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Variability of the Weddell Gyre in a global high-resolution numerical model

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The Weddell Gyre, located in the Weddell Sea is one of the southernmost open ocean reaches in the world and largest feature of the ocean circulation south of the Antarctic Circumpolar Current. It is adjacent to a major site of bottom water production in the southwestern Weddell Sea and participates in poleward heat transport via its cyclonic circulation that brings relatively warm waters south towards the Antarctic continent. The region is covered by sea ice through most of the year, which has historically prevented long, continuous observational efforts, both in situ and remote. As a result, ocean circulation models offer perhaps the best means of estimating the Weddell Gyre's variability. Using a coupled ocean/sea ice high-resolution global model, ACCESS-OM2 at 0.1° horizontal resolution, we assess the variability of the Weddell Gyre on seasonal - multi-decadal timescales and explore possible drivers of this variability. The simulations suggest that the gyre exhibits large variability in its circulation that is not captured by summer-biased or short-term observations. Anomalous strong and weak periods of the gyre's circulation are linked to changes in sea ice concentration and other oceanic features of the region. We further explore the link to possible driving mechanisms, including surface stress forcing and surface buoyancy fluxes.