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A New Parameterization for Oceanic Turbulence Based on Vertical Velocity Finestructure

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Outside topographic boundary layers, turbulence and mixing in the ocean is closely related to breaking internal waves. Over the last two decades it has become common to exploit this relationship to infer oceanic turbulence and mixing levels from measurements of internal-wave parameters, such as vertical shear and strain, using a set of methods termed "finestructure parameterization methods." Here, we report on a newly discovered relationship between vertical velocity in the internal-wave band and kinetic energy dissipation due to turbulence.

Using a set of simultaneous profiles of hydrography, vertical velocity (from LADCP data) and kinetic-energy dissipation collected in dynamically diverse settings (including the open ocean, a rift valley on the MAR, Luzon Strait and Drake Passage), at latitudes between 10° and 75°, and covering a large range of density stratifications, it is shown that vertical-velocity finestructure is closely correlated with kinetic-energy dissipation. This correlation defines a new finestructure parameterization method for oceanic turbulence based on internal-wave vertical-velocity measurements. The available data indicate that the new method yields at least as good agreement between parameterized and microstructure-derived kinetic energy dissipation as the most recent of the shear/strain parameterizations, without requiring any corrections for density stratification, latitude or internal-wave frequency content.

Since current shear/strain-parameterizations and the new vertical-velocity based parameterization are sensitive to different parts of the internal-wave frequency band, it is anticipated that parameterizations based on combined vertical-shear, strain, and vertical-velocity measurements will be associated with smaller uncertainties than either of the currently available methods.