Explanation of the sporadic-E layer formation by comparing FORMOSAT-3/COSMIC data with meteor and wind shear information

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Abstract
The formation of the sporadic-\textit{E} (\textit{Es}) layer can be explained in several different ways, with wind shear theory and the meteor ionization mechanism being mostly commonly used explanations. Nevertheless, the wind shear theory or the meteor ionization mechanism alone cannot completely explain the formation of the \textit{Es} layer. The meteor ionization mechanism cannot explain the difference in the \textit{Es} layer activity between northern and southern hemisphere, while the wind shear theory cannot explain the source of the large amount of ionized particles in \textit{Es} layer. In this study, the activity in the \textit{Es} layer is compared with information about meteors and the global vertical speed of ionized particles. The information about meteors is obtained from International Meteor Organization (IMO) and Radio Meteor Observing Bulletin (RMOB). The global vertical speed information for ionized particles is calculated using the International Geomagnetic Reference Field (IGRF) model, Horizontal Wind Model (HWM07), and Mass Spectrometer-Incoherent Scatter (MSISE-90) model. The activity in \textit{Es} layer is based on the value of the irregular degree (ID) index, which is derived from the signal to noise ratio (SNR) obtained from Global Positioning System (GPS) radio occultation (RO) data. With both wind shear theory and the meteor ionization mechanism together, the source of the ionized particles in the \textit{Es} layer and the difference in the activity in the \textit{Es} layer between northern and southern hemispheres can thus be explained more completely.