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Observation of interior and boundary-layer mixing processes due to near-inertial waves in a stratified basin without tides

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Near-inertial waves form an important contribution to oceanic energy and shear spectra, and thus play a major role in mixing the ocean's interior. Here, we compare internal-wave mixing processes in the interior of a stratified basin to those occurring on the sloping boundaries. We use the virtually tideless Baltic Sea as a natural laboratory, allowing us to isolate the effect of near-inertial waves that is otherwise (often) overshadowed by internal tides. The measurements presented here consist of moored ADCPs and CTD loggers in the center of the basin and on the slopes, combined with densely spaced shear-microstructure and ADCP cross-slope transects. During summer stratification, a three-layer density structure, with a thermocline and a deeper halocline, was observed with clear signals of downward near-inertial energy propagation after a short wind event. These motions are interpreted as near-inertial wave modes interacting with the sloping topography. Dissipation rates observed in the center of the basin scale with shear and stratification parameters in the way suggested by MacKinnon and Gregg (2003) for the shelf. On the slopes, microstructure transects reveal a periodic near-bed dissipation rate signal and a growing and decaying bottom boundary layer (BBL) thickness; both signals are triggered by near-bottom currents oscillating with a near-inertial frequency. Near-bottom dissipation rates are greatly enhanced compared to the interior, and, due to the straining of lateral density gradients by the cross-slope velocity, mixing is rather efficient, and contributes significantly to the basin-scale mixing.