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Arctic sea ice decline: the transition from insulation to insolation

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The Arctic is undergoing an amplified warming 2 to 3 times faster than the global average. The rapidly decreasing sea ice area has been pointed out as a key factor in the strongly changing Arctic climate with possible remote impacts in the mid-latitudes.

Analyses of CMIP5 models projections with a strong radiative forcing (RCP8.5) show that sea ice decline in the Arctic can be separated in two distinct phases. In the first phase, sea ice volume changes are dominated by thinning, whereas in the second phase reductions in extent govern the response. Model results demonstrate that currently Arctic sea ice volume decline is still well in its first phase (thinning), despite the strong areal retreat that has been observed over the last few decades.

A shift date is defined as the year in which the system goes from phase one to phase two, and thus this separates the two phases. CMIP5 results indicate that this shift date is 2064 $\pm$ 36 years. Despite the large intermodel spread, the response of the Arctic climate exhibits clear differences in trend and variance between those two phases. The transition from phase one to phase two in Arctic sea ice volume reduction is accompanied by a gradual incline if both non-solar ocean-atmosphere surface fluxes (insulation feedback) and a solar fluxes (insolation feedback). The amplitude of solar fluxes relative to non-solar is gradually increasing during the transition.