

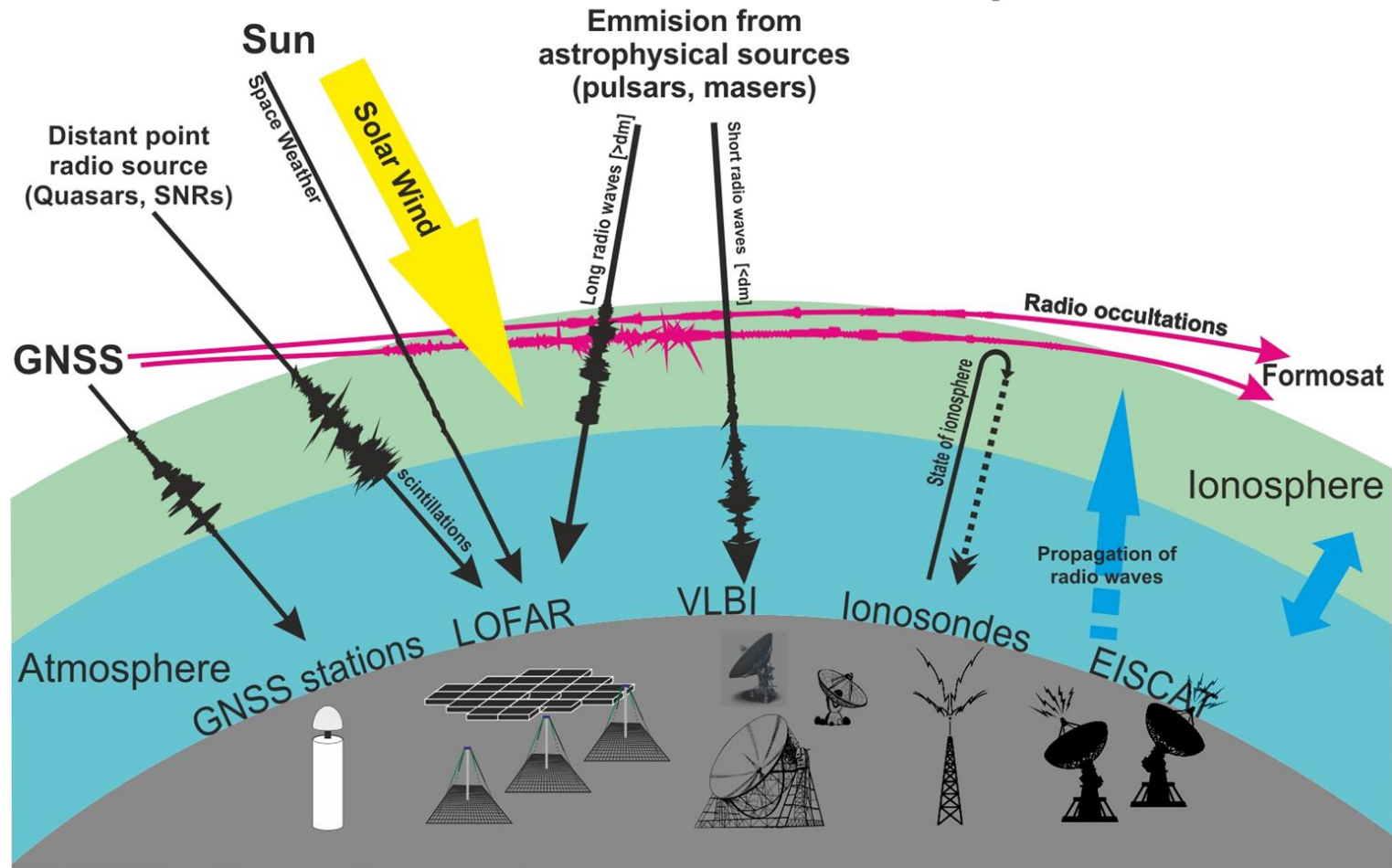


Cooperation with International LOFAR Telescope (ILT) for potential synergies

P. Flisek, B. Forte, K. Kotulak, R. Fallows, A. Krankowski, M. Bisi, L. Błaszkiwicz, A. Froń

OBJECTIVES

Interaction of the immediate environment of the earth and radio waves from distant space



OBJECTIVES

- 1) The influence of the ionospheric dynamics on the pulsar signals.
- 2) The analysis of LOFAR scintillation observations compared with TEC fluctuations from GNSS to address three main questions:
 - a) the ionisation scales which GNSS and LOFAR are sensitive to,
 - b) how scintillation varies between the VHF and the L-band,
 - c) whether LOFAR can be utilised as an alert system for GNSS-based applications.

INTERNATIONAL LOFAR TELESCOPE (ILT)

LOw Frequency ARray

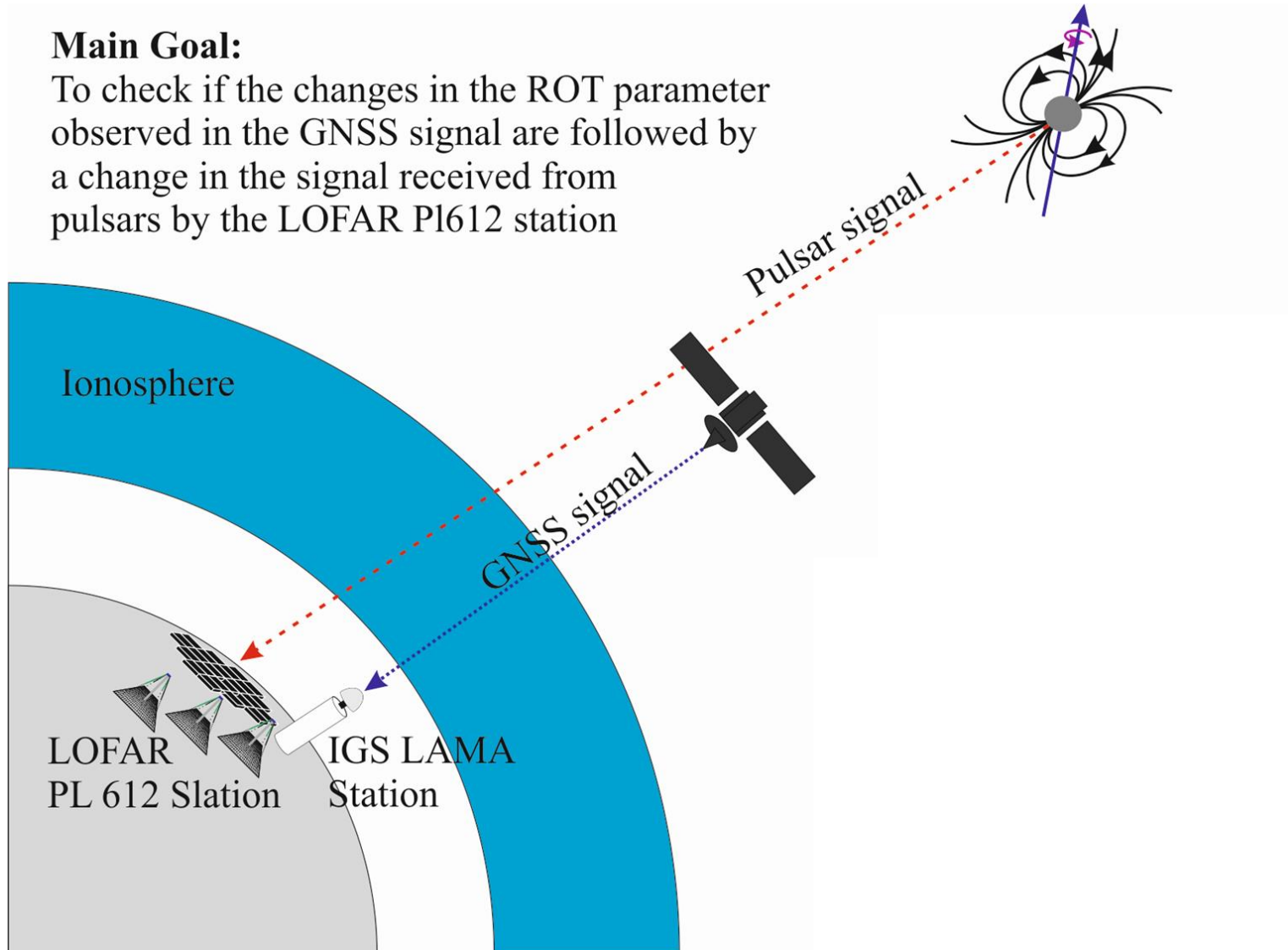


- 20 – 240 MHz frequency range
- Over 50 stations across Europe
- One station in Olsztyn (Bałdy) managed by UWM with ionospheric monitoring infrastructure (GNSS scintillation receiver by the station and ionosonde located ~20 km away)

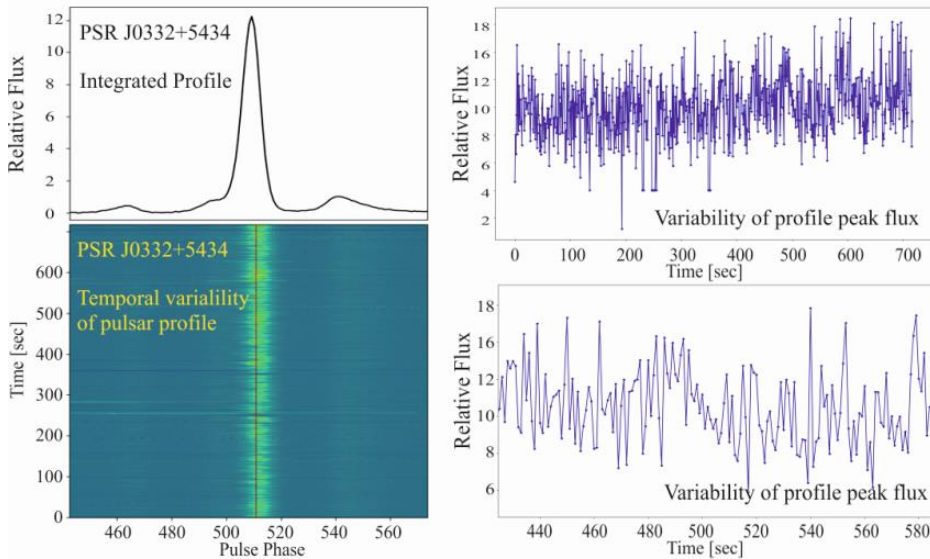
PULSARS

Main Goal:

To check if the changes in the ROT parameter observed in the GNSS signal are followed by a change in the signal received from pulsars by the LOFAR PL612 station

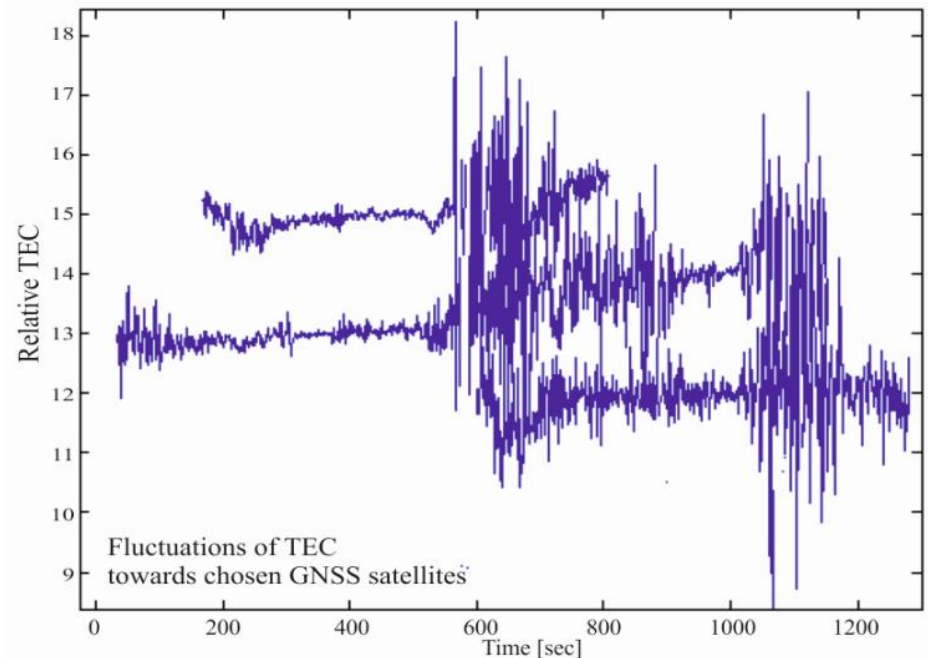


PULSARS

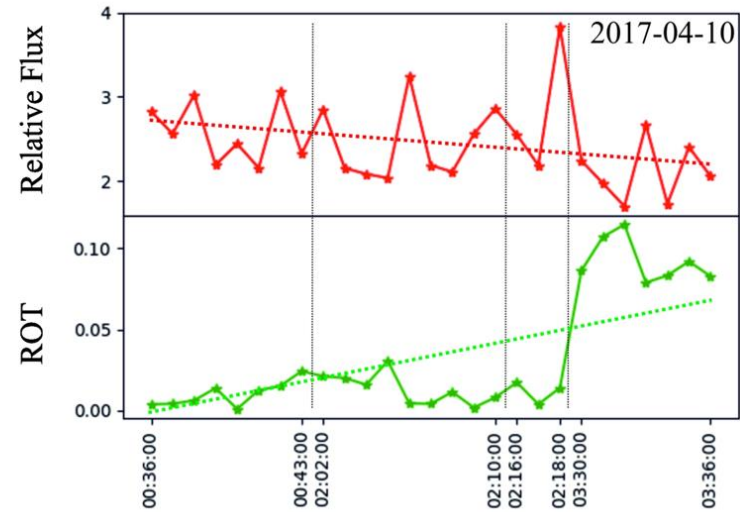
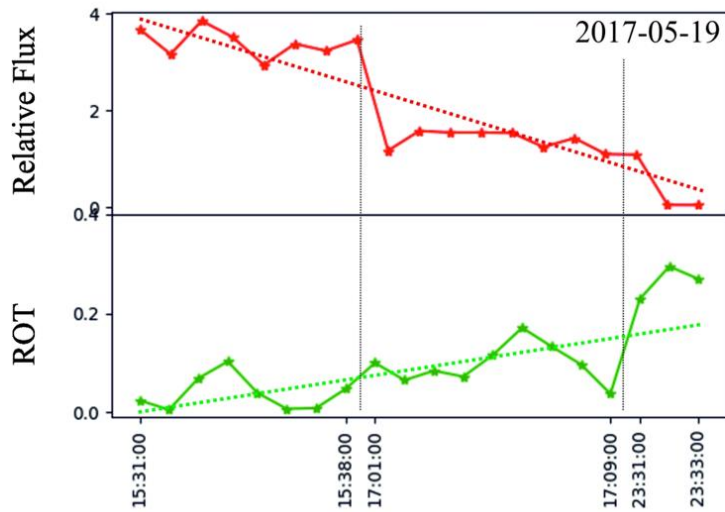
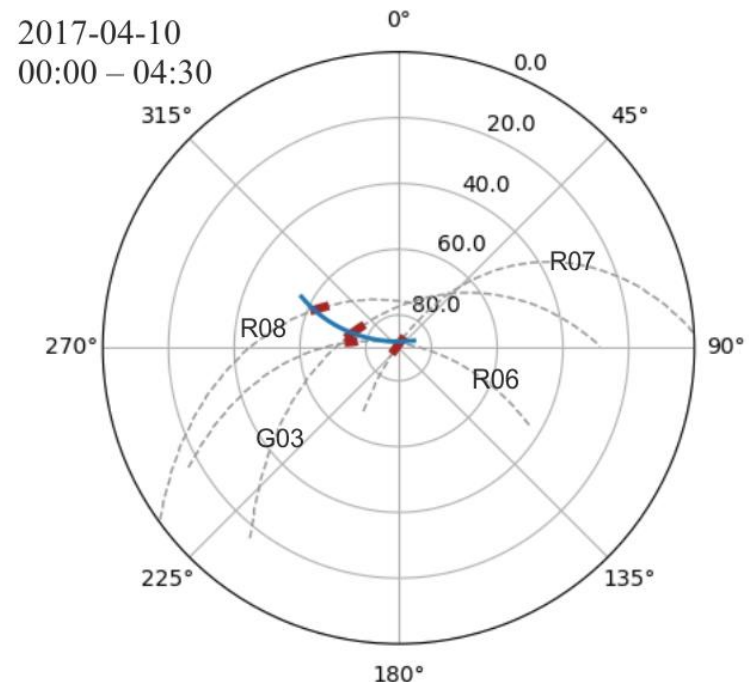
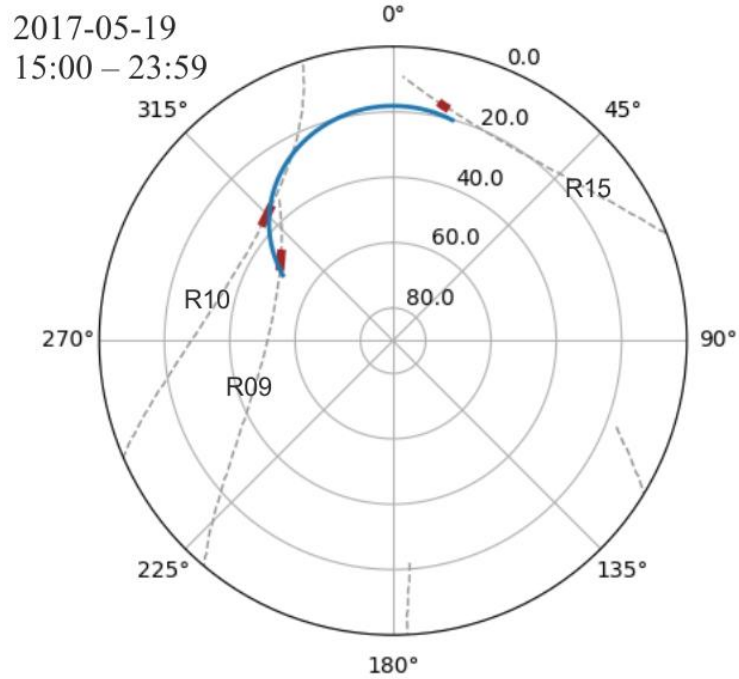


Pulsar signal is scrunched through frequency to present them in the time domain. To obtain the single profile it is necessary to find the peak of the signal with use of Gaussian function. However they are very vulnerable to the electromagnetic field disruptions.

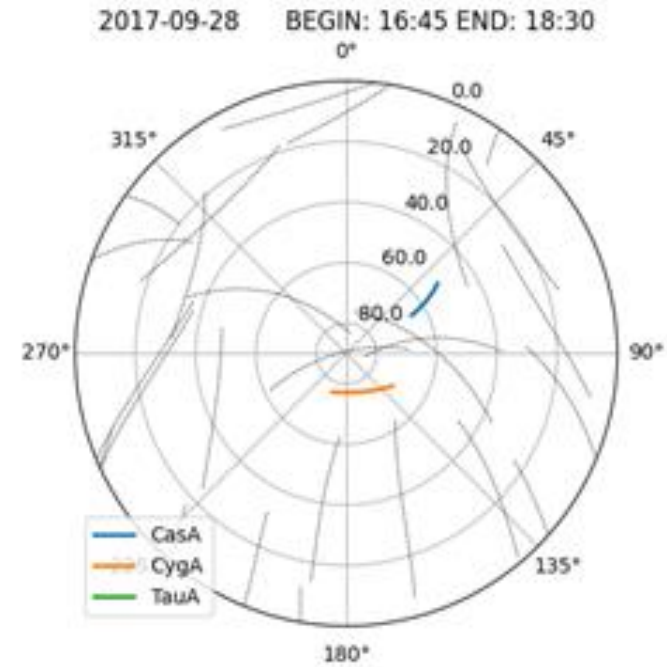
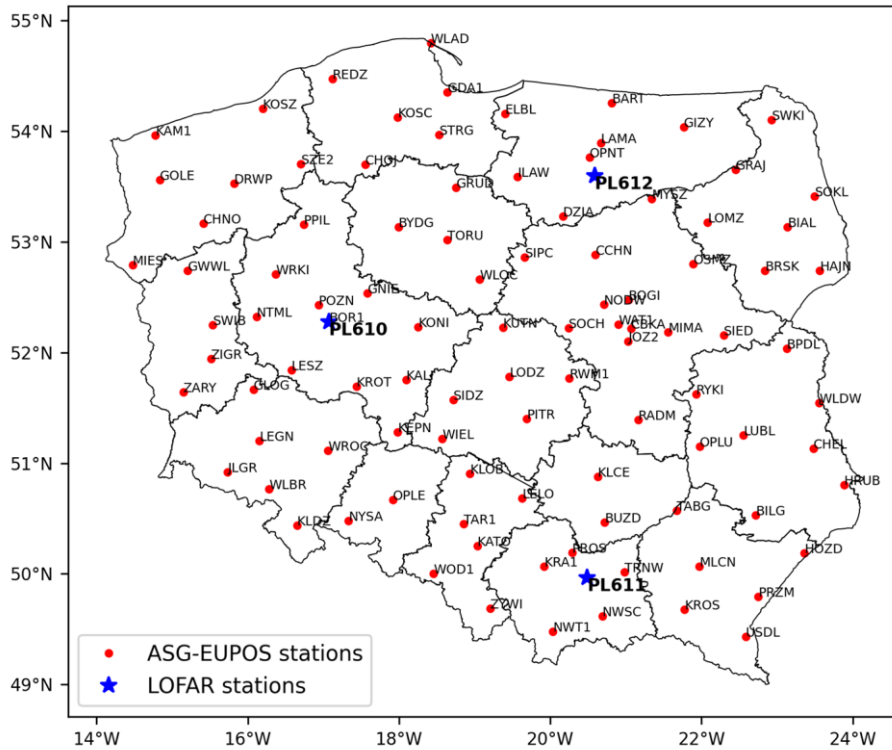
Pulsar signal's intensity is compared with the Rate Of TEC (ROT) parameter, that describes the ionospheric plasma density fluctuation.



FIRST RESULTS

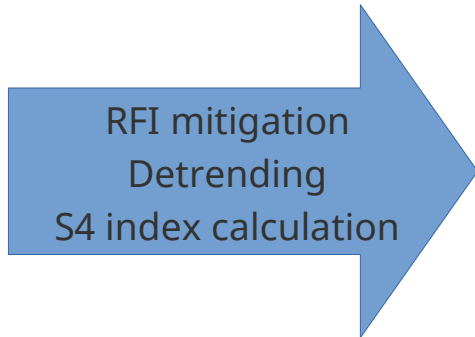
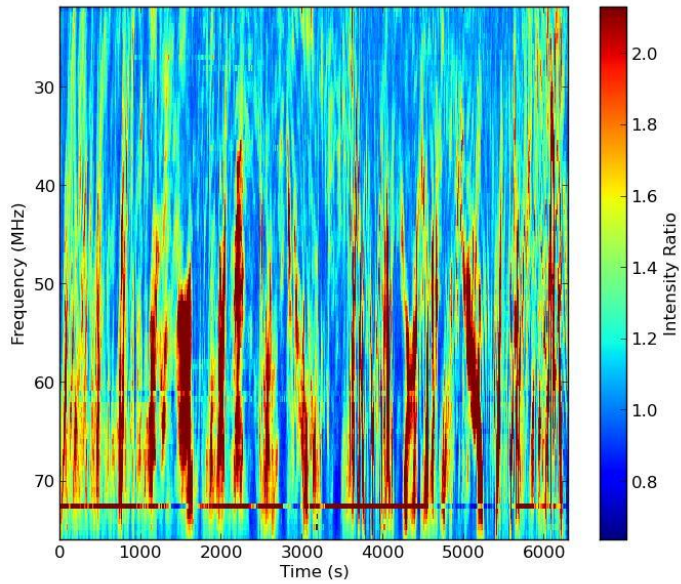


INSTRUMENTS AND DATA ACQUISITION

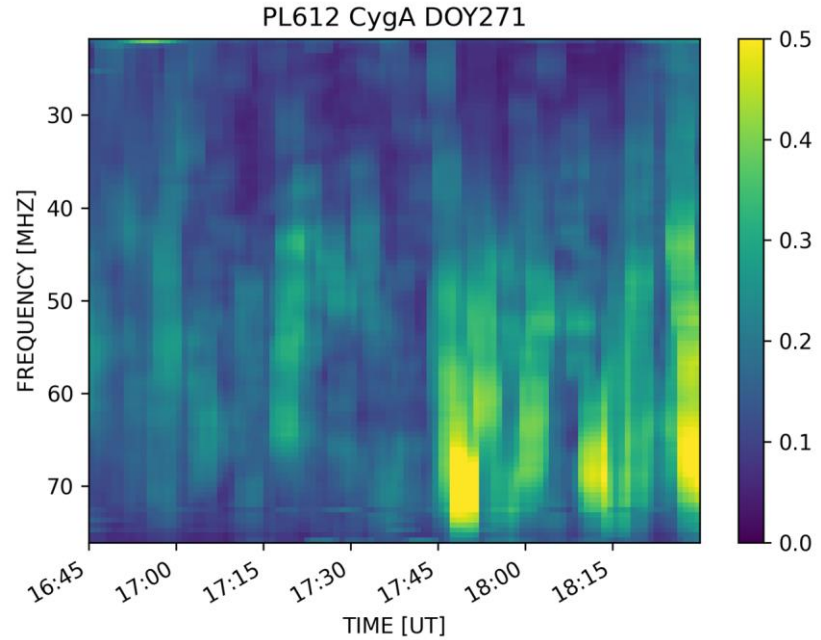


LOFAR S4 INDEX PROCESSING

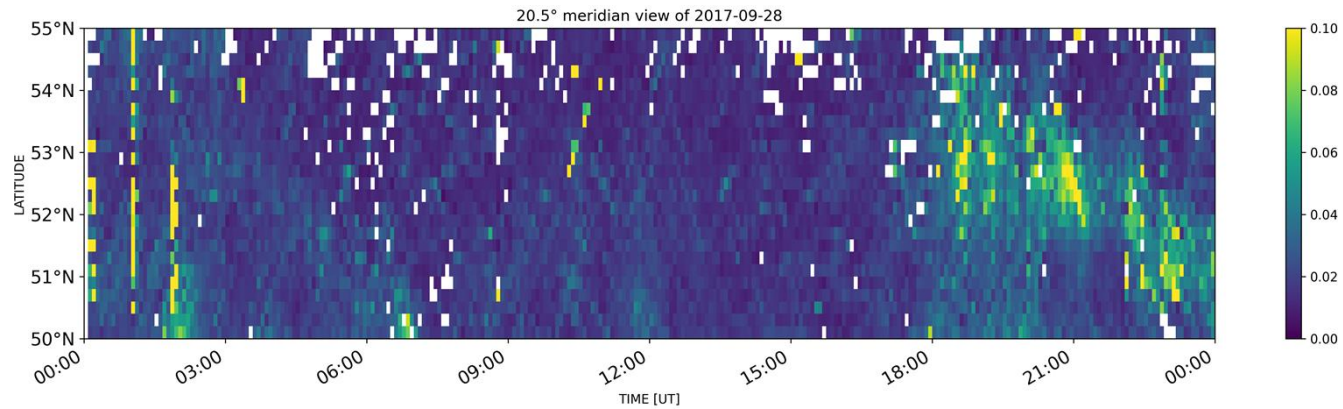
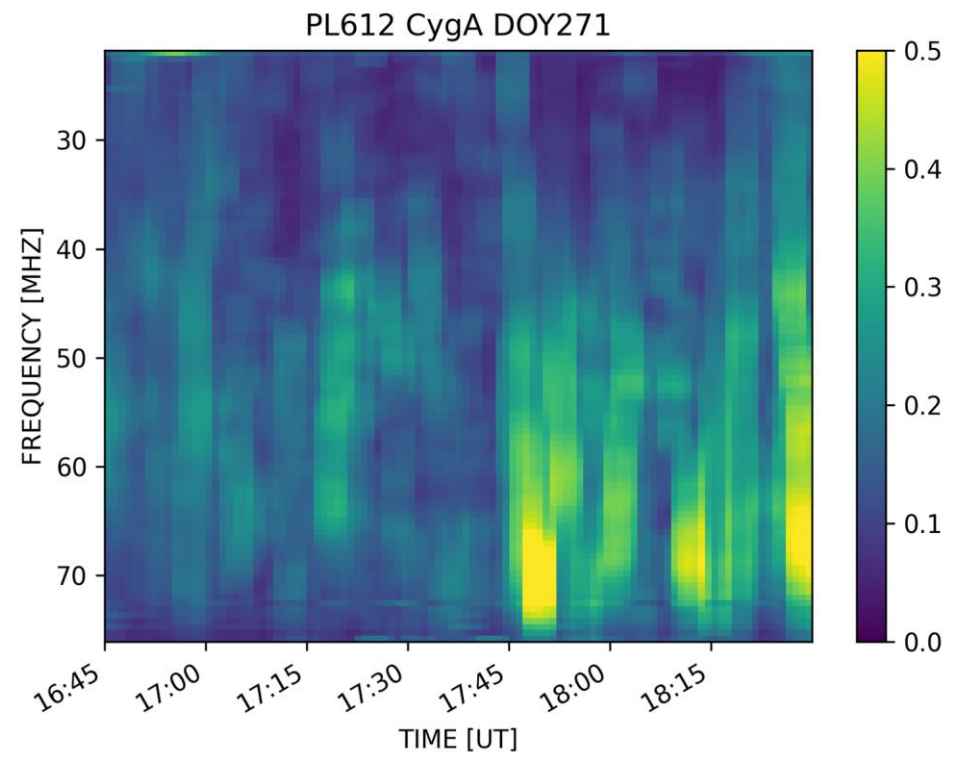
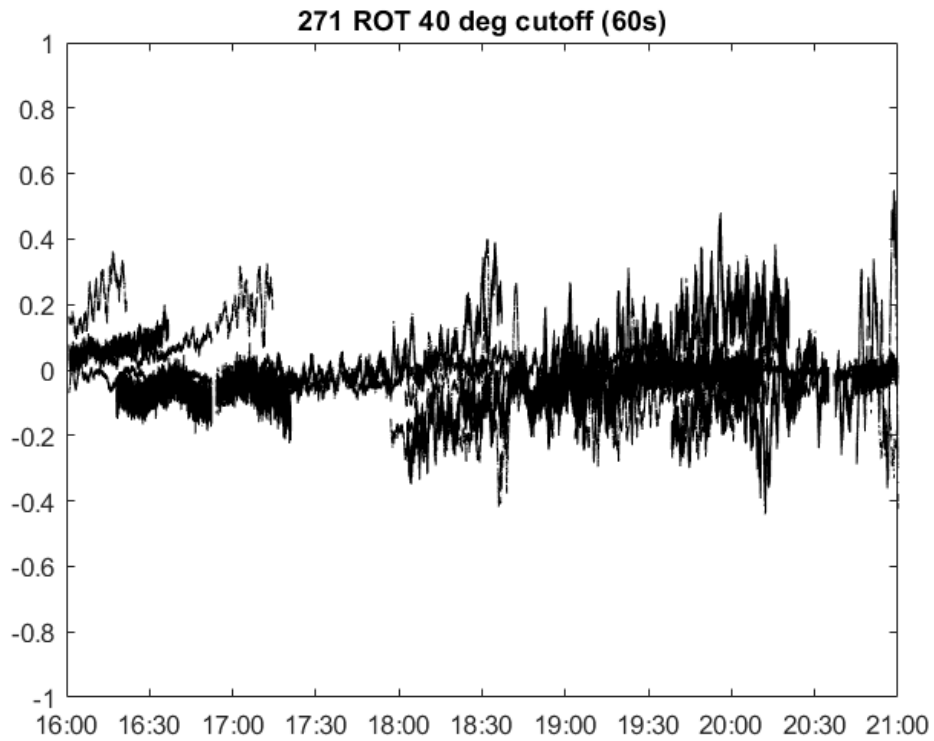
Raw intensity data



S4 index



RESULTS



SUMMARY

- .There is an evident negative correlation between pulsar signal intensity and ionospheric plasma density fluctuations described with relative TEC – strong gradients within ionospheric plasma density limits low frequency radio sources visibility.
- .More cases are analyzed to get more statistically confident results.
- .First results of simultaneous observations performed with LOFAR and GNSS shows different gradients in the ionosphere were observed, which indicates that the LOFAR is more sensitive instrument for smaller scale irregularities.
- .The question whether the gradients observed with LOFAR preceding gradients in GNSS ROT are physically connected is still open. The future work will try to answer the question through joining more LOFAR stations (Sweden, Germany, UK), as well as GNSS receivers from EPN. Moreover, instrument such as ionosondes may be included.