ANALYSIS OF LUMINOUS TRAJECTORIES OF FIREBALLS RECORDED IN ROMANIA

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Introduction: The Meteorite Orbits Reconstruction by Optical Imaging (MOROI) project [1] started in 2017 in Romania with the aim of capturing images of meteors with the use of all-sky cameras. In January 2021 the MOROI project became a part of the Fireball Recovery and Inter Planetary Observation Network (FRIPON) [2]. The meteors recorded by the FRIPON cameras are stored on a centralized database located in the Pytheas structure in Marseille [2]. The data on meteors recorded by the FRIPON cameras can be found online [3]. FRIPON (thus, MOROI) uses all-sky cameras with fish-eye lens [2]. FreeTure software is used for collecting the data that is afterwards stored at the server in Marseille [2].

Methods: The input data for this study are the slope as well as the velocity and height profiles of the meteoroids during the luminous trajectory. The characterization of meteoroids is made based on the ballistic coefficient α and the mass-loss parameter β. The way of determining the α and β parameters is explained in detail in [4]. This method is in use by the other all-sky cameras networks including the Finnish Fireball Network, the Desert Fireball Network and the Spanish Fireball and Meteorite Network [5,6]. The computed values of α and β for fireballs detected by the Prairie Network and the Canadian Network can be found in the literature [7]. The α-β algorithm was applied to meteors detected by the Desert Fireball Network in [8] and based on this the conclusion whether the meteoroid could produce or not meteorites on the ground was drawn. The account for real atmospheric conditions is presented in [9].

Results: We applied the α-β algorithm to a sample of fireballs with noticeable deceleration recorded by the FRIPON network in Romania with the use of MOROI cameras [10]. The determined α and β parameters allow to compute the mass at the beginning of the luminous trajectory and, when applicable, the remnant mass after the end of ablation process for each event [10, 4, 9]. Based on the boundary values of the shape change parameter that $\mu = 0$ (corresponding to the oriented motion of the meteoroid) or $\mu = \frac{2}{3}$ (when the meteoroid rotates fast and loses the mass uniformly in all directions) and using the criteria presented in [11,8] we identify which meteoroids from our study produce meteorites on Earth's surface.

Conclusion: The algorithms described in [4, 11, 8] allow to effectively characterize the fireball events captured by the FRIPON-MOROI network in Romania [10]. The final outcome of the meteoroids' entry into the atmosphere is shown as "likely fall", "possible fall" and "unlikely fall" [10]. This work presents a way of finding out the most interesting events out of a set of meteor data. This is important in order to select the most promising events for a further dark-flight trajectory study and subsequent meteorite recovery. This presentation shows part of the results that can be achieved by the FRIPON network in a year and a half of functionality and is useful for colleagues who that for a meteor data-processing pipeline or countries that want to initiate collaborations with FRIPON.

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