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Modeling the rheology of concentrated fluid-sediment mixtures ALLISON PENKO, JULIAN SIMEONOV, JOSEPH CALANTONI, Naval Research Laboratory — Common formulations to model the rheology in highly concentrated fluid-sediment mixtures include using a velocity damping function or an enhanced effective viscosity dependent on the local sediment concentration. Here, we implemented a three-dimensional mixture theory model (SedMix3D) to compare the results from the two different rheological formulations. The former assumes the mixture behaves as a Newtonian fluid and exponentially damps the mixture velocity dependent on the magnitude of the local sediment concentration. The latter formulation treats the mixture as a visco-plastic in which an enhanced effective viscosity depends on the Reynolds stresses and the critical stress of the sediment. SedMix3D treats a fluid-sediment mixture as a continuum by employing closures for the bulk parameters of the mixture (diffusion, hindered settling velocity, and effective viscosity) to simulate three-dimensional, bottom boundary layer flow over dynamic sediment beds. The two different rheologies were tested with simulations of an avalanching sediment pile forced with gravity only and simulations of oscillatory flow over rippled sand beds. Comparisons of the simulated hydrodynamics and sediment dynamics resulting from the two rheologies will be presented.

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