Real-Time & Near Real-Time IGS Products

Chairs: R. Weber, S. Gutman, T. Fuller-Rowell, Y. Mireault (not attending)
Wednesday, 4 June 2008 10:30 - 12:00

Presentations

1. Robert Weber (rweber@mars.hg.tuwien.ac.at)
   Title: Real-Time Quality Control for IGS Orbits

2. Seth Gutman (Seth.I.Gutman@noaa.gov)
   Title: Need for an IGS Real-Time/Near Real-Time Tropospheric Product

3. Tim Fuller Rowell (Tim.Fuller-Rowell@noaa.gov)
   Title: Need for an IGS Real-Time/Near Real-Time Tropospheric Product

4. Y. Mireault, P. Tétreault, F. Lahaye, P. Collins, M. Caissy (caissy@NRCan.gc.ca)
   Title: Canadian Real-Time/Near Real-Time Products and Services

5. P. Wielgosz & A. Krankowski (kand@uwm.edu.pl)
   Title: Real-Time Kinematic GPS Positioning Supported by Predicted Ionosphere Model

Posters

1. A. Karabatic (anna@mars.hg.tuwien.ac.at) and R. Weber
   Title: Near Real-Time Zenith Wet Delay Estimation

Presentations requested by participants:

1. André Hauschild (andre.hauschild@dlr.de)
   Title: Real-Time Clock Estimation for Precise Orbit Determination of LEO-Satellites

2. S. Gleason (STGLEASON@qinetiq.com)
   Title: RT Applications of Long Term GPS Orbit Predictions

3. Oscar L. Colombo (olcolombo@verizon.net)
   Title: RT Use for Precise Long-Baseline Differential GPS Navigation
   Possible discussions:
   a. Results of tests I am making with data from receivers of the Castilla-Leon and other NTRIP networks in Spain, and also the experimental NGS network in our area, plus downloads of the hourly navigation rinex files and the ultra-rapid orbits (predicted part) compiled and distributed by the CDDIS. My early results already look pretty decent.
   b. In early May I'll be in Argentina to visit Claudio Brunini and his group in La Plata (my alma mater), to see first hand what they are doing. They have organized the setting up of the Argentinian national GNSS network, and now run its main data

analysis center. They would like to move into some real-time support for transportation, etcetera. The IGS real-time data and products could help them greatly during software development and preliminary tests and demonstrations. So maybe I'll get out of that visit something interesting to say about what some people do, or would like to do, outside the IGS, with IGS real-time data and products.

c. I could suggest that the consolidated hourly nav files also could be streamed to the users, and that the predicted ultra-rapids could be distributed with more streams than the one, out of Finland, that is carring them already (as far as I know). Also, it would be nice if precise IONEX files --at least for areas with good IGS+local ground coverage-- were also streamed, to help with the first step in resolving ambiguities over long baselines, which is to resolve those between fixed reference sites circumscribing an area of operations, in order to interpolate their unambiguous ionspheric observables to users in that area (more or less as in VRS, but with the user software estimating its own residual tropo correction, because that cannot be interpolated very well over distances of much more than 100km). I've written some papers on that, mostly with Manuel Hernandez-Pajares and his colleagues at the UPC.

Abstracts

André Hauschild (andre.hauschild@dlr.de)
Title: Real-Time Clock Estimation for Precise Orbit Determination of LEO-Satellites

Abstract: This paper/presentation discusses the real-time estimation of clock offsets for the GPS constellation. A realtime system for clock estimation is currently developed by DLR/GSOC to support up-coming missions which require precise orbit determination in near-real-time. The algorithm is based on a Kalman-filter and estimates the GPS satellite clock based on predicted IGU orbits. The filter processes ionosphere-free combinations of the code and carrier phase observations from global Ntrip-data streams. The estimated parameters are therefore globally valid and are suitable for orbit determination of LEO-satellites. The accuracy of the orbit/clock-product is assessed with a precise orbit determination of a representative LEO-spacecraft. The results of this analysis are compared to the results obtained using other (real-time) orbit/clock products for the orbit determination.

Y. Mireault, P. Tétreault, F. Lahaye, P. Collins, M. Caissy (caissy@NRCan.gc.ca)
Title: Canadian RT/NRT Products and Services

Abstract: Natural Resources Canada (NRCan) has been involved in producing and promoting GPS Real-Time (RT) and Near Real-Time (NRT) products and services for more than 10 years. Key products and services, like 1Hz GPS station data, Ultra Rapid GPS orbits/clocks, GPS Precise Point Positioning (PPP) and GPS corrections (GPS•C), have been developed and refined over the past several years. This presentation will focus on current RT and NRT products and services developed by NRCan and made available to users in Canada and world wide. First, a description of the RT GPS tracking network covering Canadian territory and used within GPS•C will be given. Next, NRCan's hourly Ultra Rapid GPS satellite orbit and 30-sec satellite clock estimation strategy will be presented. Then, we will discuss NRCan's PPP, a free online post-processing service using IGS and NRCan's orbits/clocks and IGS IONEX products to allow GPS users world wide to compute better-accuracy positions from their single/dual frequency datasets observed in static/kinematic mode. Finally, an overview of the RT GPS wide-area correction service (GPS•C) distributed nationally through the Canada-wide DGPS will be given.

Pawel Wielgosz, Andrzej Krankowski (kand@uwm.edu.pl)
Title: Real-Time Kinematic GPS Positioning Supported by Predicted Ionosphere Model

Abstract: Precise real-time kinematic positioning (RTK) requires finding the integer carrier phase ambiguities; therefore, ambiguity resolution (AR) is of the highest importance in RTK applications. Although this task may be relatively easy over short distances (< 10 km), it becomes increasingly difficult when the separation between the rover and the reference station grows. This is due to decorrelation of the atmospheric errors with the growing distance, when ionospheric and tropospheric delays do not cancel out even in the double difference (DD) mode. Hence, application of RTK technique over longer distances (10-100 km) requires using dual-frequency receivers and special handling of the ionospheric errors in order to make the initialization time as short as possible. Recently, many techniques were developed to provide the ionospheric delay corrections that support fast on-the-fly (OTF) AR over longer distances. Most

of these techniques can be divided into two groups. The first group consists of Network-RTK approach (or VRS), where the ionospheric corrections are derived by the reference network in real-time. The second group consists of techniques that use external ionosphere information, e.g., from ionospheric models, to form ionospheric corrections. However most of the quality ionospheric models are derived in post-processing, therefore they cannot support real-time application. Hence, the desired solution is to use ionosphere models capable of predicting the ionospheric corrections. Recently, such a model was developed at the Institute of Geodesy of the University of Warmia and Mazury in Olsztyn (UWM). The model (UWMIPM) is based on several prediction techniques, such as autocovariance, autoregression moving average (ARMA) and Neural Networks, and uses the high accuracy regional ionosphere model (UWM-IM) as an input for the prediction algorithm. The UWM-IM model was developed in cooperation with West Department of the Institute of Ionosphere and Radio-Wave Propagation of the Russian Academy of Sciences (WD IZMIRAN) in Kaliningrad, Russia. This paper presents the test results of the performance assessment of the predicted UWM-IPM model in medium-range RTK positioning. The rover data collected within 40 to 60 km from the closest reference station were processed in kinematic mode with the support of the ionospheric corrections derived from the UWM-IPM model. The RTK solution was derived in single- and multi-baseline modes. All numerical tests were carried out using the MPGPS software developed in cooperation with The Ohio State University. The recent extension to the software developed at UWM allows for using external (predicted) ionosphere information. The test results are very promising, and indicate that the predicted ionosphere model can effectively support medium to long range RTK positioning, and allows for fast AR over distances of several tens of kilometers.

Oscar L. Colombo (olcolombo@verizon.net)
Title: RT Use for Precise Long-Baseline Differential GPS Navigation
Possible discussions:

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