IGS 2026 WORKSHOP
SANTIAGO DE CHILE
33°26' S 70°39' O

1–5 June 2026

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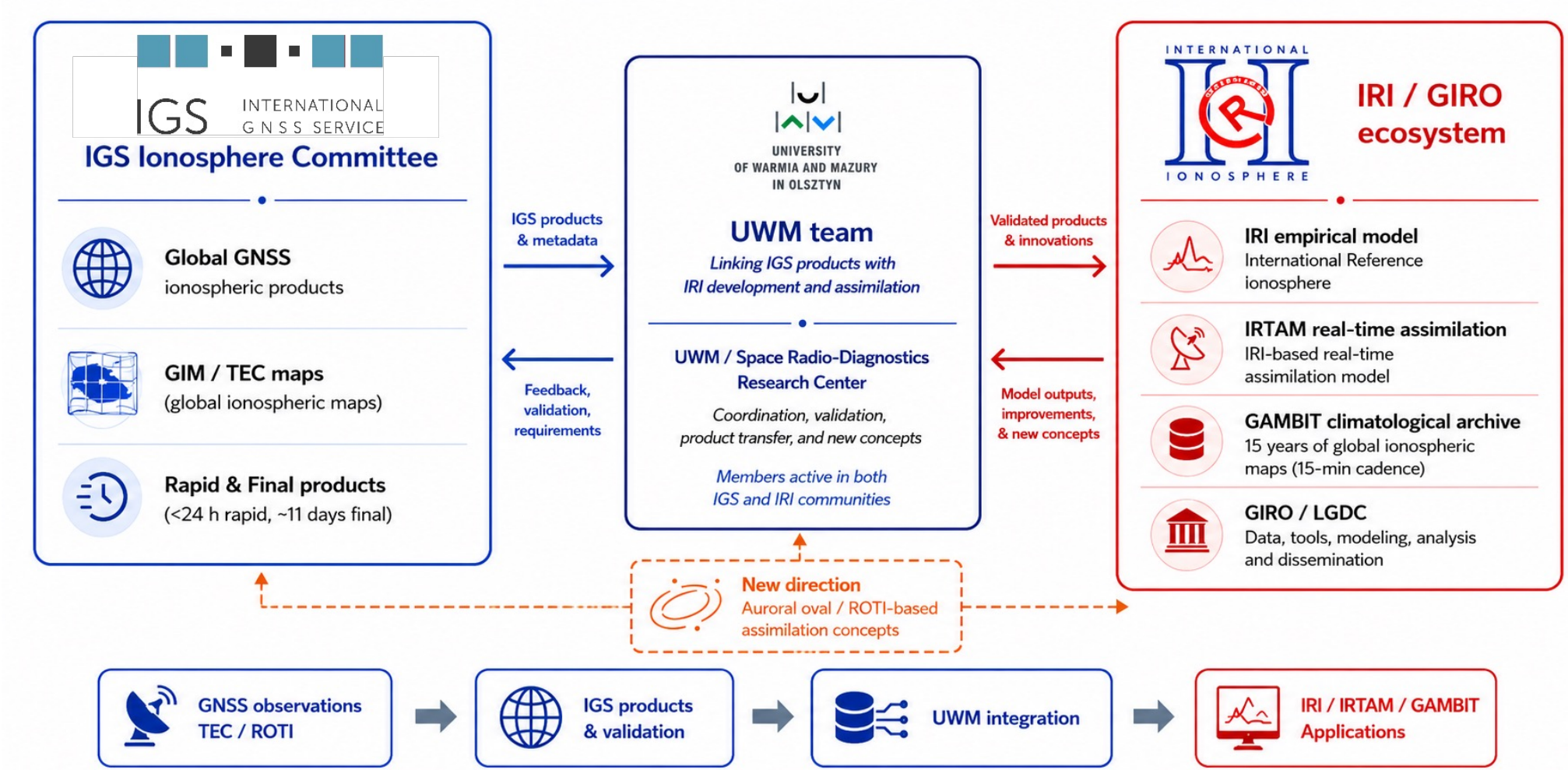
Assimilation of Climate-Scale TEC Maps, Low-Latency GNSS Products, and Auroral Oval in the IGS–IRI Cooperation

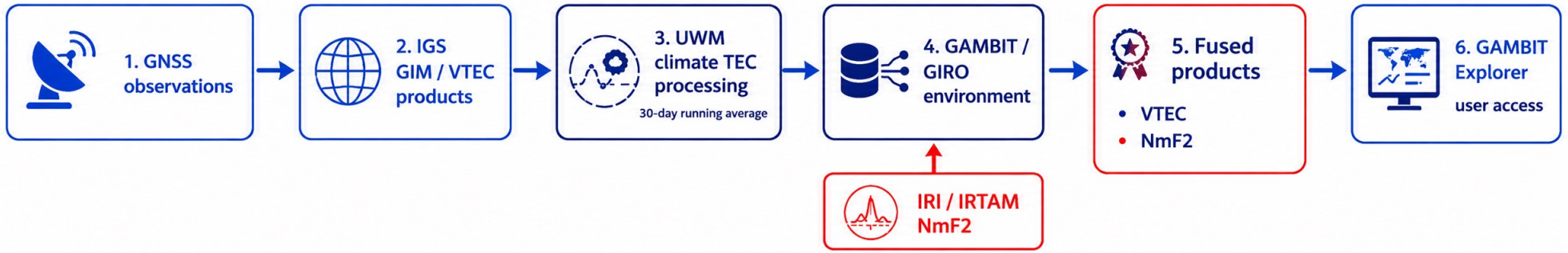
Introduction

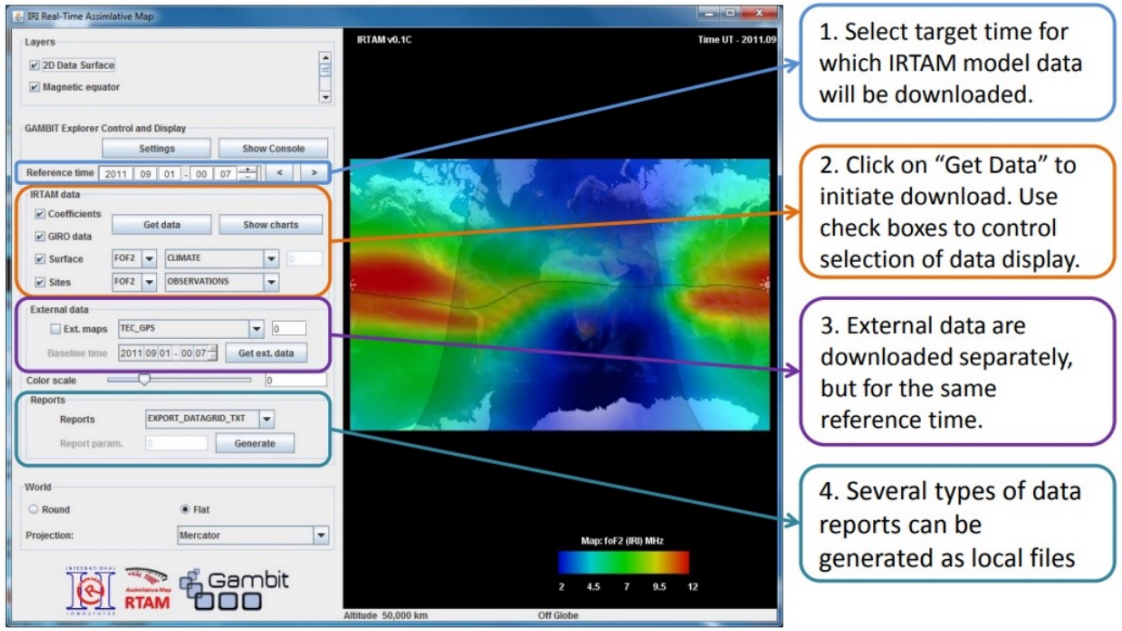
- IGS provides observation-based GNSS ionospheric products.
- IRI provides a global empirical framework for ionospheric modeling.
- The cooperation links GNSS TEC products with IRI-based assimilation tools.
- This talk focuses on three directions of the cooperation: climate TEC, low-latency products, and auroral oval assimilation.

From IGS Products to IRI Assimilation: Collaboration Framework



Collaboration Highlights: Assimilative VTEC Service and GAMBIT



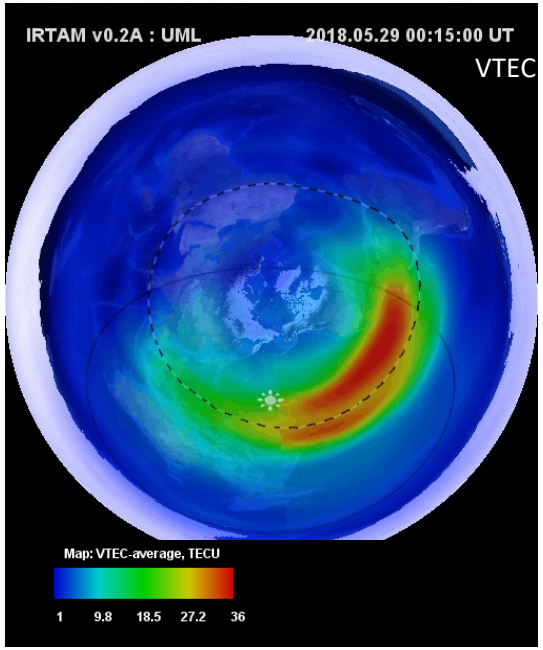


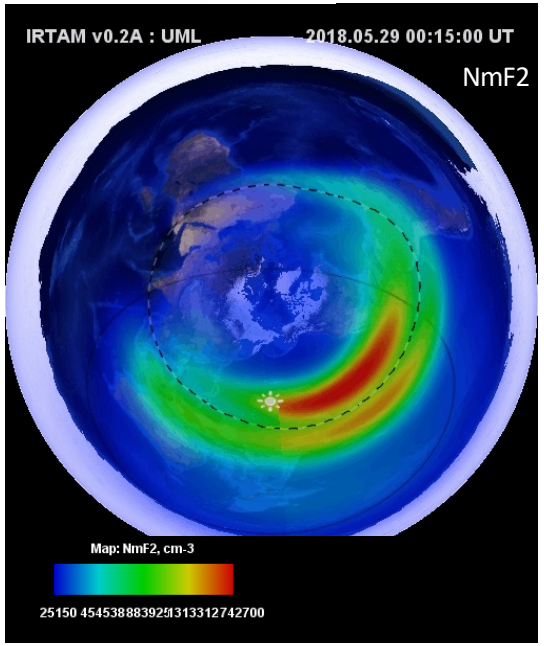
1. Select target time for which IRTAM model data will be downloaded.

2. Click on “Get Data” to initiate download. Use check boxes to control selection of data display.

3. External data are downloaded separately, but for the same reference time.

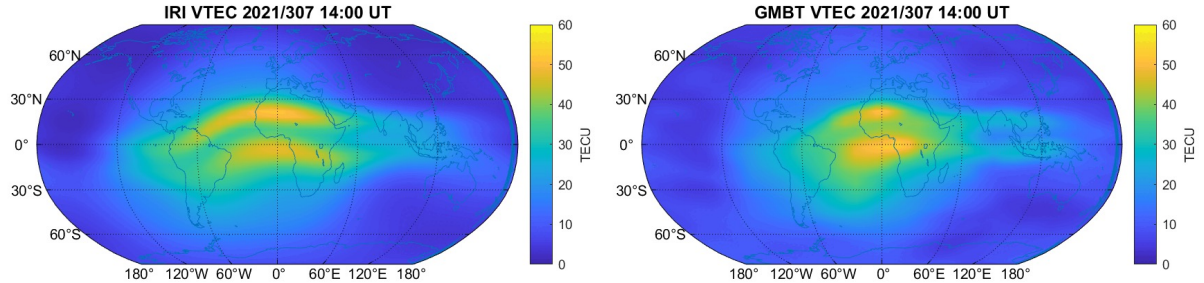
4. Several types of data reports can be generated as local files

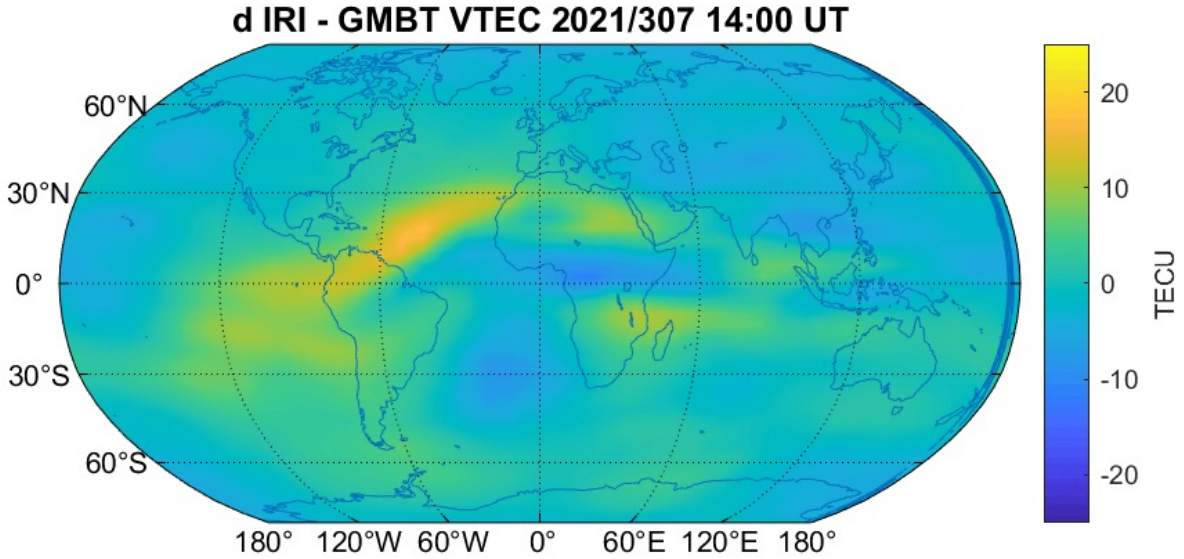




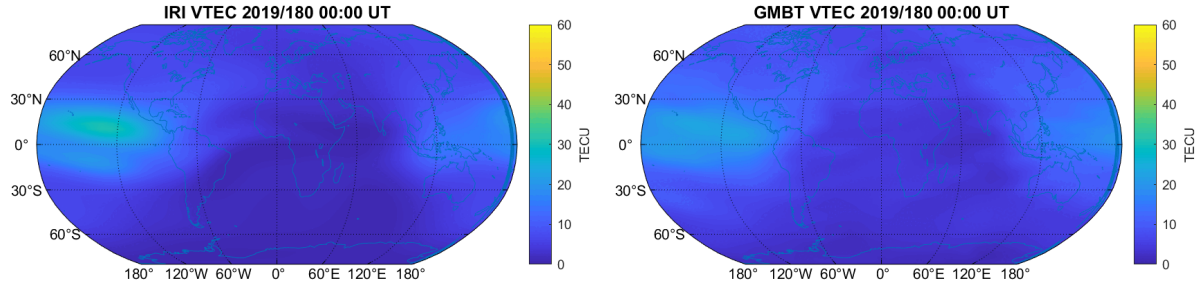
Climate TEC in GAMBIT

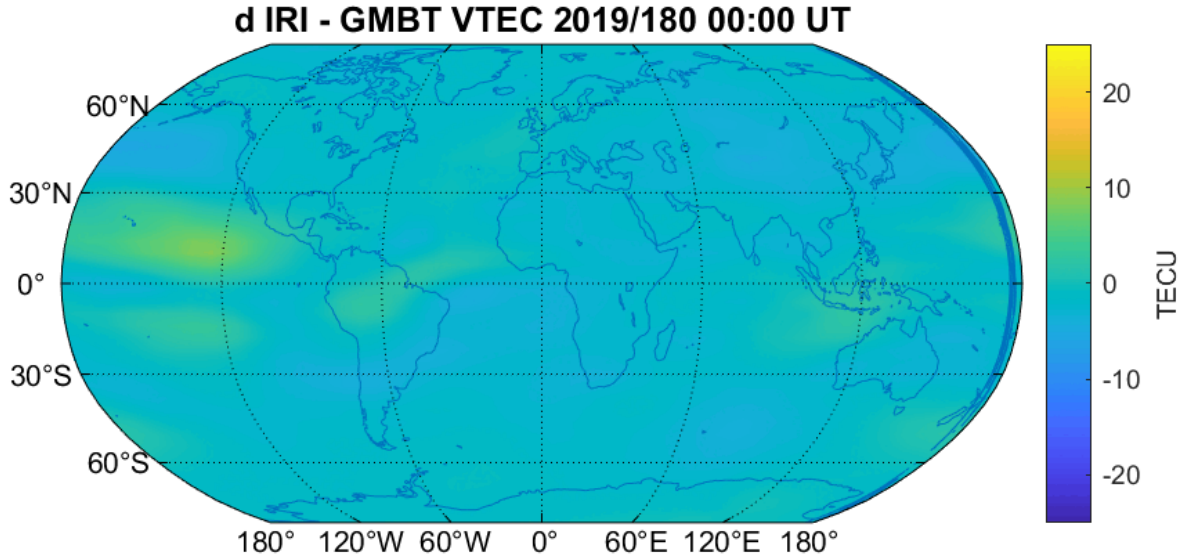
disturbed period





quiet period

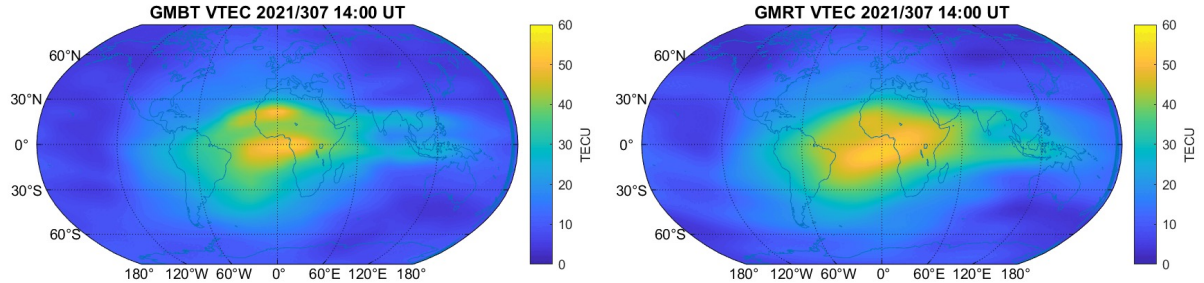


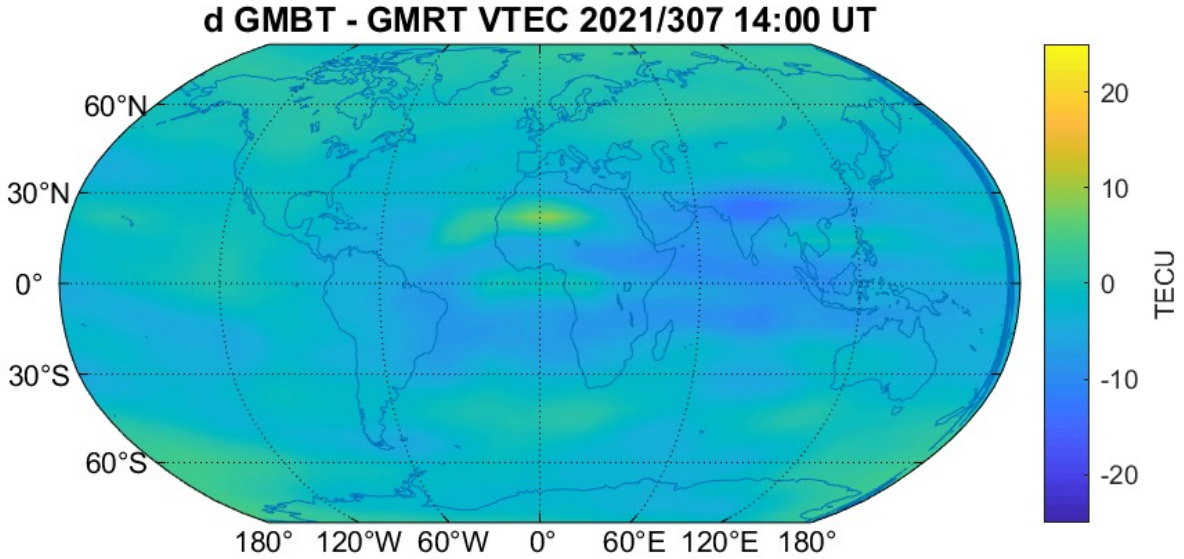


Climate TEC maps provide a stable reference but may smooth or shift storm-time structures.

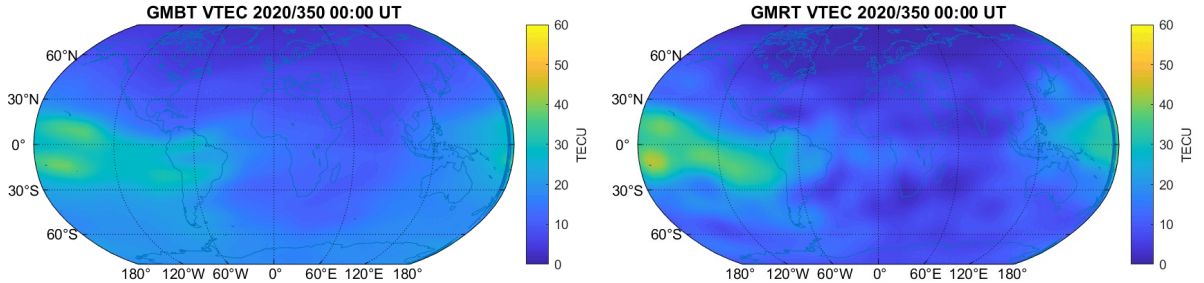
Real-time TEC in GAMBIT

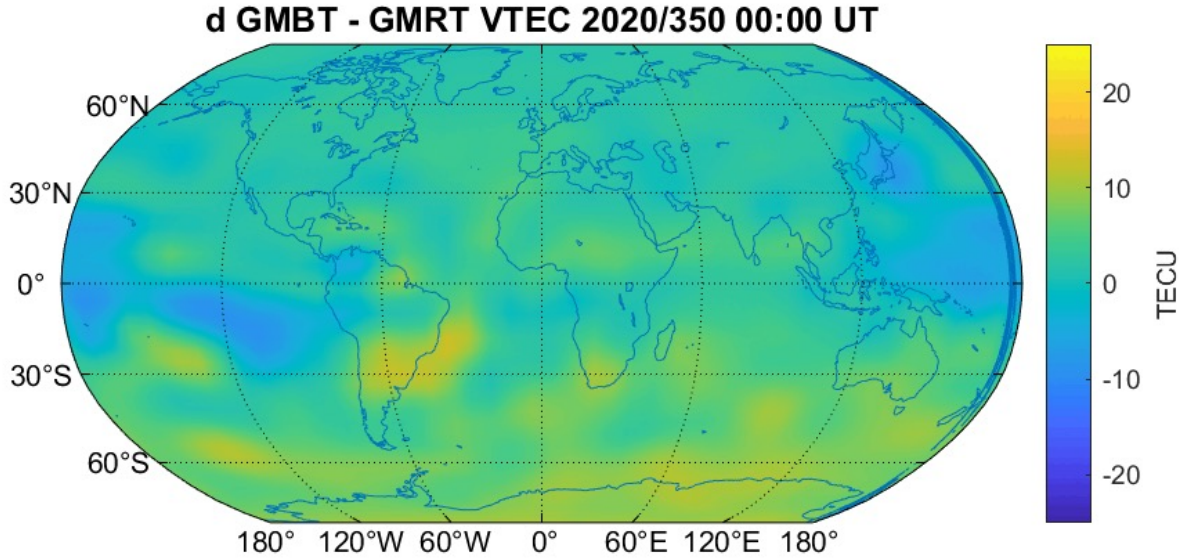
disturbed period





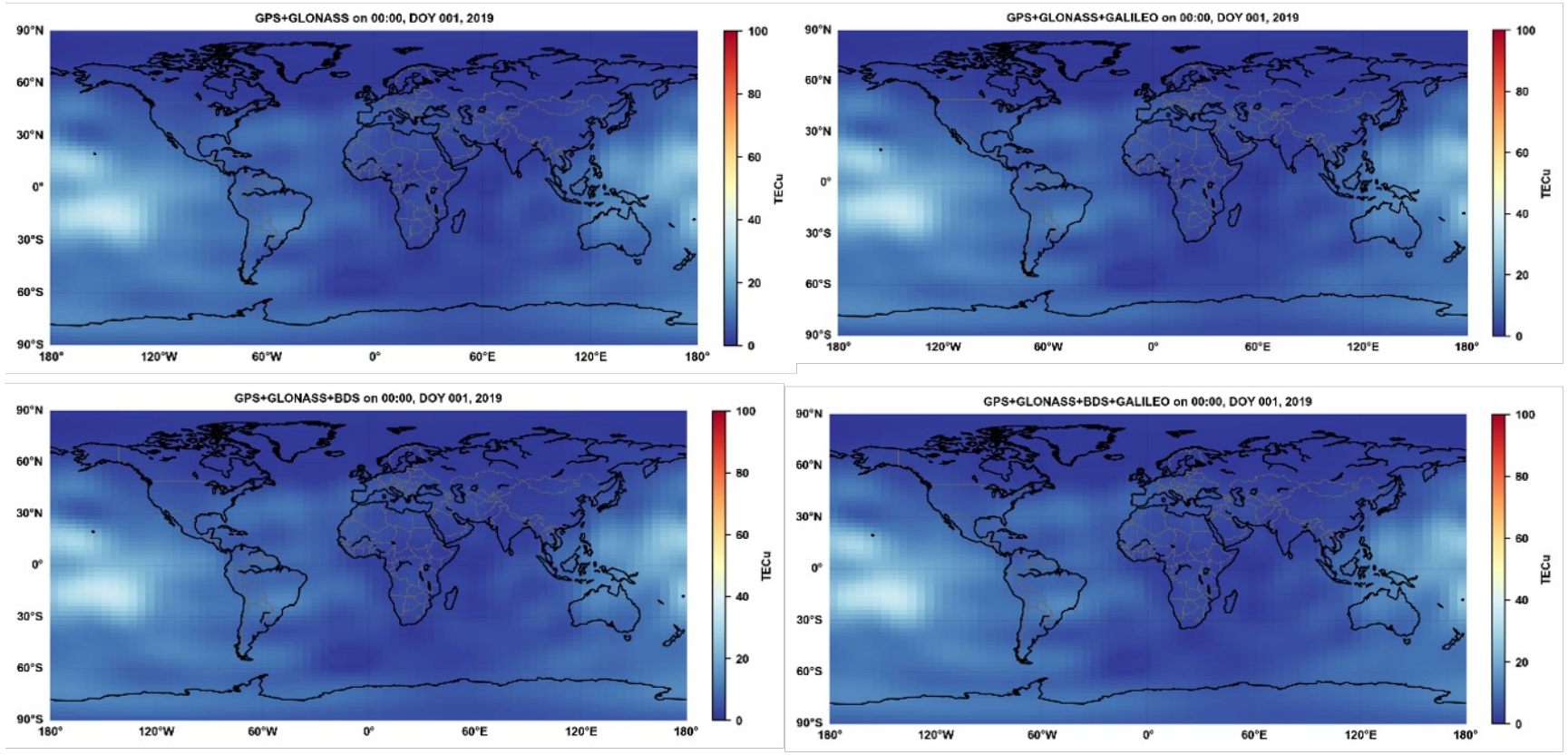
quiet period

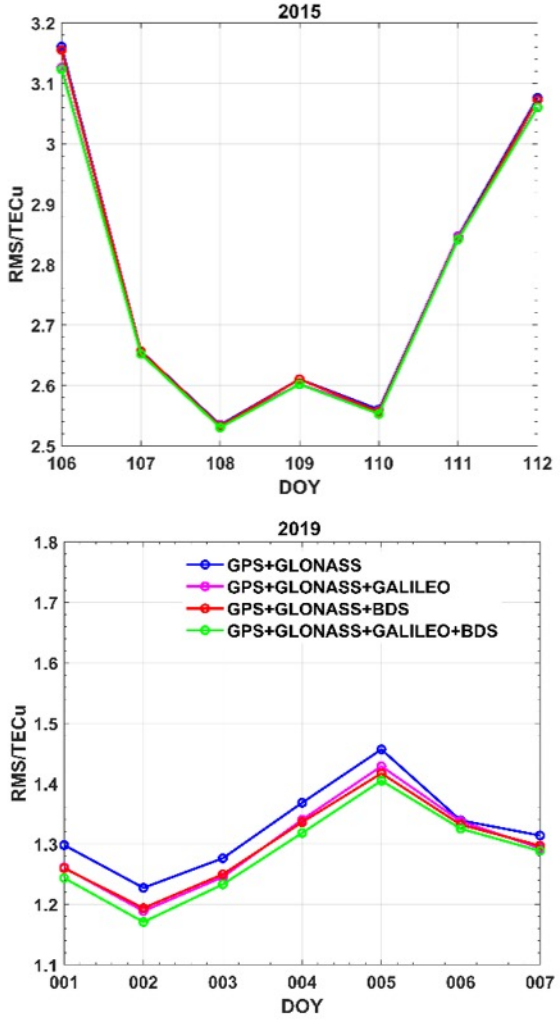




Low-latency TEC maps preserve short-term variability and better reflect disturbed conditions.

Low-latency multi-GNSS TEC mapping





Multi-GNSS approach improves spatial coverage and product stability.

Point-wise TEC comparison

IRI, GMBT climate TEC and GMRT real-time TEC at selected grid points.

IRI
empirical monthly-average model

comparison with

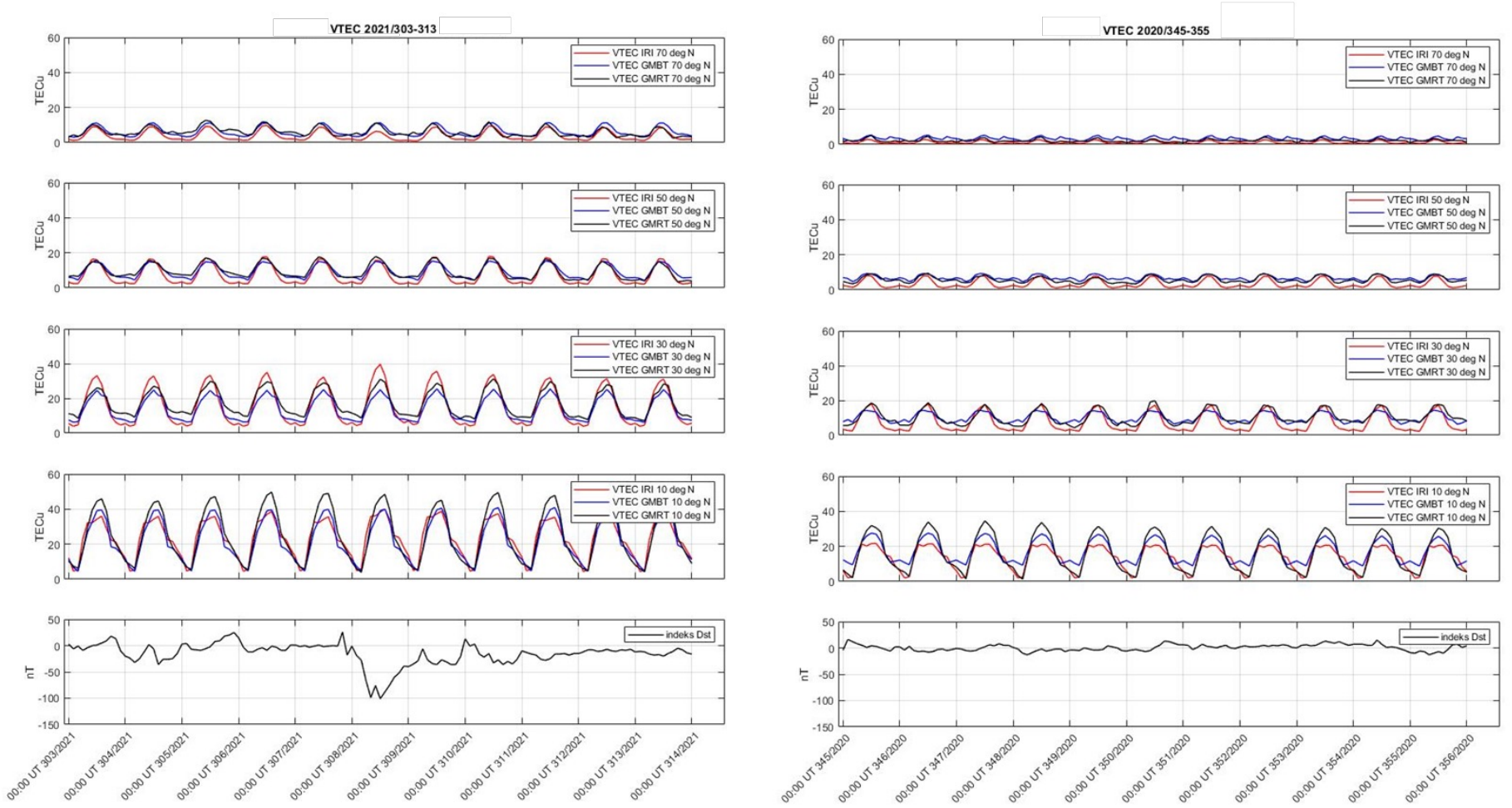
GMBT climate TEC
GNSS-based quiet-time reference

comparison with

GMRT real-time TEC
event-sensitive low-latency product

Interpretation

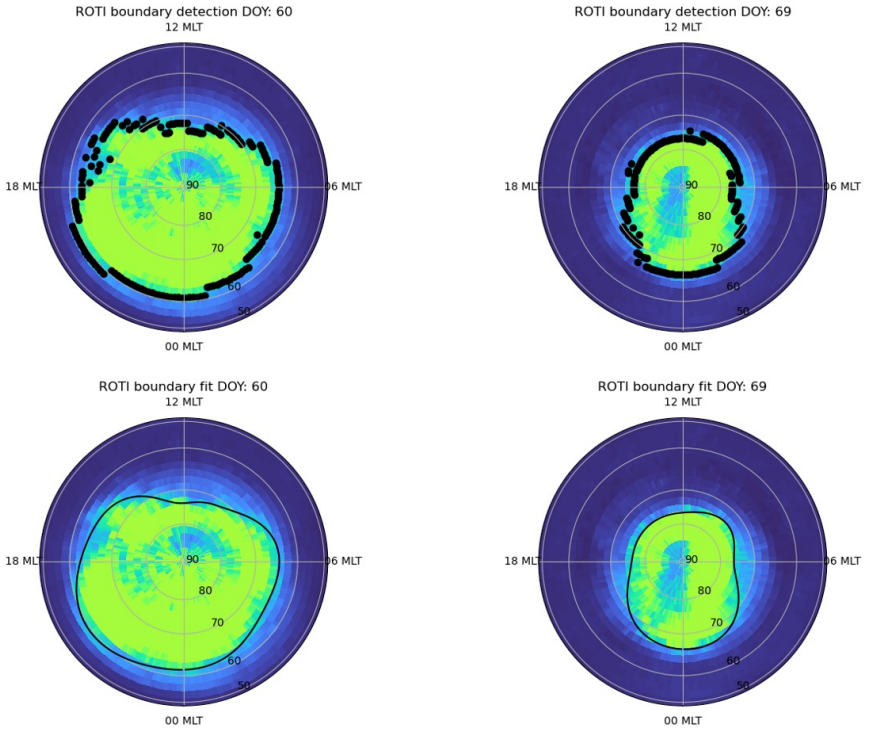
- IRI ≈ GMBT: stable conditions
- GMRT > climate: storm-time enhancement
- IRI ≠ GMBT: model mismatch
- Night-side differences: topside/plasmaspheric influence



Point-wise time series confirm different behavior of climate, empirical, and real-time representations.

Auroral oval spread elaboration for IRI

- ROTI highlights regions of enhanced ionospheric irregularities.
- The auroral oval boundary can be approximated from latitudinal ROTI gradients.
- A fitted boundary can support future dynamic IRI high-latitude updates.



Future Directions in the Collaboration and Conclusion

- GNSS TEC products provide an observational anchor for IRI-based assimilation.
- Climate and low-latency products are complementary:stable reference vs. event response.
- Product validation, stability, and latency remain key operational priorities.
- ROTI-based auroral oval information is a promising path toward dynamic high-latitude modeling.

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Thank you for attention

In case of further questions please contact adam.fron@uwm.edu.pl