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Mixing in the equatorial thermocline: the importance of small vertical scale velocity features

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The overturning cells in the ocean are closed by isopycnic mixing. For the shallow sub-tropical cells the majority of this mixing occurs in the equatorial thermocline. In addition the level of mixing in the equatorial thermocline influences the characteristics of ENSO. Mixing in the equatorial thermocline is therefore important. But it is poorly understood. Here we present recent high vertical resolution observations that show a predominance of small vertical scale features in the velocity field in the equatorial thermocline. These features have a vertical scale of order 10m and a meridional coherency that can extend in excess of a hundred kilometres. Estimates suggest these features contribute significantly to both vertical and lateral mixing. We speculate that the observed small vertical scale features are produced by a combination of instabilities of the equatorial current system and wind-induced near-inertial oscillations, which in turn provide a significant control on the level of mixing in the equatorial thermocline. The picture is very different to that assumed in present-day climate models and calls for a rethinking of the way mixing processes are prescribed in such models.