The role of Southern Ocean salinity in determining Antarctic sea ice variability

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The processes governing interannual-interdecadal variability in Antarctic sea ice are presently poorly understood. In contrast to the Arctic, the response is highly regionalised, with increases being reported in the Ross and Weddell Seas, contrasting with the simultaneous reduction in sea ice extent reported in the Amundsen-Bellingshausen sector. The role of the ocean in controlling sea ice variability has received comparatively little attention to date, despite its potentially critical role in modulating sea ice coverage via the supply of upwelled heat at the ocean-ice interface. In this work, the sea ice-ocean model NEMO-LIM is used to study upper-ocean salinity variability in the Southern Ocean, with the aim of evaluating the role of upper-ocean stratification in driving variability in Antarctic sea ice. Circumpolar salinity variability is quantified over the period 1979-2008, along with changes in upper-ocean stratification over this period. Comparisons are made between both the model representation of sea ice over this period and the satellite observational record, and the feasibility of stratification as a primary driving mechanism of sea ice variability discussed. Stratification changes may be effected by changes in the hydrological cycle and, in addition to bringing about changes in sea ice, may also occur via the sea ice formation cycle of brine rejection and freshwater input. Both precipitation and sea ice thickness are currently poorly quantified by observational data, and thus the application of model data to this problem affords the opportunity to better understand the role of these influences in driving large-scale climatic changes.