Follow up on last talk
What can we possibly achieve in the future?

SMHI current and future Numerical Weather Prediction (NWP) models

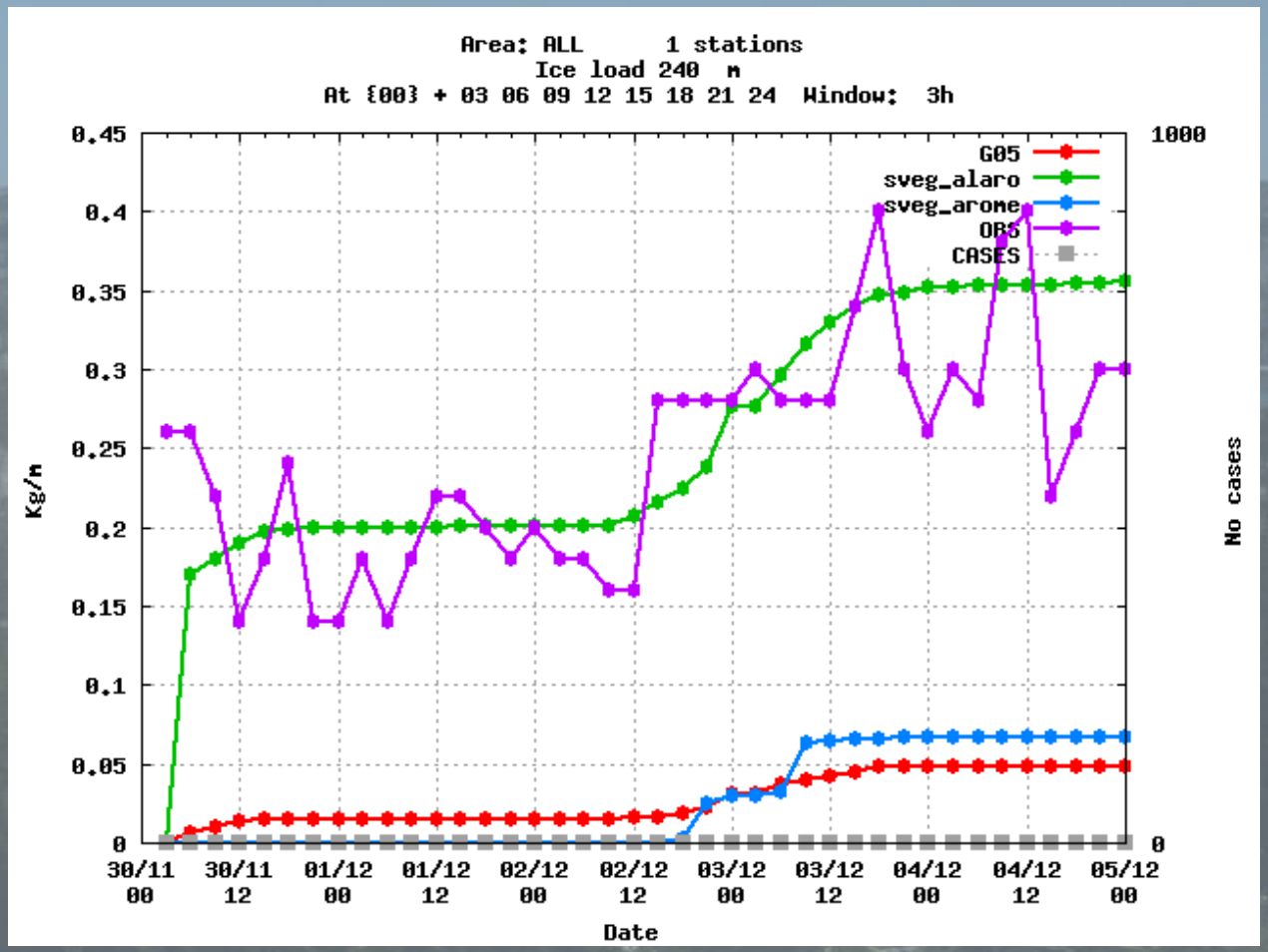
2.5 - 5km resolution

2008-11-30 – 2008-12-06

Comparsion at 240m

Observations in purple (scaled)

What is the truth?



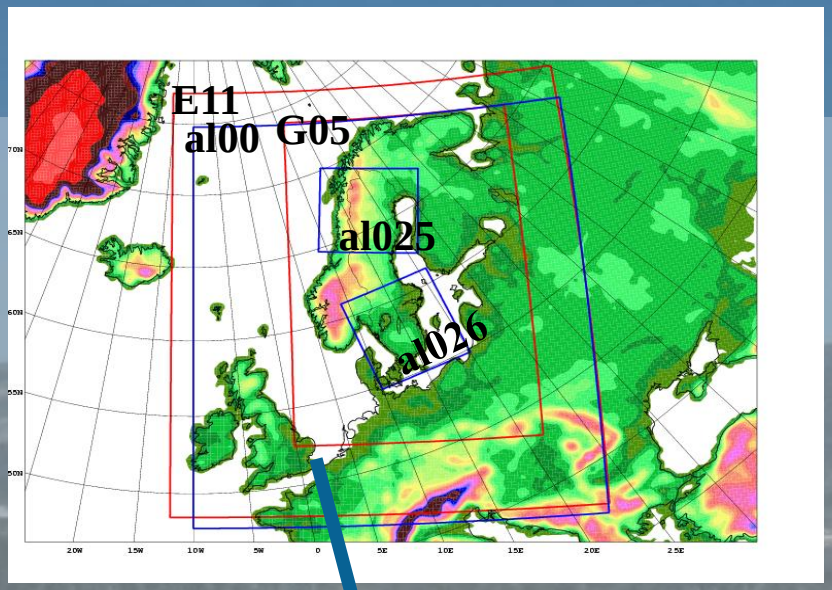
Winter winds at SMHI

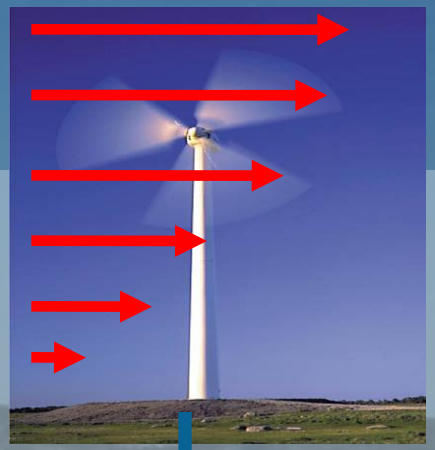
Ulf Andræ **Per Undén**

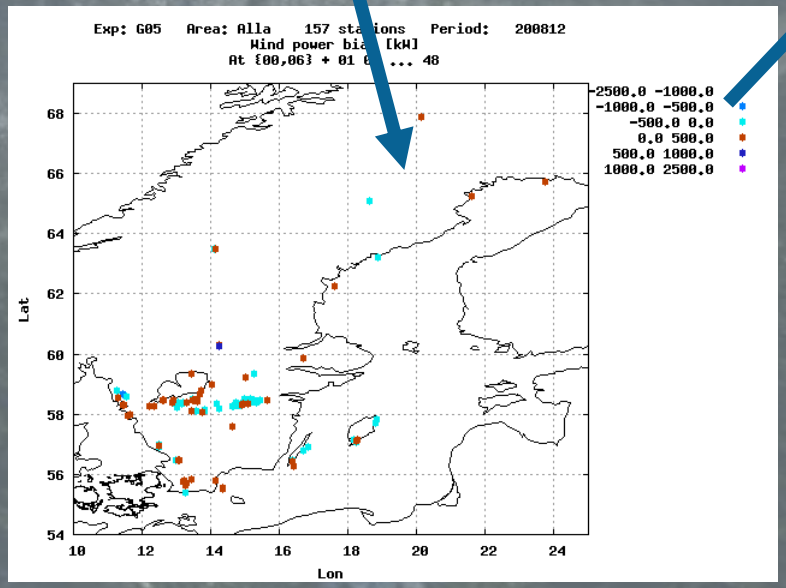
SMHI

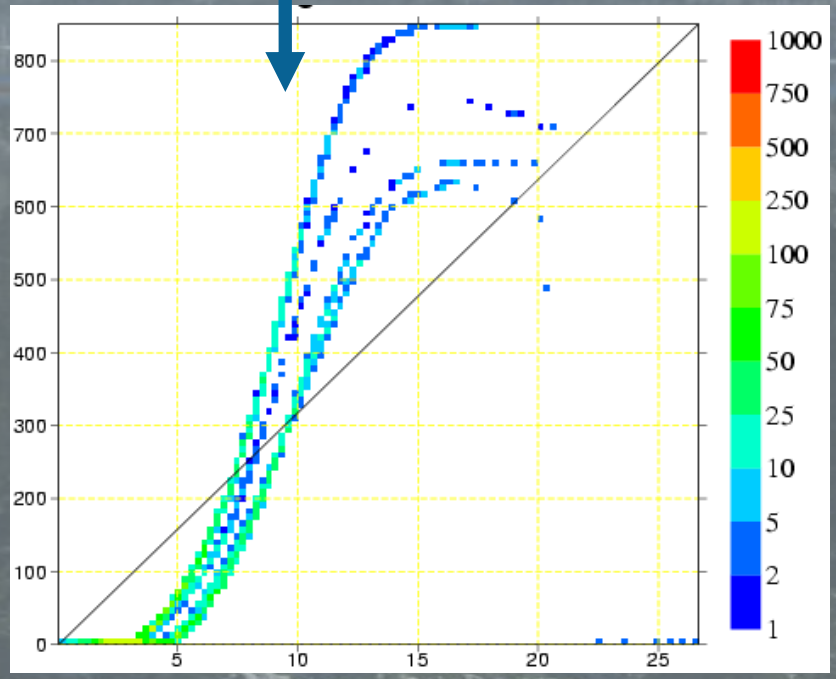
- SMHI wind power forecasts
- Mesoscale models
- Mesoscale data assimilation

Wind power forecasts at SMHI

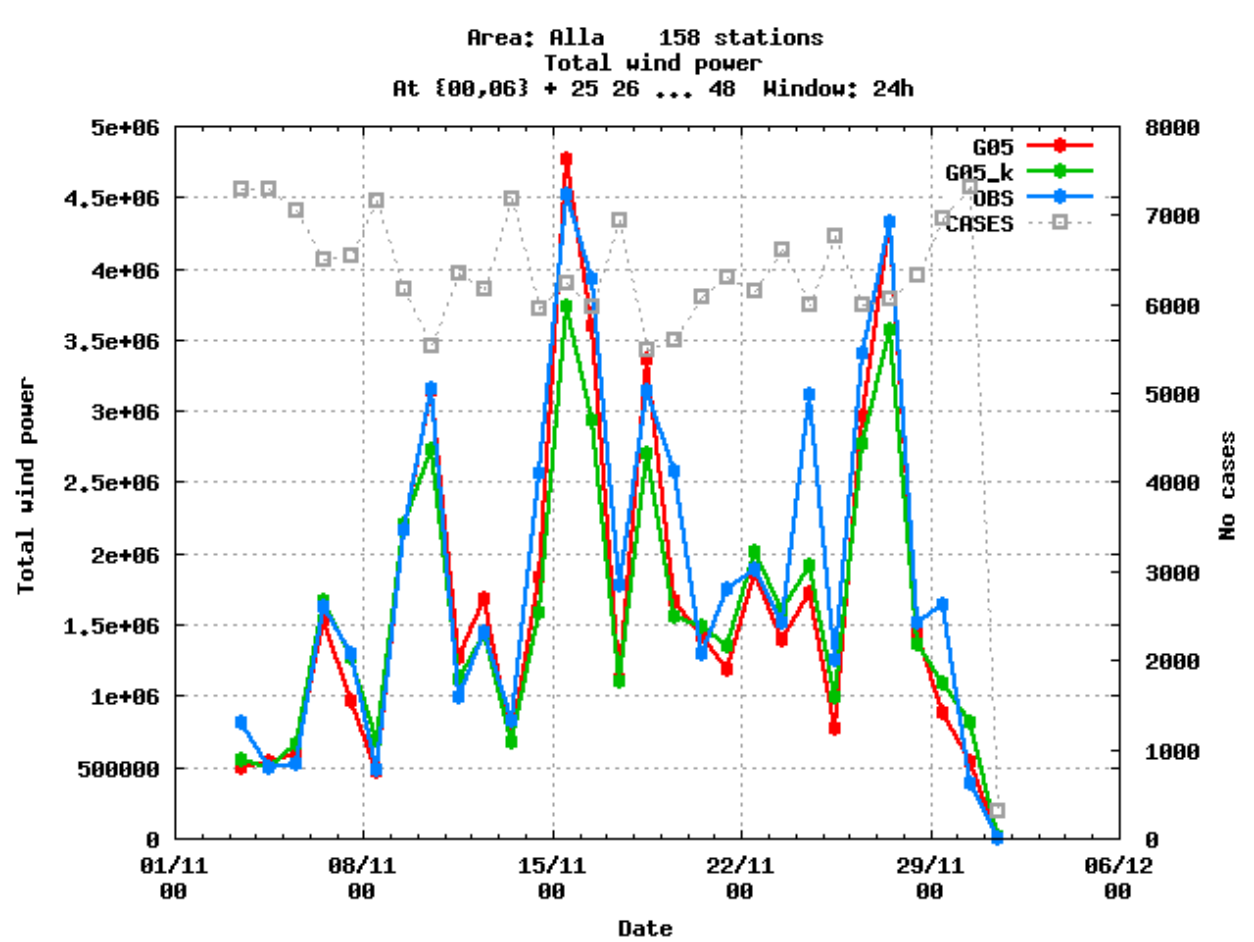








Daily predicted and reported production for November 2008



The physical model is not perfect

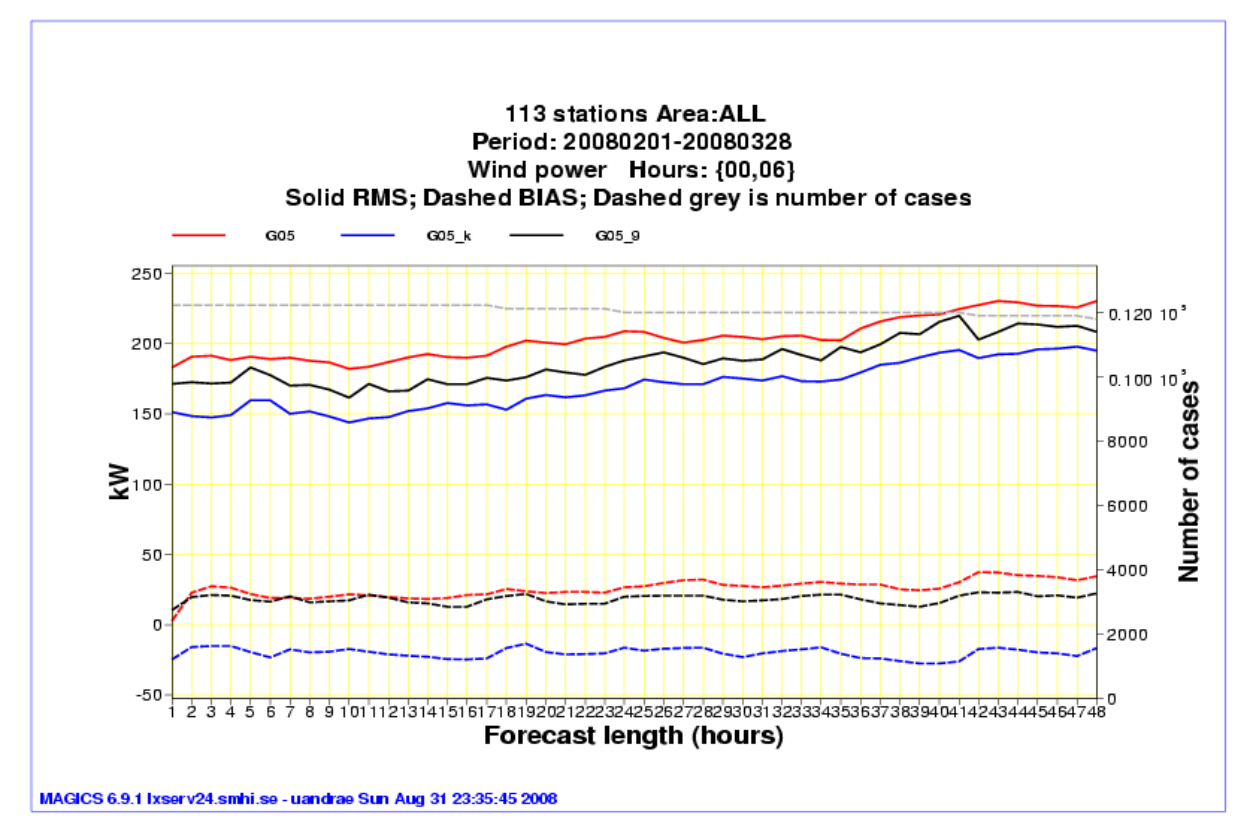
Add on statistical information

Use observations to correct for model errors

- Kalman filter technique allows use to have day to day varying correction.

- Qualtiy control of the observations is very important

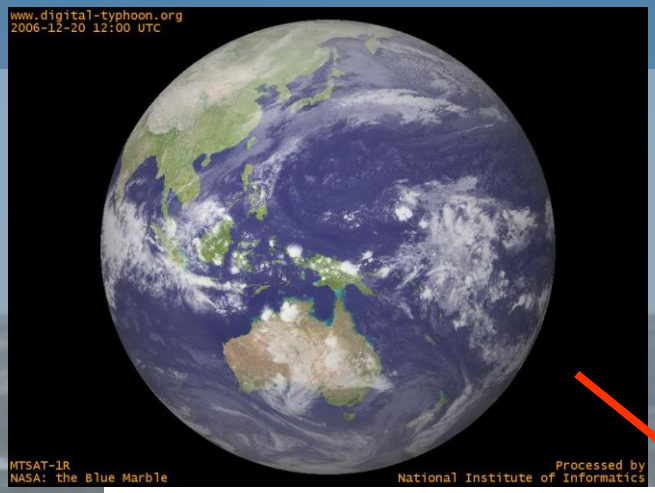
- **Detect breaks (due to icing?)**
- **Geographical anomalies**
- **Time inconsistencies**
- **Check against the model**

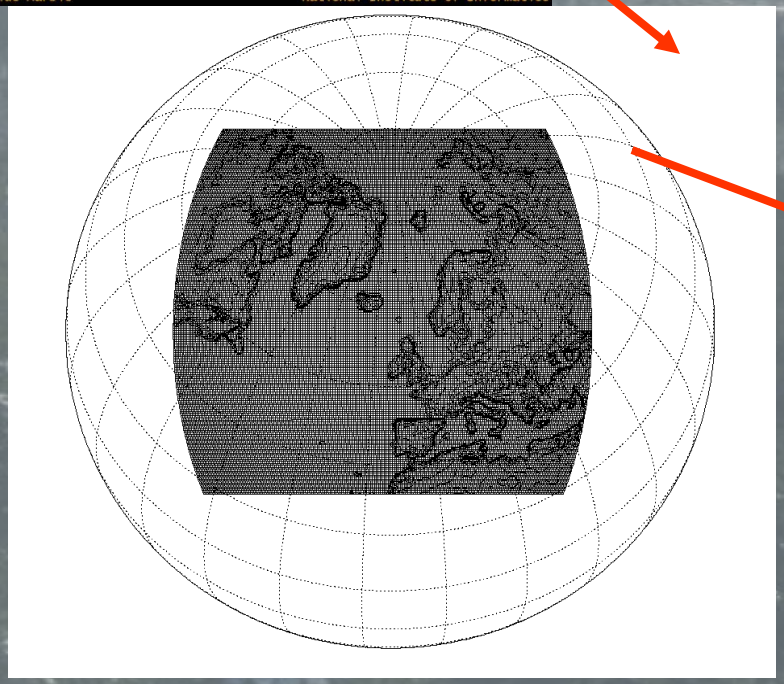


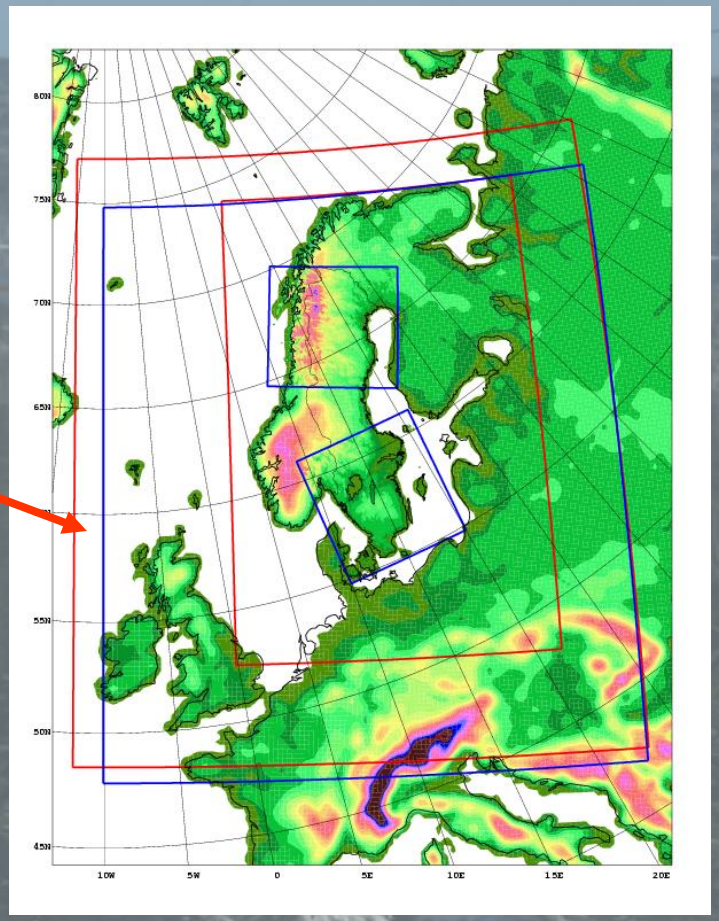
Red is uncorrected

Black/blue is after statistical correction

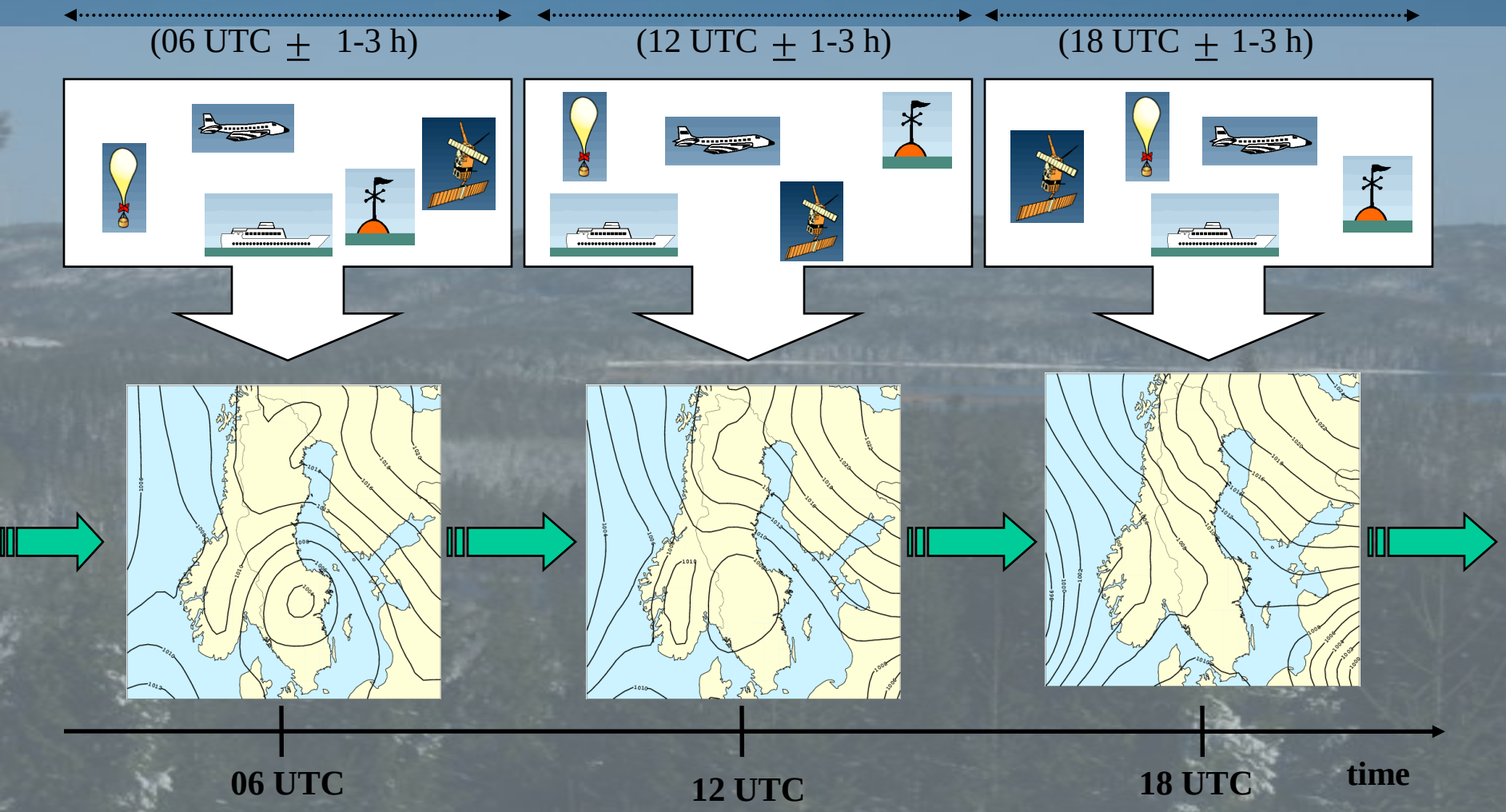
The Numerical weather prediction chain







We need to do more than good simulations, Good forecasts requires realistic initial conditions



Meso scale modelling at SMHI
HIRLAM – ALADIN cooperation since 2006

=> HARMONIE

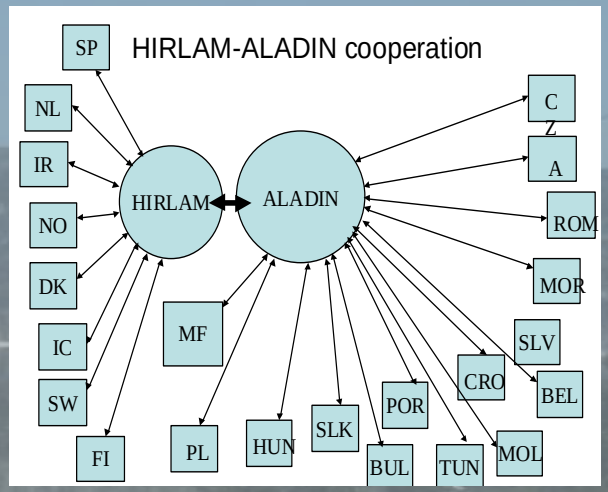
- Working on kilometre scale
  > Non-hydrostatic

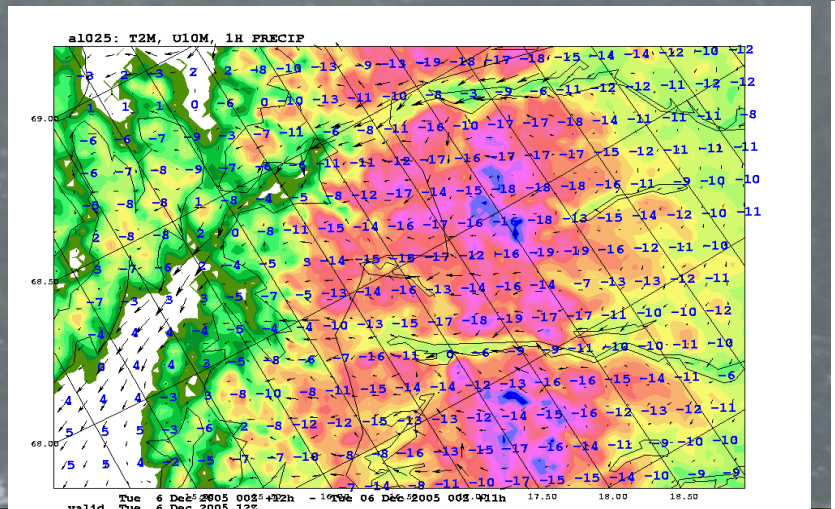
- Advanced micro physics

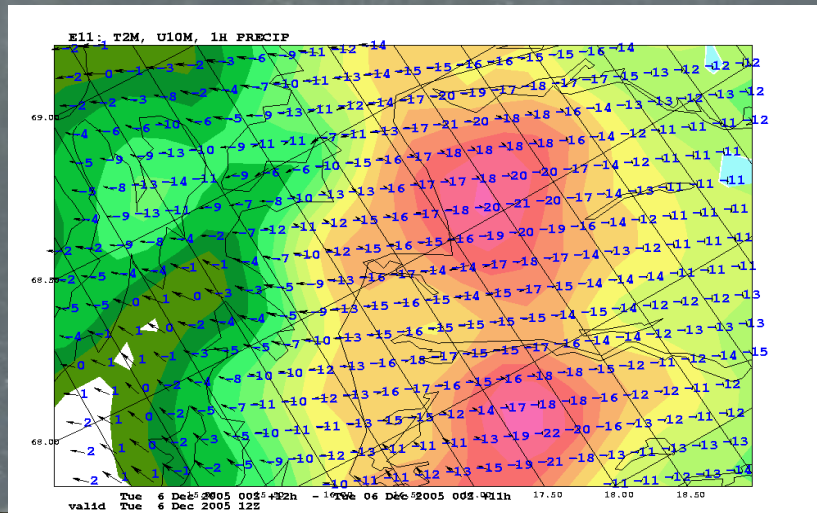
- Advanced surface modelling

  - 3/4DVAR data asssimilation

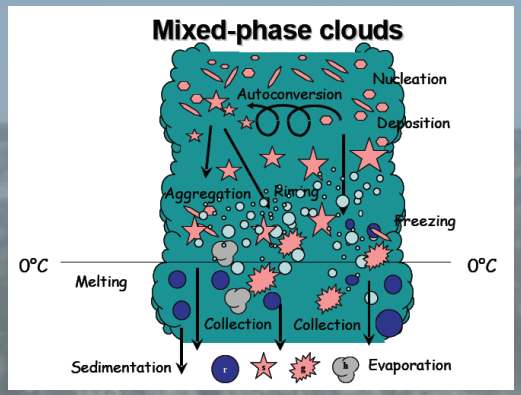
  - Efficient numerics

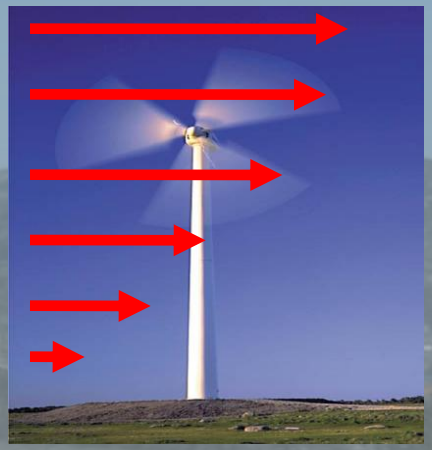


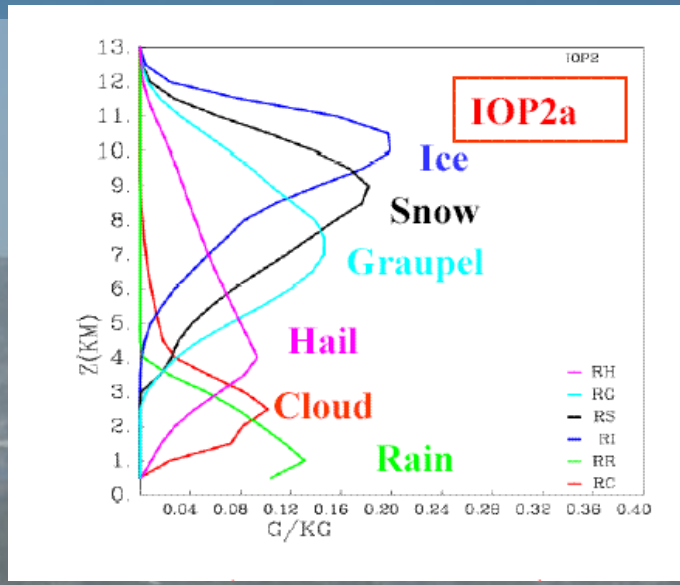


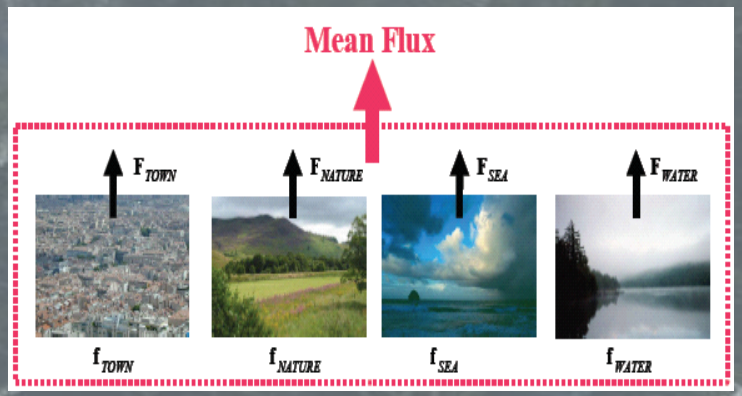


Important pieces for a realistic description of the local atmosphere

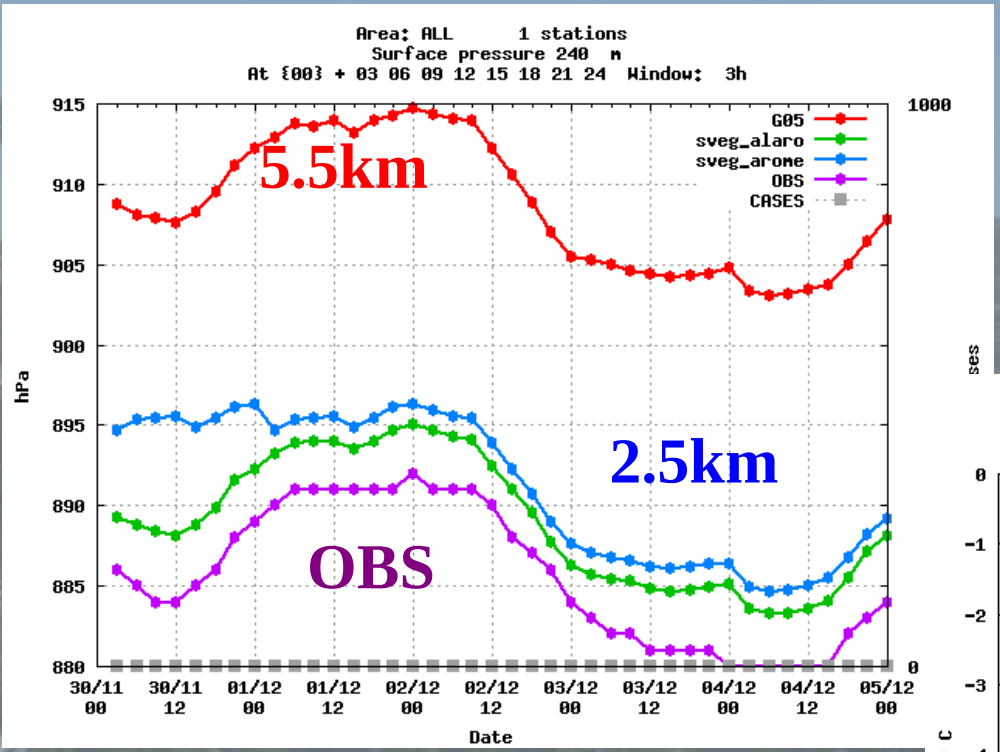






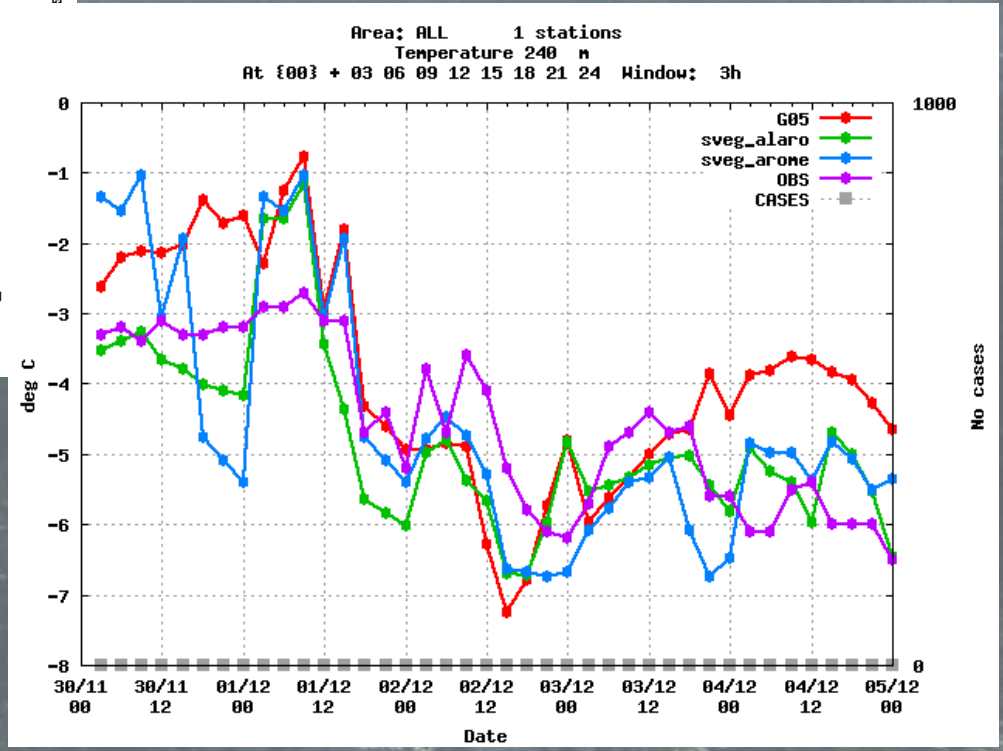


Back to the Sveg tower at 240m Comparing current 5.5km model with future 2.5 km for the period 2008-11-30 - 2008-12-06



Pressure

Temperature



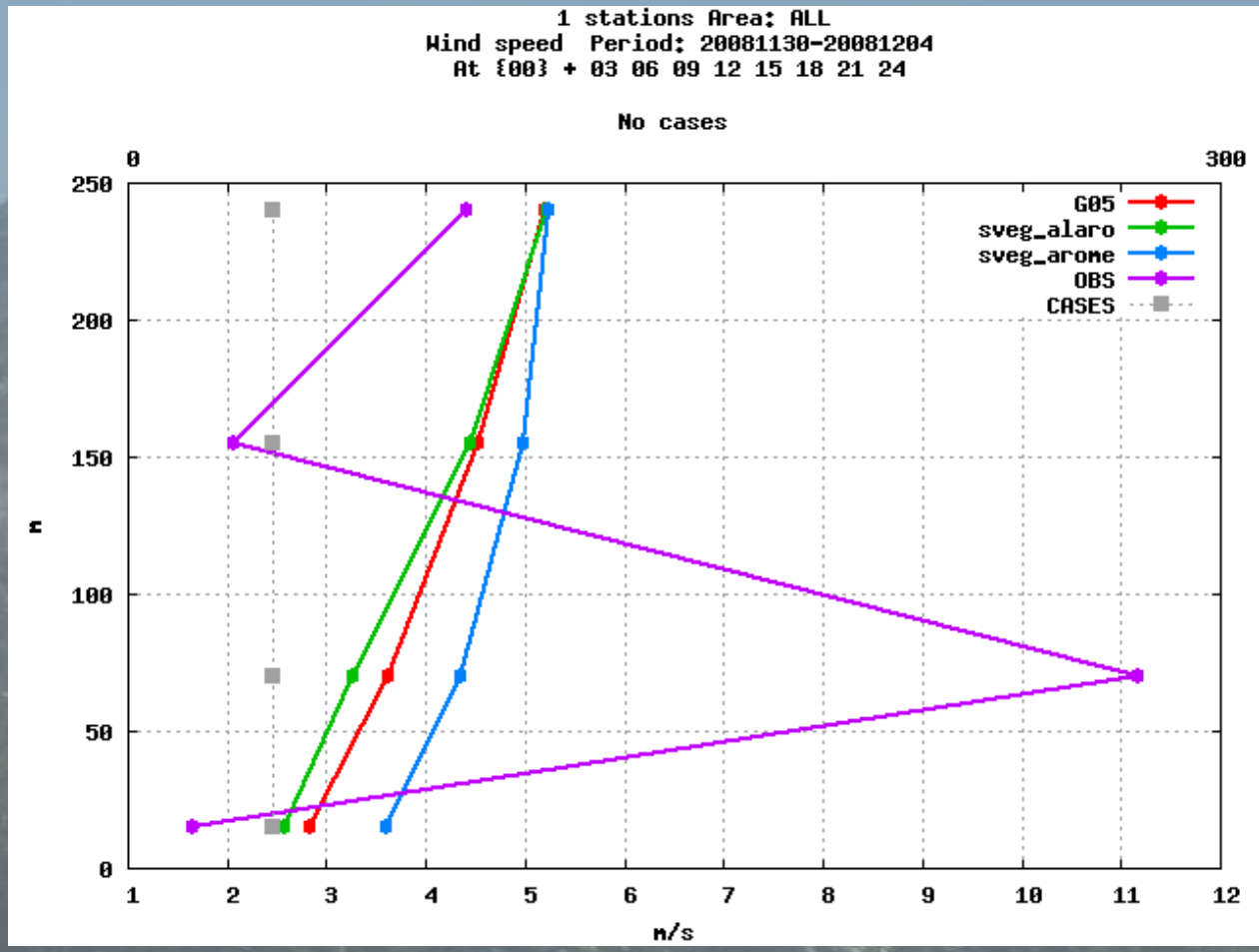
How representative are the model and the observations?

Model cannot capture the low level jet
(to coarse vertical resolution?)

OR

The measurements are totally wrong?

Important that the model and the observations can represent the same scales.

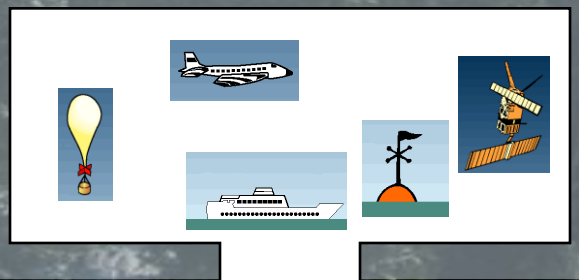


Windspeed

Current Observational Networks

- WMO in situ
- TEMP 500 km
  - 6 hours – 12 hours
- SYNOP, SHIP, BUOY, 200 km
  - 3 hours – 6 hours
  - Snapshot 10 minutes
- AIREP, AMDAR 20 km

increasing in numbers



- Automatic surface networks
  - + High frequency
  - + Relatively dense
  - Cloud (ceilometers expensive but accurate, cloud base only)
  - Use Satellite imagery
  - + Many for other purposes
  - – Not so representative
  - T 2m, RH, P,
  - Wind speed, direction
  - Rain, (cloud base)
- Rain gauges
  - + High density in areas
  - Light rain may escape
  - Snow is a problem

SMHI

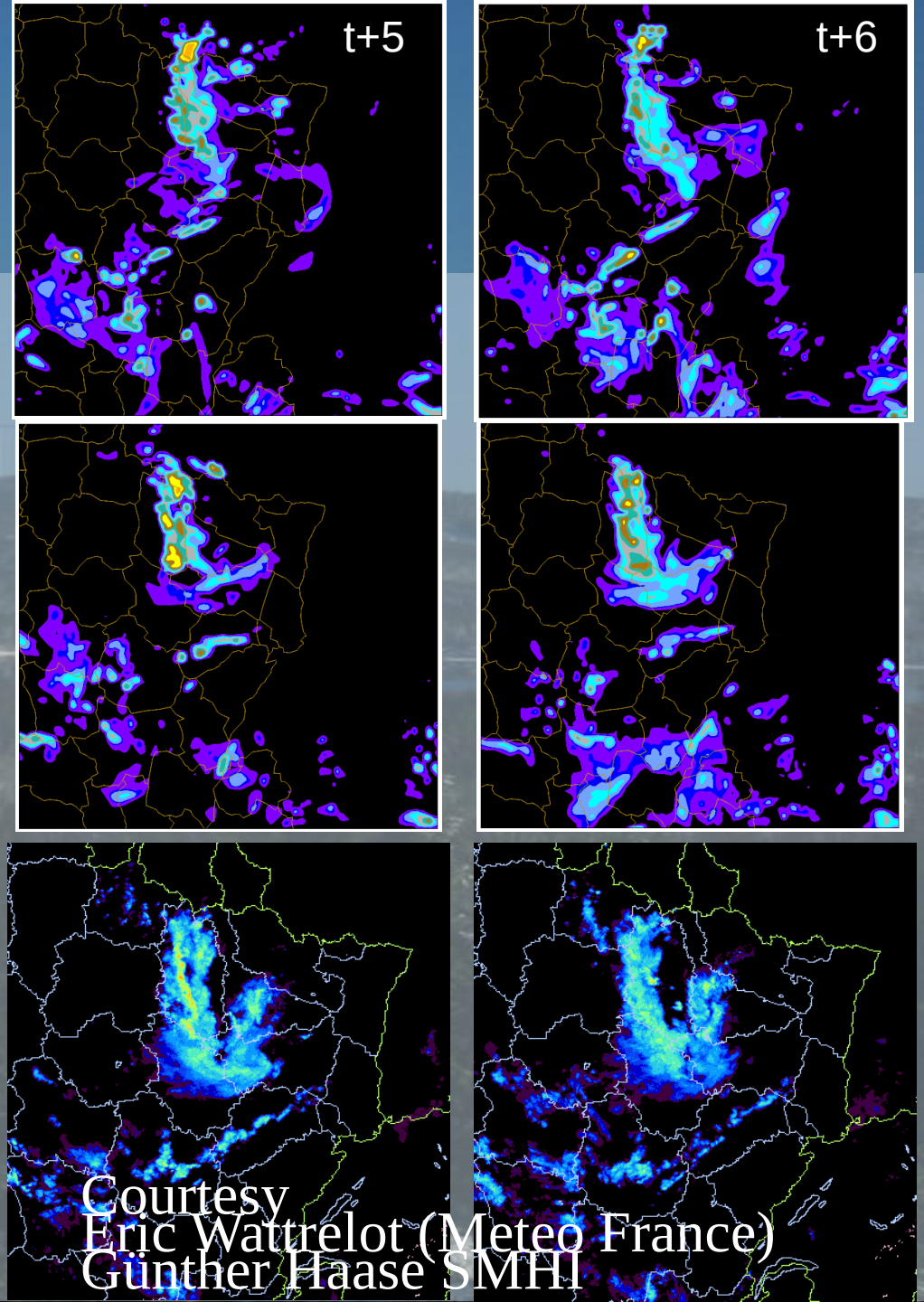
Observability and accuracy

- Fast events may be missed
- Small scale – 100 m – impossibly dense network
- Remote sensing do not resolve those variations (smoothing – an advantage?) but cannot observe small or fast events

- We need some alternatives?

Radar can be used as:

- Wind observations
- Reflectivity for assimilation of moist variables
- Future dual polarization radars gives information about droplet size distribution
- Good coverage in time and space but need tracers



Courtesy
Eric Wattrelot (Meteo France)
Günther Haase SMHI

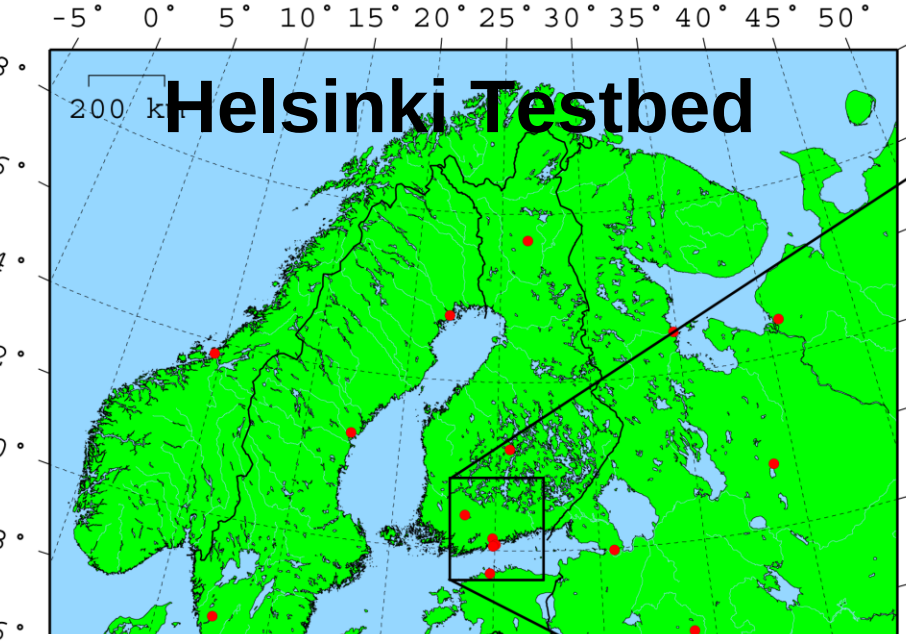
SMHI

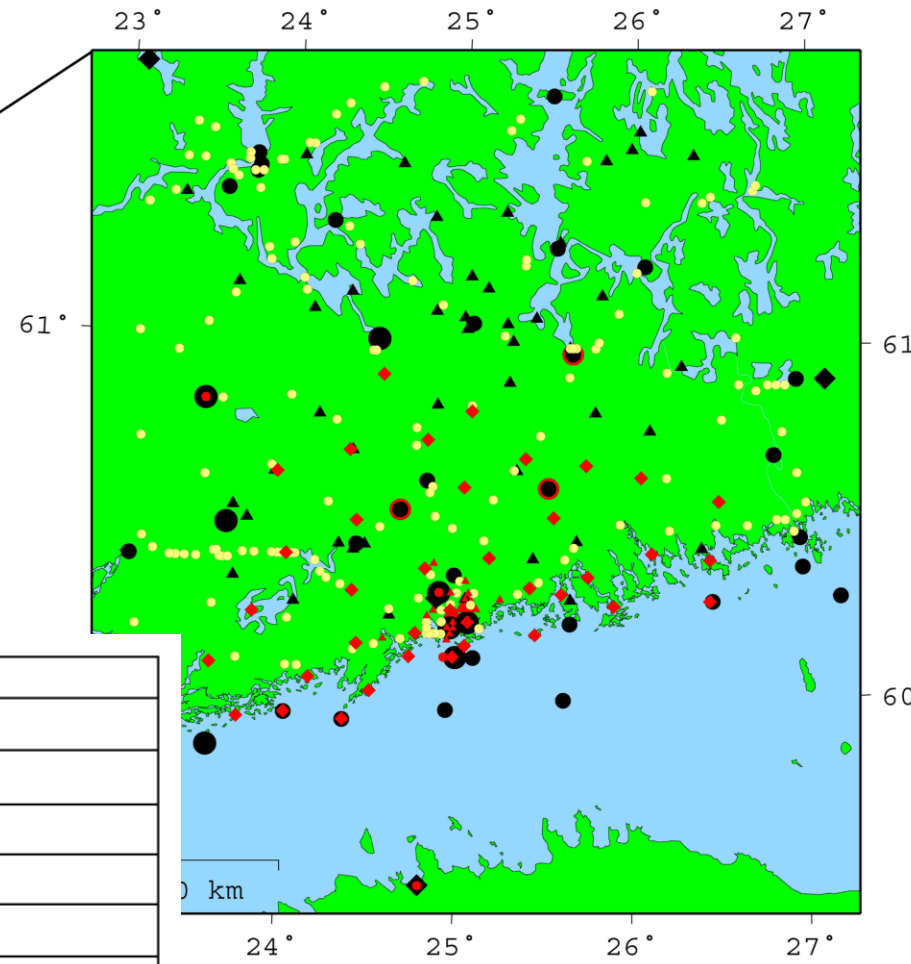
Windprofilers and RASS and SODAR

- Active vertical Doppler radars
  - VHF –huge + high up 15 km
  - UHF + managable – lower half of troposhere
- Continuous measurements (5-10 mins) in clear air too, always enough turbulence -density variations
- Affected by disturbances and drifts – maintenance
- Costly – versus benefit?
- Some networks for meso-scale

- Radio Aucustic Sounding system
- Transmits sound signals – speed due to density (virtmeasuresual temp)
  - Low range – PBL only 1-2 km
  - Interference
  - + complement profilers, radars
- SODAR
  - Aucustic doppler radar
  - A few 100 m only
    - Airport, runway

Helsinki Testbed





No.	Sites in Helsinki Testbed domain	
46	FMI weather stations	●
34	FMI precipitation stations	▲
13	Off-line temperature loggers in greater Helsinki area	▲
8	Weather transmitters in greater Helsinki area	▲
191	Road weather stations	●
292	**Surface weather stations, total**	
42	Pairs of weather transmitters in masts	◆
5	Optical backscatter profilers (new ceilometers)	●
6	FMI ceilometers	●
4	C-band Doppler radars	◆
1	Dual polarization Doppler radar	◆
4	RAOB sounding stations	●
1	UHF wind profiler	▲
-	Total lightning network	-

Back to where we started ....

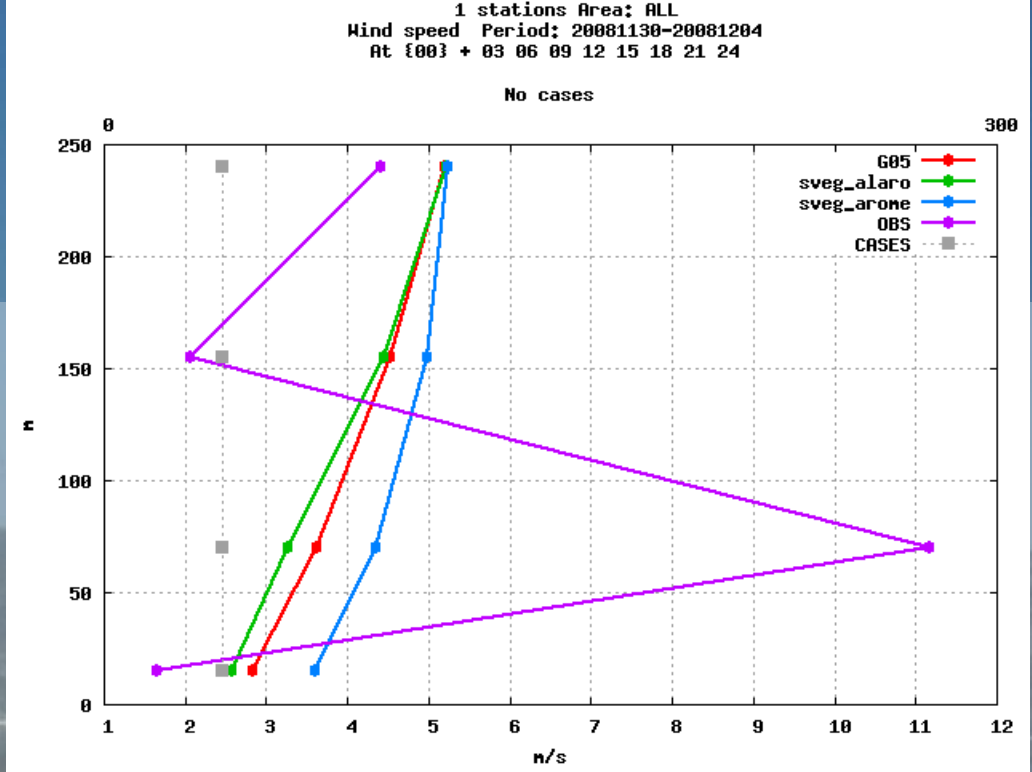
Masts and other non-conventional observations (windmills?) are important tools for:

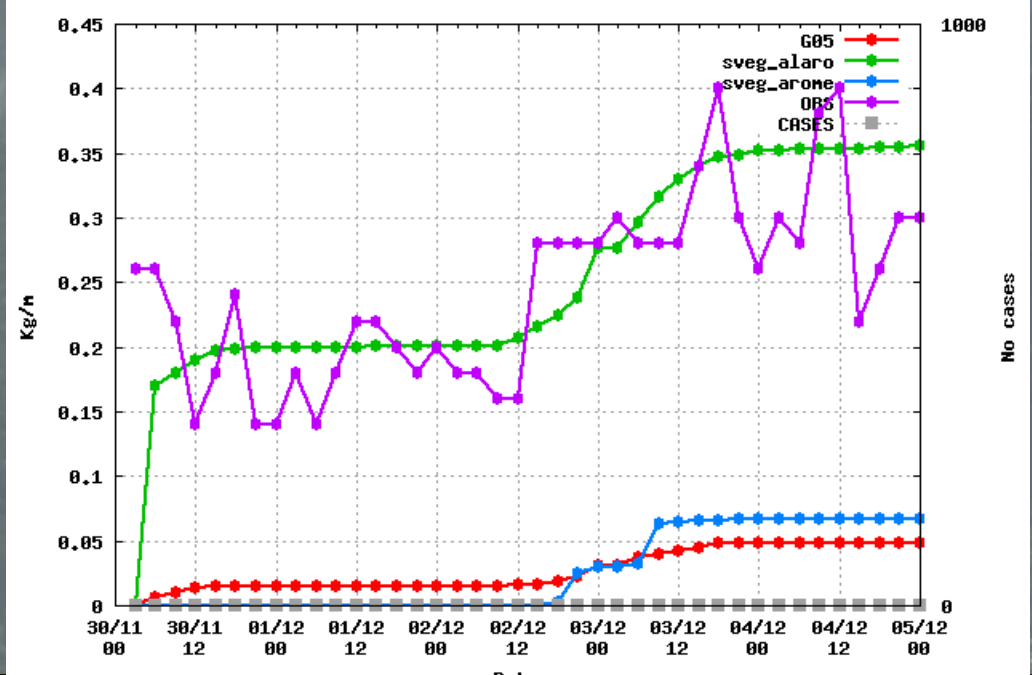
- Evaluation and model development

- Assimilation

  Quality and coverage has to be good enough.

What about the ice load?





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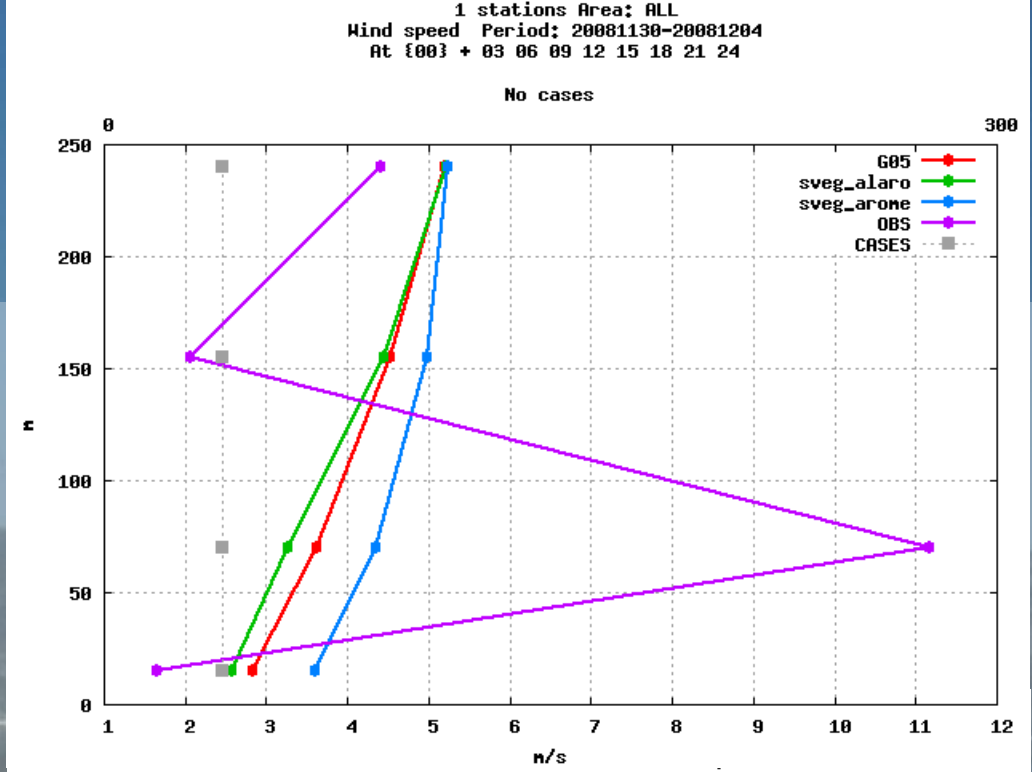
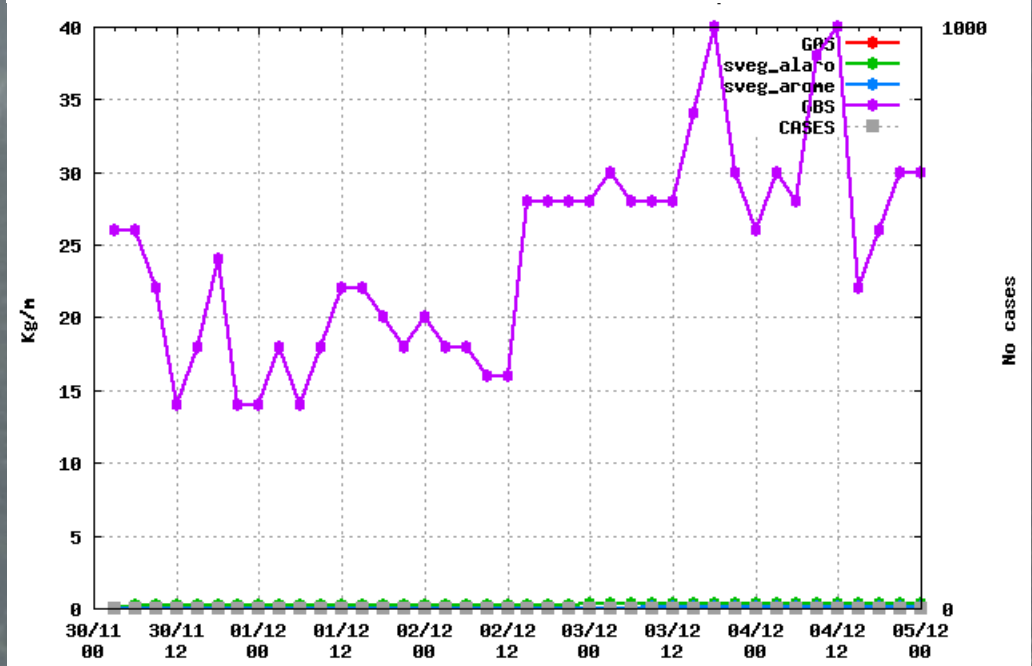
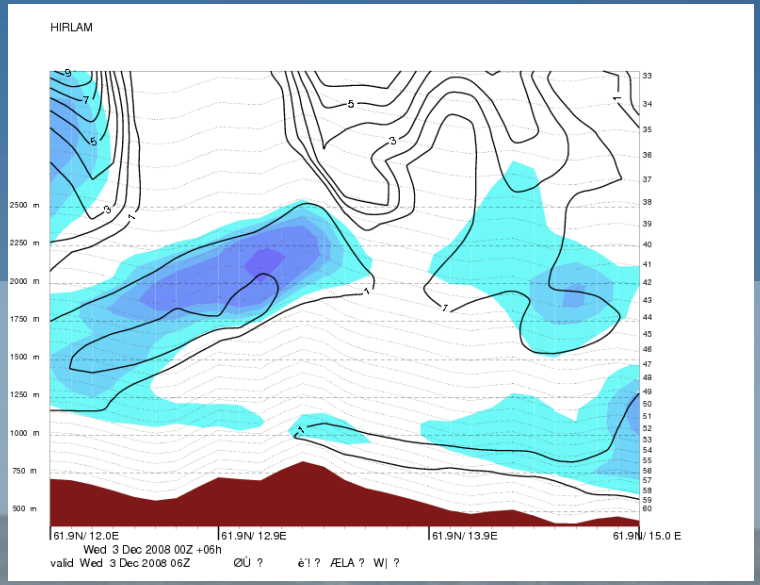


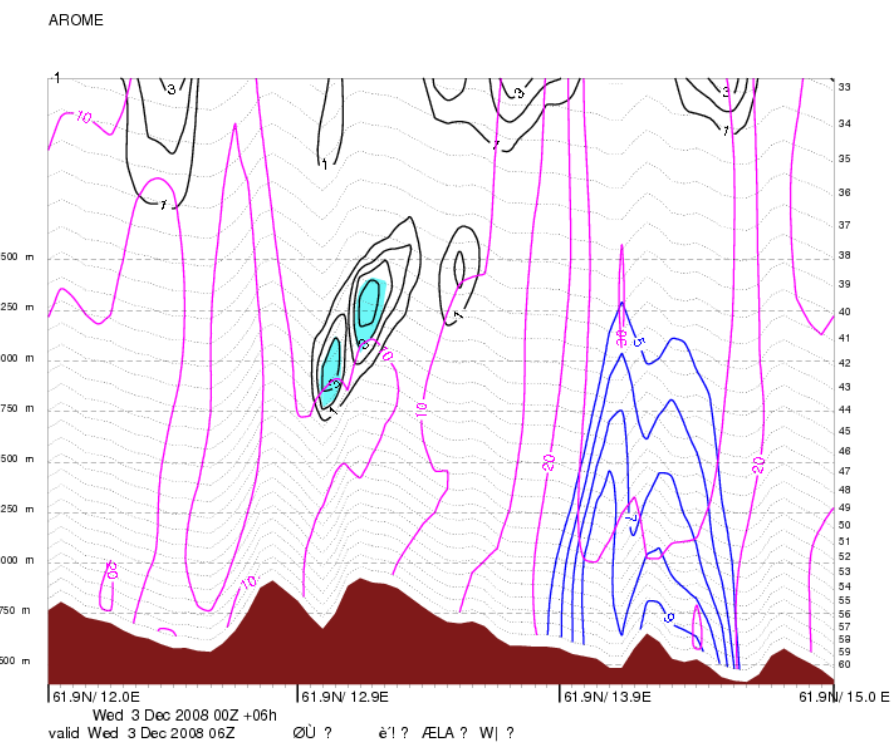


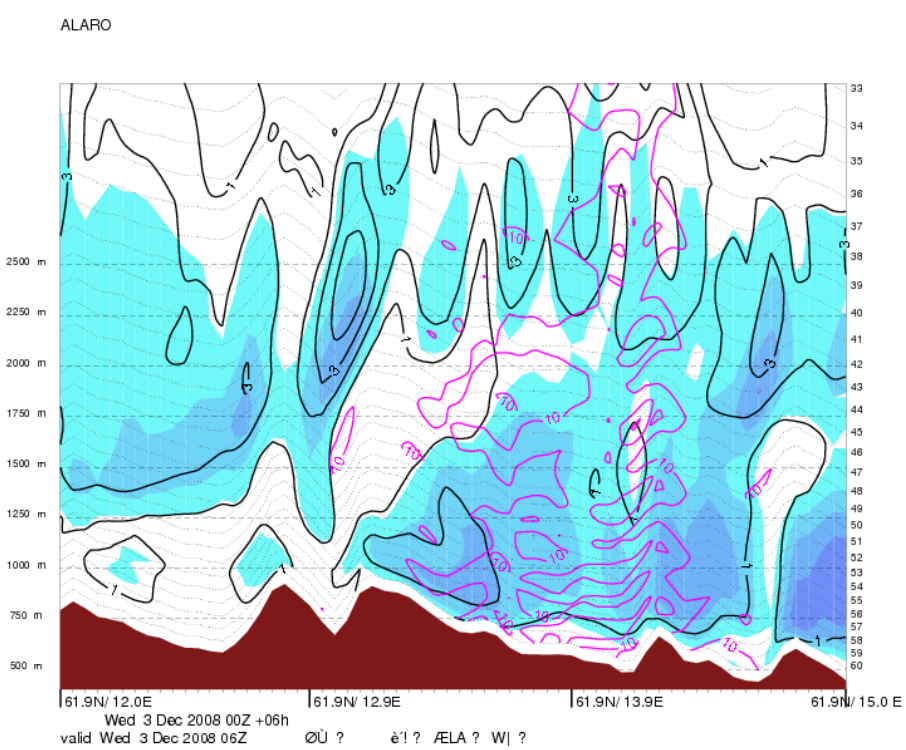
East west cross section on 2008-12-03 06

Different models gives different distribution between cloud condensate -> very different ice load.

CLOUD WATER/ICE/SNOW/GRAUPEL







Thanks for your attention