ELECTRODYNAMICS OF THE IONOSPHERIC PLASMA

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Abstract

Two important aspects of the electrodynamics of the equatorial ionospheric F region that will be discussed here are the thermospheric winds and the electric fields. The thermospheric winds are generated by horizontal pressure gradients in the atmosphere due to solar heating. The electric fields result from two main components: (1) the E region fields that are mapped to the F region through the highly conducting magnetic field lines and (2) the F region dynamo field. Besides these two regular contributions to the F region electric fields, there is a component of magnetospheric origin, that becomes very important during magnetically disturbed periods.

A very important aspect that must also be considered is the feedback between the electrodynamics and the thermospheric winds. Although the ionized component is only a minor constituent (one part in 10^3 at 300 km), a collision ion-neutral, unlike a collision neutral-neutral, will not show a momentum transfer as linear momentum, parallel to the neutral velocity, U. When a moving neutral particle strikes an ionized particle at rest in the thermosphere, some of the momentum imparted is converted into motion of the particle about the magnetic field and yields a net deflection in the $q(\mathbf{U} \times \mathbf{B})$ direction, where B is the magnetic field and q includes the sign of the particle charge. The ionized particles are trapped onto the magnetic field lines so, instead of being accelerated parallel to U, they can act as a steady drag on the neutral wind.

In this work we will discuss the three aspects mentioned above, based on measurements, and review the recent theoretical and numerical studies on the subject.