Real-Time Operations at Natural Resources Canada, Geodetic Survey Division

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Abstract

Natural Resources Canada (NRCan), Geodetic Survey Division (GSD) has been operating GNSS stations in a real-time streaming mode since 1996 and has been estimating Wide Area Differential GPS Corrections in a 24/7/365 production environment since 2003.   At present, GSD operates its core GNSS station network in a fully automated real-time streaming mode and is also estimating high precision GPS corrections in support of its mandate and as a contribution to the IGS Real-Time Pilot Project. This poster presents the current status of GSD's real-time operations. The following topics are covered: network and station operations; data and corrections handling including formats; configuration of the high availability production environment; real-time clock and orbit accuracy; and real-time precise point positioning.

1. NRCan/GSD's Real-Time Network and Station Management Environment

The core network consists of 19 GPS+GLONASS and 12 GPS only stations. At former VLBI sites 3 monuments and receivers have been installed.   1-Hertz data streams, in both RTIGS (SOC) and RTCM-MSM format, are sent to GSD facilities in Ottawa. High-rate, hourly and daily files are generated from data in these streams.

Managing a GNSS network can be a challenge. Our Active Control Management Environment has centralized and semi-automated many of the day to day activities for station operators. This environment provides: web based tools; automated site installations and upgrades; station configuration analysis; station equipment tracking; and a user's guide complete with tool tips.

2. NRCan / GSD's Station Hardware Configuration and Real-time Data and Products Flow Diagrams
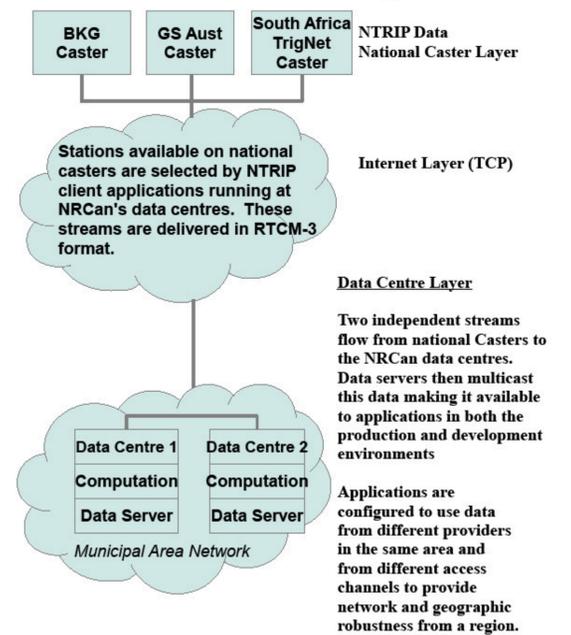
NRCan Station Equipment Configuration
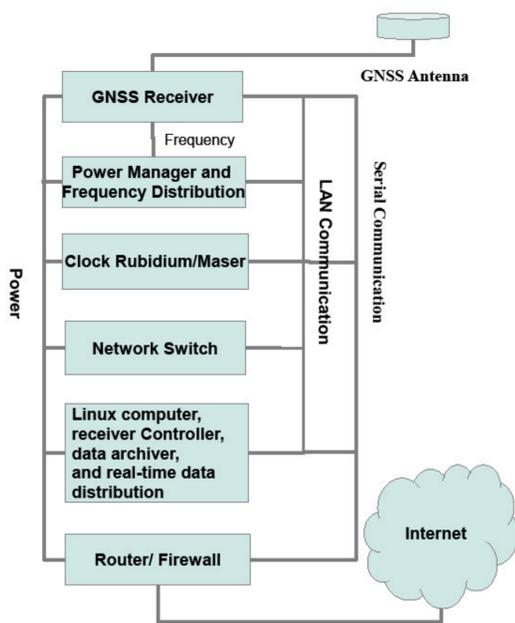
### NRCan Data Collection and Distribution Diagram
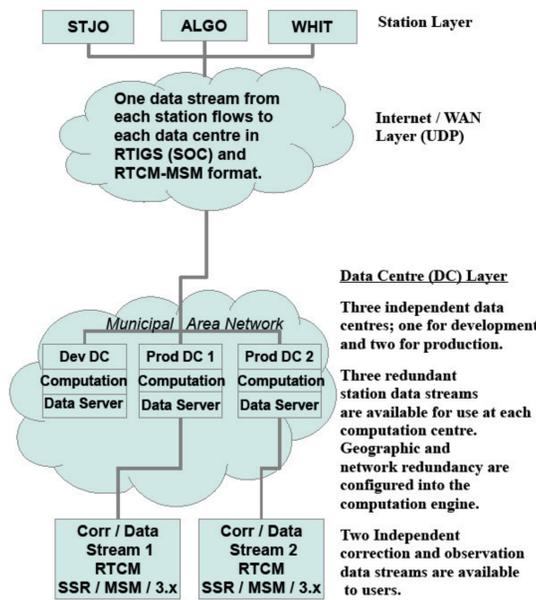
NRCan Global Data Flow Diagram


3. Real-Time Orbit and Clock Corrections

NRCan's real-time orbit and clock corrections are derived from in-house ultra-rapid orbits. The orbits are updated every hour, as opposed to every three hours for the official IGS product. The predicted orbits are held fixed in a real-time solution to estimate the satellite clocks. The orbit and clock estimation process uses up to 60 real-time stations, with a further 60 available as online back-up that can be switched in at any time. The following plots are typical of current accuracy as measured by comparison to IGS Rapid products.
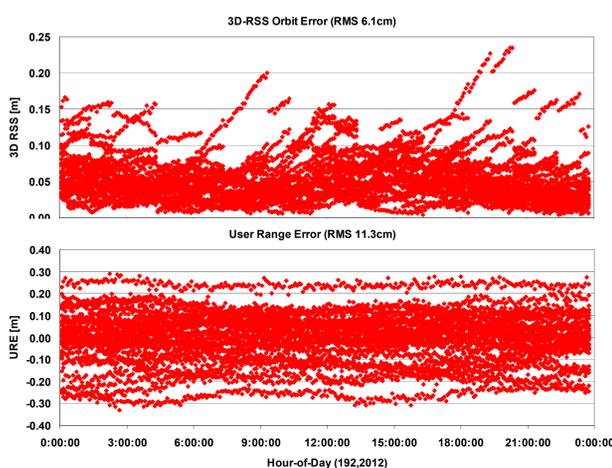
Note: User Range Error is dominated by the satellite clock error. Given the level of orbit error, these are dominated by uncalibrated code biases between receiver types and Block II-A yaw mis-modelling between solutions. The maximum URE is generally ±10cm without these errors.

4. Real-Time Precise Point Positioning (PPP)

Precise point positioning solutions are computed in real time using NRCan's real-time orbit and clock corrections. The figure below illustrates the 2D RMS error obtained for 29 Canadian stations, for a period of three months, from 1 April to 30 June 2012. The statistics were based on kinematic solutions using 1 Hz data and include any filter reset that could have occurred due to data gaps caused by network outages.
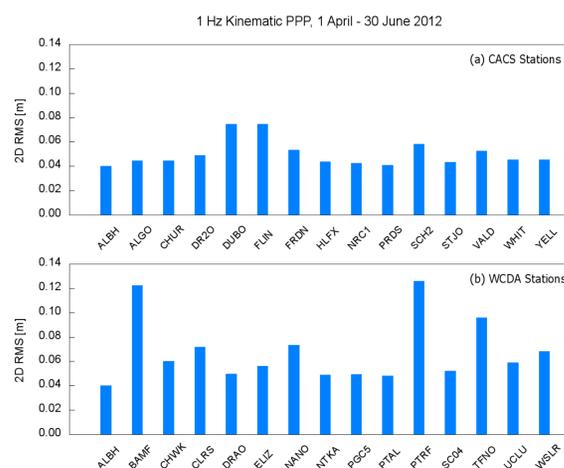
Stations from the Canadian Active Control System (CACS), run by NRCan.

Average 2DRMS = .04 m

Stations from the Western Canadian Deformation Array (WCDA), run by Geological Survey of Canada (GSC)

Average 2DRMS = .06 m.