EFFECT OF INTERNAL FRICTION ON THE DEFORMATION OF DISRUPTED METEOROID. V. V. Shuvalov. Institute of Geosphere Dynamics, 38 Leninsky prosp., bld.1, Moscow, 119334 Russia. E-mail: shuvalov@idg.chph.ras.ru

In recent decades numerical finite-difference methods have been widely used for modeling the interaction between large meteoroids (with the size equal to or greater than 10 m) and planetary atmospheres. Deformation, fragmentation, and deceleration of a cosmic body are obtained from numerical solutions of hydrodynamic equations. The numerical models differ from each other in methods of the solution of the hydrodynamic equations and in equations of state describing thermodynamic properties of projectile material. This approximation was fruitfully applied in simulations of the comet Shoemaker–Levy 9 impact into the Jovian atmosphere and in simulations of the famous Tunguska event, and allowed explaining (at least, qualitative) all the effect observed in these unique phenomena. At the moment these models probably provide the most detailed and accurate description of “meteor explosions” in the frame of given physical assumptions.

In all the models under consideration the falling body is assumed to be a liquid-like strengthless body (no shear stresses). This assumption seems to be satisfied for rather large (>10 m) impactors which penetrate to dense atmospheric layers and experience fast and severe fragmentation at low altitudes, where aerodynamic loading strongly exceeds material strength. For this reason the projectile experiencing deformation can be considered as a totally fractured one.

However, even a totally fractured body differs from liquid due to internal friction, i.e. shear stresses proportional to the pressure. The internal friction could influence the process of deformation and, consequently, could change a depth of penetration into the atmosphere. The purpose of this work is to estimate an effect of the internal friction on the modeling of projectile deformation and fragmentation.

The approximation described in [1] was used to model the interaction between a meteoroid and the Earth’s atmosphere. The model of dry friction (Coulomb-Mohr model) was added to take into account the internal friction.

The results of numerical simulations show that the internal friction strongly influences the deformation of disrupted meteoroid and results in a strong decrease (10 to 20 km) of an altitude of deceleration and an altitude of energy release. However, “acoustic fluidization” and penetration of shock compressed gas in the interior of fractured meteoroid can considerably decrease the internal friction.

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References: [1] Shuvalov V.V. and Artemieva N.A. 2002. *Journal of Planetary and Space Science* 50/2:181–192.