Stratification, Mixing and Vertical Salt Flux in the Sumjin River Estuary: a Numerical Model Study

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Three-dimensional numerical modeling (Finite-Volume Coastal Ocean Model (FVCOM)) is performed to study along channel variability in stratification, mixing and salt flux in the Sumjin River estuary. The model is particularly effective at reproducing the well-partially mixed condition during spring tide. Large observed variations in stratification during neap tides are captured limitedly by the model. During neap tide, the bottom mixed layer is limited near the mouth and seaward advection of freshwater at the surface near the mouth is weak, as a consequence the variability is found near the mouth and inner regime between the model and the observation. The depth-average longitudinal salinity of the model shows well consistency with the observation during spring tide compared to neap tide. The most notable discrepancy between the model and the observation is found in the vertical salinity structure. The greatest variability of vertical salt flux was found during spring tide due to turbulent mixing by large tidal amplitude. During neap tide, vertical salt flux becomes strong through entrainment process, with less fluctuation.

The main result of the numerical simulations was that mixing across the halocline showed marked along-channel variability due to bathymetric effects and channel constrictions. The MY2.5 turbulence closure overpredicts the thickness of the surface mixed layer. More detailed temporal observations are required to guide improvements in the turbulence closure and the proper parameterization of bottom stress to assess the performance of the model.