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Interplay between subsurface eddies and sea ice over the Arctic Ocean

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The paucity of observations over the Arctic Ocean prevents us from fully understanding the interaction between sea ice and mesoscale dynamics. Previous studies on this interplay have documented the interaction between surface eddies and sea ice, omitting the subsurface eddies. This work focuses on the possible role of these subsurface eddies in shaping the sea ice distribution. First, we perform an extensive eddy census over the period 2004-2020 over the Arctic Basin, based on data from Ice Tethered Profilers (ITP) and moorings from the Beaufort Gyre Exploration Project. About 500 subsurface eddies are detected, including both submesoscale (radius between 2-10 km) and mesoscale (up to 80 km) structures. Second, we investigate the dynamical or thermodynamical signature that these eddies may imprint at the surface. On average, these eddies do not cause significant variations in either the temperature of the mixed layer or the melting of sea ice. However, we estimate that subsurface eddies induce a dynamic height anomaly of the order of a few centimetres, leading to a surface vorticity anomaly of O(10^{-5} - 10^{-4}) s^{-1}, suggesting that they may be a significant local forcing for the sea ice momentum balance. Our results suggest that there is no link between the sea ice evolution and the energy level associated with the presence of subsurface eddies. It suggests that once formed, these structures may evolve at depth independently of the presence of sea ice.