

Decadal variability and predictability in the Southern Ocean - implications for interpreting recent observed trends

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While decadal variability and predictability in the North Atlantic and North Pacific have received considerable attention, there has been less work on decadal variability and predictability in the Southern Ocean. As shown previously, a coherent mode of decadal to centennial variability exists in multiple climate models. The mechanism involves a multidecadal accumulation of heat in the subsurface of the Southern Ocean, which is then rapidly discharged through intense oceanic convection when the accumulation of subsurface heat reduces the stratification of the water column. The release of this accumulated subsurface heat can have considerable regional scale climatic impacts, along with substantial impacts on ocean heat uptake. Using a large suite of perfect predictability experiments, in concert with long control simulations, we show that this variability has a high degree of predictability. We present further results that show this type of variability may play an important role for interpreting recently observed trends of sea ice and temperature in the Southern Ocean. Specifically, observed trends over the last several decades resemble a particular phase of this variability in which reduced oceanic convection leads to subsurface warming and surface cooling, with associated increases in sea ice extent. This phase of natural variability may substantially contribute to observed decadal trends, working in concert with other factors.