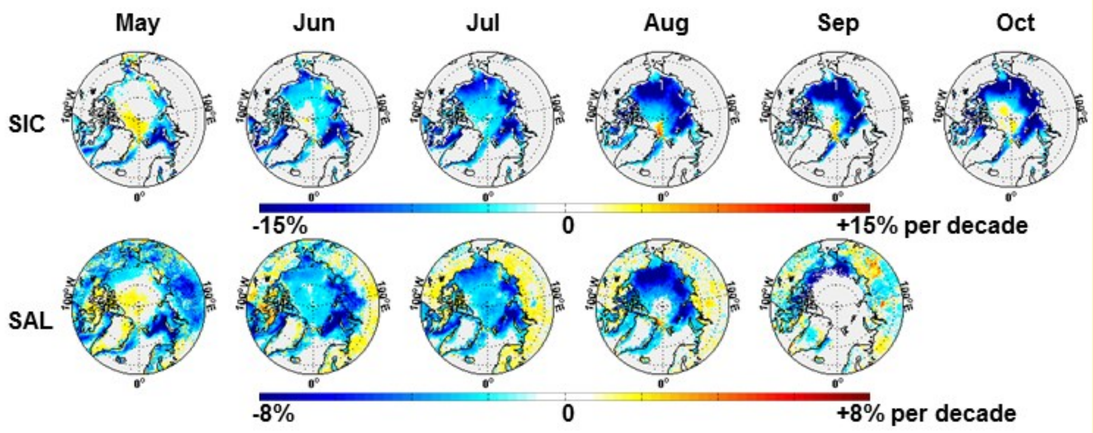
TOWARDS NEAR REAL-TIME MONITORING OF ARCTIC ATMOSPHERE USING SATELLITES: FOCUS ON EXTREME EVENTS

Abhay Devasthale, Atmosfärisk fjärranalys, FoU, SMHI, SE-601 79 Norrköping, Sweden. (abhay.devasthale@smhi.se)

The Arctic climate is changing rapidly

Declining trends in sea-ice concentrations and the surface albedo



- The sea-ice concentrations (SIC) are decreasing at unprecedented rates in the recent decades.
- The surface albedo (SAL) also shows corresponding decreases in the summer months.

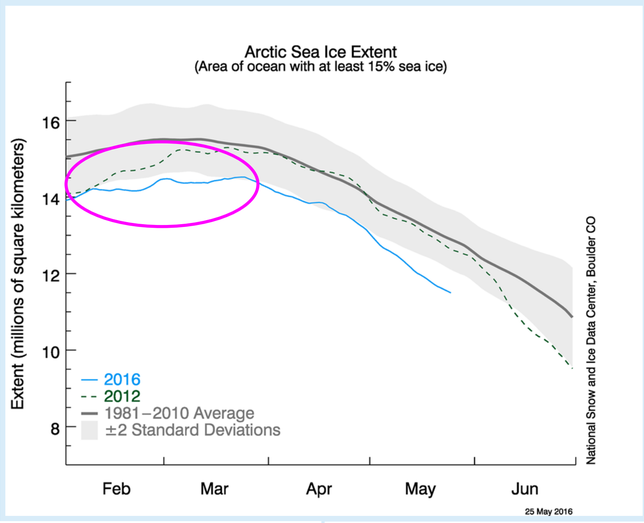
The extreme events have lasting impact on already thinning sea-ice

- The Arctic sea-ice extent has shrunk to record low values thrice in the last decade.
- In the backdrop of long-term thinning trend, these record events can have lasting impact of long-term sea-ice recovery.
- The studies show increasing control of atmospheric processes and their long-lasting impact on seasonal evolution and interannual variability of sea-ice.
- Among other processes, the moisture transport into the Arctic is considered to be a key process influencing sea-ice variability.
- The moisture transport can not only accelerate sea-ice melt, but it can also hinder seasonal sea-ice recovery in the autumn and winter months.
- Therefore, monitoring of the changes in the atmospheric thermodynamics is of critical importance.

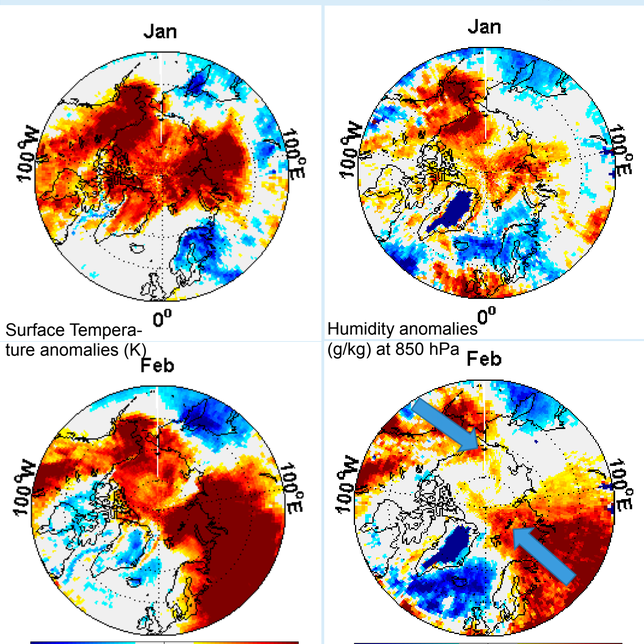
We are setting up a framework to monitor extreme anomalies in thermodynamical variables in the Arctic in near-real time

- We have archived nearly 15 years of temperature and humidity profiles over the Arctic derived from Atmospheric Infrared Sounder (AIRS), the hyperspectral instrument onboard Aqua satellite flying as a part of the A-Train convoy.
- These data are updated daily and monthly. The corresponding weekly and monthly climatologies are updated continuously.
- Python based system integrates data and the analyses are carried out.
- The system continuously monitors the temperature and humidity anomalies.
- If anomalies over a certain region (user defined) exceed a certain threshold (also user defined, for example, 2-sigma or 3-sigma), then the system should prompt an alert ,and compute, save and plot the anomalies of thermodynamical variables.
- The work is in progress to fully automatise the system and to integrate other useful satellite datasets.
- **Here, we provide examples of two extreme events to demonstrate the usefulness of such monitoring.**

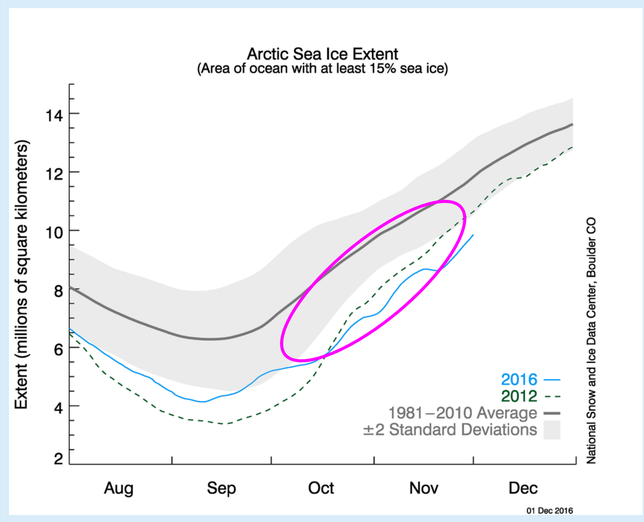
Example #1: Sea-ice extent in the winter/spring of 2015-16 was under 2-sigma levels



- In Jan and Feb 2016, the monthly mean surface temperature anomalies were 4-8K higher than climatology in the Kara Sea and Beaufort Sea regions.
- The circulation patterns clearly favoured moisture transport over these sectors, visible in the increased humidity anomalies at 850 hPa.
- The resulting longwave forcing at the surface was strong enough to hinder sea-ice growth.



Example #2: Sea-ice extent in autumn of 2016 was under 3-sigma level. Record low extent for Nov month.



- The regions that experienced influx of heat and moisture (Pacific and Atlantic sectors in October and Atlantic sector and Central Arctic in November) showed lower tropospheric warming reaching up to 7K in monthly averages.
- As a result, downward LW flux anomalies were upward of 25 w/m2 over areas that experienced slowest sea-ice recovery.
- The surface temperature anomalies exceeded 3-sigma levels.