WIND DRIVEN COASTAL UPWELLING

Along the south coast of South Africa, wind driven coastal upwelling occurs. This process is not to the same extent as the West Coast upwelling. Easterly winds generate offshore Ekman transport in the upper layer (refer Figure 1). These winds are more common during summer. Where the offshore bathymetry is relatively abrupt, the upwelling process progresses right to the coast itself. The upwelling events generally occur over only a few days (Schumann, 1999).

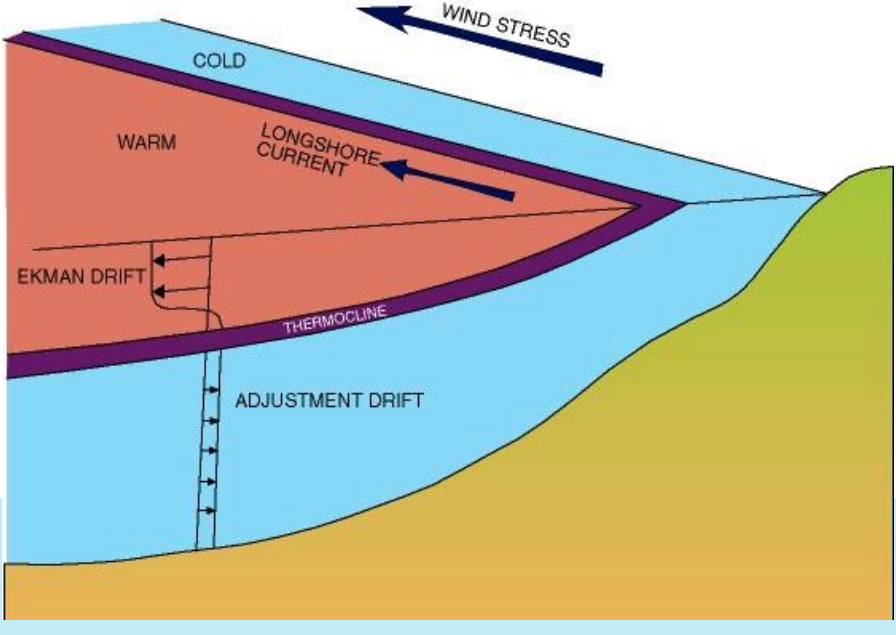

Figure 1 - A diagrammatic representation of Ekman transport resulting in upwelling. Wind stress at the water surface causes Ekman drift in the upper layers. An adjustment drift occurs in the deeper layers causing colder water to upwell at the coast. Water at the coast is not completely replaced resulting in a falling sea surface at the coast and thus pressure gradients, which cause longshore currents to flow. (Diagram reproduced and altered from Schumann et al., 1982).

Pressure cells over the south coast of South Africa have the greatest influence on the winds. In summer, the Westerly Belt migrates southward and draws these pressure cells further south, resulting in mainly easterly winds. In winter the opposite occurs with the Westerly Belt and pressure cells migrating northwards. The Indian Ocean High pressure cell is less dominant in winter.

The wind driven coastal upwelling in this region is prevalent during summer and autumn, and is concentrated off prominent capes (such as Cape Recife, Cape St Francis and Cape Seal). The presence of an easterly wind does not guarantee upwelling, as other factors such as strength and duration of the wind also influence this process. If the wind is favourable then in the bays east of each cape, downwelling will occur (refer to Figure 2). The abrupt topography south of each cape causes the surface flow to be predominantly offshore, resulting in surface divergence and upwelling. A coastal jet develops south of each cape and as a consequence, the upwelling will progress westwards.

CLASSIC PAPER

Schumann, E. H., Perrins, L. -A. and Hunter, I. T. (1982). **Upwelling along the South Coast of the Cape Province, South Africa**. South African Journal of Science, 78, 238-242.

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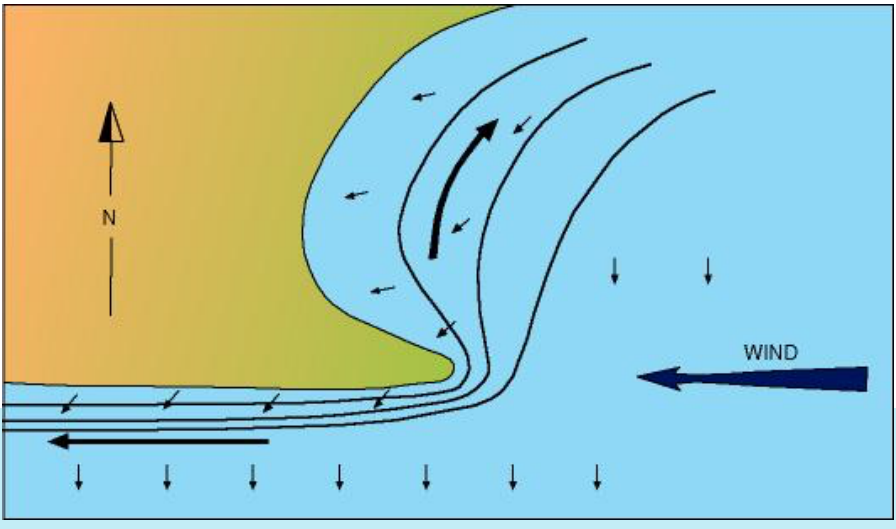

Figure 2 - Suggested processes operating around a cape to produce upwelling. Small arrows show surface Ekman drift induced by surface wind. Long arrows represent alongshore currents generated by pressure gradients caused by the Ekman drift. Water depth on the inner bay side of the cape is considerably less and thus the surface flow aligns closely to the wind direction with downwelling occurring. (Diagram reproduced and altered from Schumann et al., 1982).