A model of atmospheric entry in Earth's atmosphere and its application to the data acquired by fireball networks

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The analysis and modelling of the atmospheric flight requires the detailed knowledge about physical properties of the object (most of which change along the flight), such as bulk and grain density, shape, mass, etc. A different approach to tackle this problem is based on dimensional analysis, scaling, and similarity laws. Thus instead of using the average values as input data, all unknowns can be gathered into dimensionless parameters, retrievable from the observations with the help of inverse techniques. Such approach has been recently implemented in (Gritsevich, 2009; Gritsevich and Koschny, 2011; Bouquet et al., 2014). In this report we describe several improvements to this model, including a possibility to correct calculations with account for the real atmospheric conditions (Lyytinen and Gritsevich, 2015). Furthermore we suggest several side applications of the introduced parameterization, such as, for example, determination of duration and the terminal height of the fireballs (Moreno-Ibáñez et al., 2015). In order to demonstrate the applicability of the model, we have used archived data from the Meteorite Observation and Recovery Project operated in Canada between 1970 and 1985 (MORP) as well as selected recent fireball registrations (Trigo-Rodríguez et al., 2015). Our next steps foresee processing of the data obtained by the Finnish Fireball Network (FFN) and the Spanish Meteor Network (SPMN).

References

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