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Understanding the mesoscale eddy genesis mechanisms in the marginal ice zone

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As one of the most important phenomena in the marginal ice zone (MIZ), mesoscale eddy influences the distribution of the sea ice and current, which in turn change the environment in the high latitude. Based on the observations and numerical simulations, Johannessen proposed three eddy genesis mechanisms in the MIZ: the baroclinic and/or barotropic instability of the current, momentum flux curl across the ice edge, and the effect of topography. With the observations, we demonstrate how front genesis and eddy genesis (front slump) in the Chukchi Sea, the mechanism of front genesis and the structure of the front are different from the previous studies. For the barotropic instability mechanism, we found an ice-edge jet driven by wave energy dissipation has strong horizontal shear, which helped small turbulence grow into mesoscale eddies. For the momentum flux curl across the ice edge (nonlinear advection), the eddy strength is largely damped by the vertical velocity, and is much weaker than the other two mechanisms.