Statistical Approaches to Regional Climate Models for Adaptation

SARMA

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**Norsk Regnesentral and
SARMA Executive Committee**

TRI Network kick-off, Oslo

27–28 October 2010

Outline

► Scientific backdrop

► Network goals

► Organisation

► Activities

► Nordic added value

Statistics in climate science – why?

► Climate science challenges (selection…):

- Finding patterns and structures in huge data sets
- Estimation, interpretation and communication of uncertainty
- Complex processes call for advanced methods

► Statistics offers theory and tools for:

- Collection and analysis of data
- Interpretation and communication of results and their uncertainty
- Model building

The American Statistical Association (ASA):
- Advises US Congress on climate change issues
- Endorses the IPCC 4th AR conclusions

Statistical climatology – "basics"

► Uncertainty
  - Compound sources
  - Estimation

► Variability
  - Natural climate variability
  - Indications of climate change

► Communication
  - Instruments for visualization
 - Perception

Uncertainty in impact studies

► Sources
  - Climate system itself
  - Scenario assumptions
  - Insufficient resolution
  - Incomplete data
  - Model approximations
  - Measurement errors
  - …

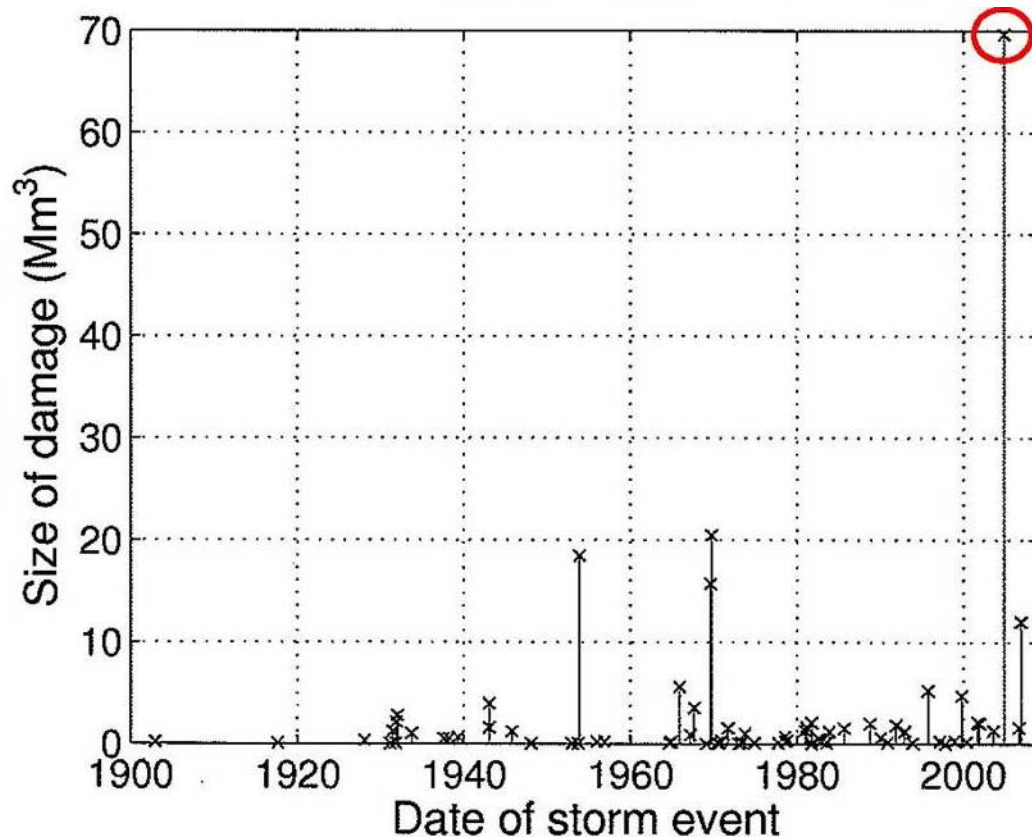Uncertainty is an instrument to quantify understanding of effects, not an obstacle!
  ◦ Necessary for informed policy making and adaptation

Propagating uncertainty

Climate system

Climate scenario

Global climate model

Regional climate model

Impact model
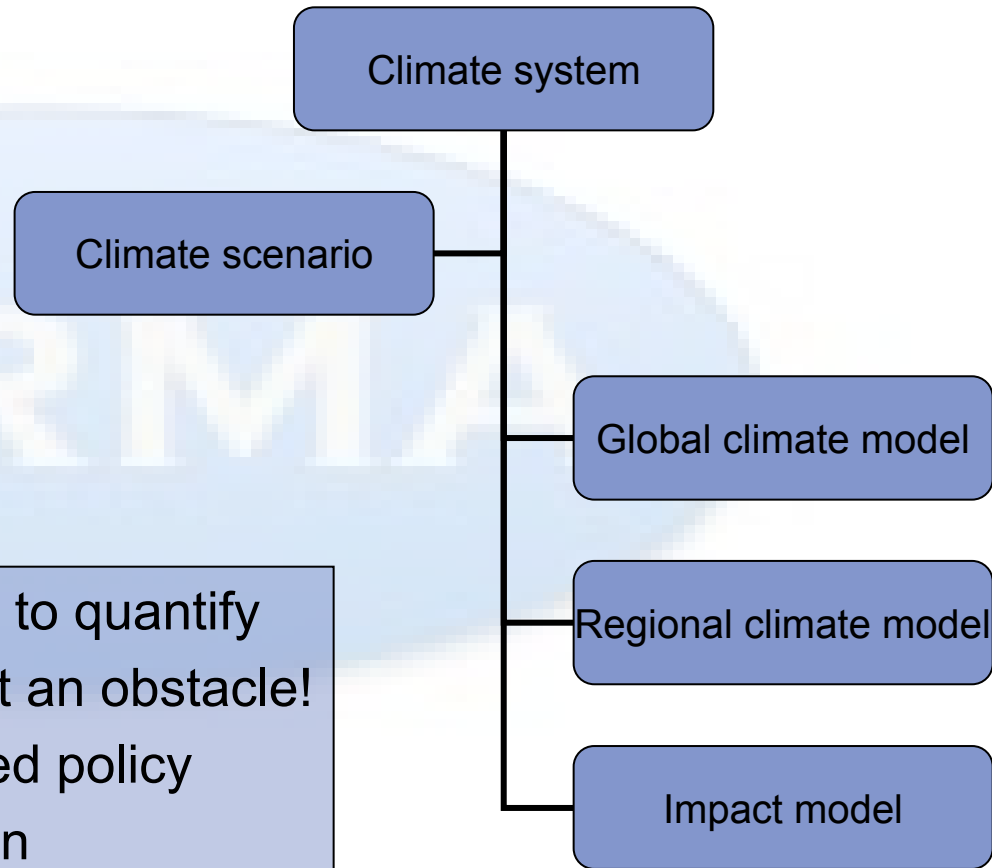
Variability: Gudrun storm event (2005)

Forest damage – was it "just" a 100-year event?

Statistics confirms: Yes – it could very well be a 100-year event!

Bengtsson and Nilsson, Natural Hazards and Earth System Science, 2007

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Communication

► Care and sobriety should be excercised in communicating climate change

► Are climate studies too detailed?

    ▪ Example (The Swedish Climate and vulnerability study): *"The consequence of increased wind climate on crayfish catch with cage- and trawl-fishing will be 1.4 and 14.1 MSKR, respectively"*

► Exaggerated illusory precision...

    ▪ …lowers credibility

    ▪ …opens up for criticism

Statistical climatology – more challenges

► Validating complex models in time and space

► Regional models – downscaling to local conditions

► Reconstruction of the past and prediction of the future

► Risk analysis
  ▪ Models that describe the normal state of affairs – do they describe the extreme events equally well?
  ▪ How do extreme event mechanisms change with changing climate? Do they follow a general trend och do they have their own laws?

SARMA network goals

► Increased communication between statisticians and climate scientists

► Joint supervision of interdisciplinary PhD students

► Increasing interest in postgraduate studies in applied mathematical statistics

► Develop links with international groups and networks in statistical climatology

Organisation

SARMA:
18 nodes
at
13 places
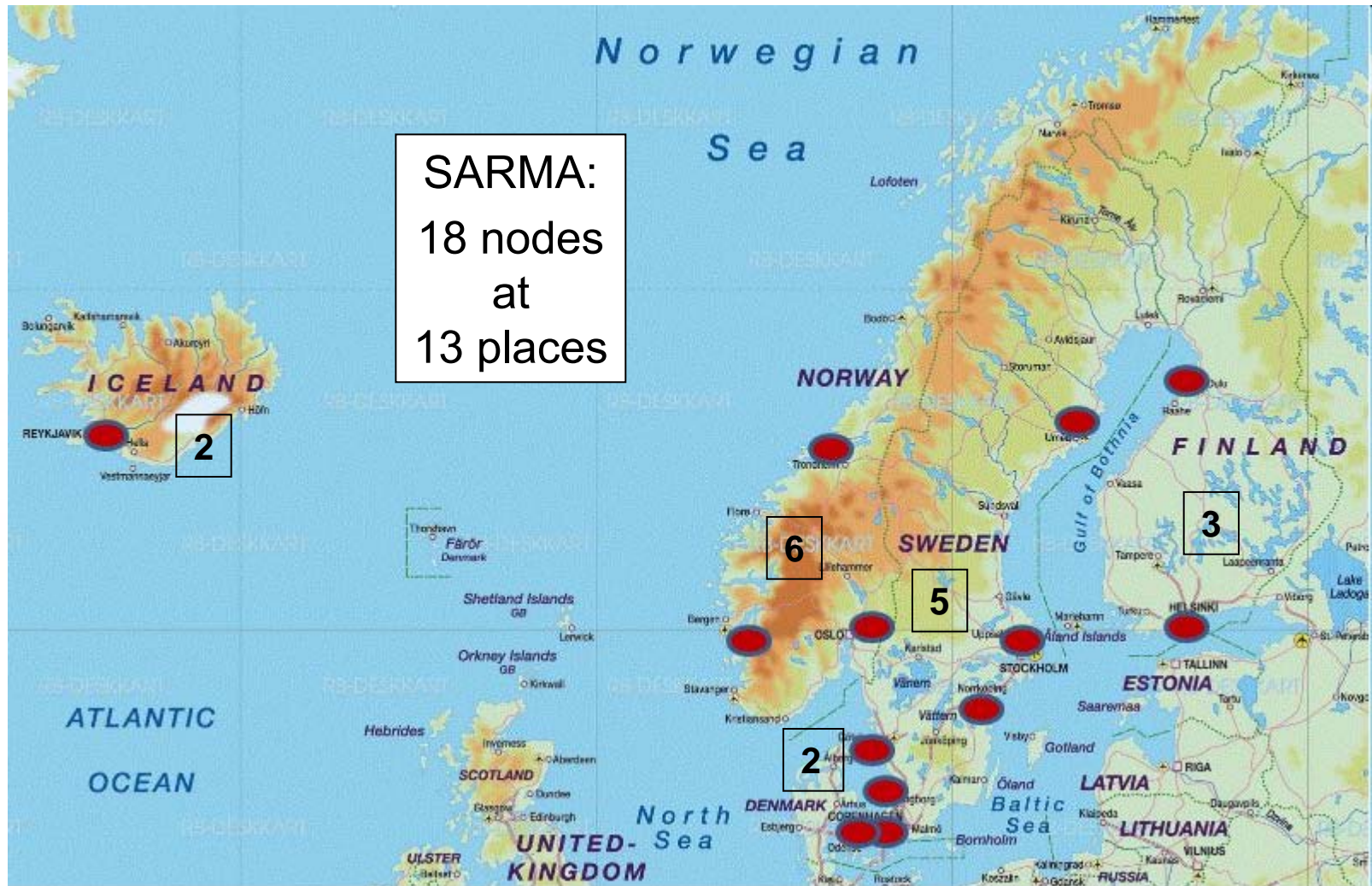
Nodes - statistics

- ◦ Norwegian Computing Center (P. Guttorp, network leader)
- ◦ University of Oslo
- ◦ Norwegian University of Science and Technology

- ◦ University of Iceland

- ◦ University of Oulu

- ◦ Lund University
- ◦ Chalmers University of Technology
- ◦ Stockholm University
- ◦ Umeå University

- ◦ Danish Technical University

Nodes – climate sciences

- ○ Bjerknes Centre for Climate Research
- ○ Norwegian Meteorological Institute
- ○ Center for International Climate and Environmental Research (CICERO)

- ○ Icelandic Meteoro-logical Office

- ○ University of Helsinki
- ○ Finnish Meteorological Institute

- ○ Swedish Meteorological and Hydrological Institute/ Rossby Centre

- ○ Danish Meteorological Institute

Initial activities

► 1–2 February 2010: International Workshop on Modern Statistics for Climate Research, Oslo

- 75 participants from all Nordic countries and met services

► 12–16 July 2010: International Meeting on Statistical Climatology, Edinburgh

- 13 participants from the network

► 23–27 August 2010: Workshop on Climate Extremes, Banff, Canada

- 7 participants from the network

► Website is up and running:

- www.nrcse.washington.edu/NordicNetwork/home.html

Scheduled activities

- ► April 2011: Statistical downscaling workshop, Lund
    - Together with strategic research initiatives MERGE and BECC on Climate models and Ecosystems effects
        - ◦ How to move knowledge between global – regional – local scale models

- ► August 2011: Visualization workshop, Reykjavik
    - Jointly with TIES, the International Environmetrics Society
        - ◦ Novel solutions for common climate science graphical displays

Further plans

- ► Three more workshops:
    - ▪ Insurance applications of regional climate models (2012?)
    - ▪ Statistics workshop for the TRI NCoEs (2012?)
    - ▪ Comparing regional models to data (2013?)
- ► Summer courses, joint with other programmes
- ► Travel grants to visit nodes or attend meetings
- ► International conference on statistical climatology (2013?)
    - ▪ Lessons learnt and emerging issues in key areas:
        - ◦ Climate modeling
        - ◦ Impacts of and adaptation to climate change
        - ◦ Regional uncertainty assessments

SARMA actions for cont. co-operation

1. Start joint Nordic multidisciplinary PhD supervision

2. Involve new groups

3. Apply for a TRI NCoE in statistical climatology

4. Act towards the industry to get their interest and support (*e.g.* funding PhDs)

5. Use EU funding opportunities

6. Prepare linked applications to the national councils

7. Build alliances with other (international) groups in statistical climatology

Nordic added value

► Fertilized interaction between statistics and climate science

  - Crossdisciplinary, -national and -institutional
  - Joint student supervision and summer schools
  - Joint international projects and collaboration

► Nordic groups joining forces allows for more extensive research ambitions

► Professionals within statistical climatology will hold expert competence urgently requested in society

A strong community in statistical climatology will represent a decisively advantage of Nordic climate science – propagating to society and industry!