Development of monitoring by variables (beyond atmosphere and sea ice), intervals (beyond season), origin (in-situ/ reanalysis), formats (graphics/ text/WIS)

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WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

New information sources, techniques and variables

New information sources implemented at AARI by January 2020 for monthly and seasonal monitoring

- ❖ Reanalysis:
    - ❖ ERA5 - Monthly averaged data on single/pressure levels from 1979 to present (atmosphere, snow, ocean)
    - ❖ MERCATOR - Global Ocean 1/12° Physics Analysis and Forecast updated Daily (ocean)
- ❖ Stations combined with analysis
    - ❖ Greater amount of obs from coastal stations on panarctic scale
    - ❖ ArcticGRO (rivers)
    - ❖ CALM (permafrost active layer depth)

New techniques
- ❖ Scripts in R allowing automatic production of graphs both for the Arctic and Antarctic
- ❖ Updates weekly (sea ice, atm), monthly (atm), seasonally (other)
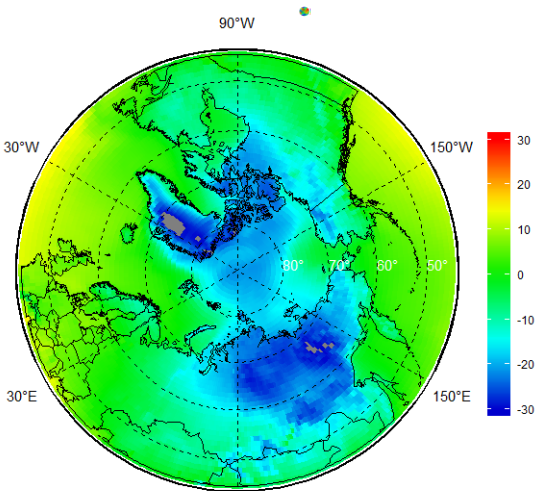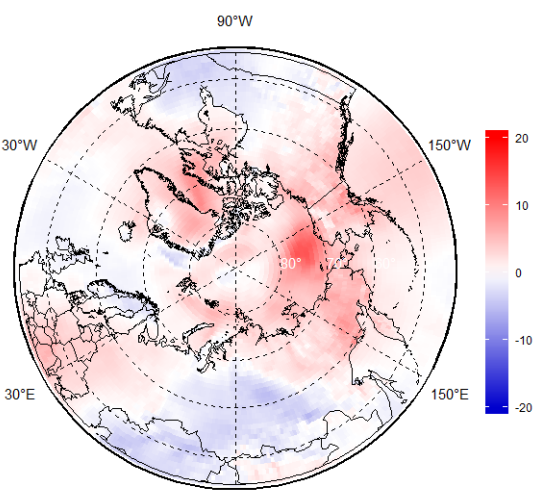- ❖ Validation (jointly with HMC Moscow, YOPP ?)

Atmosphere

❖ **Surface air temperature**
    ❖ **Stations: GTS**
    ❖ **Reanalysis: NCEP, ERA5**
❖ **Precipitation**
    ❖ **Stations: GTS**
    ❖ **Reanalysis: NCEP, ERA5**
❖ **Geopotential heights (500, 200, 50 Hpa)**
    ❖ **Reanalysis: NCEP, ERA5**
❖ **Wind (daily mean, maximum in gust)**
    ❖ **Reanalysis: ERA5**
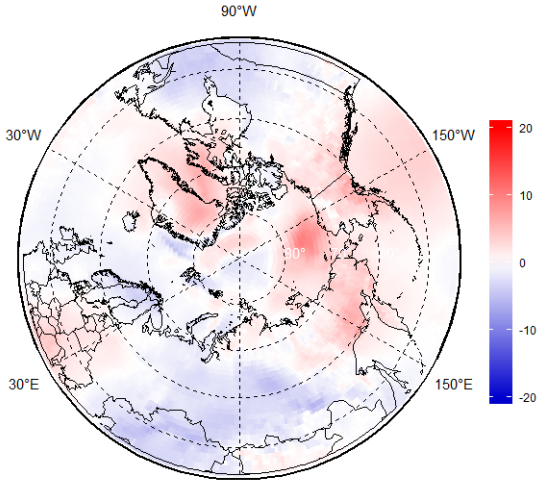
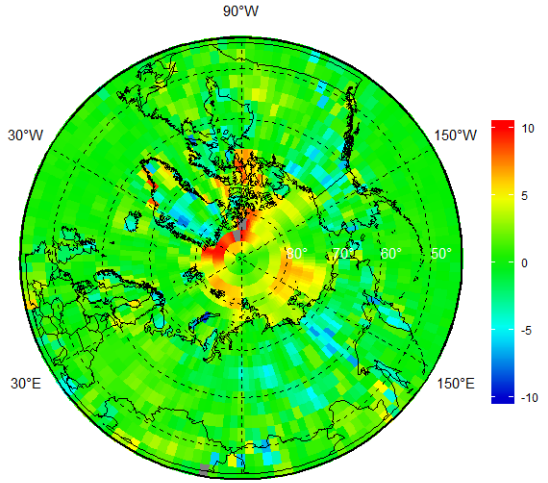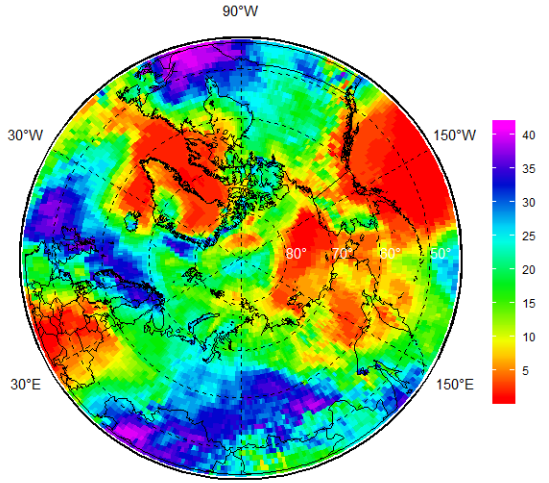**Weather ∙ Climate ∙ Water**

Atmosphere: SAT ERA5

Nov 2019
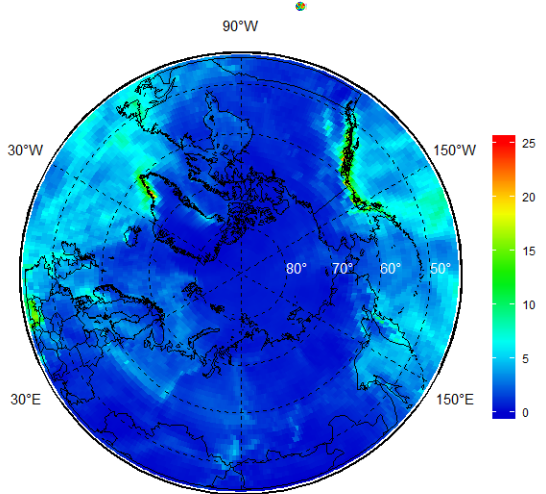
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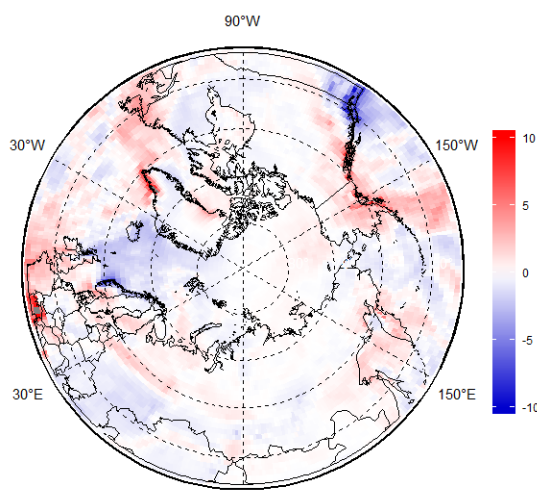
Anom 2000-2019

ERA5 – NCEP

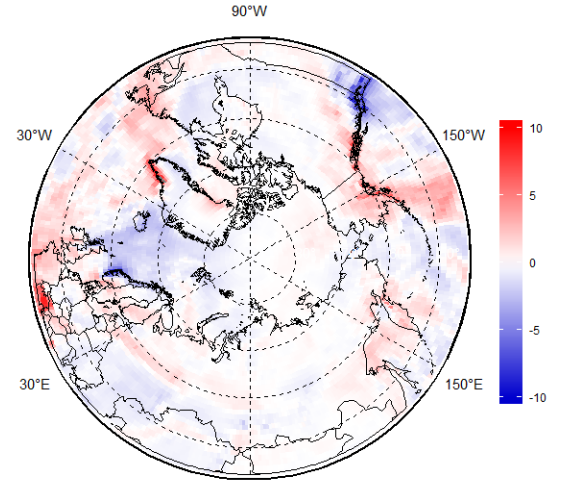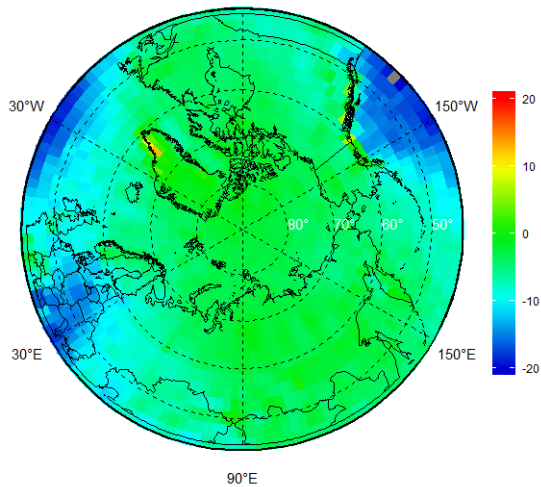Rank Nov'2019

Rank SON 2019

Weather · Climate · Water
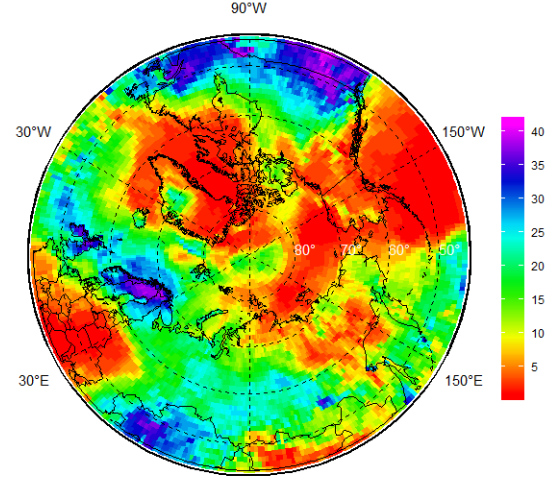
Atmosphere: Prec ERA5

Nov 2019
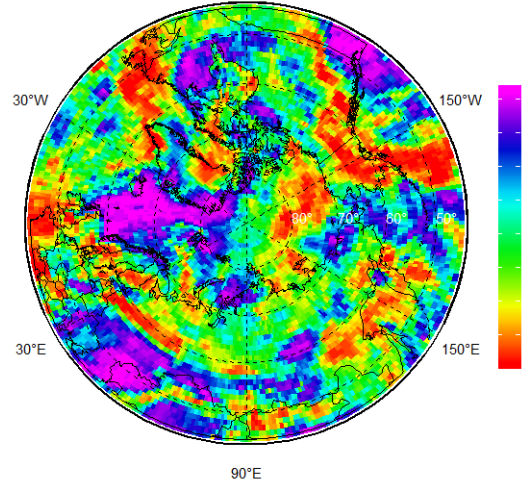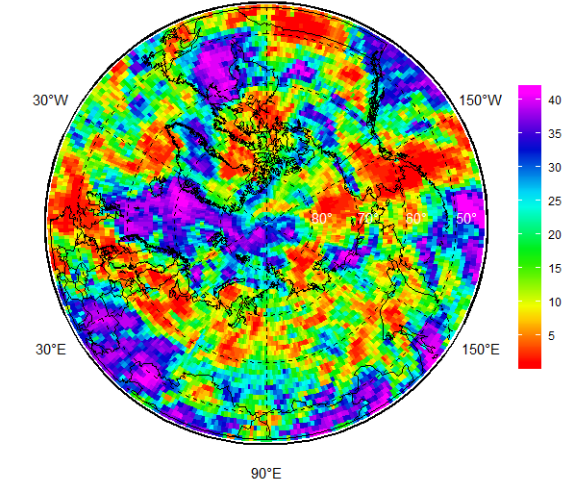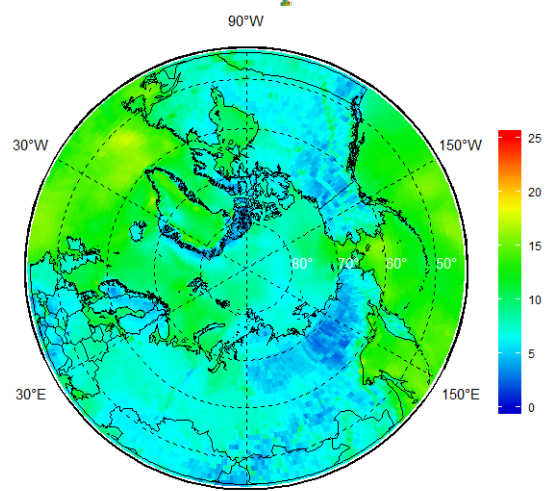
Anom 1981-2010

Anom 2000-2019

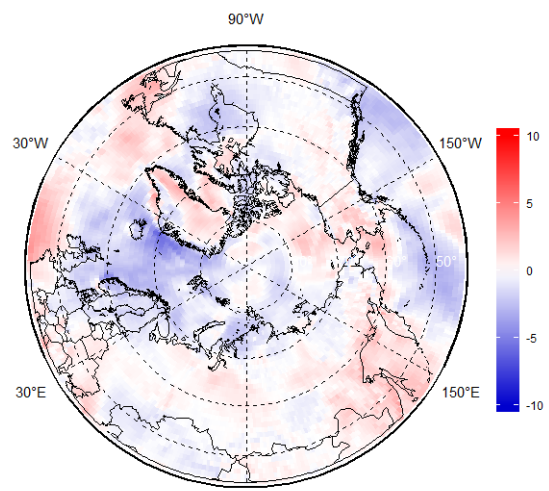ERA5 – NCEP

Rank Nov'2019

Rank SON 2019
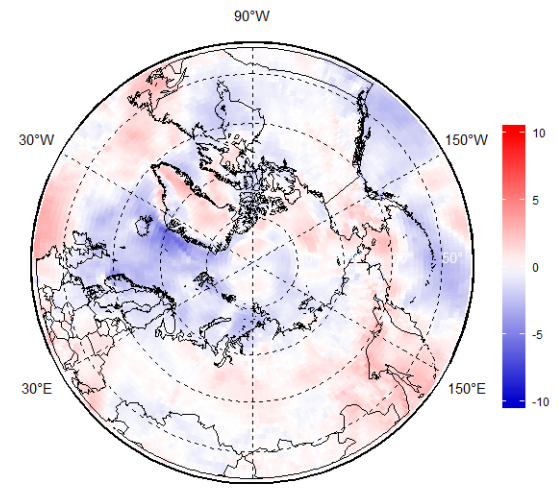
Weather · Climate · Water

Atmosphere: Wind gust ERA5

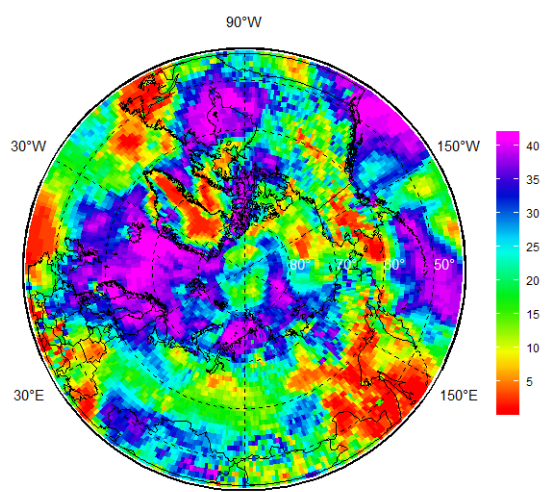Nov 2019

Anom 1981-2010

Anom 2000-2019

Rank Nov'2019

Rank SON 2019

Weather · Climate · Water
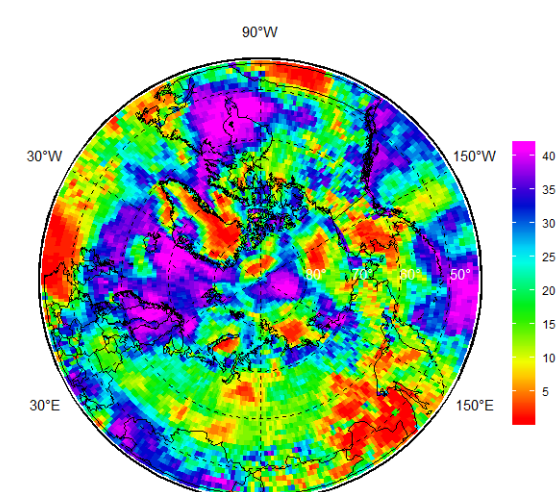
Sea ice

❖ **Ice extent and area**
  ❖ **Weekly ice extent and area for the major and all regions of the Arctic and Antarctic**
❖ **Ice conditions**
  ❖ **Ice charting**
  ❖ **Stations: sea ice phenomena for selected stations from nat'l ice services**
❖ **Ice thickness**
  ❖ **Stations: maximum ice thickness by the end of freezing period for selected stations from nat'l ice services**
  ❖ **Reanalysis: DMI, PIOMAS**
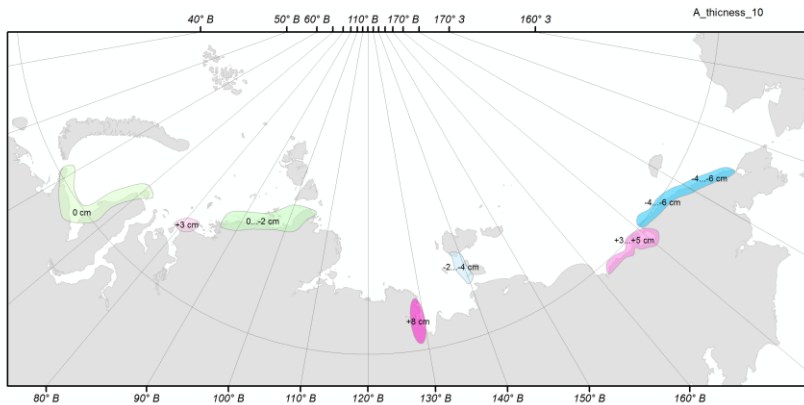
Weather • Climate • Water
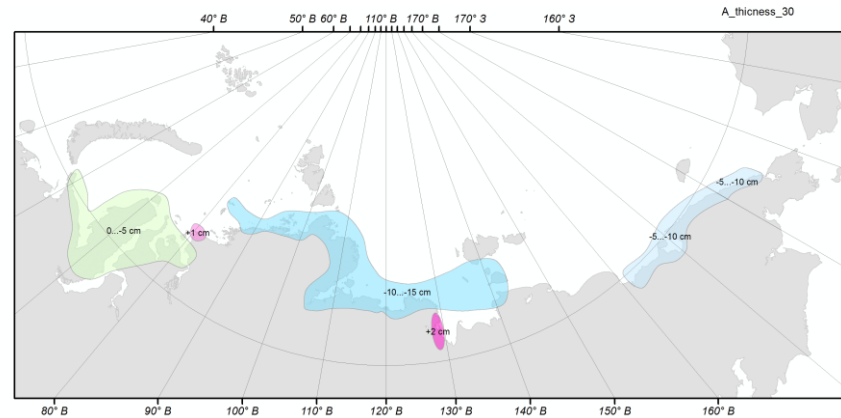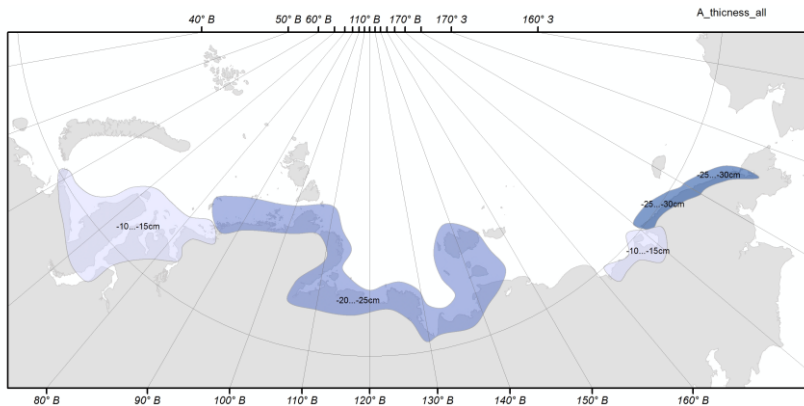
Ice conditions: 17-21 Jan 2020
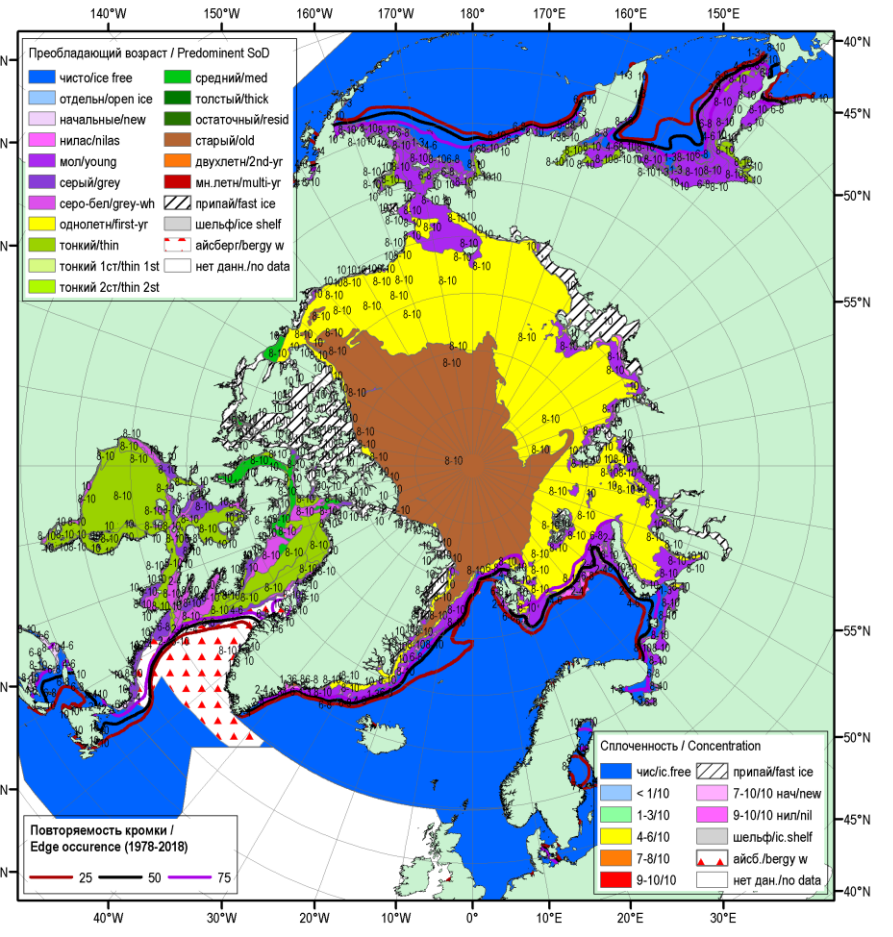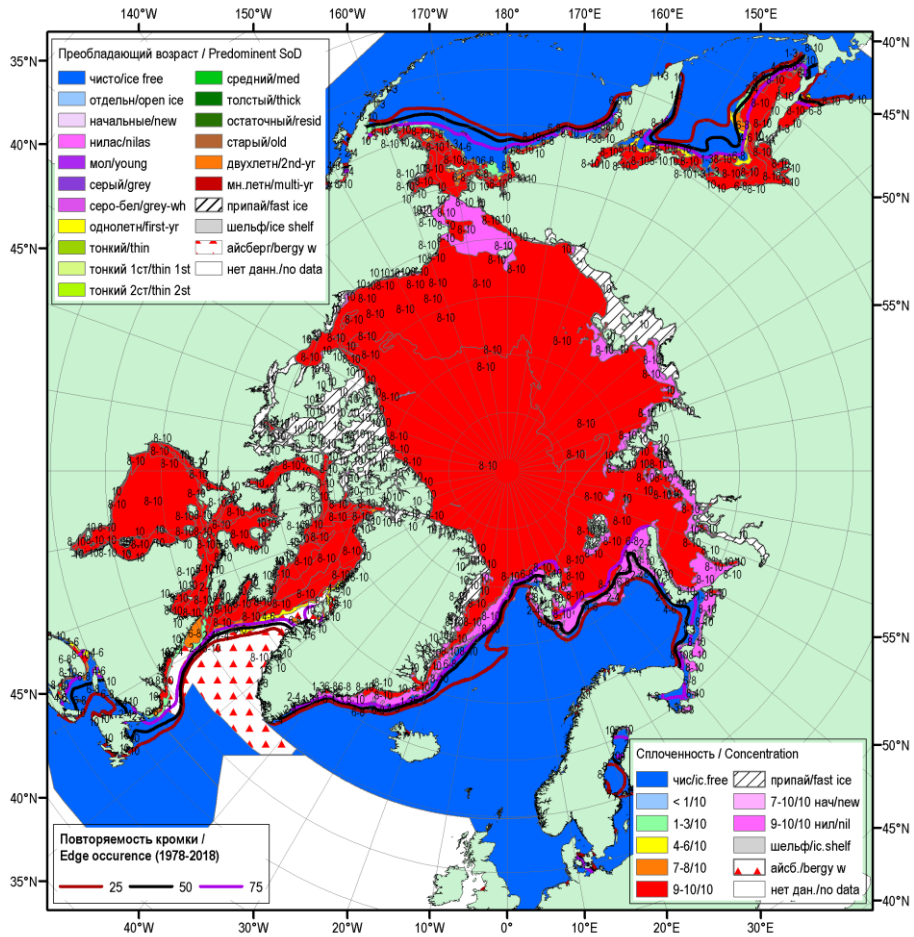
Sea ice: maximum ice thickness

EuAsia anomaly in 2019 against 2009-2019

EuAsia anomaly in 2019 against 1990-2019
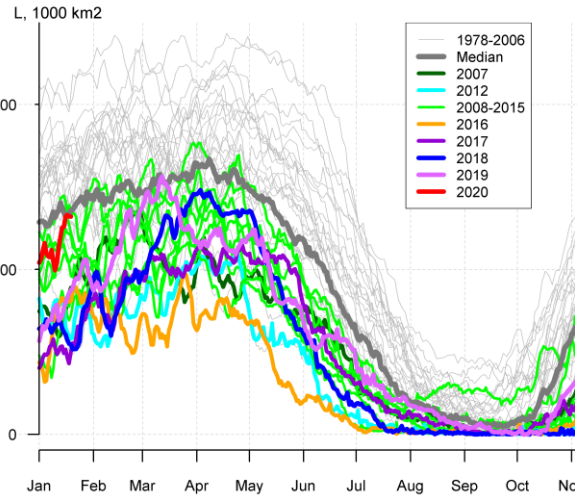

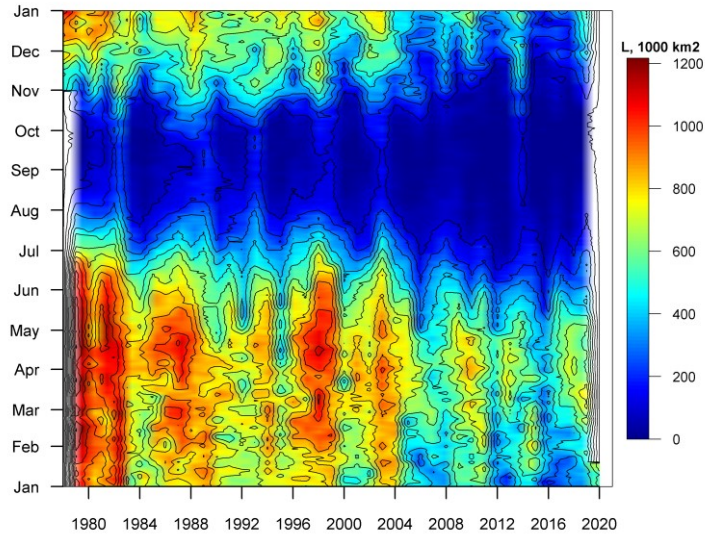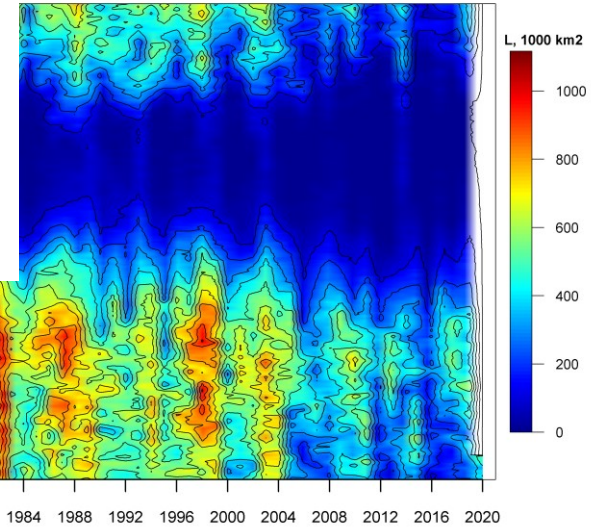**EuAsia anomaly in 2019 against whole period**

Weather • Climate • Water

Sea ice: extent, area

Barents sea, extent

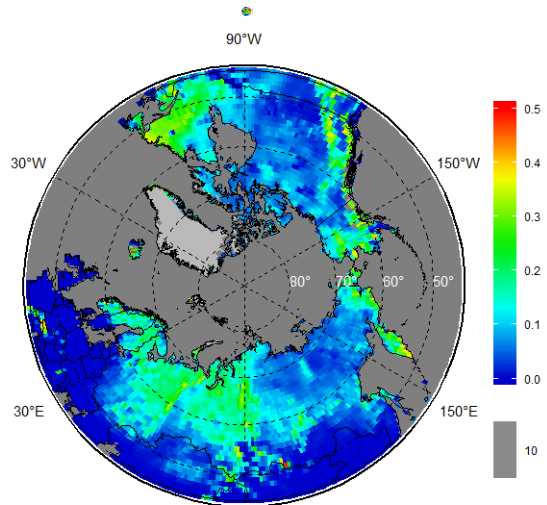Barents sea, extent
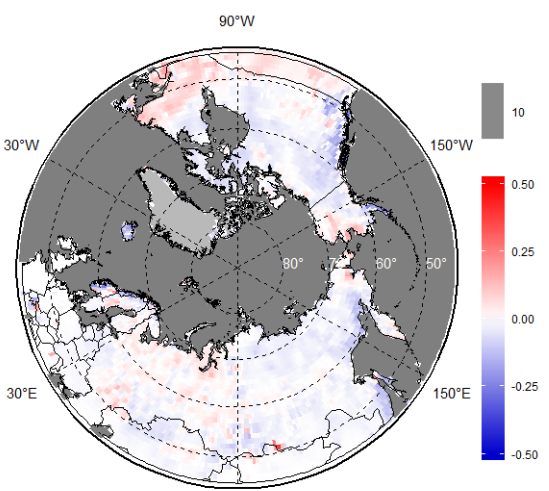

Barents sea, area

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Snow

❖ **Snow height**
  ❖ **Combined stations and satellites: SnowWatch**
  ❖ **Reanalysis: ERA5**
❖ **Snow extent**
  ❖ **Combined stations and satellites: SnowWatch**
  ❖ **Reanalysis: ERA5**
❖ **Snow water equivalent**
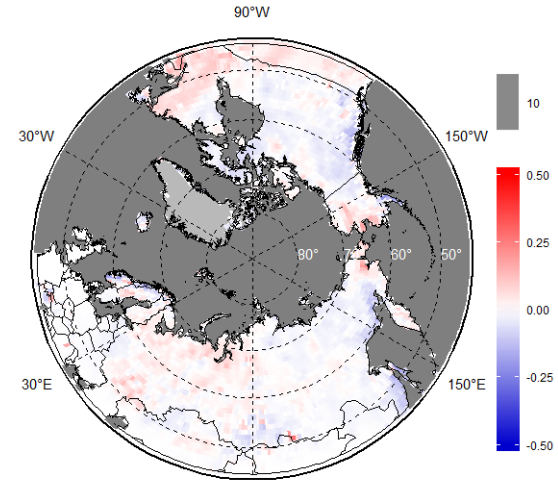 ❖ **Combined stations and satellies: SnowWatch**
  ❖ **Reanalysis: ERA5**

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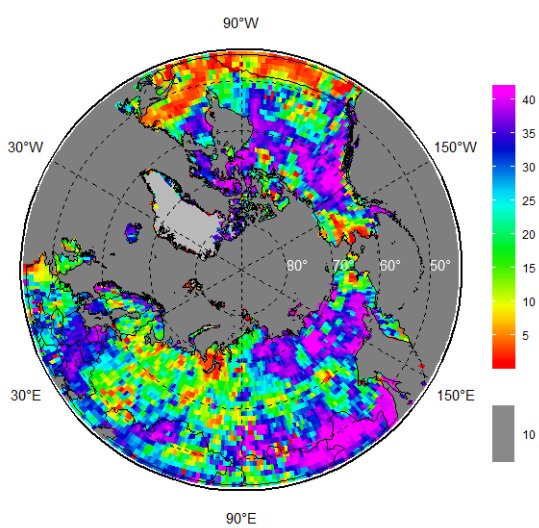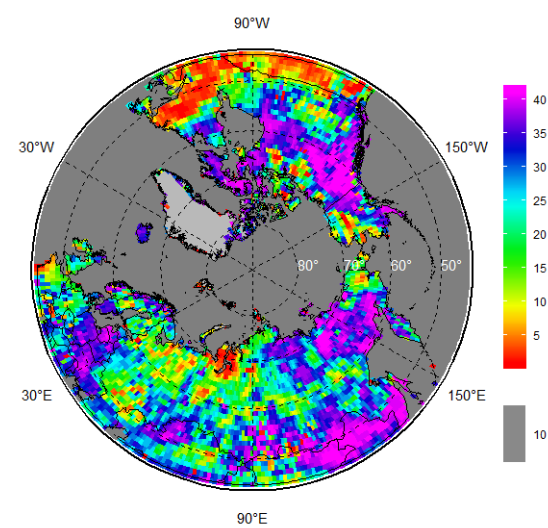
Snow: height ERA5

Mar 2019

Anom 1981-2010

Anom 2000-2019

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Rank Mar'2019
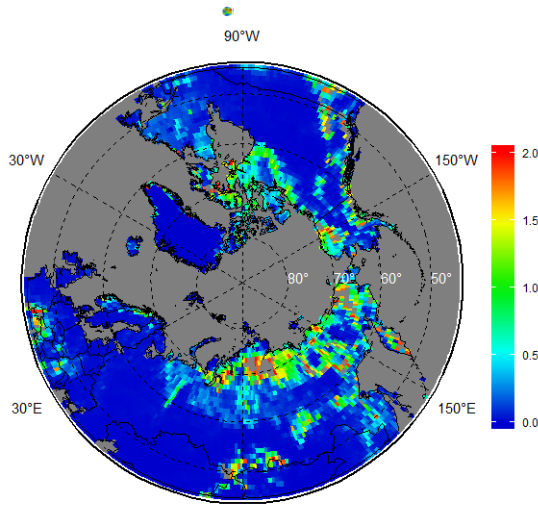
Rank MAM 2019

Weather · Climate · Water

Rivers

❖ **Discharge**
   ❖ **Stations (and analysis): ArcticGRO (Arctic Great Rivers Observatory)**
   ❖ **Reanalysis: ERA5**
❖ **Surface runoff**
   ❖ **Reanalysis: ERA5**
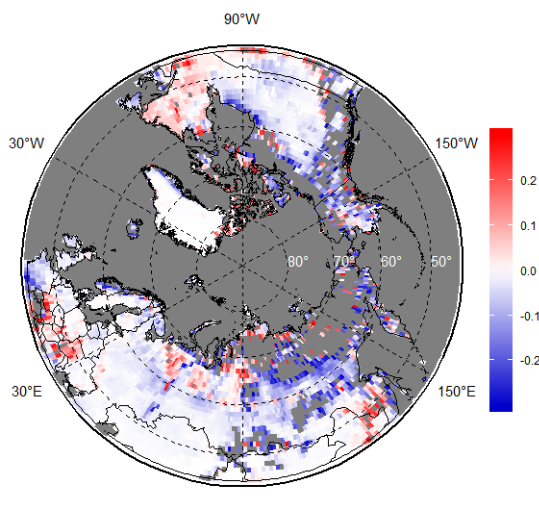

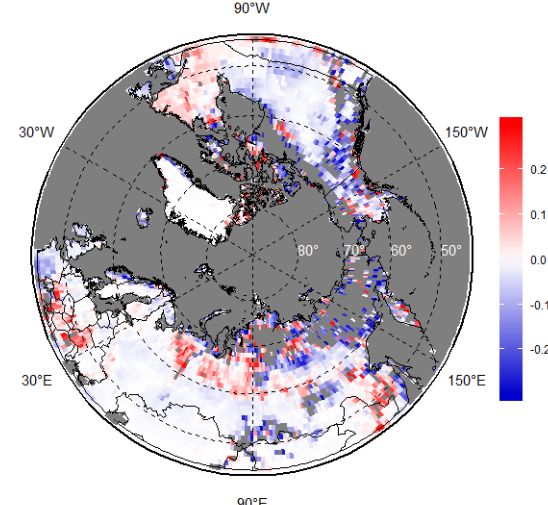**River basins with discharge values available from ArcticGRO**

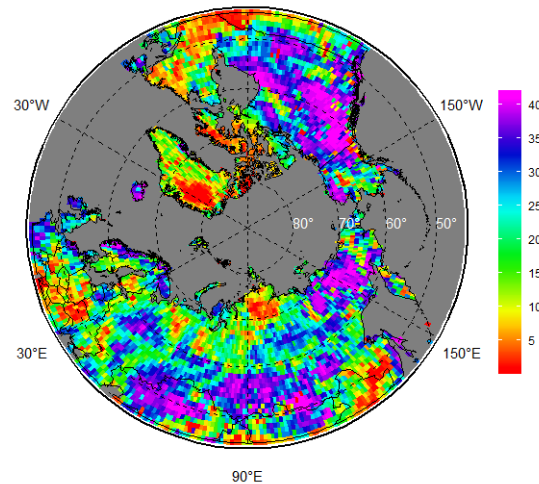**Weather · Climate · Water**

River: surface run-off ERA5

May 2019

Anom 1981-2010

Anom 2000-2019

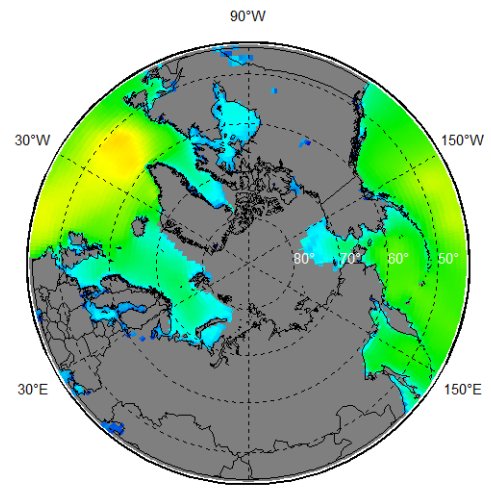–

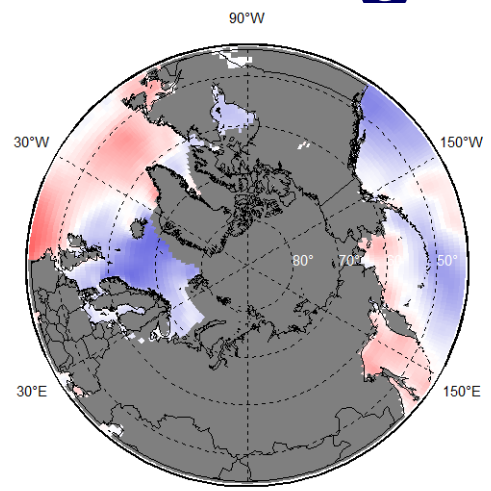Rank May'2019

Rank MAM 2019

Weather · Climate · Water
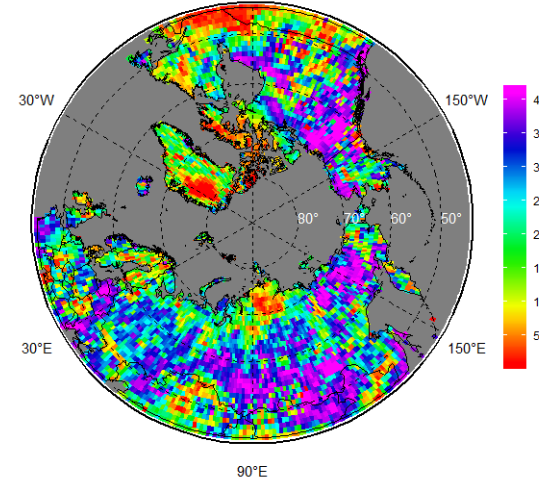
Ocean

❖ **Waves (wind and swell height)**
  ❖ **Reanalysis: ERA5**
❖ **Sea surface temperature**
  ❖ **Reanalysis: ERA5**
❖ **Heat capacity (20, 50, 100 meters etc)**
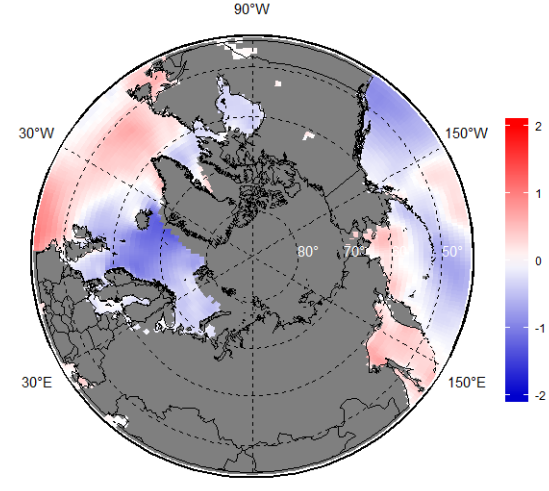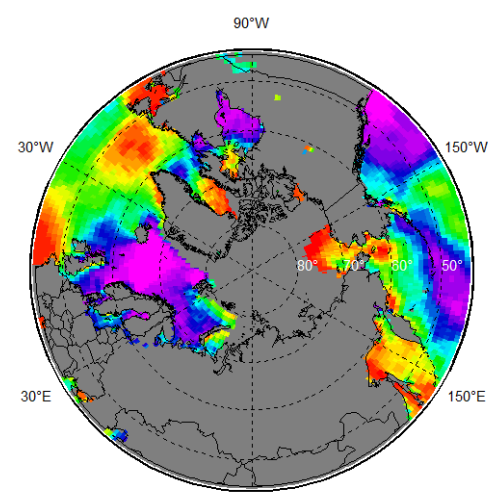 ❖ **Reanalysis: MERCATOR analysis**

Ocean: wind+swell height ERA5

Nov 2019
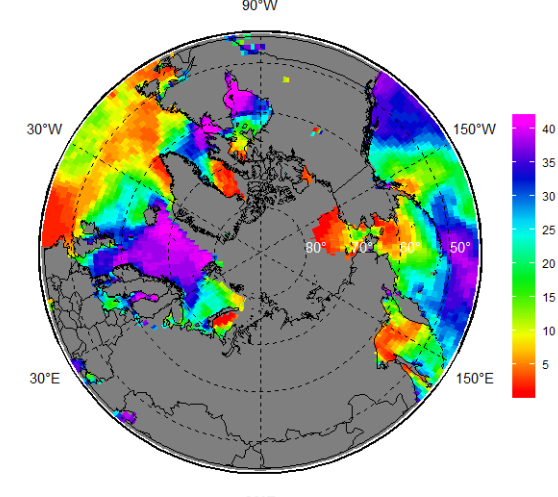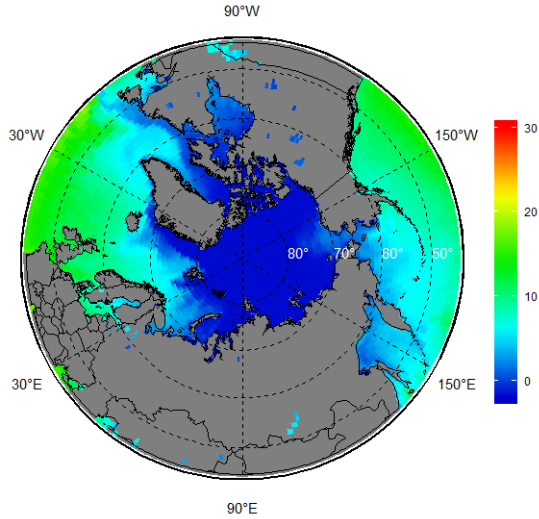
Anom 1981-2010

Anom 2000-2019
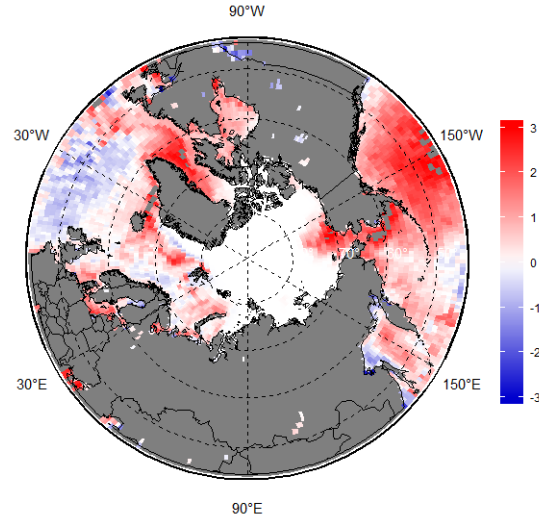
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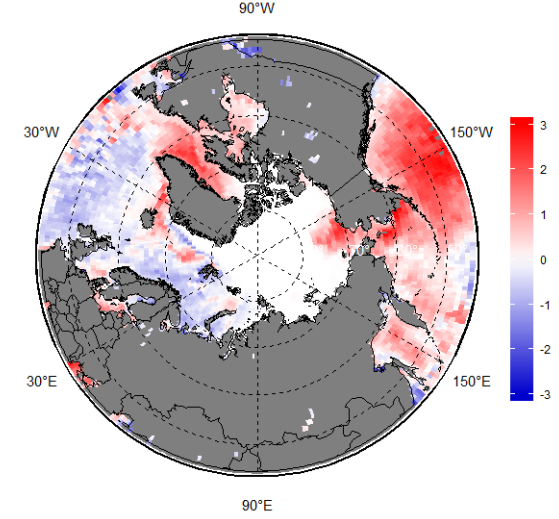Rank Nov'2019

Rank SON 2019

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Ocean: SST ERA5

Nov 2019

Anom 1981-2010
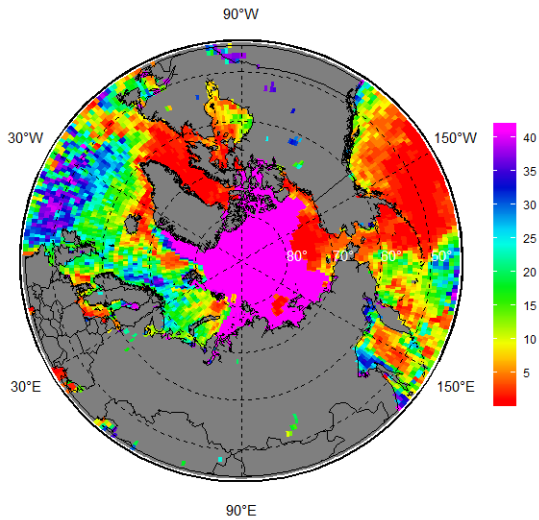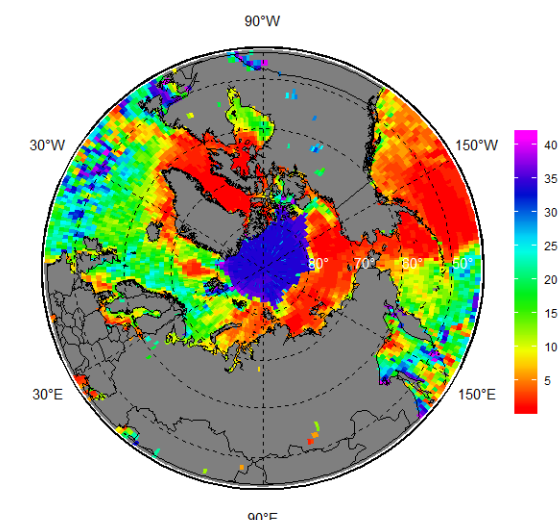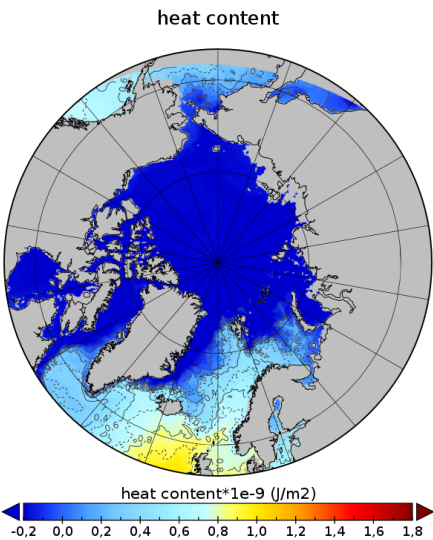
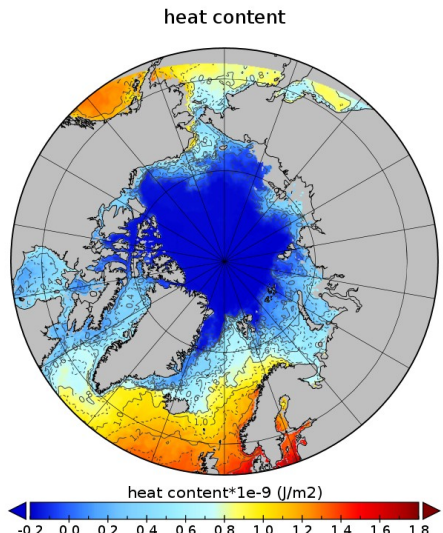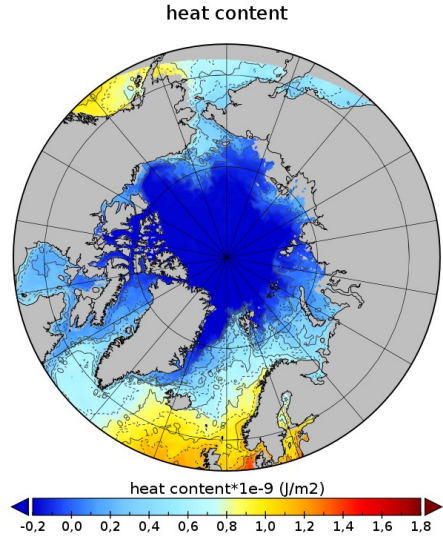Anom 2000-2019

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Rank Nov'2019

Rank SON 2019

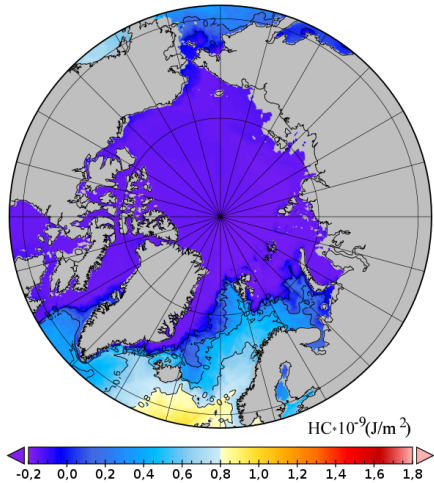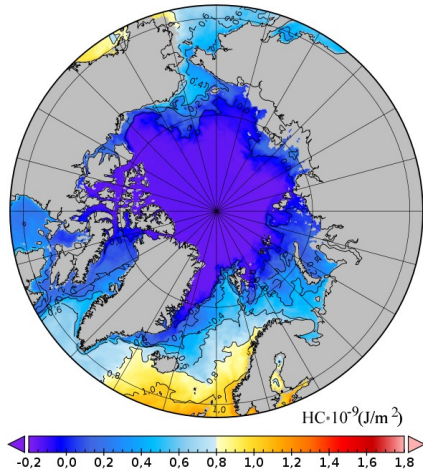# Ocean: heat content upper 20 m, MERCATOR

Mav 2019

Aug 2019

Oct 2019

May, diff 2019 - 2004

Oct, diff 2019 - 2004

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Permafrost

❖ **Active layer depth (ALD)**
  ❖ **Stations: CALM**
❖ **Soil temperature by single layers**
  ❖ **Reanalysis: ERA5**

Positions of CALM network 2019
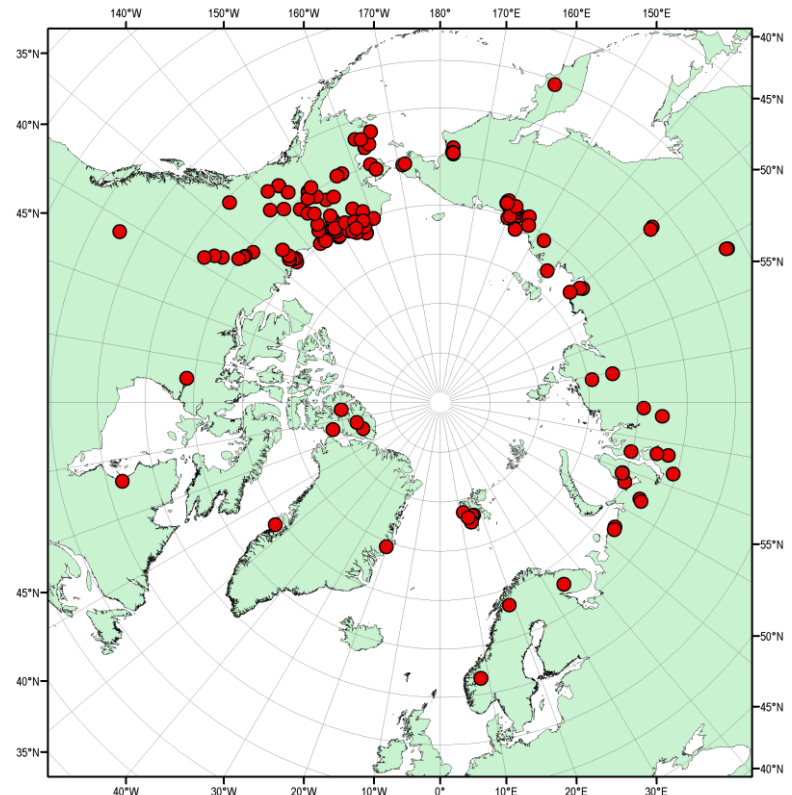
Questions to be answered

❖ Stations and in-situ data
  ❖ Ensure the quality checked data is panarctic (e.g. not for Eurasia or Canada only) and timely for all kinds of observations, e.g.
    ❑ surface obs become available with delay of ~1 week for the last full month from NOAA but several weeks from Roshydomet Obninsk, does additional QC is significant for ArcRCC summaries ?
    ❑ Availability and timeliness of coastal obs is still a problem
    ❑ CALM and ArcticGRO look to provide timely obs now but the snow obs timeliness is unclear
❖ Reanalysis:
  ❖ Cooperate with communities making validation (e.g. YOPP projects) so that we may know to what extent we may trust the variables
  ❖ Choose the best from the point of accuracy, resolution, variables, timeliness, e.g. ERA5 could be the most modern for surface and pressure levels but delay is currently close to 4 weeks (for analysis) opposite to NCEP-NCAR (several days)
  ❖ What are applications for the growing set of variables ?
❖ Reference periods
  ❖ At the moment different for different variables
❖ License, umbrella, terms of use