1. Introduction

The western Pacific is a place of energetic internal tides generated over its complex bottom topographic features. The Solomon archipelago is one of the most efficient place for the generation of M2 internal tides (Fig. 1).

The Solomon Sea is on the pathway of Western Boundary Currents (WBCs) connecting the subtropics to the equator. Its complex bottom topographic features and the Solomon archipelago are one of the key sites for the generation of internal tides. The model simulates well the tidal forcing. (Fig. 2).

The next step is to quantify the impact of such tides on water mass transformation (Fig. 3). The model simulate well the tidal forcing. (Fig. 2).

2. Numerical Model: NEMOv3.6

The M2 internal tides are generated at the extremities of the Solomon archipelago and of the PNG peninsula. The M2 baroclinic energy flux radiates from these zones inside and outside the Solomon Sea. A total of 13 GW is lost from the barotropic tide within the PNG peninsula. The M2 baroclinic energy extends along the central Solomon Sea from the production zone, two at the north and south extremity of the Solomon archipelago and one at the southeastern extremity of the PNG peninsula.

The impact of internal tides on mixing is illustrated by looking salinity anomalies between the simulation with and without tidal forcing for the Surface Waters (SW; 21-23.3 sigma) and the Upper Thermocline Waters (UTW; 23.3-25.7 sigma) (Fig. 7). Positive SW and negative UTW anomalies argue for diapycnal mixing by tides.

3. M2 internal tides: Depth integrated view

The generation of M2 internal tides is defined by the conversion rate from the barotropic to baroclinic tides (Fig. 4). Three zones emerge: two at the north and south extremity of the Solomon archipelago and one at the southeastern extremity of the PNG peninsula. The M2 baroclinic energy flux is superimposed (vectors). The model simulate well the tidal forcing. (Fig. 2).

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4. M2 internal tides: Vertical view

With a well marked stratification typical of the tropical oceans, M2 internal tides don't propagate from the surface to the bottom as usual but they are located in the surface layers. (Fig. 6a). Snapshots of the velocity field related to the M2 internal tides at different depths illustrate that, except in the generation zones, no signature of internal tides exist below 300 m depth. (Fig. 6c,d).

At the surface, amplitude of M2 internal tides is about 4-5 cm reaching 8 cm in the generation zones. The associated wavelength is about 100 km. (Fig. 6b).

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5. Water mass transformation

The impact of internal tides on mixing is illustrated by looking salinity anomalies between the simulation with and without tidal forcing for the Surface Waters (SW; 21-23.3 sigma) and the Upper Thermocline Waters (UTW; 23.3-25.7 sigma) (Fig. 7). Positive SW and negative UTW anomalies argue for diapycnal mixing by tides.

6. Conclusion

The model simulate well the tidal forcing. Internal tides are generated at the extremities of the Solomon archipelago and of the PNG peninsula. They propagate in the Solomon Sea with a 4-5 cm amplitude.

The next step is to quantify the impact of such tides on water mass transformation.

References