

Velocity and Sediment Concentration Distributions of Turbidity Currents

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Abstract. In this work, we present a mathematical model to describe the distribution of the velocity and the particle concentration of the turbidity currents. The turbidity current is described by the Navier-Stokes equations with the use of Boussinesq approximation to approximate the effect of sediment concentration on the flow, the diffusion/dispersion equation for the sediment transport, and k-ε turbulence model for the problem closure. The model is simplified by a roof-like configuration which allows a steady equilibrium state of the flow. The numerical solution of the distribution of the flow velocity, the sediment concentration, the turbulence energy, and the dissipation rate are obtained by the finite-difference numerical scheme. The study shows that the entrainment capacity of sediment due to turbulence and the dampening characteristic of turbulence is related with Richardson number and non-dimensional settling velocity. The model is capable of capturing the fundamental characteristics of the turbidity current which provides a vital base state for the analysis of morphodynamics generated by the turbidity current.

Keywords: turbidity current