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Formation of Anticyclonic Eddies Southeast of Sri Lanka during Summer Monsoons

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Recent observations collected as a part of ASIRI and MISO-BOB programs show that regional circulation in the southern Bay of Bengal (BOB) consists of the Southwest Monsoon Currents (SMC) and two prominent mesoscale eddies: a cyclonic eddy (the Sri Lanka Dome, SLD) to the east of Sri Lanka, and an anticyclonic eddy to the southeast of Sri Lanka. In August 2015, the anticyclonic mesoscale feature observed $\sim$ 500 km southeast of Sri Lanka had surface velocities of about 1 m/s and radius 110 km. Satellite sea surface height anomalies indicate that the eddy is part of a Rossby wave train present during summer monsoon season.

While it has been suggested that the formation of the anticyclonic eddy is due to interaction of SMC and a Rossby wave propagating westward from the Sumatra coast, we propose an alternative hypothesis for generation of anticyclonic eddy in the Rossby wave framework based on a set of laboratory experiments. The latter were performed in a circular rotating tank with β effect mimicked by a sloping bottom (α) and SMC by a jet. The laboratory Rossby number was maintained between 0.3 and 0.5. When the topographic perturbation of Sri Lanka was considered together with the SMC and the β effect, the anticyclonic eddy (and associated cyclonic eddy or SLD) due to topographically attached Rossby wave is mimicked, and the simulation well reproduced ocean observations. For the experiment performed without β effect (α = 0°), the anticyclonic eddy is generated by the Coriolis effect on the mean flow while the cyclonic eddy was largely absent though the separated flow is expected to have a cyclonic vorticity.

Intra-seasonal oscillations (ISOs) dominated by 30-60 day variability form December 2013 to August 2015 and detected by currents and temperature moored observations in the anticyclonic eddy study area are also part of this presentation. Momentum and heat flux analysis show that ISOs can have a significant impact on mean temperature and velocity fields in the thermocline.