

Physical processes along the southern
continental shelf and slope of Western
Australia

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To *Ummi*,

Who taught me the meaning of patience, courage, sacrifice and struggle.

Abstract

The circulation along the south coast of Western Australia was examined using field data and numerical modelling. Physical processes in this region, particularly along the continental shelf and slope regions, were poorly understood due to a paucity of field measurements. Data were collected during a research cruise on RV *Southern Surveyor* (04/2006) during April 2006 consisting of 18 CTD transects from Twilight Cove (126°E) to Cape Leeuwin (115°E) and was augmented by shipborne ADCP data. The field data set provided a detailed understanding of three major current systems: Leeuwin Current (LC), Leeuwin Undercurrent (LU) and Flinders Current (FC). The LC along the south coast exhibits different characteristics when compared to that along the west coast. The LC flows into the colder and lower salinity subantarctic environment of the south coast. This is evident in a strong geopotential gradient off the south-west corner of Australia (Cape Leeuwin) resulting in rapid acceleration of the LC as it reaches a maximum velocity in this region. Numerical modelling studies, using the Regional Ocean Modelling System (ROMS) indicated that wind stress is an important component of the dynamics in this region. This was identified when comparing summer and winter conditions when the winds act in opposite directions, from north-westerly to south-easterly respectively. Along the shelf break and slope, the Flinders Current (FC) interacts with LC. As the dominant current, the FC serves both as a surface and as an undercurrent, transporting sub Antarctic mode water (SAMW). This interconnection the FC and LU can be seen clearly from the salinity, temperature and velocities within the depth range 200-700m postulating a connection between subsurface waters off Tasmania (origin of the Flinders Current) and the tropical Indian Ocean through the Flinders and Leeuwin Undercurrents.