

The Ekman spiral, dynamic topography, and coastal and equatorial upwelling

Upwelling, the upward movement of deep water, occurs when surface water moves away or apart to create a space into which deeper water can move. This happens consistently, and at large volume, at two places in the oceans. One is in the Trade Winds belt on the east side of ocean basins. There, both the consistent action of the northeasterlies and the net transport of water as represented by the Ekman spiral move water westward away from the coast. That

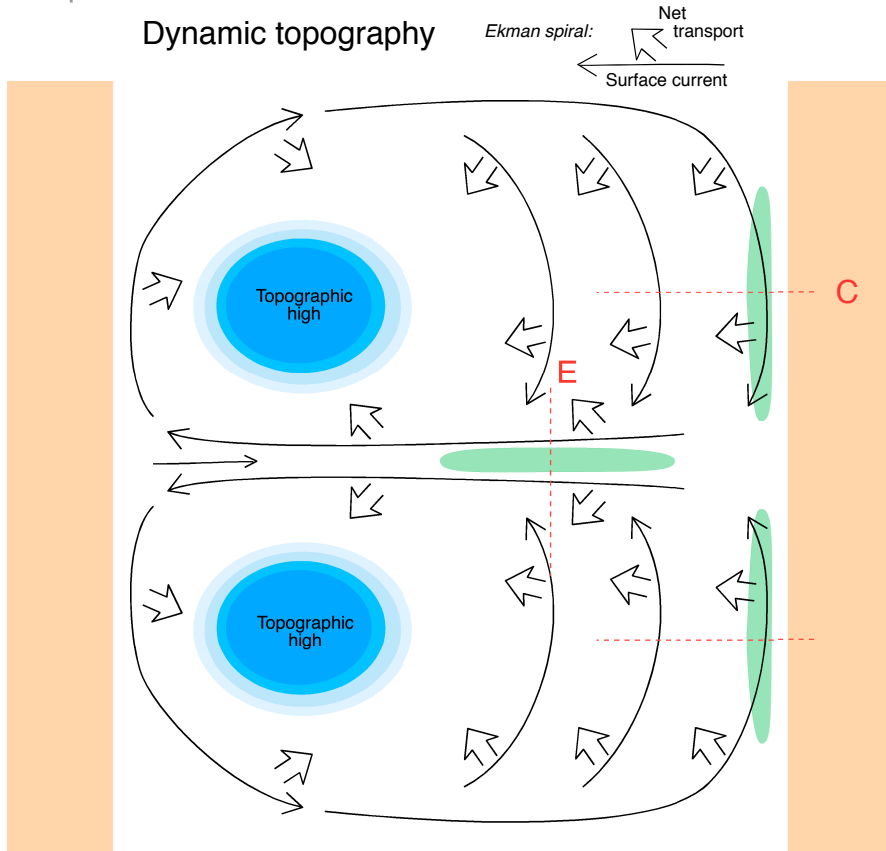
allows deep water to move up. The effect is not significant on the west sides of ocean basins because the mass of water in the dynamic topographic high precludes upward movement of the underlying deep water

The second region in which upwelling occurs is along the equator, where divergence of water in the motion represented by the Ekman Spiral allows deep water to move up. This is most noticeable in the

eastern, rather than western, equatorial regions, probably again because of the effect of the dynamic topographic high in the west.

Upwelling is significant because the deep water is cold and is rich in nutrients. The former has important climatic effects, most notably the cooling of coasts on east sides of ocean basins. The latter is significant because it allows significantly greater photosynthesis by phytoplankton and thus allows much greater biological productivity and flourishing ecosystems.

Map:



Cross-sections:

