Internal tides in the Indonesian Seas

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Abstract

A wide range of values is obtained for dissipation within [10-8, 10-4] W/kg with spots of higher dissipation in the ocean interior correlated with a strong internal tide signal. Deduced Kz values are found between 510-4 to 5 10-1 m2/s, much more higher than open ocean values. Surface mixing, below the base of the mixed layer is found to be very strong above all straits, with values within [10-4, 10-3 m2/s]. Introduced in a model using an adapted parameterisation to the Indonesian archipelago, models show good agreement with the observations, where strong water mass transformation has been previously diagnosed. This additional mixing produce a _˜0.5◦C surface cooling and reduces by 20% the overlying deep convection. The El Nino Southern Oscillation (ENSO) amplitude is slightly reduced while the Indian Ocean Dipole/Zonal Mode (IODZM) variability increases. The MJO is also improved in the model. Changes in the coupled system in response tidal mixing are as large as those found when closing the Indonesian Throughflow, emphasizing the key role of IA on the Indo-Pacific climate. This suggests that climate models need to take into account this intensified mixing to properly represent the mean state of the atmosphere and its climate variability. Modeling of the explicit tides show that a small fraction of the internal wave are radiated and dissipate away of the generation site, that was not taken into account in the previous parameterization. Also bottom friction induced by barotropic tides on the shelve may produce significant surface mixing, that may also affect the climate.

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