

ON THE ESTIMATION OF THE STRENGTH OF METEORIDS. K. Nazarova¹, P. A. Bland¹ and N. A. Artemieva². IARC, Department of Earth Science and Engineering, Imperial College London, South Kensington, SW7 2AZ, London, UK; Institute for the Dynamics of Geospheres, Russian Acad. Sci., Leninsky Prospect 38/6, Moscow, Russia 117939

Information on the strength of meteoroids over a range of sizes is rather limited. The strength of the body depends on material, structure, composition, dimension, shape, and its life history. Fragmentation of meteoroids by aerodynamic forces is closely connected with their strength – improving models of meteoroid strength is fundamental to understanding of meteoroid fragmentation and to improving our understanding of impact rates at planetary surfaces [1].

Measurements of the mechanical properties of meteorites are an important source of information on iron and stony meteoroid strength [2]. But this dataset is clearly limited, and extending strength estimates from meteorites to large meteoroids is problematic. To improve our understanding of meteoroid strength, we are comparing results from modelled atmospheric disruptions to fireball data, and modelled cratering events to the size and morphology of small crater fields on Earth (for those cases where impactor-type is known).

There are three main approaches to describing the atmospheric motion of meteoroids which are relevant to estimating the conditions for meteoroid break-up. The first - a hydrodynamic approximation - considers the impactor as a liquid-like object or droplet – so-called ‘pancake’ models [3, 4]. The second approach is based on studying the motion of the finite number of large well-separated fragments, which may be described individually [5, 6]. The third approach describes an intermediate situation when the fragments are not well-separated and move like a swarm of particles [3].

Here we use the model of separate fragments (SF) and a hydrodynamic approximation to estimate the strength of terrestrial impactors. By varying bolide strength in our simulations of atmospheric disruption, or small-asteroid impact, we can achieve a best-fit to specific fireball events and terrestrial crater fields. In this paper, we compare our modelled strength estimates from >20 fireball events, and a number of small crater fields, to laboratory data on meteorite strength [7, 8], to derive a strength model for iron and stony meteoroids extending over a $1\text{-}10^6\text{kg}$ mass range.

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