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The Impact of Internal Wave Seasonality on the Continental Shelf Energy Budget

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Heating-stirring models are widely used to simulate the timing and strength of stratification in continental shelf environments. Such models are based on bulk potential energy (PE) budgets: the loss of PE due to thermal stratification is balanced by wind and tidal mixing. The model often fails to accurately predict the observed vertical structure, as it only considers forces acting on the surface and bottom boundary of the water column. This highlights the need for additional internal energy sources to close this budget, and produce an accurate seasonal cycle of stratification.

We present new results that test the impact of boundary layer and internal wave forcing on stratification and vertical density structure in continental shelves. A new series of continuous measurements of full water depth vertical structure, dynamics and meteorological data spanning 17 months (March'14-July'15) provide unprecedented coverage over a full seasonal cycle at a station 120 km north-east from the continental shelf break. We observe a highly variable but energetic internal wave field from the onset of stratification that suggests a continuous supply of internal PE.

The heating-stirring model reproduces bulk characteristics of the seasonal cycle. While it accurately predicts the timing of the onset in spring and peak stratification in late summer there is a persistent 20 J m^{-3} positive offset between the model and observations throughout this period. By including a source of internal energy in the model we improve the prediction for the strength of stratification and the vertical distribution of heat. Yet a constant source of PE seems to result in a seasonal discrepancy resulting in too little mixing during strong stratification and too much mixing during transient periods. The discrepancy seen in the model is consistent with the seasonality observed in the internal wave field.

We will establish the role that changing stratification (N2) exerts on the internal wave field and vice versa. Ultimately, we will demonstrate how the strength and vertical range of shear varies seasonally and what effect it has on supplying PE to midwater mixing.