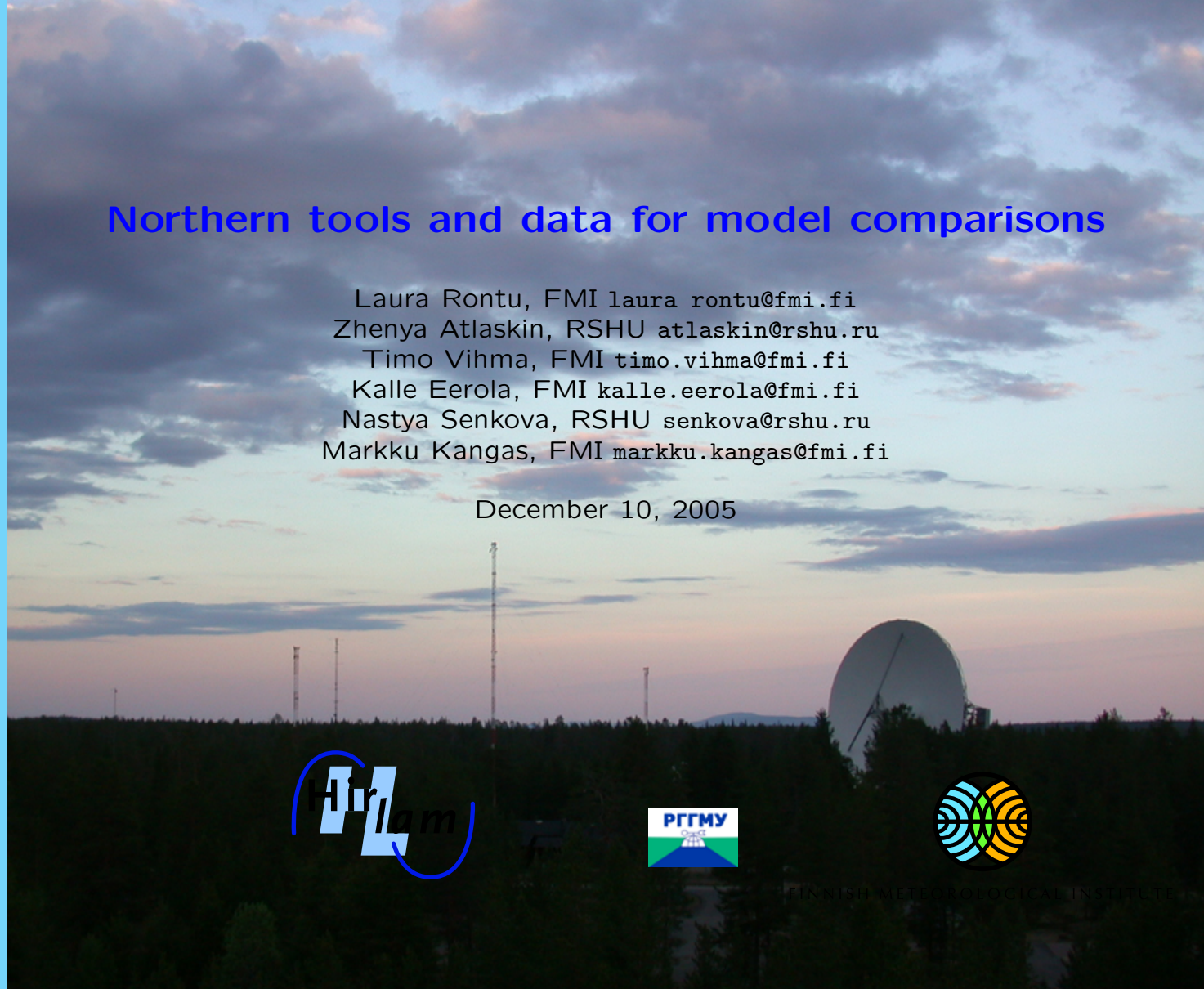

Northern tools and data for model comparisons

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December 10, 2005


How to validate a new scheme?
Standard station verification
Details of bias
Introduction to Sodankylä
Sounding comparison
Mast comparison
Further possibilities

How to validate a new scheme?

How to validate a new scheme?

Northern winter problem

In the model, too warm predicted near-surface temperatures in a stable arctic boundary layer. Differences between observation and forecast of the order of ten degrees are common. In reality, clear sky, no significant SW radiation, shallow surface layer with strong surface temperature inversion over snow covered surface. Relative humidity may be large but not close to saturation. Observed latent and sensible heat fluxes are small, in the model generally somewhat larger. Extra clouds/fog may form in HIRLAM.


SFS: a possible element of the solution

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- Snow - Forest - Scheme by Stefan Gollvik et al.
- Detailed handling of interactions
  in (snow covered) forest and open land
- ISBA framework with diffusion equation in soil
  partly based on the old HIRLAM surface scheme
  developed for the Rossby Centre Climate Model
- references: Norrköping SRNWP workshop, Sodankylä summer school

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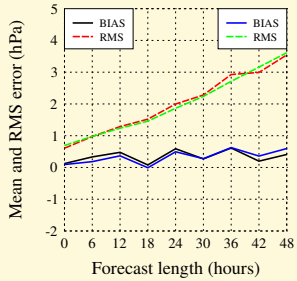
The scheme is ready for one-dimensional and three-dimensional comparisons

How to know if it solves our problem?

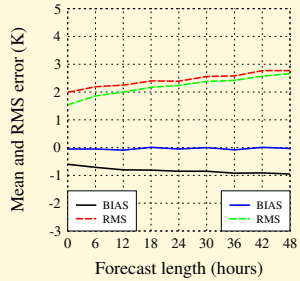
Standard station verification

against Scn observations
40E (left) OMA (right)
Period: 20050101 - 20050131

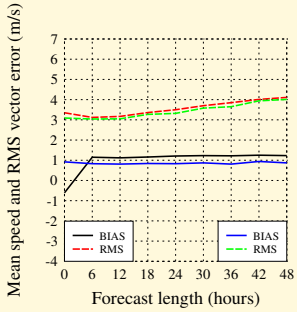
Surface pressure



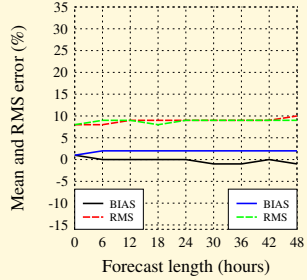
Two metre temperature



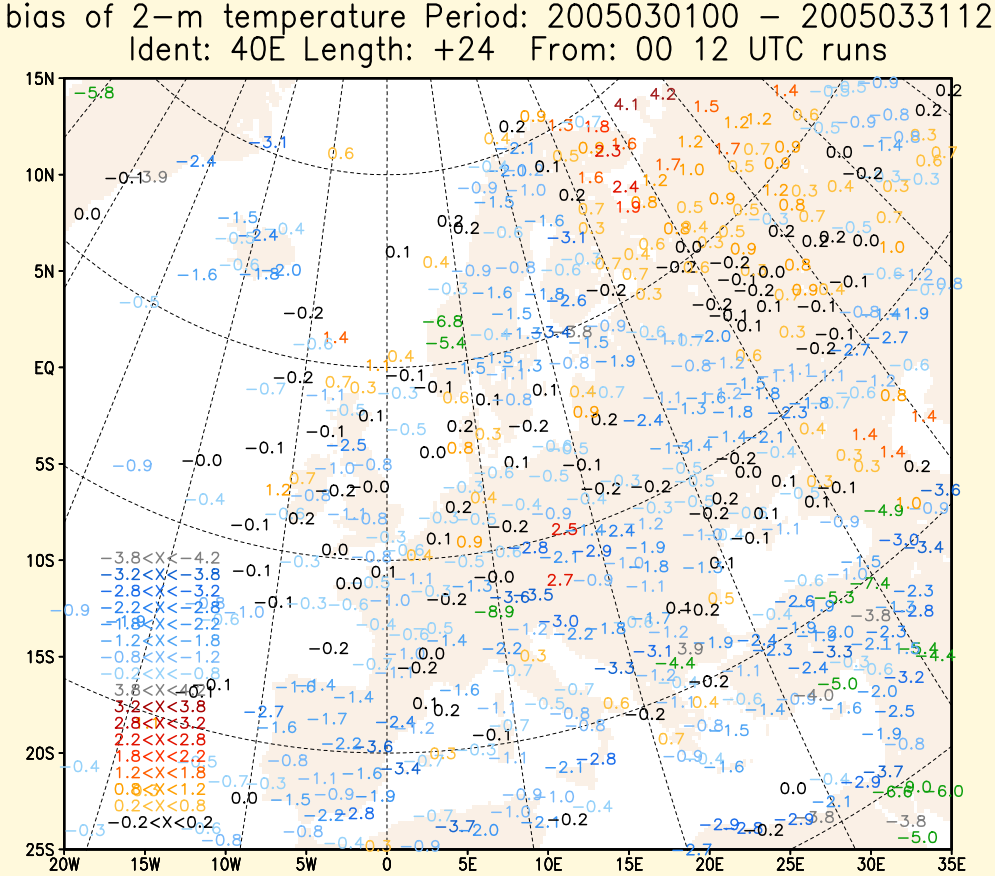
Ten metre wind



Two metre relative humidity



ZOBS or details of the bias (1)

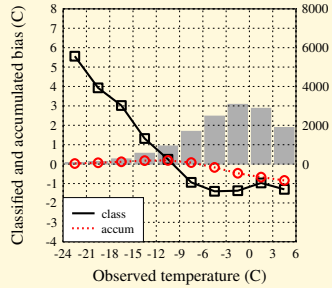


ZOBS (2)

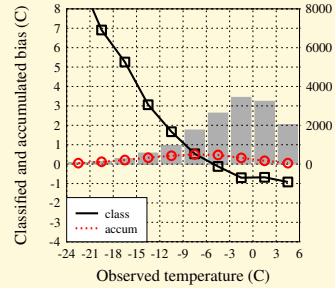
observations WMO022221
experiment 40E
Period + fc length: 200501+024

observations WMO022221
experiment OMA
Period + fc length: 200501+024

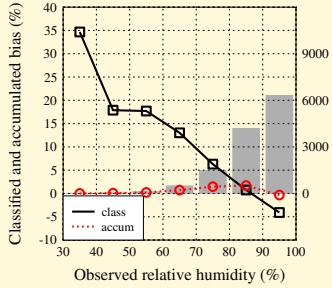
Two metre temperature



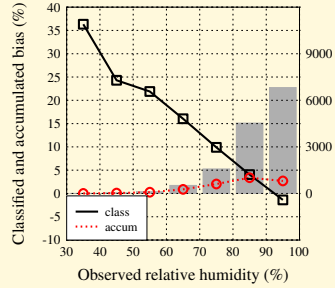
Two metre temperature



Two metre relative humidity



Two metre relative humidity

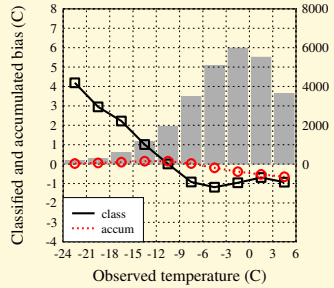


Details of the bias (3)

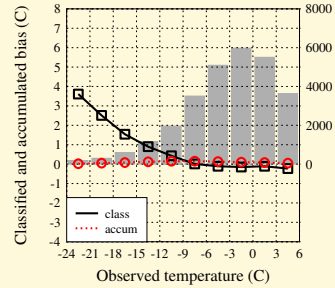
observations WMO022122
experiment 40E
Period + fc length: 200501+000

observations WMO022122
experiment OMA
Period + fc length: 200501+000

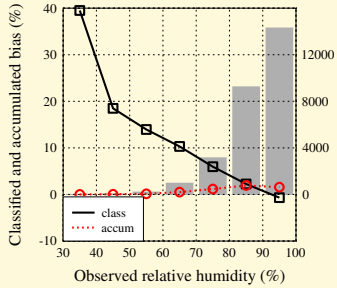
Two metre temperature



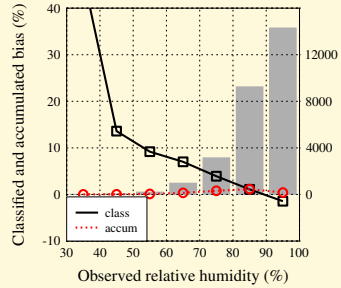
Two metre temperature



Two metre relative humidity



Two metre relative humidity



Introduction to Sodankylä - FMI ARC

What makes Sodankylä observations interesting?

Introduction to Sodankylä - FMI ARC

What makes Sodankylä observations interesting?

Boreal - subarctic enviroment

- (long-living) Stable boundary layer, cold T_s
- Boreal forest, snow, low solar elevations

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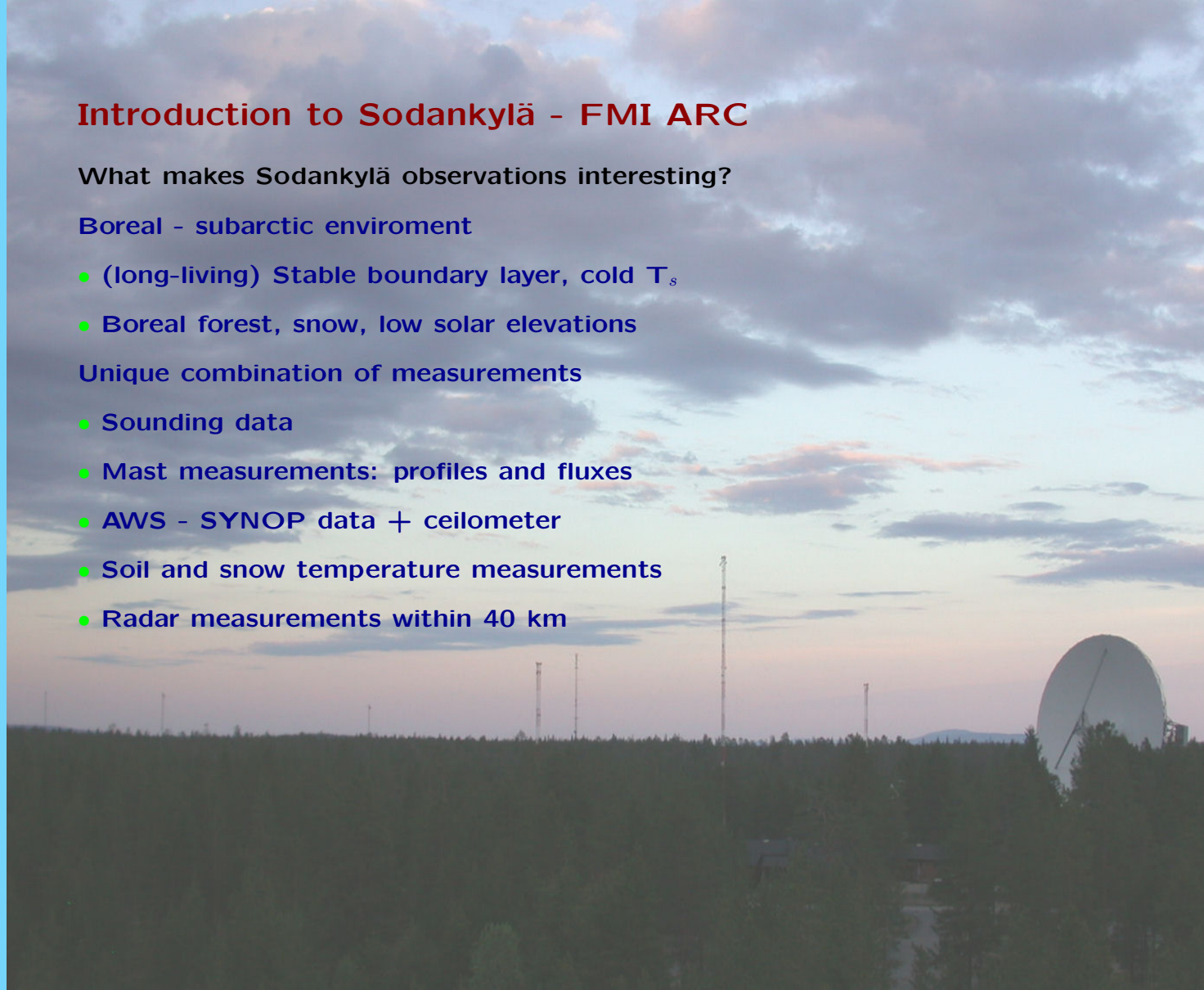
Unique combination of measurements

- Sounding data
- Mast measurements: profiles and fluxes
- AWS - SYNOP data + ceilometer
- Soil and snow temperature measurements
- Radar measurements within 40 km



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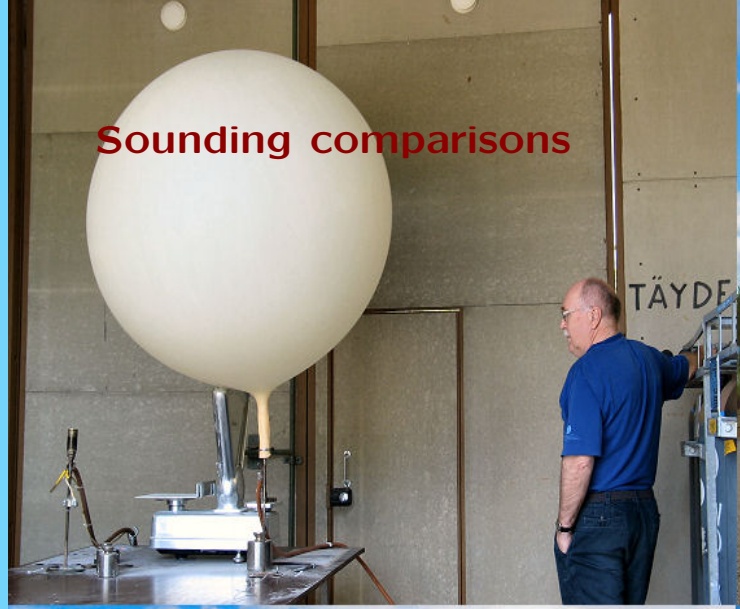
Operational and continuous observations

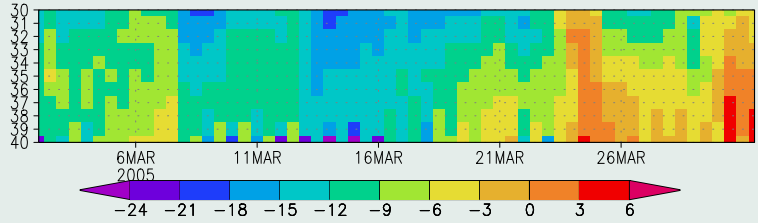
- Used for operational monitoring
- Quality control: + and -
- Data/Tools availability: + and -
- Possibility for special observation periods

Sounding comparisons

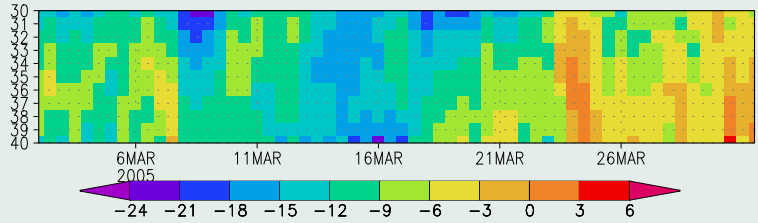


EXP 40E-0305

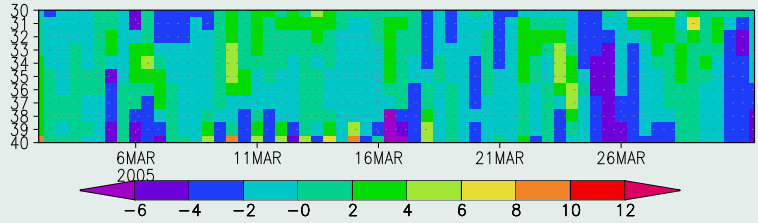
Temperature, sounding



Temperature, fc24

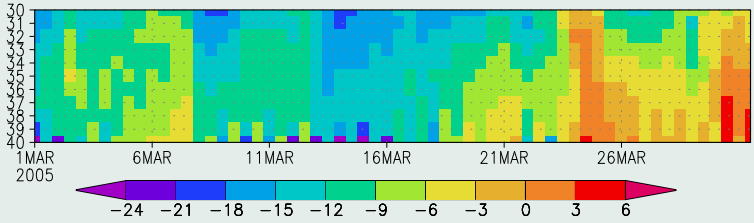


Temperature, model−sounding

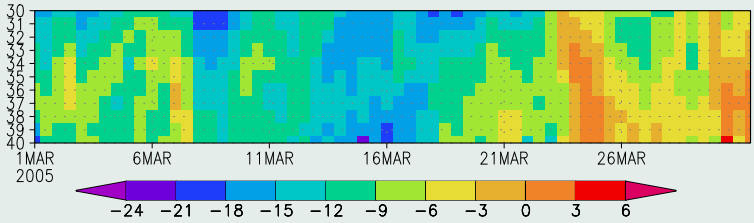


EXP 40E-0305

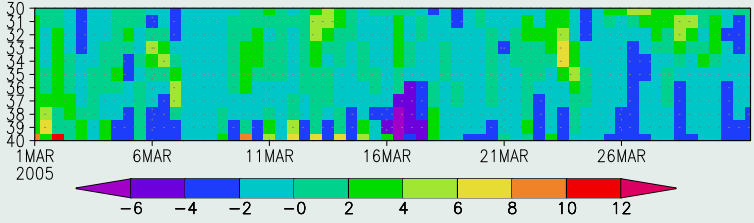
Temperature, sounding



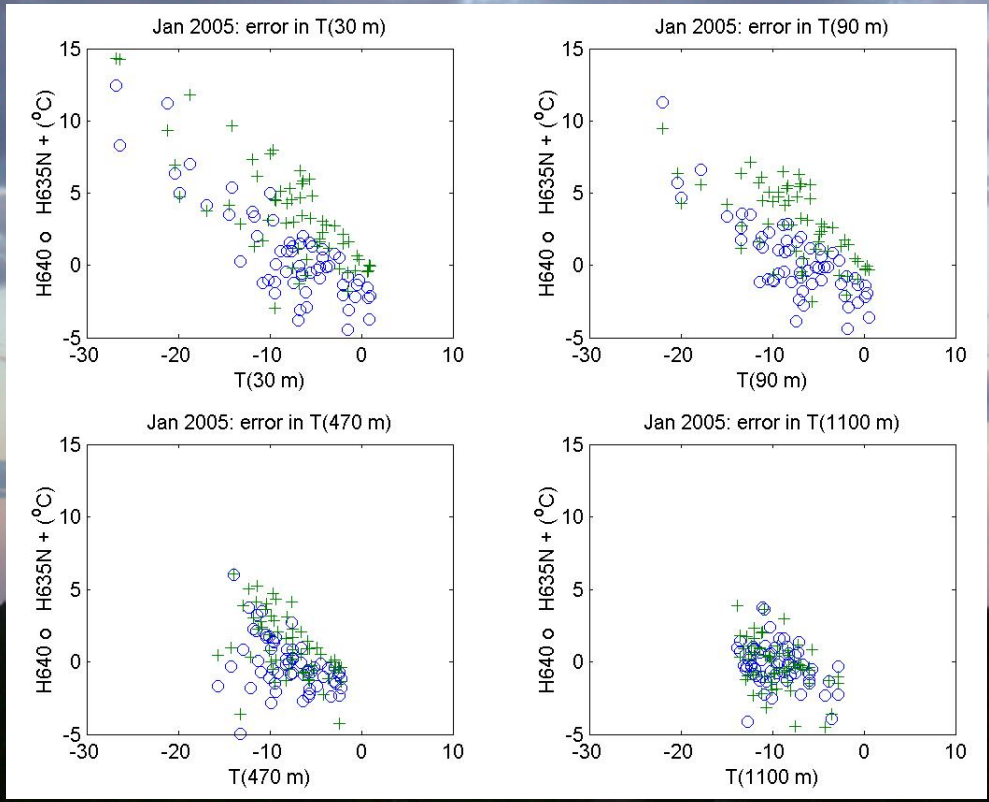
Temperature, fc00



Temperature, model-sounding



Sounding v.s. model as a function of temperature




Data for SCM

Data for SCM

- Sounding data as initial profile
- HIRLAM experiment data as initial profile
- Observed fluxes etc as lower boundary condition

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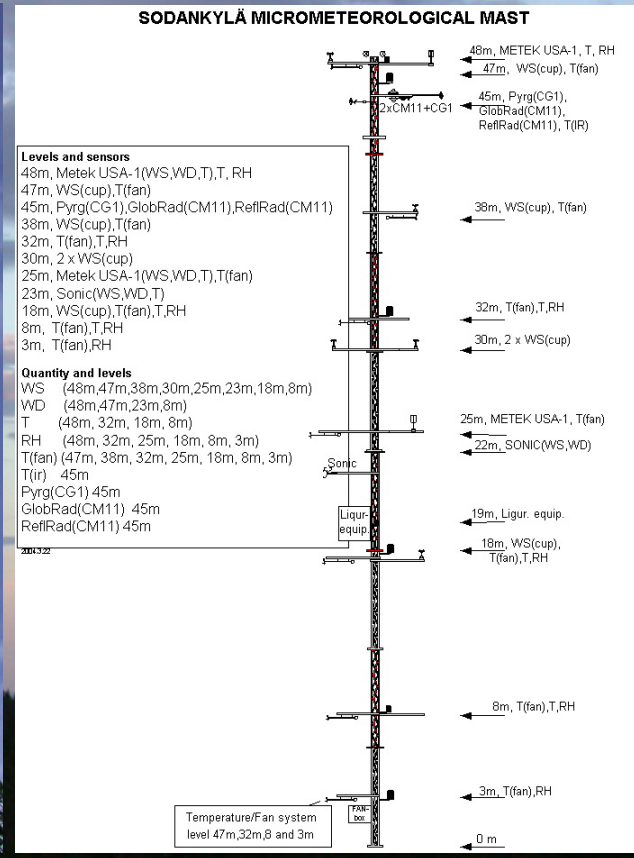
Tools to pick HIRLAM profile in ASCII

Tools to write ASCII input based on HIRLAM profile

Tools to handle sounding data

Mast comparisons



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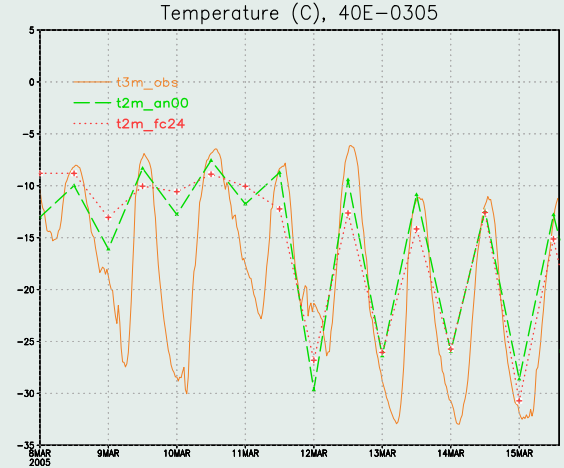
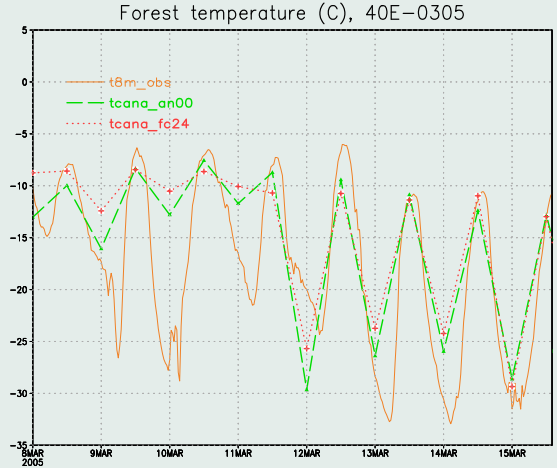
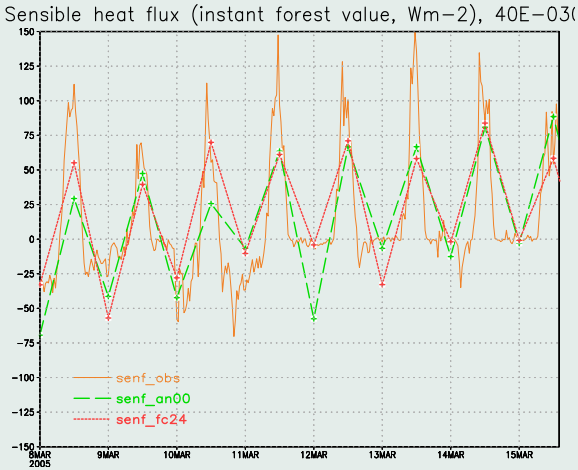
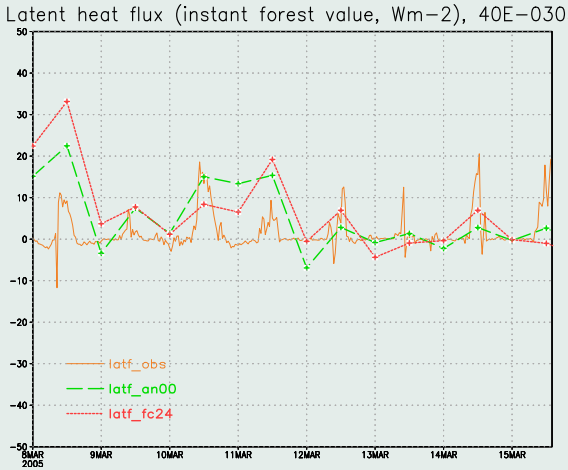

Temperature (C), 40E−0305
t3m_obs
t2m_an00
t2m_fc24
5
0
−5
−10
−15
−20
−25
−30
−35
8MAR 2005
9MAR
10MAR
11MAR
12MAR
13MAR
14MAR
15MAR


Forest temperature (C), 40E−0305
t8m_obs
tcana_an00
tcana_fc24
5
0
−5
−10
−15
−20
−25
−30
−35
8MAR 2005
9MAR
10MAR
11MAR
12MAR
13MAR
14MAR
15MAR


Sensible heat flux (instant forest value, Wm−2), 40E−03(
senf_obs
senf_an00
senf_fc24
150
125
100
75
50
25
0
−25
−50
−75
−100
−125
−150
8MAR 2005
9MAR
10MAR
11MAR
12MAR
13MAR
14MAR
15MAR


Latent heat flux (instant forest value, Wm−2), 40E−030
latf_obs
latf_an00
latf_fc24
50
40
30
20
10
0
−10
−20
−30
−40
−50
8MAR 2005
9MAR
10MAR
11MAR
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15MAR

How to make the sounding and mast comparison pictures?

Raw material

How to make the sounding and mast comparison pictures?

Raw material

- Sodankylä soundings - ASCII tables
- Mast profiles: T, RH, wind
  - raw observation ASCII files
- Mast fluxes: senf, latf, momf, SWdn, SWup, LWup
  - raw observation ASCII files
- (LWdown separate measurements
  - raw observation ASCII files)
- HIRLAM analyses and forecast
  - GRIB files, possibly subareas/ASCII profiles

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Tools

- Main shell scripts RunSounding, RunMast
- Fortran programmes interpol.f90 and sodaconv.f90
- (Tools to pick subareas and profiles from HIRLAM)
- Grads scripts for drawing

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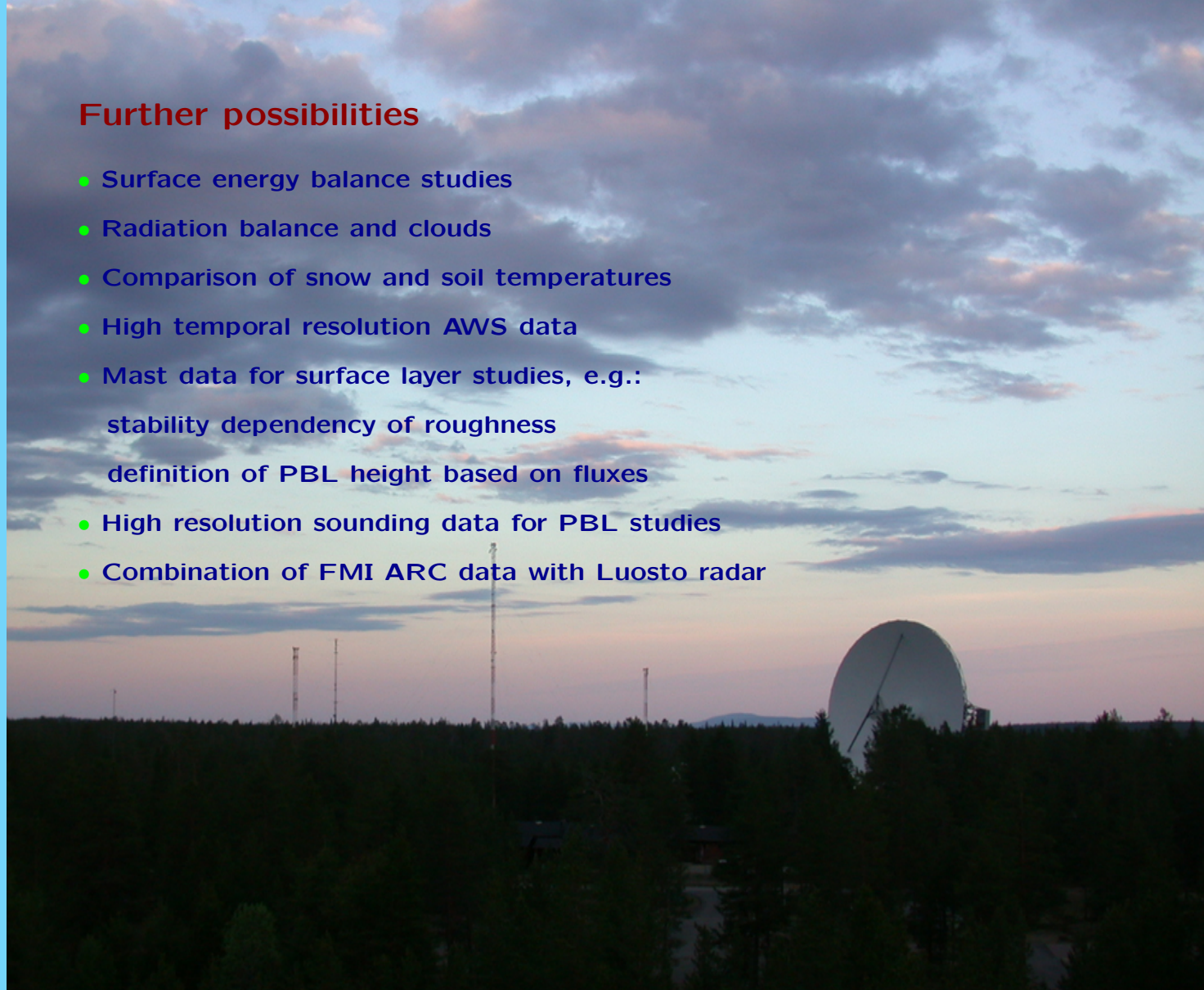
Output

- Readable converted and interpolated ASCII data
  - for drawing, reading, calculations
- Grads pictures

Further possibilities

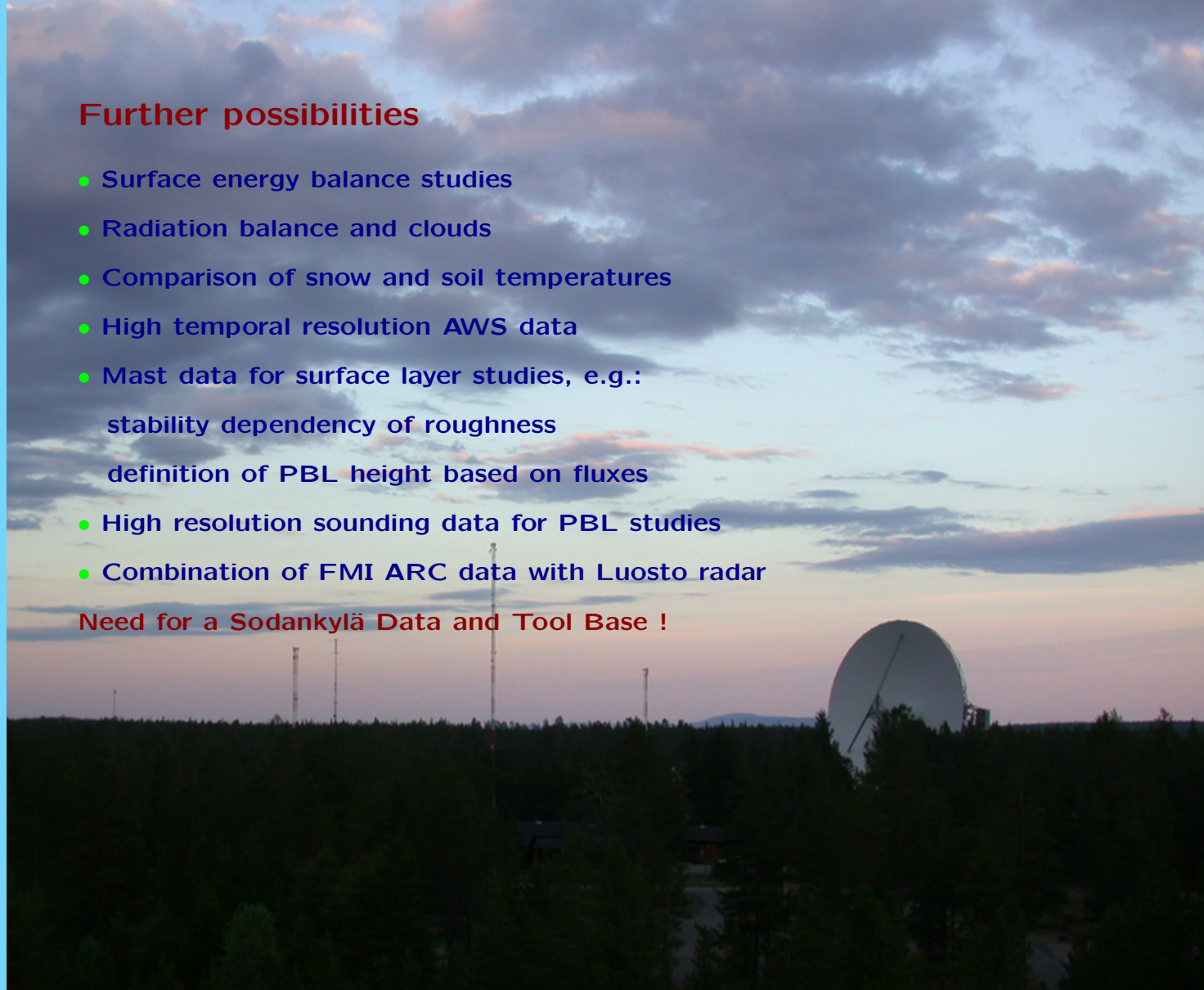


Further possibilities

- Surface energy balance studies
- Radiation balance and clouds
- Comparison of snow and soil temperatures
- High temporal resolution AWS data
- Mast data for surface layer studies, e.g.:

  stability dependency of roughness

  definition of PBL height based on fluxes
- High resolution sounding data for PBL studies
- Combination of FMI ARC data with Luosto radar



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Need for a Sodankylä Data and Tool Base !