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The Arctic sea ice in climate models - variability and anthropogenic climate change

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Changes due to global warming are particularly obvious in the Arctic. The IPCC-Report of 2007 shows, that the warming in the Arctic is twice as strong as the mean global warming. We investigate changes in the Arctic sea ice in a set of 19 CMIP-3 Models with a focus on the entire Arctic as well as for different regions. In all regions, the models predict a reduction in sea ice extent, sea ice thickness and sea ice volume during the period 1900-2100. Furthermore, changes are obvious in the amplitude and phase of the seasonal cycle. The phase of the seasonal maximum ice extent occurs later in the year. However, this effect is not visible for the sea ice thickness and the sea ice volume. For the sea ice extent, the amplitude of the seasonal cycle increases in nearly all regions, because of the strongest sea ice extent decrease in September. In the entire Arctic, the amplitude of sea ice volume shows a damping because of the reduction of sea ice volume is stronger in March than in September. All model projections show a strong discrepancies in different regions. However, a multi model mean estimates are comparable with observational data for the entire Arctic. In smaller regions, the differences between the multi model mean and the observational data are large. The local sensitivity against global warming has been investigated. Here, we analyze the difference between different periods for the sea ice extent and the surface air temperature. A seasonal dependence of the sensitivity has been found in all models. The differences between the model predictions are smaller in winter in comparison to summer season. However, in the regions Barents Sea and Greenland-Iceland-Norwegian Sea the models sensitivities are very different in all season.