Impact of bathymetry on simulation of the mixed layer in the northeastern Arabian Sea

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Ocean General Circulation models (OGCMs) generally use bathymetry derived from ETOPO5 to represent the sea-floor topography. ETOPO5 is known to be unreliable for shallow regions, especially over the continental shelves. For example, ETOPO5 includes an artificial seamount on the broad shelf off Mumbai on the Indian west coast; the ETOPO5 ocean depths in this shelf region are off by about 150 m [1]. We use a newly available improved bathymetry of the Indian Ocean [1] in a high-resolution OGCM. One major difference between two simulations, one each with the new bathymetry (Snew) and ETOPO5 (Sold), is seen during winter, when the West India Coastal Current (WICC) flows poleward. Comparisons with Sold show that the mixed layer in the simulation with Snew is shallower by about 40 m north of the seamount (off Saurashtra, India). The difference in mixed-layer depth decreases farther poleward; a heat-budget analysis shows that the difference is due to horizontal advection. Elimination of the artificial seamount results in two changes in the vicinity of the seamount and north of it. First, the WICC is simulated better in Snew: it flows along the continental slope and does not veer offshore as in Sold. Second, since the offshore veering seen in Sold is eliminated, the WICC in Snew transports more heat poleward, reducing the impact of cooling and convective mixing, which is forced by cold continental winds in the region [2,3,4]. Comparisons with climatology [5] show that simulation SNew captures better the pattern of the mixed layer in the winter-cooling regime of the northeastern Arabian Sea; the Snew simulation is similar to that of a model that does not include bottom topography [3].

Keywords: Indian Ocean modelling; ETOPO5; Modular Ocean Model; Eastern boundary currents; Heat budget.

References

[1] Sindhu et. al., *J. Earth Syst. Science*, ***116***, 3 (2007).
[2] Shetye et. al., in *Oceanography of the Indian Ocean*, ed. by B.N. Desai, Oxford and IBH, New Delhi (1992).
[3] McCreary et al., *Progr. Oceanogr.*, *31*, 181 (1993).
[4] Madhupratap et al., *Nature*, 384, 6609 (1996)
[5] Chatterjee et al., abstract communicated to *AOGS2010* (2010).