Analysis of different methods used to compute meteors orbits

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Despite of the development of the cameras networks dedicated to the observation of meteors, there is still an important discrepancy between the measured orbits of meteoroids computed and the theoretical results. The gap between the observed and theoretic semi-major axis of the orbits is especially significant. An accurate determination of the orbits of meteoroids largely depends on the computation of the pre-atmospheric velocities. It is therefore imperative to dig out how to increase the precision of the measurements of the velocity.

In this work, we perform an analysis of different methods currently used to compute the velocities and trajectories of the meteors. They are based on the intersecting planes method developed of Ceplecha (1987), the least squares method of Borovicka (1990), and the multi-fit parameterization method published by Gural (2012). The only way to objectively compare the performances of these techniques is to apply them to well known meteors. We therefore simulate realistic meteors to perform this analysis. Some of them are built following the propagation models studied by Gural (2012), and others created by numerical integrations using the Borovicka et al. 2007 model. In order to reproduce the meteors recorded by the CABERNET cameras, an analysis of the measurement error on the location of the centroids in the images is conducted. Once the simulated meteors are created, we test different optimization techniques to perform the multi-fit parameterization and pick the most suitable one.

We will present the results of this analysis as well as their limitations. We also investigate the influence of the geometry of the trajectory on the result.

References

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