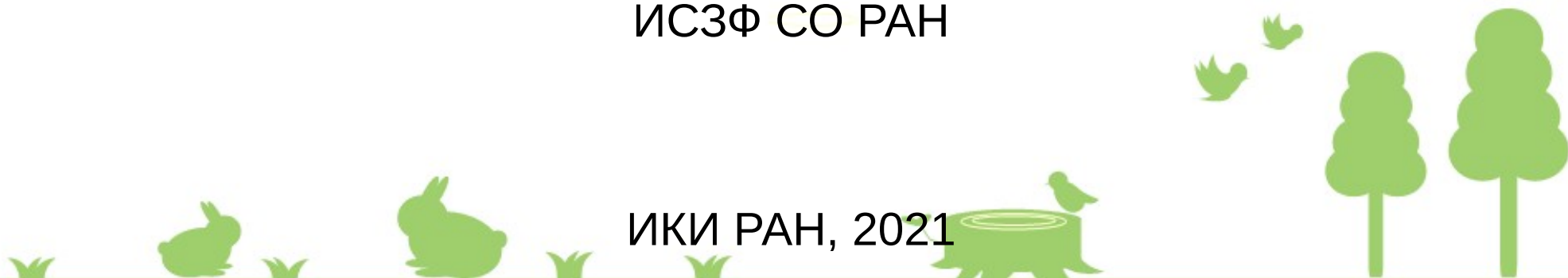


# Динамические карты вариаций ROTI

Едемский И.К., Ясюкевич Ю.В., Веснин А.М., Киселев А.В.  
ИСЗФ СО РАН

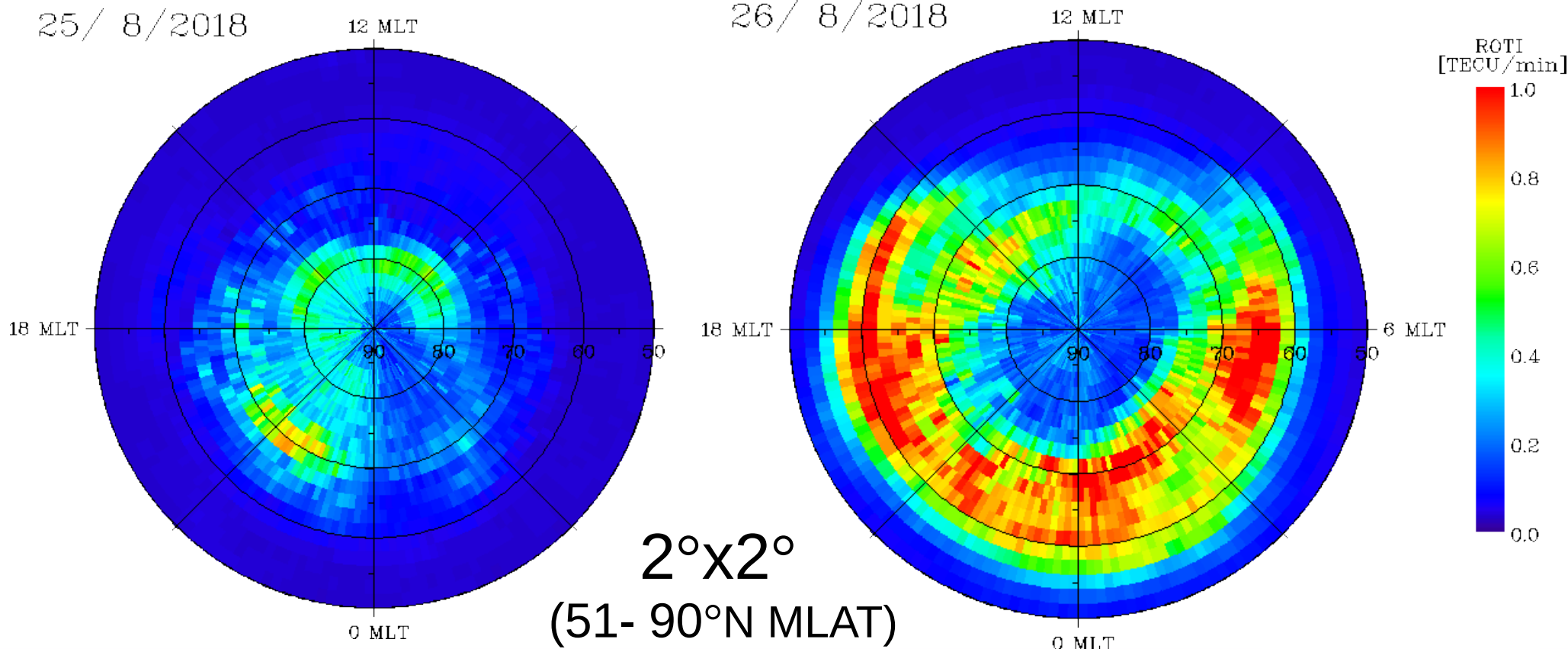
ИКИ РАН, 2021



# Карты ROTI службы IGS

$$ROTI = \sqrt{\langle ROT^2 \rangle - \langle ROT \rangle^2}$$

$$ROT = \frac{sTEC_k^i - sTEC_{k-1}^i}{t_k - t_{k-1}}$$

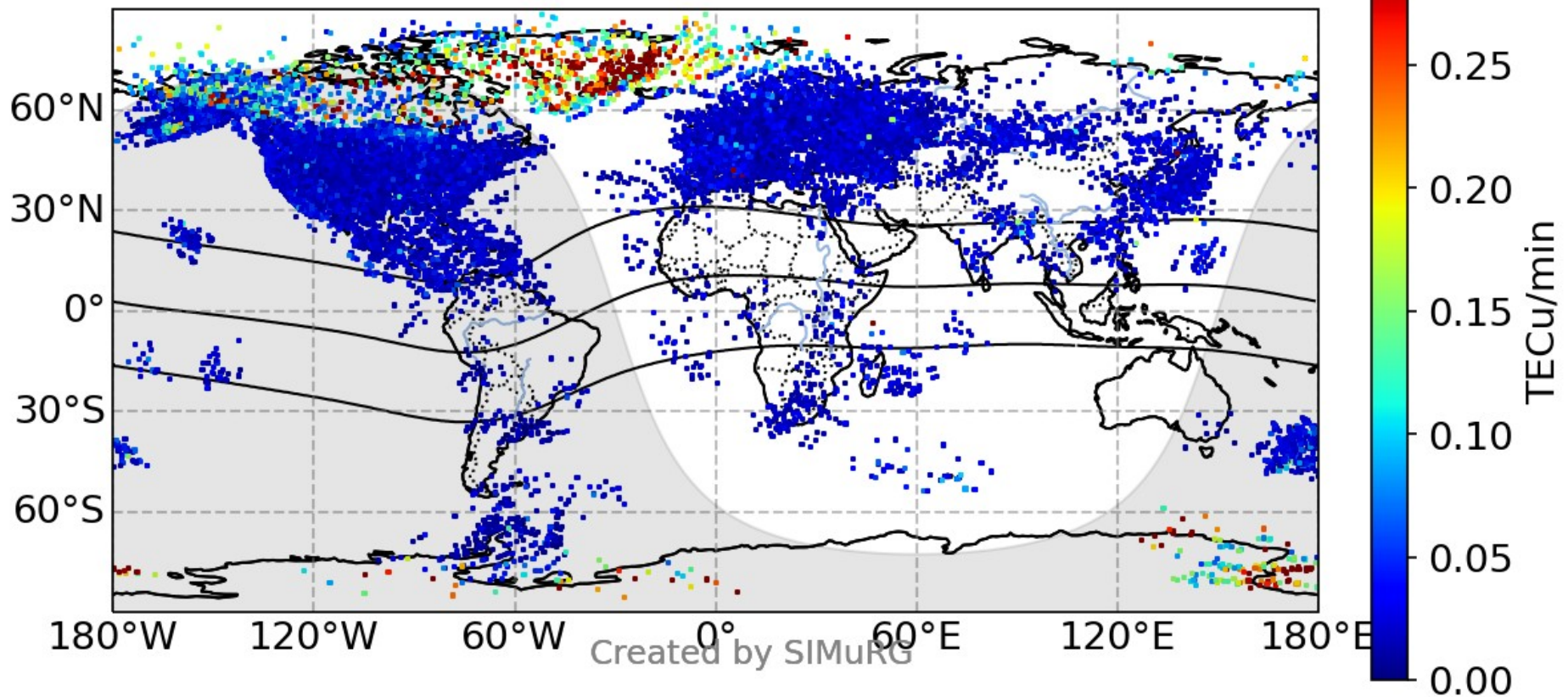


# Карты SIMuRG\*

Created by SIMuRG

2021-05-12T08:00:00Z (DOY 132)

ROTI



System for Ionosphere Monitoring and Research from GNSS:

<https://simurg.space/>

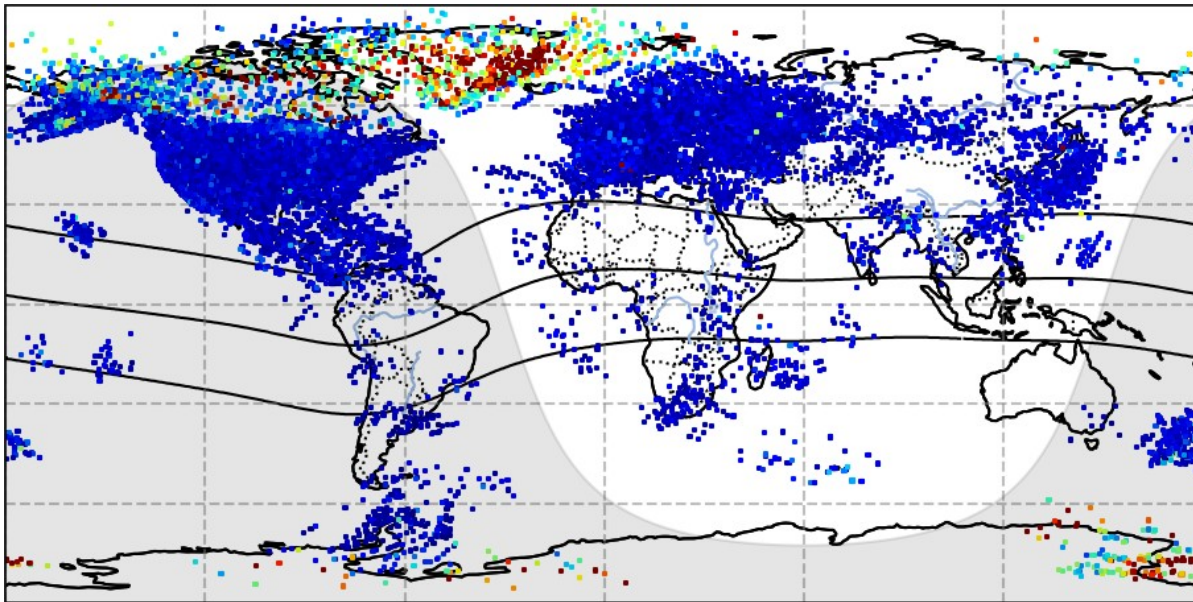
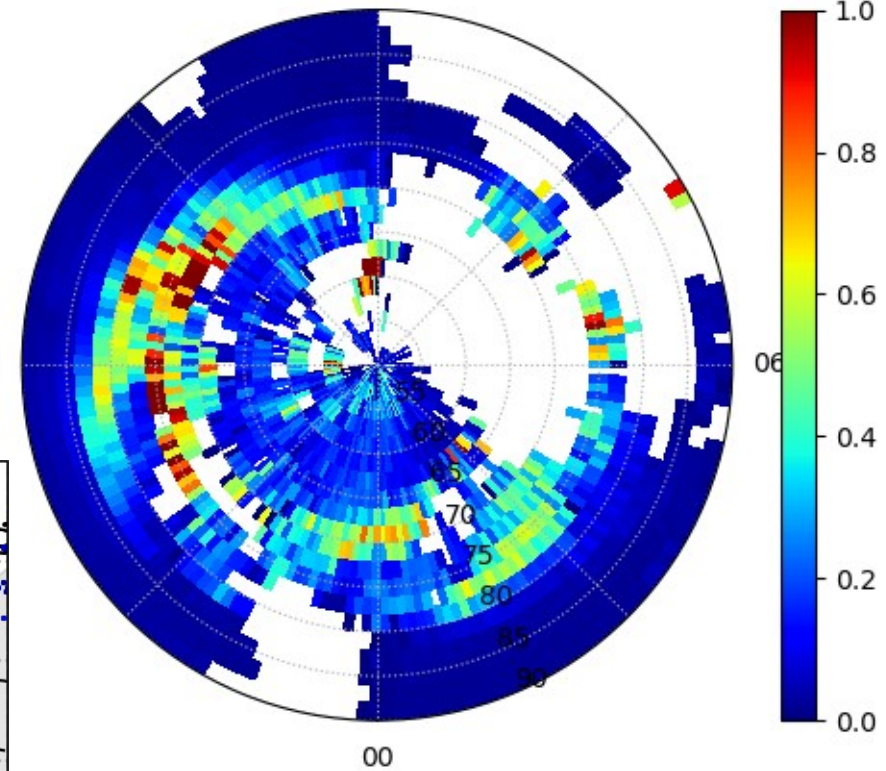
# Часовая карта ROTI

$$R_{i,j} = \frac{\sum_{i,j} R_n}{n}$$

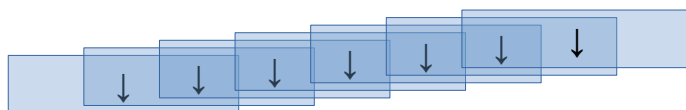
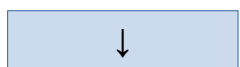
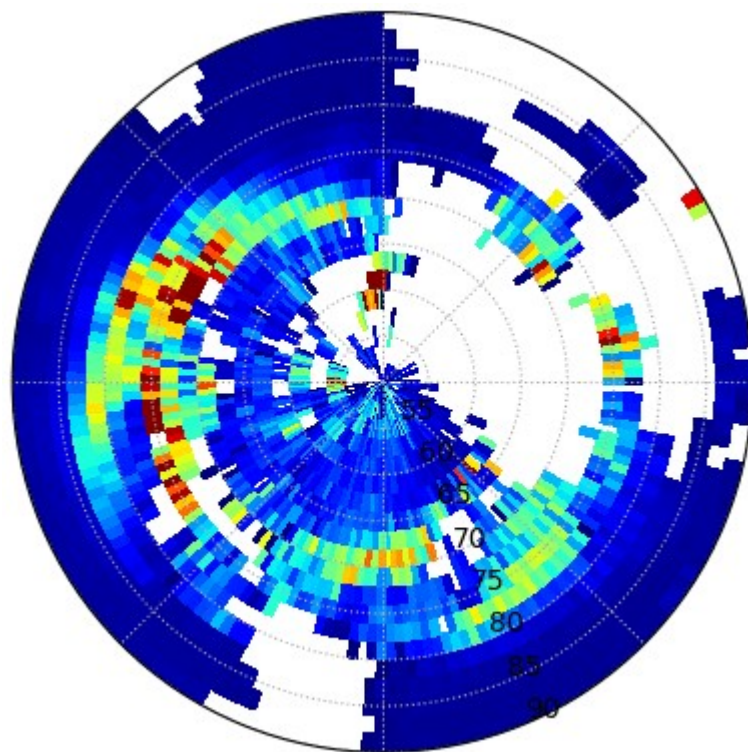
ROTI variations during 26.08.18

12

18



# Динамическая карта ROTI



Анимированное изображение:

<http://gps.iszf.irk.ru/conf/iki2021.html>



# Площадь покрытия и число измерений в ячейке

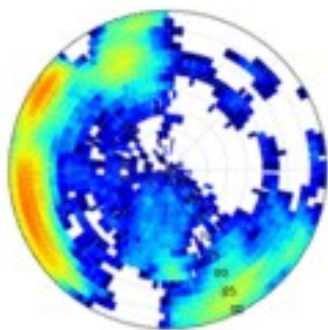
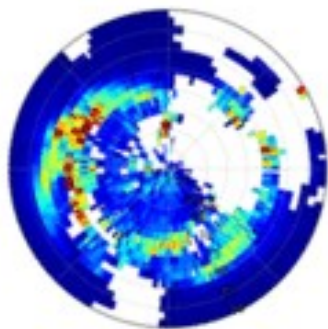
1ч

2ч

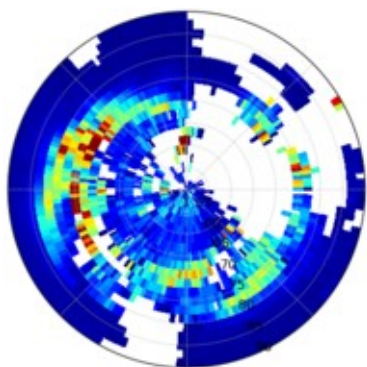
3ч

4ч

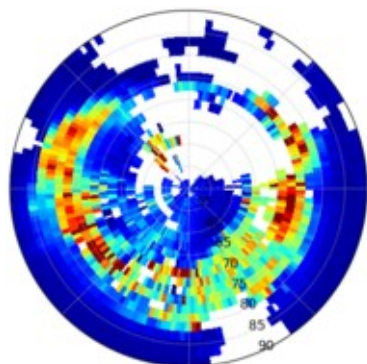
5ч



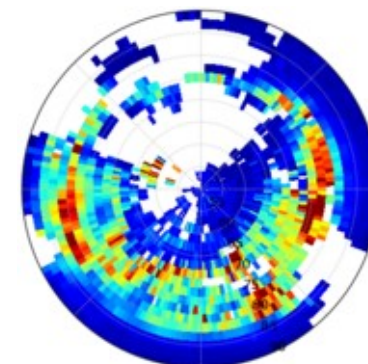
# Интерполяция методом кригинга



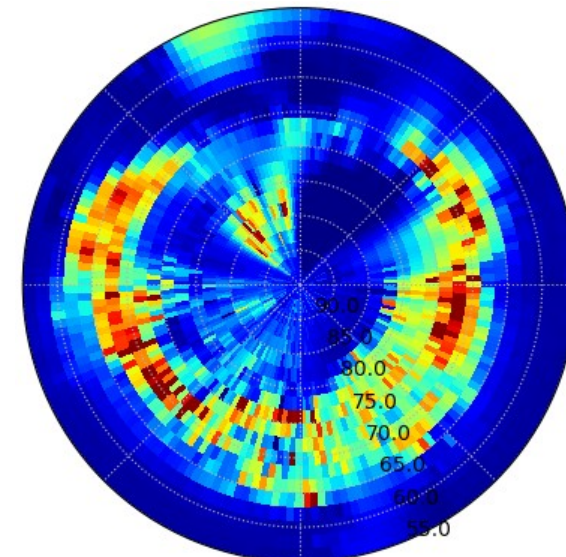
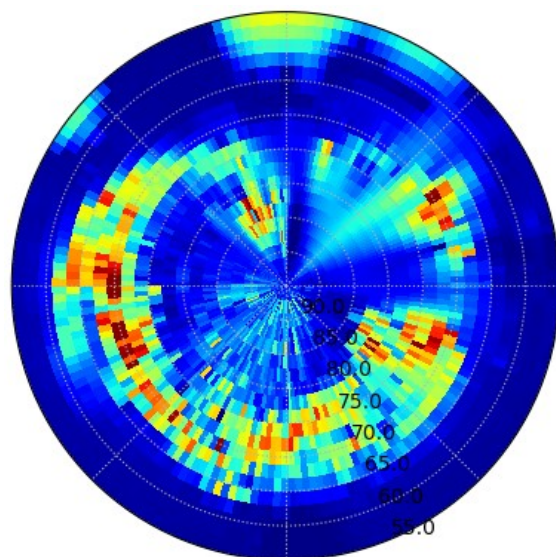
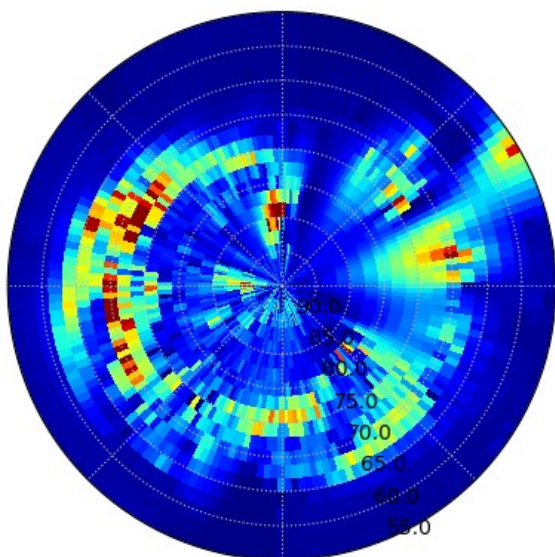
26.08.18 00:30



26.08.18 01:45



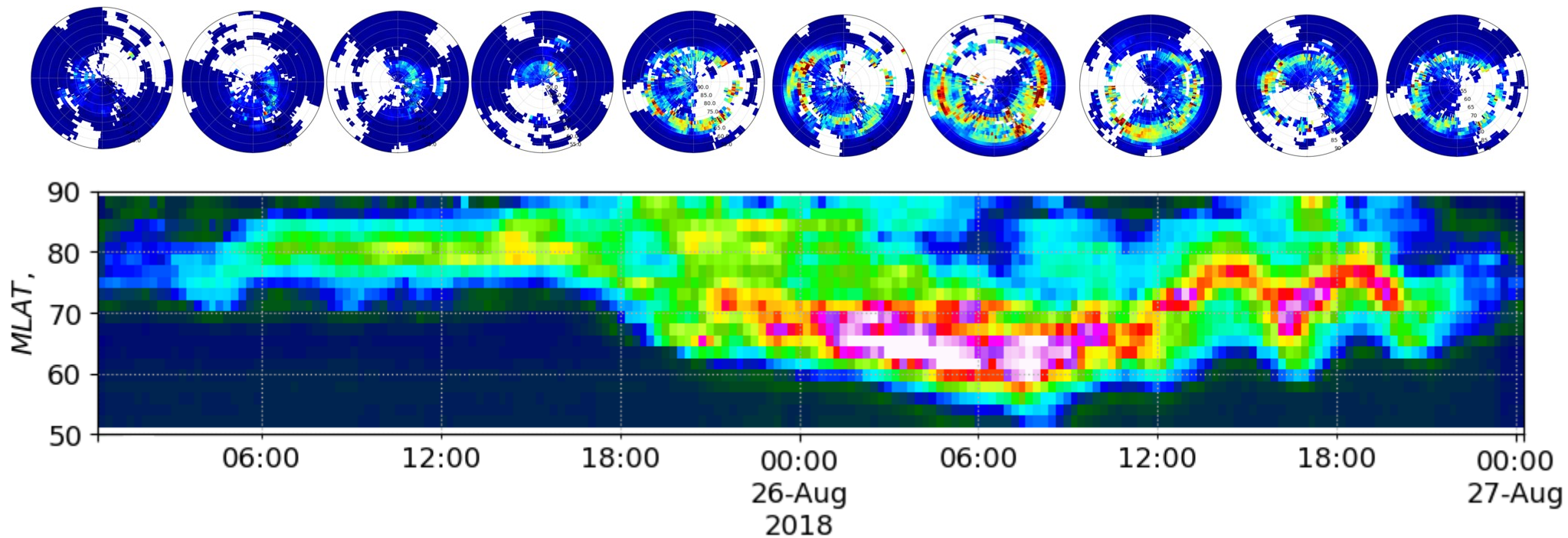
26.08.18 03:00



Интервал усреднения 1 ч

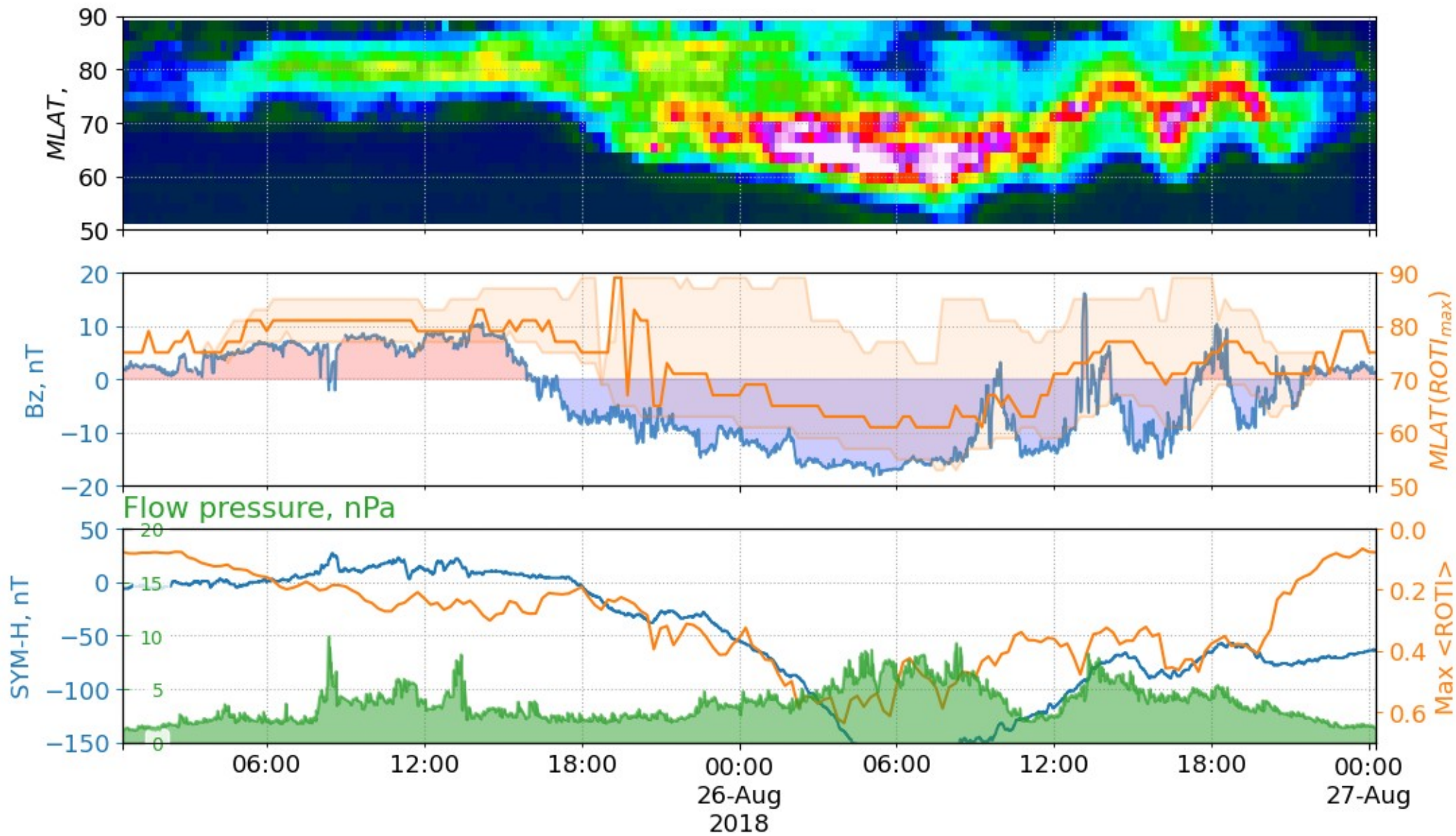
# Широтная кеограмма

$$R(\varphi_M, t) = \langle R(\varphi_M, \lambda_M, t) \rangle_{\lambda_M}$$





# Широтная кеограмма



# Заключение

- Динамические карты ROTI дают более детальную информацию о состоянии ионосферы в течение дня
- Увеличение времени усреднения снижает чувствительность карт к короткопериодным изменениям
- Кригинг позволяет получить сплошное заполнение, но может вносить артефакты
- Широтная кеограмма ROTI показывает положение овала неоднородностей ионосферы. Ее вариации коррелируют с вариациями индексов космической погоды



# Спасибо за внимание!

System for Ionosphere Monitoring and Research from GNSS:  
<https://simurg.space/>

The screenshot shows the SIMuRG website home page. At the top, there is a navigation menu with links for Home, Sites, Data, Queries, Events, GEC, and Documentation. A language selector is also present. Below the navigation, a yellow banner contains a disclaimer: "Please keep in mind SIMuRG is under development yet. All data and formats are provided as is and could be changed in future. Request can be dropped for reason of system modification. The data integrity is granted only for the algorithms and methods contained in system authors publication list. Please report bugs, issues, suggestions to [eremeev@iccr.kz](mailto:eremeev@iccr.kz)".

The main content area features the SIMuRG logo and the title "SIMuRG: System for Ionosphere Monitoring and Research from GNSS". Below this, a brief description states: "SIMuRG is the tool for collecting, processing, storage and presentation of GNSS total electron content data. The data products are TEC variations series, corrected TEC, TEC variations maps, Wtec and Iv indices, ionospheric disturbances parameters". It also mentions it was developed under Russian Science Foundation support (project № 17-77-00001).

Two featured sections are visible: "Latest maps" showing a TEC variation map for 2021-10-28T00:00:00Z (DOY 301) with a 7-10 minute TEC variations scale, and "Interesting event" showing a flare event on 2014-12-20 00:28 with characteristics: Type - X1.8, start - 2014-12-19 23:56, end - 2014-01:32, maximum - 2014-12-20 00:28.

At the bottom, it says "SIMuRG group 2021".

The screenshot shows the SIMuRG website Events page. It features a grid of event cards, each displaying a world map with ionospheric data and a list of event details. Each card includes a "Show" button.

- Event 1:** 2017-09-30T13:23:00Z (DOY 255) ROTI. Event - flare, type - X8.2, begin - 2017-09-30 15:20, maximum - 2017-09-10 16:06, end - 2017-09-10 16:46.
- Event 2:** 2017-09-07T14:05:00Z (DOY 250) ROTI. Event - flare, type - X1.3, begin - 2017-09-07 14:05, maximum - 2017-09-07 14:36, end - 2017-09-07 15:00.
- Event 3:** 2017-09-06T11:38:00Z (DOY 248) ROTI. Event - flare, type - X1.3, begin - 2017-09-06 11:38, maximum - 2017-09-06 12:02, end - 2017-09-06 12:25.
- Event 4:** 2017-09-06T08:42:00Z (DOY 248) ROTI. Event - flare, type - X2.2, begin - 2017-09-06 08:42, maximum - 2017-09-06 09:10, end - 2017-09-06 09:32.
- Event 5:** 2015-05-05T21:53:00Z (DOY 125) ROTI. Event - flare, type - X2.7, begin - 2015-05-05 21:50, maximum - 2015-05-05 22:11, end - 2015-05-05 22:30.
- Event 6:** 2015-03-11T16:03Z (DOY 018) ROTI. Event - flare, type - X2.2, begin - 2015-03-11 15:56, maximum - 2015-03-11 16:22, end - 2015-03-11 16:44.