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Approximate formula of daytime ionospheric conductance ratio

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Solar zenith angle (SZA) dependences of daytime ionospheric conductances are studied. In particular, we developed a simple theoretical form for the Hall to Pedersen conductance ratio against SZA. The European incoherent scatter (EISCAT) radar observations located at Tromso (67 MLAT) on 30 March 2012 were used to calculate conductances.

Daytime electric conductances in the ionosphere are associated with plasmas created by Solar extreme ultraviolet radiation into the neutral atmosphere of Earth. Previous conductance models have been either consistent or not with the ideal Chapman theory of such plasma productions.

Our results indicate that the SZA dependence of the Pedersen conductance can be consistent with the Chapman theory after modifications. Such modifications include an approximation of vertically-uniform plasma densities in the topside E region, and taking atmospheric temperature upward gradient into account. The Hall conductance decreases with increasing SZA more rapidly than the Pedersen conductance does. This is because that the Hall conductivity layer thins from noon toward night.

Keywords: ionospheric conductivity, ionosphere, conductance, EISCAT, incoherent scatter radar