Effects of suspended sediment matters induced by high riverine discharge on coastal mixing: a model simulation

*干場 康博[1]、松村 義正[2]、羽角 博康[1]、伊藤 幸彦[1]、山下 洋[3]
*Yasuhiro Hoshiba[1], Yoshimasa Matsumura[2], Hiroyasu Hasumi[1], Sachihiko Itoh[1], Yoh Yamashita[3]

1. 東京大学大気海洋研究所、2. 北海道大学低温科学研究所、3. 京都大学フィールド科学教育研究センター
1. Atmosphere and Ocean Research Institute, The University of Tokyo, 2. Institute of Low Temperature Science, Hokkaido University, 3. Field Science Education and Research Center, Kyoto University

Rivers transport fresh water, suspended sediment matters (SSMs) and nutrients from land to coastal seas where biological productivity is high. Rivers directly supply dissolved inorganic nutrients to coastal areas. On the other hand, riverine buoyant freshwater inputs induce horizontal river plumes and vertical circulations which indirectly supply nutrients from the deeper nutrient-rich layer to the surface layer. The form and strength of horizontal river plumes and vertical circulations (e.g., estuary circulation) depend on the density difference between river water and seawater. SSMs are not just passively transported to coastal seas by such plumes and circulations but also change them by influencing the density of river water and seawater, as seen in the case of hypopycnal flows. The change of coastal mixing driven by the plumes and circulations due to the density-change by SSMs is expected to be important for coastal biogeochemistry, especially when a lot of SSMs are supplied to the sea, that is, huge flooding. However, the interaction between the physical (i.e., horizontal plumes and vertical circulations) and the biogeochemical (i.e., SSMs) processes has not been quantitatively discussed. In this study, we employ a non-hydrostatic ocean model (kinaco) with Lagrangian particles, which represent SSMs and affect the density of seawater, in order to estimate the mixing effect by SSMs. We used experimental settings of a realistic topography of Tango Bay, Japan during the flooding in Sep. 2013. Tango Bay is a region of freshwater influence by Yura River where extraordinary river-discharge was observed in Sep. 2013. We especially focus on influenced vertical mixing due to upwellings and downwellings accompanied by sinking of SSM-particles near the coast, and investigate the sensitivities of physical processes to density of SSM-particles, etc.

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