



INSTITUTE OF COSMOPHYSICAL RESEARCH AND RADIO WAVE PROPAGATION FEB RAS
**SOLAR-TERRESTRIAL RELATIONS AND PHYSICS
OF EARTHQUAKE PRECURSORS** 11th International
Conference

September 22 - 25, 2020, Paratunka, Russia

<http://www.ikir.ru/ru/Events/Conferences>

Changes in the GNSS precise point positioning accuracy during the strong geomagnetic storm

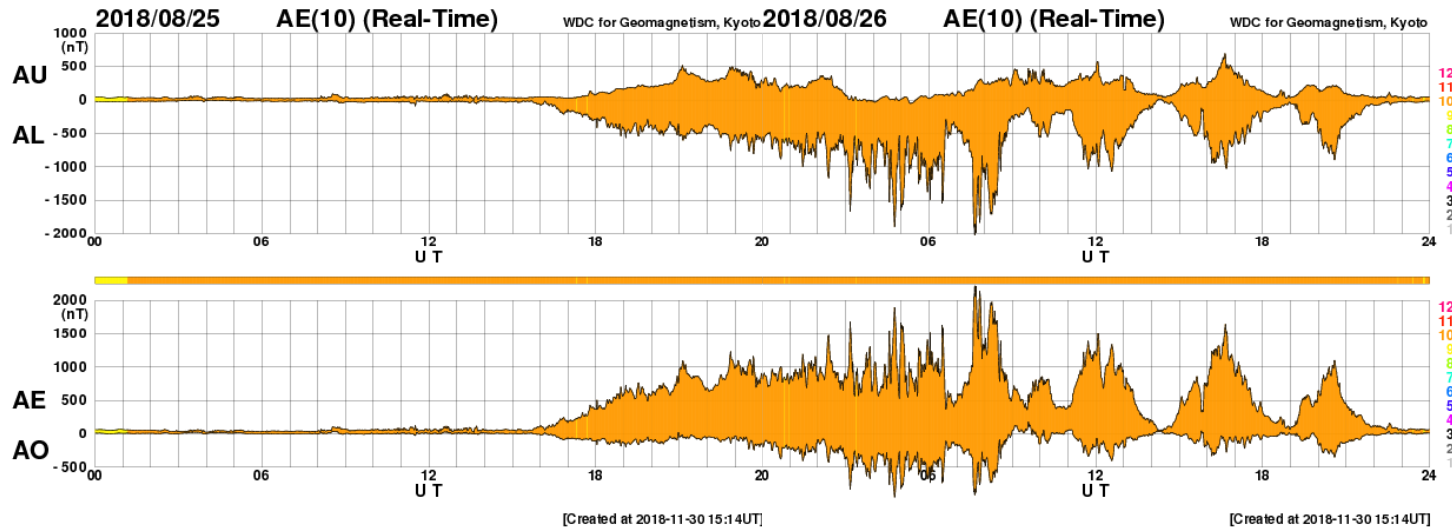
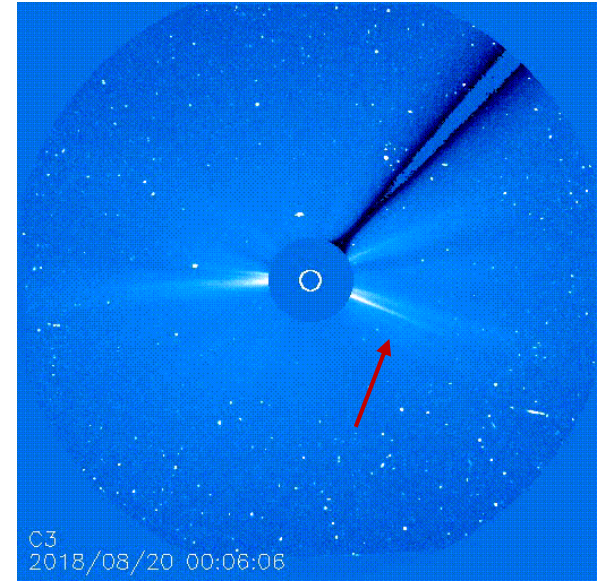
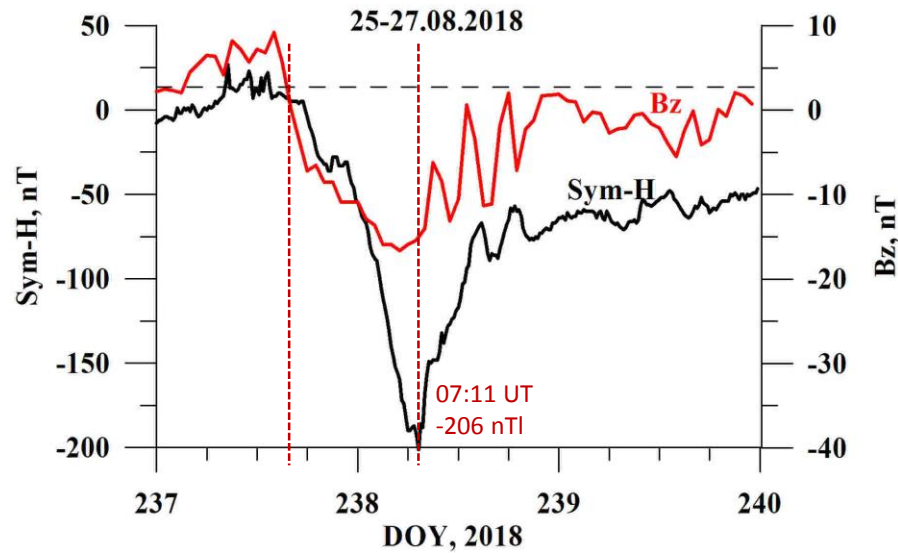
A. Yasyukevich, S. Syrovatskii, and Yu. Yasyukevich

Institute Of Solar-Terrestrial Physics SB RAS

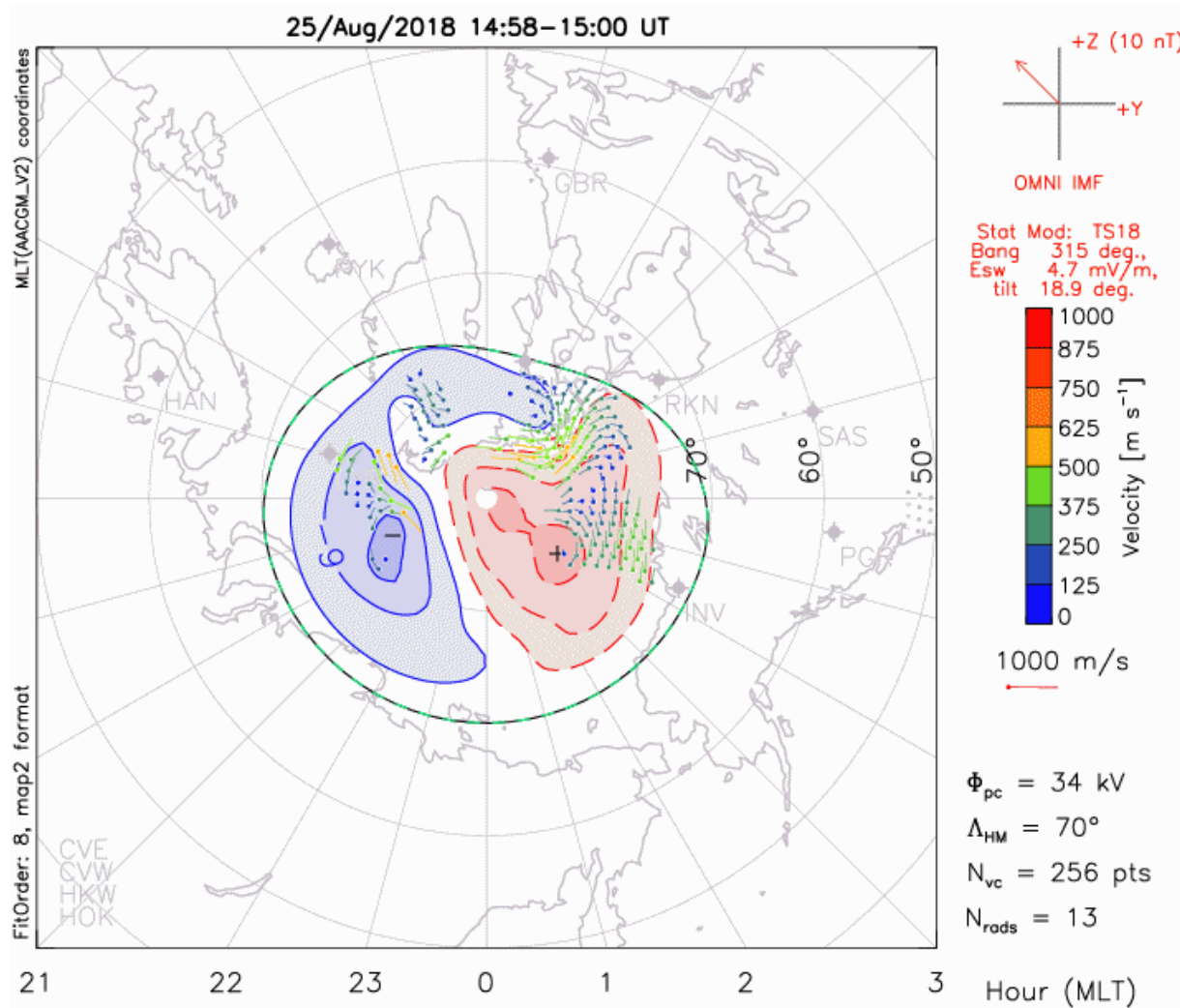
a.yasuykevich@gnss-lab.org



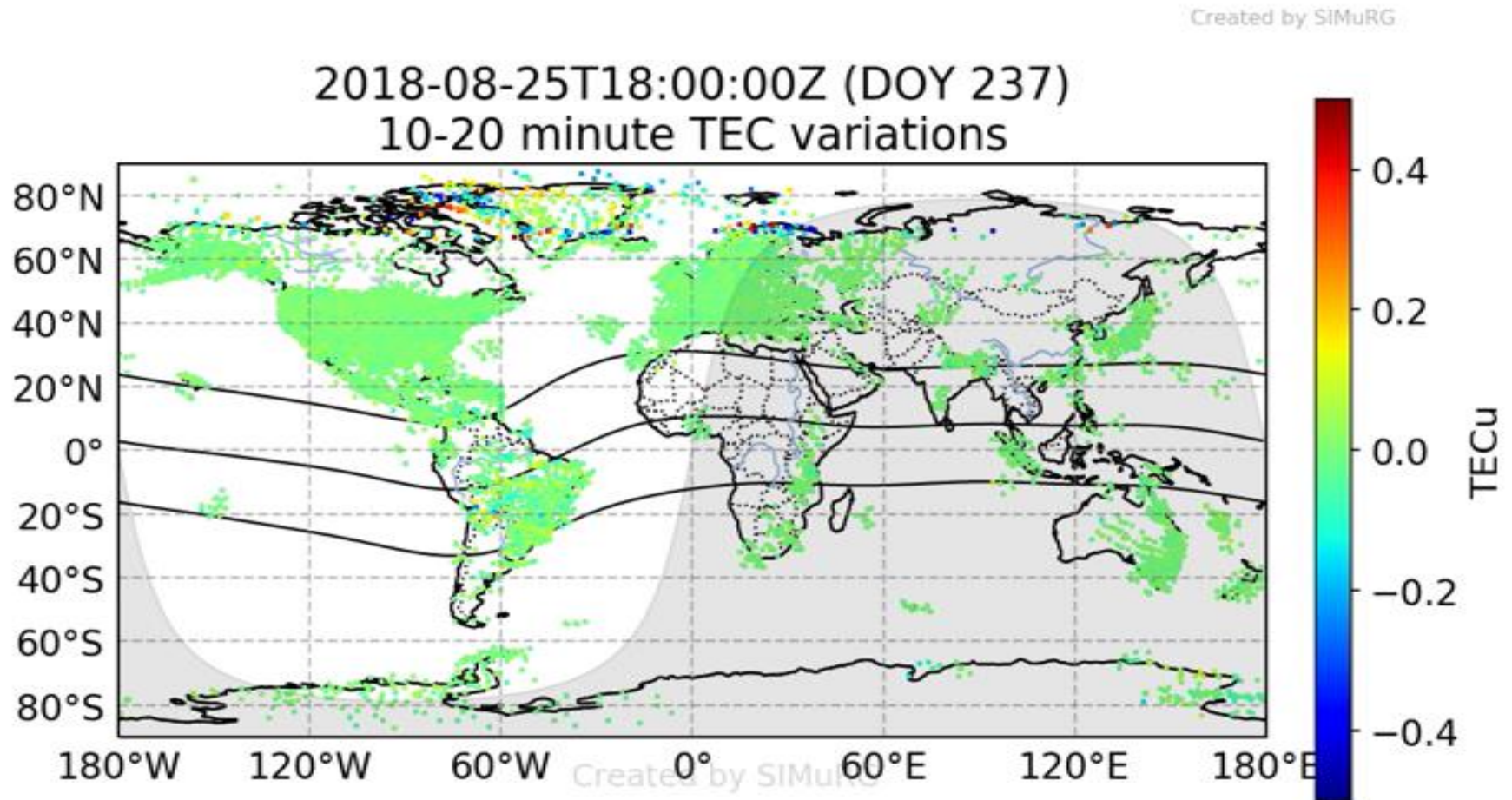
August 25-26, 2018 Geomagnetic storm



Auroral activity

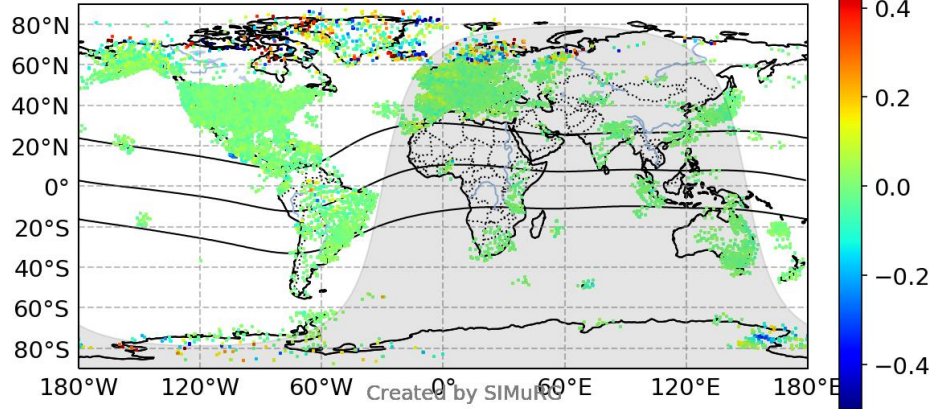


Total electron content, 10-20 min variations

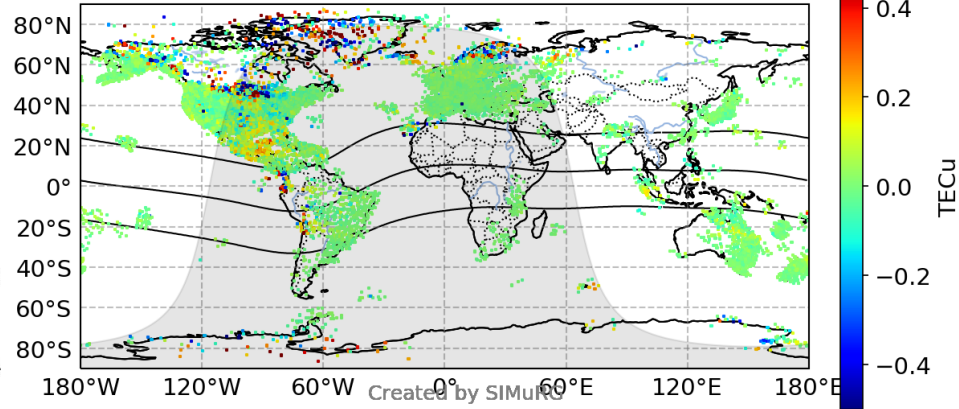


Total electron content, 10-20 min variations

2018-08-25T20:00:00Z (DOY 237)
10-20 minute TEC variations

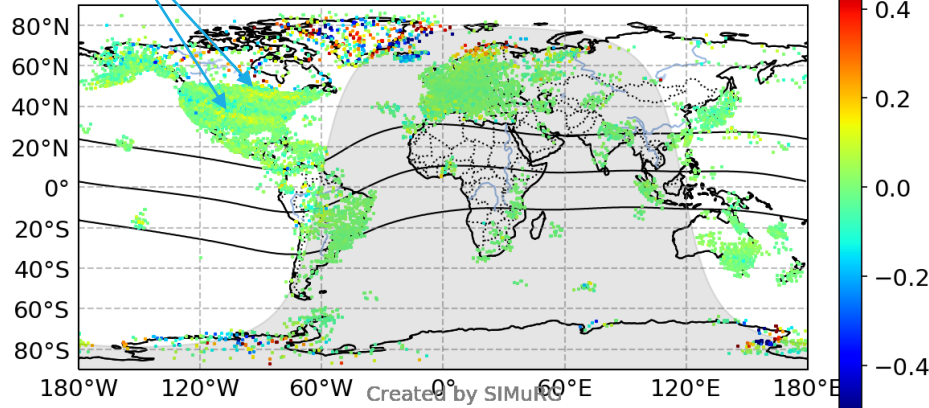


2018-08-26T01:45:00Z (DOY 238)
10-20 minute TEC variations

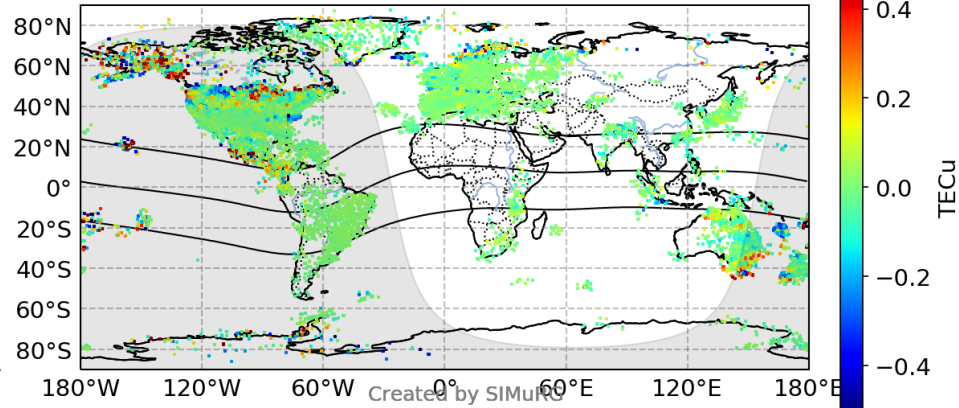


TID

2018-08-25T22:05:00Z (DOY 237)
10-20 minute TEC variations



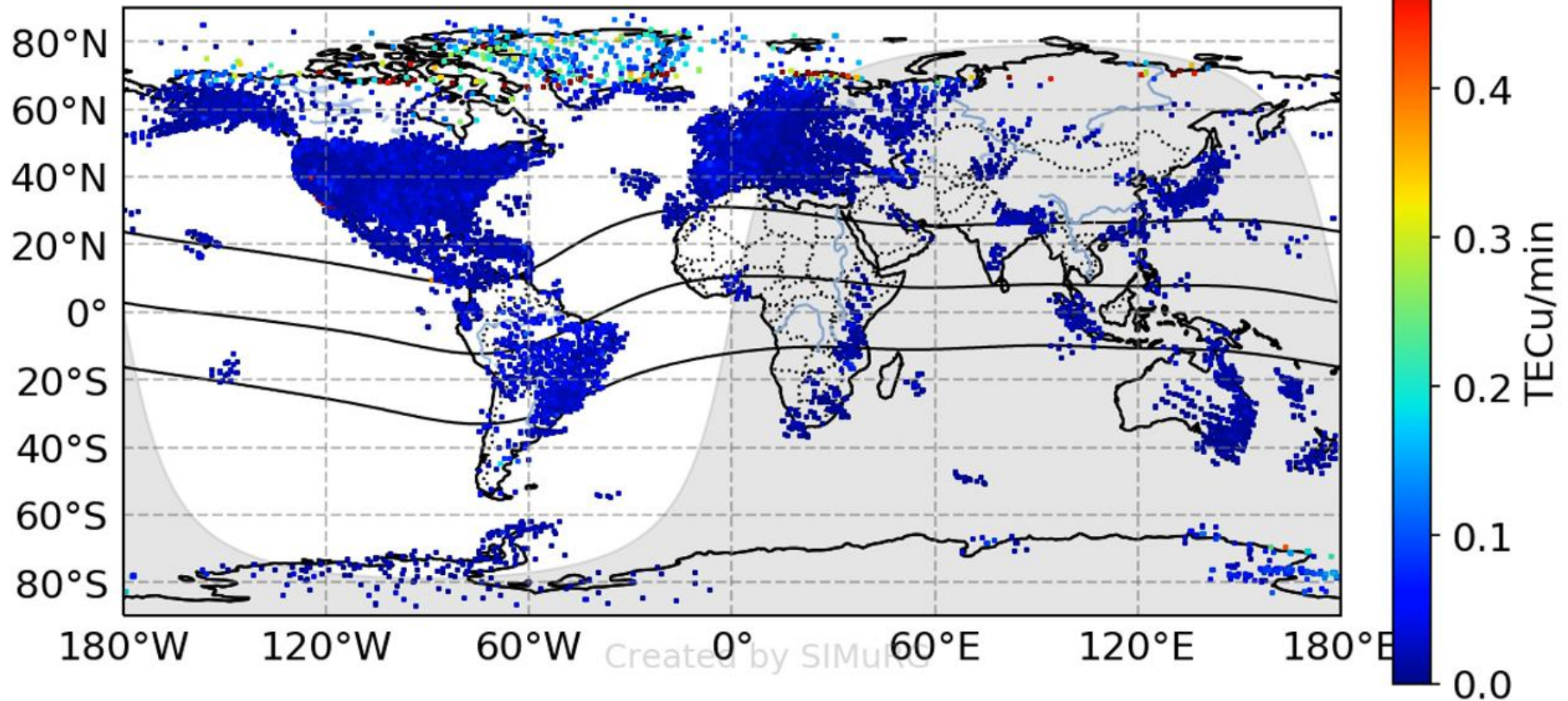
2018-08-26T07:45:00Z (DOY 238)
10-20 minute TEC variations



ROTI maps

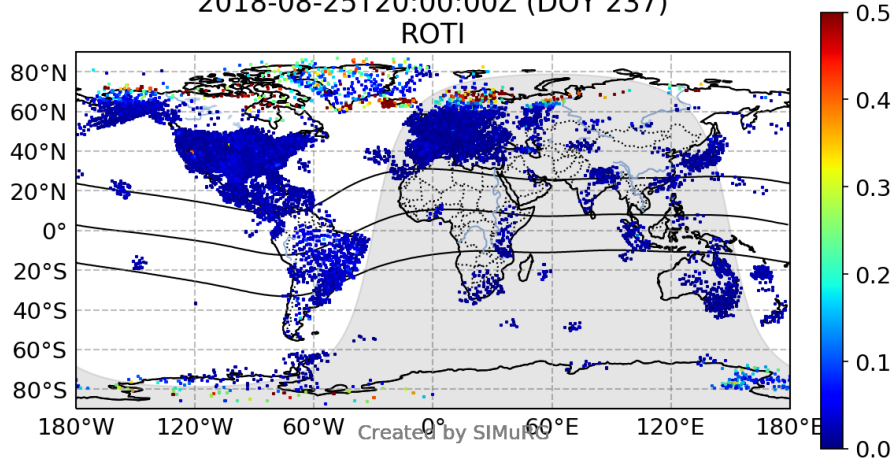
Created by SIMuRG

2018-08-25T18:00:00Z (DOY 237)
ROTI

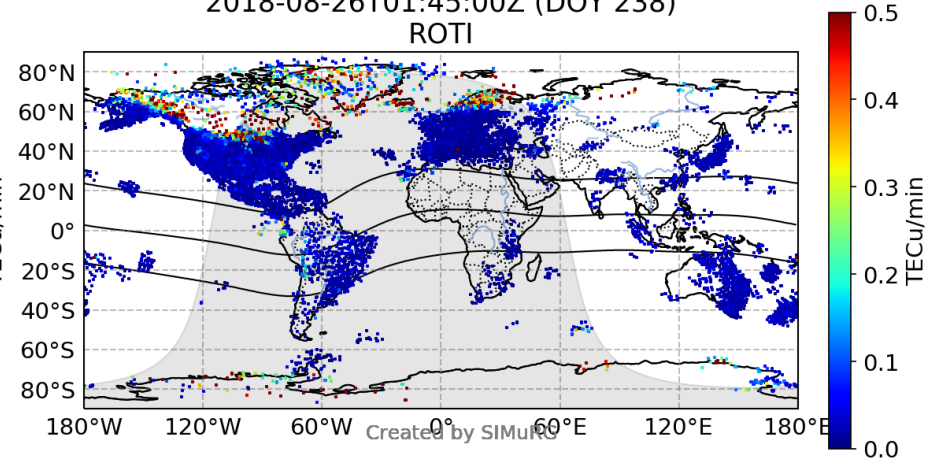


ROTI maps

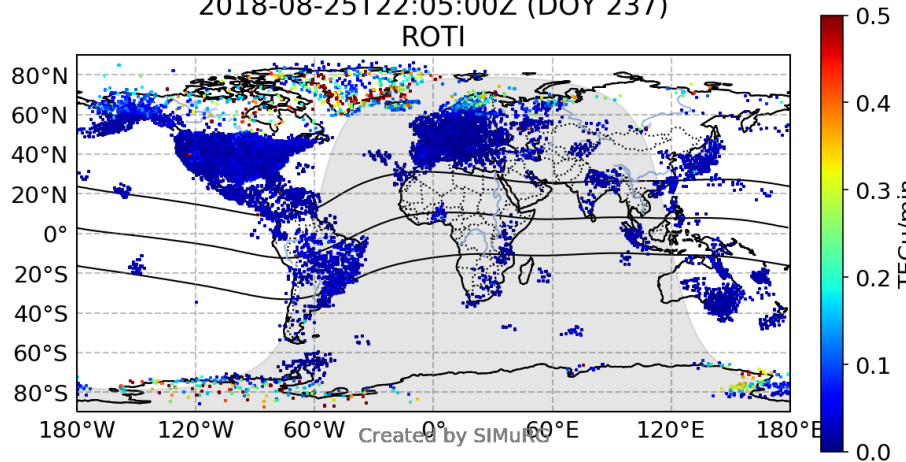
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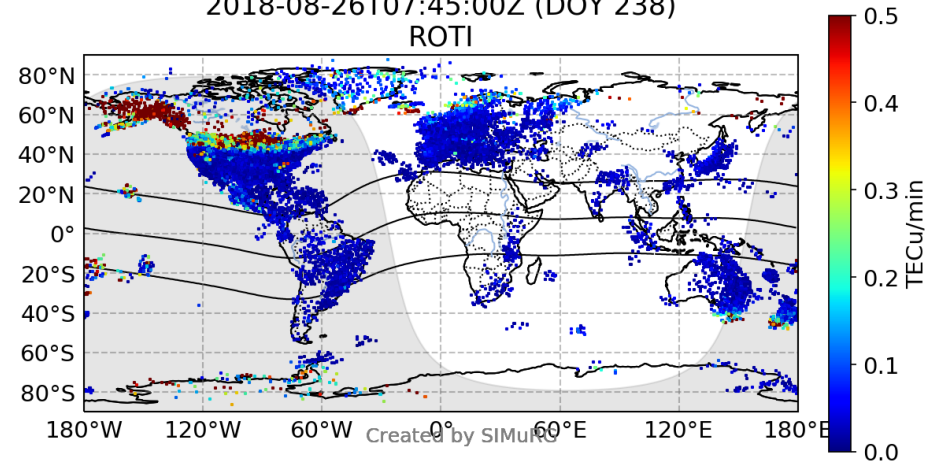
2018-08-26T01:45:00Z (DOY 238)
ROTI



2018-08-25T22:05:00Z (DOY 237)
ROTI



2018-08-26T07:45:00Z (DOY 238)
ROTI

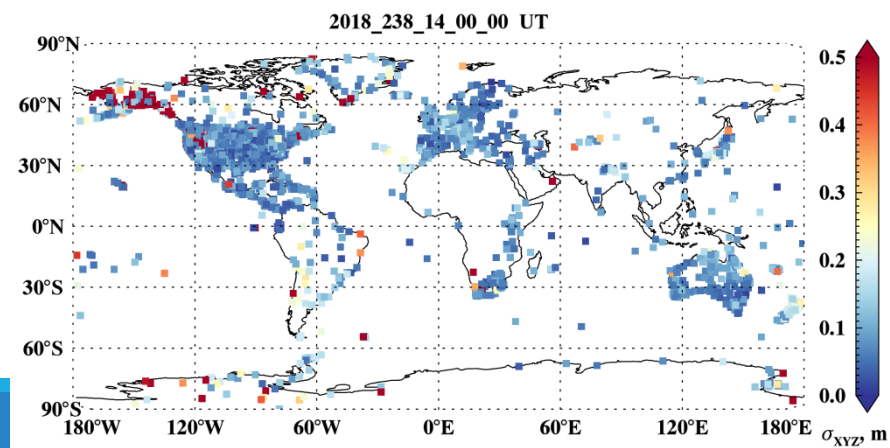
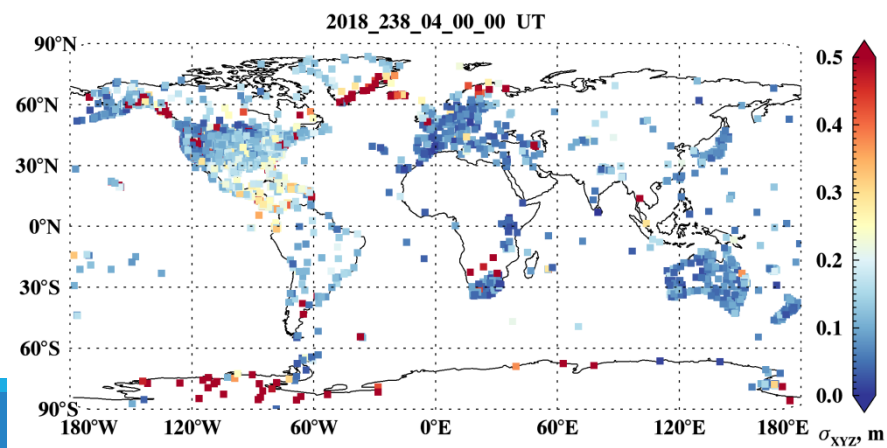
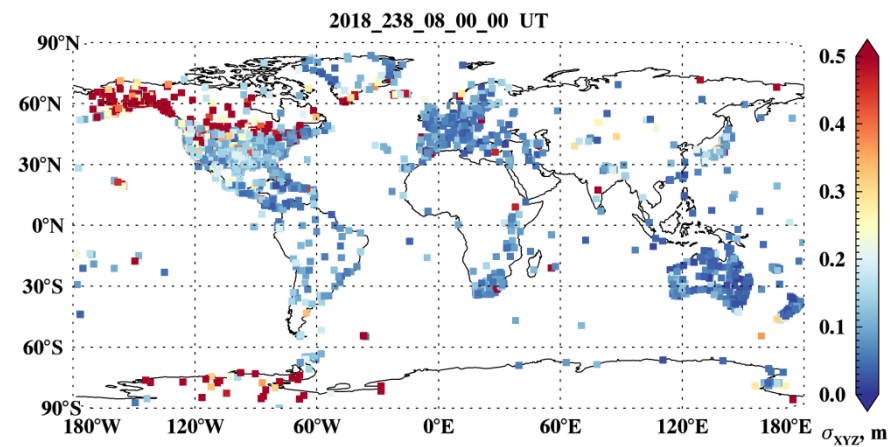
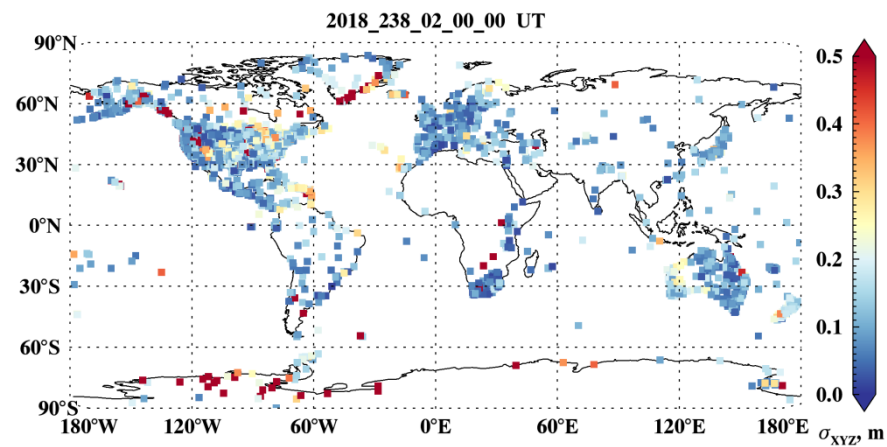
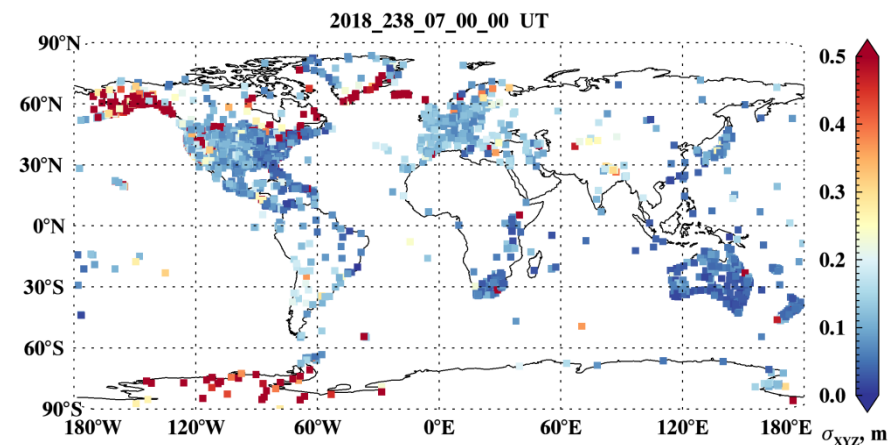
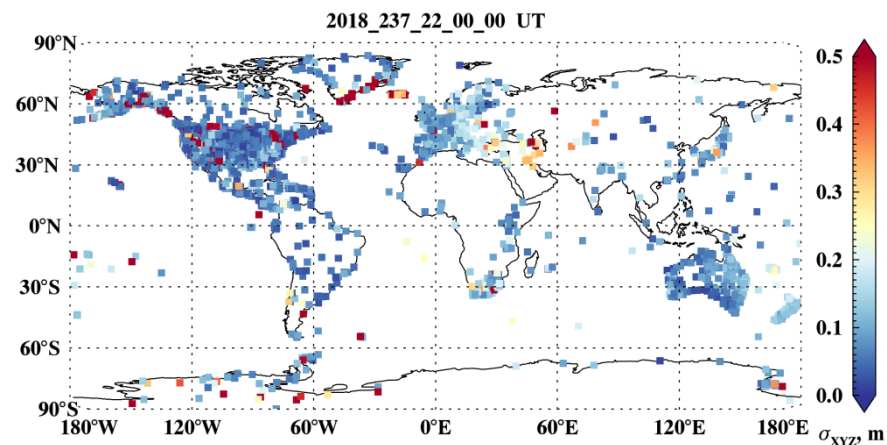


Precise Point Positioning errors

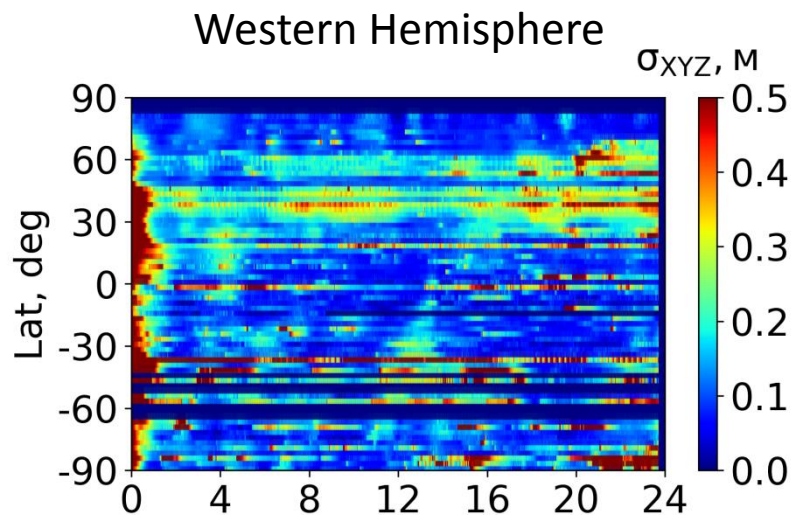
To estimate the changes in positioning accuracy, for every station we calculated GPS precise point positioning (PPP) coordinates in the kinematic mode. The calculating was performed using the GAMP opensource software [Zhou et al., 2018]. Receiver and satellite clock offsets are considered in GAMP PPP solution by applying IGS precise satellite orbit and clock products.

The 24-hour averaged values of X, Y, Z coordinates for a station were regarded as reference positions. The total positioning error was calculated as a difference between the reference and the instant position:

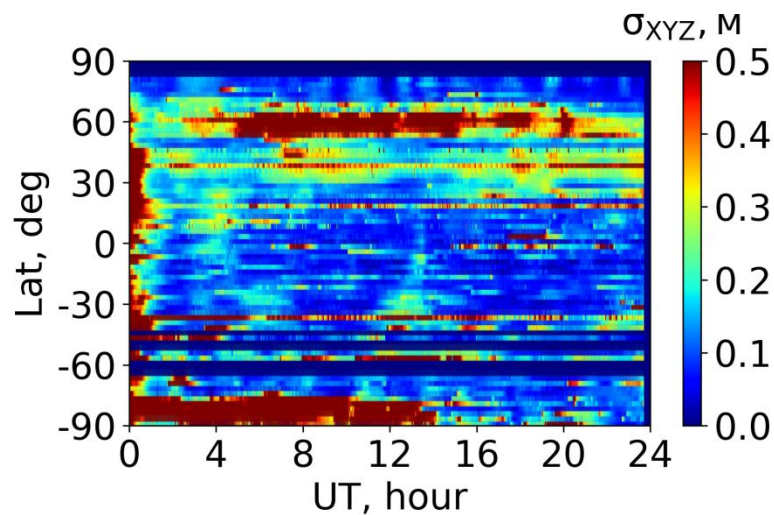
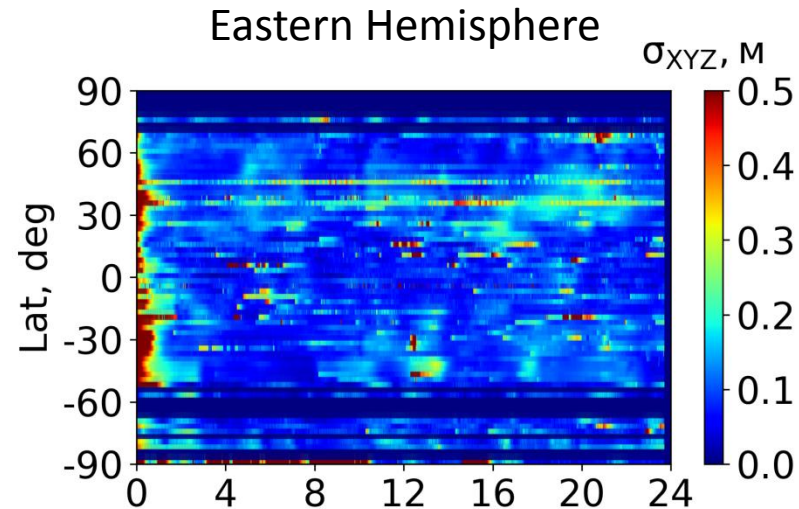
$$\sigma_{XYZ} = \sqrt{(\Delta X^2 + \Delta Y^2 + \Delta Z^2)}.$$



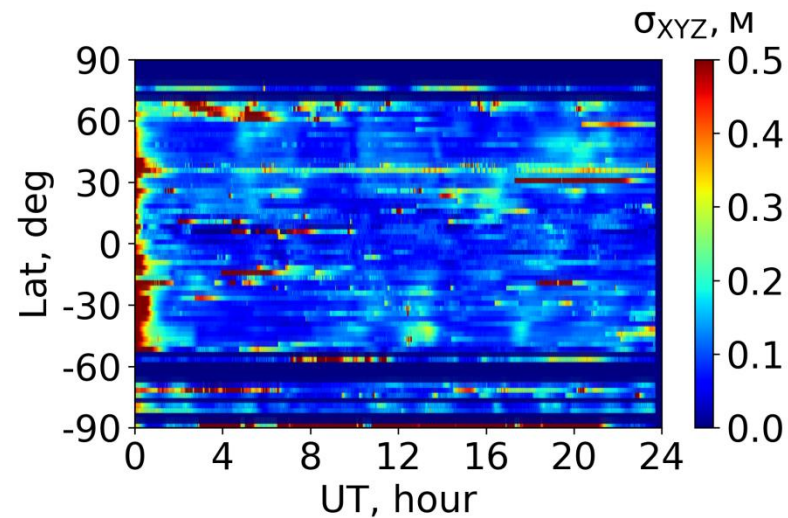
Zonal mean PPP error



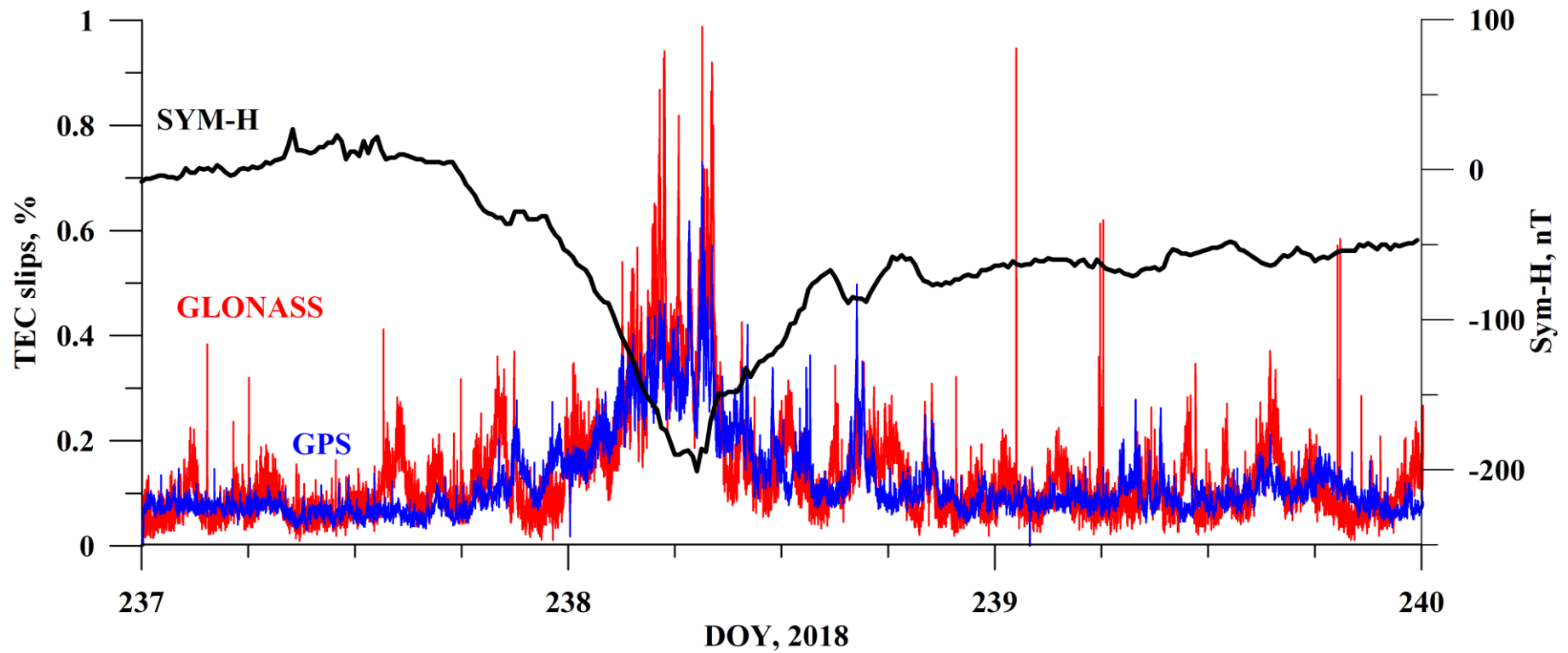
25 August 2018



26 August 2018

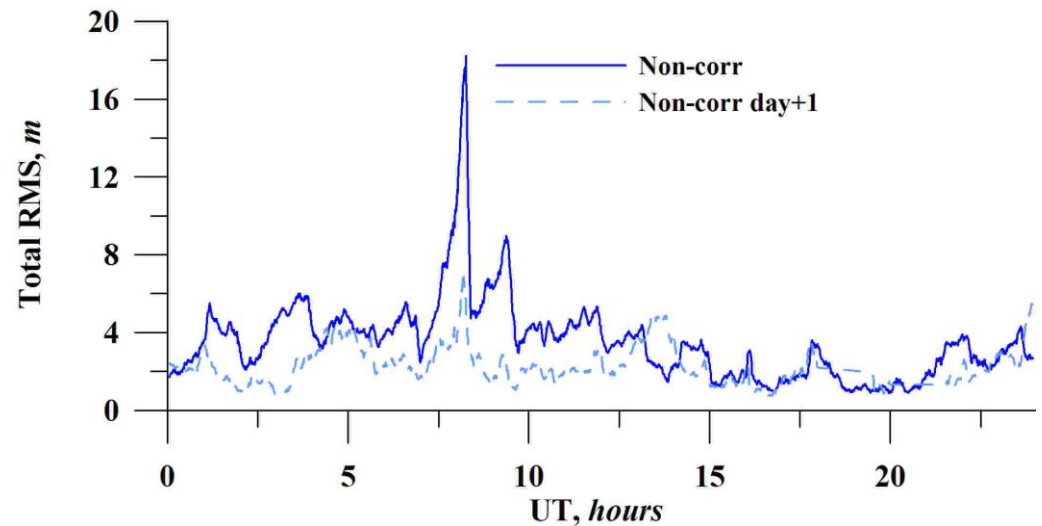
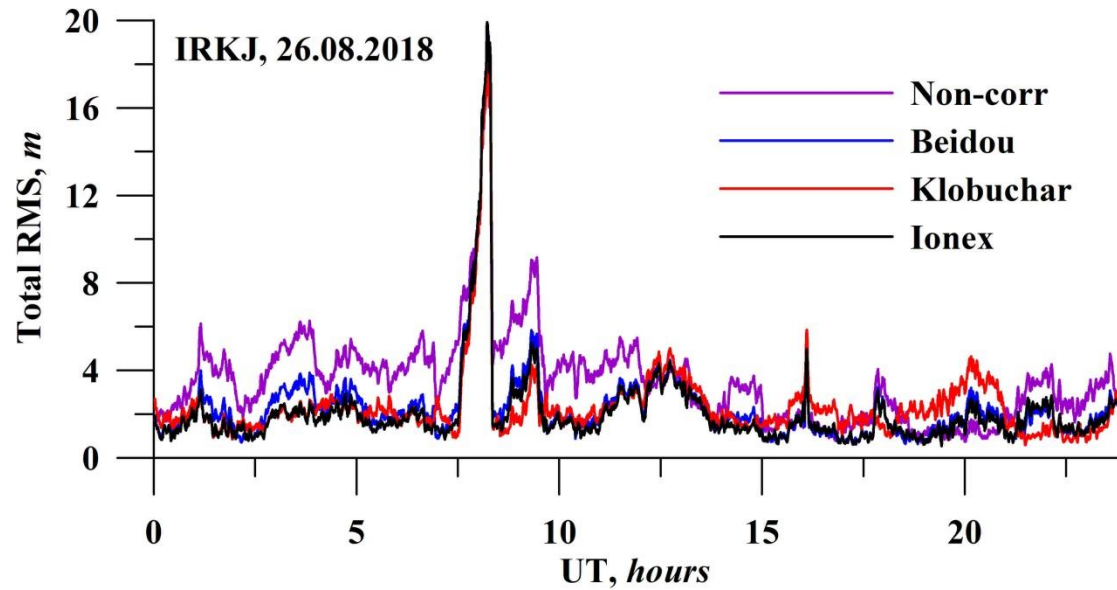


TEC slips



* TEC slips – cases of unphysical jumps in TEC dynamics

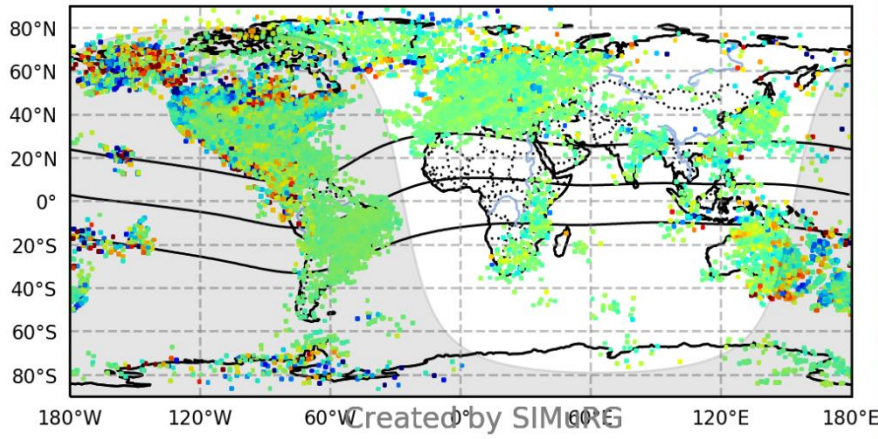
Single frequency positioning



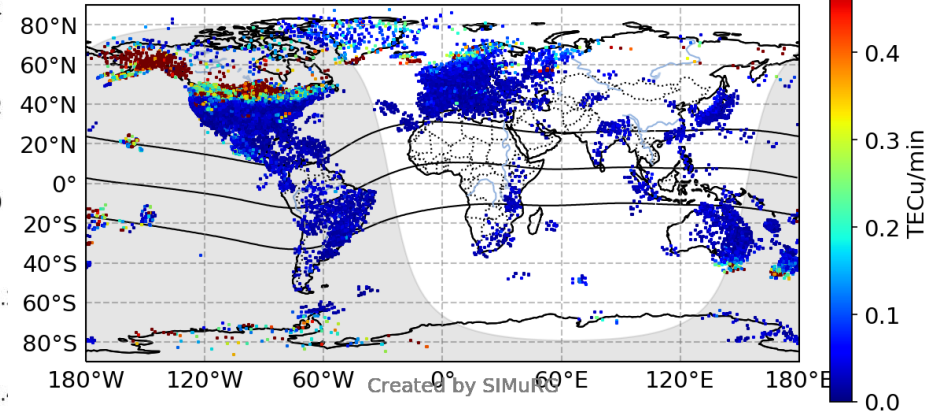
Summary

Created by SIMuRG

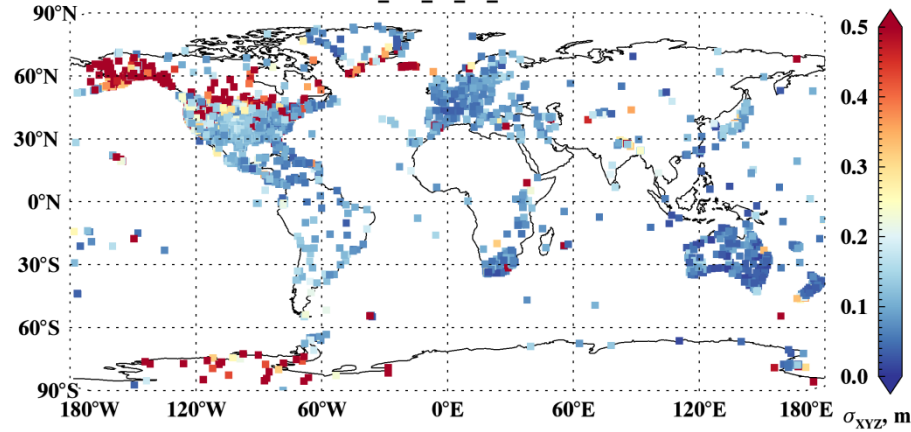
2018-08-26T07:45:00Z (DOY 238)
10-20 minute TEC variations



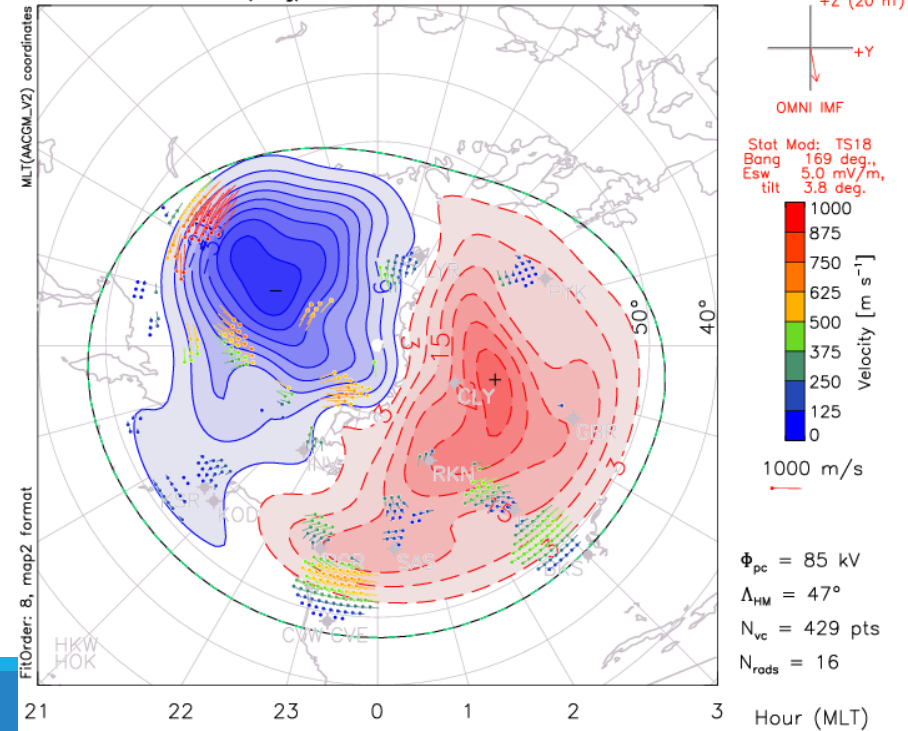
2018-08-26T07:45:00Z (DOY 238)
ROTI



2018_238_07_45_00 UT



26/Aug/2018 07:58-08:00 UT



Thank you for attention!

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TEC variation and ROTI maps are obtained via **SIMuRG** on-line service (<https://simurg.iszf.irk.ru>).