An application of a Lagrangian-Eulerian dispersed multiphase flow model to riverine discharge

*Yoshimasa Matsumura[1]

1. Atmosphere and Ocean Research Institute, University of Tokyo

While the density of seawater is basically determined by its temperature and salinity, the apparent density increases when the water mass contains a suspended sediment. Simiraly, apparent density declines when water mass contains fine scale materials of lower density such as bubbles and ice crystals. Such density anomaly caused by small suspended materials dispersed in seawater sometimes plays important roles in ocean physics, particularly at coastal regions where the influences of riverine discharge are substantial.

To simulate these oceanic dispersed multiphase flow, a new modeling framework using an online Lagrangian particle tracking method is developed. In this model, Lagrangian particles are dynamically coupled with a finite-volume non-hydrostatic ocean model. The buoyancy force acting on each individual particle is reflected on the RHS of prognostic equation for vertical velocity of continuous water phase at each time-step.

With using this model, idealized and realistic simulations for the transport and sedimentation processes of suspended materials provided by riverine and glacial meltwater discharges have been performed. In the presentation, we specifically introduce the results of hyperpycnal plume simulation where the apparent density of turbid discharge exceeds the density of ambient seawater.

Keywords: suspended sediment, Lagrangian particle tracking, non-hydrostatic ocean model, hyperpycnal plume