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Results of a 3D MD-based landslide model with hydrologically triggering conditions modeled by means of fractional Richards equation

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We present an exhaustive investigation of parameters and some further results about the integration between the fractional Richards equation, used to model the infiltration processes in the soil, and a particle-based methods for simulating three-dimensional schemes of triggered deep seated landslides. The integration between the two models is achieved by means a numerical method, according to the failure criterion of Mohr-Coulomb to simulate the static conditions that underlie the triggering mechanism. The basic mechanism was presented by us to EGU 2013 (Particle-based models for hydrologically triggered deep seated landslides - Vol. 15, EGU2013-10599-1, 2013). Initially the modified Lubachevsky-Stillinger (LS) algorithm is used to generate hard-sphere packings. Then we use MD to generate mechanically stable jammed packings of particles interacting with Hertz-Mindlin forces in order to simulate a consolidate soil. In this way we obtain the input structure of our "fictitious" soil to model landslides considering the infiltration processes caused by rainfall. We study the model by varying the stiffness of particles. The models presents similar characteristics proving that the minimal representation of particles (material points with smooth interaction potential) is sufficient to have a good description of the dynamics. We also analyze the sensitivity of the models varying some parameters (hydraulic conductivity, cohesion, slope and friction angle, soil depth, variation of random properties, fractional order of the generalized infiltration model, etc.) and considering both regular and random configuration of the particles. In particular, we consider the triggering time of the simulated landslide by varying the slope angle. At about 45 degrees, depending on the choice of parameters, we observe a change in the dependences of the triggering times on the slope, characterizing the critical angle of the slope.