High latitude satellite SST and IST at DMI

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ABSTRACT:

The ice surface temperature (IST) and high latitude Sea Surface Temperature (SST) are essential variables for atmosphere, ocean and sea ice models and for coupled systems.

DMI delivers operational high latitude satellite IST and SST from the Metop-A satellite in 1 km resolution, within the MyOcean and OSI-SAF projects, using the NWC SAF PPS cloud screening. Current activities focus upon the validation of the products and the improvements of the cloud masking.

An ice surface temperature reanalysis will be developed in 2013 within the NACLIM project (EC-FP7). In addition, a level 4 interpolated surface temperature product will be developed within the MyOcean-2 project.

Several studies have shown that Arctic summer open ocean and Marginal Ice Zone (MIZ) SST observations have significantly higher errors than the global SST observations (e.g. Høyer, 2012).

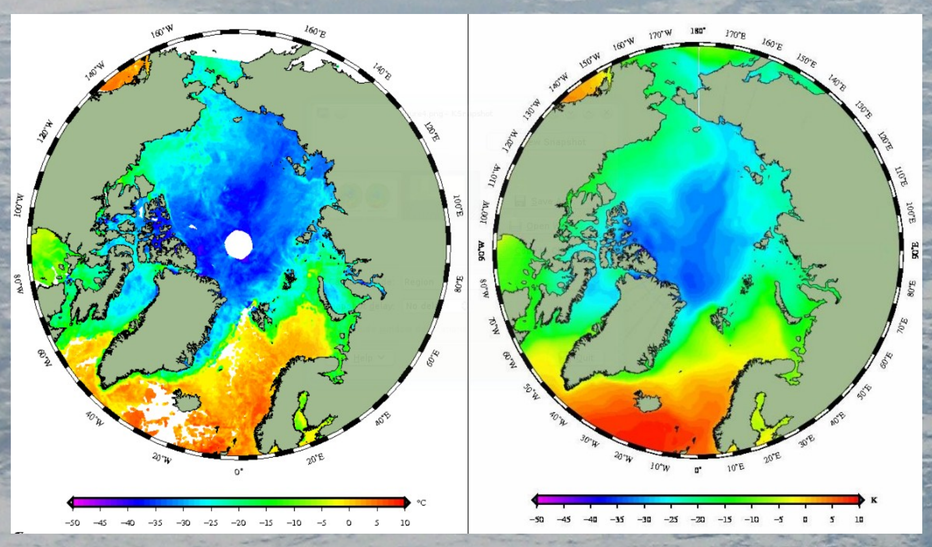
This is unfortunate, since the Arctic region is also very sparse on in situ observations for proper validation and calibration. Ice surface temperature observations from drifting buoys are not very representative of the skin ice surface temperature (Dybkjær et al., 2012).

In addition, numerical weather prediction models tend to have large errors in surface temperature representation of ice covered surfaces, such as: the Arctic Sea ice pack and the Greenland ice sheet, due to the lack of observations

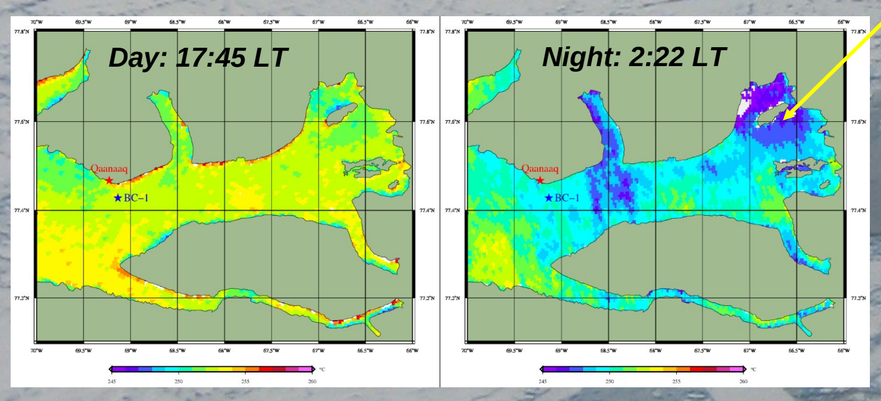
Therefore, there is a need for more and accurate surface temperature observations in the Arctic, to quantify the temperature in ice covered areas. DMI use satellite observations from the AVHRR instruments together with a self calibrating infrared radiometer (ISAR), to build up a high latitude surface temperature reference data set, against which, the satellite observations can be compared.

DMI has agreements with the Greenland shipping company, Royal Arctic Line, for instrument deployment on their regular weekly routes between Greenland and Denmark, for measuring high latitude SST and frequent arrangements with ice breaker cruises in the Arctic Oceans and Baltic seas for in situ IST measurements.

Operational IST and SST products



6 day mean satellite Metop IST and SST (left) corresponding ECMWF T2m (right).

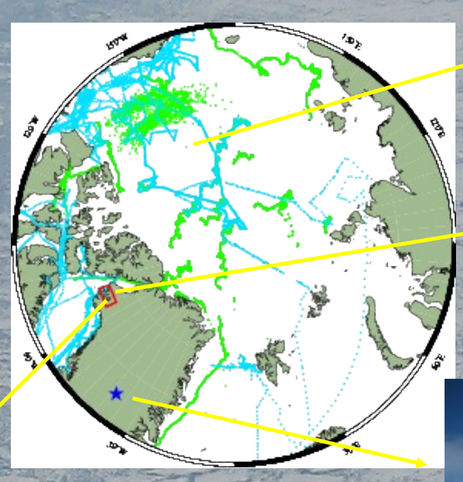


Snapshots of daytime (left) and night time (right) IST in Inglefield Bredning (Qaanaaq). The observations are within 9 hours.

Future Plans

- ***Extend operational IST+SST production to Southern Hemisphere***
- ***Develop Level 4 surface temperature (IST+SST) field***
- ***Perform IST Reanalysis from 1989 to 2009, using AVHRR GAC data***
- ***Obtain more in situ observations for validation***
  - ***6 weeks icebreaker cruise to North Pole, carrying an Infrared Radiometer (ISAR)***
  - ***ice mass balance buoy deployment***

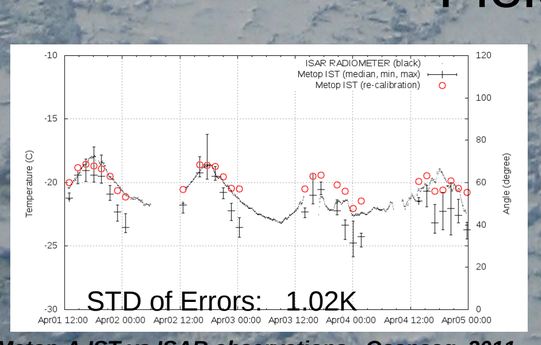
Product Validation



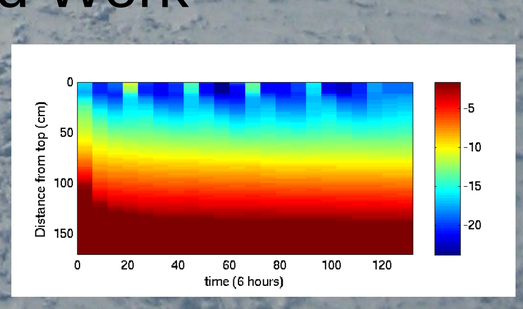
IST validation has been performed with observations from self calibrating Infrared Radiometers, Buoys, Ships and T_2m from Summit. The validation results are shown in the table below.

Metop IST inter-comparison	STDE (K)	BIAS (K)
IST – $OBS_{ARCTICBUOYS}$	3.69	-2.76
IST – ISAR	1.02	-1.81
IST – $OBS_{GREENLANDSUMMIT}$	3.48	-3.35
IST – $NWP_{SURFACE}$	3.92	-3.5

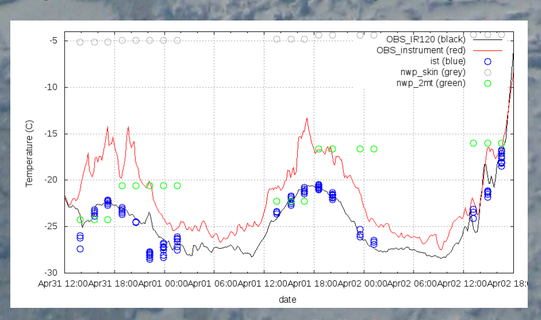
Field Work



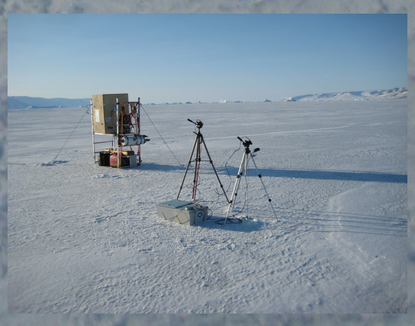
Metop-A IST vs ISAR observations , Qaanaaq, 2011.



Ice temperature profile from ice mass balance buoys.



Metop-A IST vs (IR120(Campbellscientific) and ECMWF (T_2m and T_skin), Qaanaaq, 2012.



Two campaigns in 2011 and 2012 have been conducted to obtain IST validation data from Infrared Radiometers. Comparisons with satellite IST show good agreements (within 1 deg C) and large errors in ECMWF skin temperature.

References

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