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Topographically trapped waves along the continental slope north of Svalbard

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On the continental slope north of Svalbard, Atlantic Water is transported eastward as a part of the Arctic Circumpolar Boundary Current. As inflow of Atlantic Water through the Fram Strait is the largest oceanic heat source to the Arctic Ocean, it is important to improve our knowledge about the dynamics and processes that govern the heat exchange between Atlantic Water and water masses of Arctic origin. This includes processes that enable lateral exchange across the shelf break or into the interior of the deep basin. Here, we study the vorticity dynamics on the slope and its contribution to the water mass modifications and heat exchange. Focusing on topographically trapped waves – sub-inertial oscillations trapped to follow the continental slope – we establish their existence and properties on the northern slope of Svalbard using a free baroclinic wave model. Their dependence on background stratification and current properties is explored in sensitivity analysis. Next, we discuss their contribution to lateral exchange from the boundary current on the slope to the continental shelf, troughs, and the deep Nansen Basin in the Arctic Ocean, including exchange associated with instabilities and resulting eddy shedding off the vorticity waves. Hydrographic and current time series from 2018-19 at two mooring arrays crossing the slope north of Svalbard (The Nansen Legacy project) are used to associate the observed physical environment with model-predicted topographic waves. Analysis of the in-situ data will determine which wave mode that can exist over the sloping seafloor and the observed hydrography and flow, and the model will give the corresponding spatial characteristics for the given frequencies and wave numbers. Energetic oscillations present in the observations are analyzed in light of the model results. Of special interest are the seasonal variability in hydrography and current strength and the resulting modification of the wave characteristics. Moreover, the interaction between the vorticity waves and tidal oscillations in the diurnal band is emphasized.