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Nonlinear internal wave generation over the Yermak Plateau

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North of the critical latitude (78.4), internal waves of the M_2 tidal frequency can no longer freely propagate, and the energy conversion from the barotropic to the internal tides vanishes. Near the continental slopes around the Arctic Ocean, internal wave energy is enhanced and comparable to values at mid-latitudes (Rippeth et al. 2015, Levine et al. 1985). Observations on the northern flank of the Yermak Plateau (YP) has characterized the region as one of enhanced internal wave activity and nonlinear internal waves have been observed (Czipott et al. 1991, Padman and Dillon 1991).

The YP is a bathymetry feature stretching out into the Fram Strait north-west of Svalbard. The YP plays a prominent role in the Arctic's heat balance due to its interaction with the West-Spitsbergen current which is a main contributor to the heat transport into the Arctic Ocean. Nonlinear waves generated over the YP are a significant energy source for mixing and can therefore modulate and force exchange processes.

To study the nonlinear internal wave generation mechanisms over the YP, we used a high resolution, nonlinear, non-hydrostatic model. We found that nonlinear internal waves are forced not by the M_2 but the K_1 tide which has been observed to have significant variability over the YP (Padman et al. 1992). Barotropic, diurnal shelf waves generated on the eastern side of the YP propagates counter-clockwise, amplifying the cross-slope currents. This amplification is the necessary condition for nonlinear internal wave generation over the YP.