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Observation of temporal variations in global sporadic E occurrence rates derived from GPS radio occultation measurements

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The GPS radio occultation (RO) technique has been established as a powerful tool for ionospheric research. With approximately one million of globally distributed profiles per year provided by the FORMOSAT-3/COSMIC satellites, our data base allows for sporadic E (Es) layer observation with a high spatial resolution and global coverage.

Sporadic E layers are thin regions of enhanced electron density in the lower ionospheric E region. They cause strong amplitude scintillations in GPS occultation signals. We use Signal-to-Noise Ratio (SNR) profiles of the GPS L1 signal in order to obtain information on the sporadic E occurrence. Sudden changes in the vertical electron density gradients, which indicate the presence of a sporadic E layer, appear as strong fluctuations in the SNR above 85 km altitude.

The FORMOSAT-3/COSMIC data, together with measurements collected by the satellites CHAMP and GRACE which provided continuously RO data since 2001 and 2006, respectively, enables initial trend analysis of Es occurrence.

In this study we focus on the variations of sporadic E occurrence rates on different time scales. We will present the diurnal, annual and interannual variability of sporadic E layers and show their connection to other geophysical parameters like solar tides.