

RESEARCH ARTICLE

Ocean circulation around Sri Lanka

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Abstract: Sri Lanka, located in the northern Indian Ocean with the Arabian Sea on its western side and the Bay of Bengal on its eastern side and experiences bi-annually reversing monsoon winds. This brief overview explored the dynamics of the surface circulation and coastal upwelling in the waters around Sri Lanka, particularly along the southern coast, using satellite imagery and numerical simulations using the Regional Ocean Modelling System (ROMS). The results confirmed the presence of the reversing current system, between the equator and Sri Lanka, in response to the changing wind field: the eastward flowing Southwest Monsoon Current (SMC) during the Southwest (SW) monsoon and the westward flowing Northeast Monsoon Current (NMC) during the Northeast (NE) monsoon, respectively. Along the eastern and western coasts, during both monsoon periods, flow is southward converging along the south coast. During the SW monsoon the Island deflects the eastward flowing SMC southward whilst along the east coast the southward flow results from the Sri Lanka Dome recirculation. The major upwelling region was located along the south coast resulting from southward flow converging along the south coast and subsequent divergence associated with the offshore transport of water. The location of the flow convergence and hence the upwelling centre was dependent on the relative strengths of wind driven flow along the east and west coasts: during the SW (NE) monsoon the flow along the western (eastern) coast was stronger migrating the upwelling centre to the east (west).

Keywords: Island-mass effect, monsoon, Sri Lanka, surface circulation, upwelling.

INTRODUCTION

The Island of Sri Lanka occupies a unique geographic/topographic and oceanographic location in the equatorial

northern Indian Ocean, with the Arabian Sea on its western side and the Bay of Bengal on its eastern side (Figure 1). The Island is an extension of the Indian sub-continental landmass into the ocean with deeper water (water depths > 2000 m) on either side of the Island. The interaction between the ocean currents and the Island topography controls the ocean circulation (de Vos *et al.*, 2014). From an oceanographic perspective, location of Sri Lanka is unique with its offshore waters transporting water with different properties, originating from Bay of Bengal and the Arabian Sea, through reversing ocean currents, driven by monsoon winds (Schott & McCreary, 2001; Su *et al.*, 2021). The northern Indian Ocean is characterised by bi-annually reversing monsoon winds resulting from the seasonal differential heating and cooling of the continental land mass and the ocean. The Southwest (SW) monsoon generally operates between June and October and the Northeast (NE) monsoon operates between December through April (Tomczak & Godfrey, 2003). The transition periods are termed the First Inter-Monsoon (May) and Second Inter-Monsoon (November). During the SW monsoon, the Southwest Monsoon Current (SMC) flows from west to east transporting higher salinity water from the Arabian Sea (Figure 2a) whilst during the NE monsoon the currents reverse in direction with the Northeast Monsoon Current (NMC) transporting lower salinity water originating from the Bay of Bengal from east to west (Figure 2b). During the SW monsoon, increased chlorophyll concentrations (> 5 mg m⁻³) have been recorded around Sri Lanka, particularly along the southern coast (Vinayachandran *et al.*, 2004; de Vos *et al.*, 2014) which appears to be a major upwelling region.

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