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Changes in Arctic sea ice distribution and variability during the next decades

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The current and future distribution of sea-ice in the Arctic is of interest to various scientific and non-scientific groups e.g. policymakers, fisheries and shipping companies. Their focus is on the development during the next decades. The assessment of Arctic sea-ice is challenging due to internal variability being superimposed on the general trend. On inter-annual and decadal time scales, large patterns such as the Arctic Oscillation and the North Atlantic Oscillation are suspected to play an influencing role.

Sea-ice data derived from satellites are limited to the present and the past three decades. To understand the sea-ice variability and its causes, longer time periods need to be considered. General circulation models (GCM) offer the possibility to produce long time series and to extent these into the future by applying greenhouse gas emission scenarios. High spatial resolution is crucial to represent properly the formation and transport of sea-ice as well as the underlying ocean. Within the ACCESS project, a high resolution (0.25°) regional coupled ocean-sea ice model is used to simulate the current and future Arctic sea-ice. We use a specific set-up of the GCM of the Massachusetts Institute of Technology, MITgcm. It uses atmospheric reanalysis data as forcing for hindcasts and validation experiments. In addition, atmospheric output from global coupled GMCs from the coupled model intercomparison projects (CMIP) CMIP3 and CMIP5 are applied to our regional model for downscaling experiments. These downscaling experiments cover a time range of several decades in the past as well as into the future, allowing us high resolution analysis of sea-ice on inter-annual and decadal time scales and to identify its variability.