Project: **474,** Project title: **Laptev**
Project lead: **Günther Heinemann,** Report period: **2021-01-01 to 2021-08-31**

The project focuses on simulations with the atmospheric climate model COSMO-CLM (CCLM) adapted for the Arctic (Heinemann et al. 2021, Heinemann 2020) with 15km (C15) and 5km (C05) for the Arctic (C15 being part of Arctic CORDEX). Climate runs with C15 simulations for recent climate and for scenarios the end of the 21st century are nested in AWI-CM CMIP6 runs using sea ice information from the sea-ice/ocean model FESOM of AWI-CM. Sea ice data are available on a variable grid with a resolution of 10-25km for the Arctic. These runs are evaluated together with the hindcast of C15, which is nested in ERA-Interim/ERA5 data for 1987-2019 and uses sea ice information from microwave satellite data and ice thickness from PIOMAS.

With the granted resources for 2021 most of the planned simulations were or will be possible. C15 runs were rerun with a new sea ice model and tile approach for the winter periods 1978-2012 and 2070-2100 (SSP5-8.5). A study with tests of new turbulence parameterizations and a new sea ice model was published (Heinemann et al. 2021). Runs with C05 for the Laptev Sea were performed for 2014-2020, a verification study with long-term (3 years) of SODAR/RASS data at Cape Baranov (Bolshevik Island, Siberia) is in progress. C15 hindcast data were used for a model-based climatology of gap flow jets in the Nares Strait (Kohnemann and Heinemann 2021). First runs for the MOSAiC drift of Polarstern for the period 2019-2020 have been performed using C15 with different sea ice data sets.

Fig.1 shows the climate change signal for the 2m-temperature and the 10m-wind speed for SSP5-8.5. The climate change signal is the difference between the periods 2070-2100 and 1978-2012. The decrease in sea ice concentration (SIC) is strongest in the regions of the Barents and Kara Sea, which leads to the strongest warming. A delayed freeze-up is simulated for the Siberian shelf seas, and a decrease of ice thickness to values of less than 1m in January is present also in the central Arctic. The climate change signal for the wind speed shows an increase particularly in areas with a decrease in SIC.

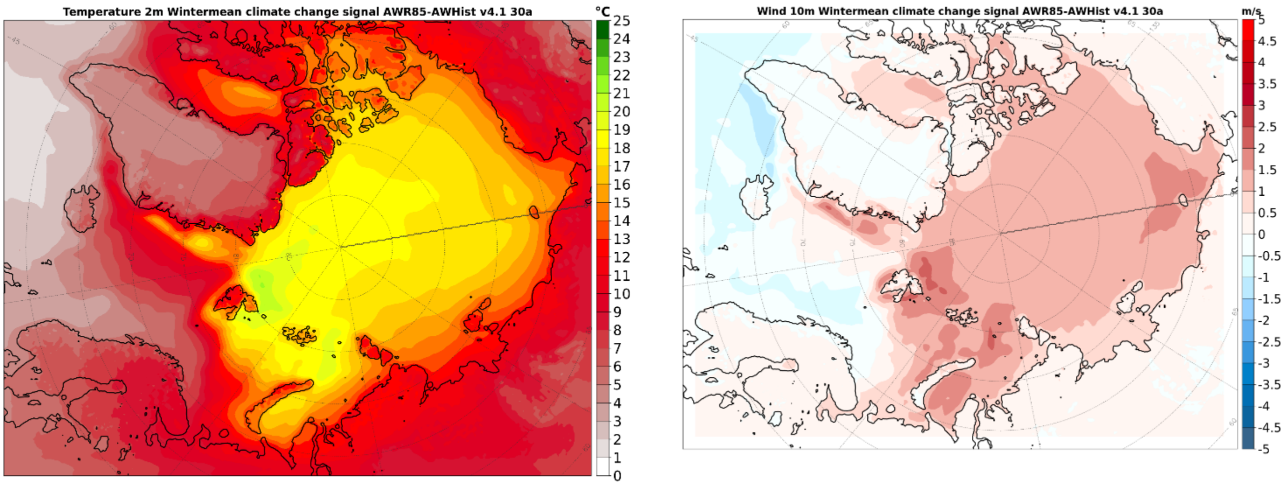

Fig.1: Wintertime (Nov.-April) climate change signal for the 2m-temperature and the 10m-wind speed for SSP5-8.5.

Literature

Heinemann, G., 2020: Assessment of regional climate model simulations of the katabatic boundary layer structure over Greenland. Atmosphere 11, 571, doi:10.3390/atmos11060571.

Heinemann, G., Willmes, S., Schefczyk, L., Makshtas, A., Kustov V., Makhotina, I., 2021: Observations and simulations of meteorological conditions over Arctic thick sea ice in late winter during the Transarktika 2019 expedition. Atmosphere 12(2), 174, doi: 10.3390/atmos12020174.

Kohnemann, S., Heinemann, G., 2021: A Climatology of wintertime low-level jets in Nares Strait. Polar Research, 40, 3622, doi: 10.33265/polar.v40.3622