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# Southern Ocean open-sea convection teleconnections

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We show that Southern Ocean (SO) temperatures in the latest generation of Earth System Models exhibit two major modes of variation, one driven by deep convection and the other by tropical variability. We show that multiyear variability in Southern Ocean sea surface temperatures (SSTs) can in turn influence oceanic and atmospheric conditions in the tropics on short time-scales. We argue that the strength and pattern of SO-tropical teleconnections depends on the intensity of SO deep convection.

Periodic convection in the SO is a feature of most CMIP5 models under preindustrial forcing (deLavergne et al., 2014). Models show a wide distribution in the spatial extent, periodicity and intensity of their SO convection, with some models convecting most of the time, and some showing very little convection. In a highly convective coupled model, we find that multidecadal variability in SO and global SSTs, as well as SO heat storage are driven by Weddell Sea convective variability, with convective decades relatively warm due to the heat released from the deep southern ocean and non-convective decades cold due to the subsurface storage of heat. Furthermore, pulses of SO convection drive SST and sea ice variations, influencing absorbed shortwave and emitted longwave radiation, wind, cloud and precipitation patterns, with climatic implications for the low latitudes via fast atmospheric and oceanic teleconnections.

We suggest that these high-low latitude teleconnection mechanisms are relevant for understanding hiatus decades. Additionally, Southern Ocean deep convection varied significantly during past, natural climate changes such as during the last deglaciation. Weddell Sea open convection has recently weakened, likely as a consequence of anthropogenic forcing and the resulting surface freshening. Our study opens up the tantalizing possibility that such large-scale changes in SO deep convection might have tropical and indeed global implications via atmospheric teleconnections. We advocate the collection of both paleo and modern proxies that can verify these model-derived mechanisms and global teleconnections.