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Presentation of met.no's experience and expertise related to high resolution re-analysis

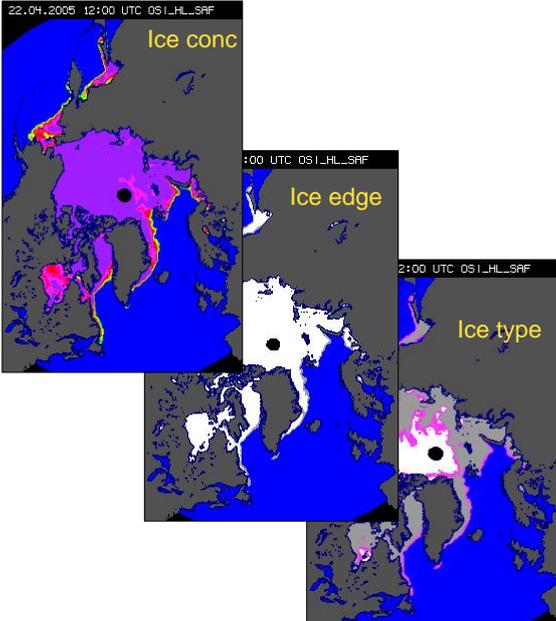
Oyvind Saetra, Ole Einar Tveito, Harald Schyberg
and Lars Anders Breivik
Norwegian Meteorological Institute



Daily analysis of sea ice concentration edge and type on 10 km grid from northern and southern hemisphere

Satellite data input:
SSM/I, scatterometer

Products (GRIB, HDF5) can be downloaded from the HL centre homepage,
<http://saf.met.no/>
or via EUMETCast



OSI SAF Sea ice reanalysis



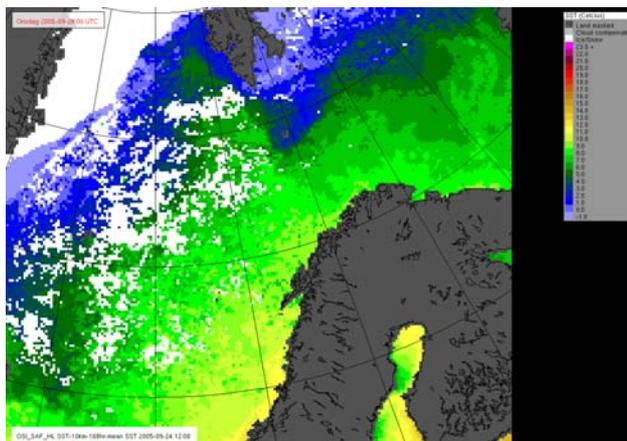
- Data used:
 - Recalibrated SSM/I brightness temperature dataset from Remote Sensing Systems (1987 – 2005)
 - ECMWF ERA-40 reanalysis data (1987-2002)
 - Operational ECMWF short forecasts (2002-2005)
- Partners
 - met.no, DMI, UK Met Office
- Improvements to be implemented before run
 - Improved tiepoints (especially SH)
 - New algorithm(s): Suggest to process both Bristol and 85 GHz based fields
 - If successful: Correction of cloud liquid water using satellite derived information (R-factor)

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SST-analysis



- A system for SST-analysis based on OSI SAF sst products has been implemented
- This is in use for the HIRLAM model as well as for the operational ocean model MIPOM-arctic



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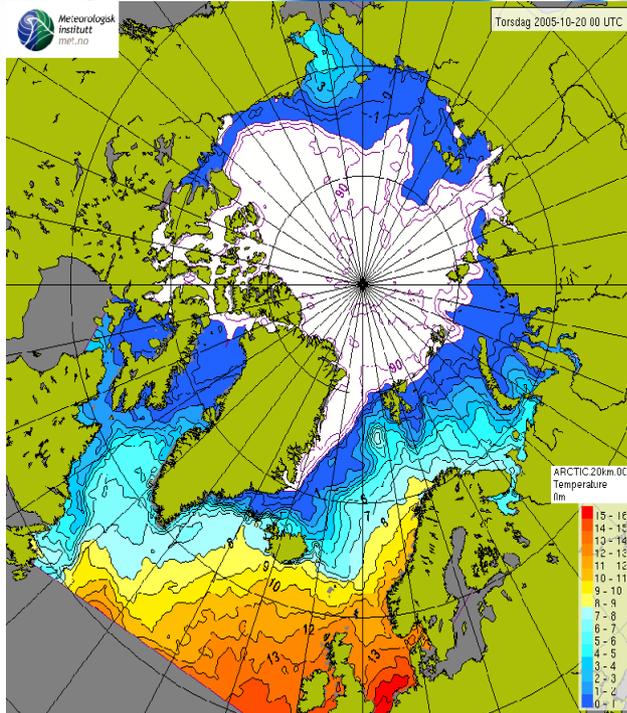
Assimilation of SST and sea ice in coupled ice ocean model

Ice Concentration and SST is assimilated in the ocean and sea ice model system.

The model receives updated ice concentration and SST (OSI SAF) valid at 12 hours before model analysis time.

A nudging scheme is then executed during the 30 hour long assimilation period (hindcast period).

The assimilation scheme has been refined to ensure consistent behavior of ice thickness and ice concentration. The nudging of the model values towards the data consists in melting or freezing of ice, which in the model translates into modifying the ice production rates.



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Met.no work on high-resolution modelling and data assimilation



Met.no is part of the HIRLAM consortium, and also has a cooperation with Met Office

HIRLAM and Aladin/AROME started a cooperation on high-resolution NWP modelling in 2005

Met.no runs non-hydrostatic models MM5 and Met Office Unified Model operationally (4km) at present, and intends to run Aladin/AROME in the future

Met.no intends to contribute to the development of a high-resolution data assimilation system in the framework of HIRLAM-Aladin-AROME

Work topics for high resolution assimilation: Assimilation of cloudy radiances, assimilation of radar wind and precipitation information

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Experience with some particular observation types



Met.no has a particular interest in filling data gaps over ocean areas and Arctic regions covered by sea ice:

- Experience on assimilation of scatterometer data (ocean wind)
- Work on methods for assimilating AMSU sounding data over sea ice, particularly microwave surface emissivities over sea ice.

Could contribute with methods for improving the use of such observations in a reanalysis

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An example: The effect of adding AMSU-A temperature sounding data over sea ice

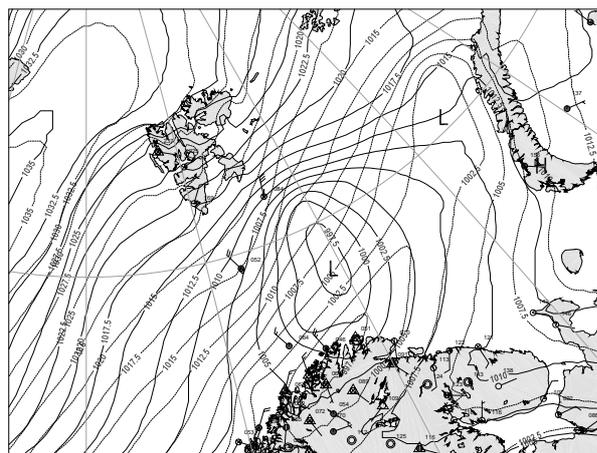


A case from a longer impact study performed at met.no:

A low pressure system is seen in the Barentz Sea when using AMSU-A over sea ice, but not in the reference run not using any AMSU-A.

The existence of this low is supported by the few conventional observations available in the area.

(Takes place in a period of predominantly Northerly upper winds in the area)



+24 hrs forecasts valid 00Z 14 March 2005

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Gridded climatology products for Norway

-spatial resolution 1x1 km²

Monthly mean values

- Temperature and precipitation 1961-90

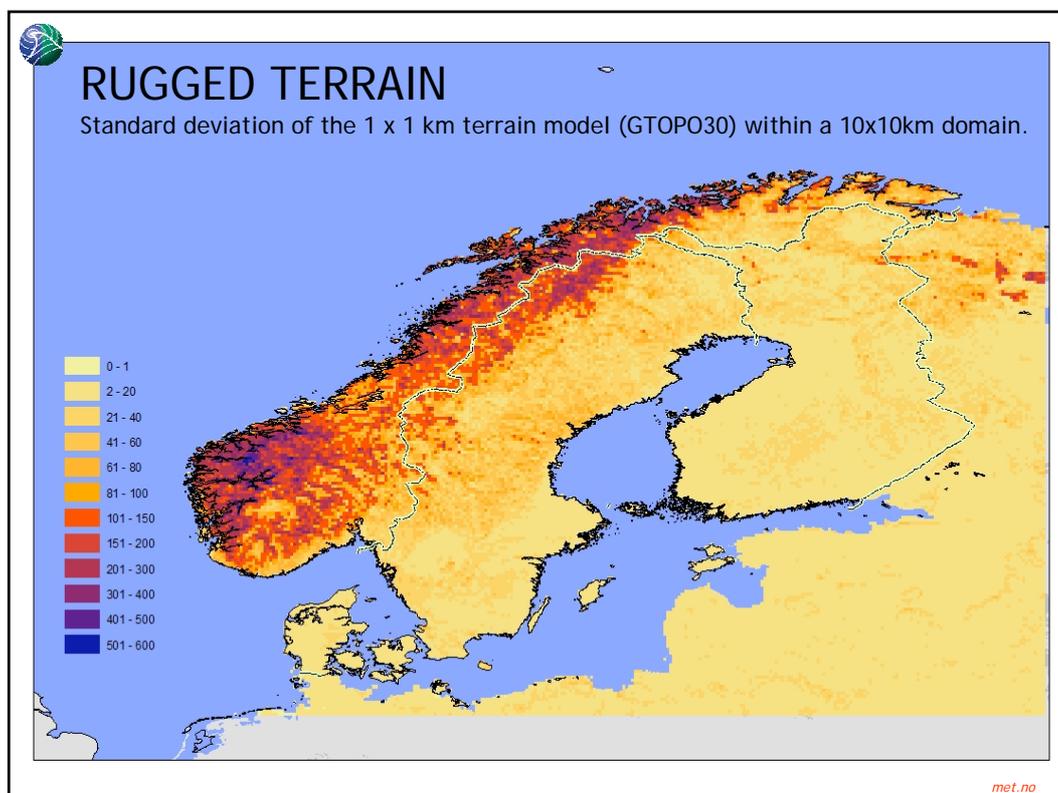
Monthly anomaly grids (with adjacent absolute value grids)

- Temperature 1900-now
- Precipitation 1900-now

Daily values: → Primarily developed for hydrological purposes

- **Precipitation** 01.01.1960 - 30.06.2005 (Applying triangulation and/or IDW with altitude adjustment, in verification phase).
 - Next step: Improved representation of terrain combined with circulation conditioned interpolation.
- **Temperature** 01.01.1960 - 30.06.2005 (by residual interpolation)

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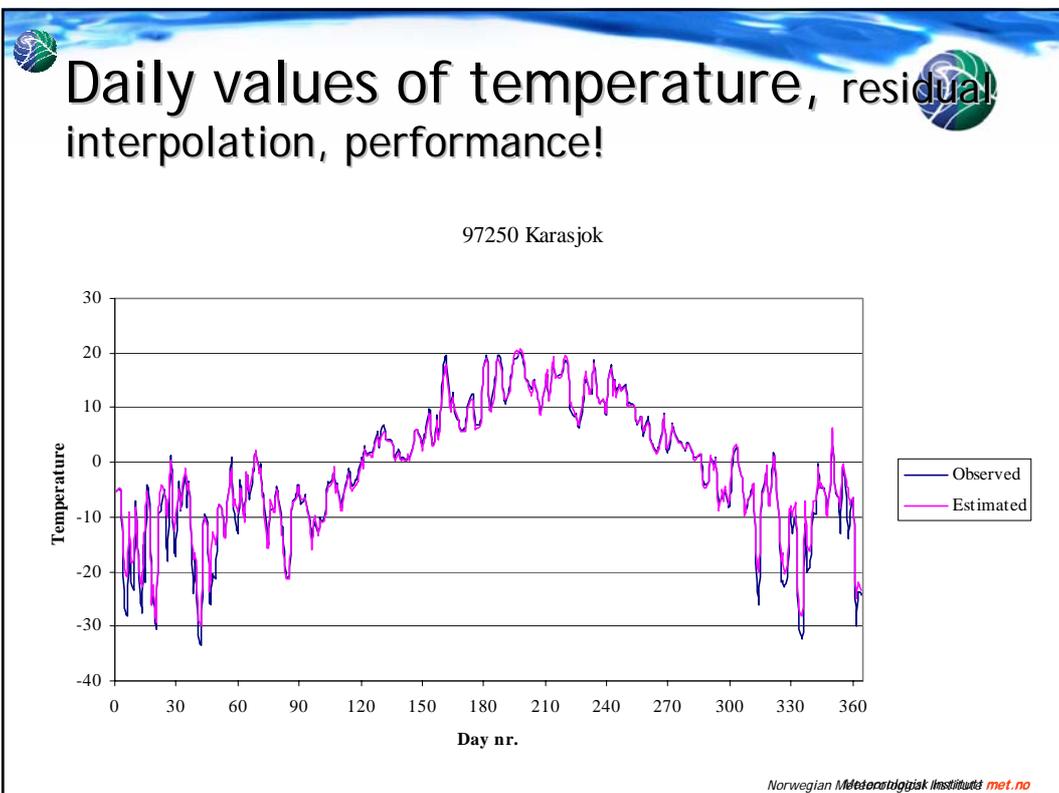


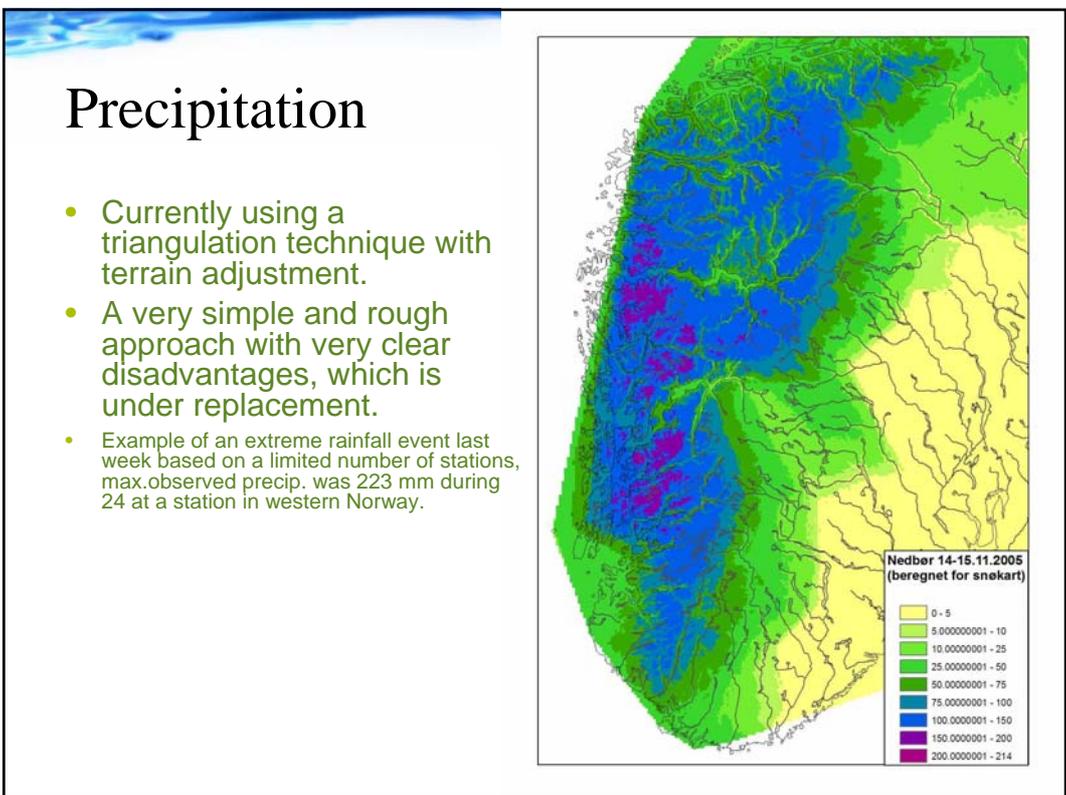
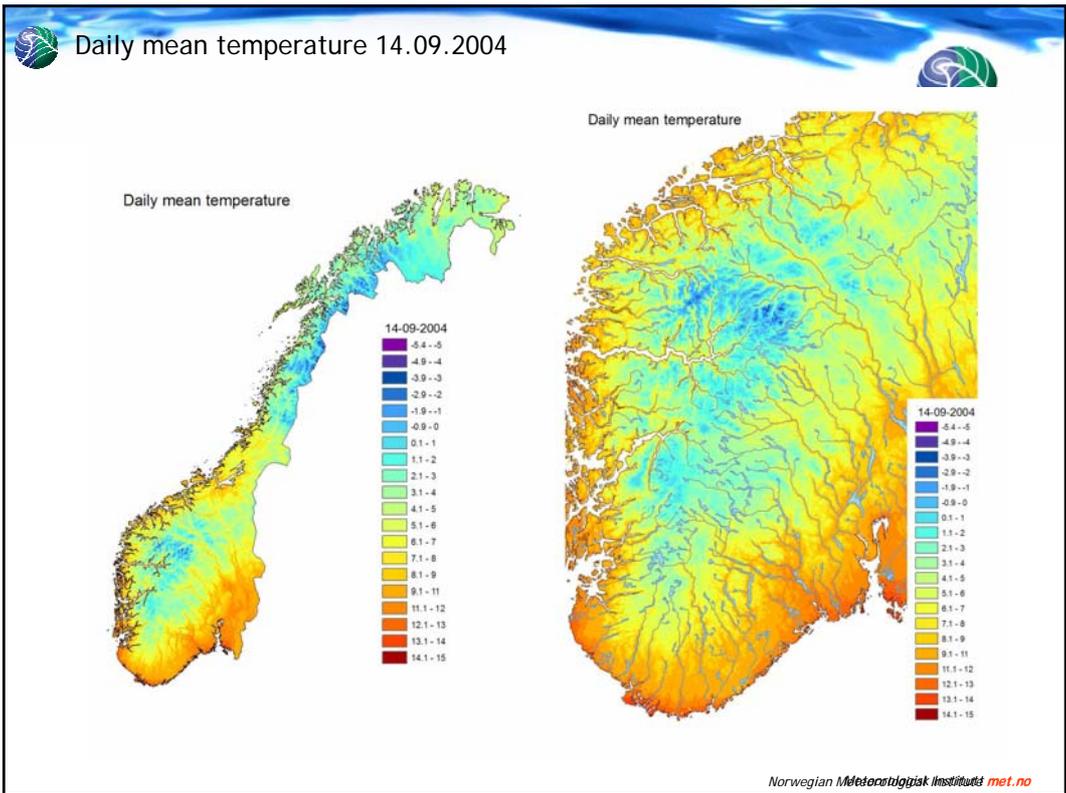


Daily values:

- Residual interpolation (geo-statistical method) where climate signals due to terrain, distance to coast and other landscape characteristics are removed before interpolating the residuals.
- Applies only in-situ observations
- Why not NWP-models?
 - Systematic errors.
 - Long climate series:
 - Too computer demanding.
 - Data assimilation and inhomogeneities...
 - Large area: Spatial resolution (far) too coarse.

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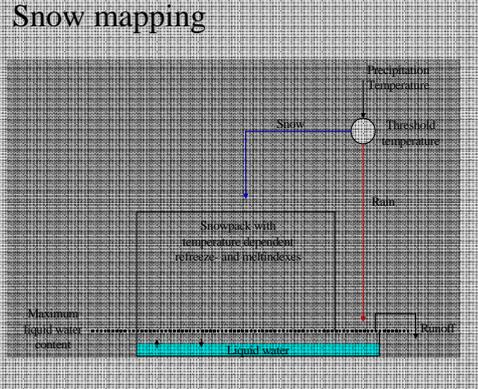





Input to other models.

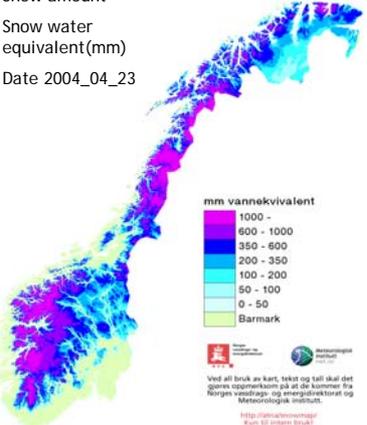
- Gridded climatological values can be used as input to distributed models in e.g. hydrology and agro-ecology.
- Snow mapping
 - Potential for improved snow-analysis in NWP-models.

Snow mapping



The diagram illustrates the snow mapping process on a grid. It shows 'Precipitation' and 'Temperature' as inputs. A 'Threshold temperature' is used to determine if precipitation falls as 'Snow' or 'Rain'. 'Snow' is added to a 'Snowpack with temperature dependent freeze- and thaws'. 'Rain' is added to 'Liquid water'. The 'Maximum liquid water content' is also indicated. 'Runoff' is shown at the bottom.

Snow amount
Snow water equivalent(mm)
Date 2004_04_23



mm vannekvivalent

- 1000 -
- 600 - 1000
- 350 - 600
- 200 - 350
- 100 - 200
- 50 - 100
- 0 - 50
- Barmark

Ved all bruk av kart, tekst og tall skal det gjøres oppmerksom på at de kommer fra Norges vassdrags- og energidirektorat og Meteorologisk institutt.

http://vassdragsverket.no/
Kart 60 meters bredde

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