

Simulation of river plume behaviors in a tropical region: Case study of the Upper Gulf of Thailand

Xiaojie Yu¹, Xinyu Guo^{1*}, Akihiko Morimoto² and Anukul Buranapratheprat²

¹ Center for Marine Environmental Studies (CMES), Ehime University, Japan

² Department of Aquatic Science, Faculty of Science, Burapha University, Thailand

River plumes are a general phenomenon in coastal regions. Most previous studies focus on river plumes in middle and high latitudes with few studies examining those in low latitude regions. Here, we apply a numerical model to the Upper Gulf of Thailand (UGoT) to examine a river plume in low latitudes. Consistent with observational data, the modeled plume has seasonal variation dependent on monsoon conditions. During southwesterly monsoons, the plume extends northeastward to the head of the gulf; during northeasterly monsoons, it extends southwestward to the mouth of the gulf. To examine the effects of latitude, wind and river discharge on the river plume, we designed several numerical experiments. Using a middle latitude for the UGoT, the bulge close to the river mouth becomes smaller, the downstream current flows closer to the coast, and the salinity in the northern UGoT becomes lower. The reduction in the size of the bulge is consistent with the relationship between the offshore distance of a bulge and the Coriolis parameter. Momentum balance of the coastal current is maintained by advection, the Coriolis force, pressure gradient and internal stresses in both low and middle latitudes, with the Coriolis force and pressure gradient enlarged in the middle latitude. The larger pressure gradient in the middle latitude is induced by more offshore freshwater flowing with the coastal current, which induces lower salinity. The influence of wind on the river plume not only has the advection effects of changing the surface current direction and increasing the surface current speed, but also decreases the current speed due to enhanced vertical mixing. Changes in river discharge influence stratification in the UGoT but have little effect on the behavior of the river plume.

Keywords: River plume, Low latitude, Wind effect, River discharge, Upper Gulf of Thailand

*Presenter: E-mail: guoxinyu@sci.ehime-u.ac.jp