



# Representativeness issues in Verification practices

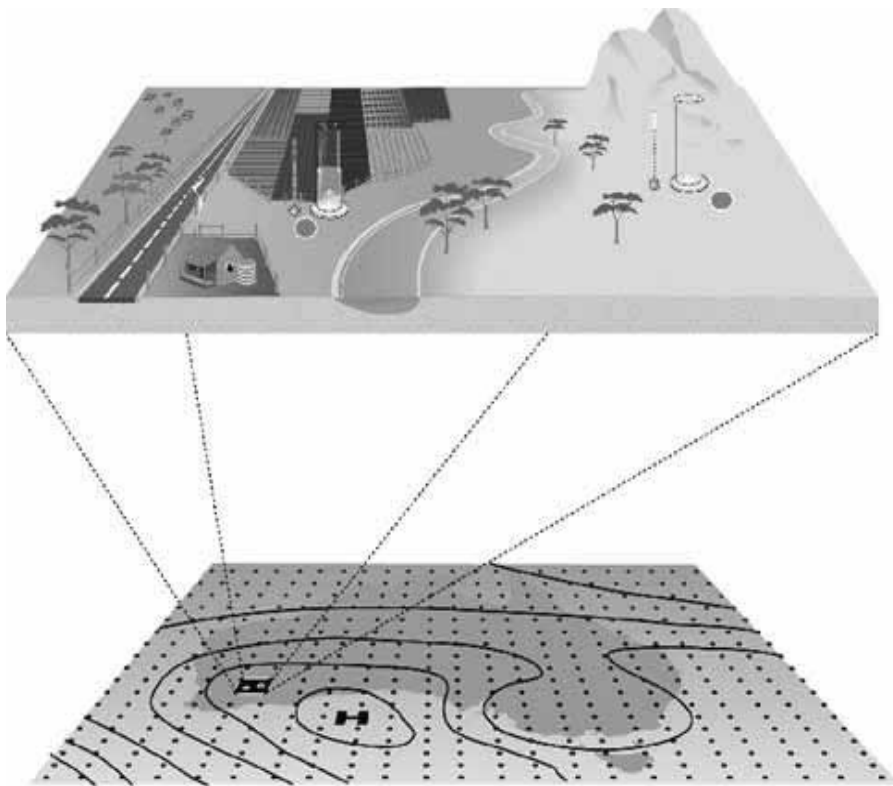
**Barbara Casati**, François Lemay, Nelson Shum,  
Thomas Haiden, Morten Koltzow

Talk Outline :

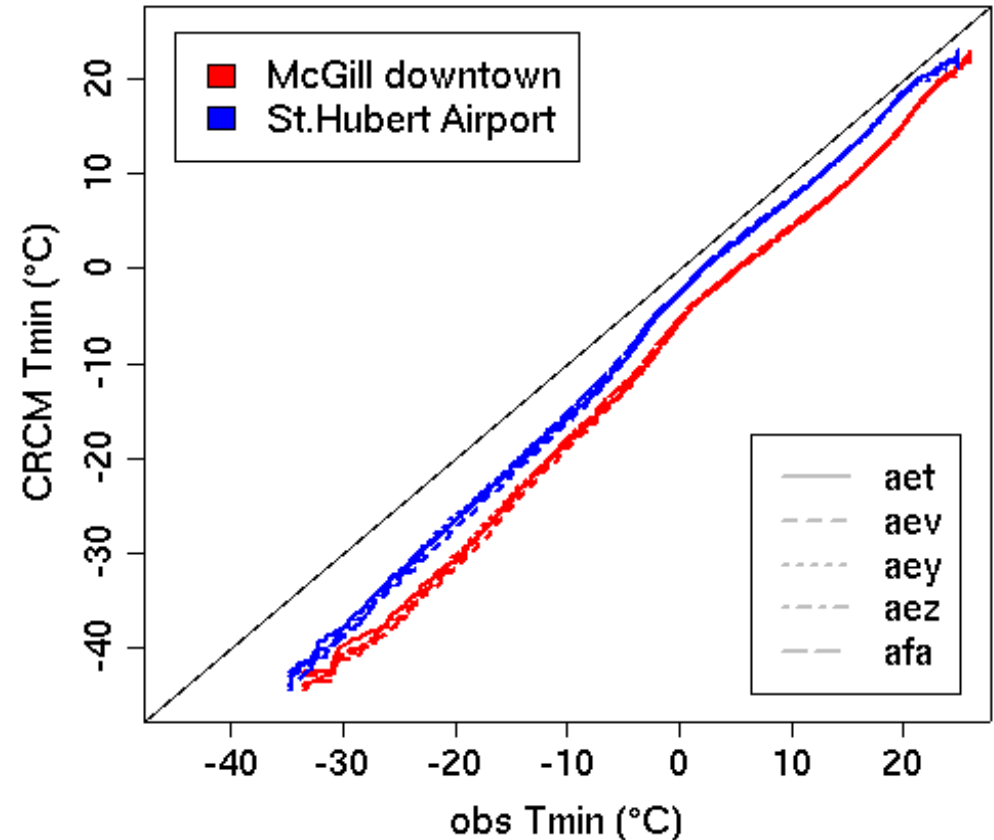
- Model tile versus station elevation
- Land versus ocean tile component

# Sub-tile representativeness

NWP systems cannot resolve explicitly sub-grid phenomena due to local effects or characterized by a sub-grid scale (e.g. convective precip): the model resolution is a limiting factor.



Montreal, CRCM gpt (142,108)  
stations 7025280 and 7027320

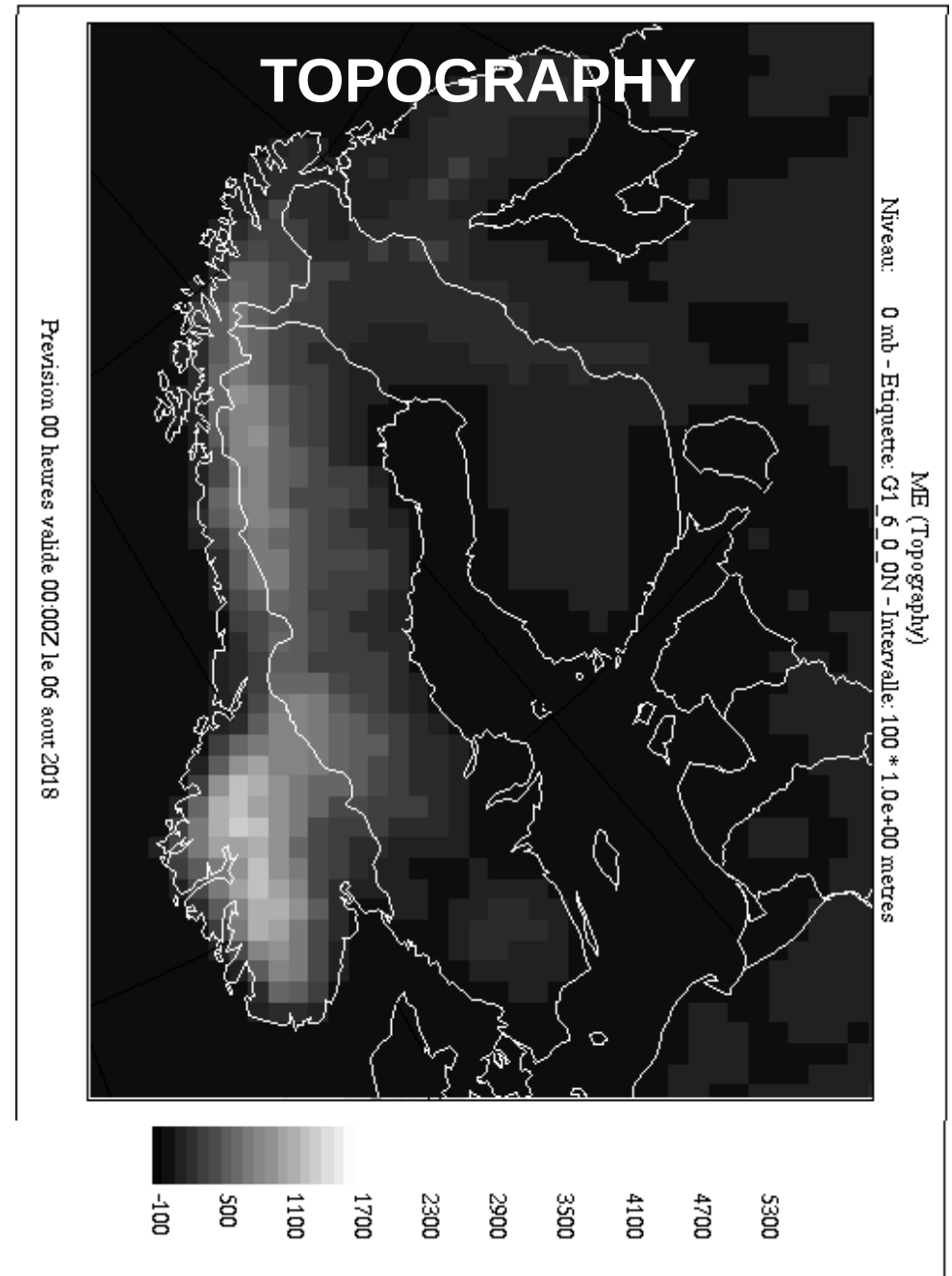


There is a scale mis-matching between the value observed at the station “point location” and the tile-aggregated value provided by the model: they “represent” two different quantities

# 1. Model tile versus station elevation

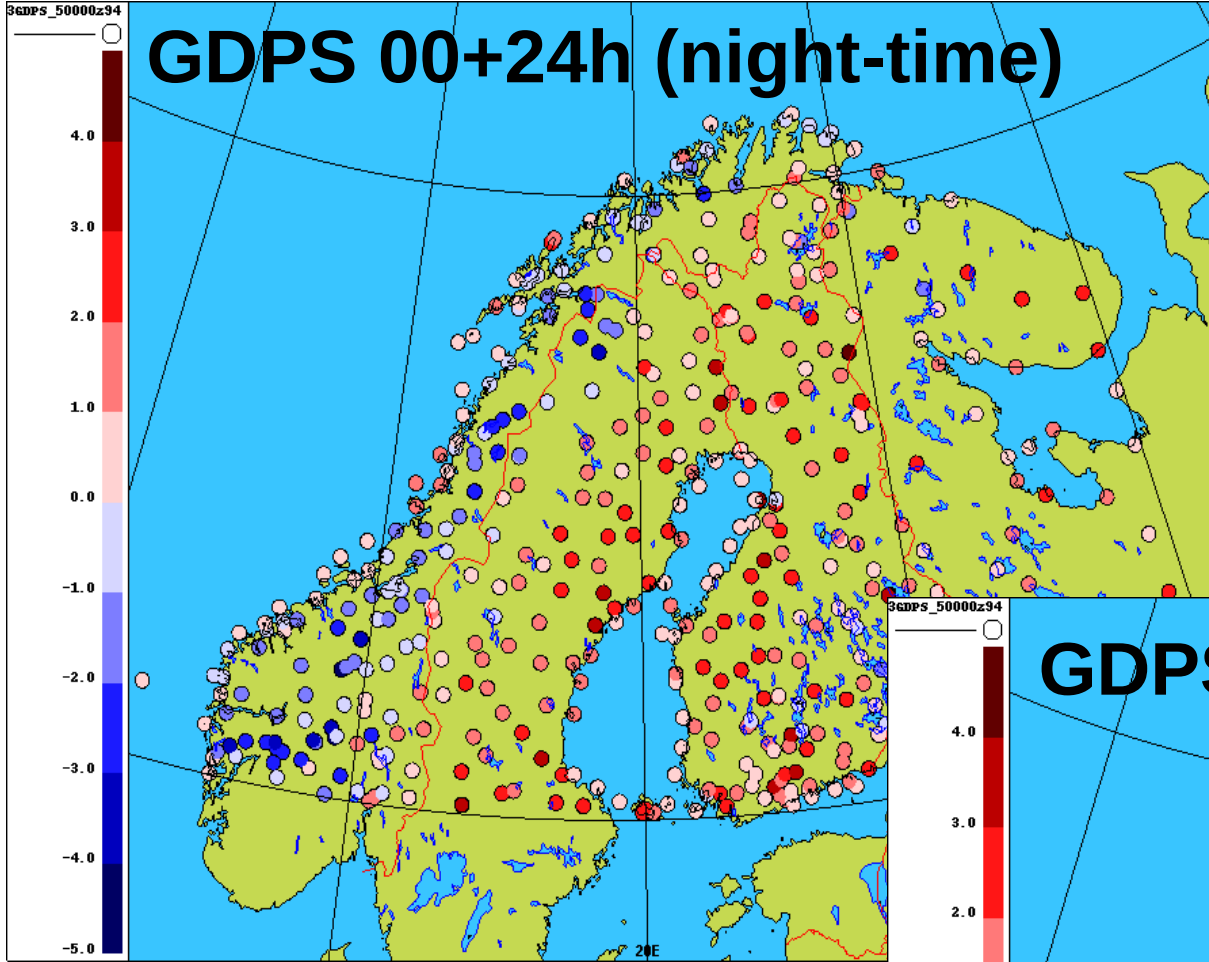
Gridded models cannot always fully resolve the complex topography associated to complex mountain terrain. Model tiles often result at a higher elevation than stations, which are usually located in the valley.

Temperature in a standard atmosphere decrease with altitude with a lapse-rate  $\sim 0.0065 \text{ C / m}$ . Model temperature is then adjusted to station elevation by applying this lapse-rate adjustment (WMO manual 485).

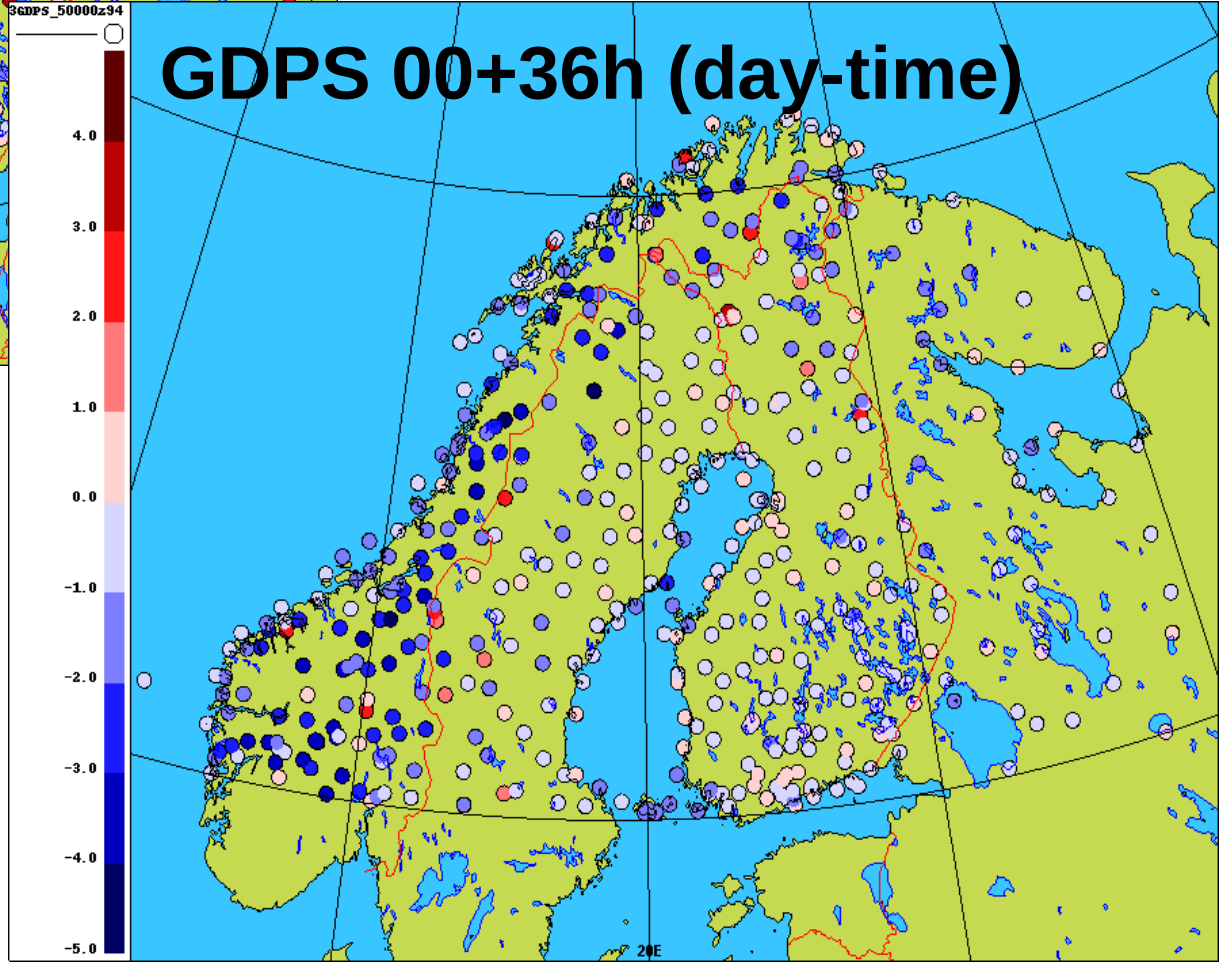


# GDPS 00+24h (night-time)

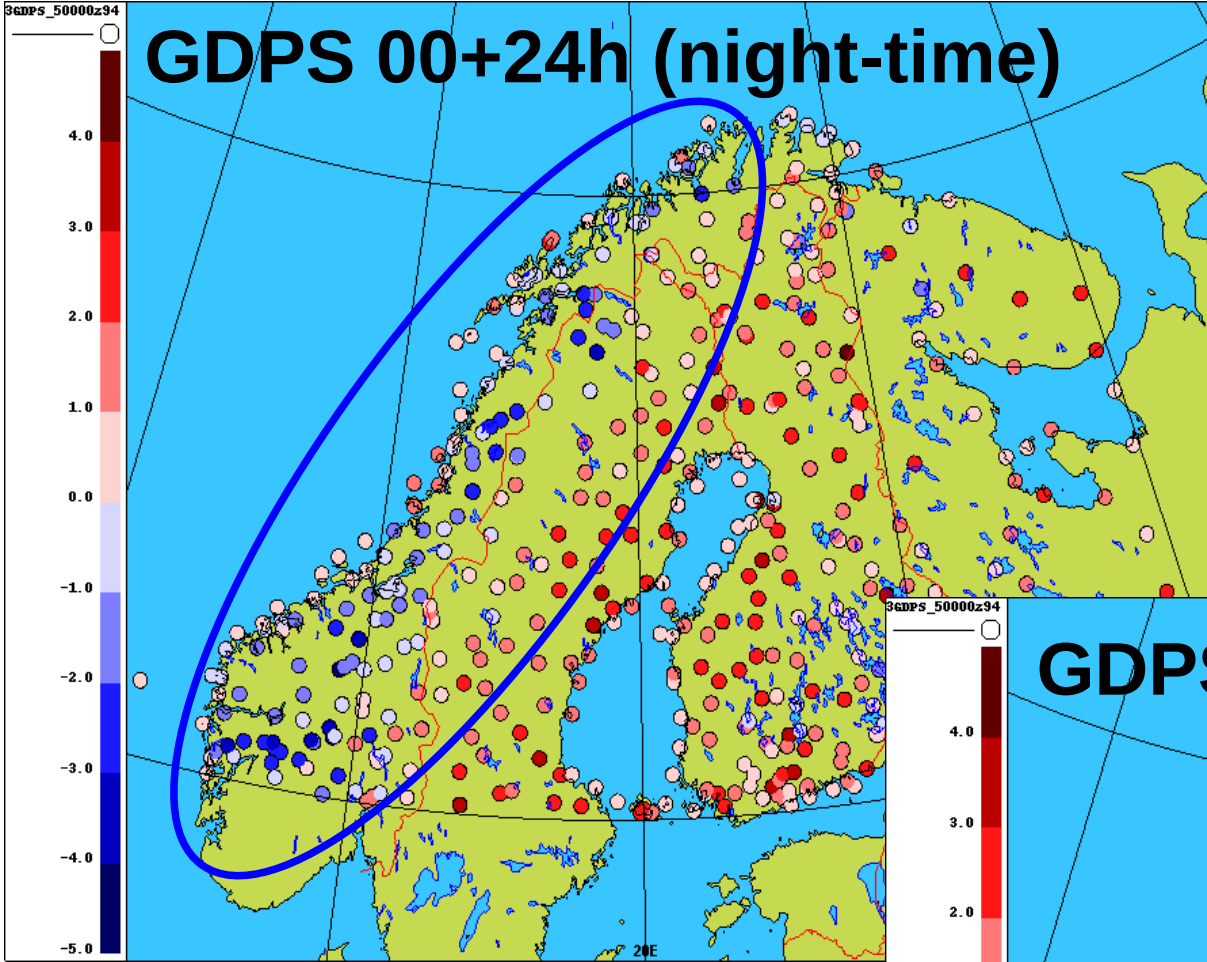
**Surface  
Temperature Bias,  
Fennoscandia,  
summer SOP**



# GDPS 00+36h (day-time)

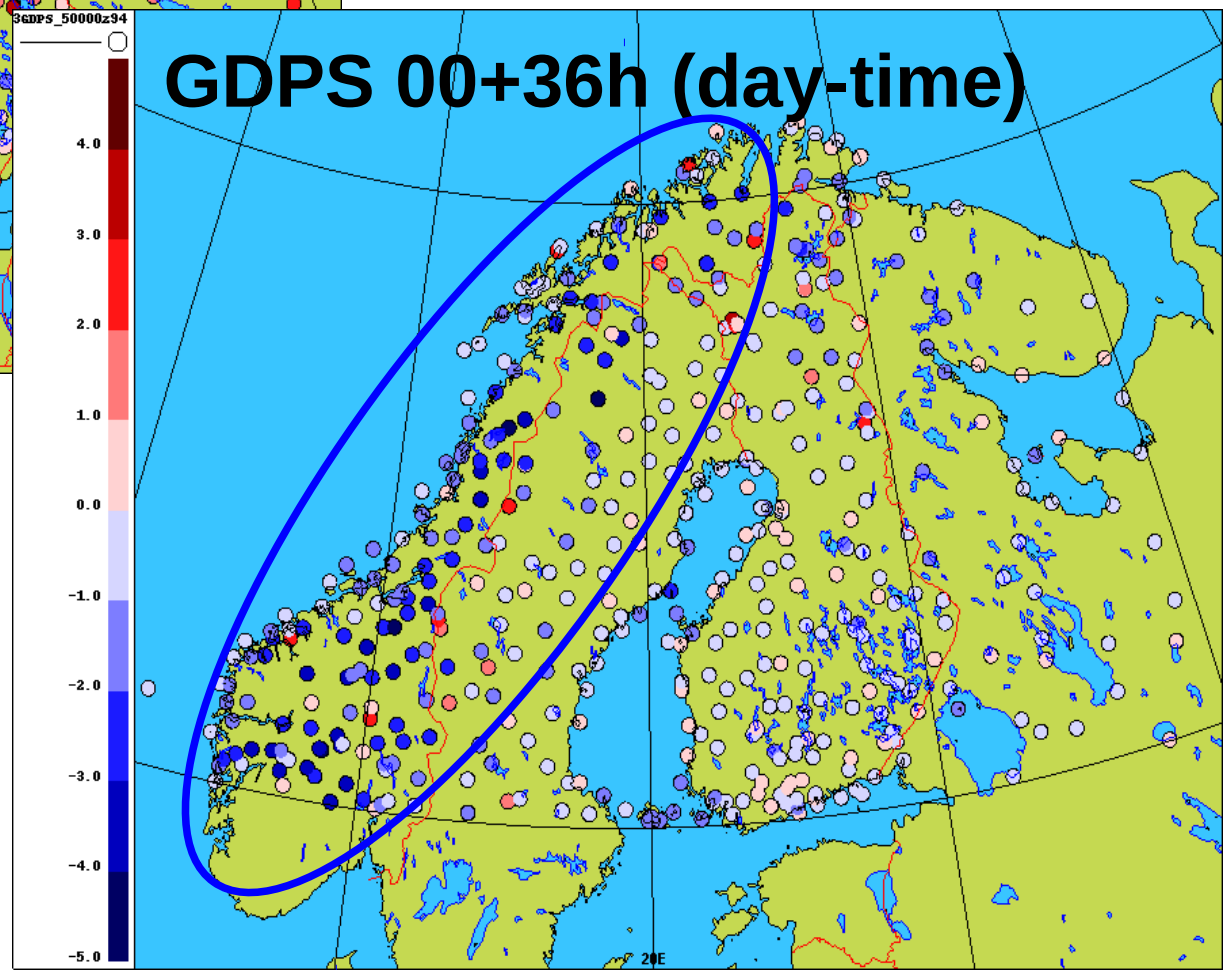


# GDPS 00+24h (night-time)



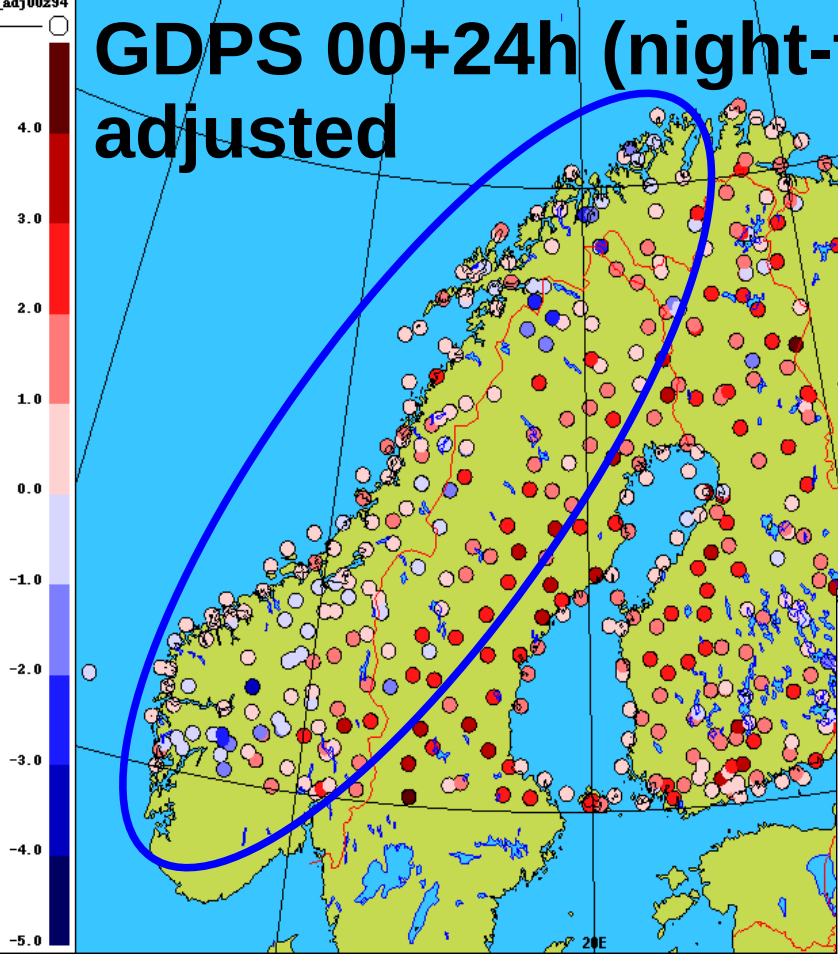
**Surface  
Temperature Bias,  
Fennoscandia,  
summer SOP**

# GDPS 00+36h (day-time)

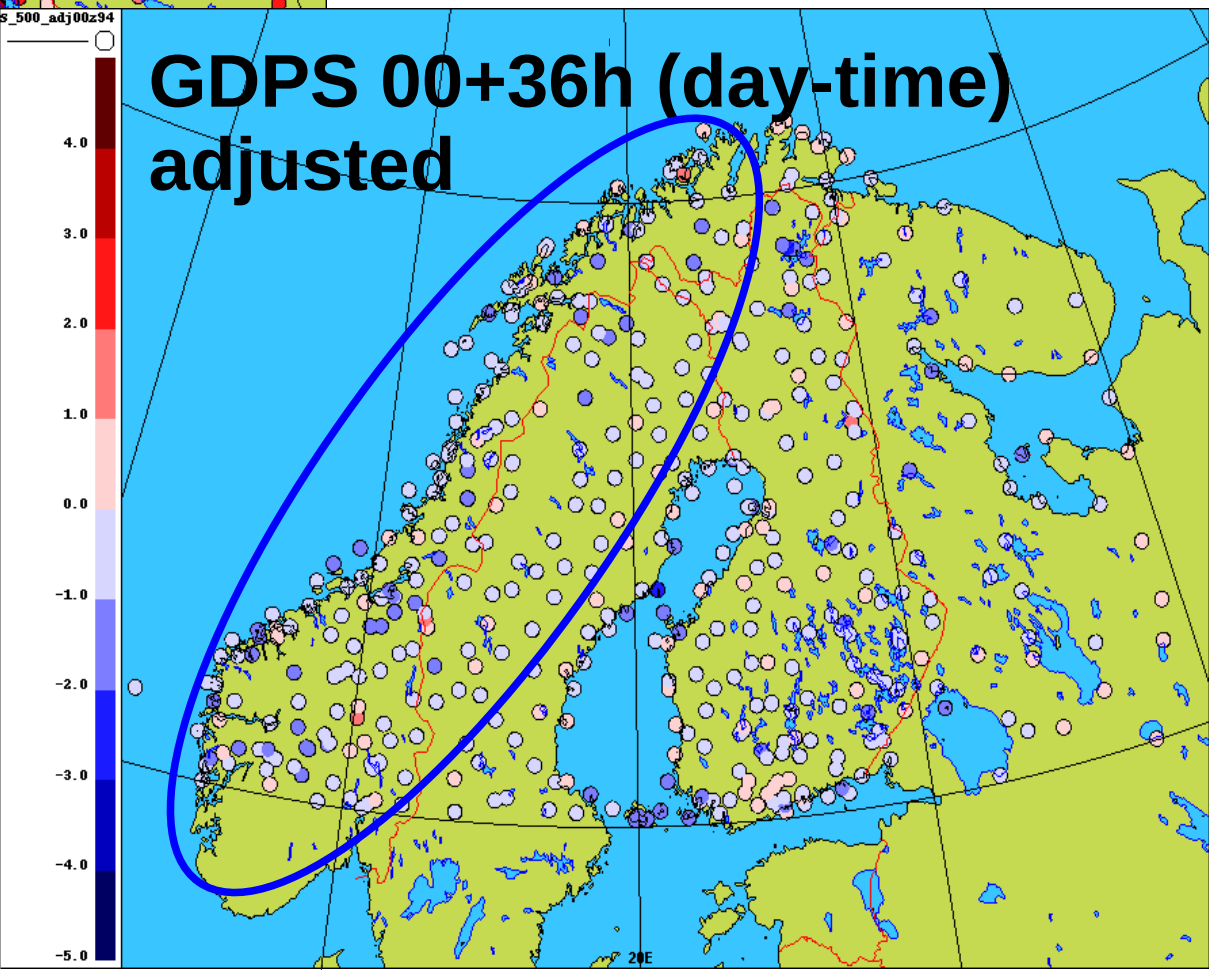


# Surface Temperature Bias, Fennoscandia, summer SOP

## GDPS 00+24h (night-time) adjusted

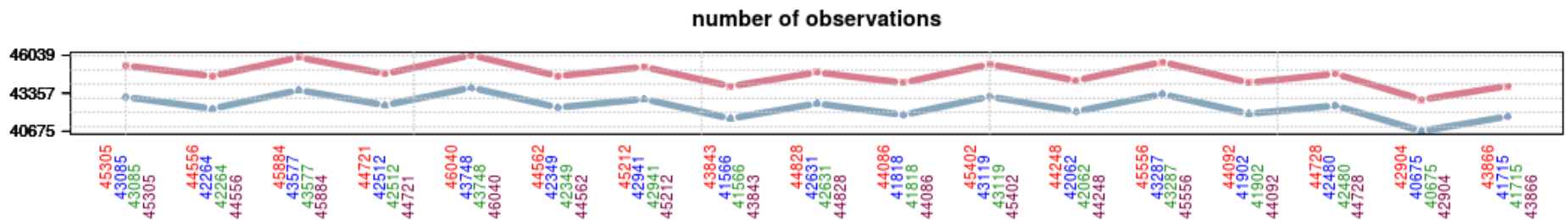
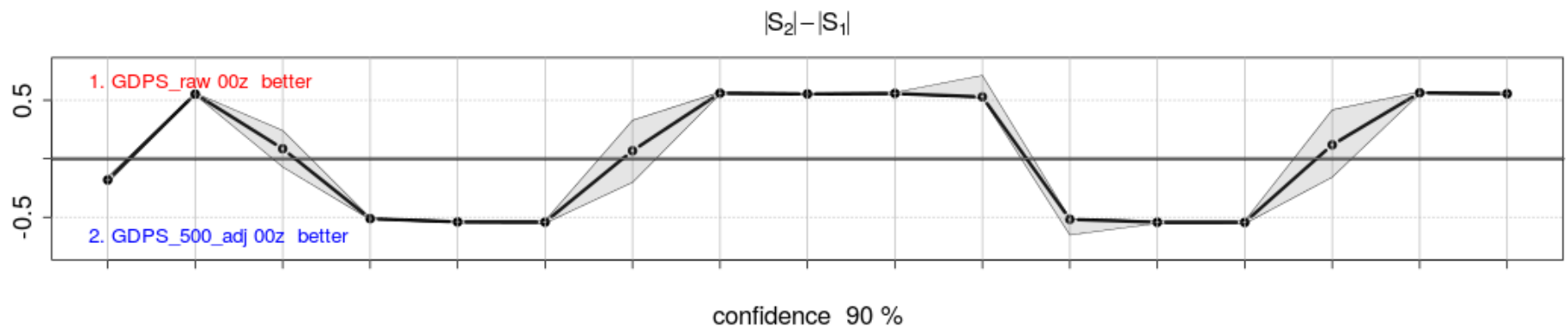
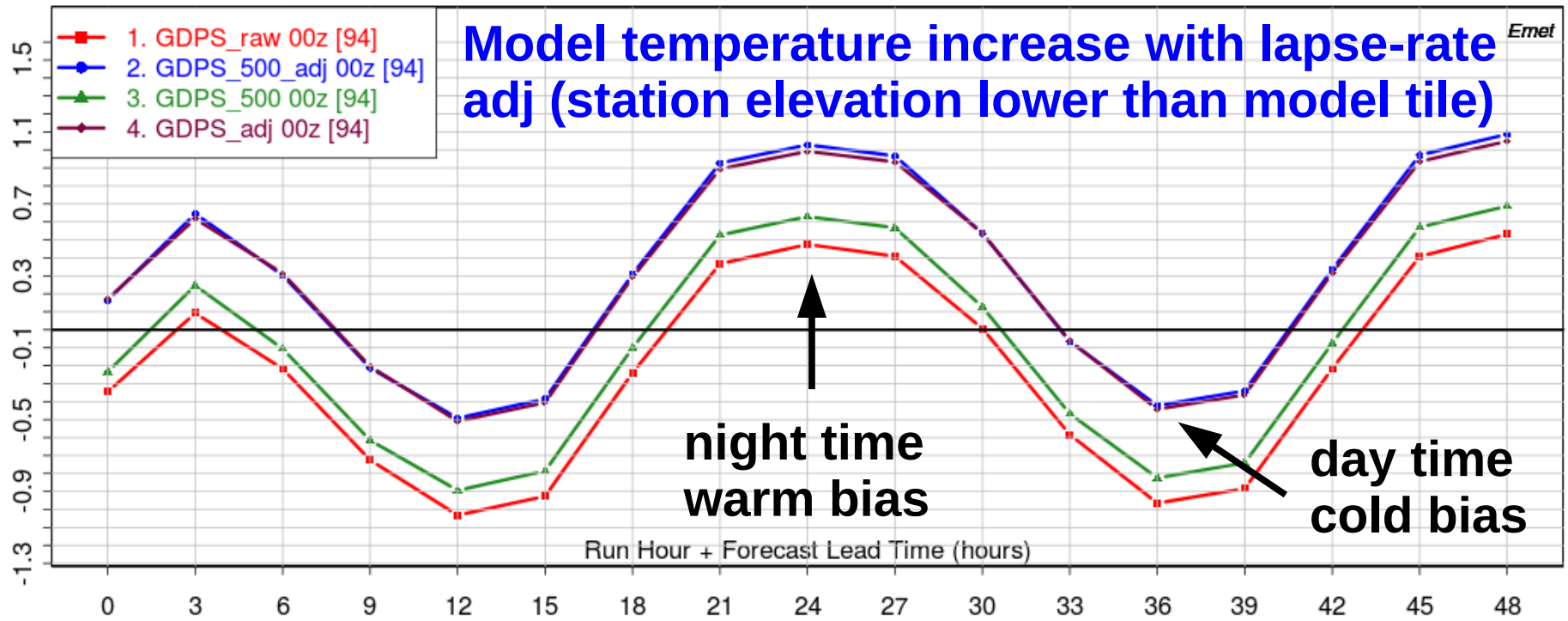


## GDPS 00+36h (day-time) adjusted

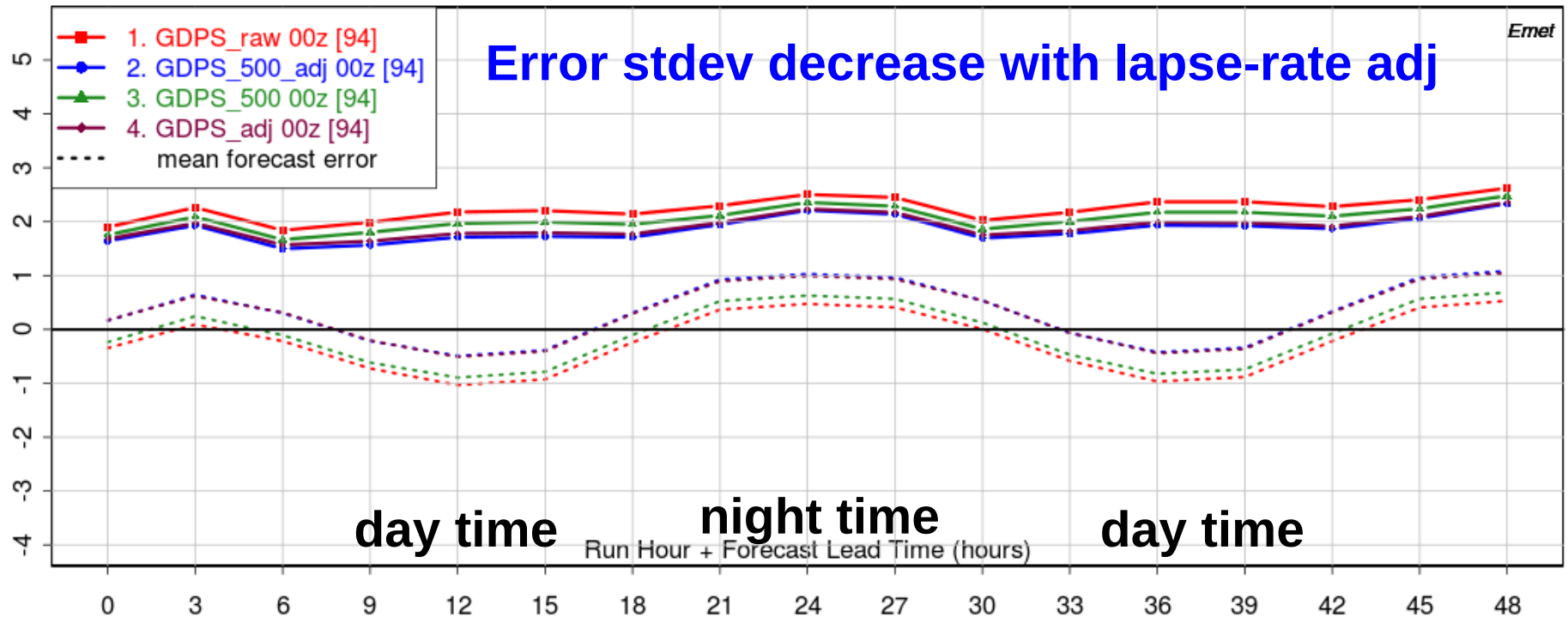


Model temperature is adjusted to station elevation by applying the standard atmosphere (0.0065 C/m) lapse-rate: cold bias in Norwegian mountains is reduced

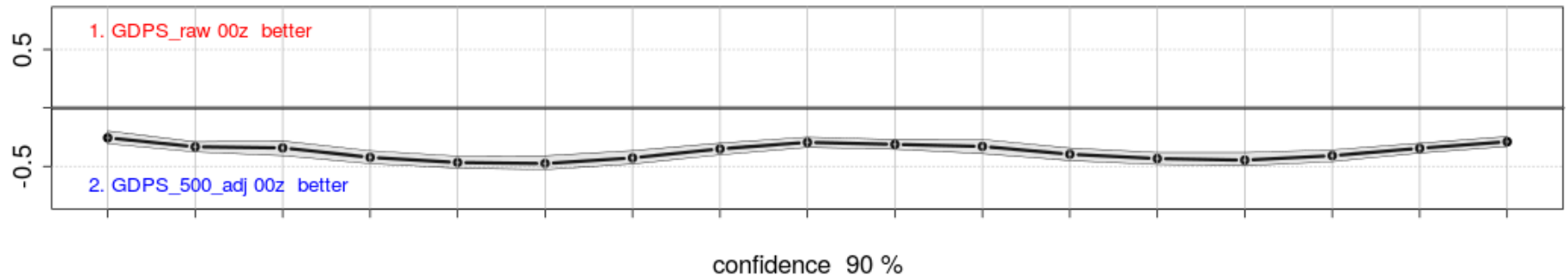
MEAN ERROR (P-O) OF SURFACE TEMPERATURE (C) 2018-06-28 @ 2018-09-30  
alt diff max 500 ade synop Fennoscandia



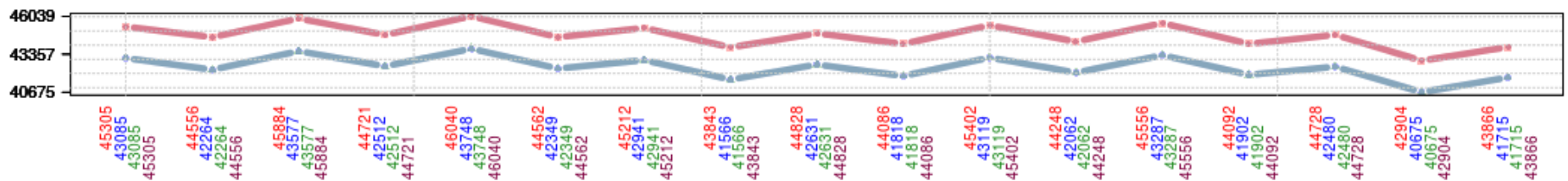
STANDARD DEVIATION (P-O) OF SURFACE TEMPERATURE (C) 2018-06-28 @ 2018-09-30  
alt diff max 500 ade synp Fennoscandia



$S_2 - S_1$



number of observations

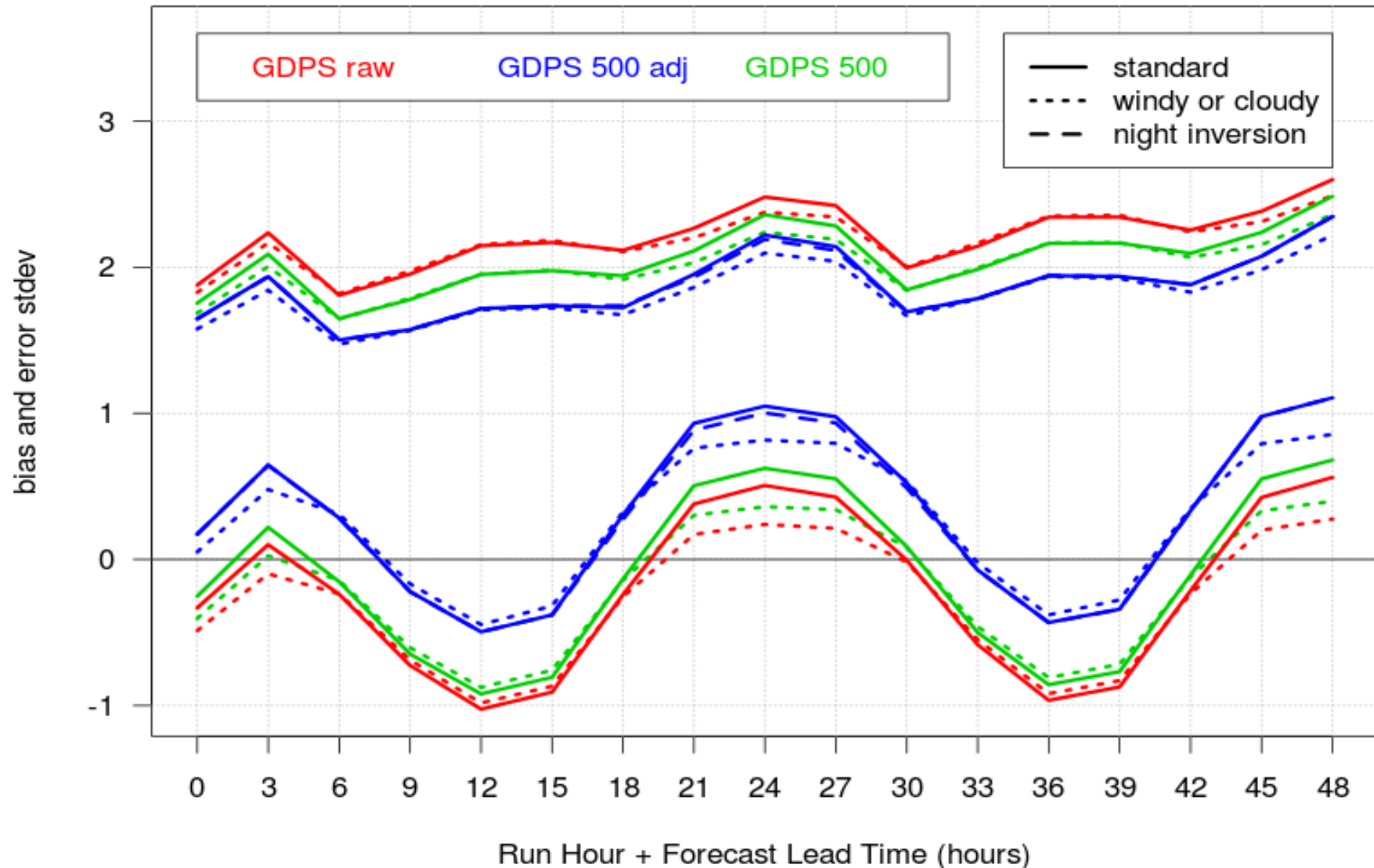




# What about night inversions?

Night inversion conditions contribute to a significant portion of the error; however the inversion lapse rate does not add significant gain.

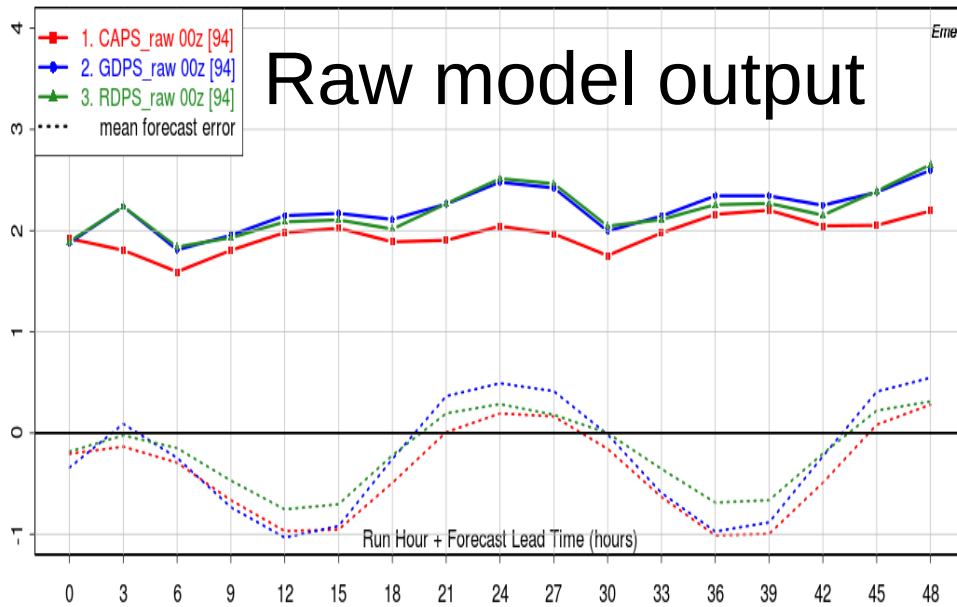
**bias and error standard deviation**  
**Fennoscandia 20180628-20180930**



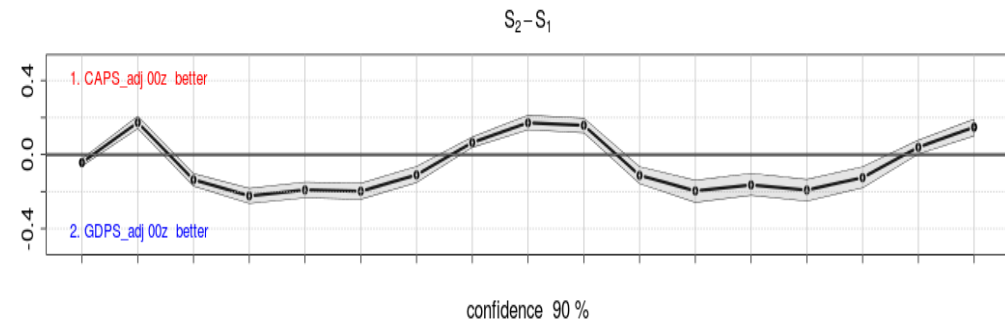
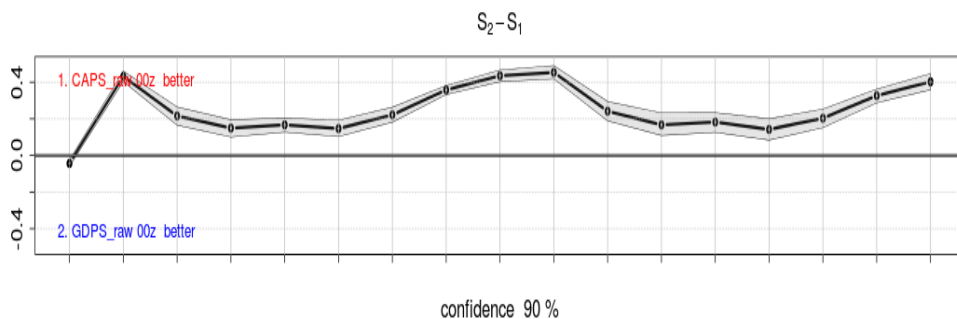
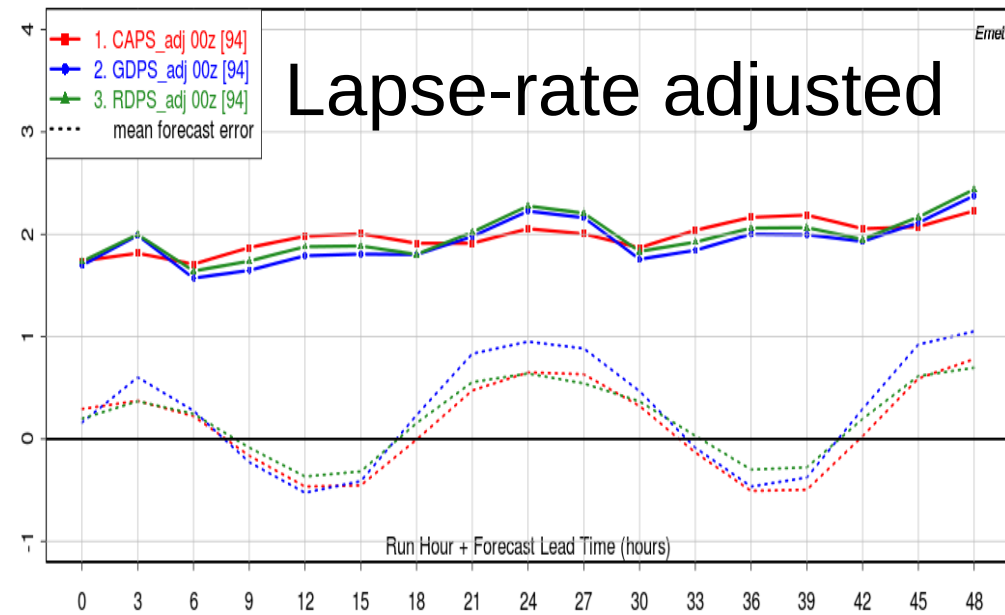
# Model ranking with and without lapse-rate adjustment

Differences in model performances are reduced when applying the temperature lapse-rate adjustment: the coarse **GDPS ~ 25km** (more strongly affected by representativeness issues) becomes more comparable to the higher resolution **CAPS ~ 3km** (**RDPS ~ 10km**)

STANDARD DEVIATION (P-O) OF SURFACE TEMPERATURE (C) 2018-06-28 @ 2018-09-30  
wind and could obs ade synop Fennoscandia

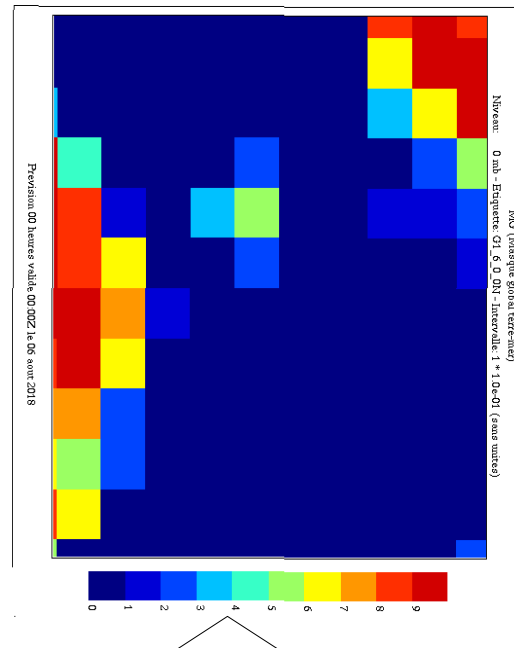
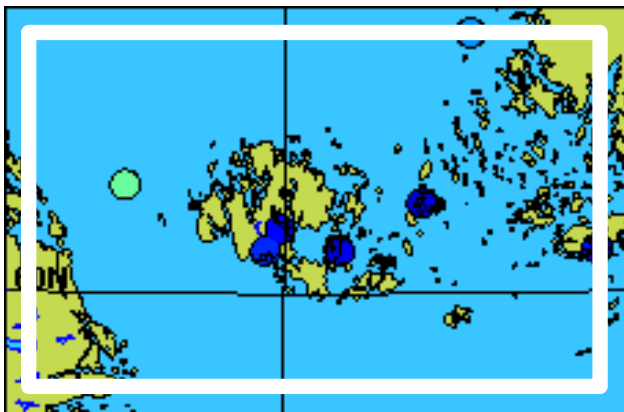
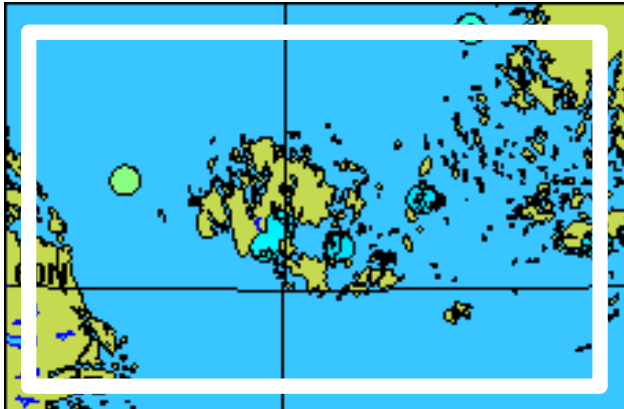


STANDARD DEVIATION (P-O) OF SURFACE TEMPERATURE (C) 2018-06-28 @ 2018-09-30  
inversion calm and clear night ade synop Fennoscandia

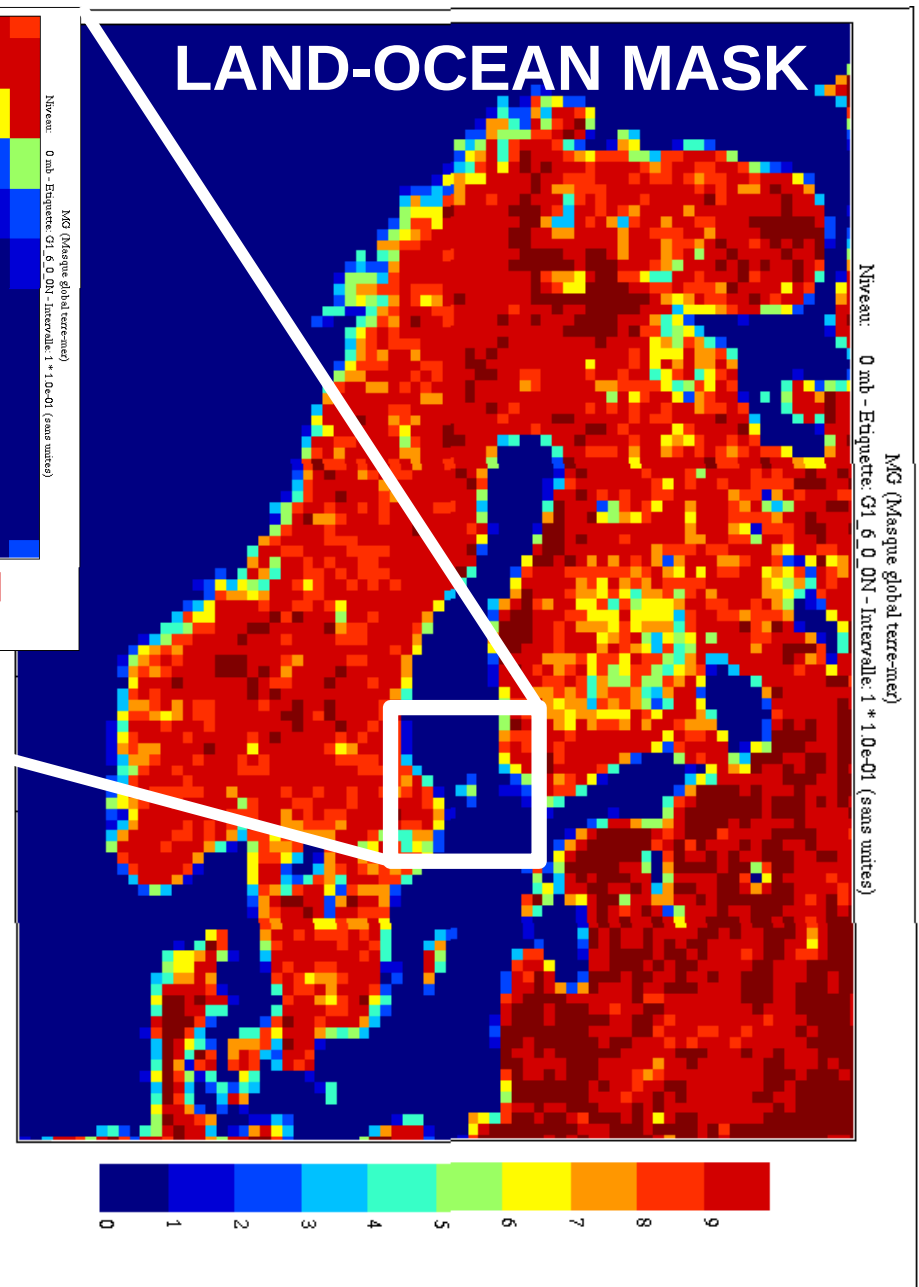


# 2. land versus ocean tile component

Water versus land proportion within the model tile



Aland Islands: model tiles are dominated by water!



Aland Islands: adjustment leads to colder bias => model is at sea-level, whereas stations are higher, inland!

(slide A. Zadra, ECCO)

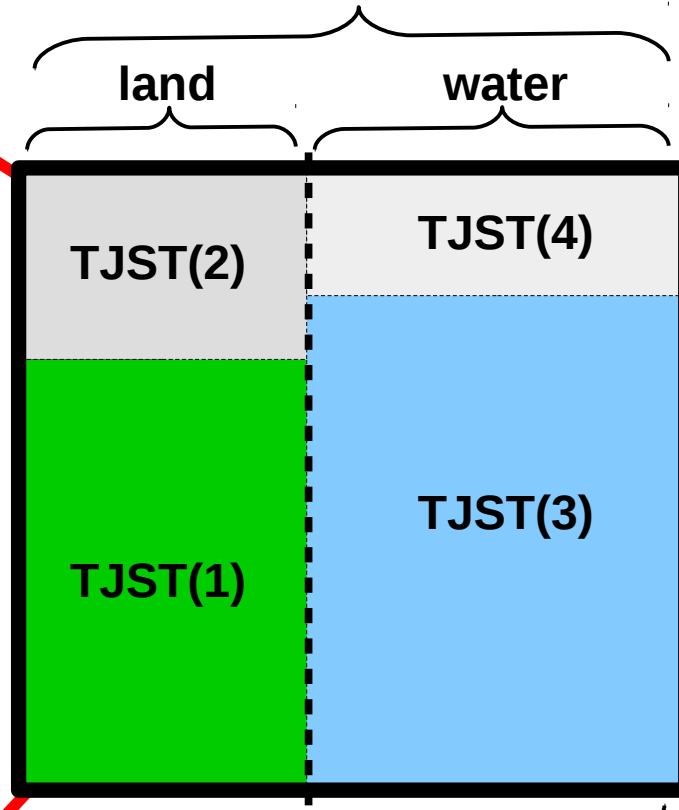


2) glaciers



4) "sea-ice" (frozen ocean, lakes, rivers)

# grid cell



1) land (ISBA, SVS)

3) water (oceans, lakes, rivers)

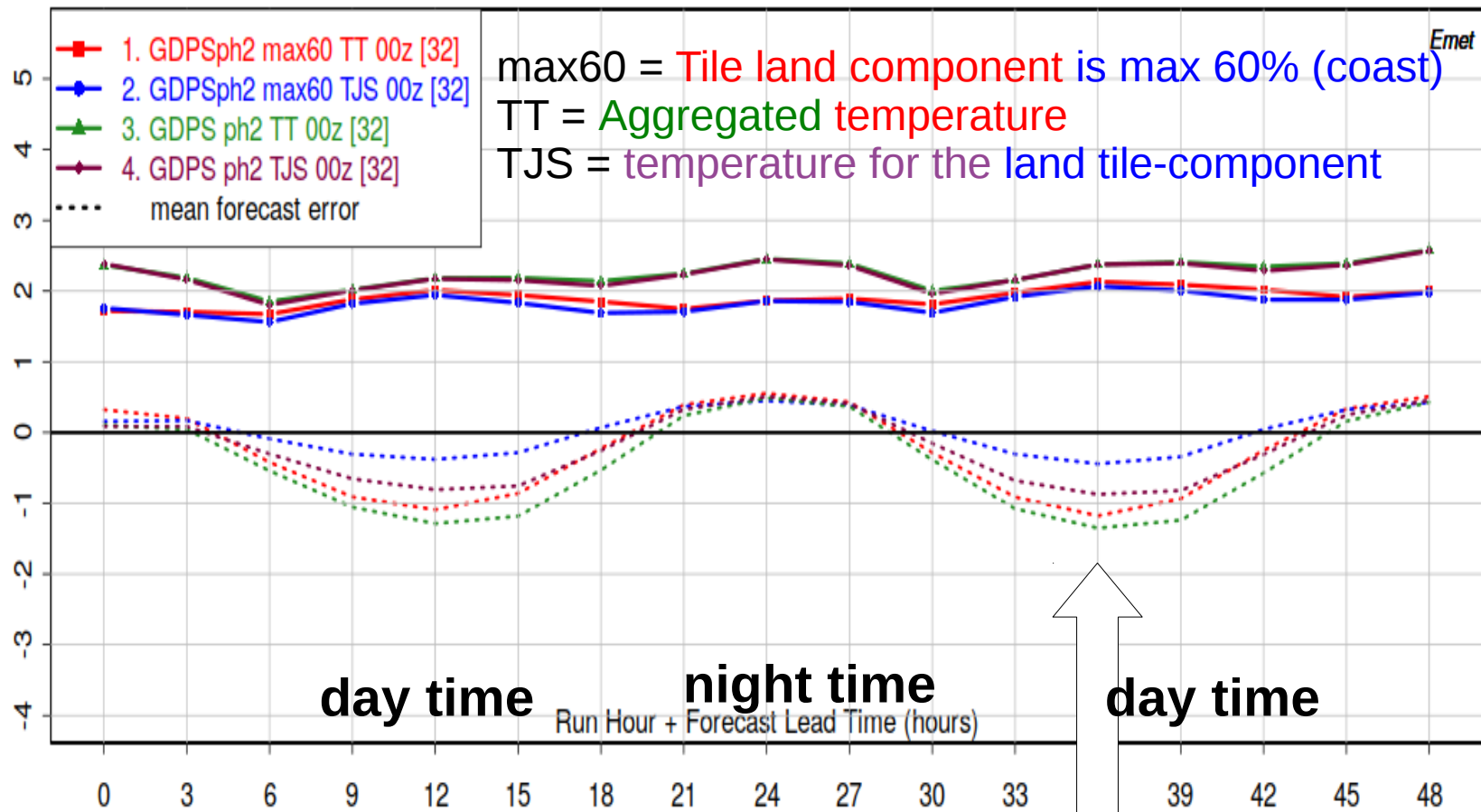


*aggregation*

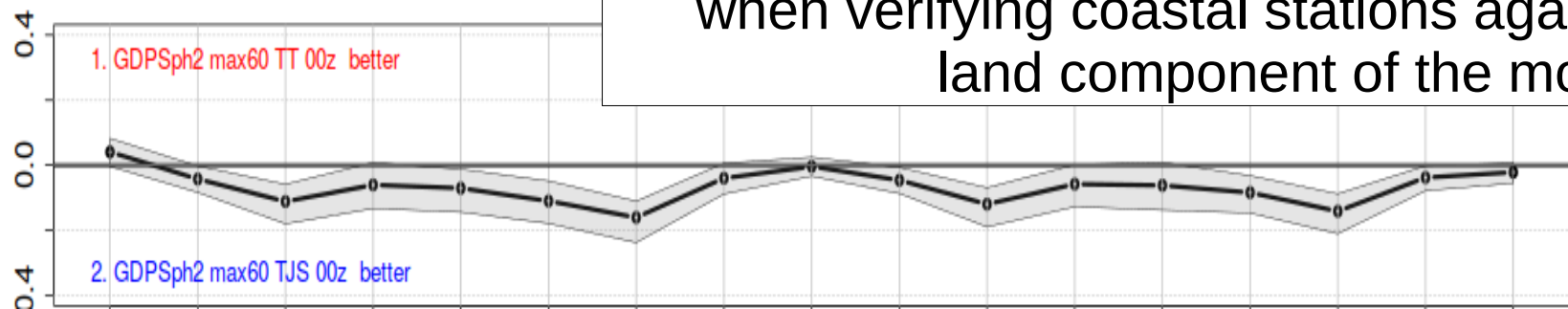
**TJST(5) = diagnostic near-surface air temperature @ 1.5m**

# STANDARD DEVIATION (P-O) OF SCREEN-LEVEL AIR TEMPERATURE (C) 2018-06-29 @ 2018-09-30

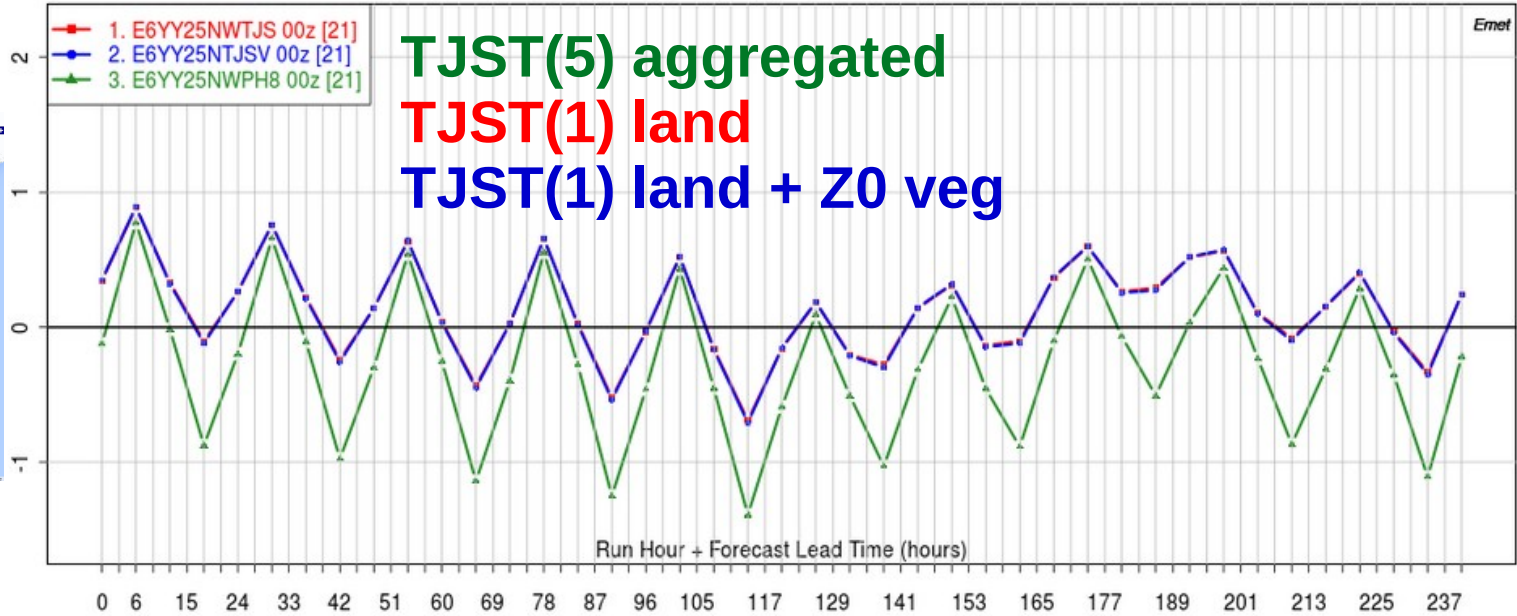
ade synop Fennoscandia



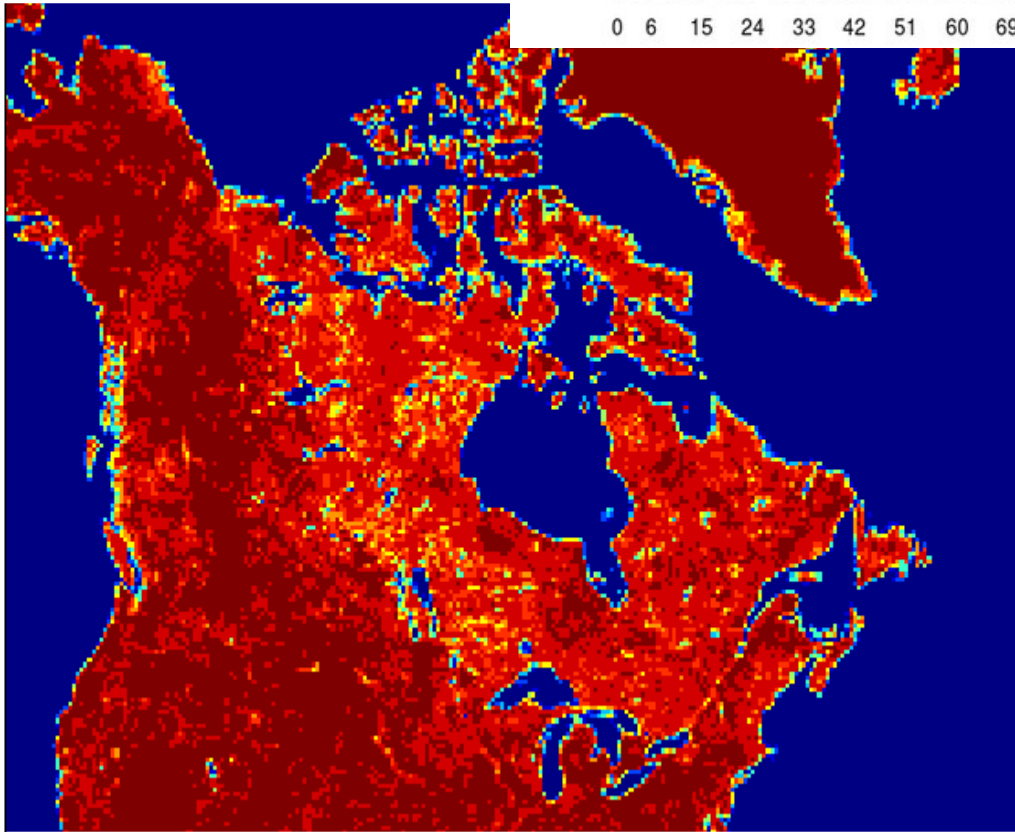
day-time cold bias and error are reduced when verifying coastal stations against the land component of the model tile



# Canada East



## Land-Ocean Mask



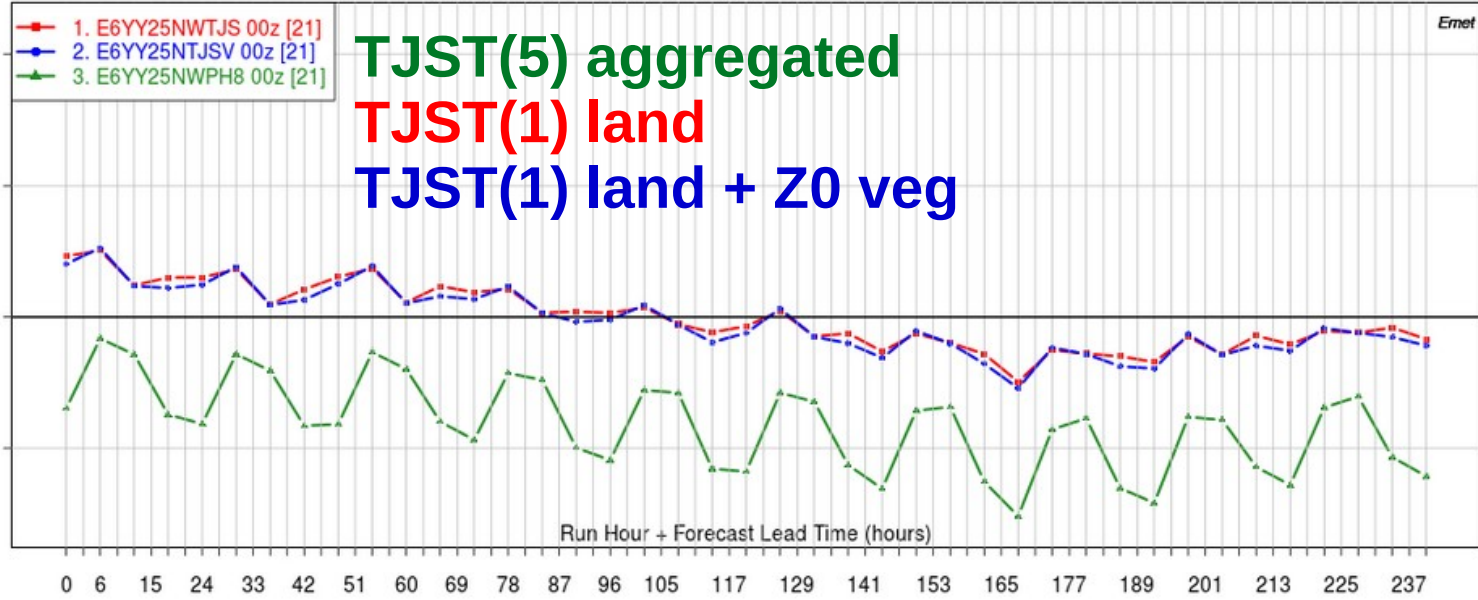
Prevision 00 heures valide 00:00Z le 06 aout 2018

Aggregated TJST(5) near-surface air temperature cold bias is potentially dominated by the water component of the tile

(analysis A. Zadra, ECCCC)

# Alaska and Canadian Arctic

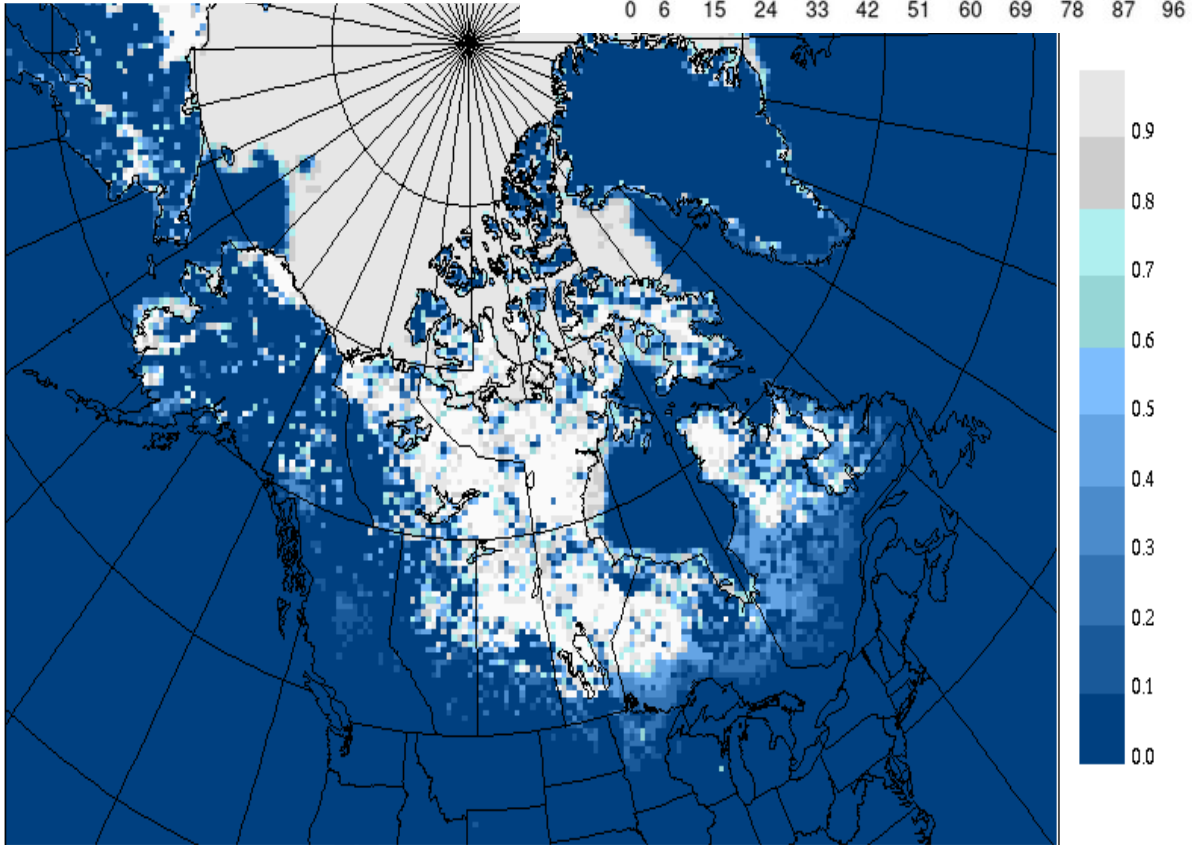
MEAN ERROR (P-O) OF SURFACE TEMPERATURE (C) 2016-06-19 @ 2016-08-21  
alt diff max 100 synop\_swob\_metar Alaska plus Canadian Arctic



Ermet



## Cryosphere Mask



**Aggregated TJST(5) near-surface air temperature cold bias is partially due to the water component of the tile, but it is potentially dominated by the **cryosphere!!****

(analysis A. Zadra, ECCO)

# Summary

Representativeness  
can dominate the forecast error:

Model tile temperatures are adjusted to station  
elevation by applying a standard atmosphere  
lapse rate: model ranking (coarse versus higher  
resolution) is affected by the adjustment.  
Future: verify and use model lapse rate.

Model sub-tile component might be more  
representative of station observations, than the  
tile aggregated values.

Pending questions: the different behaviour of the  
sub-tile components is a model feature only, or  
is it also observed? Are coastal stations  
representative of in-land or ocean weather?

