

Scaling relations for shock wave effects from impacts of cosmic objects with diameter from a few meters to 3km.

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The destructions and injuries caused by the shock wave are one of the most important dangerous consequences of the impact of cosmic objects. In the case of the Chelyabinsk event, the shock wave was the only one dangerous effect whose action led to a little structural damage, a large number of broken windows, window frames and doors.

The overpressure and maximum wind speed behind the shock front, resulting in one or other hazards, may be estimated based on the data on nuclear explosions or based on the especially elaborated model of cosmic objects passing through the Earth atmosphere. The atmospheric entry of cosmic objects was modelled for a large number of different scenarios for the entry of space bodies into the atmosphere of the Earth (Artemieva et al. 2017). Based on these simulation results scaling relations for the maximal overpressure, the relative pressure spatial distribution (the ratio of disturbed pressure to the undisturbed atmospheric pressure at the point) and wind speed are constructed. The scaling relations of the relative pressure and wind speed take into account the inhomogeneity of the distribution. Suggested scaling relations are dependent only on the properties of the entering object (size, density, velocity and entry angle).

Suggested scaling relations were tested on data of Tunguska and Chelyabinsk events and showed satisfactory agreement. This scaling relations have been implemented in the web-site application which allowed quick and quite accurately assess the various effects of impacts. The test version of web-calculator is available by the url - [http:// http://www.AsteroidHazard.pro](http://http://www.AsteroidHazard.pro).