Updates to the CSRS-PPP online service

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CSRS-PPP Service

• Users submit RINEX files through:
  – PPP Direct (desktop application)
  – Script for automated/batch processing

• PPP solution outputs include:
  – Estimated position / trajectory
  – Tropospheric zenith delay
  – Receiver clock offsets

• Online service available since 2003
CSRS-PPP Service

Over 6,000 active users

Close to 600,000 RINEX files processed last year
CSRS-PPP Service

(Klatt and Johnson, 2017)
CSRS-PPP Service

(Klatt and Johnson, 2017)
CSRS-PPP Service

- NRCan PPP software used by the *Instituto Brasileiro de Geografia e Estatística*

(Klatt and Johnson, 2017)

http://www.ppp.ibge.gov.br/ppp.htm
**CSRS-PPP Service**

In 2017:
- 89% static (11% kinematic)
- 99% dual-frequency
- 21% NAD83(CSRS), 79% ITRF

### Orbit and Clock Products | Usage
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NRCan Ultra-rapid | 7%
NRCan Rapid | 20%
IGS Final | 68%
IGS Final (repro1) | 5%

(Klatt and Johnson, 2017)
Service Modernization

• The new processing engine (online 16 Aug 2018):
  – Is capable of handling all constellations and signals
  – Supports RINEX version 3
  – Is our pathway to faster convergence:
    • ambiguity resolution (AR)
    • precise ionospheric corrections
      (features available in 2019)
Service Modernization

- Convergence analysis based on 1000 RINEX files (20 stations, 50 weeks) in 2016
- Height bias (4-5 mm) in previous engine (PACE) due to Shapiro correction not being accounted for
- Improved kinematic solution performance
Service Modernization

• User Impacts
  – No impact on RINEX submission process
  – Height discontinuity (mm level)
  – Some output files have changed (sum, res) but PDF almost identical

• PPP-AR will bring further benefits to users
Future Plans

- PPP convergence analysis based on 40 globally distributed stations, 24 hourly sessions

- Useful for shorter on-site occupation times

![Graph showing PPP convergence analysis](image)

- Actual service
- Future service
Future Plans

- ~40 stations in eastern Canada-USA processed over a 10-year period.
- This plot shows the repeatability of daily PPP-AR positions after removing linear and seasonal trends, and discontinuities.

(Goudarzi and Banville, 2017)
Future Plans

• The NRCan CSRS-PPP service relies on IGS products (70% of files ≈ 400,000 in 2017)

• Performing PPP-AR at the user end requires clock and bias (code and phase) products.

• To offer a PPP-AR service, we would currently need to rely on our own products instead of the IGS products.
Future Plans

• Since NRCan is a contributor to, and user of, IGS products, we proposed a new IGS PPP-AR working group (WG)

• The PPP-AR WG would analyze the feasibility of combining these products:
  – Analyze the inter-operability of clock/bias products among ACs
  – Assess current data formats for completeness (satellite attitude)
  – Develop and test a modernized clock/bias combination software
  – Make recommendations to the GB about adding a combined clock/bias solution as an official IGS product
Summary

• NRCan CSRS-PPP service used globally to access the ITRF
• The service leverages IGS products (final and repro)
• A modernized engine was introduced in August 2018
• Future plans include ambiguity resolution
• NRCan has proposed a new WG to analyze the feasibility and benefits of having the IGS adopt a modernized clock/bias combination process
Acknowledgements

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