

Anomalous ambipolar diffusion observed using meteor radars in northern high latitudes

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Ambipolar diffusion coefficients are estimated through radar echo decay rates of ionized meteor trails. Information of neutral atmosphere temperature in the lower thermosphere can be further deduced from the ambipolar diffusion coefficient when electron and ion temperatures can be regarded the same with the neutral atmosphere temperature [e.g., Tsutsumi et al., 1994,1996; Hocking et al., 1999, 2004]. We found that the ambipolar diffusion in the polar mesosphere was sometimes anomalously enhanced in Arctic meteor radar observations. Comparison with collocated Na lidar and EISCAT radars in Tromsø showed that such enhancements were not observed in neutral temperature field, and that enhanced electric field in the lower thermosphere seemed responsible for the anomalous ambipolar diffusion. This further indicates that meteor radar observations in polar regions have a potential to give a certain measure of electric field in the lower thermosphere and even the upper mesosphere, which is very difficult to observe without an incoherent scatter radar.

Keywords: ambipolar diffusion coefficient, meteor radars, polar mesosphere and lower thermosphere