



Dmi

Center for Ocean and Ice



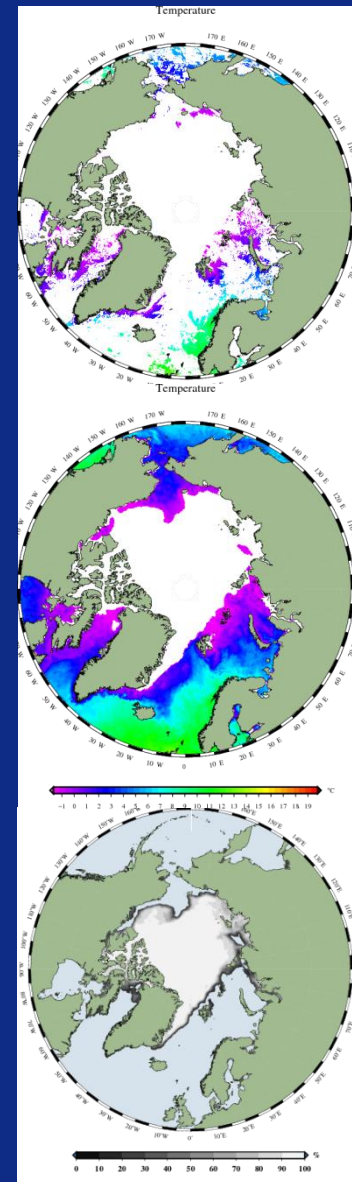
An Arctic sea surface temperature Climate Data Record

Jacob L. Høyer, Eva Howe,
Center for Ocean and Ice
Danish Meteorological Institute
jlh@dmi.dk



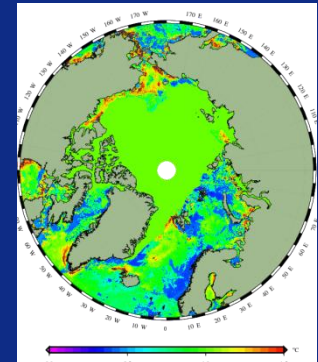
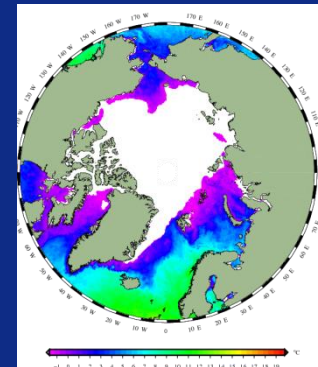
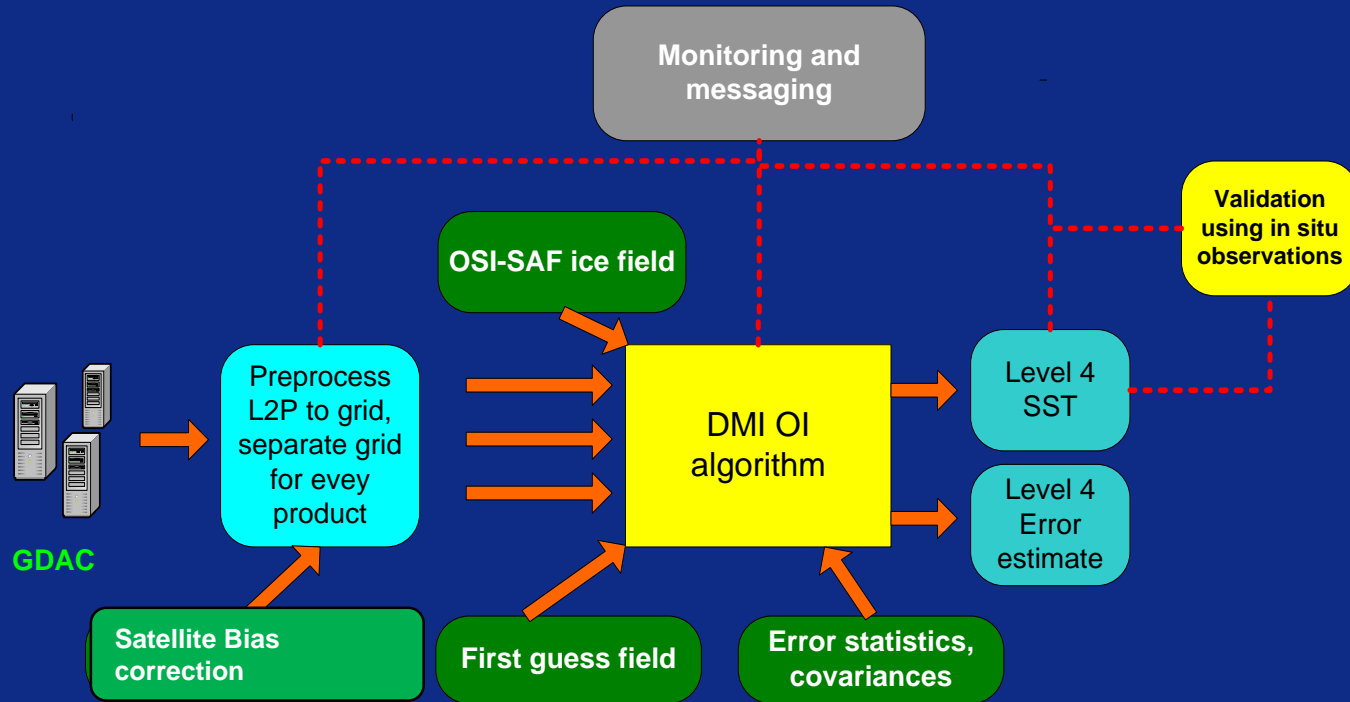
Data overview

- Daily SST fields from 1982 to 2010 without gaps, using:
 - Pathfinder version 5.0+5.1
 - AVHRRs on NOAA satellite series
 - 4 km resolution
 - Daily nighttime observations from 1982-2010
 - Quality flags 4-7
 - ARC version 1.0
 - ATSR 1+2 on ERS 1+2, AATSR on ENVISAT
 - 0.1 degrees resolution
 - Daily observations from 1991 to 2012
- ICOADS In situ observations, version 2.5
 - From 1800 to 2012
 - QC by UK Metoffice. Observations passed all quality control procedures.
- OSI-SAF sea ice concentration
 - Based upon the SSMR + SSMI MW observations
 - 1978 – 2012
 - 10 km resolution.





DMI-OI L4 processing chain

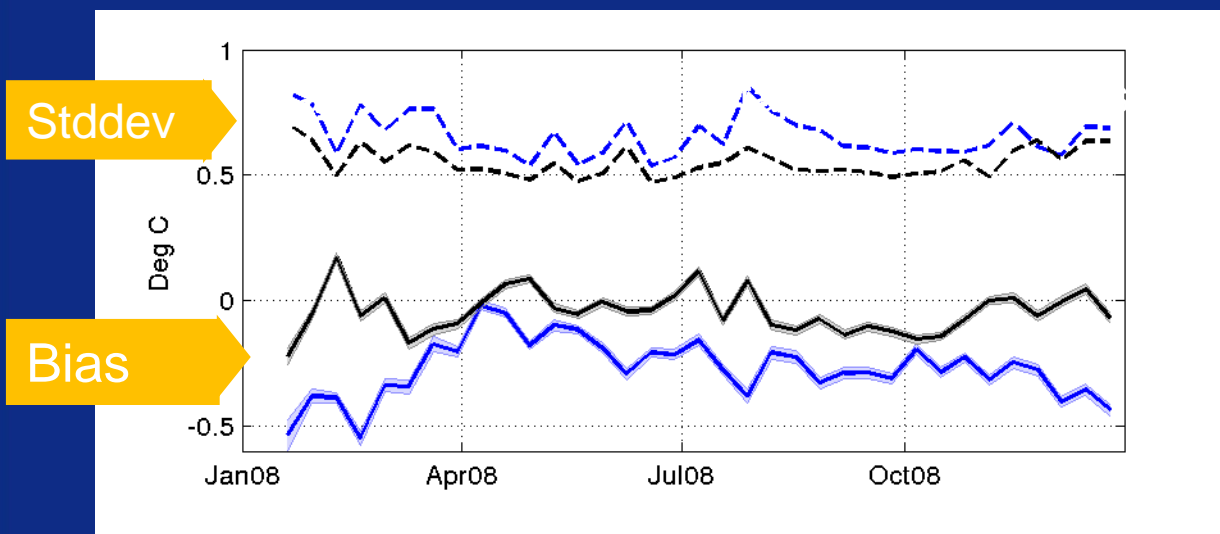


- Spatial resolution: 0.05 degrees
- Daily fields, 1982-2010



Arctic Bias correction method

- Dedicated Arctic bias correction method
- Using error statistics and method developed in: Høyer et al., 2012, 2013
- Bias correction method reduces bias and stddev on Level 3 products
- L4 OI product significantly improved
- Best performance when both reference sensors are available, but also improvements with ATSR reference alone



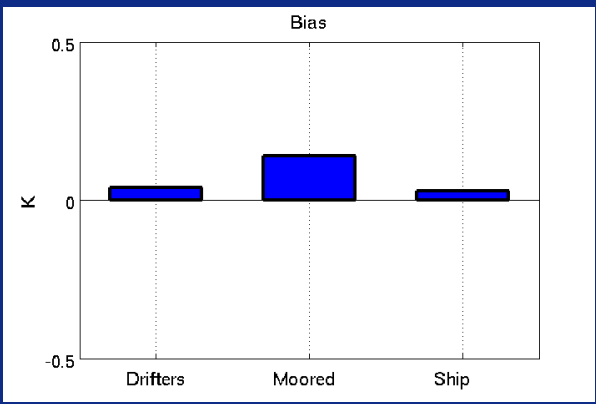
- Høyer et al.. Multi sensor validation and error characteristics of Arctic satellite sea surface temperature observations. Rem. Sens Env, 2012.
- Høyer et al. A bias correction method for Arctic satellite sea surface temperature observations. Rem. Sens Env., 2013 *In Press*.



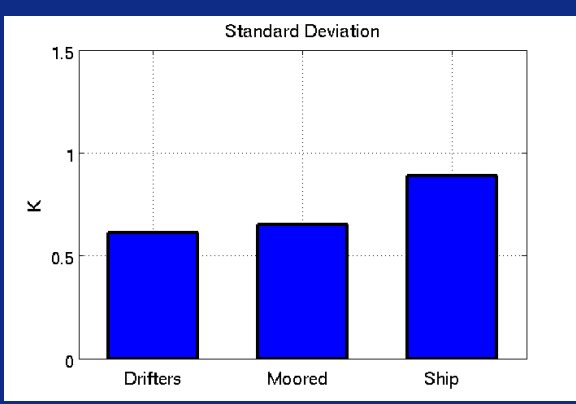
Reanalysis, validation, overall results

- Daily validation against in situ observations not included in the analysis
- 3 types of in situ observations
 - Drifting buoys
 - Moored buoys
 - Ship observations
- Nighttime:
 - Overall bias < 0.1 K
 - Stddev ~0.6 K

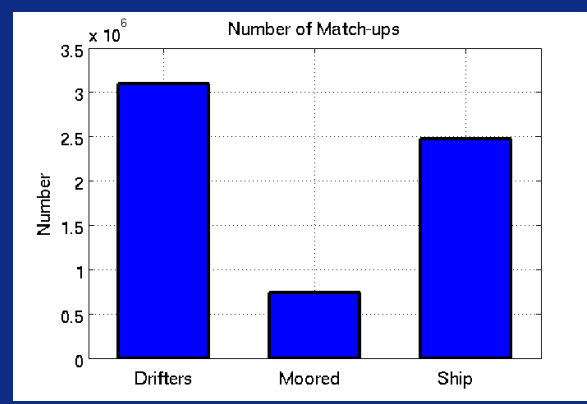
Bias



Standard deviations



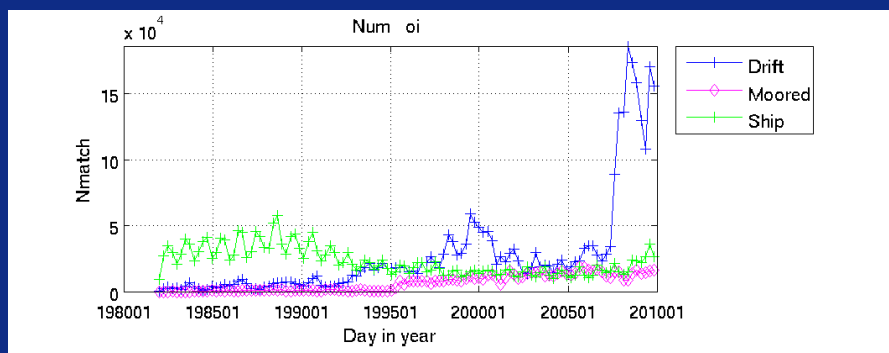
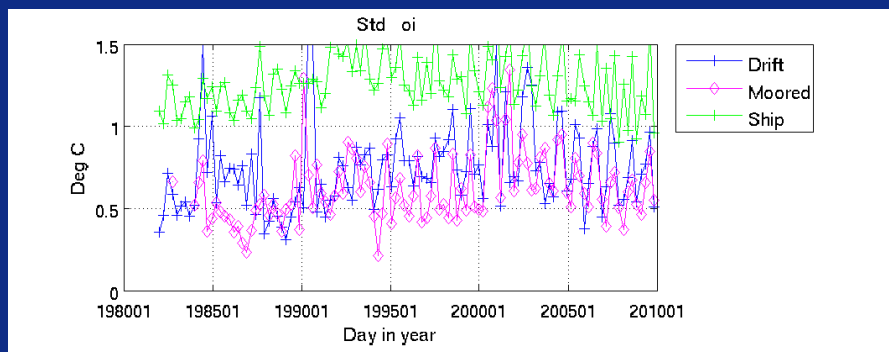
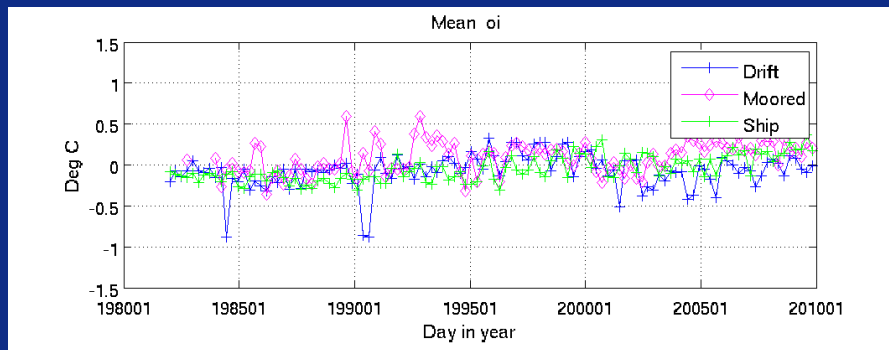
Number of comparisons





Validation of Reanalysis

- Stable bias results
- Drifters and Moored bouys better than ship observations.
- Temporal changes in observational network:
 - 1980s: Mostly ship obs
 - 2000s: Mostly Drifting buoys





Validation of Reanalysis, Yearly

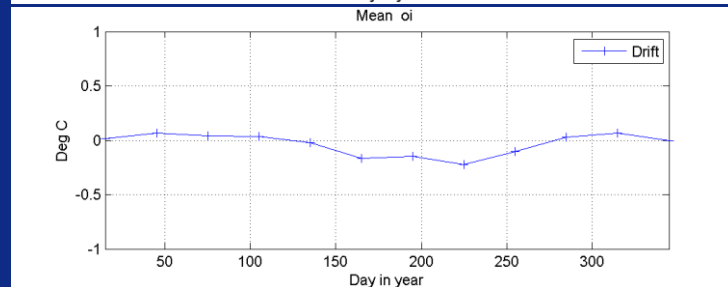
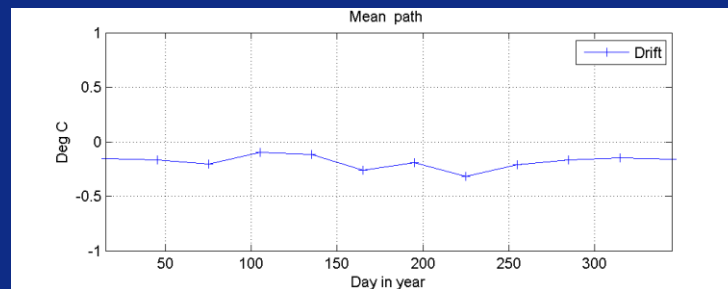
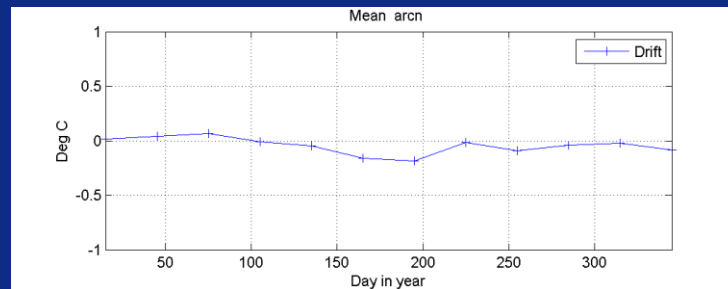
- Year 2002 to 2010
- Stable bias results throughout the year
- Yearly bias similar to ARC, 10 times more match-ups

Arc

Pathfinder

OI

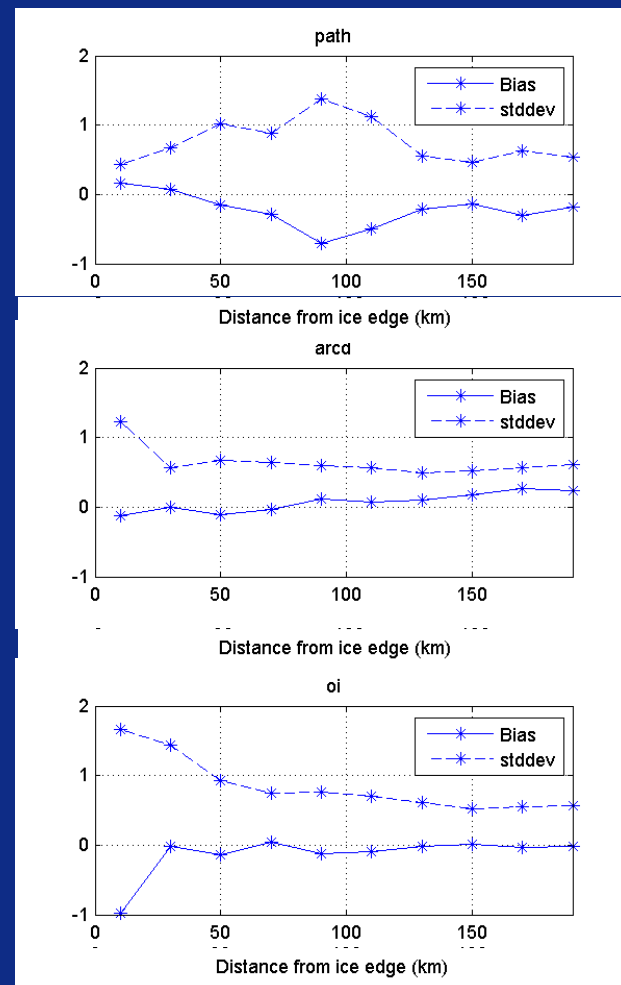
Bias





Validation in MIZ

- Ice edge defined as ice concentration = 30 %
- Matchups with buoys year 2002 – 2010
- Distance to ice edge calculated for matchups
- Different behaviour for Pathfinder and ARC
- Cold bias in OI product close to ice edge.

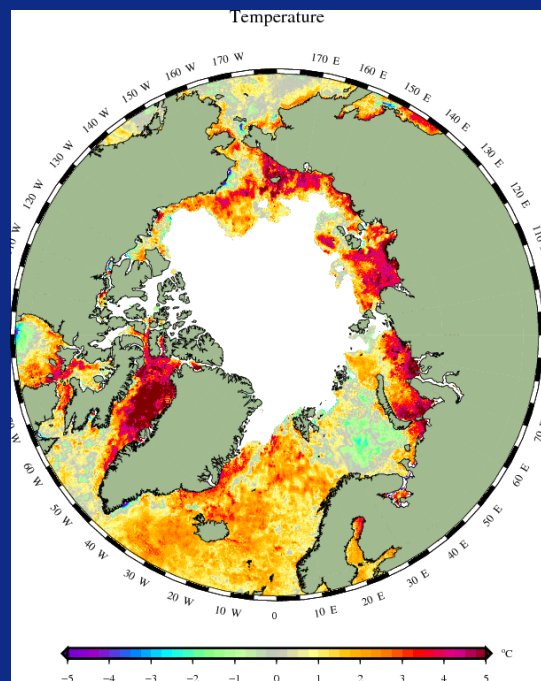




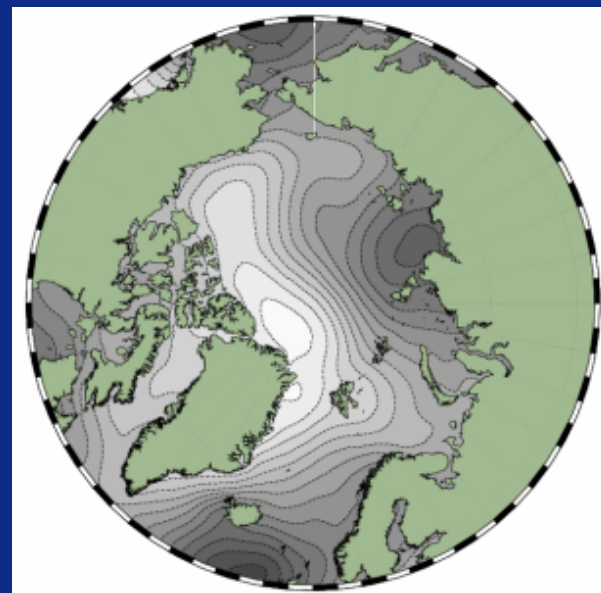
Baffin Bay, 2009

- August, 2009
- High pressure system result in very warm and dry atmosphere
- SST anomalies $> 7\text{ }^{\circ}\text{C}$ in Baffin Bay

SST deviation from climatology



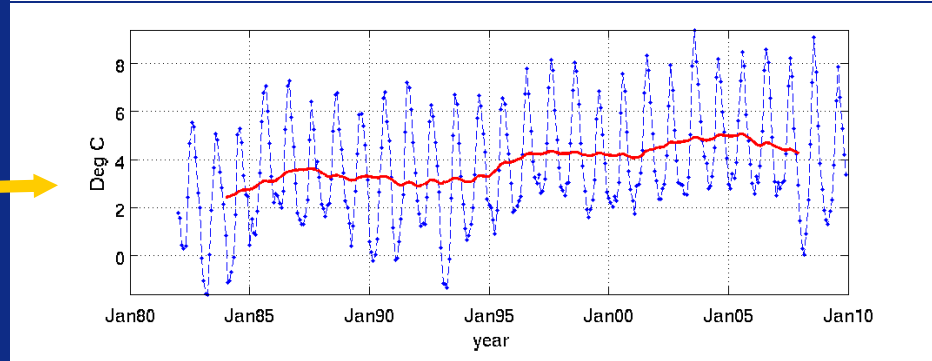
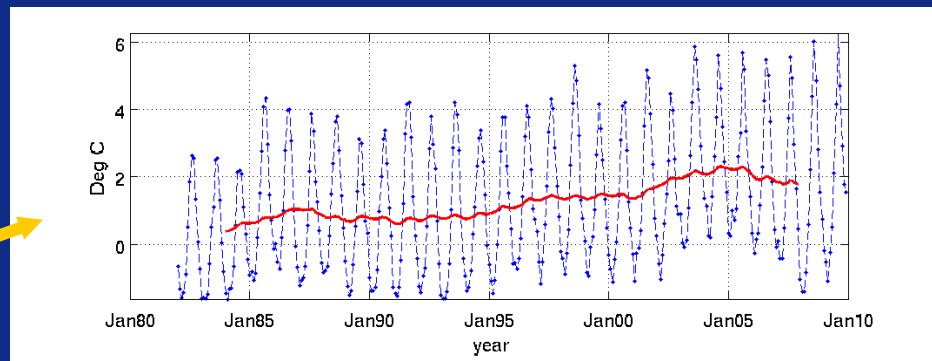
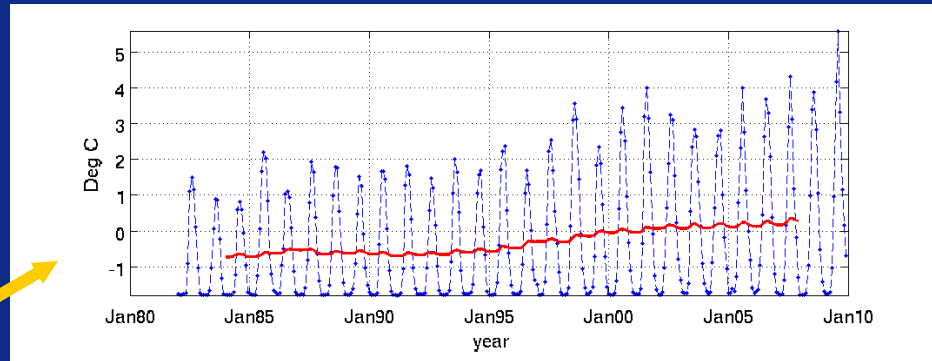
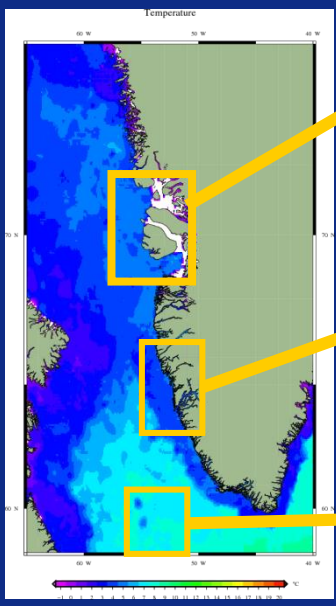
Atmospheric pressure





Regional SST variations

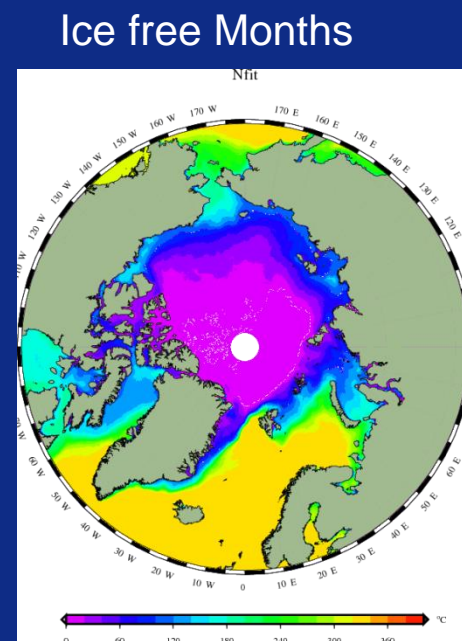
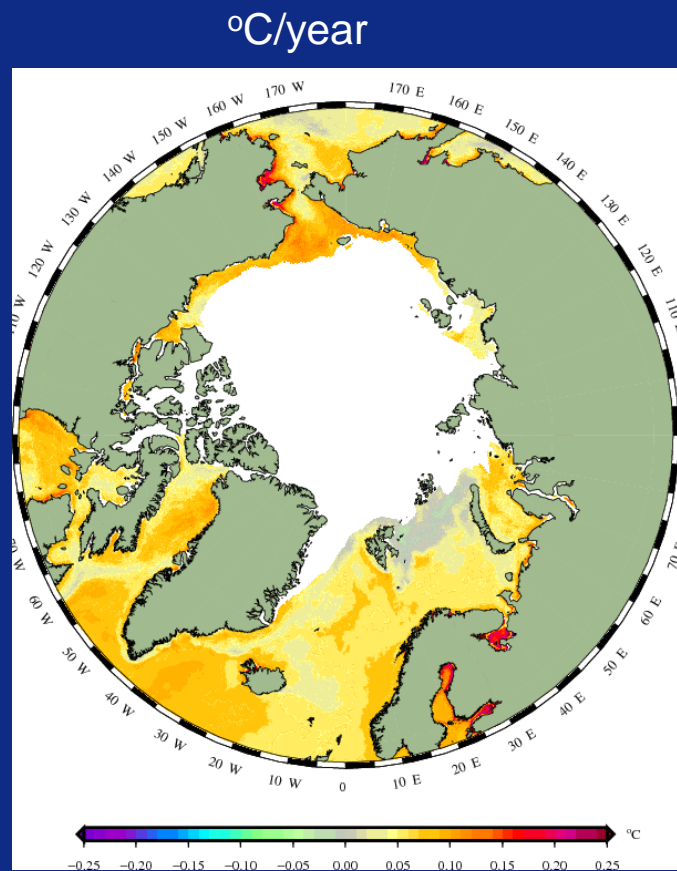
- 3 regions
 - Disko
 - Nuuk
 - Labrador Sea





Observed trends in SST

- Linear trends estimated from monthly averages (1982-2010)
- Positive or zero trends in all Arctic
- Largest in Baffin Bay and Chukchi Sea

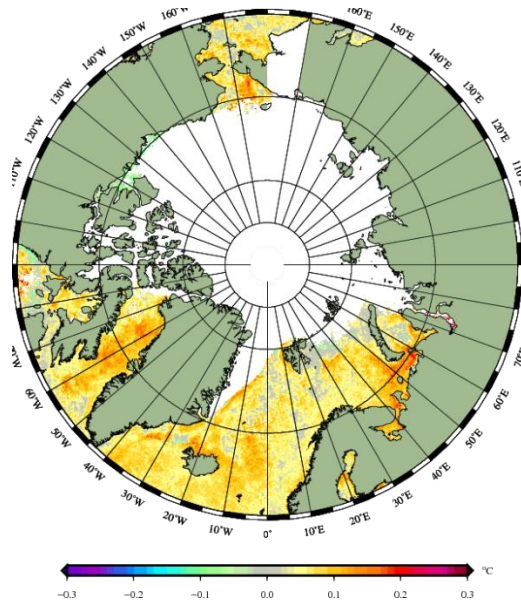




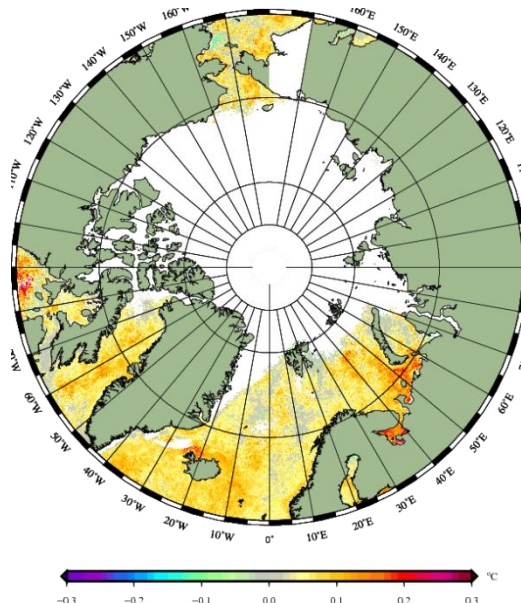
1992-2010 trends in SST (SON)

- Three estimates of trends for same periods
- Good agreement on spatial patterns

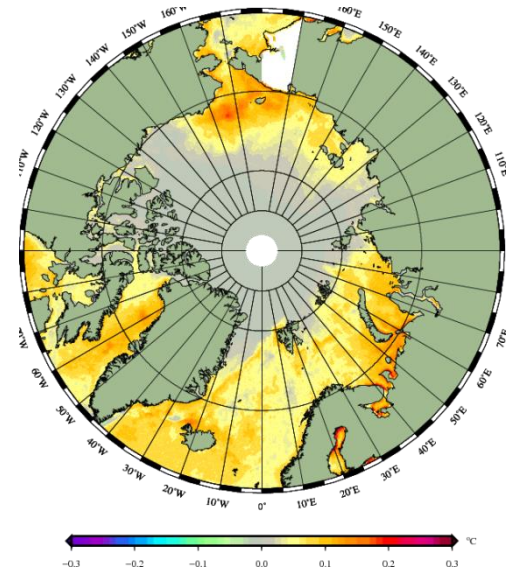
Arc



Pathfinder



OI





Conclusions

- Daily SST fields constructed from 1982-2010
- Spatial resolution 0.05 degrees
- Compared against in situ observations:
 - Bias = 0.1 °C
 - Standard deviation = 0.6
- Overall positive SST trends 1982-2010
- Good agreement between spatial pattern of trends in Pathfinder, Arc and OI products.
- Future work
 - Climatology for Arctic Ocean
 - More analysis of trends and consistency
 - MIZ performance