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The role of atmospheric forcing in Laptev Sea sea-ice production in the Finite Element Sea-ice Ocean Model (FESOM)

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The Arctic Laptev Sea is an important region for the creation of sea ice, contributing 40% to the sea-ice mass transported in the Transpolar Drift. Its hydrography is strongly influenced by the freshwater input from the Lena and Khatanga rivers and by the Vilkitsky Strait Current, which transports water masses originating in the Kara Sea. The magnitude of this Kara Sea freshwater input strongly depends on the wind fields in the region. These are also important for the opening of polynyas, the heat exchange between ocean and atmosphere and the depth of the oceans mixed layer, thereby influencing sea-ice production in the Laptev Sea.
Recent studies have shown that the horizontal resolution of atmospheric models greatly influences maximum wind speeds especially near orographic features with strong slopes and that atmospheric models with increased resolution represent measured wind extremes more precise than coarse-resolution reanalysis data sets.
As output from atmospheric models and reanalysis data sets are frequently used as atmospheric forcing for ocean models like FESOM the increased wind speeds might significantly alter the ocean atmosphere sea-ice interaction and lead to significantly different rates of sea-ice production.
To investigate the influence of the forcings resolution on sea-ice production and hydrography in the Laptev Sea two high-resolution FESOM runs were performed. One uses ERA-interim reanalysis data with a resolution of roughly 79 km as forcing. The second run uses output from a CCLM run nested within ERA-interim with a resolution of 15 km for the Laptev and Kara Sea region. Both realizations were run over a time period of 30 years from 1987 to 2017.
Comparison of the two runs show a significant increase of wind speed in the vicinity of Severnaya Zemlya, especially in the Shokalsky Strait. This leads to a local increase in the polynya sea-ice production due to increased sea-ice advection and heat loss from the ocean.