عنوان مقاله:

Observational and Numerical Methods for Quantifying and Modeling of Turbulence in a Stratified Reservoir

محل انتشار:

دوماهنامه مکانیک سیالات کاربردی, دوره 9, شماره 4 (سال: 1395)

تعداد صفحات اصل مقاله: 12

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خلاصه مقاله:

The interplay between stratification and shear in lakes controls the vertical mixing, which is the most important mechanism affecting the transport of heat, salt, momentum and suspended and dissolved substances. This study attempts to quantify and characterize the turbulence from direct measurements conducted in a reservoir. A ۳D numerical model is used to investigate the water column hydrodynamics for the duration of measurements and the performance of various turbulence models used in the CFD model are investigated via simulation of mixing in the reservoir. The drawdown curves produced by the turbulence models are formulized through linear equations. Although, use of different turbulence models do not have significant effects on the flow hydrodynamics away from the intake structure; significant effects especially on turbulence kinetic energy production are observed at the orifice. Therefore, for simulation of withdrawal flow, either use of shear stress transport (SST) k-omega models solving equations all the way to the wall or k-epsilon models with the nonequilibrium wall function is recommended to account for the changes in the pressure gradient. In this study, the methods using quantified turbulent characteristics of the flow to reformulate the Stokes' settling velocity to be applied in turbulent flows are also investigated. An approach to predict setting velocity in turbulent flows that utilizes acoustic Doppler instruments for quantification of turbulent characteristics is presented. Modification of the Stokes' settling velocity with the nondimensionalized turbulent kinetic energy production profiles lead better results than other turbulence characteristics (buoyancy flux and by Richardson number flux) widely used in characterizing turbulent mixing.

کلمات کلیدی:

Vertical mixing, Stratified reservoirs, Turbulent mixing, Settling velocities, Turbulence models