Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Turbulence modeling of sediment-laden, open channel flows SANJEEV JHA, FABIAN BOMBARDELLI, University of California Davis — In spite of the knowledge already gained of multi-phase flows by employing the multi-component flow theory in fluid mechanics, there is still no consensus among researchers on the most appropriate models to use in a given case. The issue complicates even further with the modeling of turbulence in those flows. In the special case of sediment transport in natural open channels (i.e., rivers), the understanding of the interaction between the different phases (water and sediment) presents diverse challenges. First, the bottom of the channel interchanges material with the water column, creating a constant source of disperse phase; second, the turbulence is non-homogeneous and non-isotropic. Most studies in the past have focused on the mean flow characteristics and on the distribution of sediment in the vertical, but they have not dealt with the turbulence statistics. In this work, we test diverse theoretical and numerical models for one-dimensional, open-channel flow with the dataset of Muste et al. (2005), one of the few datasets reporting detailed distributions of turbulence statistics in the vertical direction in the open channel. We analyze the performance of models of different complexity, ranging from simple "mixture" models to complete two-fluid models. For turbulence closure, we test the standard $k - \varepsilon$, $k - \omega$ and Reynolds stress (RSM) models, and also their extended versions proposed by different authors.

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Date submitted: 07 Aug 2007 Electronic form version 1.4