SESSION: (B1) Mechanisms of S2D predictability

(B1-06)

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. This accumulation of heat in the subsurface tends to reduce ocean stratification, eventually leading to the onset of intense oceanic convection and venting of heat to the atmosphere. The discharge of heat from the interior ocean, combined with surface freshening, restratifies the water column and the cycle begins again with the accumulation of subsurface heat. During the phase when the accumulated subsurface heat is released through oceanic convection, there can be 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 and experimental hindcasts, we show that this variability has a high degree of predictability on decadal scales. 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 and freshening, 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.