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Multi-resolution ionospheric electron density and external field over Antarctica from altimetry and CHAMP magnetic observations

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Current knowledge of the behavior of the disturbed geomagnetic field and ionospheric electron distribution due to the effect of solar radiation comes from geodetic observations. However, the relationship between the electron concentration and the external field is not well understood partly due to the limitations of the models and partly due to the paucity of the data. The global potential field and the electron density are commonly represented by spherical harmonic models of low degree. In particular, models representing electron concentrations, such as the Global Ionosphere Model (GIM), are constructed from GPS observations made at ground stations with large data gaps over the oceans. Furthermore, fields of the magnetospheric and ionospheric currents, collected at ground stations mostly populated in the northern hemisphere, are grouped to form geomagnetic activity indices (e. g., Kp, AE, Dst). But the veracity and applicability of these models and indices over the polar regions and at satellite altitude are uncertain.

Many low orbiting satellite mission data have now come on-line that facilitate a correlative study of the external field and the ionosphere total electron content (TEC). In particular, the German geoscience satellite CHAMP (CHAllenging Minisatellite Payload) provides the best coverage of magnetic field data over the polar regions. The dual frequency Envisat altimeter data can be exploited for details on nadir electron concentration through the most active regions of the polar ionosphere. Enhanced

representation and analysis of these data sets can improve our understanding of solar-terrestrial activity. Here, we present results from multi-resolution techniques based on spherical splines, scaling functions and spherical wavelets. Since these base functions are compactly or at least quasi-compactly supported, they can be appropriately applied to represent and analyze spatially heterogeneous distributed, i.e., scattered data.