

A Nowcast/Forecast System for Circulation in the Strait of Hormuz

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The Strait of Hormuz (SOH), separating the Persian Gulf from the Gulf of Oman with a narrow channel of water that is 40 to an excess of 200 meters in depth, is bordered by the Iranian province of Hormozgar to the north and the Omani exclave on the Musandam Peninsula to the south. The strait is approximately 280 km long and about 50 km wide at its narrowest point. The SOH is influenced by the extra-tropical and Indian monsoon wind regimes. The extra-tropical wind regime occupies west of SOH. The mountains from Iran and Iraq act to channel winds to the southeast. The extra-tropical winds are predominantly northwesterly in the northern portion of the gulf, becoming more westerly further south and become southwesterly on the western portion of the SOH. Iran's Zagros Mountains restrict the strongest of the southerly winds to the southeastern Gulf (therefore, the western portion of the SOH). The Indian monsoon wind regime occupies east of SOH with northwesterly winds in winter and southwesterly winds in summer.

The flow pattern and transition in SOH are investigated using the nowcast data of winds and currents (1 March to 31 July 2006) from a one-way coupled atmosphere-ocean model. The ocean component is the U.S. Navy's Shallow Water Analysis and Forecast System (SWAFS), which has been developed on the base of the Princeton Ocean Model (POM) with data assimilation capability. The atmospheric component is the U.S. Navy's Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS). The surface winds, air temperature, and mixing ratio calculated from COAMPS are used as input to SWAFS. The coupled model was running in the operational mode at the Naval Oceanographic Office with assimilating satellite and in-situ observed data.

Three main flow regimes are identified: (1) outflow regime with the surface current flowing out of the Persian Gulf and into the Gulf of Oman, (2) inflow regime with surface current flowing westward into the Persian Gulf, and (3) convergent regime. Smaller eddies formed in the eastern bend of the strait especially during the transition periods from inflow to outflow and from outflow to inflow. This is also the time period where the convergent flow regime is observed.

A particular feature was an eddy that formed at the tip of the peninsula and rotated in a cyclonic fashion. This 'peninsular eddy' was a near constant feature that disappeared during periods of heavy currents and was often displaced to the north towards Bandar Abbas, Iran as well as to the west towards the island of Qeshm. However, eddies forming in the eastern leg of the strait rotated in an anticyclonic direction and were a transient feature that grew in frequency and population towards the early summer as the force of the flow from the eddy in the Gulf of Oman became more evident.