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Application of the Lagrangian approach to calculate dispersion coefficient in estuaries

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The purpose of this work is to simulate and explain the one-dimensional dispersion process in alluvial estuaries by using a Lagrangian approach. A three-dimensional hydrodynamic model that includes a Lagrangian particle-tracking simulation (SELFE) has been used for particle tracking. The model was used to investigate the dispersion processes in response to different boundary conditions, such as density difference, freshwater discharge, tidal amplitude at the seaward boundary etc. We reconstructed vertical and lateral profiles of velocities in a one-dimensional framework under an assumption of local equilibrium. The obtained velocities were used in a Lagrangian method of tracking particle pathways to estimate migration of solute particles (e.g., salinity) as influenced by tide and river discharge. In this way, the dispersion coefficient can be obtained directly. The results are compared with a numerical model for homogeneous and inhomogeneous simulations (i.e. without and with salinity), where we assessed the effects of the salinity-induced density gradients on the dispersion in estuaries.