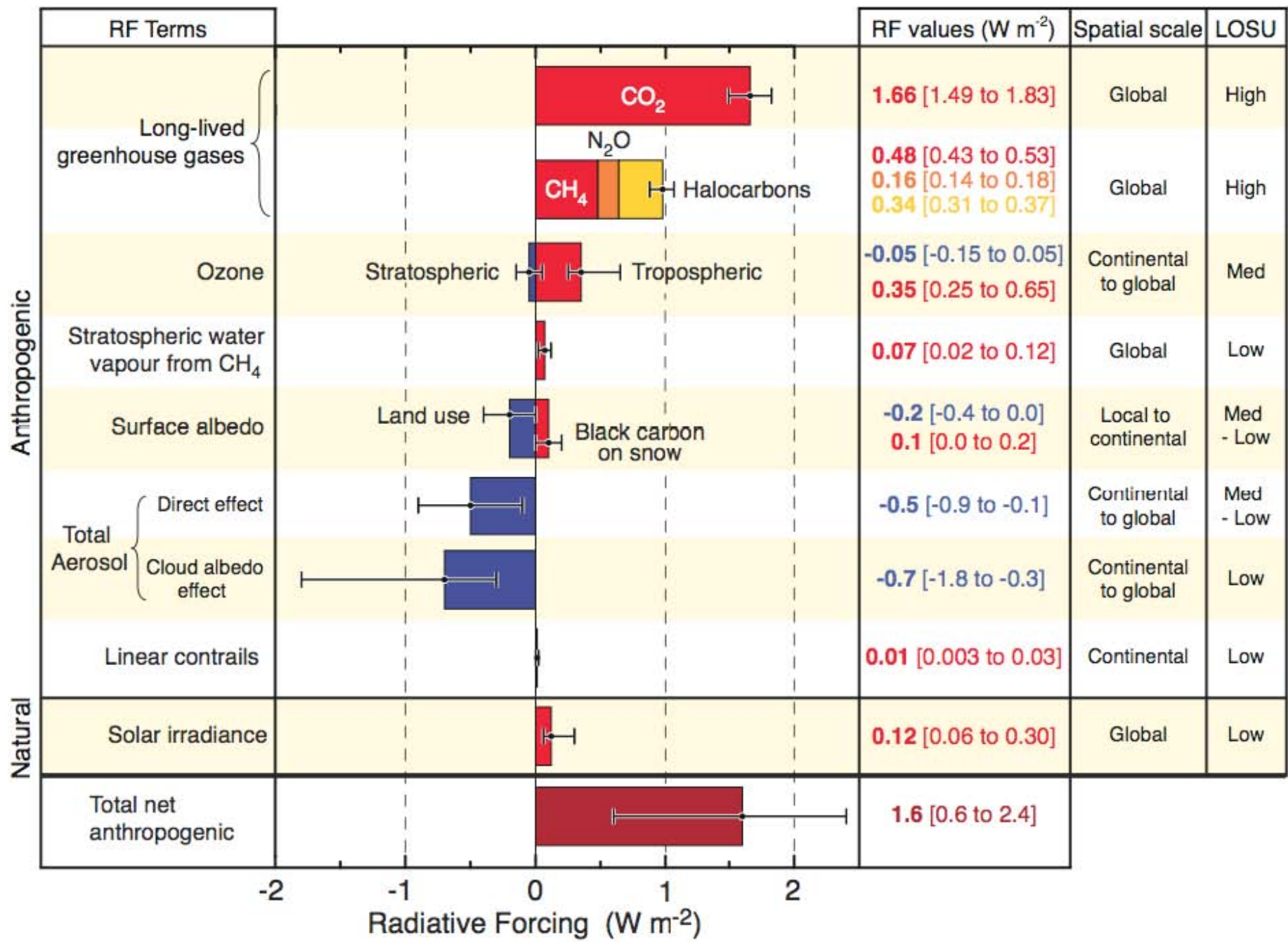
# Net carbon dioxide losses of northern ecosystems in response to autumn warming

Shilong Piao<sup>1</sup>, Philippe Ciais<sup>1</sup>, Pierre Friedlingstein<sup>1</sup>, Philippe Peylin<sup>2</sup>, Markus Reichstein<sup>3</sup>, Sebastiaan Luyssaert<sup>4</sup>, Hank Margolis<sup>5</sup>, Jingyun Fang<sup>6</sup>, Alan Barr<sup>7</sup>, Anping Chen<sup>8</sup>, Achim Grelle<sup>9</sup>, David Y. Hollinger<sup>10</sup>, Tuomas Laurila<sup>11</sup>, Anders Lindroth<sup>12</sup>, Andrew D. Richardson<sup>13</sup> & Timo Vesala<sup>14</sup>



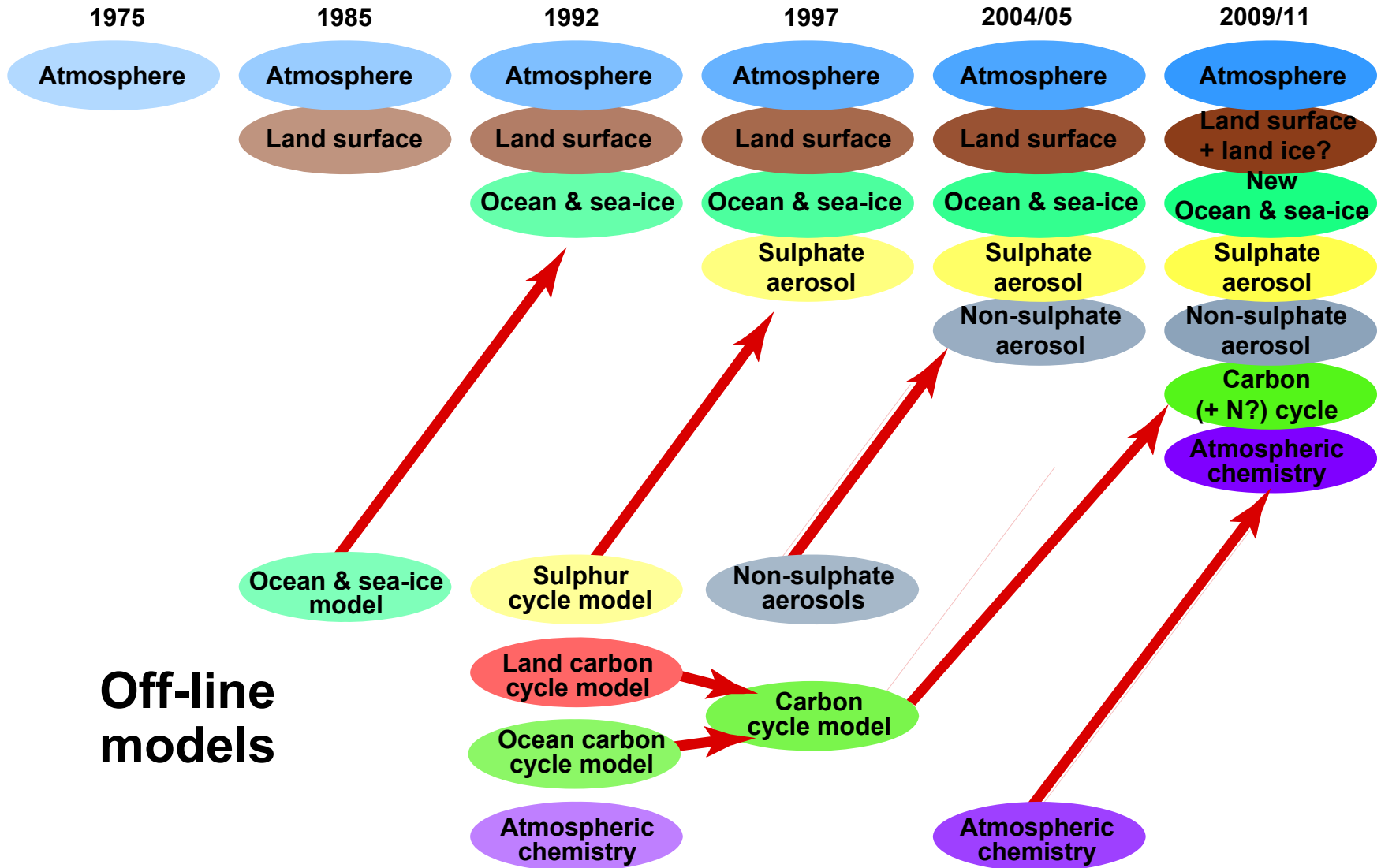


# Radiative Forcing Components



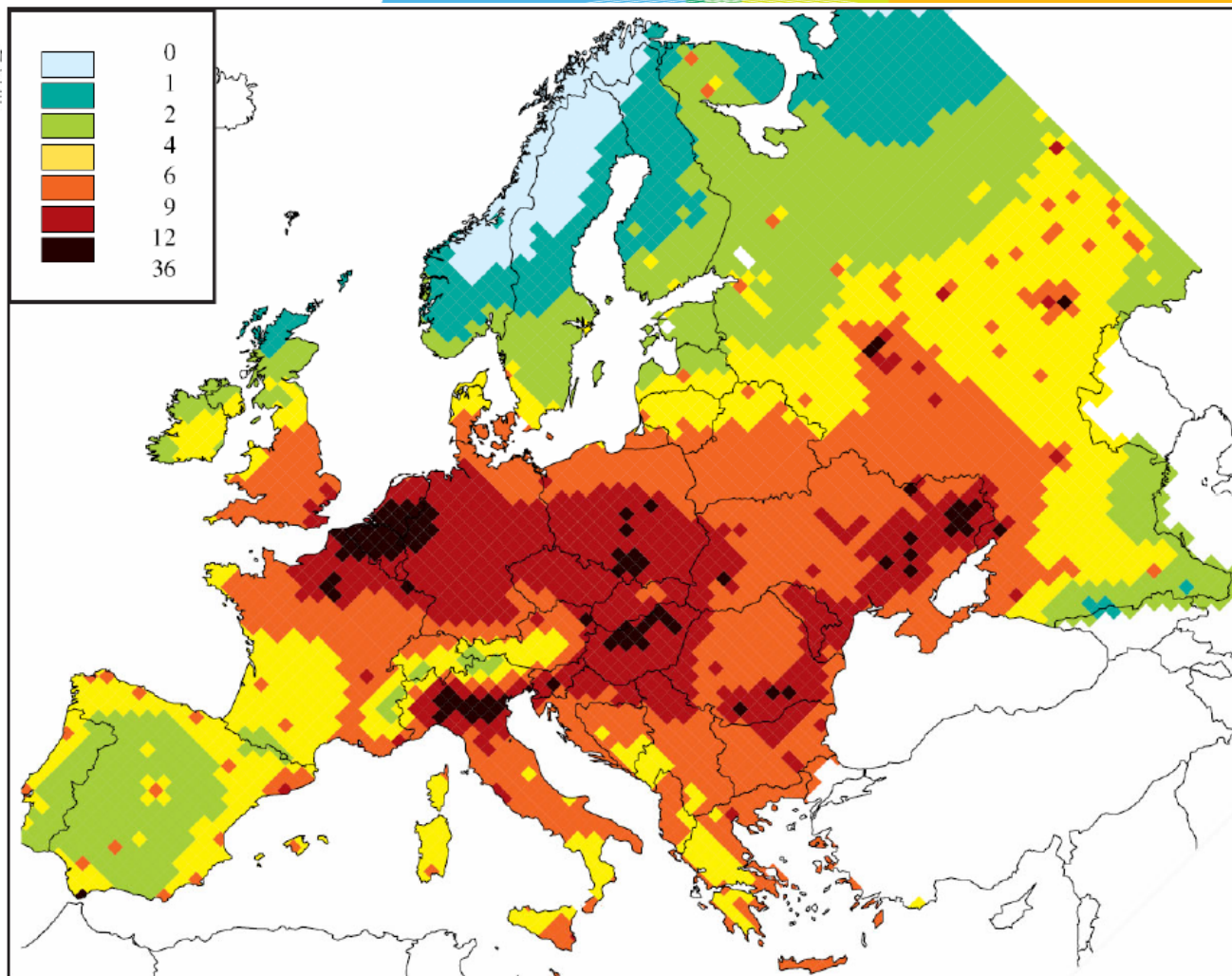


# CLIMATE MODELLING, ECHAM5





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**Loss in life expectancy (months) attributable to exposure to anthropogenic PM<sub>2.5</sub> for year 2000 emissions (Source: EC, IIASA).**





## CAFE assessment on health impacts of PM2.5 in Finland (2000)

• Premature death cases	1 270
• Life years lost	13 840
• Infant death cases (0-1 y)	2
• New cases of chronic bronchitis	620
• Hospital admission cases (lung + heart)	383
• Lower respiratory symptom days (5-14 y)	778 870
• Restricted activity days in adults (15-64 y)	1 323 390
• Value of health damage	1 – 2,9 billion € / year



# ENERGY

- **Wind atlas for Finland 2009**
- **Solar energy**
- **Hydropower now & future**
- **Emissions and their impacts**
  - Climate
  - Health



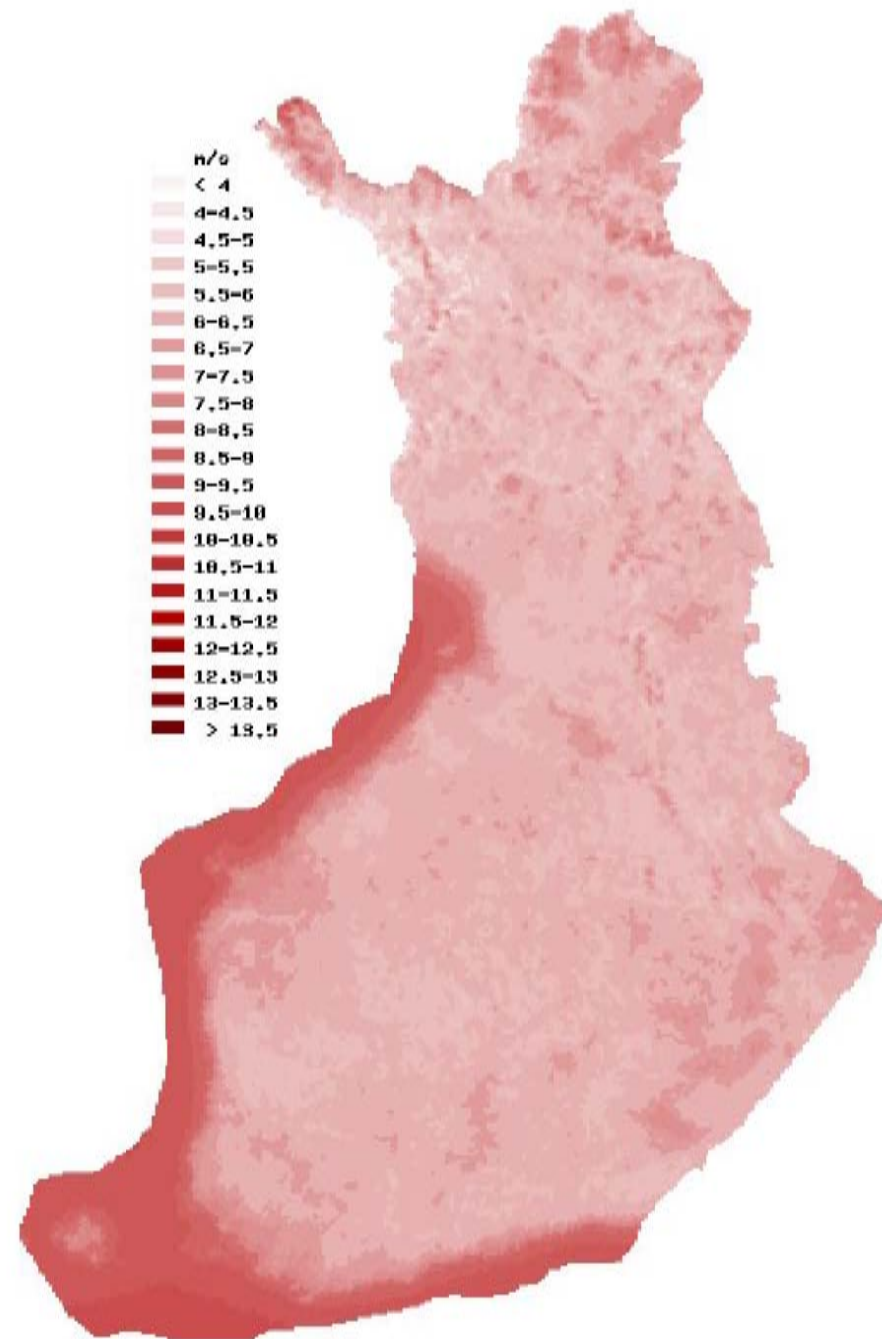


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# WIND ENERGY POTENTIAL IN FINLAND

## WIND ATLAS 2009

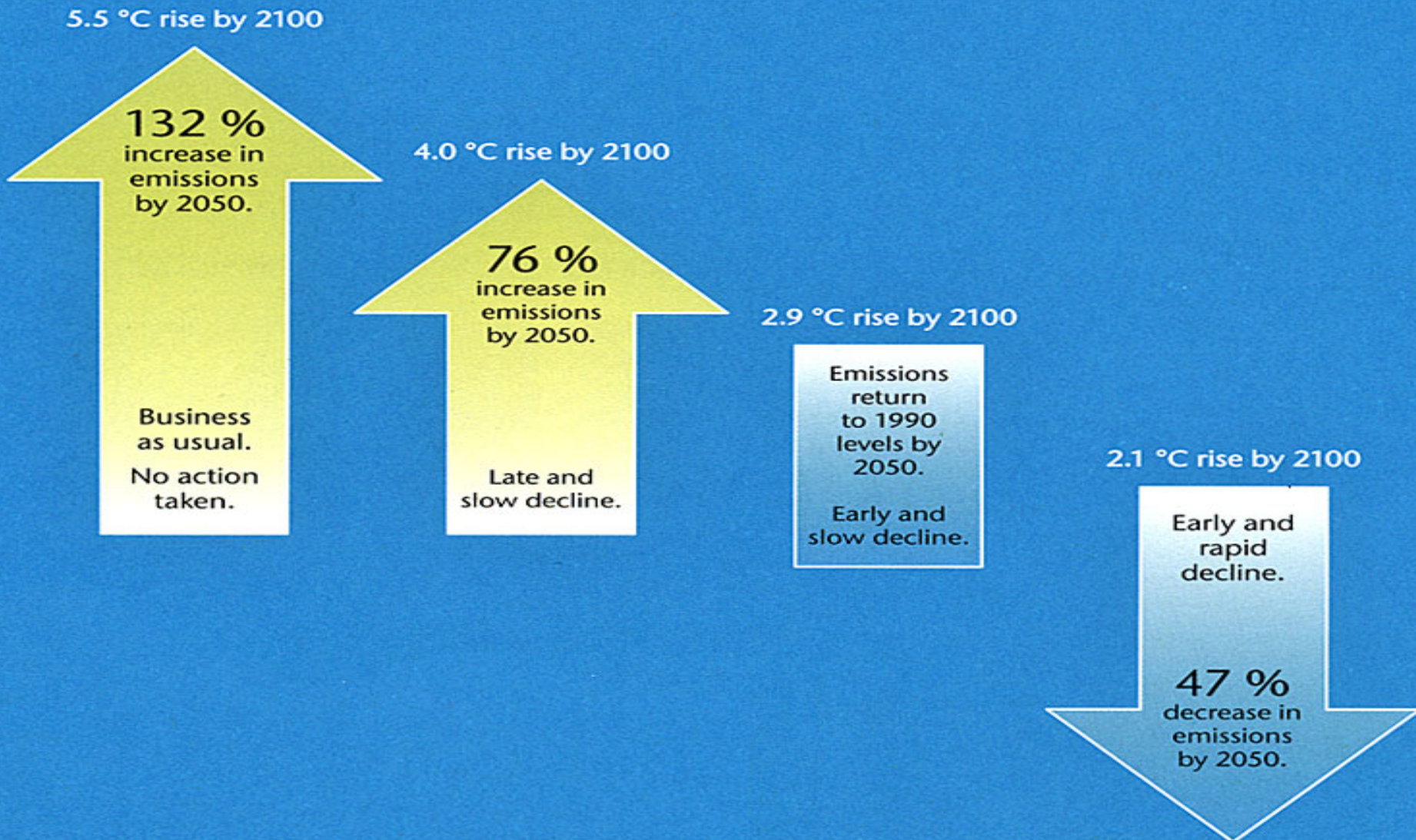






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# EMISSIONS/GLOBAL WARMING





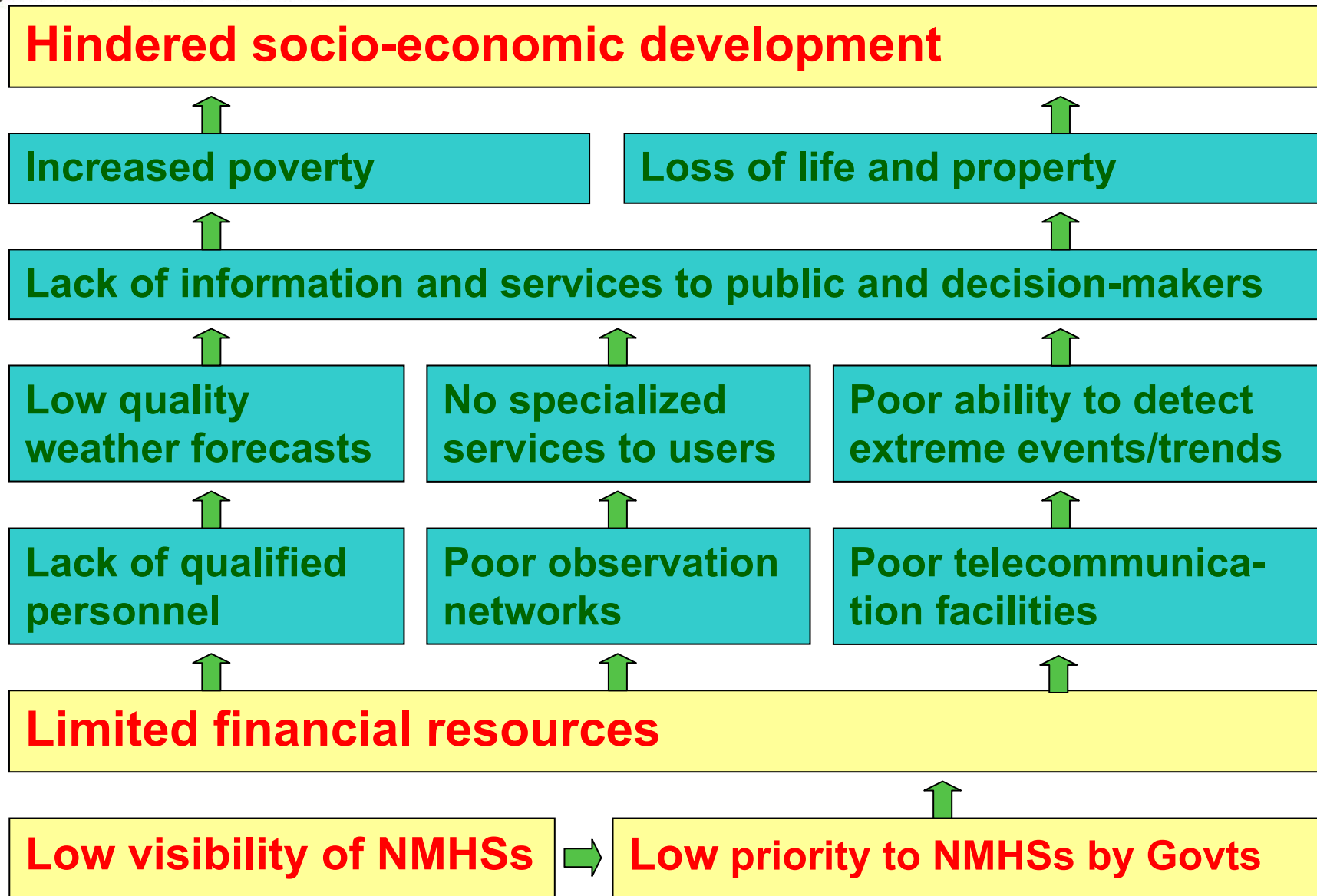


# INTERNATIONAL PARTNERSHIPS



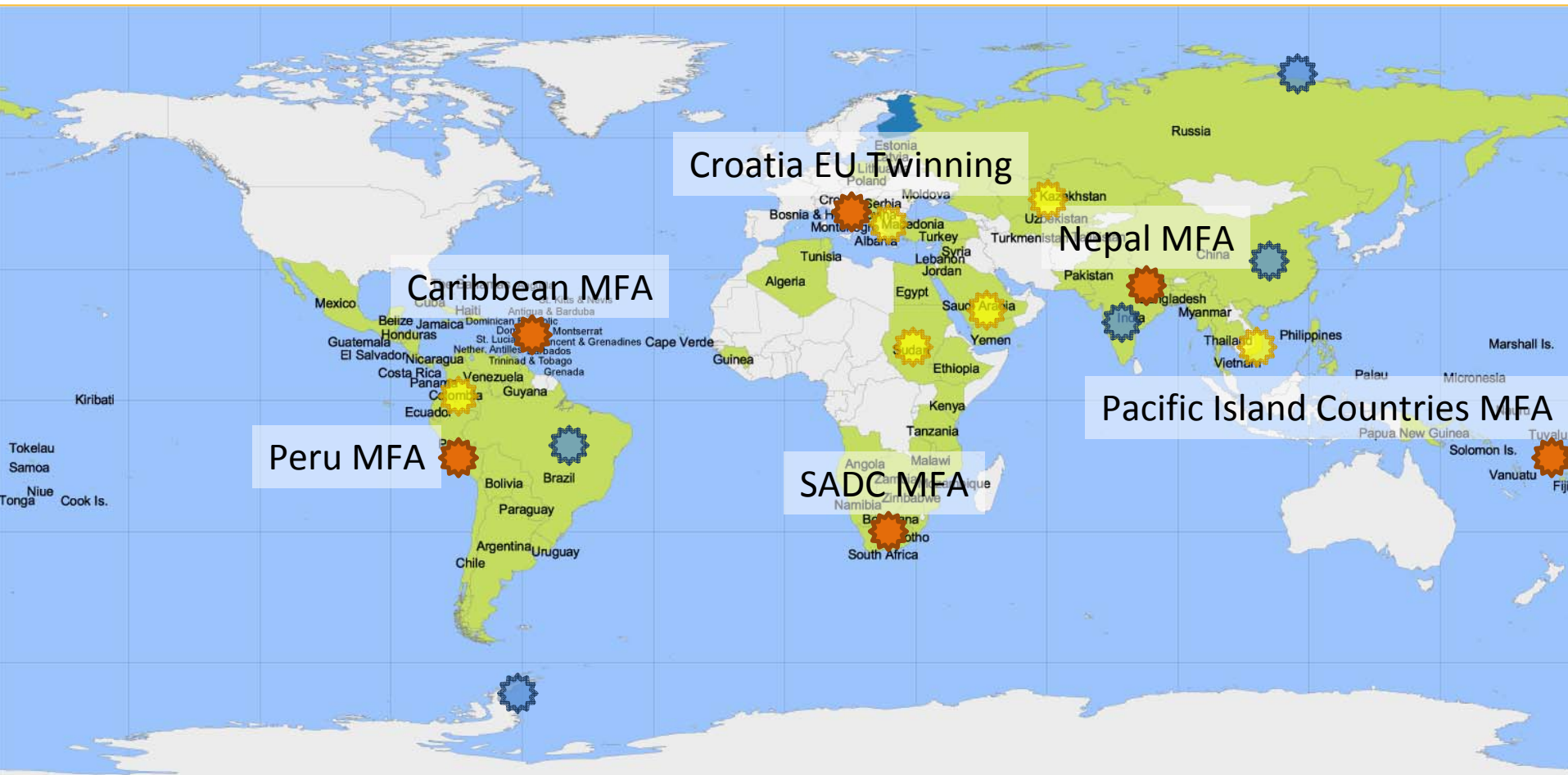


# MET. SERVICE PROBLEM CYCLE





# FMI CONSULTACY AND DEVELOPMENT PROJECTS



-  Ongoing Project
-  Scientific Collaboration
-  Project under Preparation





# WHAT CLIMATE CHANGE WILL CAUSE?

- 1) GLOBAL GCM CLIMATE SCENARIOS 2010-2100,  
RESOLUTION >100 km
- 2) DOWNSCALING TO NATIONAL/REGIONAL LEVEL,  
RESOLUTION ~10 km
- 3) NATIONAL CHANGES IN METEOROLOGICAL AND  
HYDROLOGICAL PARAMETERS 2010-2100
- 4) IMPACT ON VARIOUS SECTORS: Agriculture,  
infrastructures, health, forestry, water resources,  
energy, tourism, transport, nature
- 5) SOCIO-ECONOMIC IMPACT ESTIMATE
- 6) NATIONAL ADAPTATION STRATEGIES



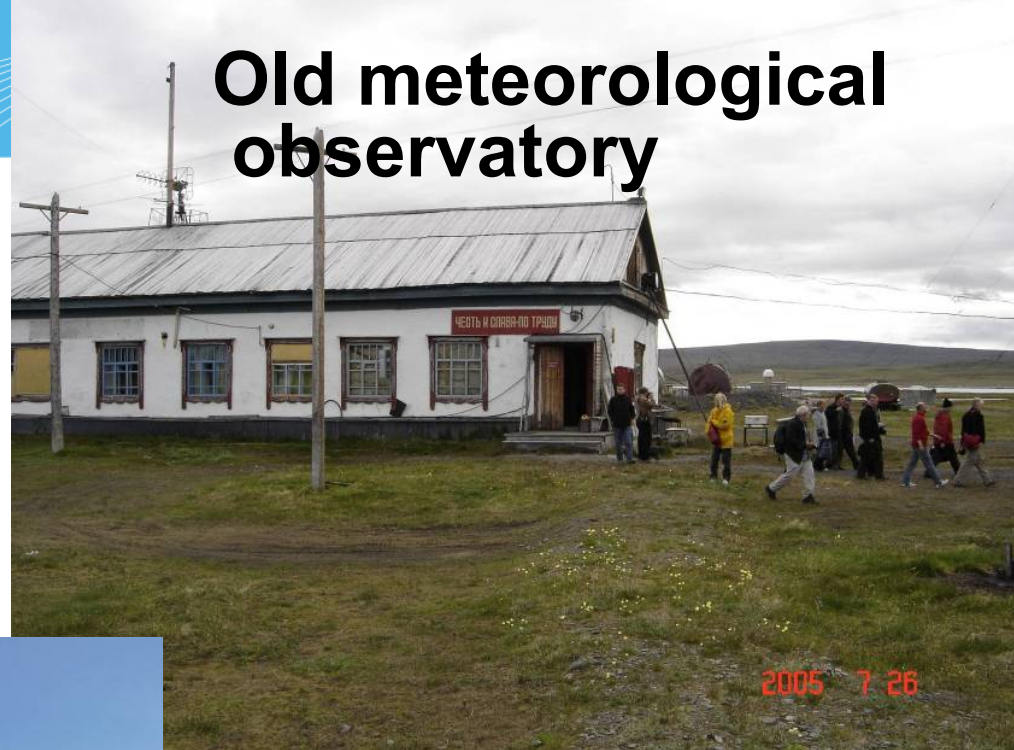


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## Tiksi Siberia

71 deg 35' 10.4" N  
128 deg 55' 0.8" E

## Old meteorological observatory



## National Science Foundation, USA, rebuilt Tiksi observatory

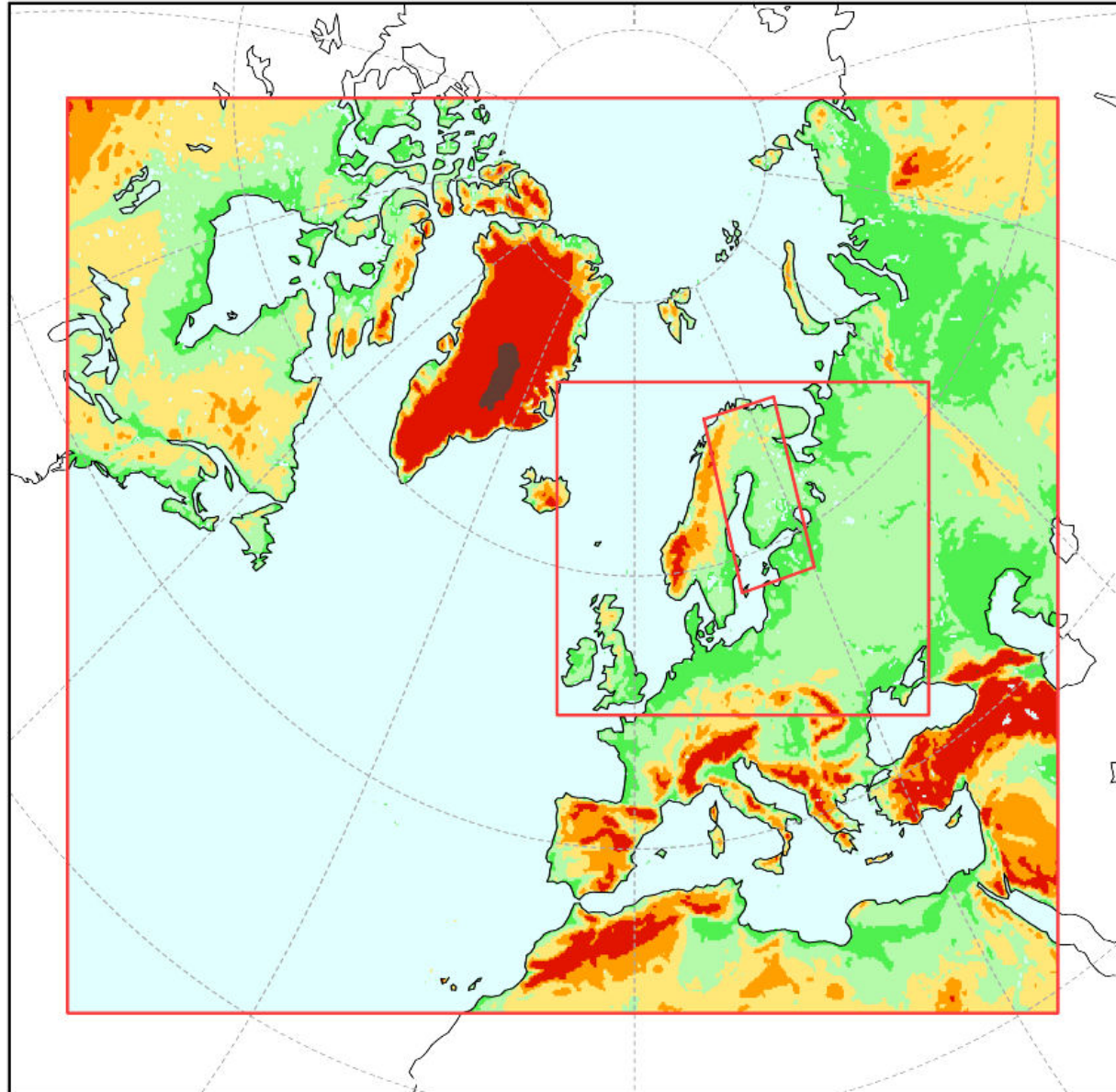






# FORECAST MODELS

- **HIRLAM RCR (resolution 16km)**
- **HIRLAM-MBE (7.5km)**
- **AROME (2.5km)**
- **Global ECMWF (25 km)**



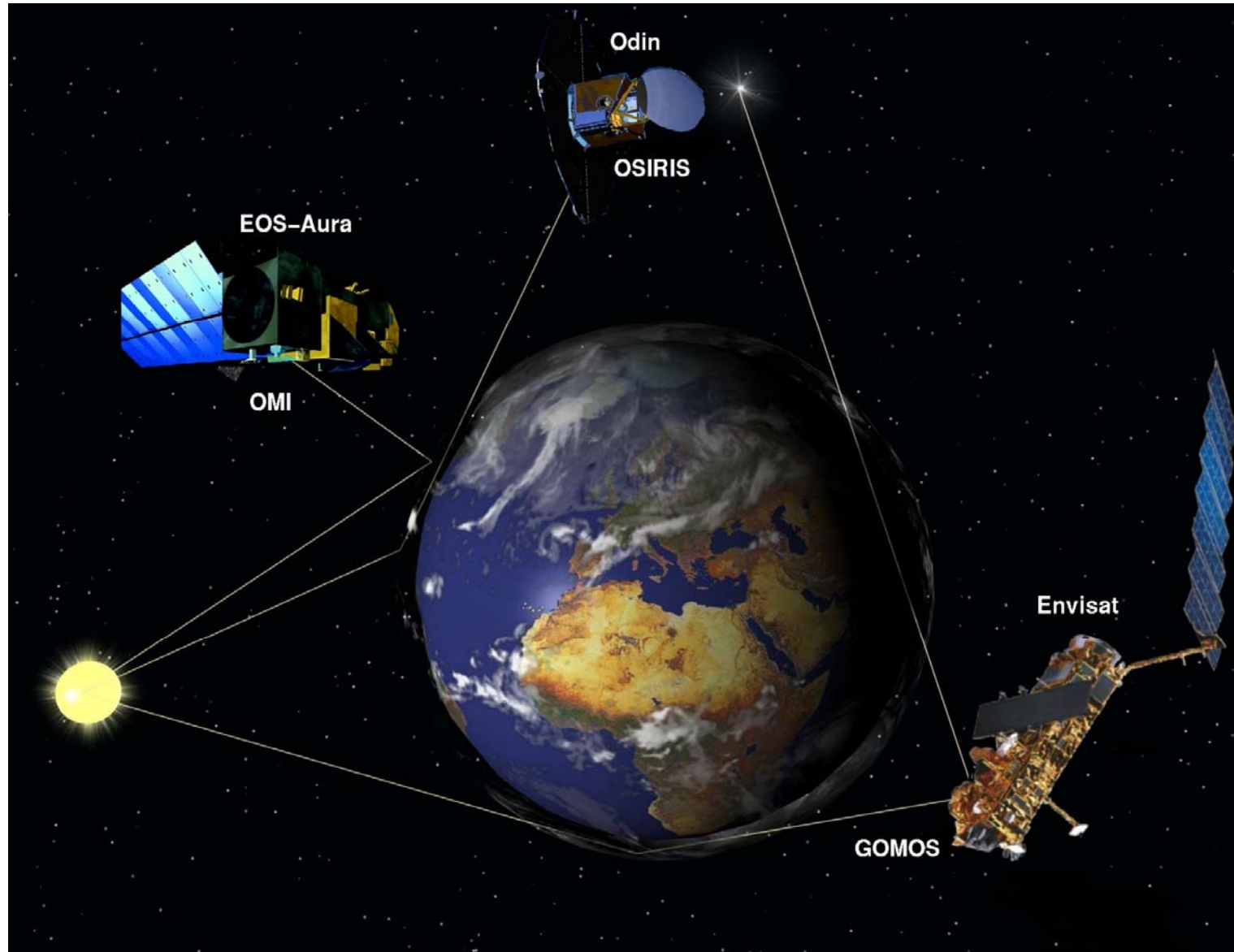




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# SATELLITES AND SPACE

- ESA, NASA & EUMETSAT
- Atmospheric chemistry SAF
- Algorithms
- Receiving & Processing
- Atm. chemistry
- Global change
- Weather, Sea

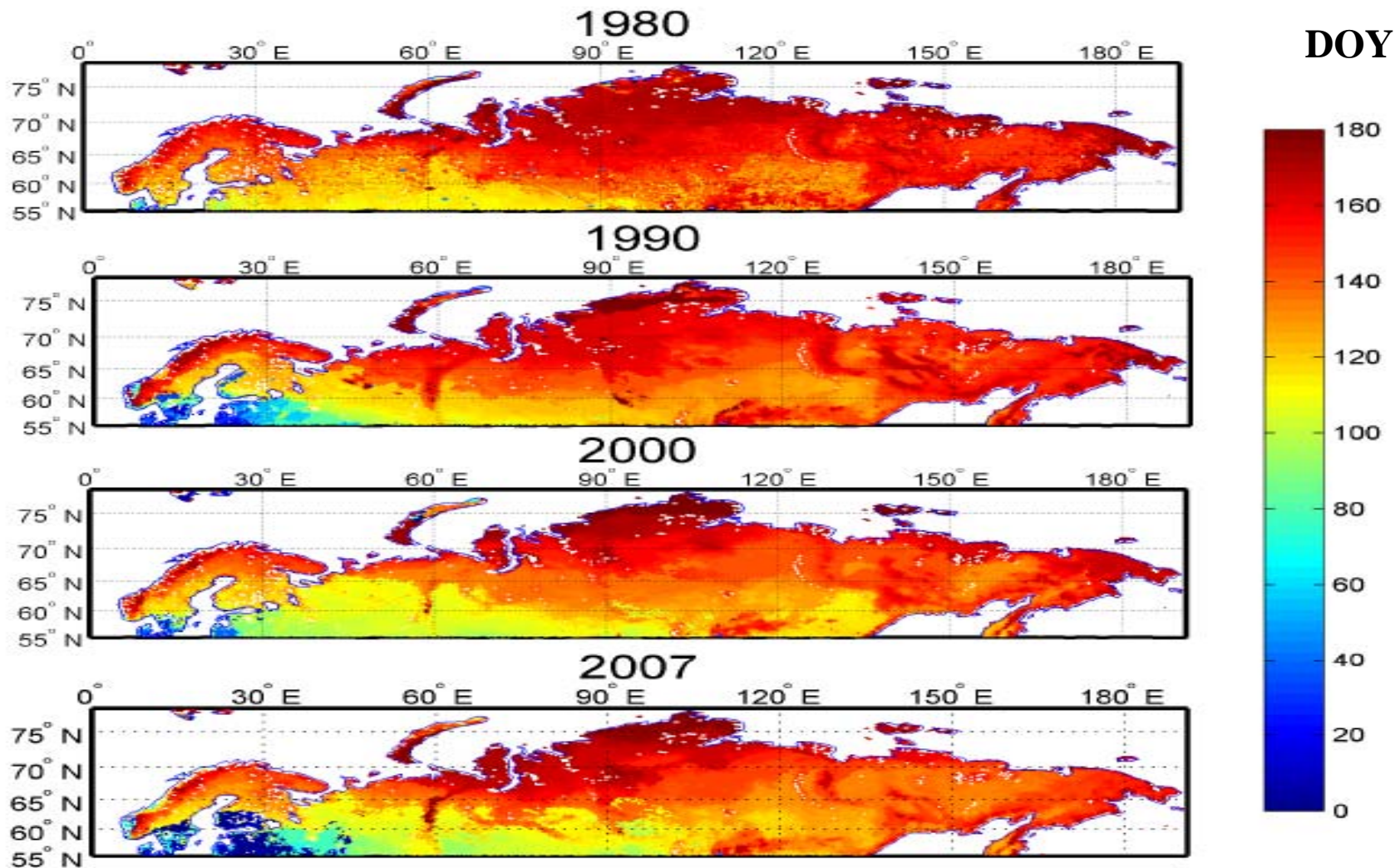




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M  
FI

# Snow melt date 1980-2007/satellite microwave obs.



Calibration against ~200 ground-based stations

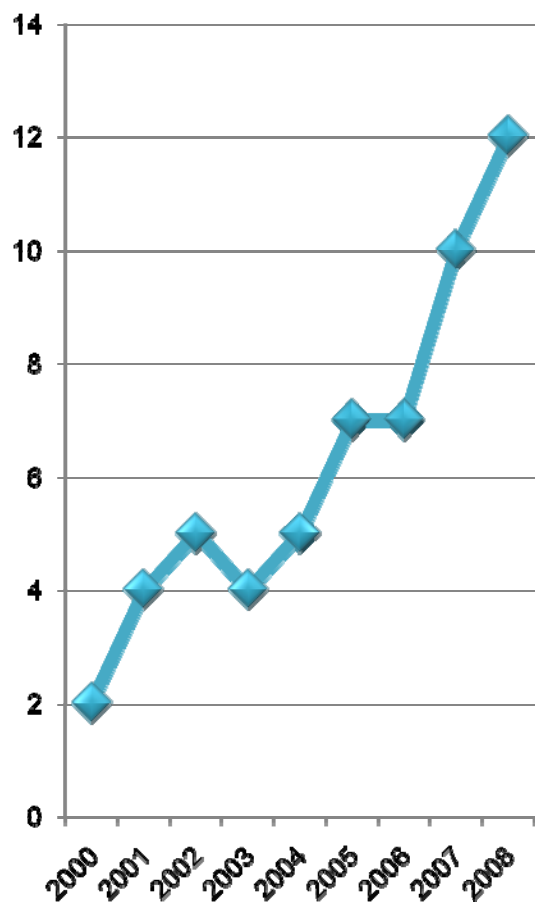
FMI Director General

The color code is the number of the melt date since January 1.

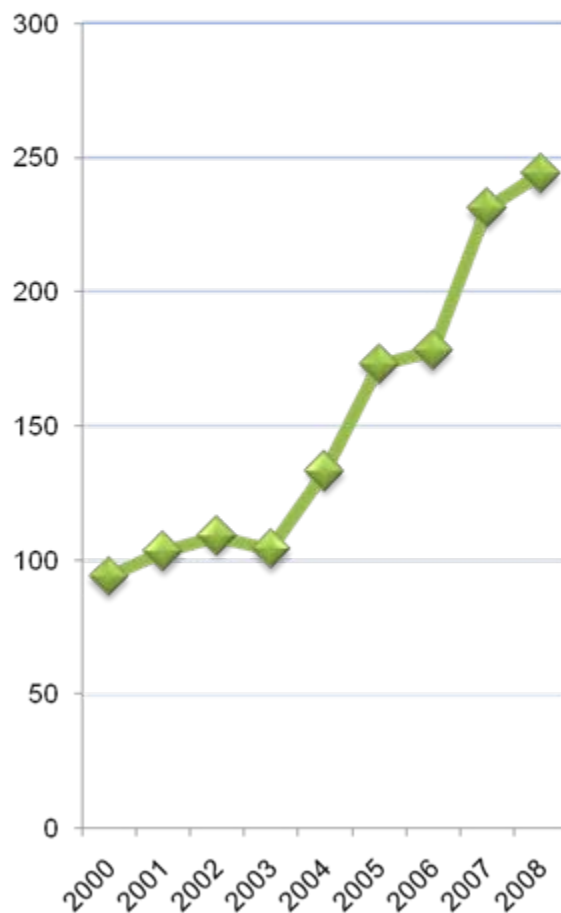


# PUBLICATIONS 2000–2008

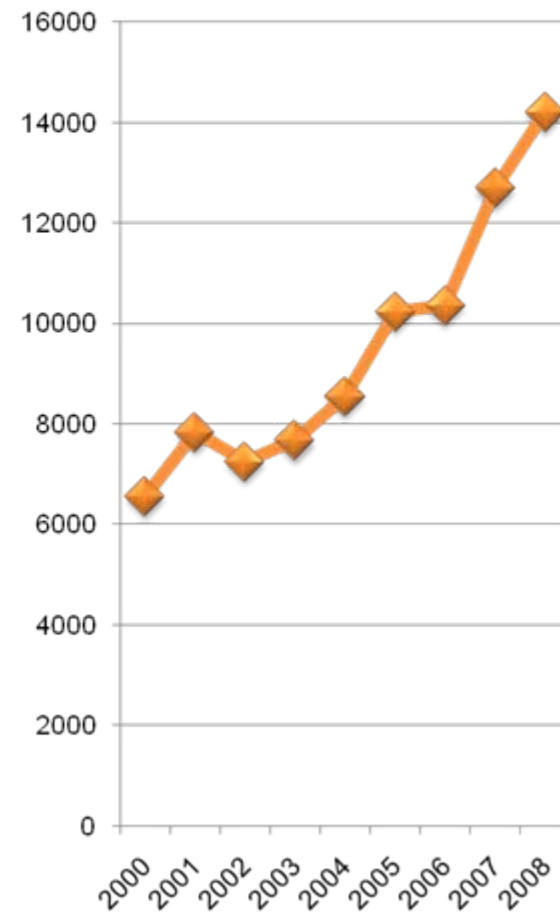
## Doctoral dissertations



## Peer refereed articles



## Publications index

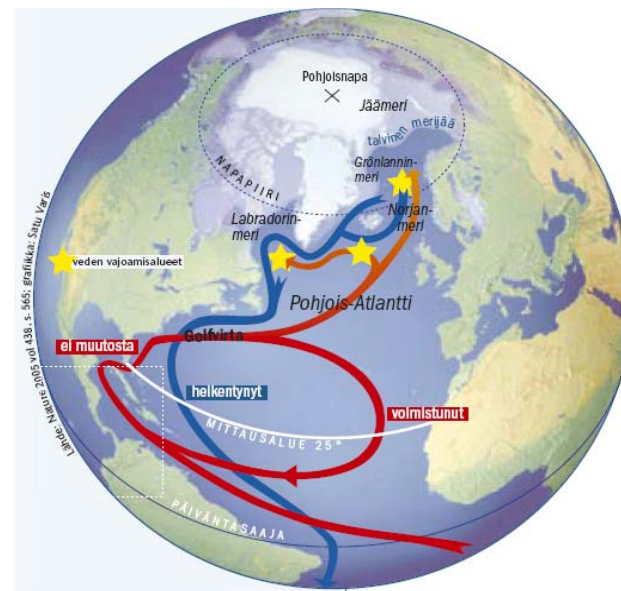
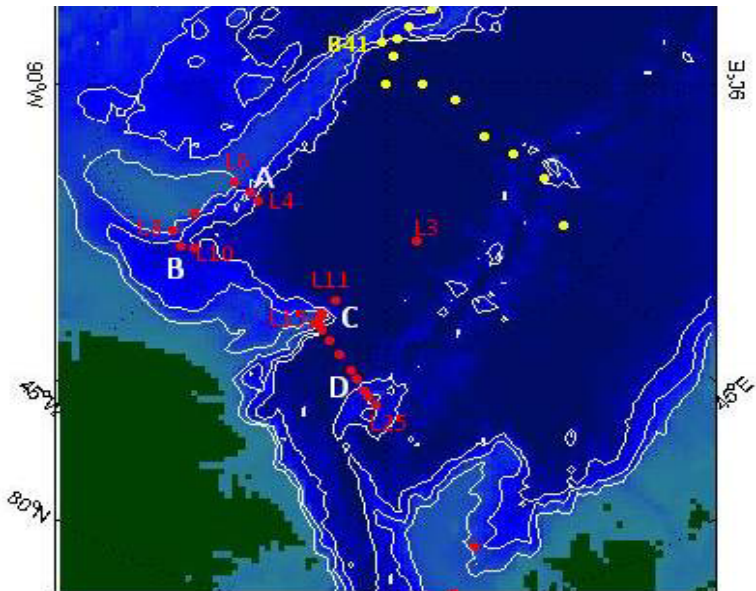
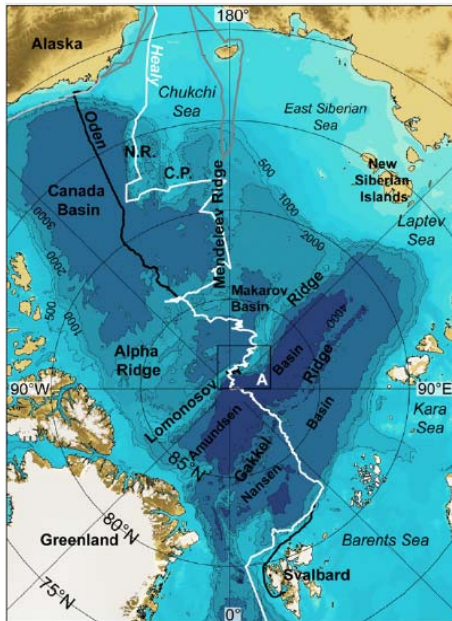


# STRATEGIC RECRUITMENTS 2005-2009

1. A joint professorship was formed (2005) together with the University of Kuopio. Prof. **Kari Lehtinen** from University of Helsinki was recruited to the position.
2. Prof. **Jouni Pulliainen** was recruited (2007) from Helsinki University of Technology to take lead of Arctic Research Centre.
3. A joint professorship for Meteorology was formed (2007) together with University of Helsinki and Vaisala Inc. Prof. **David Schultz** from NOAA was recruited to the position.
4. A joint professorship for Earth Observation was formed (2007) together with University of Helsinki. Prof. **Gerardus de Leeuw** from TNO was recruited to the position.
5. Prof. **Douglas Worsnop** from Aerodyne Inc. and Boston College became a Finland Distinguished Professor funded by the Academy of Finland. This is a half-time position shared with the Universities of Kuopio and Helsinki (2007-2011).
6. Prof. **Sergej Zilitinkevich** got an European Research Council Advanced Grant (2008-2012).
7. Prof. **Ari Laaksonen** was recruited (2008) from the University of Kuopio to take lead of Climate Change Research.
8. A joint 2-year professorship was formed (2009) together with the University of Kuopio. Dr. **Jim Smith** from NCAR was recruited to the position.
9. Prof. **Adriaan Perrels** was recruited (2009) together with the State Economic Research Institute for socio-economic research.



# Arctic and Baltic Sea Marine Research





# Polar Communications & Weather (PCW)/ PolarSat Mission



Canadian Space Agency  
Agence spatiale canadienne

Canada



## LESSONS LEARNED

- $1+1 > 3$  in partnerships
- US open data, algorithm & model policy appreciated, way to success
- Global support and developed-developing country collaboration essential for the service capability and global infrastructure sustainability
- Personal level relationships and confidence precondition for successful collaboration