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PHYSICAL OCEANOGRAPHY

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ABSTRACT Subject :

Cross-Isobath Transport Driven by JEBAR over the Ross Sea Continental Shelf Break

Abstract 13/02/2023 06:27:50

Cross-isobath exchange over the Ross Sea continental shelf slope brings warm CDW onto the shelf, and is a potential destabilizing factor of the Ross Ice Shelf that has been previously underestimated. This work uses a model case study to examine the roles of the Joint Effect of Baroclinicity and Relief (JEBAR) and other external forces in driving the cross-isobath exchange over the Ross Sea shelf break. A coupled ocean/sea-ice/ice-shelf model is used to simulate the physical processes in the Ross and Amundsen Sea, which is forced by climatological conditions averaged over 2000-2010. The model results are diagnosed with a 2-D vorticity budget method, in which the vertically averaged cross-isobath exchange is decomposed into components driven by the JEBAR, advective flux, viscous exchange, surface and bottom stresses. Our results show that (i) Over large spatial scale, the western and eastern Ross Sea are characterized by net offshore and onshore transports, respectively; (ii) The JEBAR effect, which is determined by along-shelf density gradient, is a significant driving mechanism of the large-scale cross-shelf exchange; and (iii) Subglacial melting in the Amundsen Sea and dense water formation in the Ross Sea polynya are two key mechanisms that help to establish the density gradient along shelf break. We also show that advective flux and sea surface stress are secondary mechanisms that drive the cross-exchange. Advective flux is responsible for the smaller spatial scale variability while sea surface stress makes small positive contribution to the onshore transport over the entire Ross Sea shelf break. This work highlights the role of shelf-side buoyancy forcing in the cross-shelf exchange under a geostrophic framework.

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