INTRODUCING THE FireOwl – DATA PROCESSING SOFTWARE OF THE FINNISH FIREBALL NETWORK

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Introduction: The Finnish Fireball Network (FFN) was established in 2004 due to growing interest to continuous meteor and fireball monitoring. In the current state, the network consists of the 24 active stations with permanent instrumental setup and monitors a surface over Finland and neighbouring areas of about 400.000 km^2. Most of the active stations are run by amateur astronomers. Until recently, the majority of interesting events were reduced in the following days after the registration and the atmospheric trajectories corresponding to the visual path of fireballs were retrieved using the fb_entry program [1] [2].

In this presentation, we describe the new FireOwl software developed for and used by the Finnish Fireball Network. The software includes kernels for image calibration, fireball measurements, visible flight triangulations, dark flight trajectory, and solar system orbit calculation.

Methods: The software is a web application and is written in JavaScript. Therefore all numerical calculations are processed as client-side procedures. Results can be stored in the server for later use.

Selected cases are studied more thoroughly and may include: mass computations [3], dark flight simulations [4], search for parent bodies and pre-impact orbit estimate [5].

Results and conclusions: We demonstrate the usage and capabilities of the software using a prominent example of exceptionally durable fireball observed in Northern Scandinavia. The fireball entered the atmosphere at 2020-09-07 T20:03:34Z and was visible for 26 seconds. In addition to FFN data, visual observations of the fireball were reported by 36 observers around Finland to the Ursa's Taivaanvahti service https://www.taivaanvahti.fi.

We use image observations from the two locations and one video observation in order to define the luminous flight trajectory. These observing sites locations are Haukipudas, Tohmajärvi, and Tampere for the video observation. We calibrate cameras and measure the beginning and the end points for Haukipudas and Tohmajärvi. Video obtained from Tampere is also inspected by frames to retrieve velocity distribution of the fireball. We use dz-correction [6] to retrieve flight trajectory with good accuracy. The reconstructed flight trajectory together with velocity curve are used to inversely solve for the best fitting mass of meteoroid and its pre-impact solar system orbit. We conclude that this showcase does not turn out to be a probable meteorite-producing candidate according to numerical integration and the alpha-beta criterion [7] [8] [9].

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