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Sea ice representation in CMIP6 simulations with EC-Earth3-Veg

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In this study, we compare the sea ice in ensembles of historical and future simulations with EC-Earth3-Veg to the sea ice of the NSIDC and OSA-SAF satellite data sets. The EC-Earth3-Veg Arctic sea ice extent generally matches well to the observational data sets, and the trend over 1980-2014 is captured correctly. Interestingly, the summer Arctic sea ice area minimum occurs already in August in the model. Mainly east of Greenland, sea ice area is overestimated. In summer, Arctic sea ice is too thick compared to PIOMAS. In March, sea ice thickness is slightly overestimated in the Central Arctic but in the Bering and Kara Seas, the ice thickness is lower than in PIOMAS.

While the general picture of Arctic sea ice looks good, EC-Earth suffers from a warm bias in the Southern Ocean. This is also reflected by a substantial underestimation of sea ice area in the Antarctic.

Different ensemble members of the future scenario projections of sea ice show a large range of the date of first year with a minimum ice area below 1 million square kilometers in the Arctic. The year varies between 2024 and 2056. Interestingly, this range does not differ very much with the emission scenario and even under the low emission scenario SSP1-1.9 summer Arctic sea ice almost totally disappears.

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