HIRLAM surface developments

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Contents

- HIRLAM surface work
  - Newsnow scheme (snow and forest)
  - Lake scheme
  - Snow on ice
  - New T2m diagnostics
- HARMONIE (in cooperation with ALADIN) surface work
- (Nilu surface (analysis) work)

HIRLAM surface work

- Development and implementation of newsnow scheme
  - Forest tile with canopy scheme, separate canopy temperature and canopy air temperature
  - Snow tiles (low vegetation + bare soil, forest), one layer snow scheme
- Inclusion of Lake parameterization (FLAKE, just like in all other models)
- Inclusion of snow on ice

HIRLAM surface work

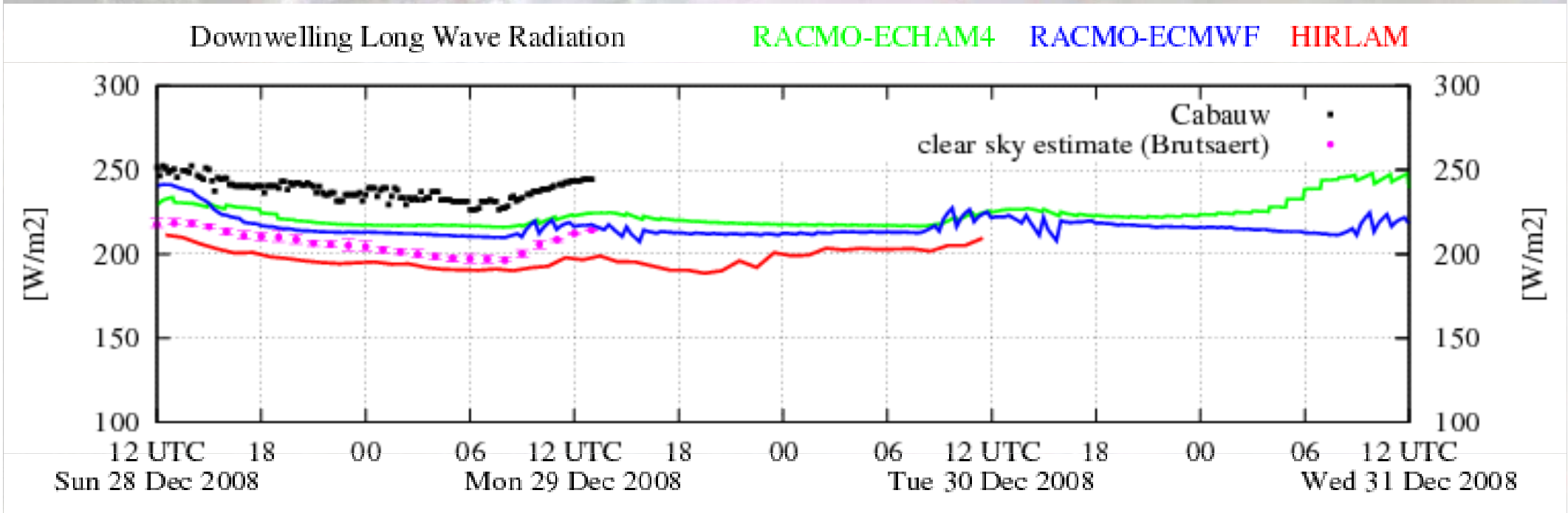
- Forest scheme:
  - Problem with forests in Nordic countries esp. in spring
  - Too cold and too wet forests, snow melting too quickly
  - Forest scheme with canopy solves problems
- Snow scheme:
  - One layer snow scheme
  - Melting, refreezing, heat conduction is density and depth dependent
  - Much quicker than old scheme, more sensitive to atmospheric model problems (magnified), old scheme was too slow in cooling conditions

HIRLAM surface work

- Forest/snow scheme:
  - Very sensitive to errors, tuning for old surface scheme not correct for new scheme
  - Knowledge of rest of model becomes very important for correct behaviour and tuning of surface scheme
  - Errors in cloud cover, radiation (especially clear sky) and microphysics (impact on radiation) holding back implementation of new scheme.
- After some large adjustments in LWD maybe soon in reference HIRLAM (after many years)!

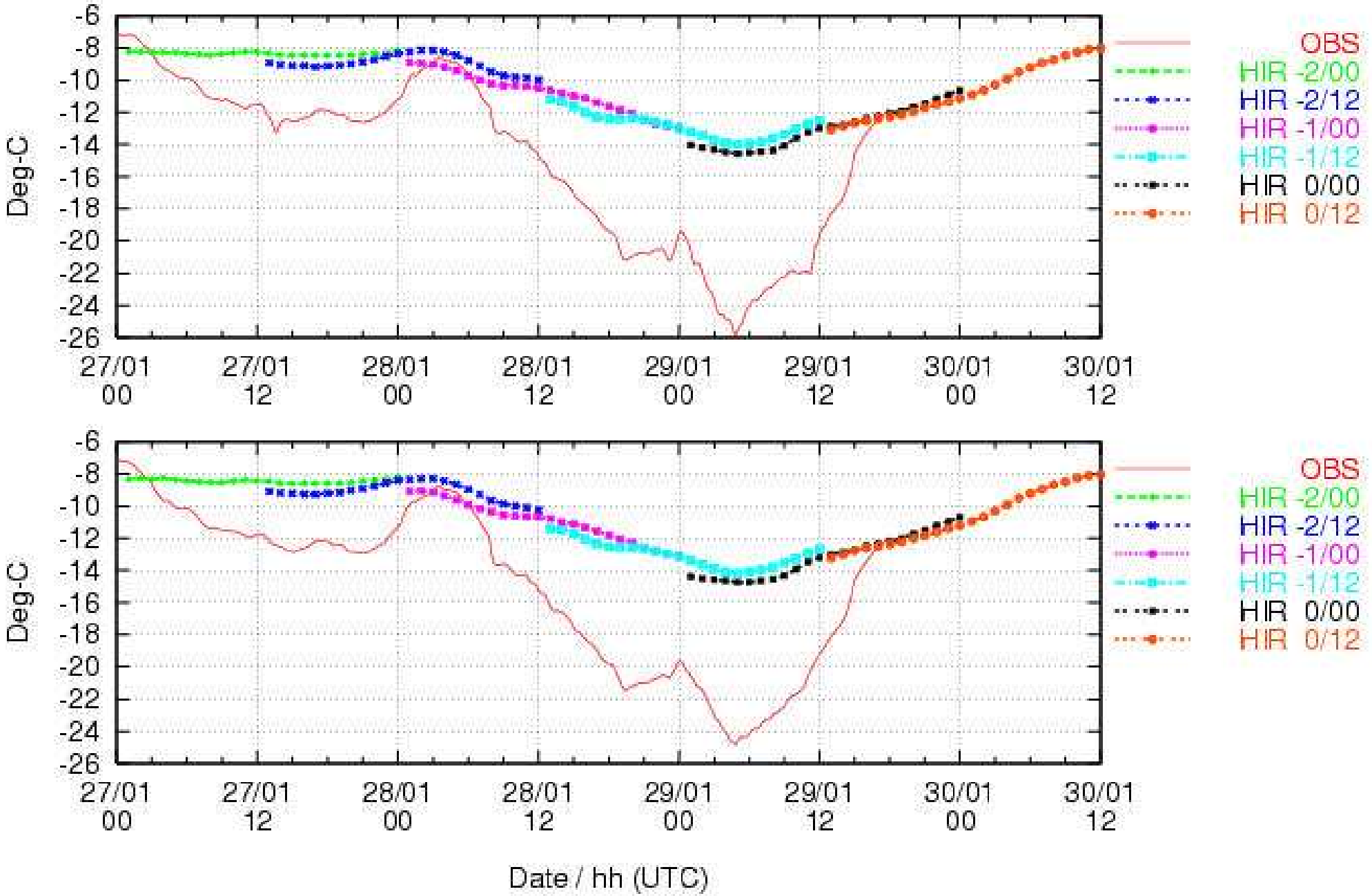
HIRLAM surface work

- LWD problem:

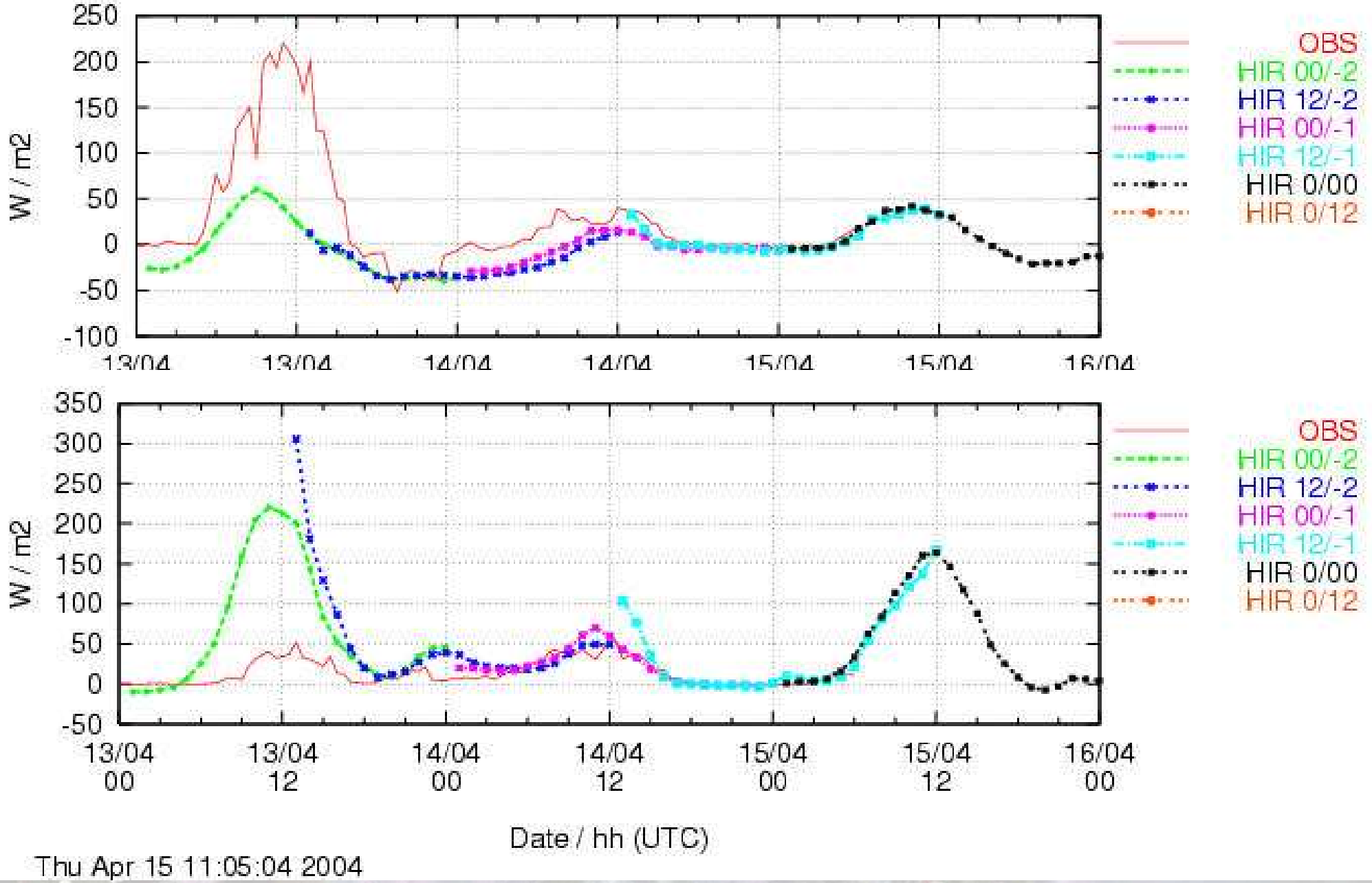


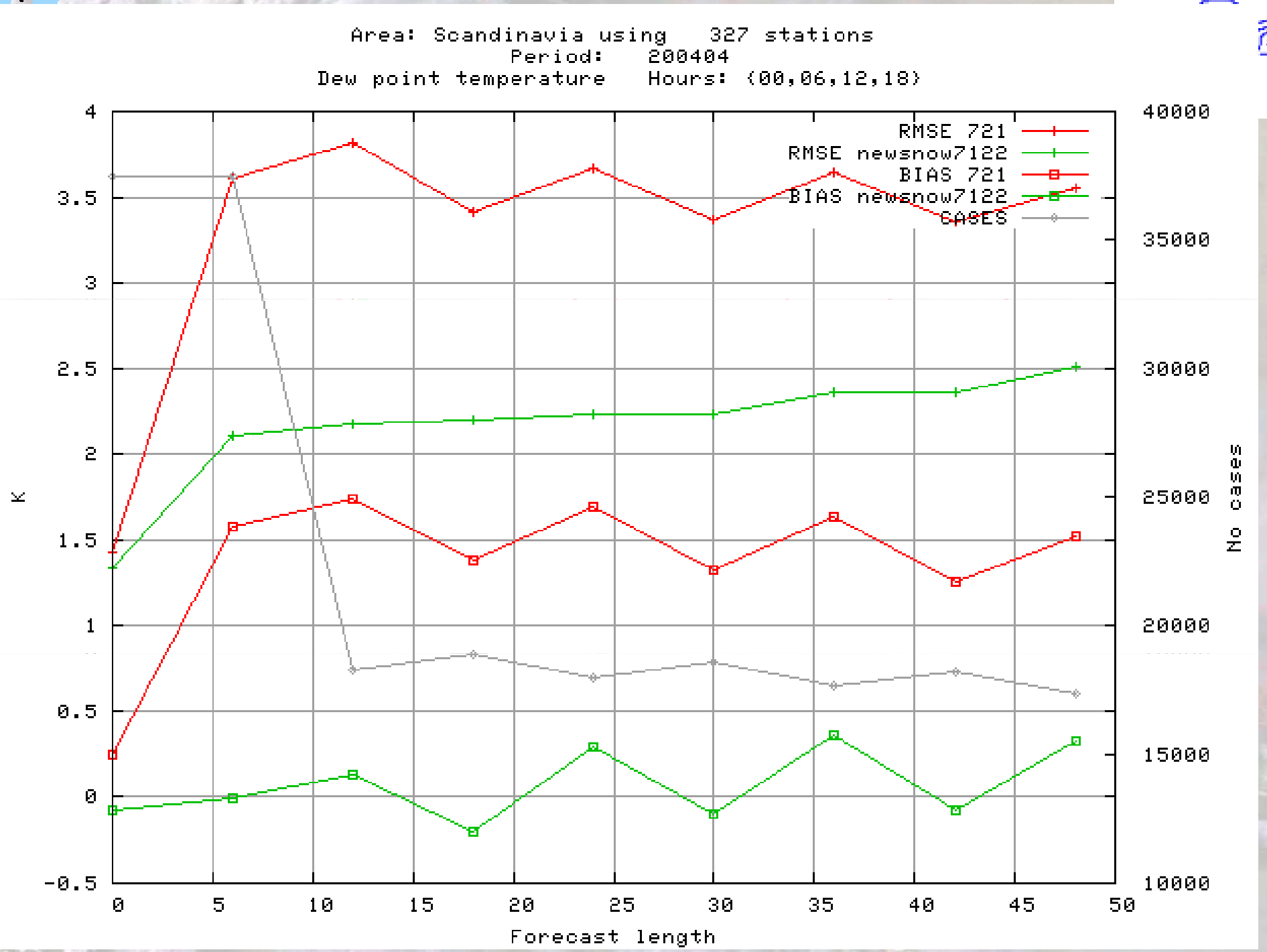
- Problem overestimated in this plot, order 20-30 W/m^2 in all seasons!

Nordic winter problem



Spring problem




Area: Scandinavia using 327 stations
Period: 200404
Dew point temperature Hours: (00,06,12,18)
RMSE 721
RMSE newsnow7122
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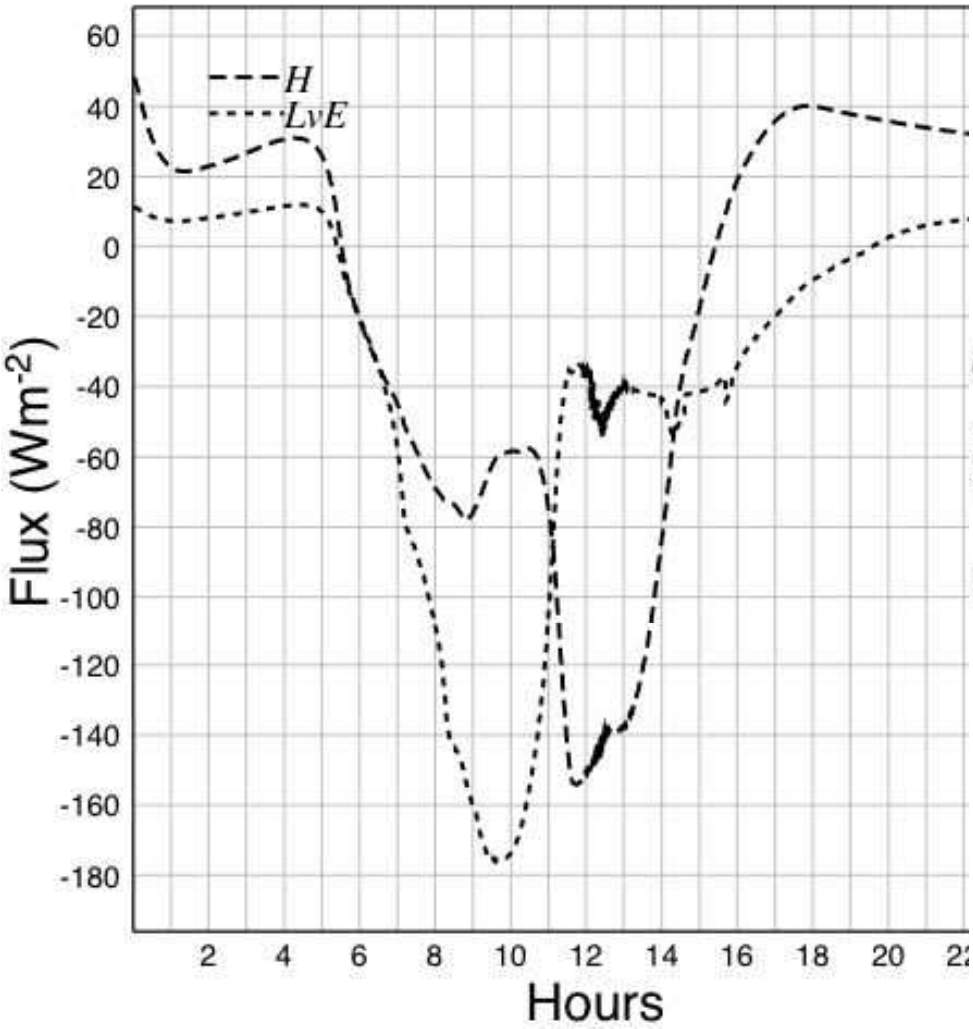
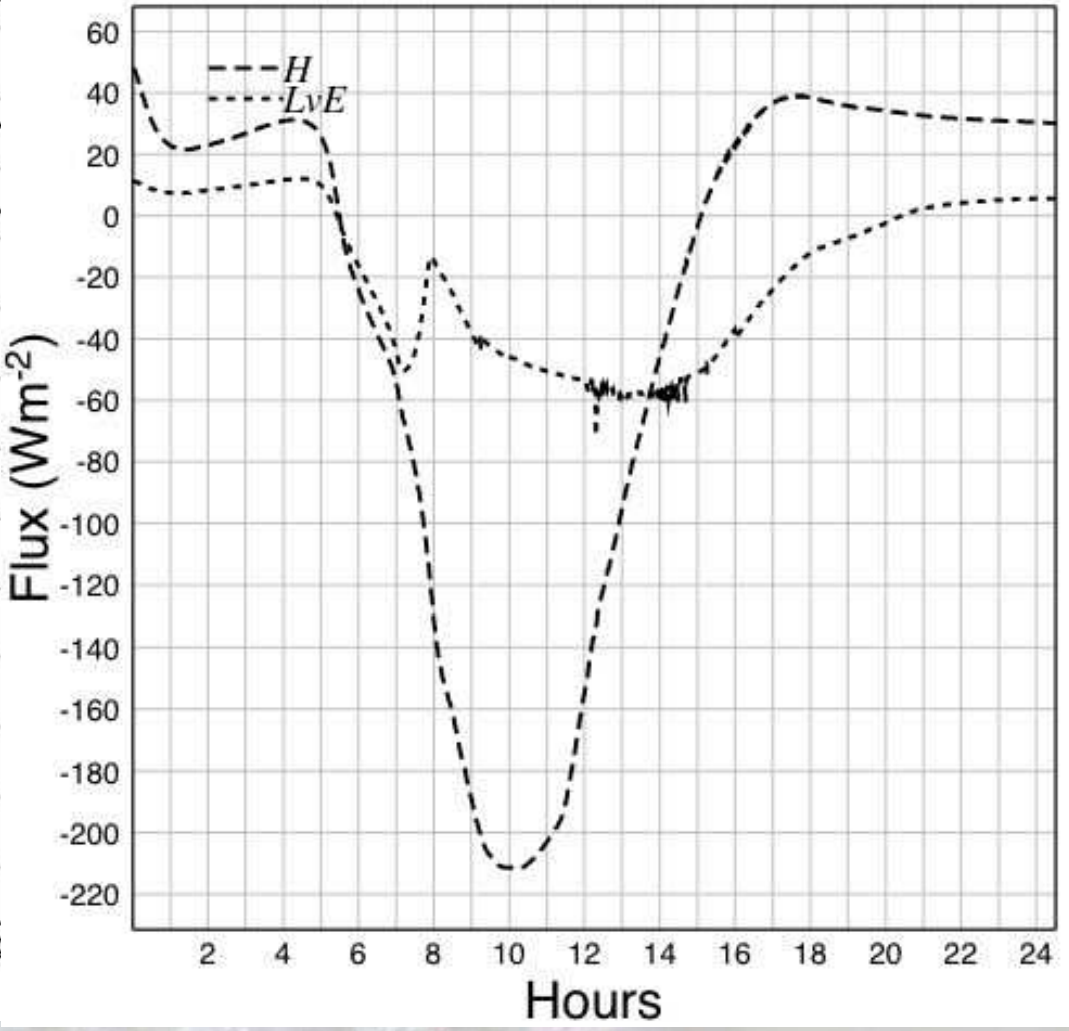
Spring problem (6.3.4snow)

H634_snow_1S40_sprin



H634_snow_1S40_spring.8_cw



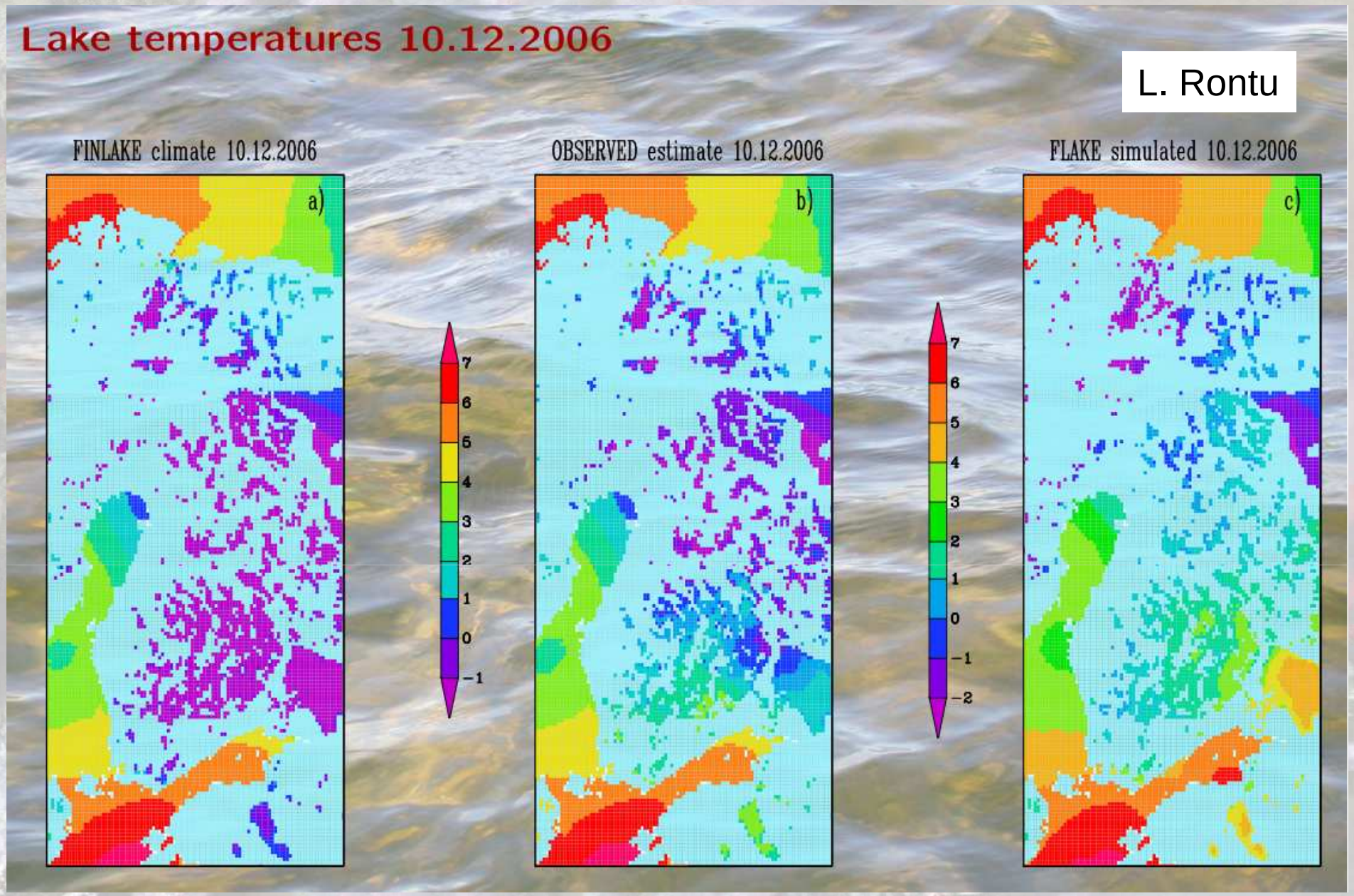
HIRLAM surface work

- Snow on ice:
  - Important for Nordic countries to have (sea) ice param in surface scheme, heat conduction through ice
  - Snow limits heat conduction and changes albedo
  - Snow on ice parameterization necessary
- 2m diagnostics
  - Improvements in 2m diagnostics (adjusted Geleyn formula) important for surface DA
  - Does not solve the long lived stable PBL problem (again mainly Nordic winter problem)

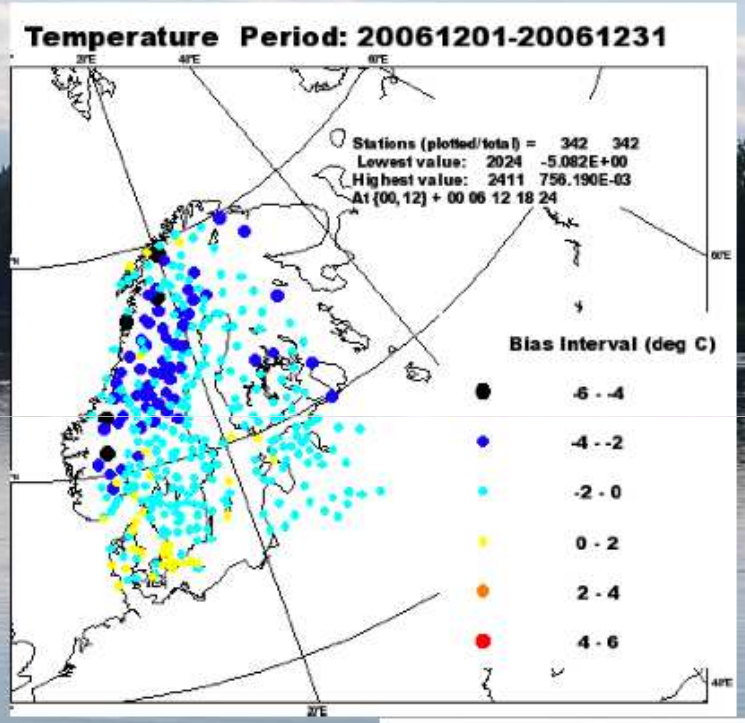
HIRLAM surface work

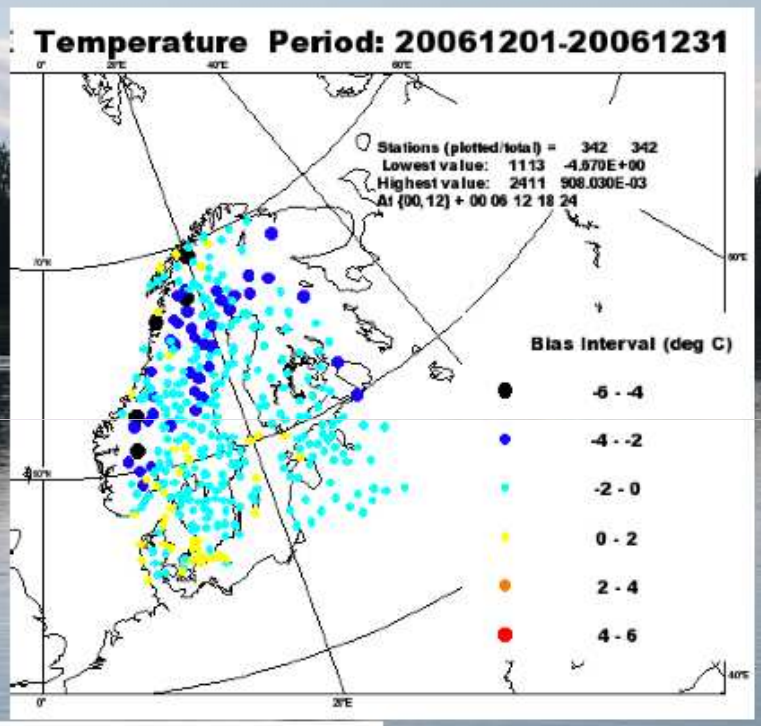
- Inclusion of FLake
  - Important again especially for Nordic countries and countries with large lakes
  - Improves T and Td especially when weather is far from climate average
  - Now T_lake is interpolated SST or climate averages, in Finland also measurements are used for lake temperature

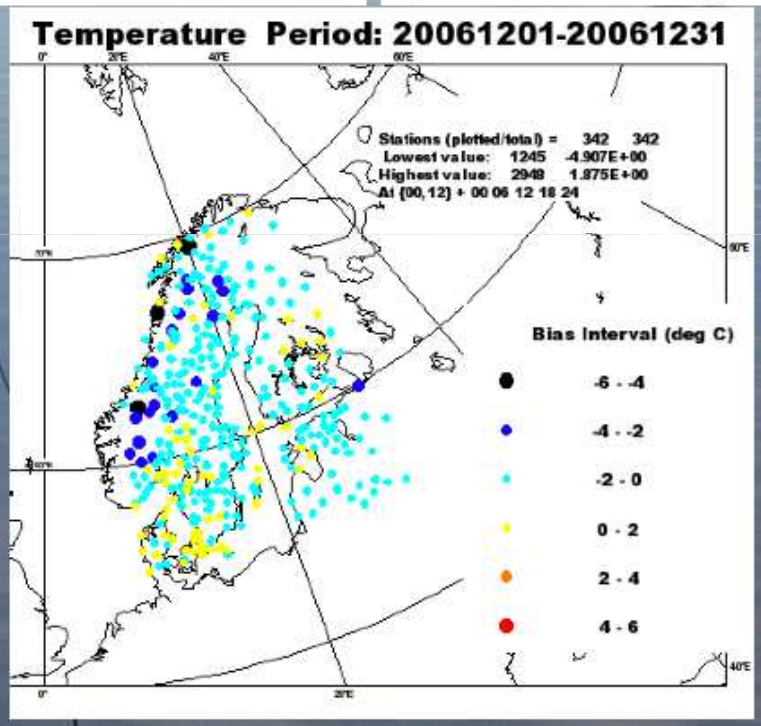
Application Flake HIRLAM



Statistical verification in December 2006







L. Rontu

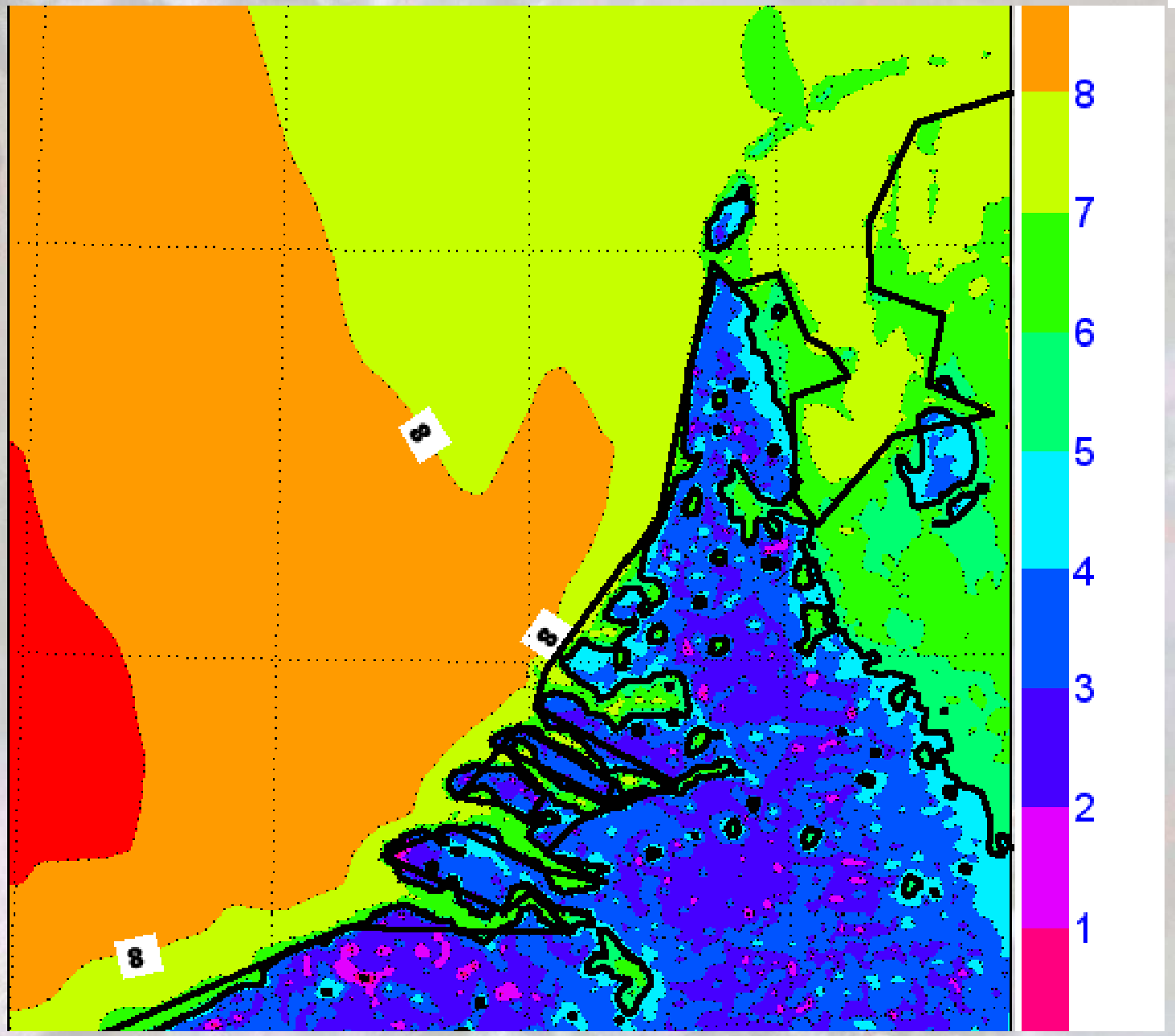
Remaining issues

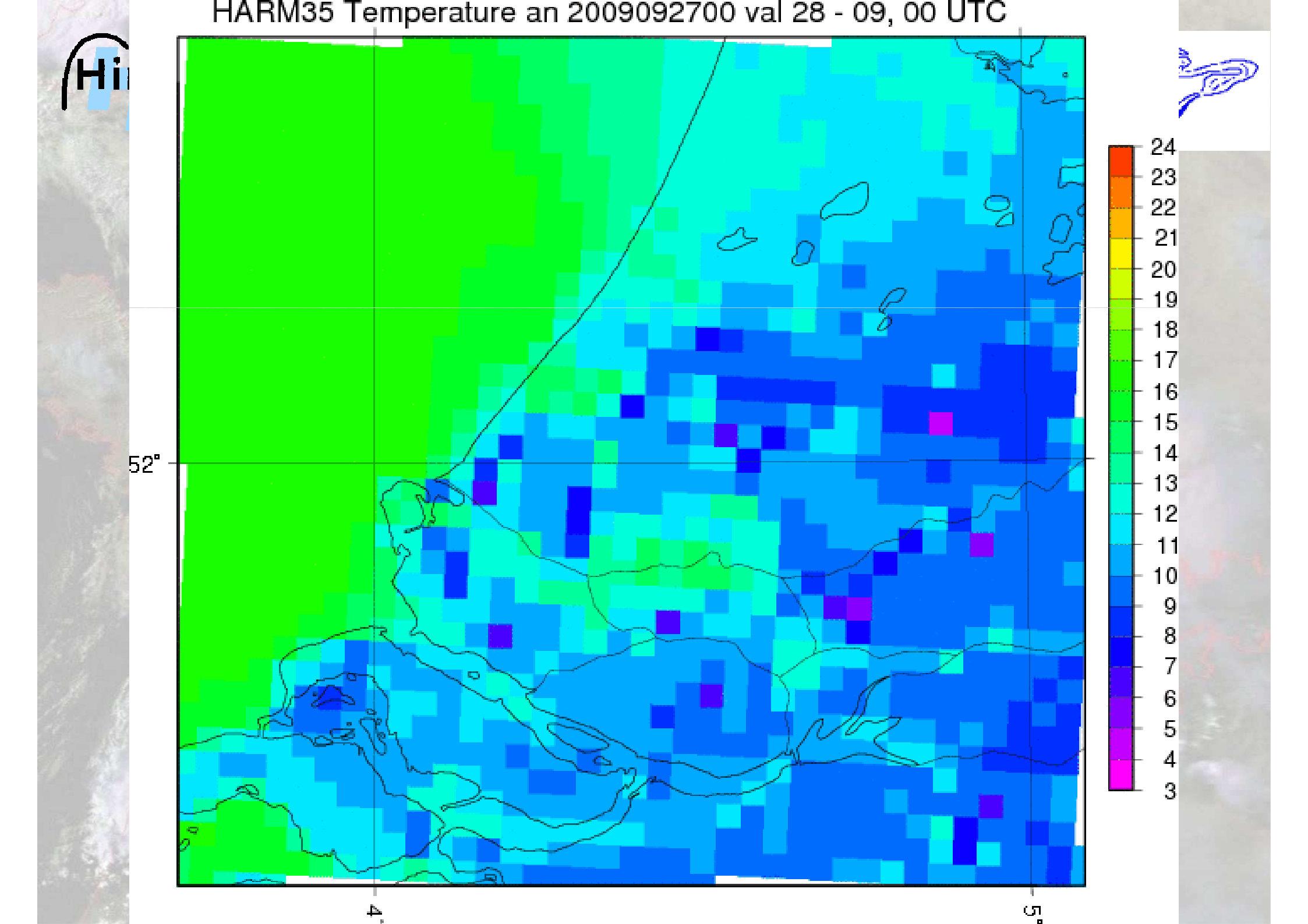
- Extension of database, search for funds
- Extension of FLake with snow on ice, for better ice cover period
- Extension to 2D, changing depth for large lakes. T and %ice depend strongly on depth.
- Flow of ice for large lakes
- Intercomparison of lake models (LakeMIP)
- Role of SRNWP in organization of workshop in ~1 year time

HARMONIE surface work

- Inclusion of forest scheme in SURFEX
- Check of physiography (Scn difference)
- Participation in Geoland project (assimilation with unscented KF)
- FMI/University of Helsinki NUMLAB course
- Testing and improving snow on lake ice for SURFEX
- Validating Town Energy Budget through use of observations in towns and at schools

Town effect in HARMONIE




HARM35 Temperature an 2009092700 val 28 - 09, 00 UTC
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Concluding remarks

- More and more difficult to improve model with improvements in surface alone
- Whole model has to be taken into account when tuning is done
- Forest, snow and FLake most important developments for HIRLAM

NILU work

- Assimilate Ts & Soil Moisture from MODIS & AMSR-E with EnKF into SURFEX, later also snow cover
- Code structure based on JFM work EKF
- Comparison of EnKF to EKF
- Evaluate obs with assimilation system
- Evaluate SURFEX with assim system
- Plans for assimilation of SMOS soil moisture data