



## Connection between the Southern Ocean Mode and the Weddell Polynya

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During the mid-1970s, a large open and ice free area in the Southern Ocean appeared, better known as the Weddell Polynya. Very recently in 2017, the Weddell Polynya appeared after more than 50 years. It has been suggested that the formation of the Weddell Polynya is driven by oceanic processes. Positive subsurface temperature anomalies destabilise the stratification of the water column which lead to mixing and eventually influence the ice formation in the Southern Ocean. However, the mechanisms of the build-up of this anomalous heat and the multidecadal timescale of the appearance of the Weddell Polynya are still unknown. Here we present results of an analysis of model output from a long (~250 years) control simulation with a high horizontal resolution (ocean: 0.1°, atmosphere: 0.5°) version of the global Community Earth System Model (CESM). In this simulation, the area, position and life cycle of the Weddell Polynya correspond well to that in observations. The variability in ocean heat content near the Weddell Polynya is mainly driven by multidecadal variability in the Southern Ocean due to the so-called Southern Ocean Mode (Le Bars et al. 2016; van Westen and Dijkstra, 2017). Ten years before the formation of the Weddell Polynya, the Southern Ocean Mode generates positive anomalies in ocean heat content. The variability in the Southern Ocean enters the Weddell Gyre and influences the subsurface ocean heat content. The results provide a new mechanism for the formation and evolution of the Weddell Polynya.

#### References:

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