Total electron content driven data products of SIMuRG

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Motivation

Madrigal Database at Haystack Observatory: Vertical TEC. Madrigal provides vertical TEC, precalculated data. Which are useful for space weather research application. Our purpose to provide more flexible interface and more data products.
Our features

- Query based
- Plots (maps and series) and data
- Various data products
- Preliminary analysis (right on the web)
- Machine Learning engine
- Slant and grided data
SIMuRG [Yasukevich et al. 2020]

https://simurg.iszf.irk.ru

SIMuRG: System for the Ionosphere Monitoring and Researching from GNSS.

SIMuRG is the tool for collecting, processing, storage and presentation of GNSS total electron content data. The data product are TEC variations series, corrected TEC, TEC variations maps, Wac and Jv indices, ionospheric disturbances parameters.

Developed under Russian Science Foundation support (project № 17-77-20005)
Data products: ROTI (solar flare)

https://simurg.iszf.irk.ru/result?id=5ea68964ef1e74e64a47abb5

2011-09-06T22:21:00Z (DOY 249)

Created by SIMuRG
Data products: variations (geomagnetic storm)

2015-06-22T20:57:30Z (DOY 173)
10-20 minute TEC variations
Data products: variations  
(examine filtration technique)

Conventional moving average window filtrations can lead to significant artifacts. SIMuRG uses the filtration that allows to analyze variations in selected band.

[Maletckii et al. 2020]
Data products: adjusted TEC

[Yasukevich et al. 2020]
Data products plots: series

https://simurg.iszf.irk.ru/result?id=5eb2928f5b0a5c1c390ec49f
Data products: geometry

GNSS sounding geometry is spatially extended. We provide the interactive plots for understanding where data are coming from. https://simurg.iszf.irk.ru/result?id=5eb2928f5b0a5c1c390ec49f
Data products: GEC  
(global electron content)

https://simurg.iszf.irk.ru/gec
Data products: REC (regional electron content)

https://simurg.iszf.irk.ru/recseries
Data products: GIM Plots
(GIMs are provided by various sources)

We provide plots of the GIMs
https://simurg.iszf.irk.ru/gecmap

Geographic

Geomagnetic
GUI and API
(https://simurg.iszf.irk.ru/documentation/how_to_api)
Event detection

Each map query has option to go to interactive mode and to detect and submit events:
https://simurg.iszf.irk.ru/interactive?id=5ea1bc4ac6fe76b9bcef3144
Using SIMuRG there was developed algorithm for solar flare detection based on GNSS data.
Research

Using SIMuRG REC it is possible to see after storm effect. Each point below corresponds to REC in slice (+- 30 latitude) for each longitude.