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Nudging the Arctic Ocean to quantify Arctic sea ice feedbacks

Evelien Dekker (1,2), Camiel Severijns (1), and Richard Bintanja (1)
(1) KNMI, Royal Dutch Meteorological Institute, de Bilt, Netherlands, (2) IMAU, Utrecht University, Utrecht, Netherlands

It is well-established that the Arctic is warming 2 to 3 time faster than rest of the planet. One of the great uncertainties in climate research is related to what extent sea ice feedbacks amplify this (seasonally varying) Arctic warming. Earlier studies have analyzed existing climate model output using correlations and energy budget considerations in order to quantify sea ice feedbacks through indirect methods. From these analyses it is regularly inferred that sea ice likely plays an important role, but details remain obscure. Here we will take a different and a more direct approach: we will keep the sea ice constant in a sensitivity simulation, using a state-of -the-art climate model (EC-Earth), applying a technique that has never been attempted before. This experimental technique involves nudging the temperature and salinity of the ocean surface (and possibly some layers below to maintain the vertical structure and mixing) to a predefined prescribed state. When strongly nudged to existing (seasonally-varying) sea surface temperatures, ocean salinity and temperature, we force the sea ice to remain in regions/seasons where it is located in the prescribed state, despite the changing climate. Once we obtain fixed' sea ice, we will run a future scenario, for instance 2 x CO_2 with and without prescribed sea ice, with the difference between these runs providing a measure as to what extent sea ice contributes to Arctic warming, including the seasonal and geographical imprint of the effects.