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Modeling large-aperture radar observations of meteors

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To address the many remaining questions on the global meteoroid flux and resulting atmospheric effects, we constructed a model that follows meteor evolution from ablation and ionization to head echo formation and through non-specular trail reflections. This model incorporates existing meteor physics together with knowledge we gained from meteor trail plasma simulations, such as instability physics and anomalous diffusion. Comparing results from this model with large radar observations of head echoes and non-specular trails shows that we can reproduce many of the salient features measured. We present results showing how this model allows us to use large-aperture radar results to better estimate meteoroid properties such as number, mass, velocity, and, roughly, composition. Additionally, when neutral winds or electric fields are included in our model, the same model predicts both short duration (˜1 second) and long duration meteor trails (several minutes) depending upon the characteristics of the meteoroid and atmosphere.