HIRLAM physics overview (mainly surface)

Sander Tijm

HIRLAM surface developments

- Overview of HIRLAM physics work
- Relevance of surface scheme work
- Current work
- Surface scheme examples

HIRLAM physics developments

- HIRLAM physics determines the ‘local’ weather in model
- Developments on:
  - Surface
  - Convection and condensation
  - Radiation
  - Turbulence
- In mesoscale model (HARMONIE) as well as synoptic scale model (HIRLAM)

HIRLAM surface developments

- Surface scheme provides fluxes of moisture, heat and momentum to atmosphere
- Important for:
  - Local weather
  - Mesoscale circulations
  - Development of boundary layer
  - Development of convection
  - Stable boundary layer development, especially very sensitive for long lived stable PBL (Nordic winter)

Importance T_{water}

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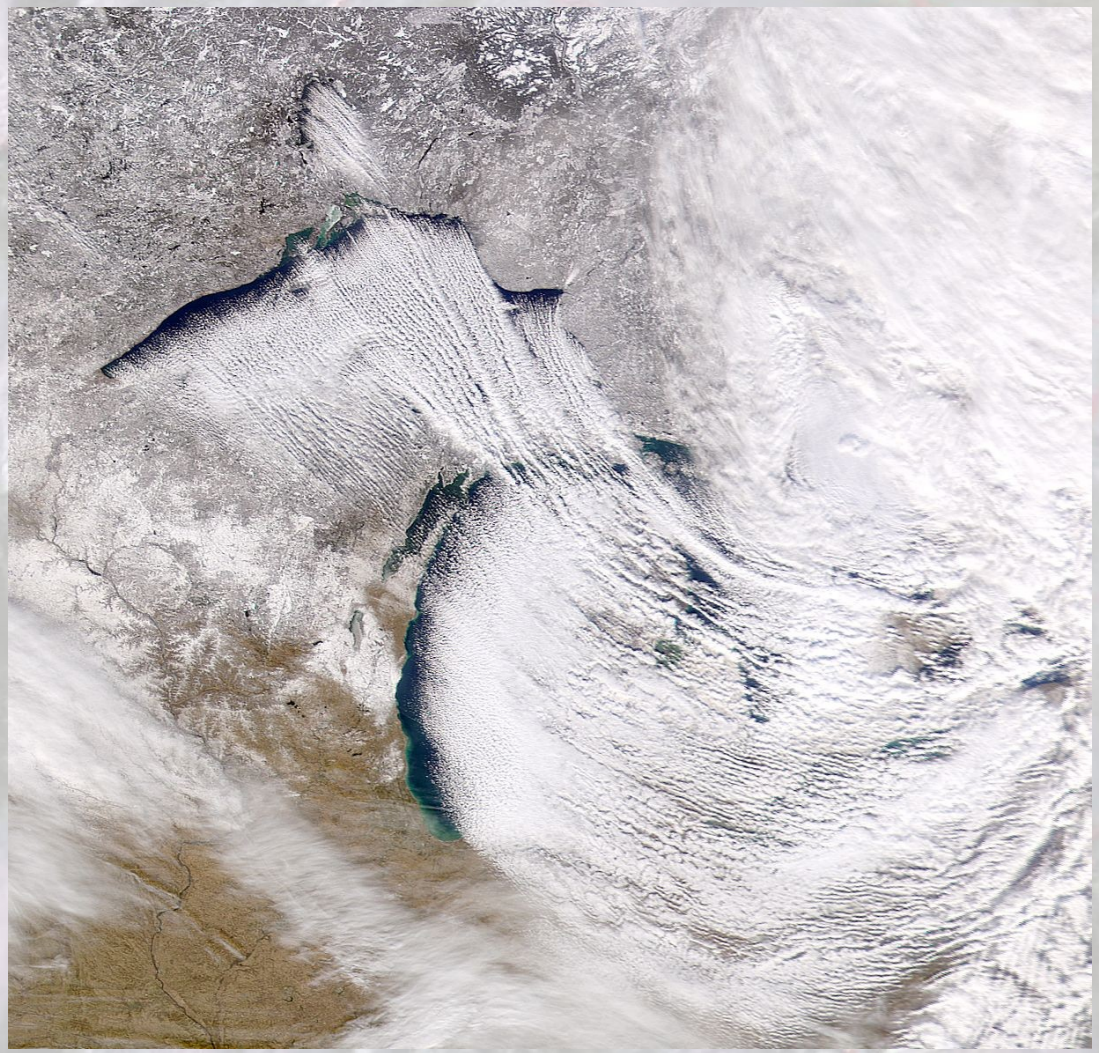


HIRLAM surface scheme work

- Developments and problem solving for new surface scheme (new: snow scheme and forest scheme)
- Inclusion of lake scheme Flake (see talks of Samuelsson; Rontu, Eerola and Kourzeneva)
- Snow on ice parameterization (insulating effect of snow)
- MSO/SSO

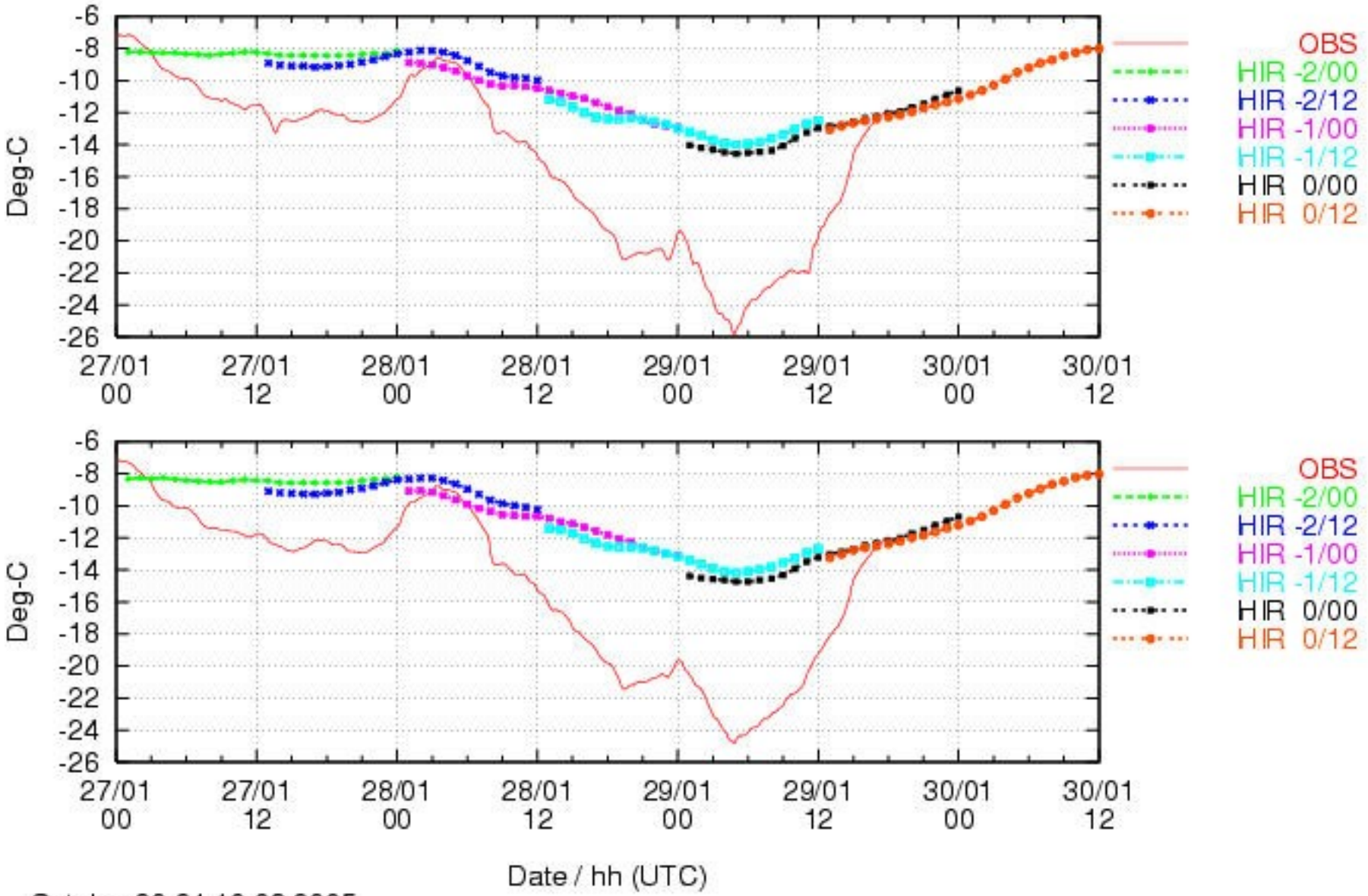
HIRLAM surface scheme work

- Contribution to SURFEX development
  - Advice on the inclusion of Flake in SURFEX
  - Checking on SURFEX behaviour in HIRLAM countries, coupling to HIRLAM surface scheme
  - Inclusion of forest scheme in SURFEX
  - Study of roughness use in SURFEX/HARMONIE

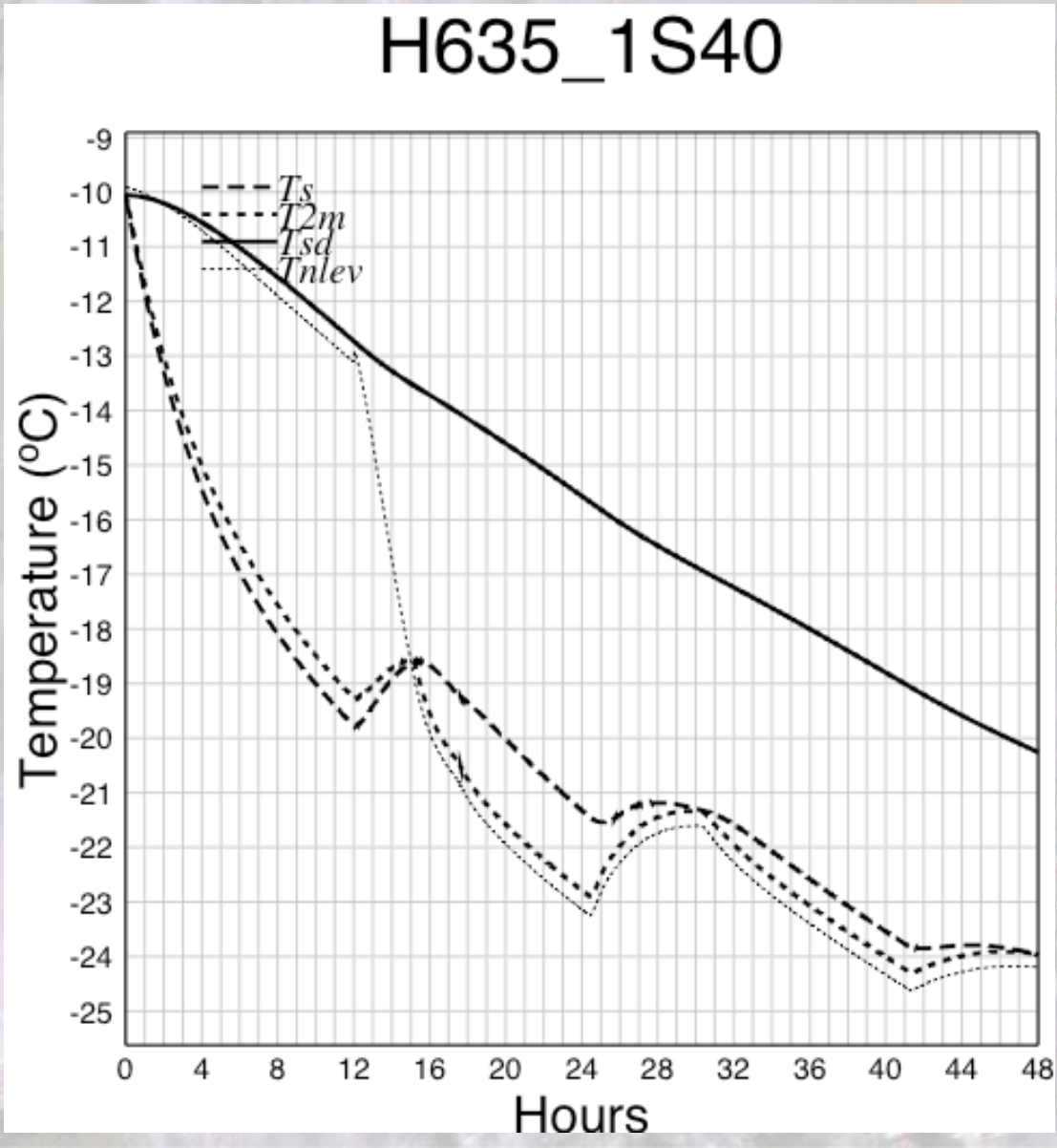
Impact of surface scheme

- New surface scheme: why?
- Problems in winter and spring in Nordic countries:
  - Too high surface temperatures due to absence of good snow scheme (too large heat fluxes from surface to atmosphere in cold conditions)
  - Too low temperatures in forest regions (almost all of Nordic countries) in Spring due to too strong coupling of atmosphere to snow on forest floor
- Work of Gollvik, Samuelsson

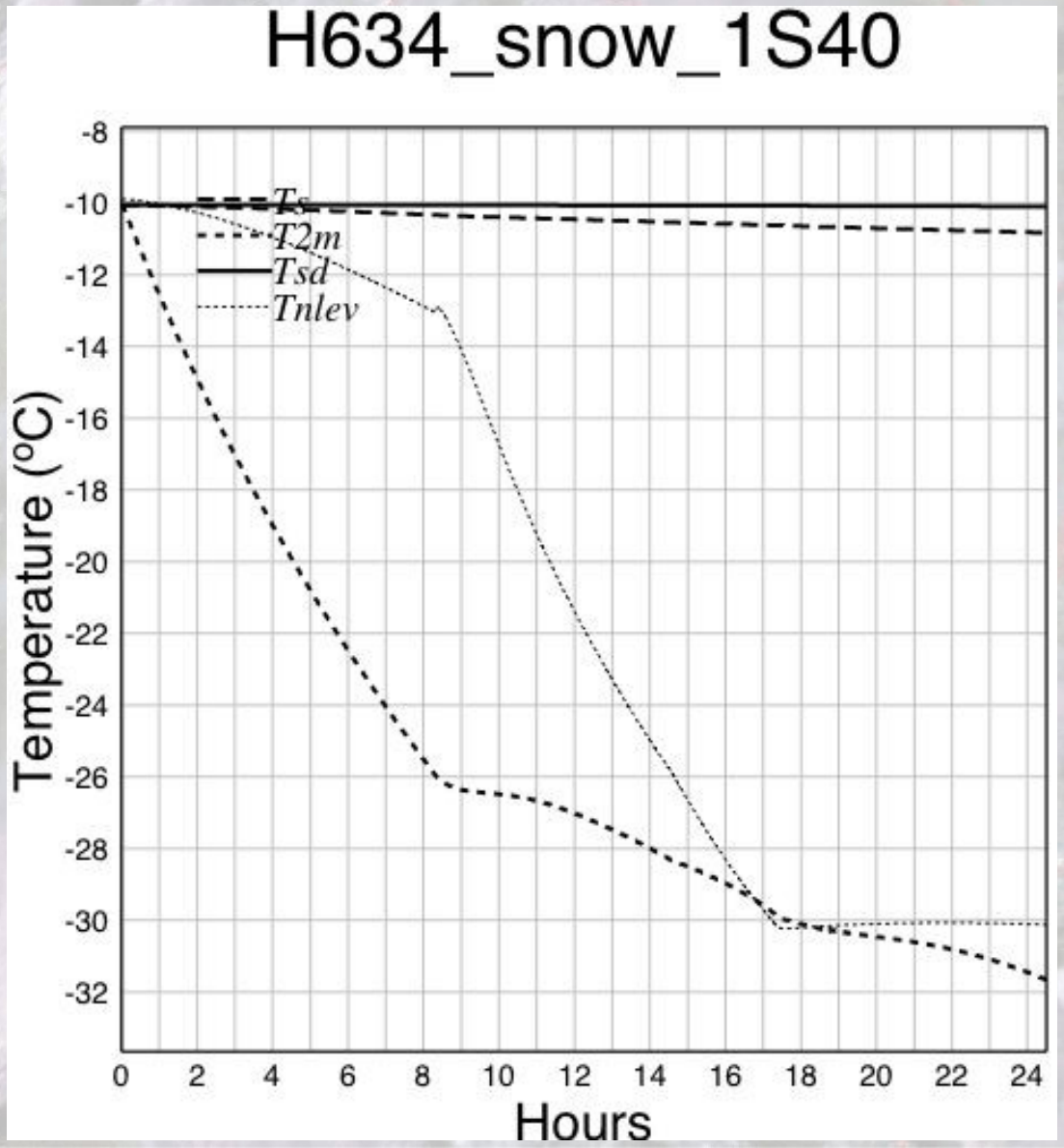
Nordic winter problem



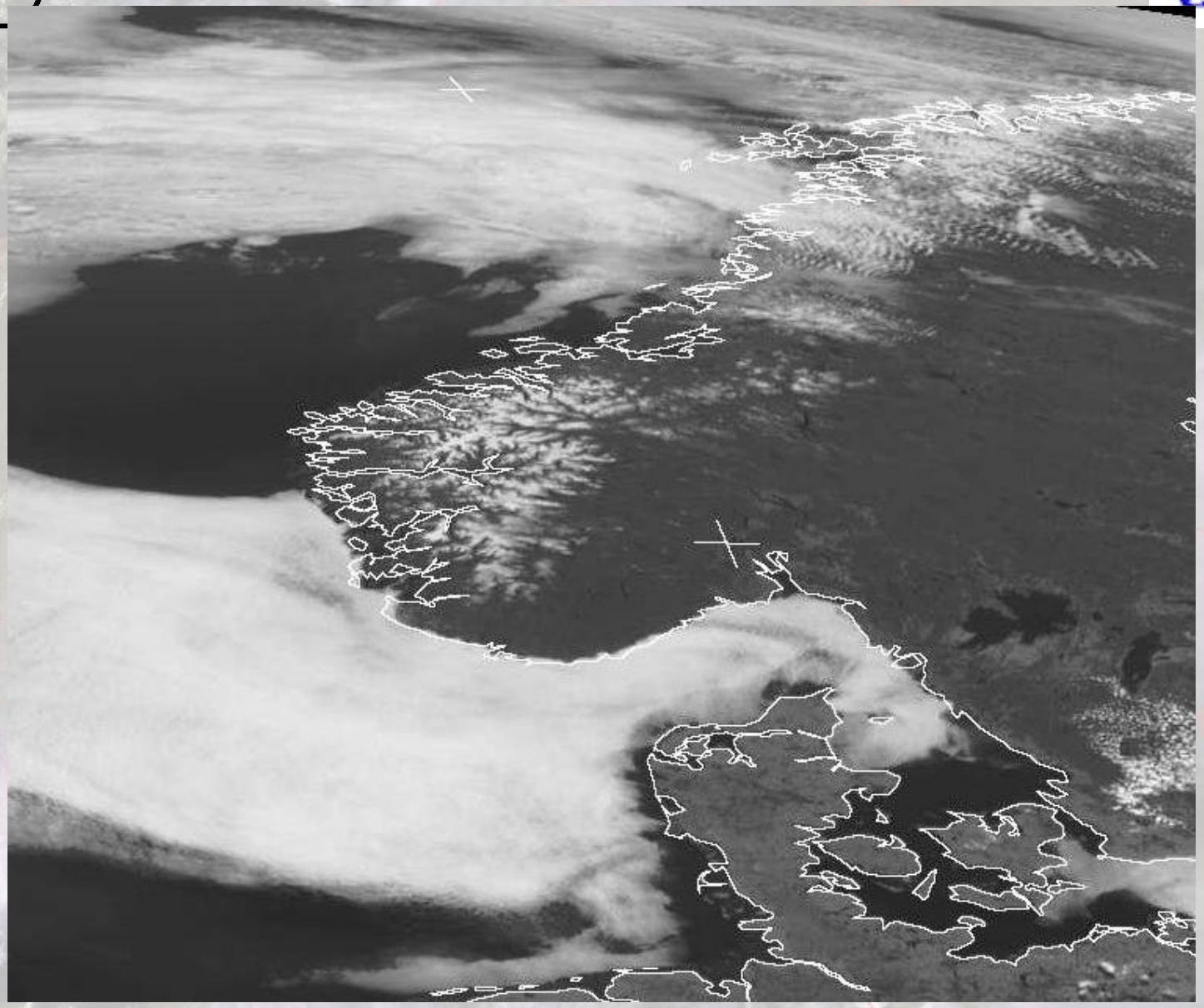
Nordic winter problem, 1D 6.3.5a



Nordic winter problem, 1D 6.3.4s

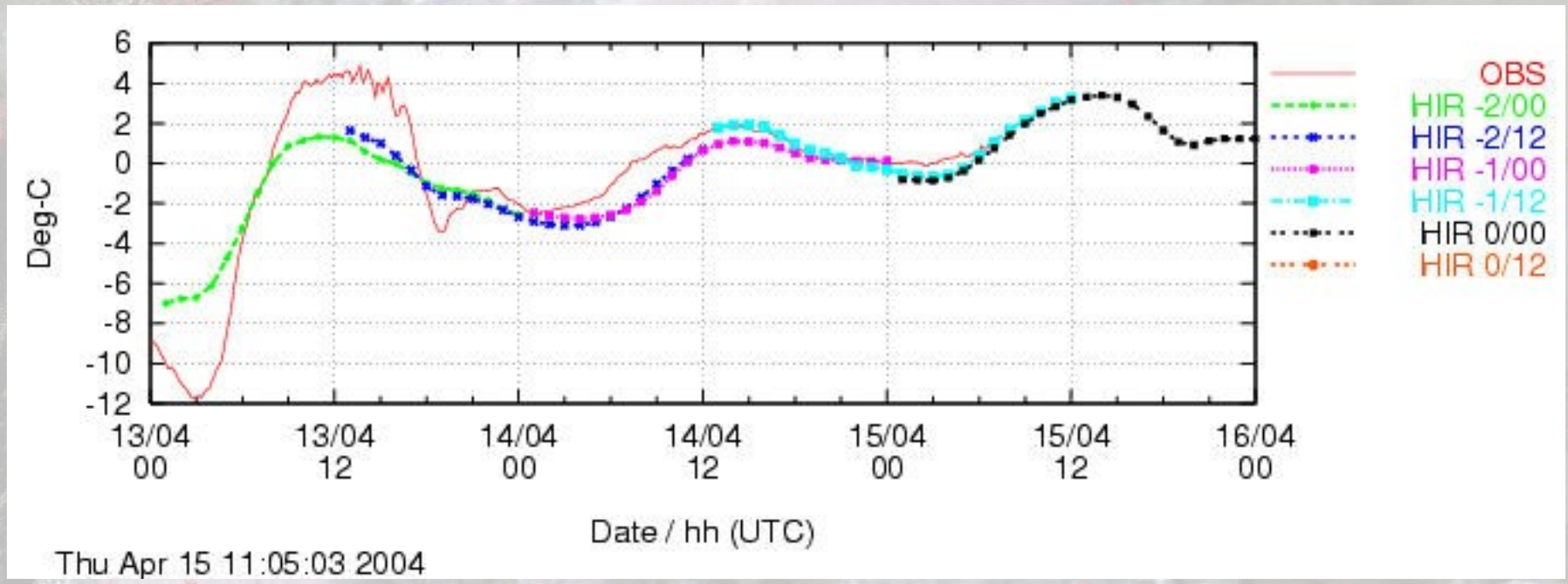


Snow scheme

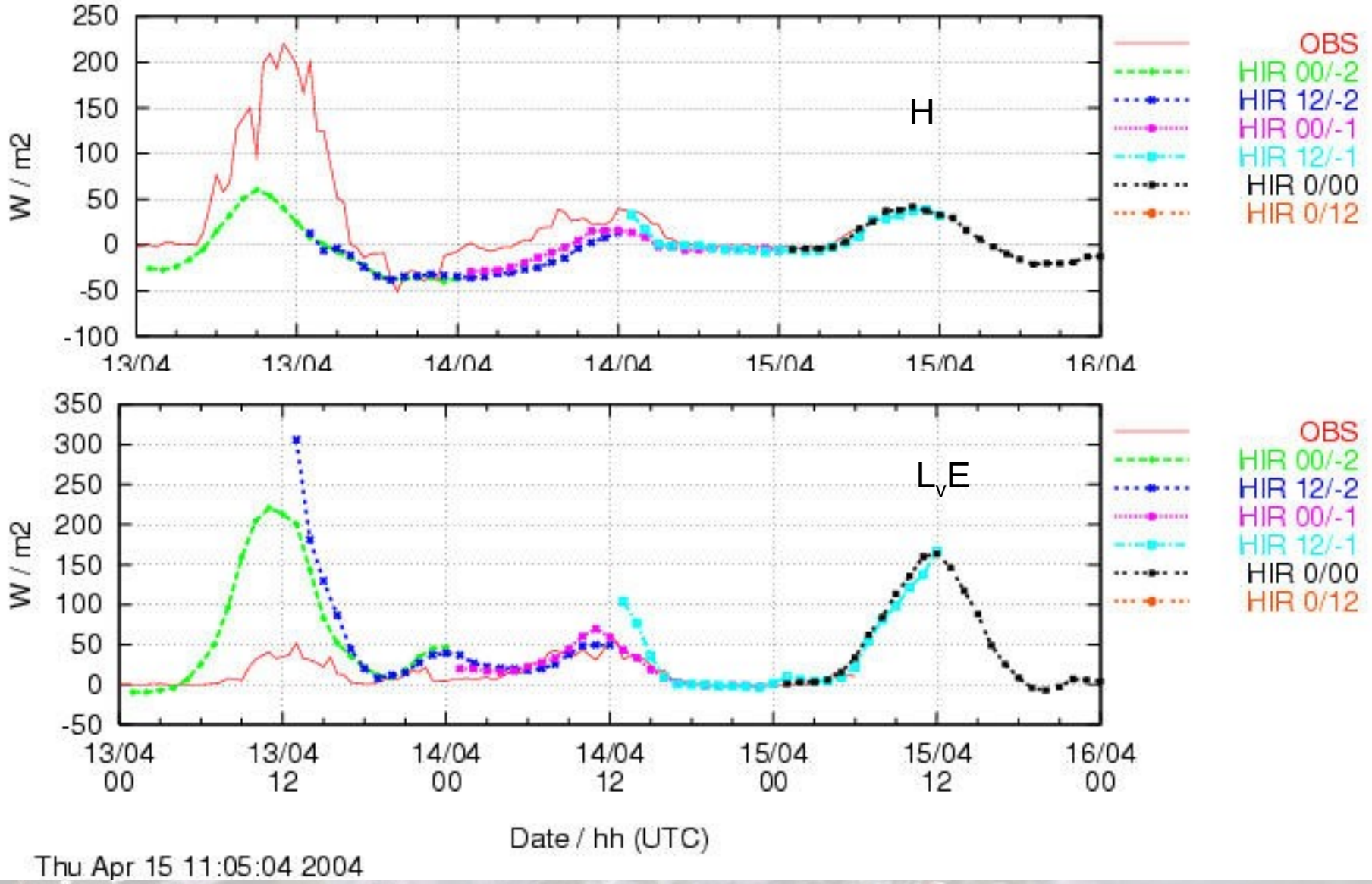


Spring problem

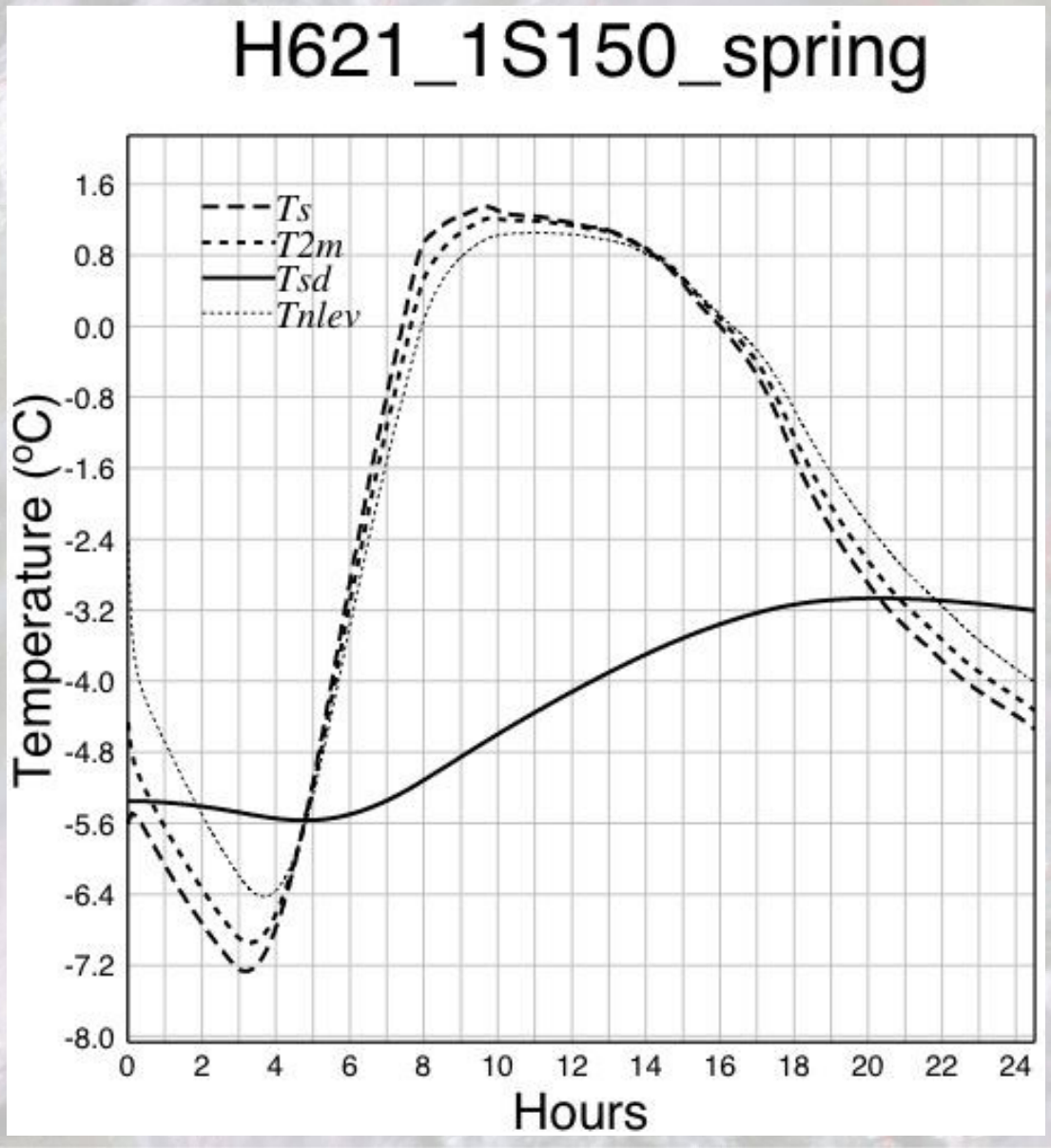
- Daily cycle wrong, min T too high, max T too low, fluxes wrong.



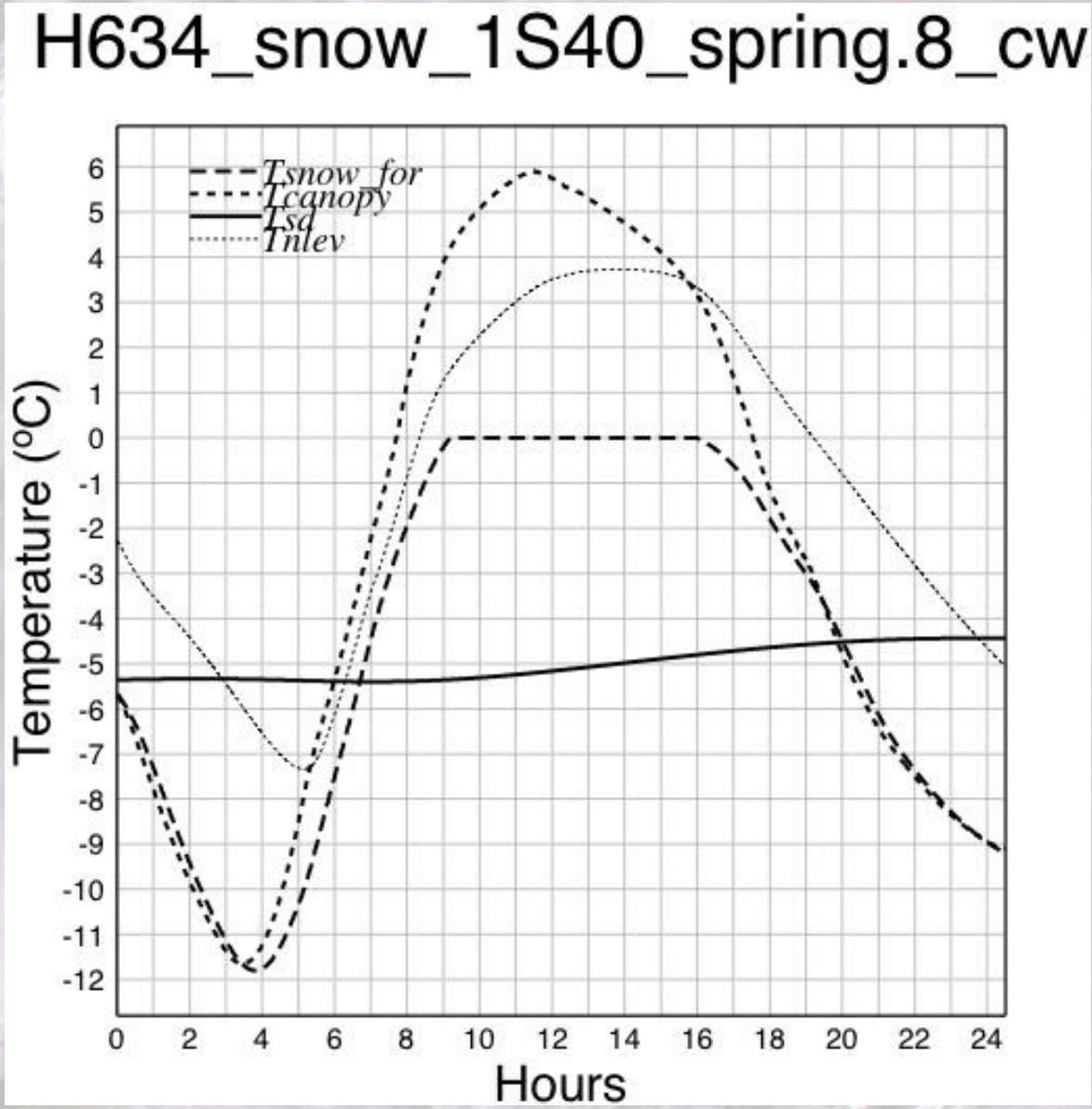
Spring problem



Spring problem (6.2.1)



Spring no problem! (6.3.4snow)

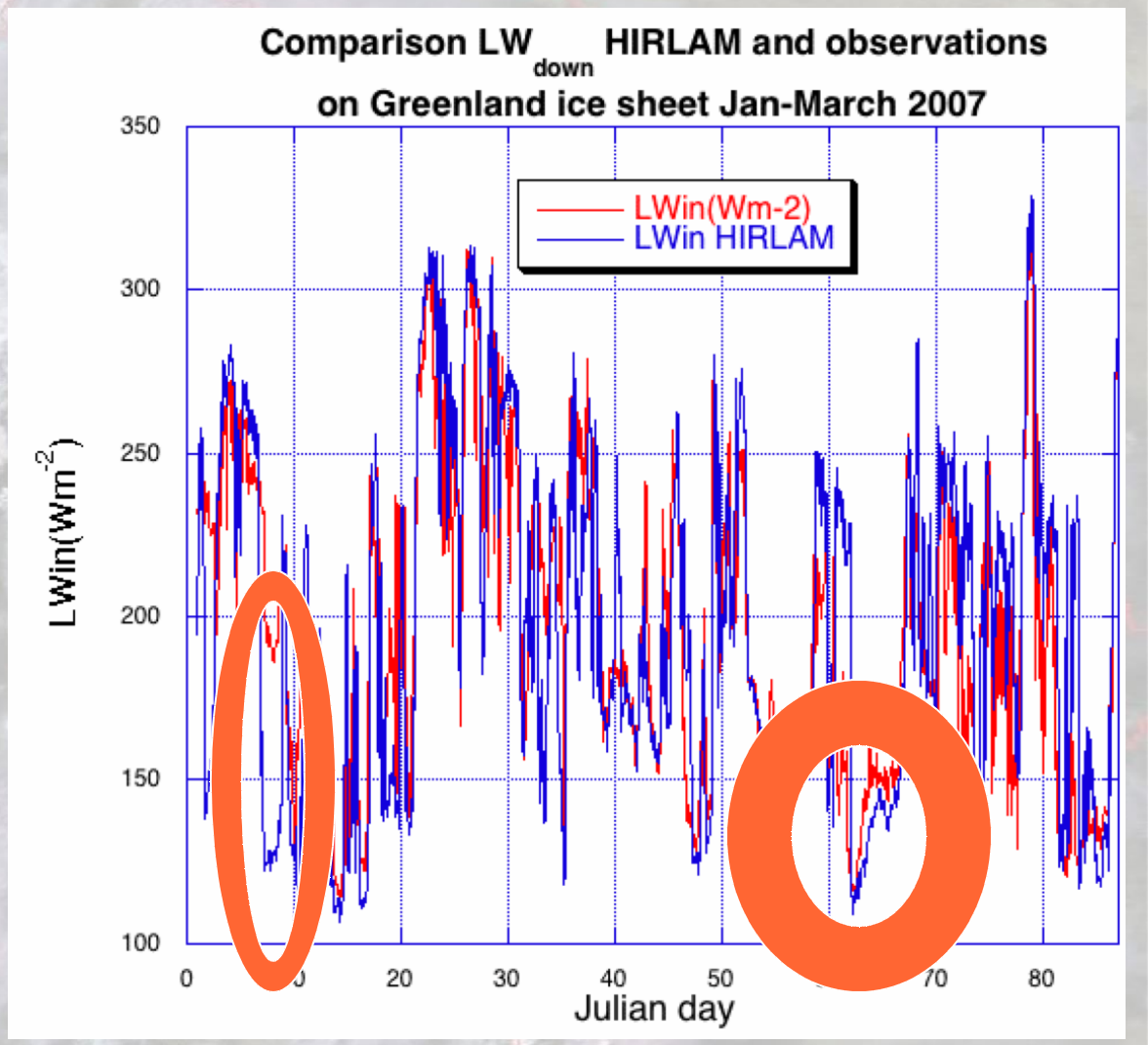


Greenland problems

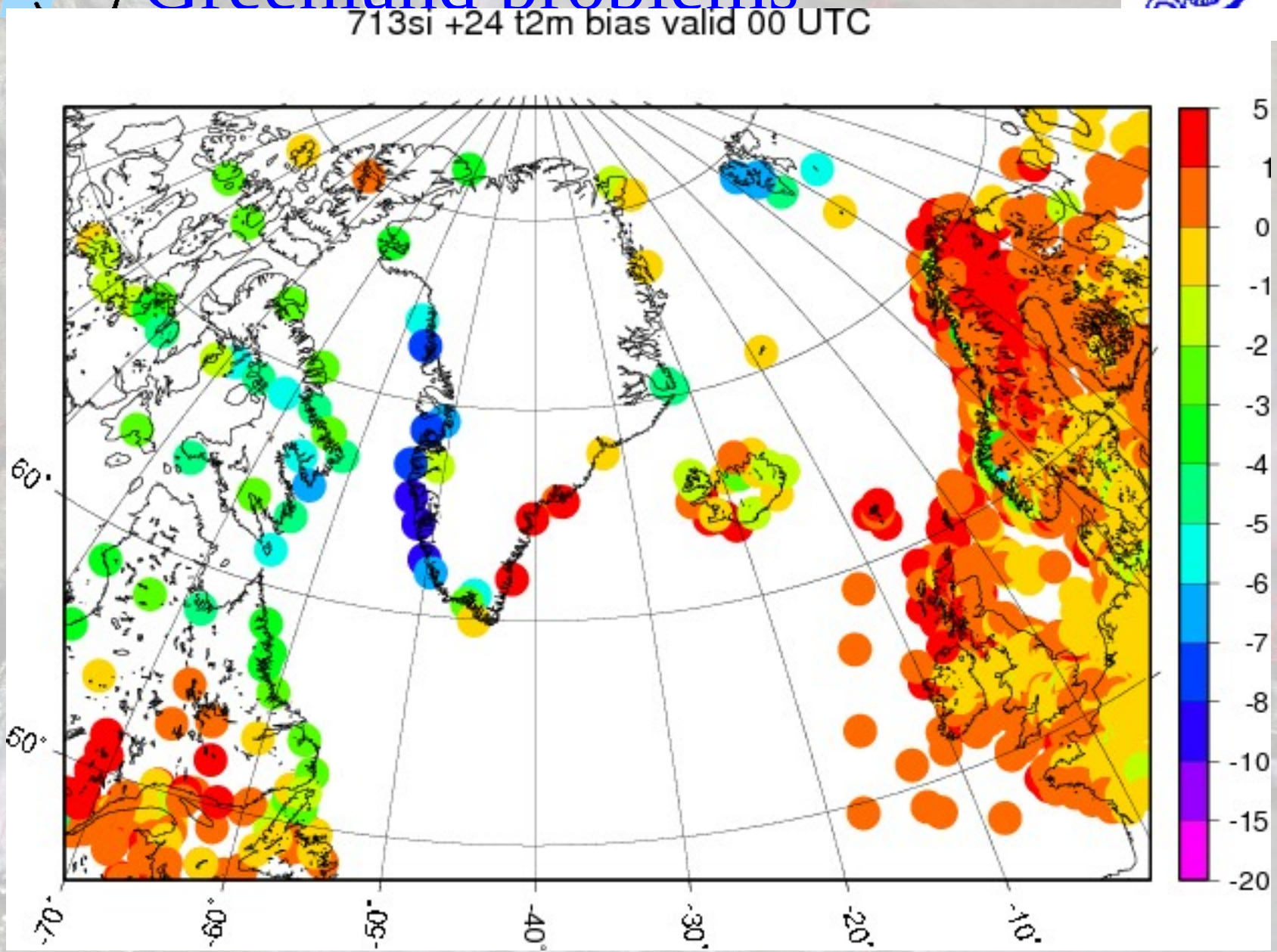
- Negative T2m bias over land that is very large in Greenland winter
- 4 main causes:
  - LW radiation forcing from atmosphere
  - No heat conduction through sea ice, too cold surroundings and advected air
  - No coupling to climate
  - Too strong coupling of T2m to surface? Translation of T_{nlev} to T2m not taking enough factors into account. Especially problem in long lived stable PBL.

Greenland problems

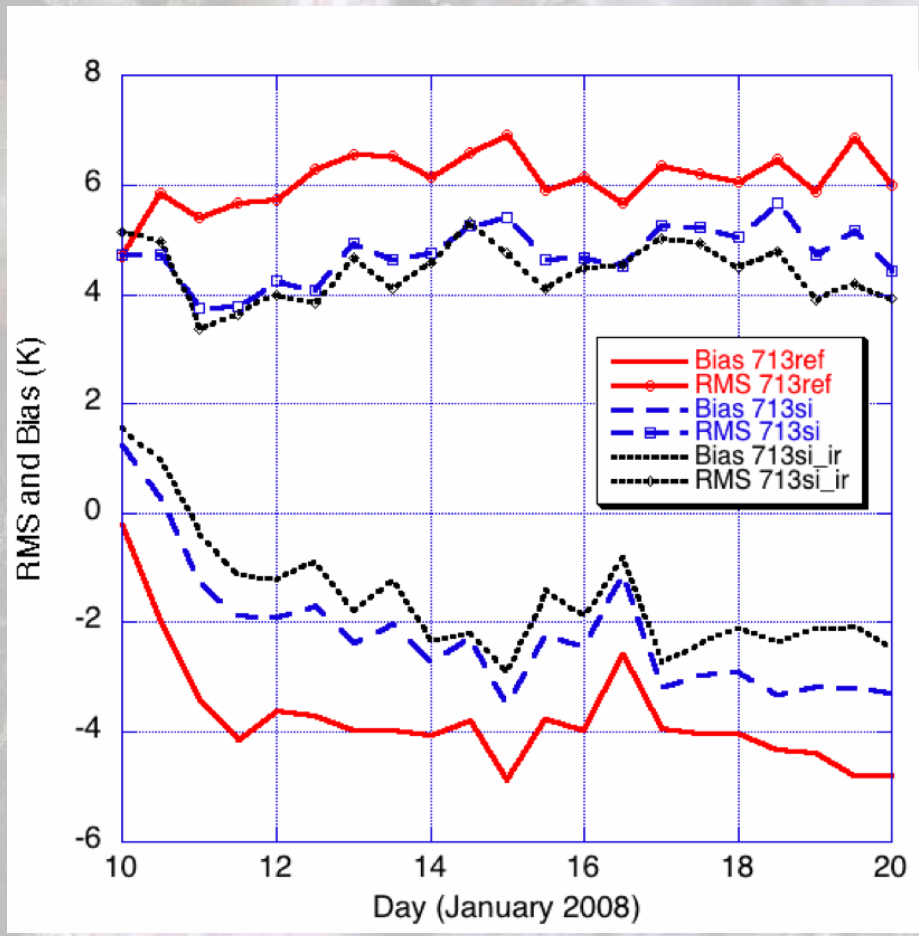
- LW energy input into surface may be part of problem

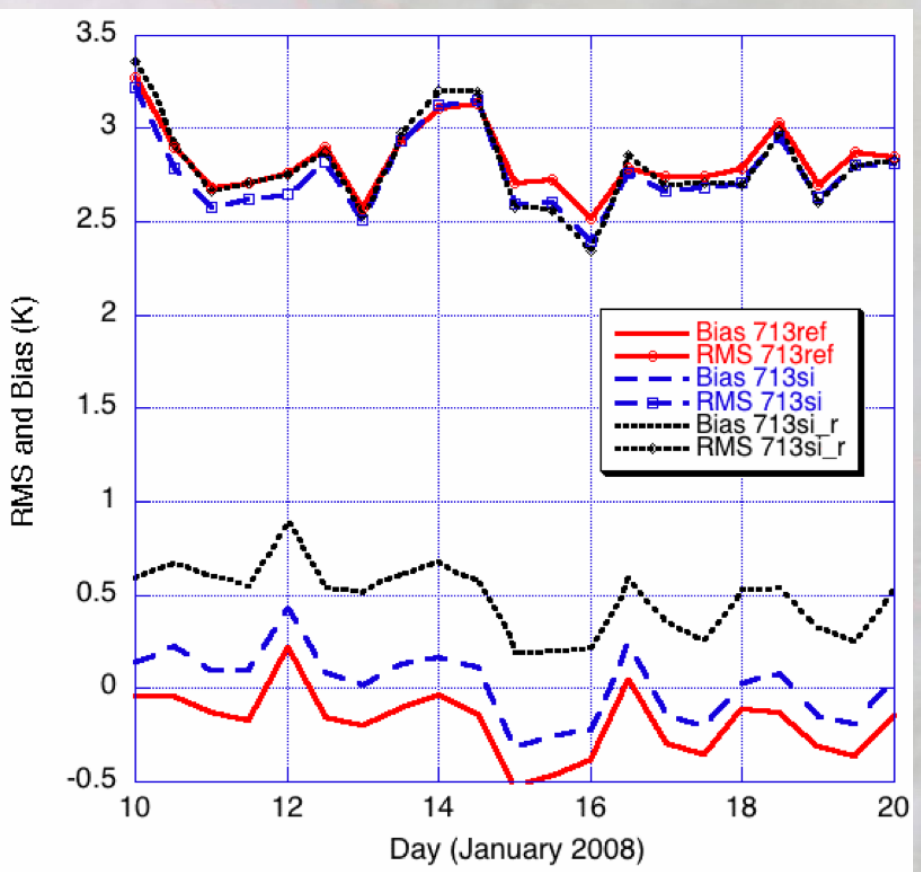


Greenland problems



Greenland problems





Conclusions

- Problem with surface temperature not always problem of surface scheme
- All schemes interacting are important in determining behaviour of complete model as well as parts of it
- Changes in one scheme often have to be accompanied by retuning of other schemes to improve complete model, due to strong tuning of entire model.
- Integral approach necessary!