PDC2015
Frascati, Roma, Italy

☐ **Planetary Defense – Recent Progress & Plans**
☐ **NEO Discovery**
☐ **NEO Characterization**
☐ **Mitigation Techniques & Missions**
☒ **Impact Effects that Inform Warning, Mitigation & Costs**
☐ **Consequence Management & Education**

IAA-PDC-15-P-87

LOCATION AND CONSEQUENCES OF CELESTIAL BODIES COLLISION WITH THE EARTH

Yuri Bondarenko[(1)], **Yuri Medvedev**[(2)]
[(1)(2)]*Institute of Applied Astronomy, RAS, nab. Kutuzova 10, 191187 St. Petersburg, Russian Federation, +78122751090,*

Keywords: *Earth's atmosphere, trajectory of motion, airburst, impact areas, overpressure areas*

ABSTRACT

Authors developed and realized dynamical model, allowing to determine the trajectory of motion of celestial bodies in the Earth's atmosphere, to determine the parameters of heliocentric orbit of celestial bodies prior to its entry into the atmosphere, to estimate probable impact areas of fragments as well as major factors of damage due the blast wave. The model researches several scenarios due to the passage of the object in the Earth's atmosphere. In case the object passed through the atmosphere, without colliding with the Earth, the moments of an entrance and exit of a body from the Earth's atmosphere are determined. The object can collide with the Earth without breakup. In this case, the differential equations are integrated until the celestial body reaches the Earth's surface. It was assumed that the object burns in the atmosphere, if its radius becomes sufficiently small. The case when object breaks up during the motion and only the fragments reach the Earth's surface was considered separately. The developed model has been implemented in the software package. One of the advantages of the package is the ability to save the results of calculations in the .kml format, allowing to display three-dimensional geospatial data in the "Google Earth" and "Google" maps (Figure 1).

Using this model the motion of Chelyabinsk and 2008 TC3 meteorites were simulated. It was shown that heliocentric orbital elements of the Chelyabinsk and 2008 TC3 meteorites before entering the Earth's atmosphere calculated using the developed software are close to the parameters obtained by other authors, the trajectory parameters are in good agreement with the initial data within their accuracy. Estimated impact areas of meteorites fragments are only in few kilometers from the recovered one. The overpressure areas due the blast wave in case of "Chelyabinsk" meteorite coincide with the real data.

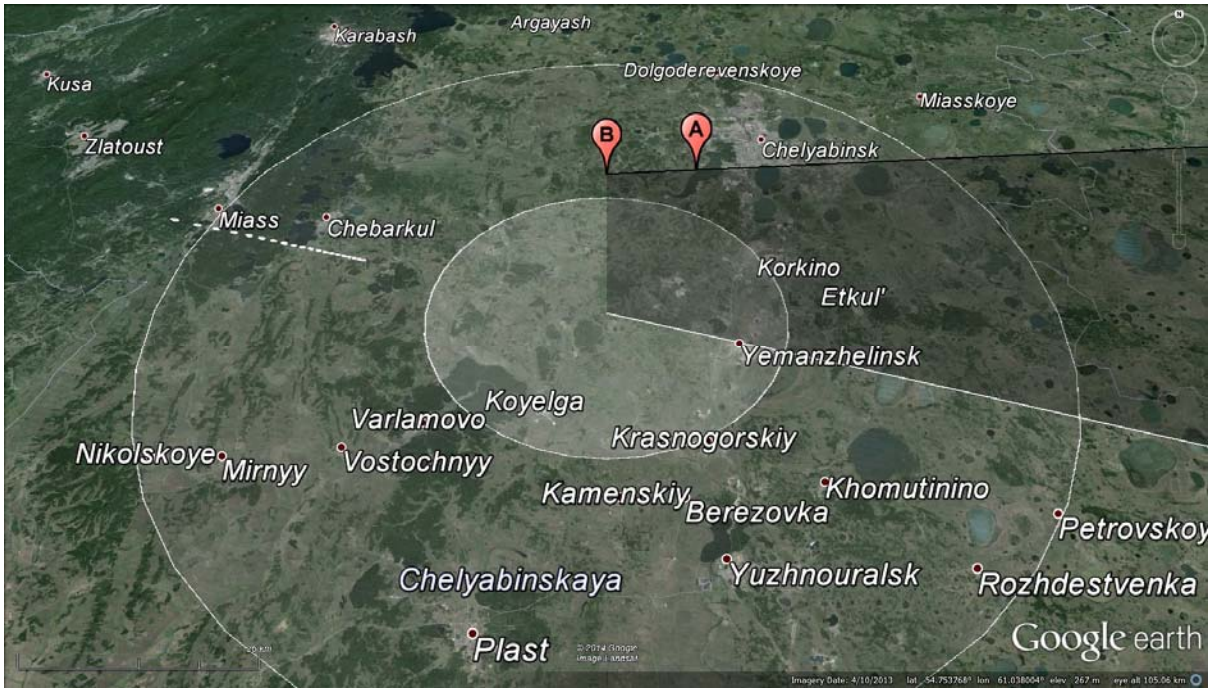

Figure 1. The flight trajectory of the Chelyabinsk meteorite (black line) and its projection to the Earth's surface, the places of meteorite break up and air burst (A and B, respectively), the impact areas of the fragments, the overpressure areas due the blast wave, as well as other useful information.