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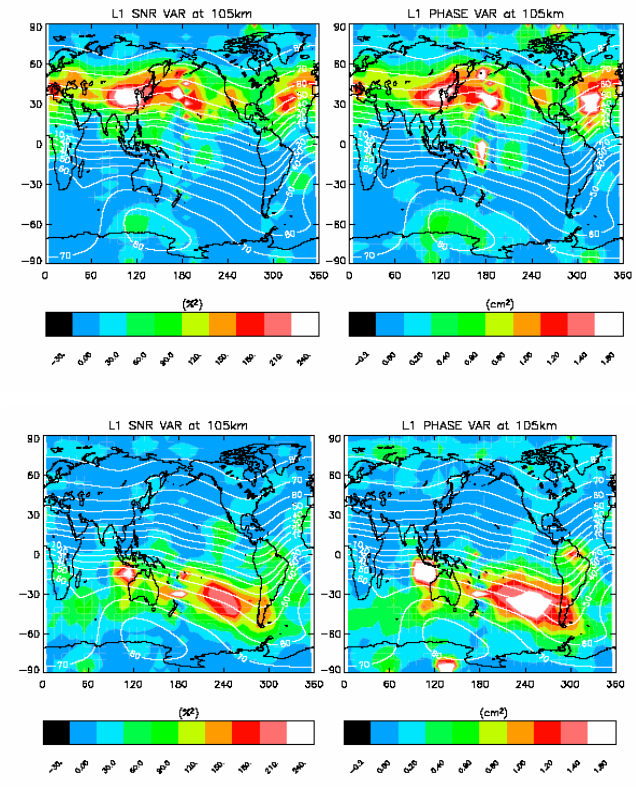
Scientific Themes: Atmospheric and Ionospheric Dynamics and Climatology.

Sporadic-*E* Morphology from GPS-CHAMP Radio Occultation. D. L. Wu, Chi O. Ao, George A. Hajj, Manuel de la Torre Juarez, and Anthony J. Mannucci, *J Geophys. Res.-Space* **110** (A1): Art. No. A01306, 10.1029/2004JA010701, JAN 19 2005

MLS contact: D. L. Wu, dwu@mls.jpl.nasa.gov, 818-393-1954.

Summary

The scintillations of phase and SNR (amplitude in terms of signal-to-noise ratio) of the GPS radio occultation signal are caused by thin ionization layers. These thin irregular electron density layers in the *E*-region ionosphere are often called sporadic *E* (E_s). For a monthly retrieval of E_s morphology, we use the variances of the phase and SNR fluctuations of worldwide about 6000 GPS/CHAMP occultations in the E-region. This paper studies global E_s climatology with the SNR and phase variances in terms of monthly zonal means, seasonal maps, diurnal and long-term variations. The zonal-mean variances reveal strong, extended E_s activities at summertime mid-latitudes but weak, confined activities in wintertime high-latitudes, peaking at ~105 km. Global maps at 105 km altitude show clear dependence of E_s activities on the geomagnetic dip angle, where the summertime mid-latitude E_s occurs mostly at dip angles of 30-60º and the wintertime high-latitude enhancement occurs mostly at dip angles greater than 80º. The mid-latitude E_s variances exhibit a strong semidiurnal variation with peak hours near 8:00-10:00 and 20:00 LST, respectively. The peak hours are delayed slightly with decreasing height, suggesting influences from the semidiurnal tide. To provide more insights on the observed SNR and phase variances, we model radio wave propagation for the CHAMP observing geometry under several perturbed cases in the *E*-region ionosphere.



This figure shows the 105-km maps of L1 SNR/SNR$_0$ and phase variances during June-August 2002 (JJA) (upper) and December 2002-February 2003 (DJF) (lower) when the summertime E_s are maximized. These maps reflect the stationary component of E_s at planetary scales that may be related to the geomagnetic field. In JJA E_s irregularities appear strongly in the summer hemisphere, mostly over China, northwestern Pacific, western United States, northern Atlantic, and southern Europe. Interestingly, they mostly fall into the latitude band where the geomagnetic-field dip angles are between 30° and 70°. This dip-angle dependence is quite striking for the summertime activities as they move north and south in latitude following the dip angle changes. The strong longitudinal variations in the 30º-70º dip angle band can not be simply related to the geomagnetic field. Other variabilities, such the horizontal winds and ion sources, must be taken into account. The wintertime E_s activities in JJA are weak and coincide mostly with the dip angles greater than 80°, the southern polar cap with open geomagnetic field lines. Patchy E_s activities are evident in the phase variance at dip angles greater than 80° in the summer pole. Equatorial E_s activities are generally weak and patchy, not showing any significant dependence on the geomagnetic field.