**A Comparison of Meteor Data Reduction Pipelines** P. M. Shober[1], J. Vaubaillon[1], S. Anghel[1,2], A. Malgoyre[3], H. A. R. Devillepoix[4], E. K. Sansom[4], D. Vida[5], and F. Colas[1], [1]Institut de Mécanique Céleste et de Calcul des Éphemerides (IMCCE), Observatoire de Paris (77 Avenue Denfert-Rochereau 75014 Paris France, patrick.shober@obspm.fr), [2]Astronomical Institute of the Romanian Academy (5 Cuțitul de Argint, 040557 Bucharest Romania), [3]Service Informatique Pythéas (SIP) CNRS – OSU Institut Pythéas – UMS 3470, Marseille, France, [4]Space Science & Technology Centre, School of Earth and Planetary Sciences, Curtin University, Bentley, WA 6102, Australia, [5]Department of Physics and Astronomy, University of Western Ontario, London, Ontario N6A 3K7, Canada

**Introduction:** Routine telescopic surveys cannot adequately characterize our solar system's population of meter-sized or smaller objects. The objects are simply just too small to be detectable in sun-reflected light. Thus, in order to better understand this population, scientists have primarily used meteor and fireball camera observation networks [1,2,3]. These networks typically monitor large portions of the night sky at each location, with locations spanning continental distances [4].

Several decades have passed since the first all-sky meteor observation networks; nevertheless, it has only relatively recently become extremely easy to get the necessary equipment to start an observation network. Originally observatories could cost >$100k, while today, you can achieve a similar setup for hundreds of dollars [4,5]. The cost is now sufficiently low that even amateur astronomers can also begin to build networks. Today, the total number of meteor observation dedicated cameras reaches a few hundred at least [6] and counting.

Despite this rapid amelioration of the hardware's cost and operation, reducing the data collected by these cameras is still very challenging. This is important because this data helps us understand the origin and evolution of debris in the solar system. Slight systematic differences in datasets can vastly change our interpretations. Producing accurate trajectories with representative uncertainties is challenging; however, this study aims to aid those who want to do meteor science.

Thus, we worked with colleagues from two other universities who also operate professional fireball observation networks like FRIPON [7] to thoroughly compare our data reduction pipelines. The three networks aforementioned include: the Fireball Recovery and InterPlanetary Observation Network (FRIPON)[7], the Desert Fireball Network (DFN)[6], and the Southern Ontario Meteor Network (SOMN)[8].

**Methods:** This comparison was done using real and synthetic data.

The real events were observed by FRIPON, and the initial analysis was focused on a subset of a few thousand 2-station detections. These events are processed through each pipeline's standard running procedure along with several other non-standard triangulation methods.

We are also conducting an extensive Monte-Carlo analysis of synthetically generated observations to fully assess the difference in the pipelines. The simulator used to generate the synthetic observations starts with randomized initial conditions. It uses the meteoroid's equations of motion, which describe the fall dynamics and ablation [9], to simulate its trajectory until it drops below 2 km $s^{-1}$ or ablates entirely. The measurements are varied within a randomized Gaussian measurement error (2 arcmin) [10] on par with those for typical FRIPON observations.

**Results:** Tens of thousands of synthetic meteor events, along with FRIPON detections, will provide a thorough comparison of three professional meteor networks: FRIPON, DFN, and SOMN. The analysis can show how the reduction methods differ and affect the trajectories and, therefore, the orbital data.

Upon publication of this analysis (Shober et al. In Prep.), the triangulated synthetic meteor dataset produced will be made publicly available. This dataset will consist of synthetic observations and the trajectories produced by three professional meteor networks. Thus, it can be used by other professional or amateur astronomers to verify/compare their data reduction pipelines when attempting to set up new meteor observation networks of their own design.

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