The impacts of tidal mixing in the Indonesian Archipelago on the transformation of the Indonesian Throughflow waters

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Tidal mixing in the Indonesian Archipelago is thought to be one of the essential factors regulating the transformation of the ITF waters. Most OGCMs are, however, incapable of reproducing the transformation of the ITF waters, since tidal forcing is neglected.

In the present study, in order to investigate the impacts of tidal mixing on the transformation of the ITF waters, the spatial distribution of vertical diffusivity obtained from the high-resolution baroclinic tide model which is forced with a single tidal constituent (M_2) is incorporated into an OGCM. It is shown that the SST is significantly reduced around the narrow straits where intensive vertical mixing takes place. As a result, the SST averaged within the Indonesian Archipelago is reduced by 0.15 ˚C compared with that predicted from the experiment without tidal mixing. In the thermocline, although the vertical mixing induced by breaking of M_2 baroclinic tides has a moderate impact on reducing the saline bias often found in the existing OGCMs, it is still not enough to completely resolve the model bias especially in the Halmahera/Banda Seas where saline waters are injected through the eastern route of the ITF. In order to explain this missing mixing in the Indonesian Archipelago, the impacts of other tidal constituents (S_2, K_1, O_1), tidal flow interaction with the ITF, and the horizontal mixing enhanced by the sub-mesoscale eddies should also be investigated in the future.

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