



ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

FMI MISSIONS AND THE TIKSI OBSERVATORY





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





FMI STAFF & BUDGET

- 645 man-years
 - **Weather & safety 277**
 - **R & D 312**
 - **Administration 48 my**
- 60 % academic, 17 % PhD
- 70 M€ 2011
 - **63 % government**
 - **37 % from commercial or research activities**
- 60 % of R & D activities externally funded
 - **EC, ESA, EUMETSAT, Finnish Academy & Technology and Innovation Funding Agency**

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



SERVICES AND KNOW-HOW OF FMI FOR FINLAND

1) SAFETY , PROTECTION OF LIFE AND PROPERTY

TRAFFIC

- SAFETY: ROAD, AIR, MARITIME & RAIL
- WINTER ROAD & AIPORT MAINTENANCE
- ICEBREAKER SERVICES
- TRAFFIC FLUENCY
- EMISSIONS: CLIMATE AND HEALTH IMPACTS

RESCUE & SAFETY

- OIL & HAZARDOUS RELEASES
- HIGH-IMPACT WEATHER
- FOREST FIRES

DEFENCE

- AIR FORCE, NAVY AND GROUND FORCE SERVICES

HEALTH AND LIFE

- NUCLEAR RELEASE DISPERSION
- AIR QUALITY & TEMPERATURE

2) PRIVATE SECTOR

ENTERPRIZES

- NEW TECHNOLOGY & SERVICES
- KNOW-HOW FOR COMPANIES
- WIND, SOLAR & WATER ENERGY

FORESTRY/AGRICULTURE

- CLIMATE ADAPTATION
- DISASTERS AND FLOODING
- DEDICATED SERVICES
- GREENHOUSE GAS FLUXES

3) INTERNATIONAL RESPONSIB

FOREIGN AFFAIRS

- DEVELOPMENT CO-OP.
- CLIMATE POLICY
- TECHNOLOGY TRANSFER

ORGANIZATIONS

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

4) RESEARCH & ENVIRONMENT

R & D

- UNIVERSITY PARTNERSHIPS
- PROFESSORS & INTRASTRUCTURES

ENVIRONMENT

- AIR QUALITY
- CLIMATE



FMI INTERNATIONAL POLICY

- **WMO**

- Support to WMO Reform: member need driven, more visible, action oriented, focused and shorter meetings, less document refinement
- Partnership in capacity development

- **ECMWF**

- Value for money high for Finland, also for additional investments
- Support for seasonal forecasting & shorter time-scales
- Status as best NWP center to be retained

- **EUMETSAT**

- EPS SG an important mission
- SAF programme beneficial
- Role in Molniya orbit polar missions

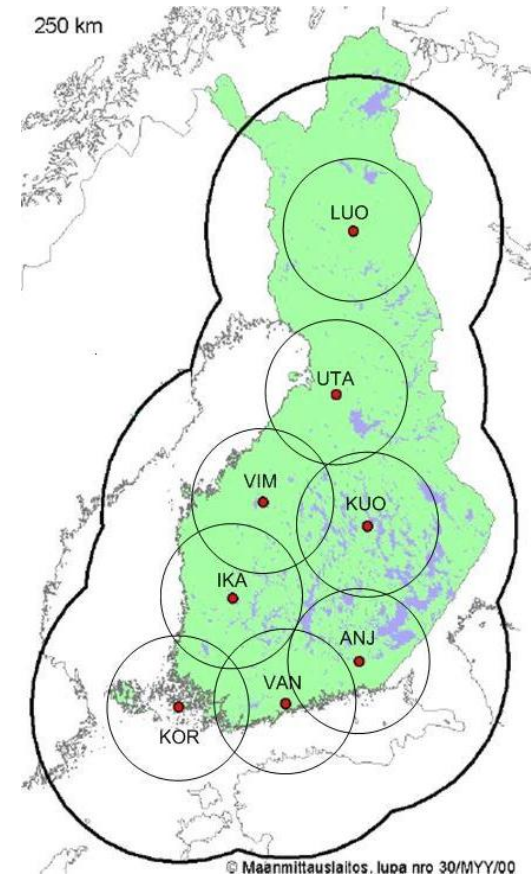




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Observation Network

- Network design, maintenance and development by FMI
- Automation rate >97%
- Operative stations ~500
- Sounding stations 3
- Weather radars 8
- Lightning detection antennas 5+3
- Air quality stations 30
- AWS stations 200
- Tidal gauge/Sea level stations (mareographs) 13
- Wave buoy 1
- Precipitation stations 200
- Special purpose (eg. masts ja radiation) 50





Air Quality monitoring networks in Finland



**Background
monitoring
network (FMI)**

~20 stations

**International
monitoring
programmes**

Gases: SO_2 , NO_x , O_3 , VOC, Hg
Particles: PM_{10} , $\text{PM}_{2.5}$, SO_4 , heavy metals, PAH
Deposition: pH, conductivity, main ions, heavy metals
Gases+particles:
 HNO_3+NO_3 , NH_3+NH_4



**34 local or
regional
networks**

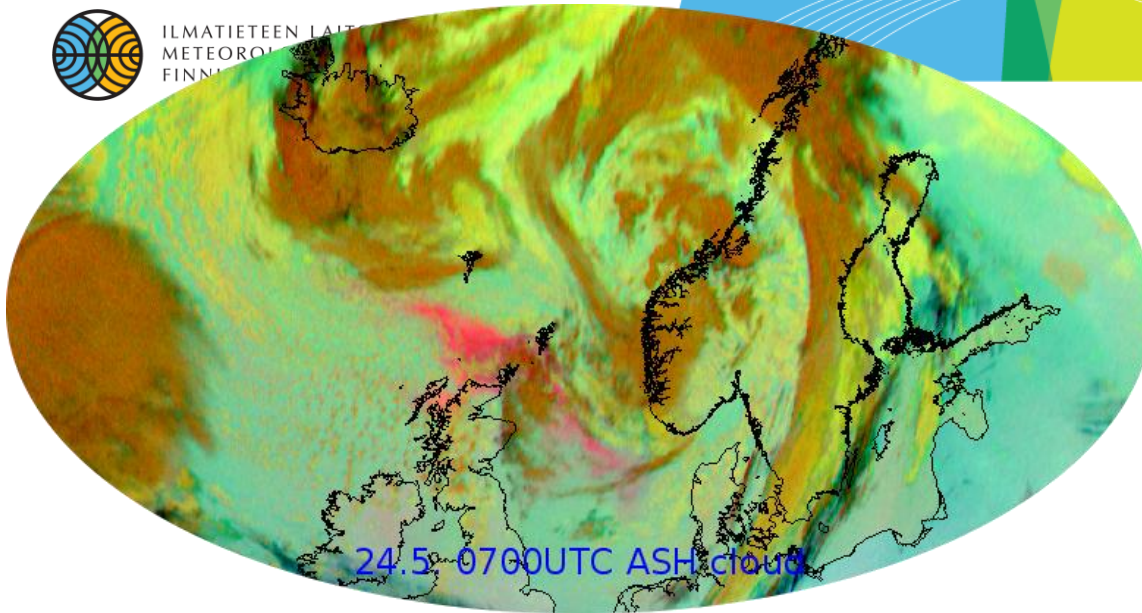
**~160 stations
in 60 cities or
municipalities**

SO_2 , NO_x , PM_{10} , $\text{PM}_{2.5}$, TSP, O_3 , CO, TRS, heavy metals, PAH, VOC

All data collected to the national air quality data base maintained by FMI.



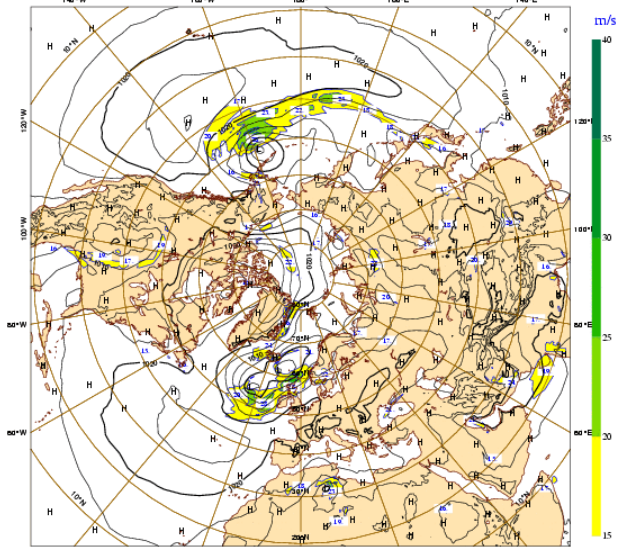
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INSTITUTE



ECMWF

17km → 10km (2015)

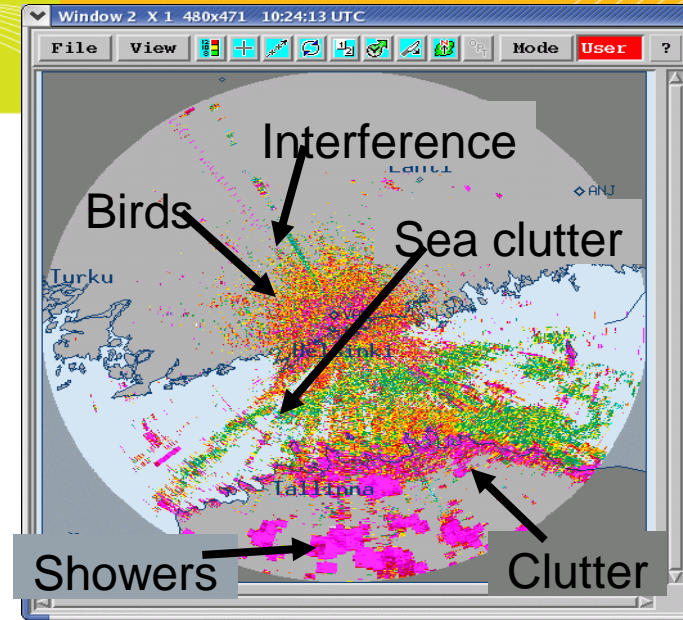
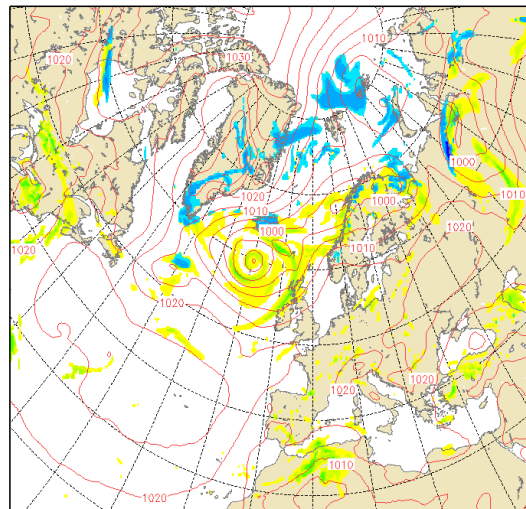
Thursday 19 May 2011 00UTC ©ECMWF Forecast 1+048 VT: Saturday 21 May 2011 00UTC
Surface: Mean sea level pressure / 850-hPa wind speed



HIRLAM

16km → 7.5km (2011)

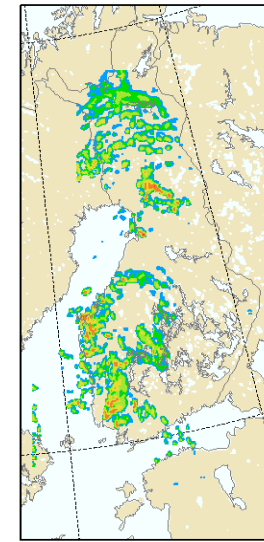
Pmsl and hourly prec. (mm) green:rain blue:snow
initial: 00Z19MAY2011 valid: 00Z20MAY2011



HARMONIE

2.5km → ~1km

AROME 12AUG2007 00 UTC Forecast. Radar reflectivity [12AUG2007 14:00 UTC (Arome_bbcase,2.5km)].



Max: 50.375
Radars:VAN,IKM,ANJ,LSU,KOR,UTA,LUO,VI
Antenna=0.3°



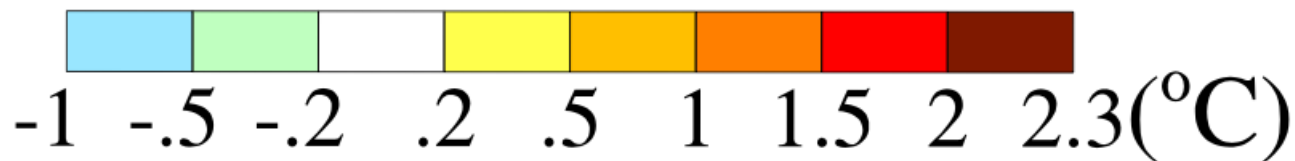
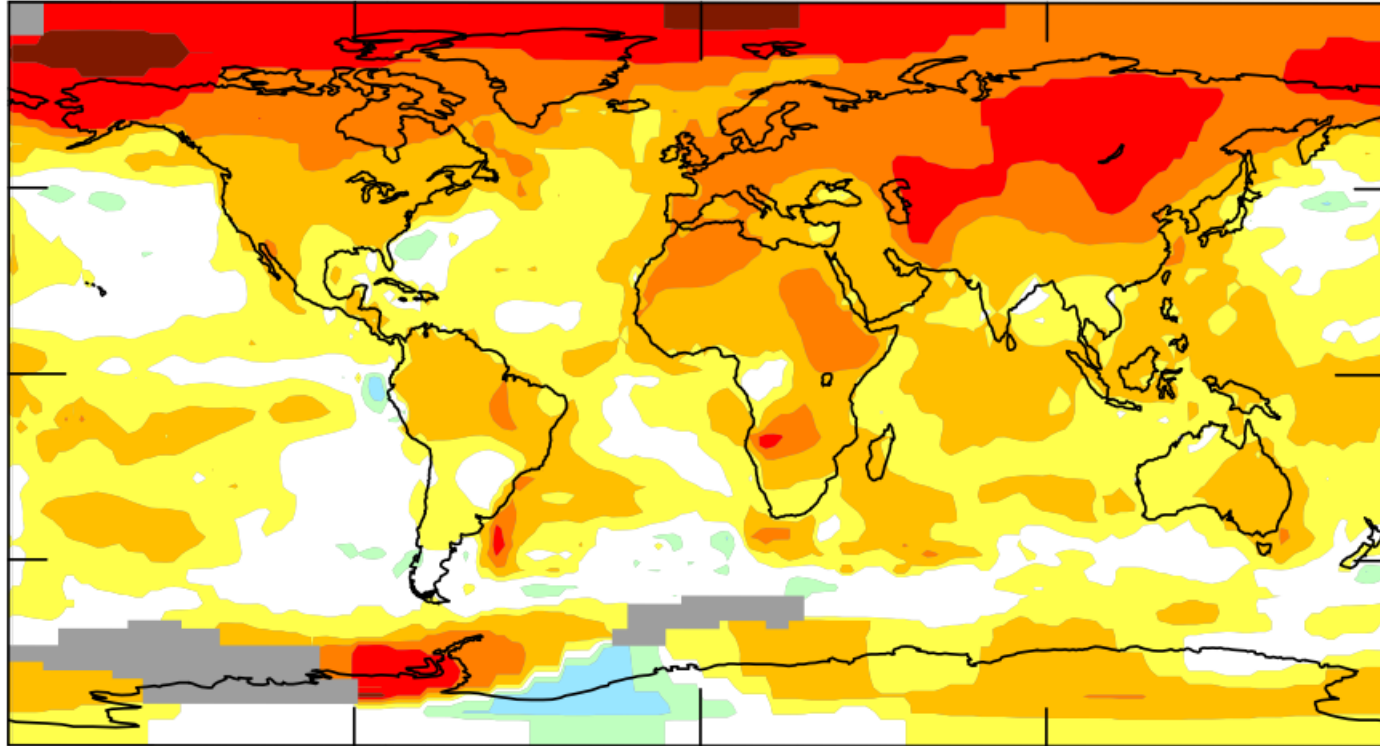
Computing environment

- **Supercomputers**
 - CSC Cray (1996-2001 for FMI)
 - 0,4 Tflops
 - CSC IBM (2001-2005 for FMI)
 - 2,2 Tflops, in partial use
 - FMI SGI Altix (2005-2010)
 - 1,8 Tflops
 - FMI/CSC Cray XT5m (2009-)
 - 34,6 Tflops
 - Next 2013
- **Basic servers**
 - Virtual servers
 - Card servers as physical environment

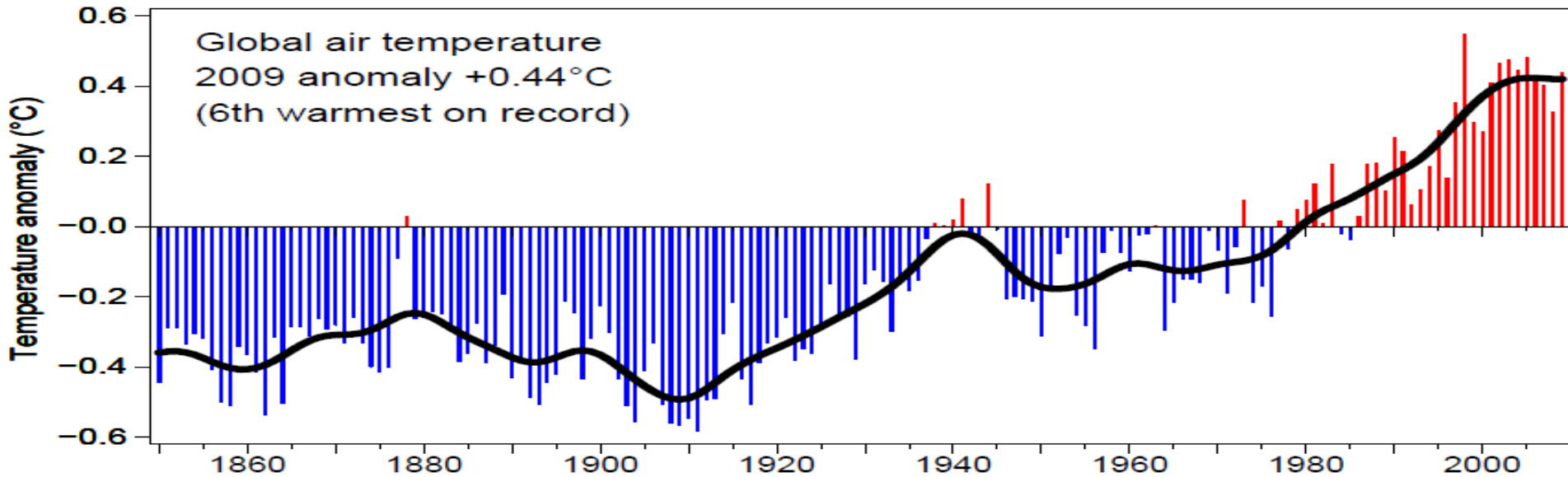
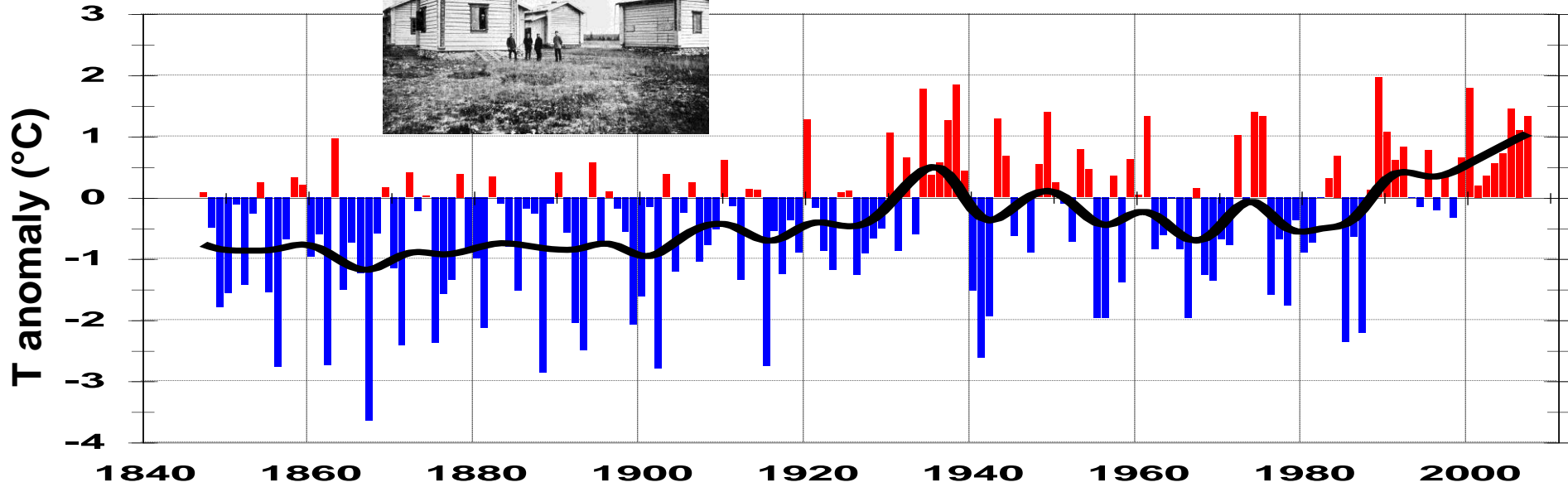




TEMPERATURE CHANGE 1950's=> 2000's



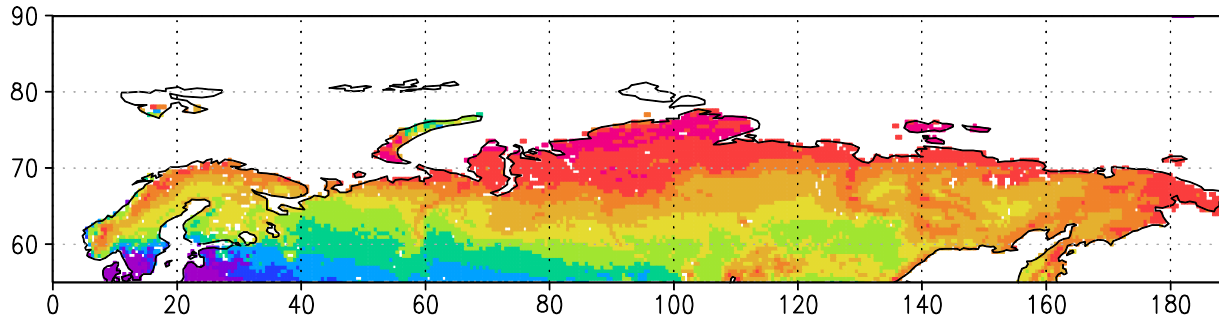
TEMPERATURE FINLAND/GLOBAL 1847-2009



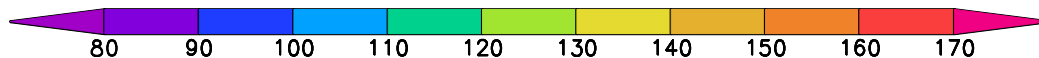
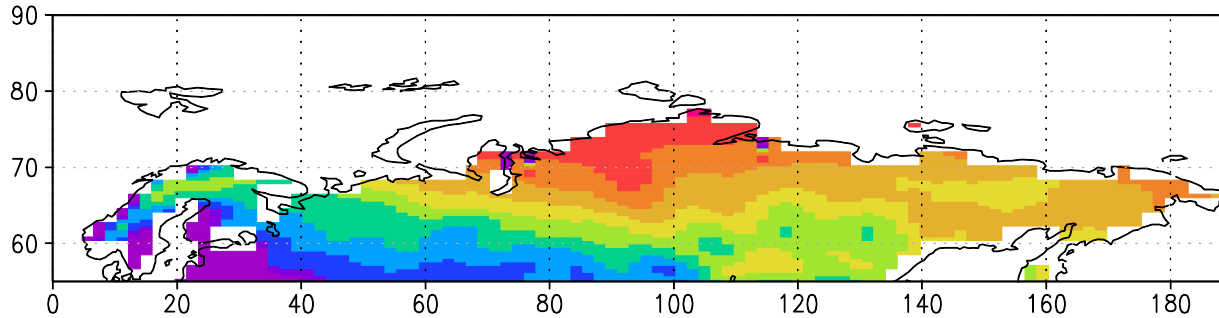


AVERAGE SNOWMELT DATE IN NORTHERN EURASIA 1979-2010

Satellite observation 1979–2001



ECHAM5 1979–2001



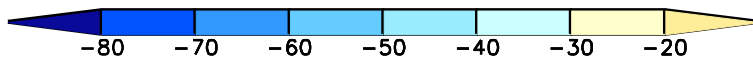
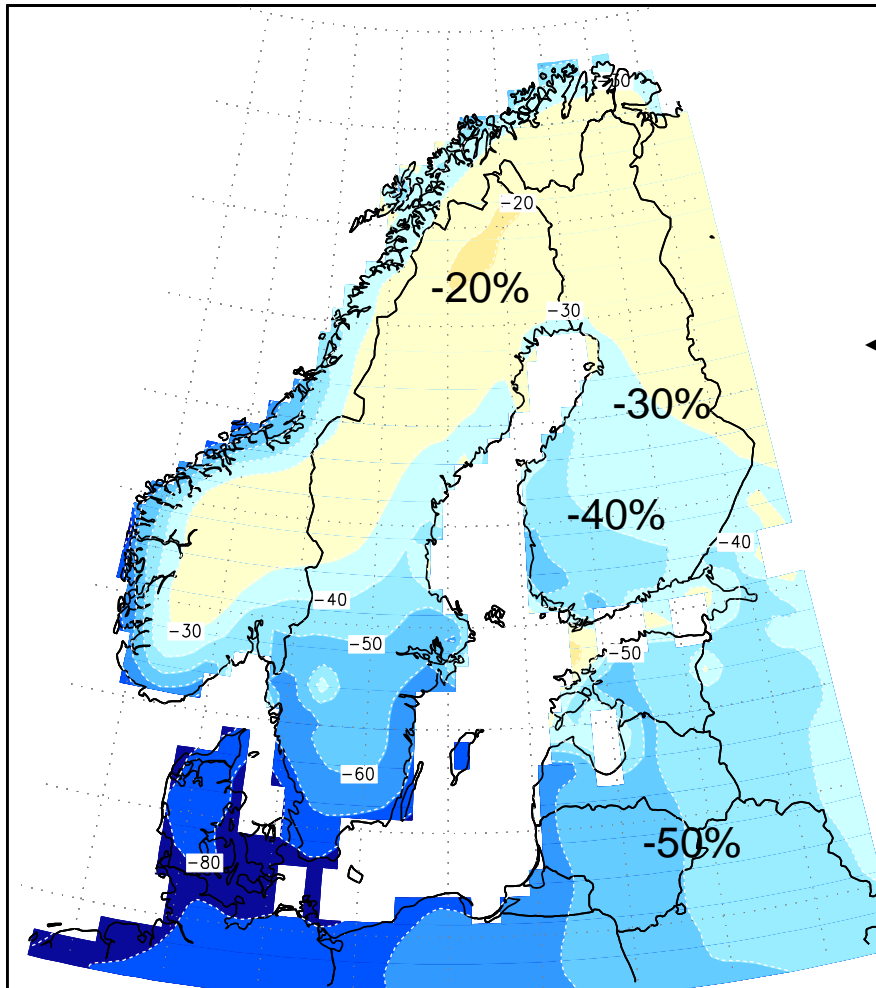
Day of year

Presently, snowmelt occurs one week earlier than 30 years ago



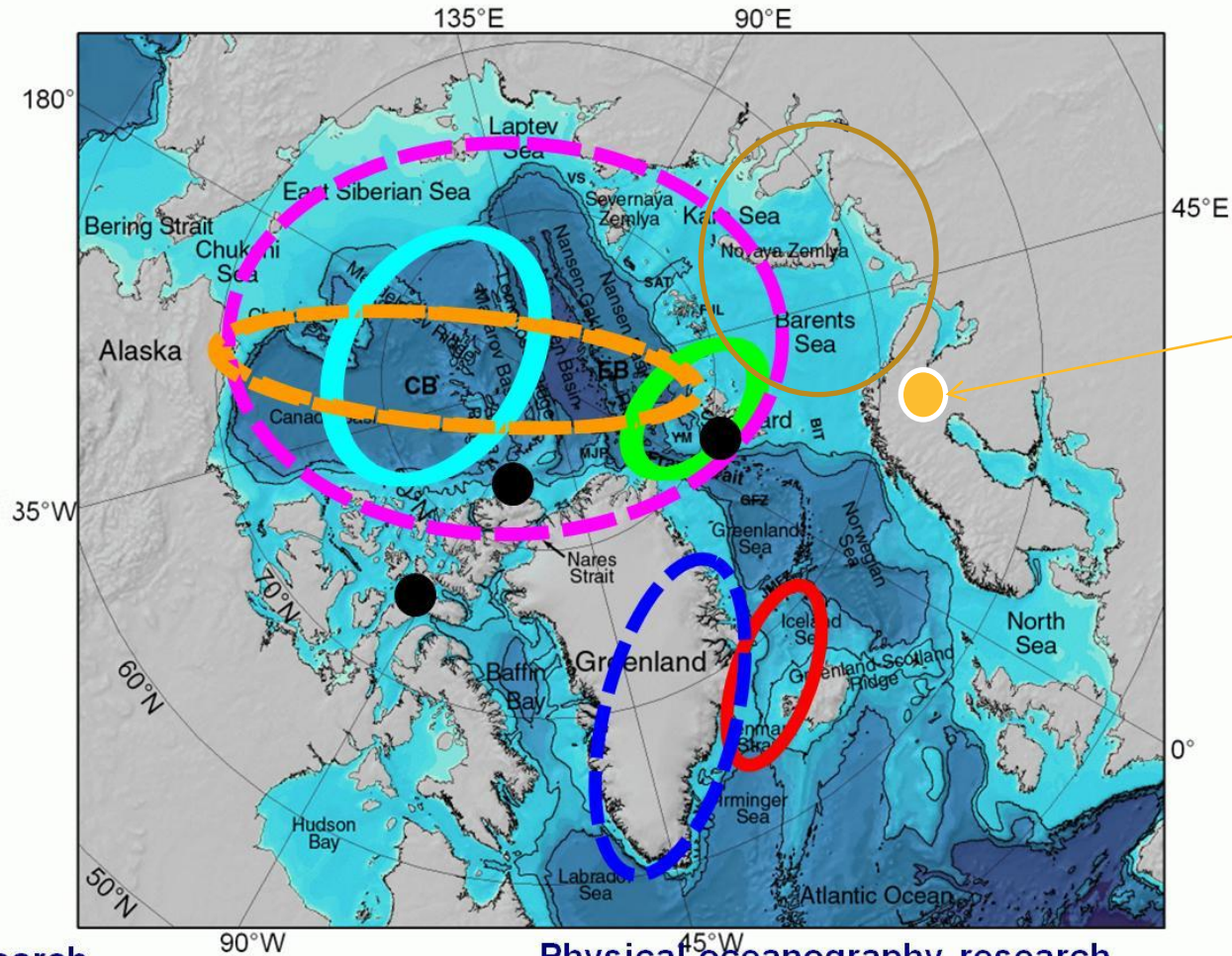
Change in days with snowcover (A2)

← 1961-90 => 2071-2100





REGIONS OF ACTIVITY DURING 1997-2011



Sodankylä
Sat. Station

Sea-ice research

FRAMZY, CRYOVEX, NO-ICE, DAMOCLES
CHINARE2003, CRYOVEX, CHINARE2008
DAMOCLES/TARA

Physical oceanography research

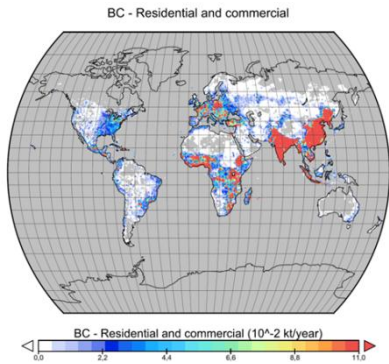
VEINS, ASOF-W, THOR, Arctic Ocean 2002
VEINS, ASOF-N
DAMOCLES, SPACE, HOTRAX, LOMROG, CHINARE2008:
KARAX





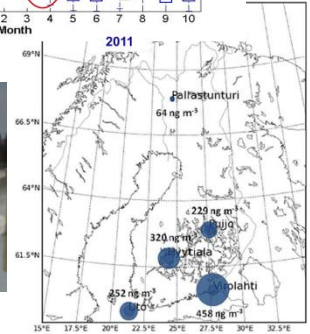
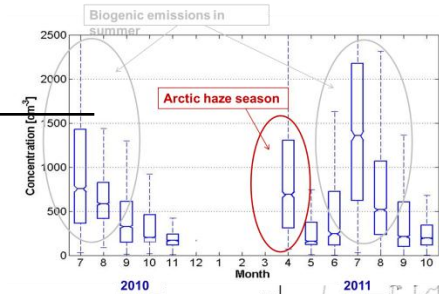
Mitigating Arctic climate by reducing European BC emissions

Emissions

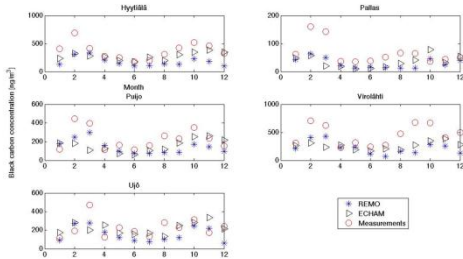


Experiments

- continuous
- campaigns



Climate modelling



Dissemination

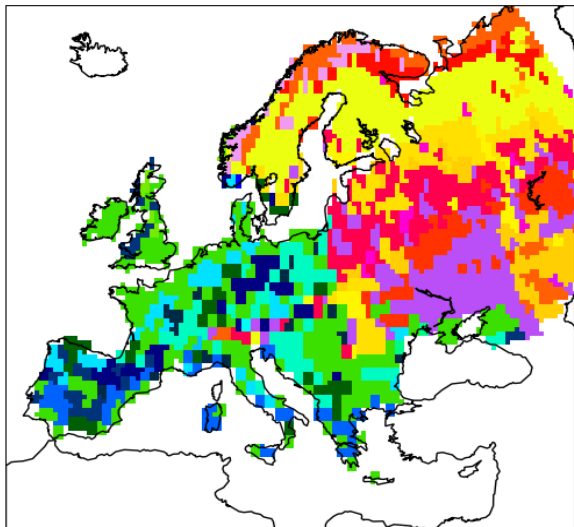
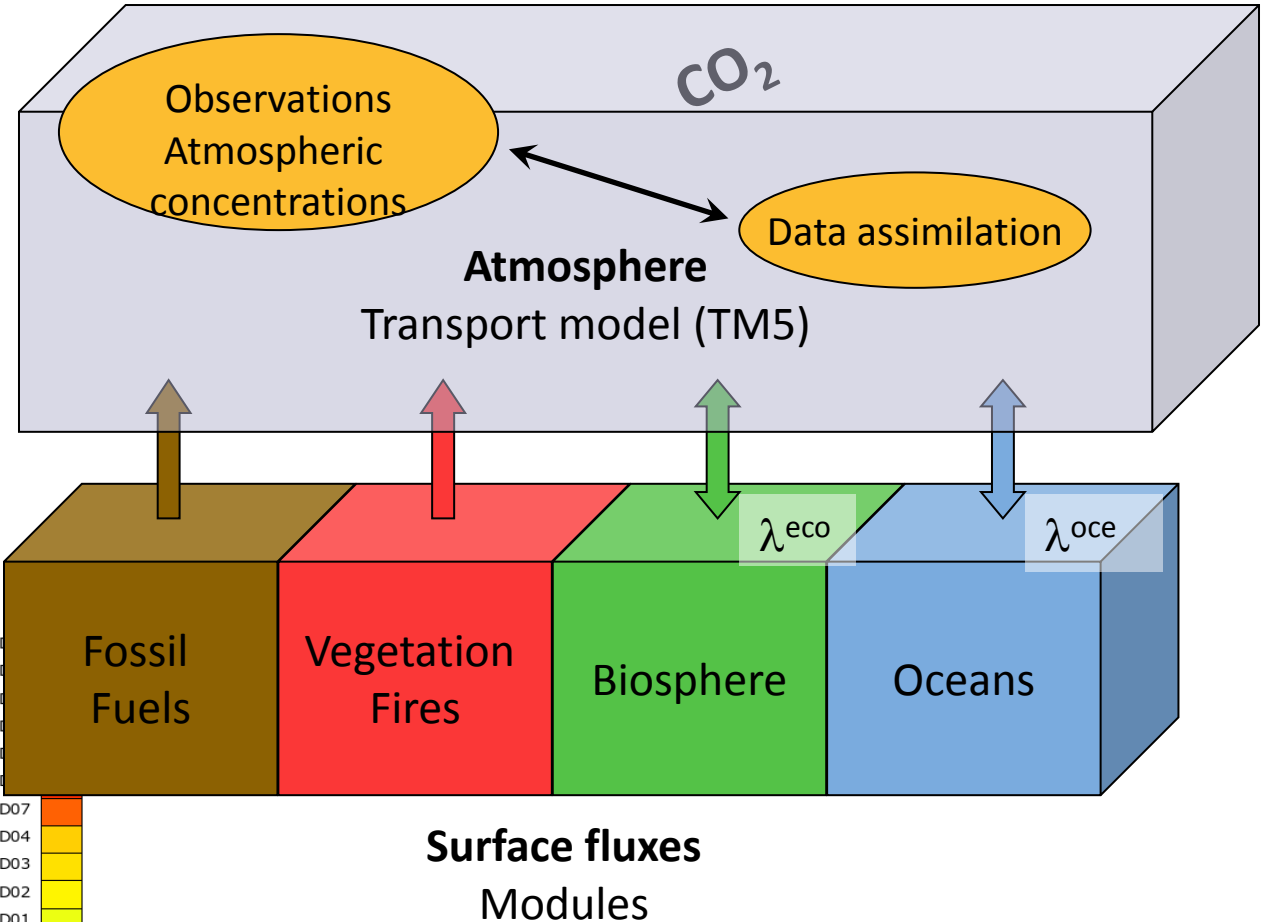
Distribution of project results and

- General information about black carbon formation, emissions and climatic effects
- Other information from existing data sources (e.g. leaflets and links to websites on good combustion practices in small-scale wood burning)
- General guidelines to national authorities to design local actions to mitigate emissions (e.g. information campaigns directed to domestic wood combustion)
- "The project will also look for opportunities to participation in local level information campaigns, e.g. by HSY Helsinki Region Environmental Services Authority."

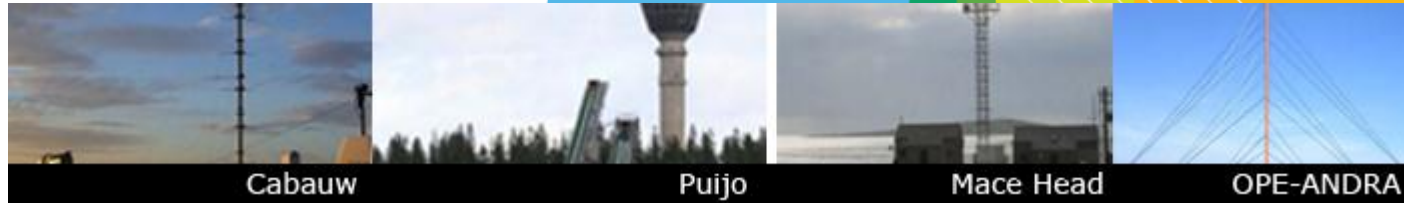


CarbonTracker

Net carbon fluxes derived from atmospheric trace gas observations



The Demo Atmospheric Network



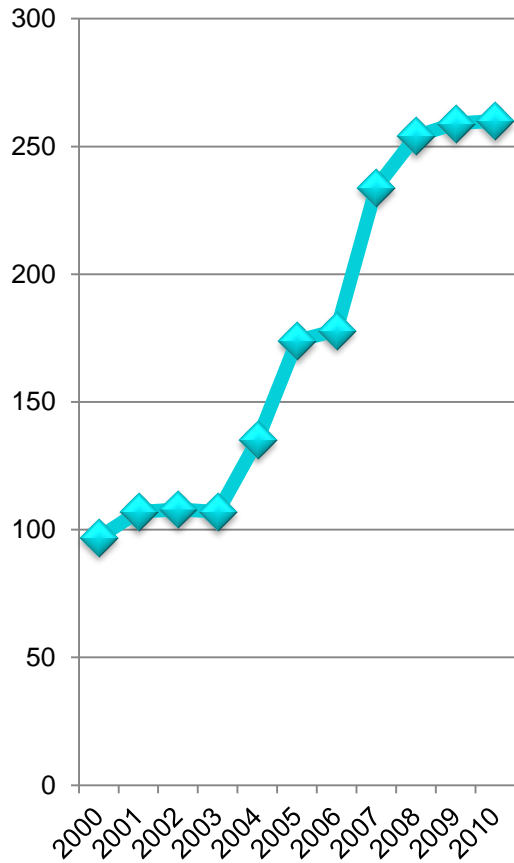
Integrated Carbon Observation System (ICOS) is a distributed European research infrastructure for measuring greenhouse gas concentrations and fluxes. 13 participating countries.

2011-12

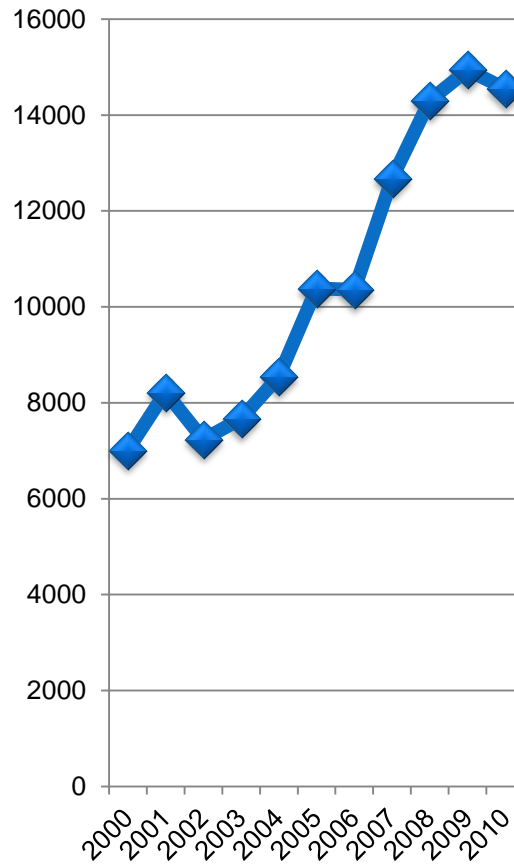
- Participation in start-up of ICOS headquarters in Helsinki
- Started new atmospheric and ecosystem stations
- Participated in developing atmospheric stations as a part of the Demo experiment



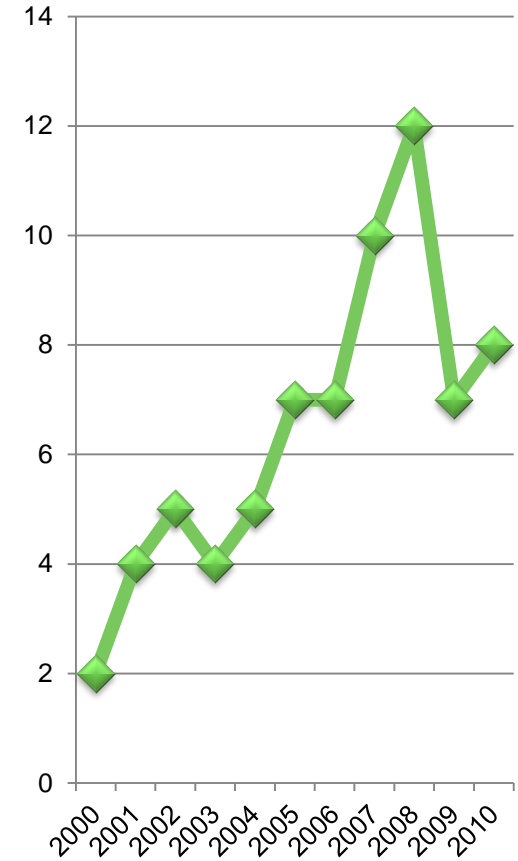
PEER-REVIEWED PUBL.



PUBL. INDEX



PHD THESIS



THANK YOU!