A NEW TOOL FOR ROUTINE ESTIMATION OF GLOBAL TEC MAPS USING 1000+ GROUND-BASED GPS RECEIVER

Komjathy, A., Sparks, L., Mandrake, L.
, Iijima, B., Wilson, B., Mannucci, A.J.
NASA Jet Propulsion Laboratory, 4800 Oak Grove, MS 238-600, Pasadena, CA 91109 USA

Abstract Submission Form

2004 National Radio Science Meeting

Abstract: komjathy23178

Date Received: September 24, 2004

As the number of ground and space-based receivers tracking the Global Positioning System (GPS) steadily increases, it is becoming possible to monitor changes in the ionosphere continuously and on a global scale with unprecedented accuracy and reliability. At the time of writing this abstract (September 2004), there are more than 1000 globally-distributed dual-frequency GPS receivers available using publicly accessible networks including, for example, the International GPS Service (GPS) and Continuously Operating GPS Stations (CORS).

To take advantage of the vast amount of GPS data, researchers use a number of techniques to estimate satellite and receiver interfrequency biases and the total electron content (TEC) of the ionosphere. Most techniques utilize grid methods, spherical harmonic expansion or basis function coefficient sets to separate the hardware-related biases from the ionospheric contribution. These methods often have a limitation of using up to 200 GPS receivers, utilizing a sequential least squares or Kalman filter approach to estimate satellite and receiver interfrequency biases as nuisance parameters. The biases are then later removed from the measurements to obtain unbiased TEC.

In our approach to calibrating GPS receiver and transmitter interfrequency biases, we take advantage of all GPS receivers using a new processing algorithm, based on the Global Ionospheric Mapping (GIM) software developed at the Jet Propulsion Laboratory. This new capability is designed to estimate receiver biases for all stations. In this new approach, we solve for the instrumental biases by modeling the ionospheric delay and removing it from the observation equation using pre-computed GIM maps. The pre-computed GPS maps use about 200 globally-distributed GPS receivers to establish the background used to model the ionosphere at the remaining 800 GPS sites.

In the talk, we will display global maps of GPS ionospheric observations using the 1000 station approach. We will demonstrate this new tool for quiet and storm periods including October 28-31, 2003. We will show point plots that use differential mapping capabilities to highlight the effects of the dramatic storm that severely impacted the US and the equatorial regions. We have made the 900-site global TEC maps freely available to the ionospheric community at ftp://sideshow.jpl.nasa.gov/pub/axk/allsites/.

1. (a) Attila Komjathy
4800 Oak Grove Dr.
M/S 238-600
Pasadena, CA
91109 USA
komjathy@jpl.nasa.gov
(b) 8183936828
(c) 8183934965

2. G - Ionospheric Radio and Propagation

3. (a) Using Radio Beacons for Atmospheric Research

4. P

5. Special Session: Using Radio Beacons for Atmospheric Research