Optimising Meteor Echo Detection Rates for the Tiger SUPERDARN Radar

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Abstract

SuperDARN HF backscatter radars can be used to detect meteor echoes and estimate mesospheric winds [1]. Large meteor echo detection rates increase the accuracy of the wind estimates, and also permit them to be estimated with better time and height resolution. Larger meteor echo detection rates can be achieved by modifying the radar hardware, radar operating parameters, real-time signal processing, and the post-processing analysis of echoes. In this study, enhanced meteor echo detection rates were achieved by modifying TIGER operating parameters and improving the post-processing analysis. The characteristics of several different kinds of echoes that contaminate the meteor echo population were identified. Echoes with unusually large spectral widths (~300 to 500 m s-1) were observed scattered throughout the meteor echo population. Their characteristics were otherwise the same as meteor echoes, and their large spectral widths were probably an artifact caused by an error in the algorithm used to process echoes with marginal signal-to-noise ratio. However, the large spectral widths may have been caused by a plasma instability acting upon the meteor trails [2]. Another kind of echo was of ionospheric origin and formed thin, continuous traces decreasing in group range from ~1200 km to ~300 km in range-time summary plots. These “descending plasma streams” (DPS) merged into and disappeared at the group ranges of meteor echoes. DPS traces were striated in group range, and oscillated on atmospheric gravity-wave time scales (~15 min to 2 h). Their behaviour resembled sporadic E associated with proton aurora as observed by other SuperDARN radars [3], and tidal ion layers observed by incoherent scatter radars [4].

REFERENCES

[1] G. E. Hall, J. W. MacDougall, D. R. Moorcroft, and J.-P. St.-Maurice, Super Dual Auroral Radar Network observations of meteor echoes, *J. Geophys. Res.*, vol. 102, pp. 14,603-14,614, 1997.

[2] K. Schlegel, Coherent backscatter from ionospheric E-region plasma irregularities, *J. Atmos. Terr. Phys.*, vol. 58, pp. 933-941, 1996.

[3] P. T. Jayachandran, J.-P. St.-Maurice, J. W. MacDougall, and D. R. Moorcroft, “HF detection of slow long-lived E region plasma structures,” *J. Geophys. Res.*, vol. 105, pp. 2425-2442, 2000.

[4] J. D. Mathews, M. P. Sulzer, and P. Perillat, “Aspects of layer electrodynamics inferred from high-resolution ISR observations of the 80-270 km ionosphere,” Geophys. Res. Lett., vol. 24, pp. 1411-1414, 1997.