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Evaluation of Mesoscale Eddy-Ice Interaction in the Southern Ocean using High-Resolution Models

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Antarctic sea ice plays an important role in the global climate through its influence on local and global oceanic and atmospheric circulations, planetary radiative balance, and the crucial support it provides for Southern Ocean ecosystem. Understanding the physical processes influencing Antarctic sea ice, and the drivers of its change are therefore of broad interest. The sea ice–covered the Southern Ocean, has relatively weak stratification in the upper ocean, where a relatively thin halocline separates the cold winter mixed layer from significantly warmer ocean interior. When warmer waters from the ocean interior enter the mixed layer, it can melt sea ice at its base. Features in the upper ocean, like mesoscale eddies can impact the thermohaline structure and stratification in this region and can impact the heat delivered to the surface. However, the mesoscale dynamics in the polar regions, especially under sea ice cover, is little known due to the limited observations and the inability of many numerical models to resolve mesoscale processes in the high latitudes.

This study aims to understand better the interaction between ocean mesoscale eddies and sea ice using high-resolution European Eddy RIch Earth System Models (EERIE) models. We investigate the effect of mesoscale eddies locally, and the integrated effect of eddy-sea ice interaction in the circumpolar Southern Ocean. Previous studies have identified eddy ice interactions to vary within regions of varying sea ice concentrations, such as in the high concentration pack ice and low-concentration marginal ice zones. The variations in the eddy-sea ice interaction in the Southern Ocean, within the open ocean, pack ice, and marginal ice zones are further investigated in this study.