Correlation between constant density and an upper inflection point in meteor radar echo decay time profiles

Joel P. Younger[1,2], Iain M. Reid[1,2], Wen Yi[3], Chris M. Hall[4], Masaki Tsutsumi[5], and Damian J. Murphy[6]

(1) ATRAD Pty. Ltd., 20 Phillips St, Thebarton, SA, 5031, Australia

(2) School of Physical Sciences, University of Adelaide, SA, 5005, Australia

(3) CAS Key Laboratory of Geospace Environment, Department of Geophysics and Planetary Sciences, University of Science and Technology of China, Hefei, China

(4) Tromsø Geophysical Observatory, The Arctic University of Norway, Tromsø, Norway

(5) National Institute of Polar Research, Tokyo, Japan

(6) Australian Antarctic Division, Kingston, TAS, Australia

A number of studies have shown a high altitude inflection point in the vertical profile of meteor radar echo decay times. Above a critical point, underdense meteor radar echo durations increase with height, which deviates significantly from the monotonic decrease in echo duration with respect to height that would be expected from a diffusion-only model of meteor trail evolution. Comparison of meteor radar data with satellite measurements of neutral atmospheric density indicate that this feature of the meteor radar echo decay time profile occurs near a constant density surface. It is speculated that the extension of high altitude meteor echo decay times is related to complex meteor trail evolution processes that arise from the interaction of meteor trail plasma with the geomagnetic field. The correlation of the upper inflection point in the meteor radar echo decay time profile with a specific neutral atmospheric density provides an additional metric for tracking variations in atmospheric density in the meteor region. Combining this result with the previously studied lower inflection point constant density surface allows meteor radar echo decay times to be used to infer an independent estimate of the atmospheric density scale height.