EGU21-1468
https://doi.org/10.5194/egusphere-egu21-1468
EGU General Assembly 2021

On the role of the Antarctic Slope Front on the occurrence of theWeddell Sea polynya under climate change

Joseph Lockwood[1], Carolina Dufour[2], Stephen Griffies[3,4], and Michael Winton[4]
[1]Department of Geoscience, Princeton University, USA
[2]Department of Atmospheric and Oceanic Science, McGill University, Canada
[3]Program in Atmospheric and Oceanic Science, Princeton University, USA
[4]National Oceanic and Atmospheric Administration, Geophysical Fluid Dynamics Laboratory, Princeton University, Princeton, New Jersey, USA

This study investigates the occurrence of the Weddell Sea Polynya under an idealized climate change scenario by evaluating simulations from climate models of different ocean resolutions. The GFDL-CM2.6 climate model, with roughly 3.8 km horizontal ocean grid spacing in the high latitudes, forms a Weddell Sea Polynya at similar time and duration under idealized climate change forcing as under pre-industrial forcing. In contrast, all convective models forming the fifth phase of the Coupled Model Intercomparison Project (CMIP5) show either a cessation or a slowdown of Weddell Sea Polynya events under climate warming. The representation of the Antarctic Slope Current and related Antarctic Slope Front is found to be key in explaining the differences between the two categories of models, with these features being more realistic in CM2.6 than in CMIP5. In CM2.6, the freshwater input driven by sea ice melt and enhanced runoff found under climate warming largely remains on the shelf region since the slope front restricts the lateral spread of the freshwater. In contrast, for most CMIP5 models, open ocean stratification is enhanced by freshening since the absence of a slope front allows coastal freshwater anomalies to spread into the open ocean. This enhanced freshening contributes to the slow down the occurrence of Weddell Sea Polynyas. Hence, an improved representation of Weddell Sea shelf processes in

current climate models is desirable to increase our ability to predict the fate of the Weddell Sea Polynyas under climate change.