Contribution ID: **531** Type: **Oral (Student, In Competition) / Orale (Étudiant(e), inscrit à la compétition)**

The nature of GPS receiver bias variabilities: An examination in the Polar Cap region and comparison to Incoherent Scatter Radar

Tuesday, 16 June 2015 14:30 (15 minutes)

The problem of receiver Differential Code Biases (DCBs) in the use of GPS measurements of ionospheric Total Electron Content (TEC) has been a constant concern amongst network operators and data users since the advent of the use of GPS measurements for ionospheric monitoring. While modern methods have become highly refined, they still demonstrate unphysical bias behavior, namely notable solar cycle variability. Recent studies have highlighted the potential impact of temperature on these biases, resulting in small diurnal or seasonal behavior, but have not addressed the, far more dominant, solar cycle variability of estimated receiver biases.

This study investigates the nature of solar cycle bias variability. We first identify the importance of the strongest candidate for these variabilities, namely shell height variability. It is shown that the Minimizations of Standard Deviations (MSD) bias estimation technique is linearly dependent on the user's choice of shell height, where the sensitivity of this dependence varies significantly from 1 TECU per 4000km of shell height error in solar minimum winter to in excess of 1 TECU per 90km of shell height error during solar maximum summer.

To assess the importance of these sensitivities, we present true shell height derived at Resolute, Canada using the Resolute Incoherent Scatter Radar (R-ISR), operated by SRI International and a Canadian Advanced Digital Ionosonde (CADI) operated by the Canadian High Arctic Ionospheric Network (CHAIN). This investigation demonstrates significant shell height variability translating to bias variabilities of up to several TECU. These variabilities, however, are found to be insufficient to account for all of the observed bias solar cycle variability.

To investigate these variabilities further, we next compare Total Electron Content (TEC) measurements made by a CHAIN GPS receiver at Resolute to integrated electron density profiles derived from the nearby Resolute ISR. Taking the ISR measurements as truth, we find that ISR-derived GPS receiver biases vary in the same manner as those derived using the MSD or other bias estimation approaches. Based on these results, we propose that standard receiver DCB estimation techniques may be interpreting a significant portion of plasmaspheric electron content as DCBs, resulting in apparent diurnal, seasonal, and solar cycle DCB variability.

Primary author: Mr THEMENS, David (University of New Brunswick)

Co-authors: Dr NICOLLS, Michael J. (SRI International); Dr JAYACHANDRAN, P.T. (University of New Brunswick); Dr LANGLEY, Richard B. (University of New Brunswick)

Presenter: Mr THEMENS, David (University of New Brunswick)

Session Classification: T2-3 Ground-based / in situ observations and studies of space environment II (DASP) / Observations et études de l'environnement spatial, sur terre et in situ II (DPAE)

Track Classification: Atmospheric and Space Physics / Physique atmosphérique et de l'espace (DASP-DPAE)