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Improved ice-ocean drag parameterization in the CICE model

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A new parametrization of momentum transfer at the sea ice-ocean interface has been developed and implemented in the CICE model. Sea ice generates internal waves by dragging a rough surface across a stratified ocean. Radiation of these internal waves into the deep ocean increases the ice-ocean drag; the contribution of the internal wave drag has not been yet accounted for in GCMs.
The phenomenon of dead waters, induced by the presence of internal waves, was first observed by Nansen in 1893 and it has been ever since been of attention for its impact on ships' motion.
The effect of the generation of internal waves on ice-ocean drag is stronger for shallow mixed layer depth and stronger the stratification of the ocean beneath the mixed layer; the geometry of the ice interface is an important parameter and needs to be taken into consideration. The increase of the ice-ocean drag transfer coefficient has consequences on the bottom melt and therefore on the sea ice state.
We have implemented the theory developed by McPhee in the CICE model and have modified it to take into account the presence of keels deeper than the mixed layer depth. We have considered the contribution to the drag originated by ridged and non-ridged ice that still presents a rough topography.
Information on the ocean characteristics are calculated from a coupled NEMO-CICE simulation from 1980 to 2016.
The non-ridged ice is characterized by parameters derived from Upward Looking Sonar topographies.
We present results on the effect of improved form drag parameterization on emergent Arctic sea ice characteristics such as motion, and deformation.