Preliminary Modeling results combining MAARSY meteor head echo observations and optical instrumentation to obtain meteoroid properties

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Although meteors are a well-known phenomena, our knowledge about the fundamental physical properties of the extraterrestrial particles is rather limited. Until today there are large uncertainties about the meteor mass input on Earth or about the amount of ablated meteoric material that is deposited in the mesosphere/lower thermosphere (MLT) due to the large discrepancies between the different observation techniques with regard to the meteoroid mass, velocity, chemical composition, fragmentation or source radiant.

Two years ago we started a continuous meteor head echo survey using the Middle Atmosphere Alomar Radar System (MAARSY) to study the Earths meteoroid environment at Northern latitudes above Andenes, Norway. The continuous radar survey was complemented by high-quality optical observations. This multi-instrumental approach allows to constrain observation technique related uncertainties, such as the ionization or luminous efficiencies, to further get an enhanced estimation of the meteoroid mass. The limited knowledge about the ionization and luminous efficiencies, so far, led to order of magnitude differences in the obtained meteoroid masses.

Meteor ablation models can help to solve some aspects of this open question. We are going to present some initial modeling results to determine the meteoroid properties constraining our meteor ablation model by the observed radar and optical quantities. In particular, we use the radar information of the pulse-to-pulse velocity and deceleration, the optical light curves as well as the trajectory information to estimate the initial out of atmosphere meteoroid mass and velocity (see Figure 1). We discuss the ablation model derived masses with respect to the dynamical mass obtained directly from the deceleration curves as well as the optical masses.

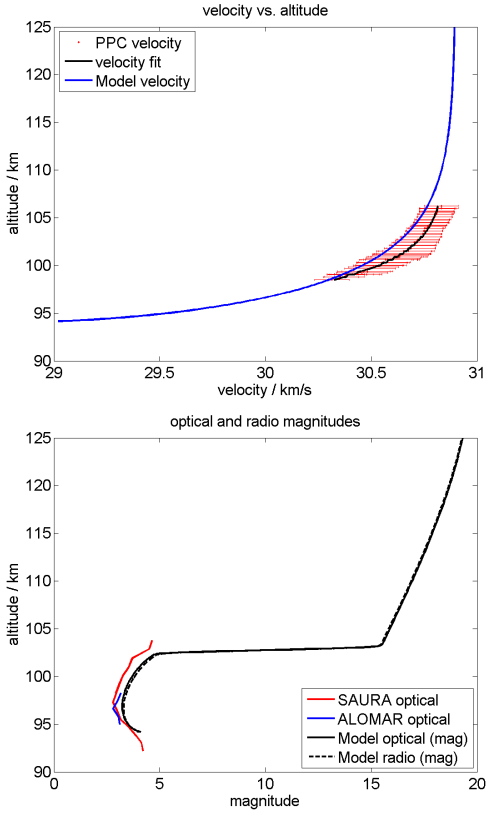

Figure 1: Simulated and observed velocity vs. altitude profile of a chondritic meteoroid with an initial mass of $1.8 \cdot 10^{-}6\ kg$, an out of atmosphere velocity of $69.74\ km/s$ and a particle density between $700 - 1000\ kg/m^3$