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The Arctic Amplification and inter-relation between Arctic Sea-Ice, cloud greenhouse heating and atmospheric circulation in ERA-Interim and EC-Earth

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The Arctic is warming faster than the global average especially in autumn and winter and substantial reductions in summer and winter sea-ice have been observed recently. It is also the part of the globe where climate model scenarios show the largest spread. The impact of clouds on sea ice and Arctic amplification is not well understood even though an increase in clouds in winter is expected to have a warming effect due to the initial small amounts of cloud condensate and especially in liquid form. Many recent observational data sets report significant amounts of mixed-phase clouds over the Arctic in all seasons. The frequent occurrence of Arctic mixed-phase clouds has important implications for the cloud radiative forcing at the surface, since mixed-phase clouds tend to be optically thicker than ice-only clouds and emit more downward long-wave flux which increases the surface temperature and sea-ice melt. A number of studies have shown that models underestimate the amount of cloud water in Arctic mixed-phase clouds. In this study we investigate how cloudiness affect the Arctic warming and sea-ice retreat in the global coupled climate model EC-Earth for AMIP and transient experiments. We also investigate how the cloud-radiation and sea-ice interactions affect the circulation in EC-Earth and in ERA-Interim reanalysis data.