Two-dimensional numerical simulations for movements of soil block

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Authors proposed a set of constitutive equations of sediment-water mixture flow based on kinematic energy balance, and suggested that the shear stress is supported with Coulomb type's quasi-static friction stress and dynamic shear stress depending on shear velocity, and that the Coulomb friction stress is dominant in the flow. The constitutive equation set has been applied mainly to debris flows. In case of the debris flow over the erodible bed, the external shear stress on the bed should be supported by the Coulomb friction stress, as a result, depth averaged sediment concentration of the mixtures is uniquely determined by the bed slope.

In this study, we apply the constitutive equation set to soil block movement. In case of soil block movement, it is not necessary that the Coulomb friction stress is in balance with the external shear stress on the bed because the sediment concentration does not change during the movement. It means that the termination of the movement should be happened rather as stopping of the movement than deposition of sediment. At the instance of termination, the direction and the magnitude of Coulomb friction stress change discontinuously. Therefore, it needs to introduce the termination condition that reflects to discontinuity in Coulomb friction stress in the numerical calculation because the termination appears usually in finite differential time. We will demonstrate several calculated results.