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# Observation and Numerical Modeling of Channel-Trapped Lateral Velocity Front in an Estuary

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A cruise survey to sample salinity, temperature, and velocity was implemented in the Pearl River Estuary (PRE). The observation shows that in channel location appeared a strong lateral velocity convergence front in ebb tide and a divergence in flood. Some SAR images also exhibit this ebb lateral velocity convergence. To identify dynamic mechanisms of the velocity convergence and divergence, we use and run the free surface Finite-Volume Coastal Ocean Model (FVCOM) for the PRE domain. The modelling results indicate that the lateral baroclinic and barotropic forcing is a critical mechanism of the lateral velocity convergence and divergence. Then, idealized experiments with a triangular estuary domain are conducted for the forcing scenarios of tide-only, the river discharge-only, and the combination of the river discharge and the tide. The results show that lateral baroclinicity arising from the estuarine gravitational current can cause the lateral velocity convergence in the surface and divergence in the bottom at the channel location even without the tidal forcing. Under the forcing of the barotropic tide, the lateral velocity convergence appears on ebb and divergence on flood. The interaction between the tide and river discharge may enhance the surface convergence in the ebb tide and lead to the surface divergence in the flood. The further analysis suggests that the along-estuary change in channel depth and width is responsible for the barotropic tide-induced lateral velocity convergence and divergence in the channel location.

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