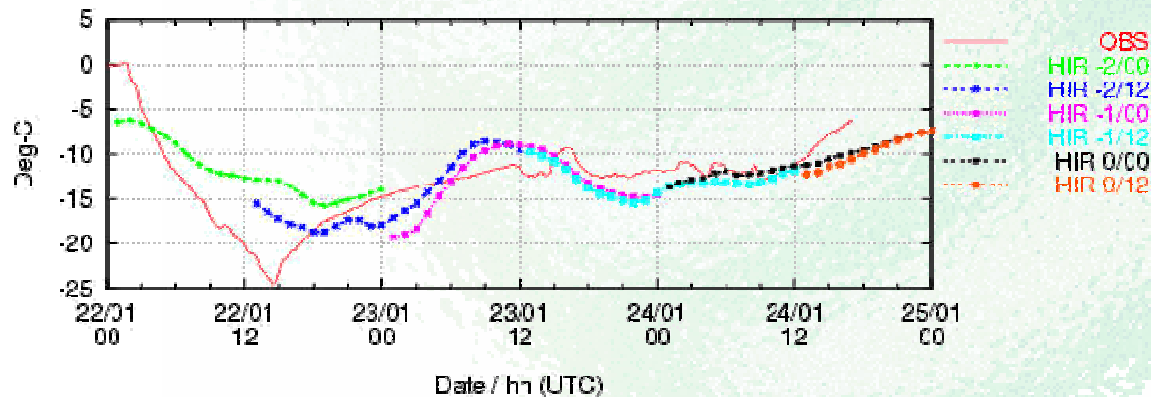


Sodankylä micrometeorological data utilization

Markku Kangas

*Finnish Meteorological Institute , Meteorological Research
Numerical Weather Prediction*



Fri Jan 24 20:31:54 2003



Outline



1. Background

2. Objectives

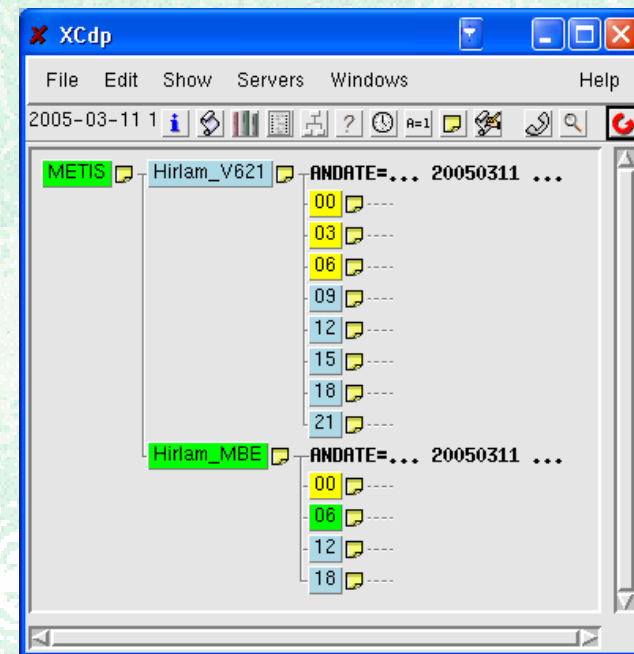
3. Data retrieval and plotting

4. Examples

5. Conclusions

Background

- Weather forecast model development tool
- Problems in cold conditions
 - Temperature inversions
 - Evaporation
 - Heat fluxes
- One way to seek solution :
 - Make measurements in problematic locations and conditions
 - Monitor model behaviour in real-time
 - Problem recognition and identification
 - when : weather conditions, time of day etc.
 - how : which parameters are affected
 - Masts : boundary layer measurements



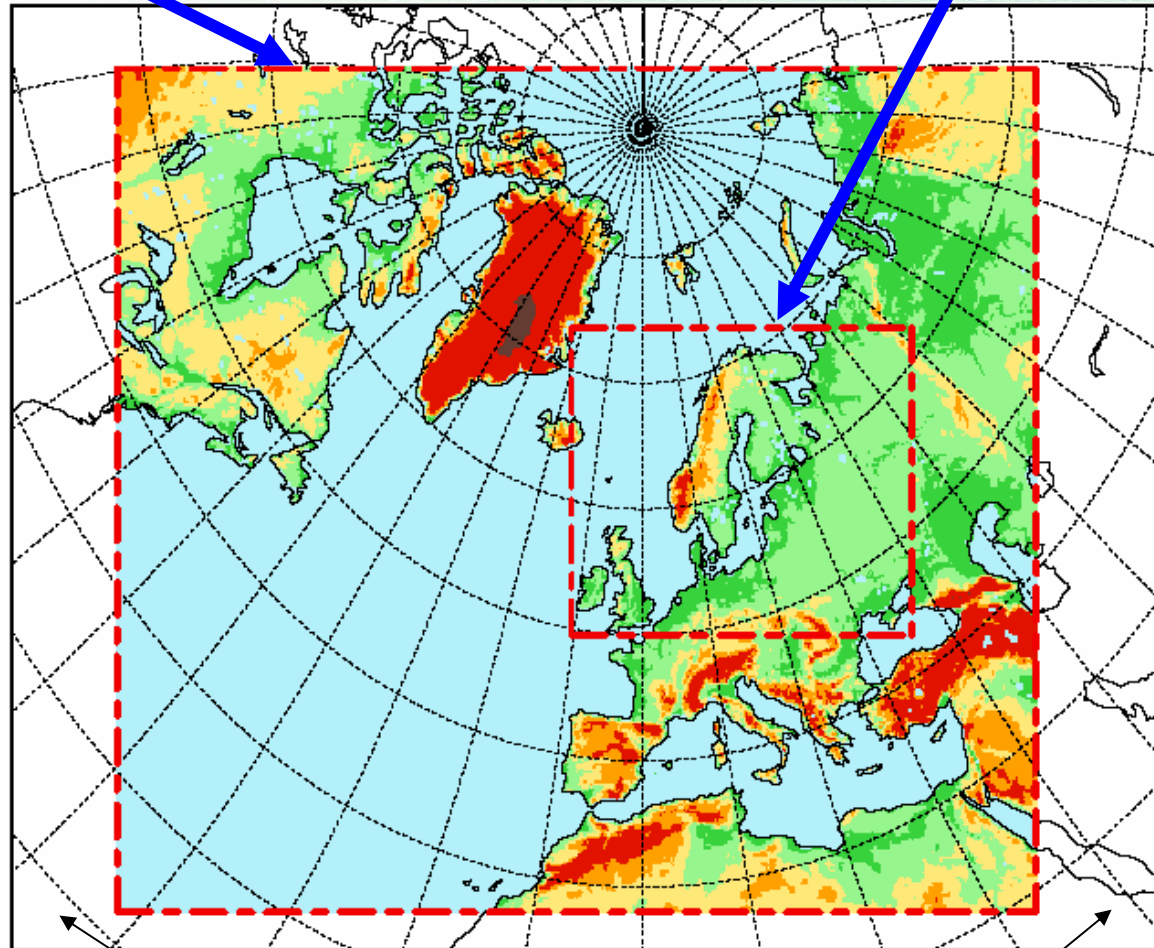
HIRLAM — Weather forecasting model

- High Resolution Limited Area Model
- International development : HIRLAM 6 project
 - Finland, Sweden, Norway, Denmark, Iceland, the Netherlands, Ireland, Spain, France
- ECMWF global model boundaries
 - refine forecast on smaller area by using better resolution and observations
- First operative version 1990
- Present reference version 6.4
- HIRLAM 7 project starting next year

Hirlam integration areas

RCR : grid 22x22 km

MBE meso- β -model : grid 9x9 km

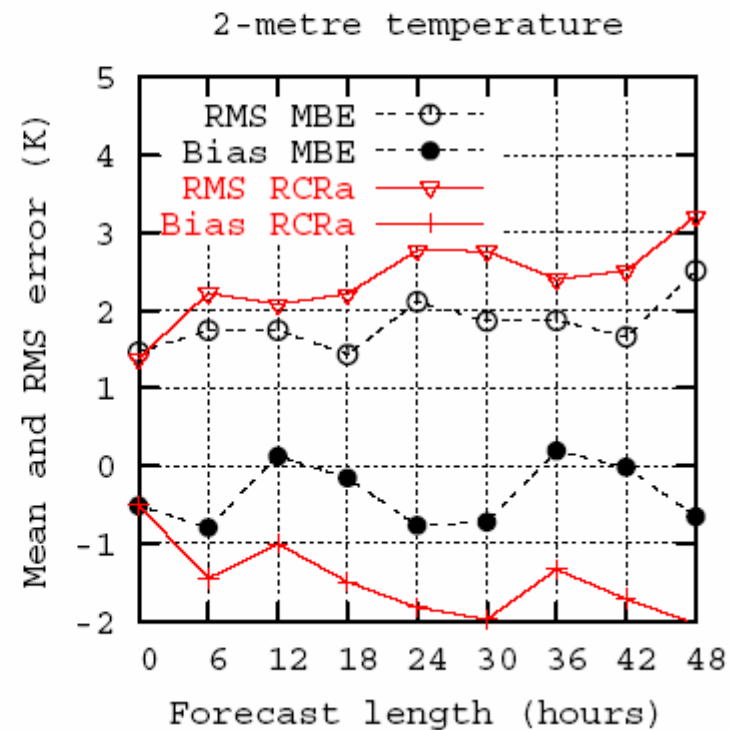
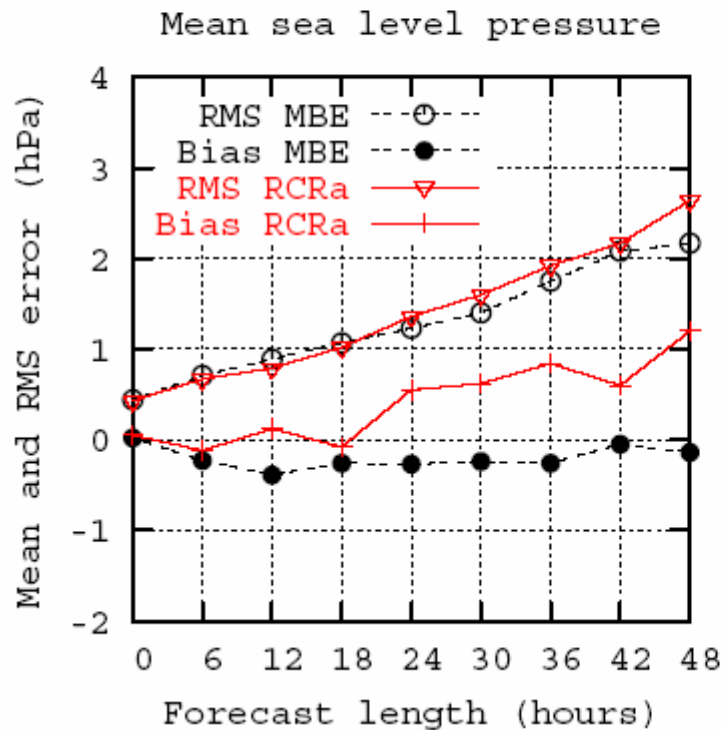


Boundaries : ECMWF global model

BIAS and RMS plot

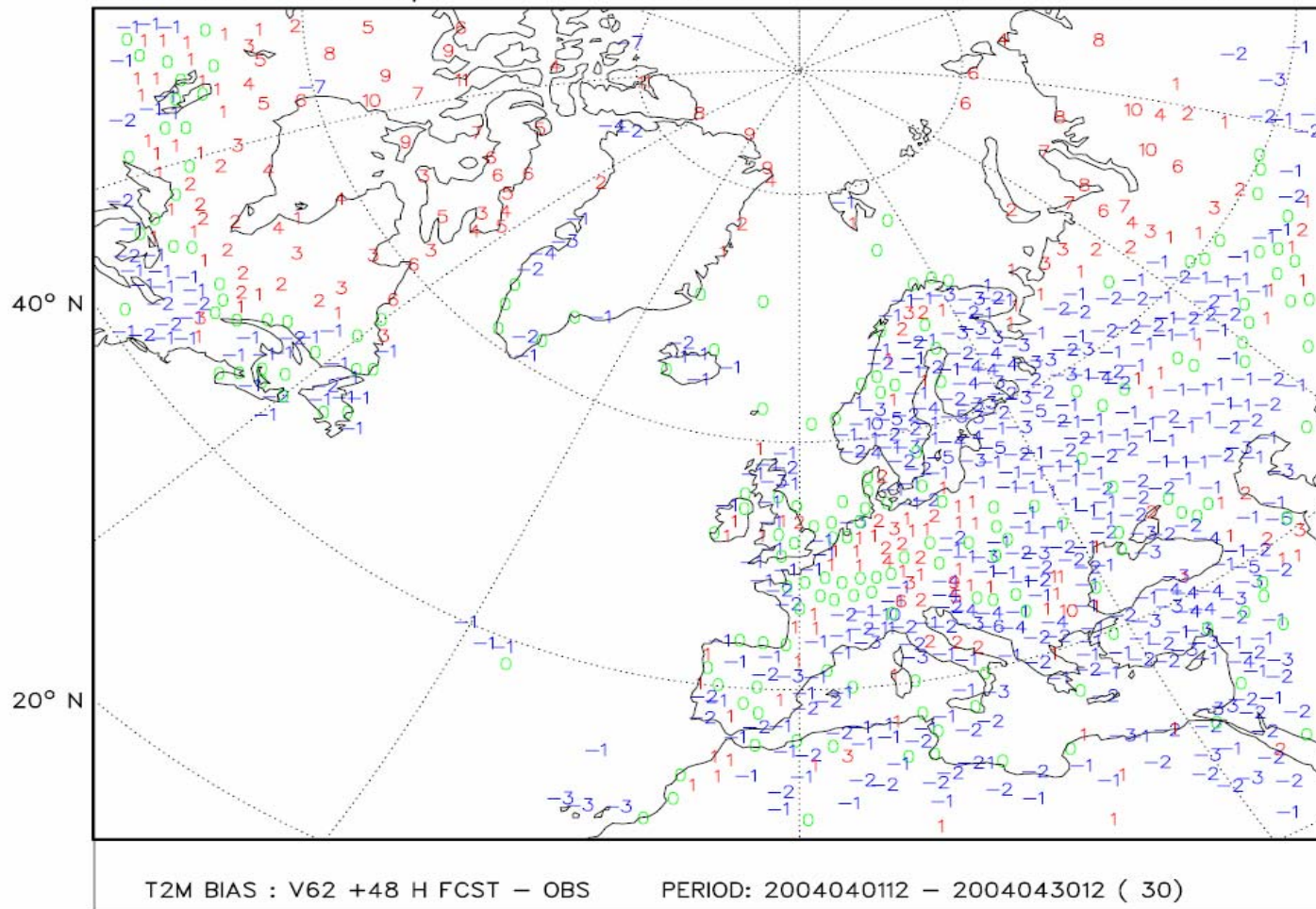
Verification against observations EXP: MBE RCRA

Time: 2004070100 - 2004073118 Domain: Scn Forecast from 12

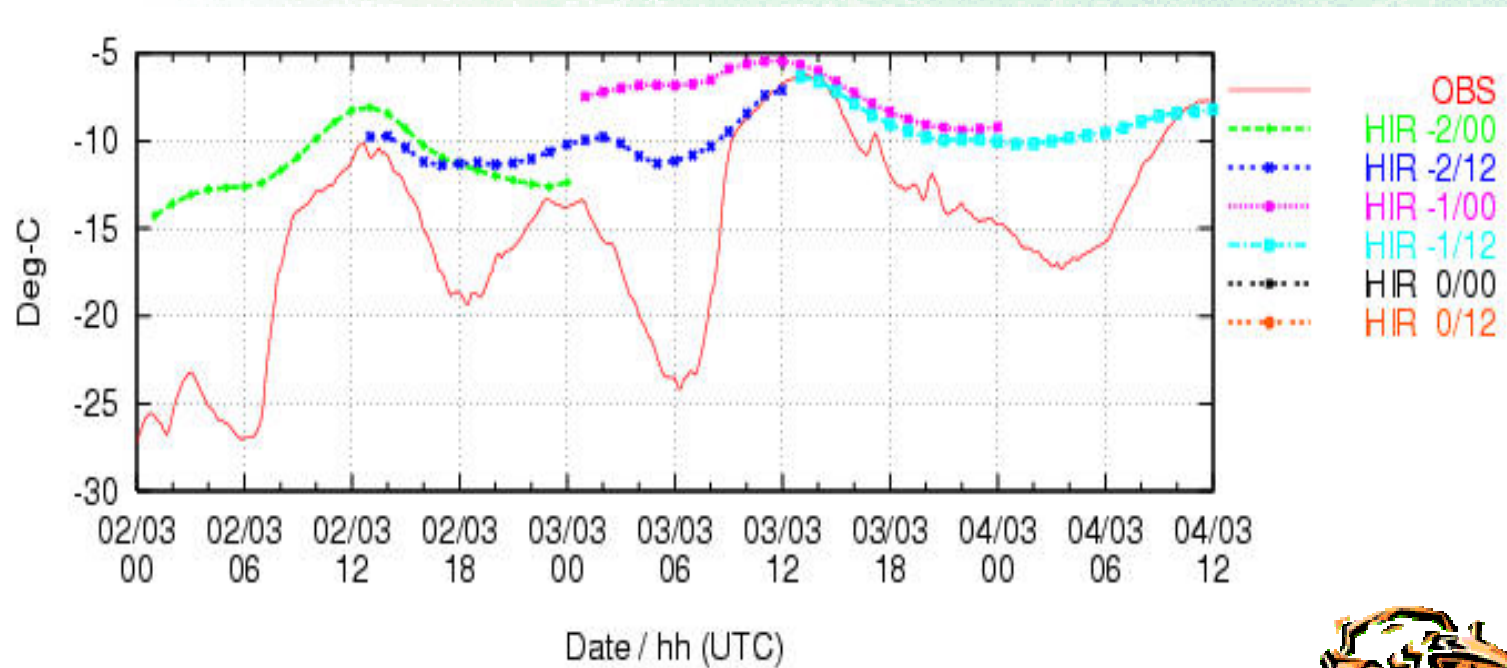


T_{2m} BIAS distribution

T2m bias for Apr 2004 : V62 + 48 h , valid at 12 UTC



T_{2m} time series : forecast / measurement



Fri Mar 04 15:10:02 2005



Objectives

HIRLAM



FINNISH METEOROLOGICAL
INSTITUTE

Weather maps

Baltic sea wind maps

Meteograms

Meteograms ABL

Mast verification

Statistical verification

Monthly report

Help and information



Monitor window

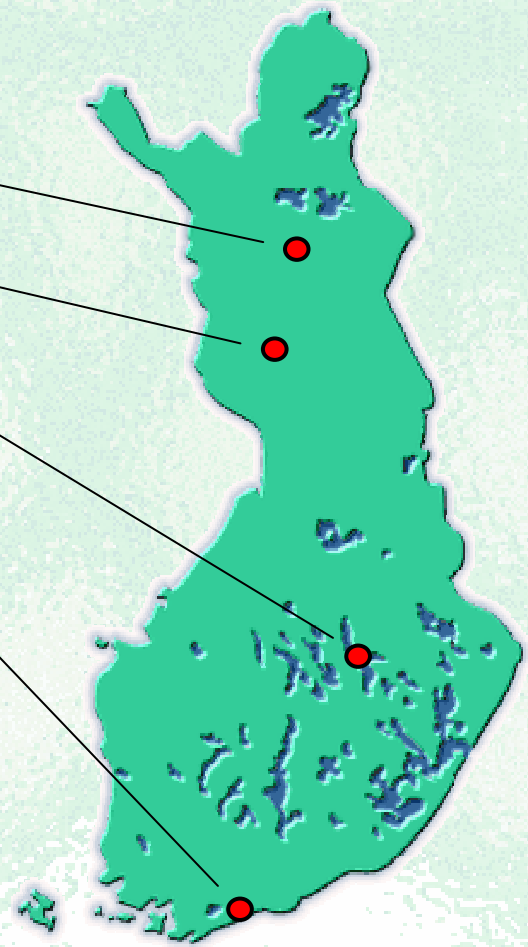
Select run (UTC) ▾



- On-line comparison of forecasts with measurements (WWW)
 - technical monitoring
 - meteorological verification
- Quickly identify problems
- To be used in connection of other HIRLAM model monitoring facilities
- Available to all HIRLAM members
- Also Arpege model (Meteo France) included

Measurement masts

- Sodankylä
 - FMI/ARC, CEOP 48 m
- Rovaniemi / Vennivaara
 - YLE*, 215 m, 66°33'N, 25°34'E
- Kuopio / Vehmasmäki
 - YLE*, 300 m, 62°40'N, 27°30'E
- Espoo / Kivenlahti
 - YLE*, 327 m, 60°11'N, 24°39'E
- Cabauw / The Netherlands
 - 213 m, 51°58'N, 4°56'E

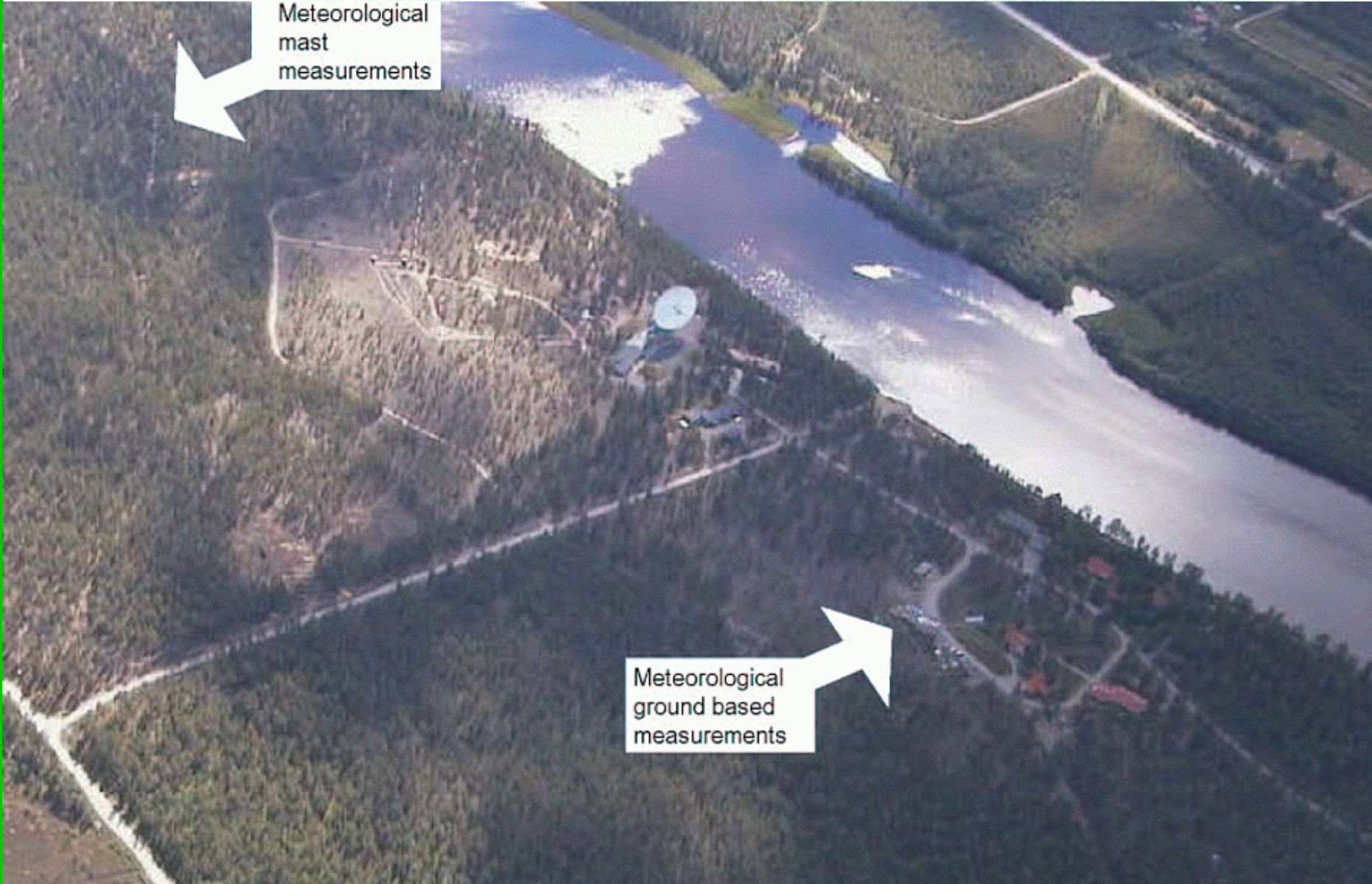


*) YLE = Finnish National Broadcasting Corporation

Sodankylä mast environment

Meteorological
mast
measurements

Meteorological
ground based
measurements



Sodankylä mast environment



Sodankylä mast environment



NOPEX / WINTEX March 1997



Sodankylä mast surroundings



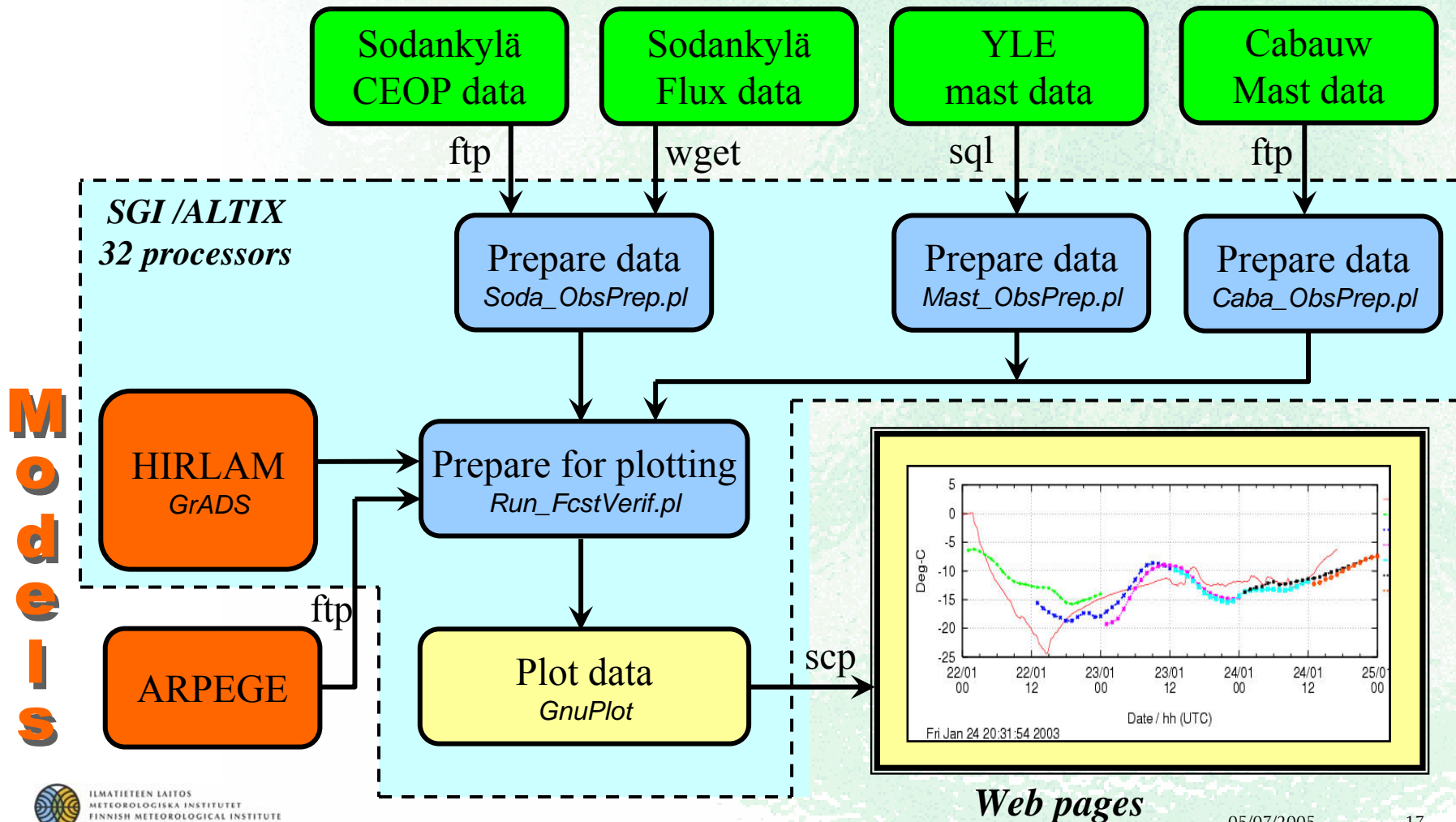
Comparison parameters

- All masts
 - Temperature at two levels
 - Temperature difference
 - Wind speed
 - Relative humidity
- Sodankylä & Cabauw mast
 - Global solar radiation
 - Long wave radiation upwards
 - Sensible heat flux
 - Latent heat flux (evaporation)
 - Momentum flux (friction velocity)

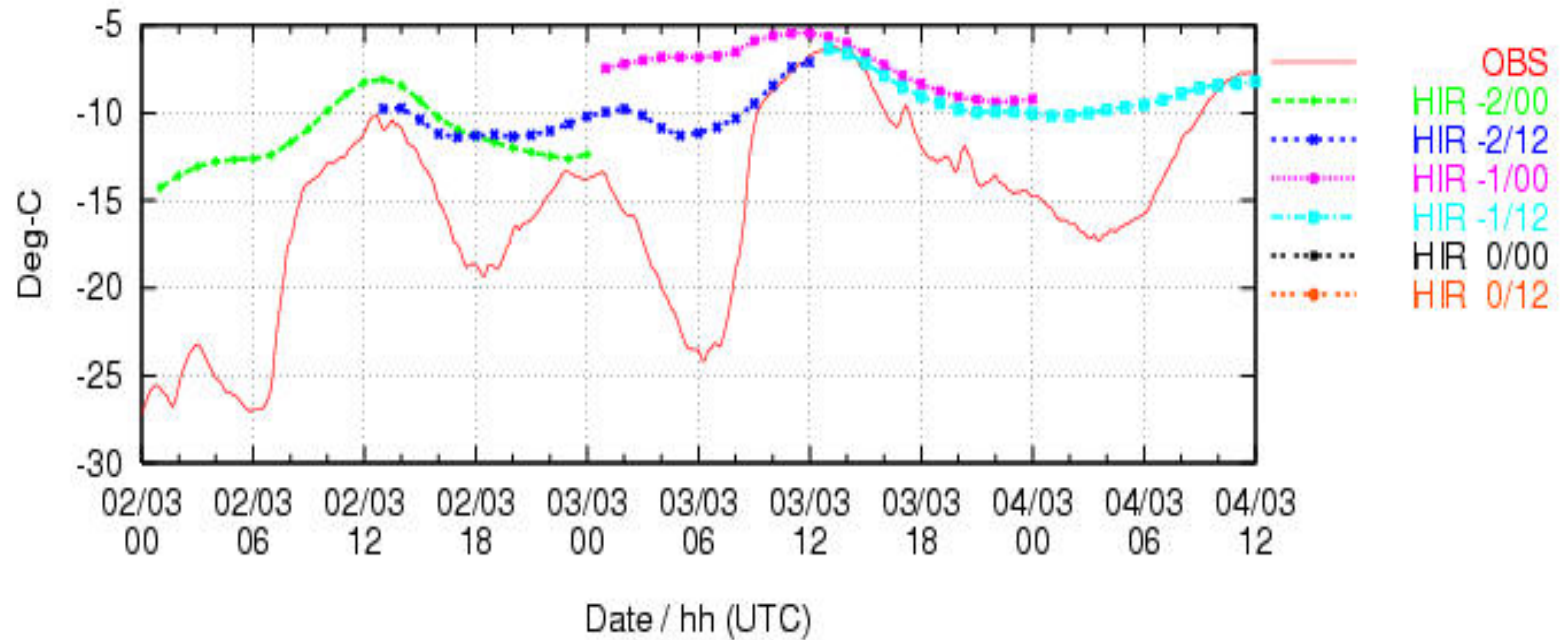


Data plotting system

M e a s u r e m e n t s



Sample plot



Fri Mar 04 15:10:02 2005

[Sodankylä](#) [Cabauw](#) [Kivenlahti](#) [Kuopio](#) [Rovaniemi](#) [INFO](#)

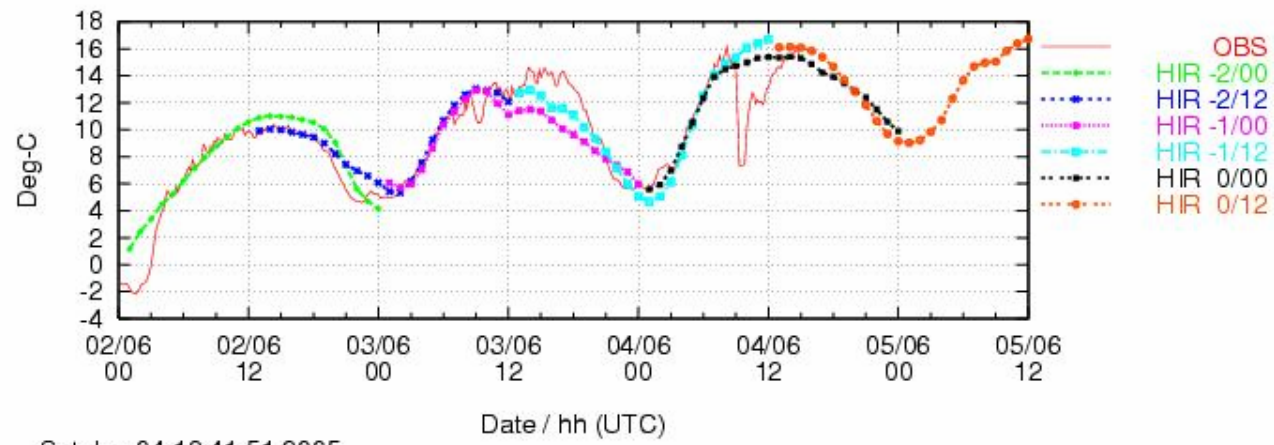
HIRLAM : [Carl Fortelius](#) [Markku Kangas](#) ARPEGE : [Eric Bazile](#) [Francois Vinit](#) Sodankylä : [Antti Poikonen](#) Cabauw : [Cisco de Bruijn](#) [Mika Aurela](#)

Sodankylä mast measurements v. HIRLAM RCR & ARPEGE



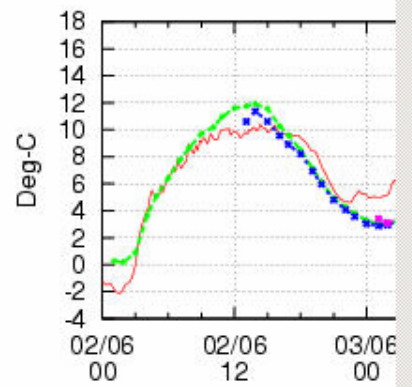
Mast description

HIRLAM RCR : Temperature (Sodankylä 3m / HIRLAM 2m)



Sat Jun 04 18:41:51 2005

ARPEGE : Temperature (Sodankylä 3m / ARPEGE 2m)



Sat Jun 04 21:15:15 2005

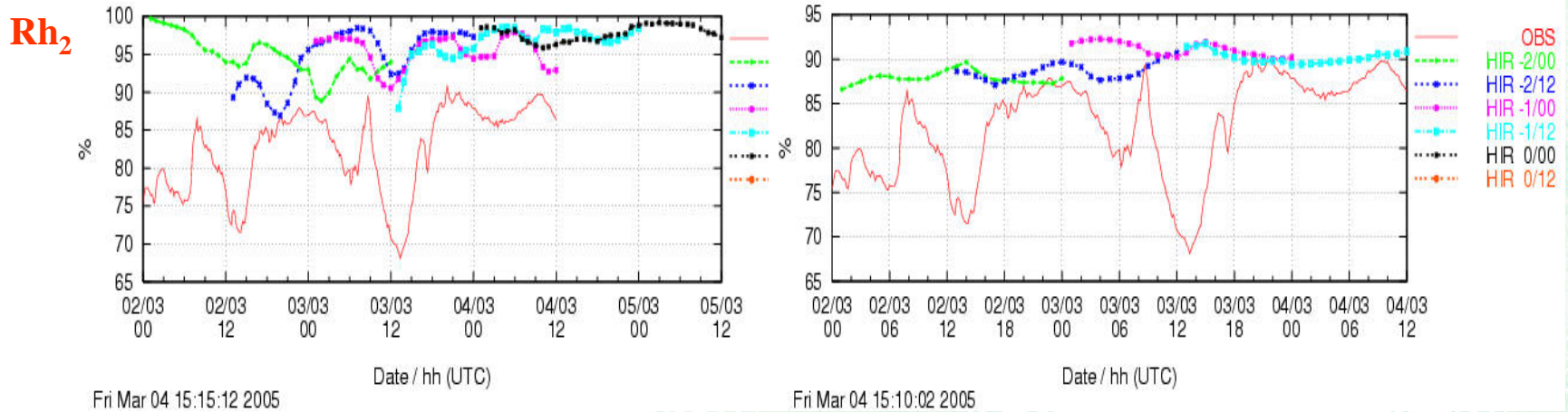
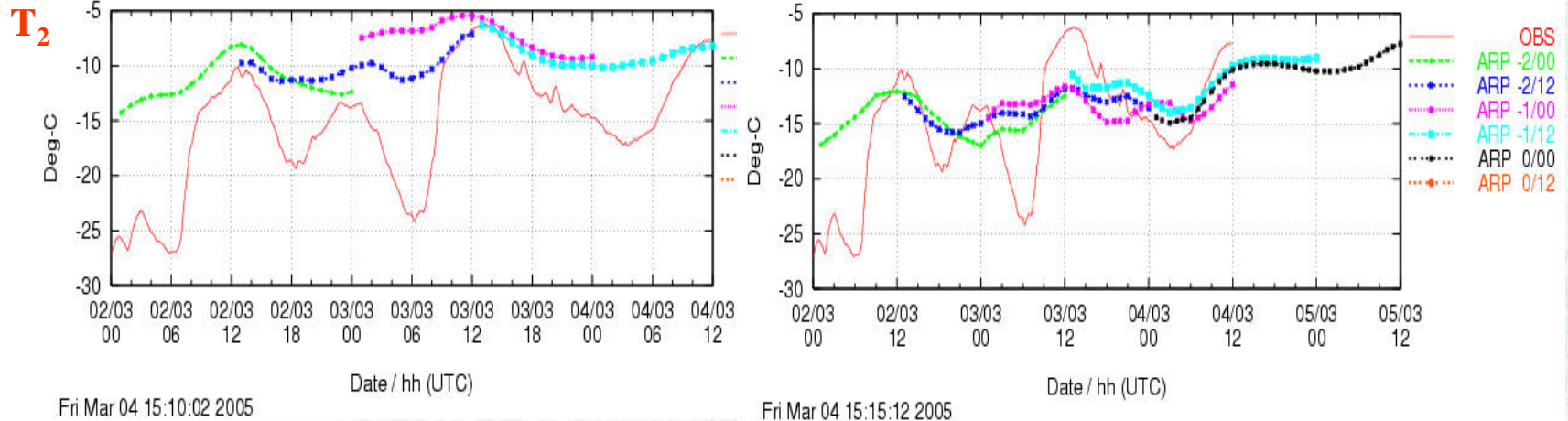
HIRLAM RCR : Temperature (Sodankylä 32m / HIRLAM 31m)



ARPEGE : Temperature (Sodankylä 32m / ARPEGE 31m)

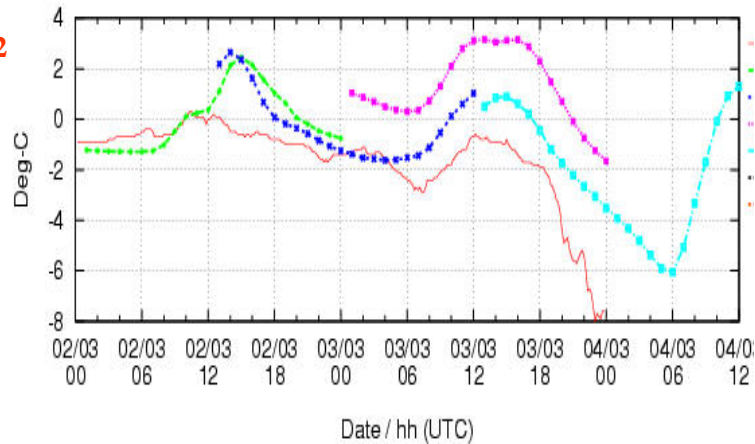


Sodankylä - Hirlam - Arpege

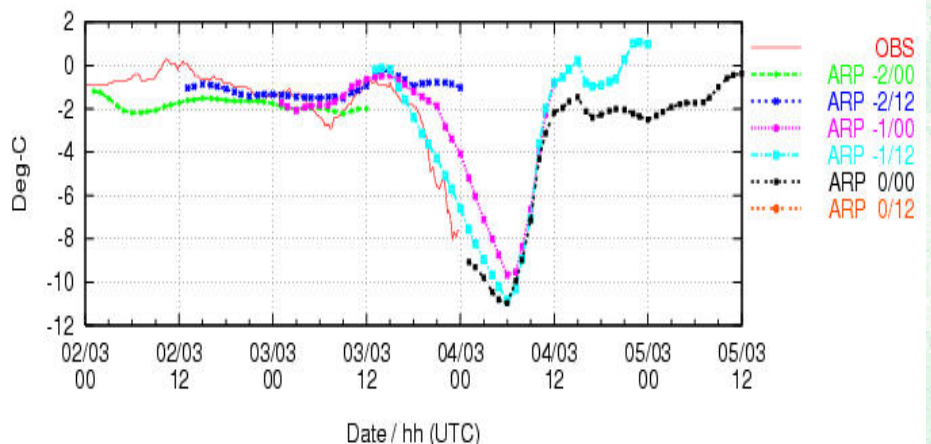


Cabauw - Hirlam - Arpege

T_2

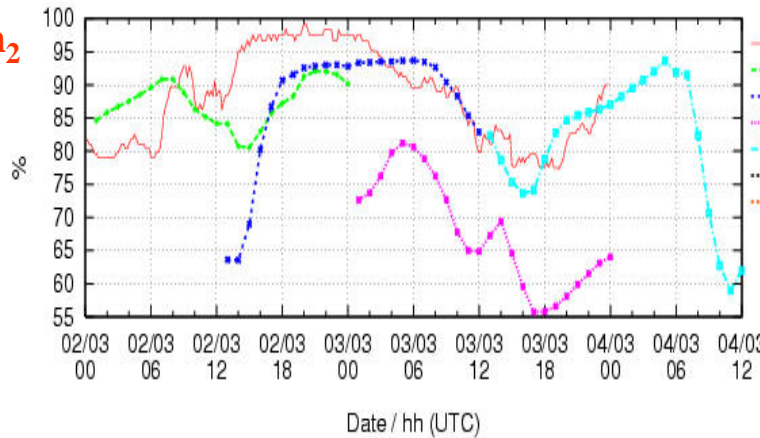


Fri Mar 04 15:10:03 2005

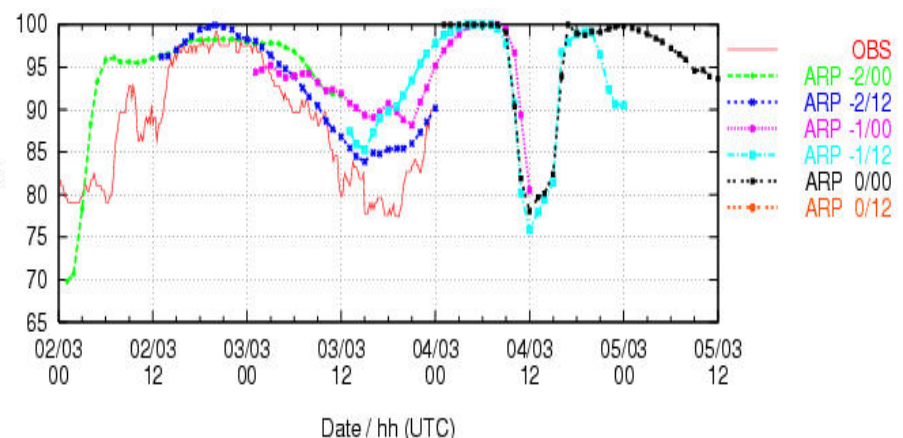


Fri Mar 04 15:15:12 2005

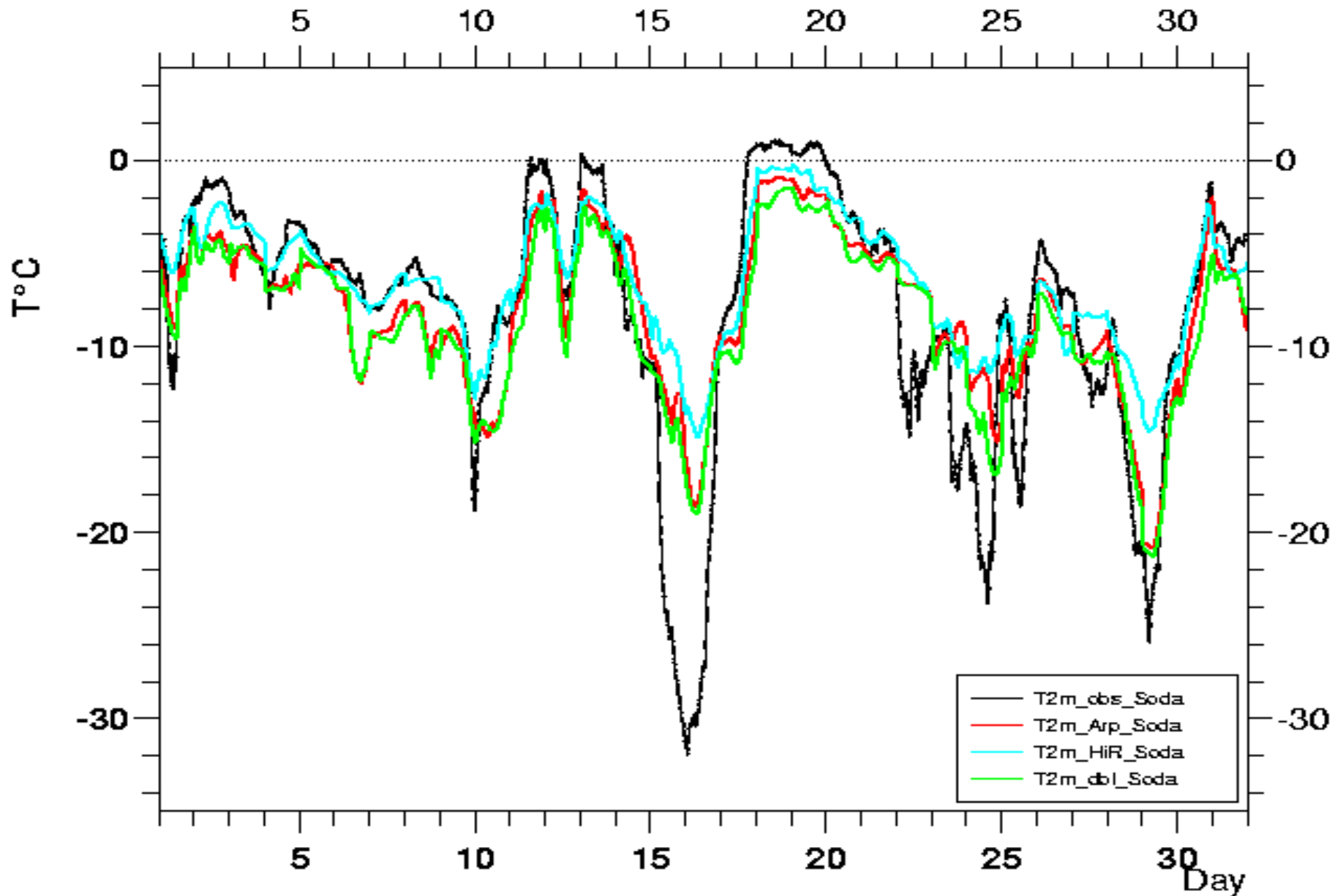
Rh_2

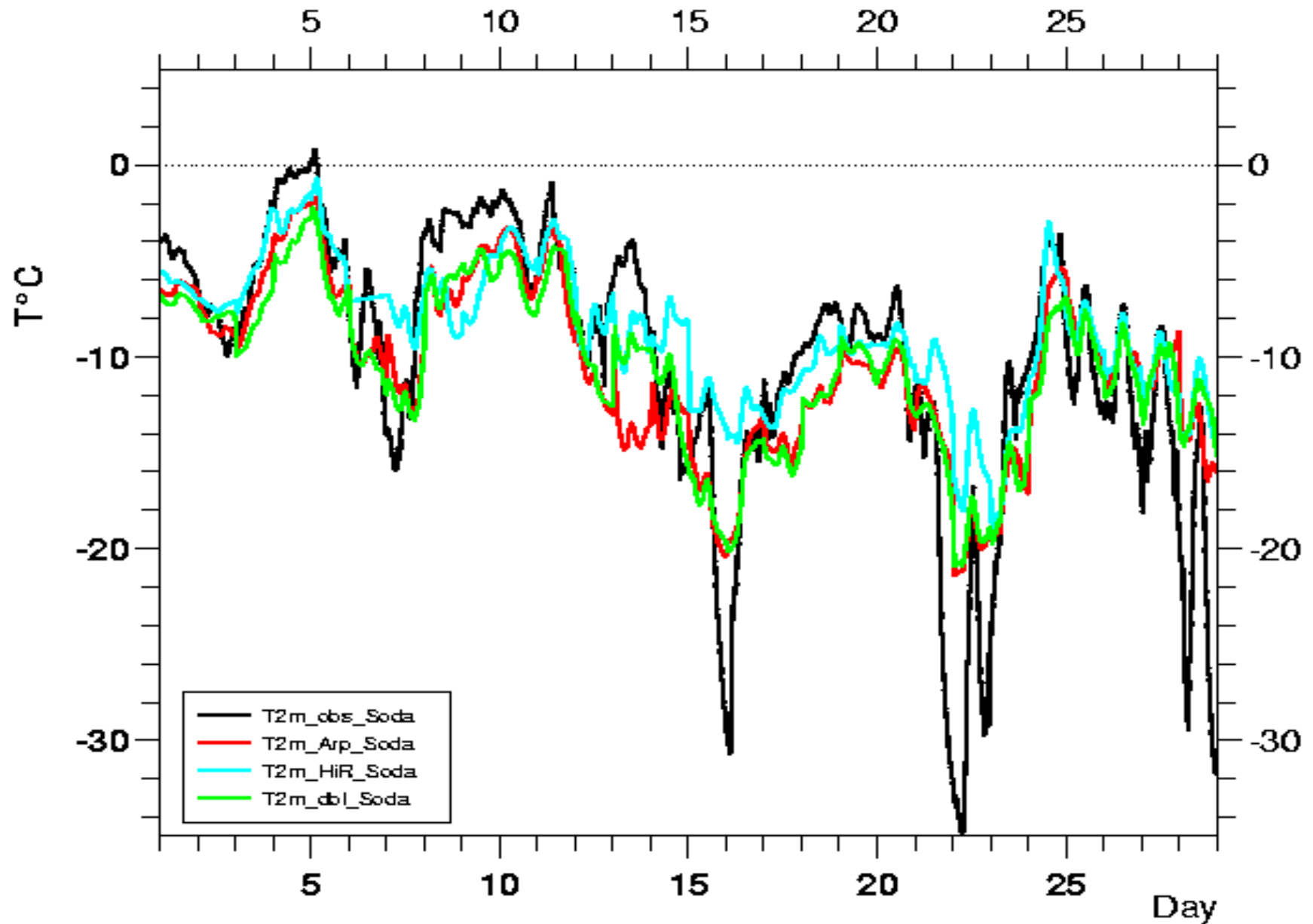


Fri Mar 04 15:10:03 2005



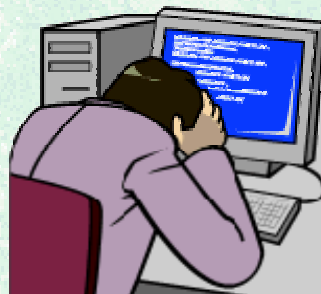
Fri Mar 04 15:15:12 2005

SODANKYLA T2M JANUARY 2005*Base 00TU fc24h*

SODANKYLA T2M FEBRUARY 2005*Base 00TU fc24h*

Conclusions

- System has worked well
 - mostly
- Proved to be usable and useful
 - pointed out model problems in cold conditions
- Attracted a lot of interest
 - many people watching and reporting problems
- Useful also for measurements
 - monitoring, system malfunction detection
 - discrepancies with model : which one is right ?



Future

- Need for boundary layer masts also in the future
 - satellites etc. : no detailed information about ABL
 - limitation : only one point
 - brings up problematic cases, which might disappear in averaging
 - must be taken into account when interpreting results
- Meso-scale models : importance of masts will grow
 - more detailed and localized measurements needed
- Future options
 - more masts
 - more parameters
 - not yet utilizing the full power
 - present masts still have potential



