Evaluating Super-satellite Plasmasphere Contribution Based on GIM and PRARE Measurements

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The total electron content (TEC) values measured from GPS network is an integration of plasma density from the bottom ionosphere to outside the plasmapause (4.3 Re from earth center), including the F layer, protonosphere and plasmasphere. To provide TEC data for satellite altimeter corrections at any time and any location and altitude, we need carefully to remove super-satellite TEC contributions due to the upper ionosphere and plasmasphere. PRARE (on ERS-2) and Topex provide two independent TEC measurements at different altitudes (790 km and 1330 km, respectively) that can be used to achieve this.

At first, we can use all of three measurements to intercalibrate the instruments and to determine the ionospheric TEC values at three different altitudes. These values are the function of local time and latitude. Every 117.4 days, Topex's orbit has an opportunity to intersect that of ERS-2 and to have a common view point from any fixed PRARE station. We have studied 5 days of common view data from Tahiti to calibrate the instruments. We find that usually TEC values from GPS are greater than those from PRARE by 1 to 7 TECU at -10:00 LT. However, occasionally GPS values are below PRARE's. TEC values from PRARE are about 65- 95% of TEC values from GIM. These preliminary results are basically consistent with the calculation from Gallagher's empirical plasmaspheric model.

PRARE and GIM measurements also provide a unique dataset to study plasmasphere features. We see that there is almost no plasmaspheric contribution at high latitudes (ionospheric troughs) and polar regions. There are larger percent differences between the PRARE and GIM measurements on the nightside (~22:00 LT) than on the dayside (- 10:00 LT). The nightside also has large fluctuations. In the equinox season (April 15), these features become obvious. During the January 10, 1997 storm, we see that the plasmasphere had a significant depletion on the nightside, compared with other quiet days, because the difference between PRARE and GIM measurements became small. This indicates that the plasmasphere had been compressed to a lower altitude by the storm process.