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Prediction skill of Arctic sea ice in decadal climate simulations of the EC-Earth3 model

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Arctic sea ice variability and long-term trend play a major role in affecting the climate of polar and lower latitudes via complex coupling with the polar atmospheric circulation and the North Atlantic Ocean circulation. Moreover, sea ice conditions in the Arctic have direct impacts on socio-economy (e.g. the key shipping regions) and on the ecosystem. Understanding and improving predictions of Arctic sea ice on seasonal to decadal time scales is therefore crucial. We investigate the skill of decadal climate prediction simulations of the EC-Earth3 model (T255L91, ORCA1L75) with a focus on Arctic sea ice. In line with the protocol for the CMIP6 Decadal Climate Prediction Project (DCPP), we launched 59 hindcasts/forecasts from 1960 to 2018. Each hindcast/forecast has 15 ensemble members which were initialized on 1 November and integrated for 10 years (+ 2 months). Anomaly initialization approach for the ocean and sea-ice (based on data from the ORA-S5-reanalysis) and full-field initialization for the atmosphere/land surface (based on ERA-Interim/ERA-Land) were applied. We first present a comparison of our hindcasts to observations for global key parameters and provide quantitative estimates of hindcast skill by using common deterministic metrics such as correlation and the Mean Squared Error Skill Score. We focus particularly on the skill regarding sea ice concentration and area in the Arctic's sub-basins and its relation to the temperature and circulation of lower troposphere as well as the mean state of the ocean outside the Arctic. We also explore relevant processes and how the ocean state and natural climate variability can affect our prediction skills to improve the prediction system.

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