Large-scale sea level, thermocline, and wind variations in the Indonesian throughflow region

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Abstract

The Indonesian throughflow is presumed to be driven by a sea level gradient from the Pacific to the Indian Ocean. Deep throughflow transport may also be driven by a steric gradient between the two basins. The sea level gradient, in turn, is thought to be maintained by the differing wind patterns in the two basins: monsoonal in the Indian Ocean and trades in the western equatorial Pacific. In the interaction between sea level, wind stress, and thermocline depth as identified from historical measurements, we find (1) over the Indian, Indonesian, and equatorial Pacific basins and specifically within the throughflow region, sea level and thermocline seasonal variations are negatively correlated (sea level rise corresponding to thermocline deepening) and sea level and meridional wind stress are also correlated; (2) the expected strong seasonal gradients in sea level through the eastern throughflow region (near the island of Timor) are found, though without an accompanying thermocline depth gradient; (3) seasonal convergence in baroclinic, upper ocean throughflow transport previously identified [Meyers et al., 1995] in the Timor Sea is associated with changes in sea level as well as upper ocean dynamic height at annual period but not at semiannual; (4) interannual variability explains more of the sea level variance in the eastern throughflow region than is explained by seasonal harmonics; however, there does not appear to be a strong interannual signal in the sea level gradient to drive fluctuations in the upper ocean throughflow. We hypothesize that seasonal

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variability in the upper layer throughflow and interannual variability in the deep throughflow are the predominant results of the complex interaction of forcing mechanisms.

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