Geophysical Research Abstracts
Vol. 17, EGU2015-4499-1, 2015
EGU General Assembly 2015

On the generation and evolution of internal solitary waves in the southern Red Sea

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Satellite observations recently revealed the existence of trains of internal solitary waves in the southern Red Sea between 16.0°N and 16.5°N, propagating from the centre of the domain toward the continental shelf [Da silva et al., 2012]. Given the relatively weak tidal velocity in this area and their generation in the central of the domain, Da Silva suggested three possible mechanisms behind the generation of the waves, namely Resonance and disintegration of interfacial tides, Generation of interfacial tides by impinging, remotely generated internal tidal beams and for geometrically focused and amplified internal tidal beams.

Tide analysis based on tide stations data and barotropic tide model in the Red Sea shows that tide is indeed very weak in the centre part of the Red Sea, but it is relatively strong in the northern and southern parts (reaching up to 66 cm/s). Together with extreme steep slopes along the deep trench, it provides favourable conditions for the generation of internal solitary in the southern Red Sea.

To investigate the generation mechanisms and study the evolution of the internal waves in the off-shelf region of the southern Red Sea we have implemented a 2-D, high-resolution and non-hydrostatic configuration of the MIT general circulation model (MITgcm). Our simulations reproduce well that the generation process of the internal solitary waves. Analysis of the model's output suggests that the interaction between the topography and tidal flow with the nonlinear effect is the main mechanism behind the generation of the internal solitary waves. Sensitivity experiments suggest that neither tidal beam nor the resonance effect of the topography is important factor in this process.