Exploiting SWPC Products to Aid Positioning and Accuracy

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Outline

GNSS Customer Survey
Model Developments
The Last Mile (actionable products)
Using Today’s Products

Acknowledgements:
- Tzu-Wei Fang
- Tim Fuller-Rowell
- Dominic Fuller-Rowell
- George Millward
- Michele Cash
Summary of User Data Product Requests

The four interviewees identified seven distinct data product requests for the GNSS sector. Requests:

1. Develop warnings for scintillation, especially in the equatorial zone.
2. Improve timing and accuracy for geomagnetic storm forecasts.
“Forecasting Small-scale Plasma Structures in the Earth’s Ionosphere-Thermosphere System,” awarded $2.4M by NSF.

[Tzu-Wei] Fang and her colleagues will model the conditions that lead to disturbances in the ionosphere and use ground- and satellite-based observations to validate the simulated ionosphere-thermosphere conditions. “Our goal is to advance fundamental research underpinning space weather forecasts. Our research will help us better forecast disturbances in the ionosphere and their impact on the satellite signals,” Fang said.
Plasma Irregularities and Scintillation
Global Specification and Forecast of **Total Electron Content (TEC)**
- Proxy for GPS positioning error
- Customers: Airlines, Maritime, Surveying and Exploration, Agriculture, Emergency Managers, DOD, FAA, DHS,

**TEC Gradient**
- Single frequency GPS/GNSS customers

**TEC Rate of Change**
- **Scintillation** (Parametrization of conditions and precursors to scintillation)
- Dual frequency and precision GPS/GNSS customers
Valid at: Jul 8 2020 13:30 UTC

Global Ionosphere

Model: WAM-IPE (wfs) Init: Jul 7 2020 18 UTC

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WAM-IPE Products and Forecast Validation

- Initial products: TEC, NmF2, hmF2, and anomalies (departure from 10-day mean)

- Example of animation of global IPE TEC for November 21 2017 (Animation courtesy George Millward)

- WAM-IPE forecasts will be validated against TEC maps from GloTEC, a data assimilation scheme combining ground (GNSS) and space-based (COSMIC RO) data (Courtesy Dominic Fuller-Rowell)
quiet initial conditions
Re-analysis vs IPE
Jan 15-17, 2019

Anthea Coster
TEC maps MIT
3. **Develop a product that includes GNSS-specific warnings and nowcast observations.** Examples include scintillation phase and amplitude, geomagnetic storms, and TEC disturbances and gradients.

4. **Develop push alerts** that are specific to users’ geographies.

5. **Provide tools to translate space weather phenomena to impacts.**

6. **Improve the SWPC website for use by non-experts** [simplify] interpretive tools that can relate or lead SWPC customers to the nature, severity, and timing of impacts they may experience.

7. **Create a mechanism for users to report GNSS issues**...through software that is already being used.
Using Today’s Products
Questions?

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