Finnish Icing project 2010

Finnish Meteorological Institute
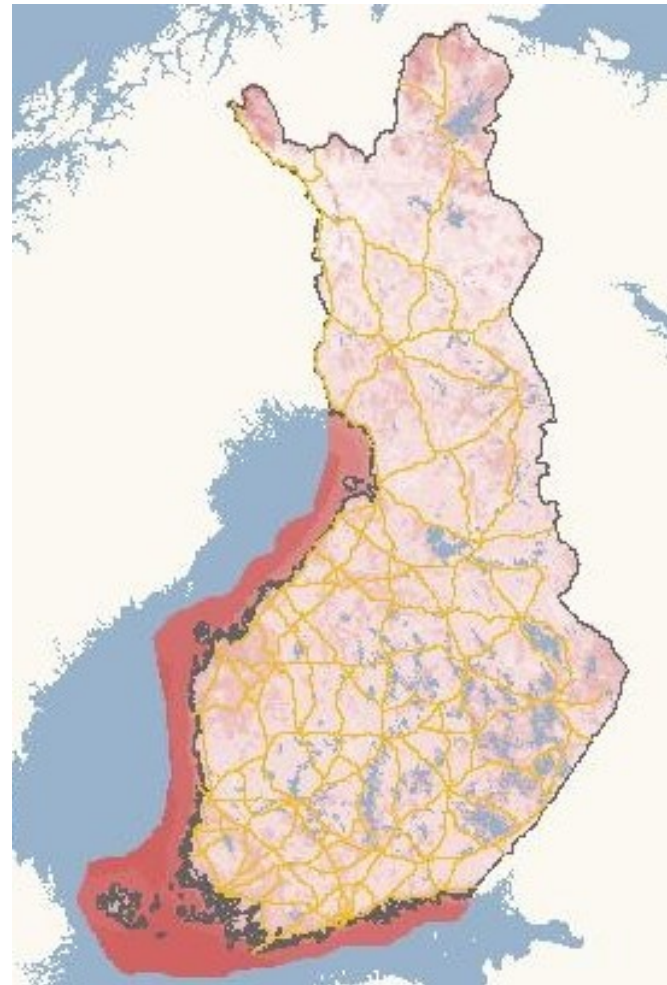
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Introduction

- **What does icing mean?**
  - If we have liquid cloud droplets and below zero temperatures → Ice accretion to structures
    - Airplanes
    - Power lines
    - Wind mils
- **Ice storms does not occur in Finland**
- **Wind farms**
  - Finnish Wind Atlas 2009
    - www.tuuliatlas.fi & www.windatlas.fi

What are we requested to do?

- **Icing climatology**
  - Frequency of icing
  - Icing intensity
- **To produce maps for each month and certain levels separately**
  - 50m, 75m, 100m, 125m, 150m, 200m, 400m

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Methods

- **We have used AROME (resolution 2,5km and 40 lev) to create Wind Atlas**

  - T, V, ci, cw, precipitation

- **From SMHI we have gotten a post processing tool originally written by B. E. Nygaard and it is based on theory by L. Makkonen**

  - Rate of Icing

$$\frac{dM}{dt} = \alpha_1 \alpha_2 \alpha_3 \, w \, \vec{V} \, A$$

Challenges

- **Verification**
    - Data available only from 3 measurement sites
    - Data quality
    - Model heights
        - We assume that if there is cloud water or ice in 50m height there is also some in surface
- **Representative years. Are they valid for this investigation?**
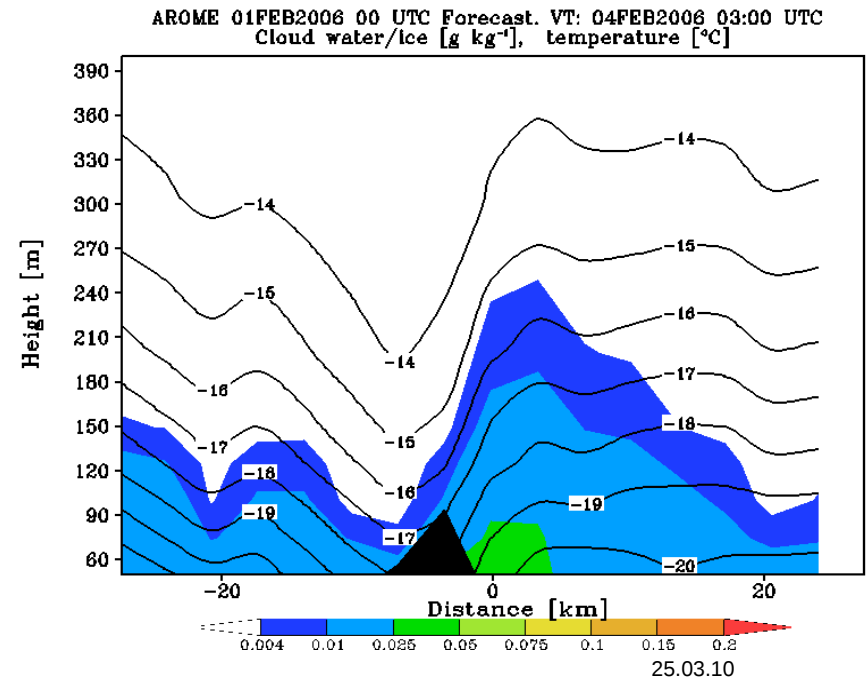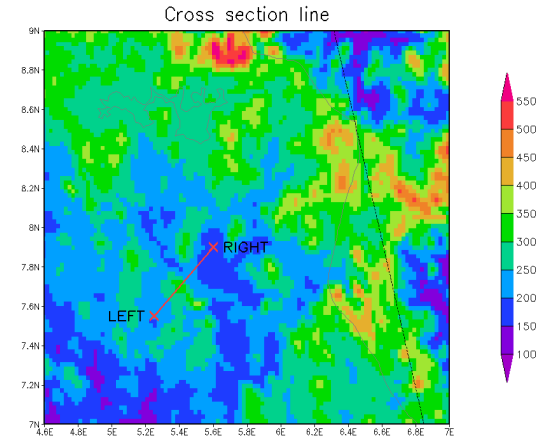   - Chosen on basis of wind climatology

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Observations

AROME					Max	Min
January	1991	1993	2000	2007	1989	2004
February	1989	1992	1998	2006	1989	1994
March	1991	1994	2002	2006	1997	2006
April	2000	2003	2005	2005	2007	2004
May	1991	1996	2000	2005	2000	1994
June	1989	1991	1992	1994	2000	1997
July	1992	2000	2002	2006	1999	1997
August	1994	1997	2001	2007	2005	2006
September	1991	1996	2003	2006	2005	1993
October	1995	1997	1998	1999	2005	1992
November	1992	1997	2004	2005	1999	2002
December	1989	1990	2000	2002	1992	2000

- **From Luosto to compare with Atlas-data**

- **To be compared with operational model:**

  - Puijo winter 2009-2010

  - Ruitunkari winter 2009-2010

State of project...

- **Confirming observations**

- **Comparing observations against model output**

- **In what kind of model conditions icing is really detected in nature?**

  - cloud water vs. cloud ice

Cross section line

AROME 01FEB2006 00 UTC Forecast. VT: 04FEB2006 03:00 UTC
Cloud water/ice [g kg⁻¹], temperature [°C]

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Thank you.