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Observed Damping of Barotropic Seiches through Baroclinic Wave Drag in the Gullmar Fjord

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ABSTRACT

Baroclinic wave drag, due to internal wave generation at steep topography, is shown to be a mechanism that effectively subdues barotropic seiches in fjords. A two-layer model for a fjord with a sill at the mouth is applied to the Gullmar Fjord, Sweden. The damping of the fundamental seiche mode observed from sea level records is well predicted by the model. This includes the observed seasonal variation in damping due to the corresponding variation in vertical stratification. It is shown that ordinary bottom friction should contribute less than 1% to the damping in this fjord.

Simultaneous current records from different depths, obtained on the slope of the sill in the fjord, are analyzed. Spectra of all records show a significant energy peak at the seiche frequency. The vertical variation of the phase of the current at this frequency shows that the motion is essentially baroclinic.

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