Monte-Carlo simulations of meteor orbit computations

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We are analyzing double-station meteor data obtained with the Canary Island Long-Baseline Observatory (CILBO) of the Meteor Research Group of the European Space Agency. CILBO has been obtaining meteor observations with image-intensified video cameras on the islands of Tenerife and La Palma, Spain, since 2012. The Meteor Orbit and Trajectory Software (MOTS, Koschny and Diaz del Rio 2002) was modified to allow the modelling of uncertainties in the accuracy of the astrometric measurements of MetRec via Monte-Carlo simulations (Albin et al. 2016). The code was used to analyse the error propagation of the initial uncertainties to the orbital elements.

This paper will present how the initial astrometric uncertainties were derived. We then perform MC runs of shower meteors and show the main dependencies of the orbital elements and where the uncertainties come from. For example, an error in the velocity determination will result in an error of the semi-major axis and of the eccentricity. These errors are connected: a given change in semi-major axis will result in a certain change in the eccentricity. Another example: the orientation of the meteoroid's path w.r.t. a camera will determine the error in velocity relative to this camera.

We derive lessons learned for the interpretation of orbit data and typical error bars for the CILBO setup. We show how these can be extended to other camera systems.

References

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