

Assessing the consequences of asteroid and comet impacts on the Earth

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Impacts of cosmic bodies on the Earth lead to hazardous effects that can immediately after the impact or subsequently have a harmful effect on humans, animals and plants, and on economic objects. Damage on the ground produced by pressure pulses of shock waves and radiation fluxes are most important dangerous effects of asteroid and comet impacts. The Chelyabinsk airburst resulted in little structural damage, other than broken windows, window frames and doors. The thermal radiation can be strong enough to be dangerous to people, to ignite fires and even to melt rocks. It may be recalled that the Chixculub crater-forming impact of an asteroid 10–15 km in size generated global wildfires, and the famous 1908 Tunguska event, caused by the entry of an object about 50 m in diameter, generated a forest fire within a radius of 10–15 km. The shock wave is also the cause of seismic effects. The Richter scale magnitude and Mercally scale intensity are used for determination of the instrumental characteristics of a seismic disturbance in the observational point. Atmospheric plume resulting from impact rises to high altitudes (100-300 km) and generate atmospheric disturbances expanding to distances up to thousands of kilometres. For crater-forming impacts, important characteristics are the size of the crater and the parameters of the layer of ejecta from crater (thickness of the ejecta blanket and fraction of melt in ejecta).

A serial numerical modeling of the interaction of cosmic objects with the atmosphere has previously been performed for a large number of different scenarios under the hydrodynamic model. Based on these simulation results scaling relations for the most important parameters of the shock wave, radiation and seismic effects and atmospheric disturbances are constructed. Suggested scaling relations are dependent only on the properties of the entering object (size, density, velocity and entry angle). Precise impact risk assessment is a significant computational challenge. This motivates the usage of simplified approaches and fast assessment of effects, which can be based on suggested scaling relations. Such calculator have been developed and it is available via internet: <http://AsteroidHazard.pro>