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An Influence of Bottom Topography on the Western Boundary Current

Yang Haijun[1], Qinyu Liu[1] and Wei Li[1]

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ABSTRACT

In this paper a linear quasi-geostrophic model with Rayleigh friction for an enclosed oceanic basin is developed to investigate the effects of different types of bottom topography (BT). The numerical method is used to solve the vorticity equation, and twelve experiments are designed to show the patterns of the Western Boundary Current (WBC) when influenced by four types of BT. The compression of vortex tubes by the slope of the BT and the bottom frictional force can generate a strong northward current in the western boundary. The location of the main axis (defined as the position of the two-third maximum northward current) of the BT-induced boundary current (BBC) varies with different BT. Besides acting in the same way as the β-effect, the BT slope is tightly related to the strength of the BBC and its main axis location. For a linear slope, there is a positive correlation between the steepness of slope and the strength of the BBC in the case where the slope width is no less than that of the boundary current. A steeper slope can force a stronger BBC and cause its main axis to shift closer to the western boundary. If the slope varies from flat to steep for a certain BT and if there is a slope break, the location of the slope break can have a remarkable effect on the velocity and width of the BBC. If the slope break is far away from the western boundary, it may well weaken the velocity near the boundary and increase the width of the BBC. As a result, the main axis of the BBC is moved in an eastward fashion gaining closer proximity to the slope break. The results of numerical experiments with the β-effect are qualitatively the same as those without. The combined effect of β and BT makes the WBC slightly narrower and weaker.

(Key Words: bottom topography, BT induced boundary current, slope break)

[1] Institute of Physical Oceanography, Ocean University of Qingdao, Qingdao, P.R.China