Ionization profile of meteors from simultaneous video and radio forward scatter observations

Hervé Lamy¹, Michel Anciaux¹, Sylvain Ranvier¹, Antoine Calegaro¹, and Carl Johannink²

¹Royal Belgian Institute for Space Aeronomy, Space Physics, Brussels, Belgium (herve.lamy@aeronomie.be)
²Dutch Meteor Society, Gronau, Germany

In this study, optical video observations of meteors with the CAMS (Camera for All-sky Meteor Surveillance)-BeNeLux network and radio forward scatter observations with the BRAMS (Belgian RAdio Meteor Stations) network obtained on 4-5 October 2018 are combined in order to obtain an ionization profile along a meteor path.

The trajectory, initial speed and deceleration parameters of a given meteor are provided by the CAMS-BeNeLux data. For a given trajectory, the positions of the specular reflection points for radio waves are computed for each combination of a given BRAMS receiving station and the BRAMS transmitter. For each receiving station which recorded a meteor echo (depending on the geometry and the SNR ratio), the power profile is computed and the peak power values of the underdense meteor profiles are used to determine the ionization (electron line density) at the various specular reflection points along the meteor path. This is done using the McKinley (1961) formula which is strictly valid for underdense meteor echoes. We discuss how we compute the gains of the antennas, the polarization factor, and how the peak power values are transformed from arbitrary units into watts using the signal recorded from a device called the BRAMS calibrator. We also discuss how to extend this study to overdense meteor echoes or those with intermediate electron line densities.

Finally, these results are combined with a simple ablation meteor model in order to obtain an estimate of the initial mass of the meteoroid.