

Observing the Sky with a Single LOFAR Station

Impact of Ionosphere on Position Measurements and
Observation of related ionospheric structures

Dorota Przepiórka-Skup,
M. Pożoga, H. Ciechowska, B. Matyjasiak,
H. Rothkaehl, R. Wronowski, T. Phung

Centrum Badań Kosmicznych
PAN, Bartycka 18A,
00-716 Warsaw, Poland

Motivation

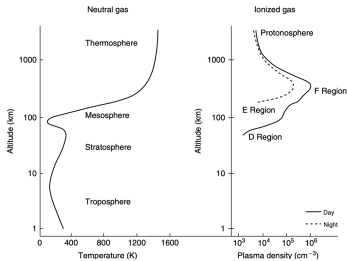
The observational setup

Results

Conclusion

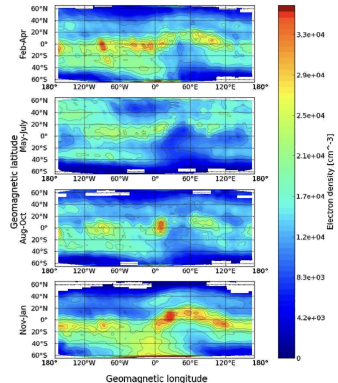
Introduction

Ionosphere - upper part of the Earth's atmosphere, composed of neutral and charged particles - the latter produced due to solar radiation.



(Kelley, 1989)

Electron density maps from DEMETER data
Kp Index = 0-2, year 2007

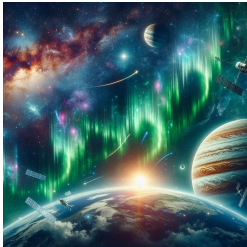


(Matyjasiak +, 2016)

Motivation

Ionosphere - from different perspectives

Space Weather &
plasma laboratory



Telecommunication &
technology

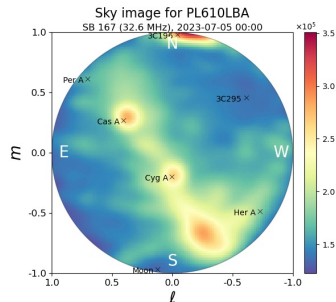


Radioastronomical
observations



The observational setup

- stand alone mode
- LBA, 167 sub-band 32.6 MHz
- interferometer resolution: 10°
- 1 s all-sky maps (cross-correlation snapshots)
- selected sources:
point-like radiosources:
CygA & CasA

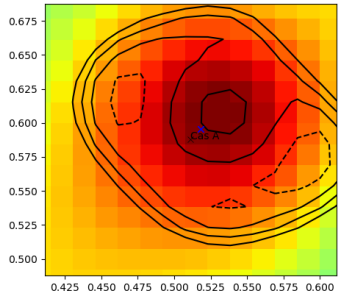


Nomenclature:

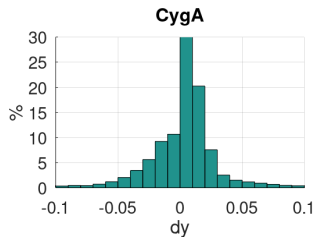
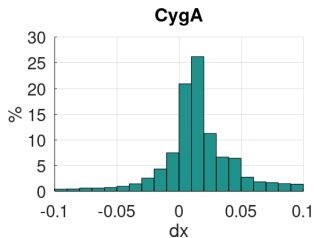
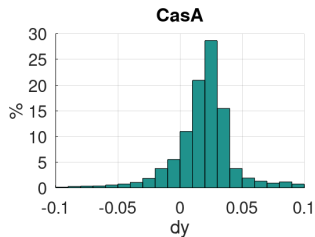
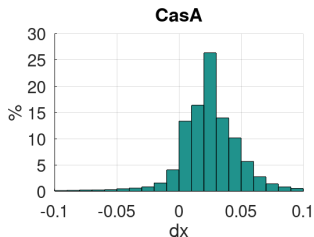
- $x = l$ - horizontal position component
- $y = m$ - vertical position component

Processing

- real/expected position from ephemeris
- the apparent position = the location of the intensity maximum
- calculate the difference between apparent and real in 2 directions



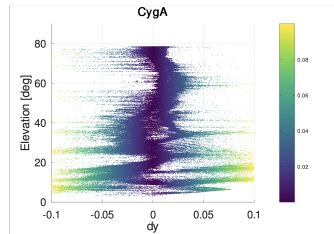
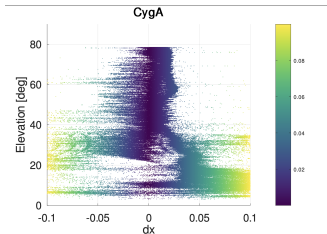
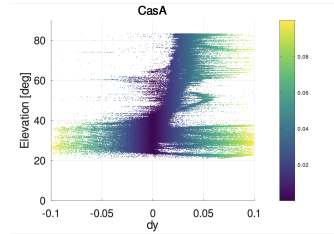
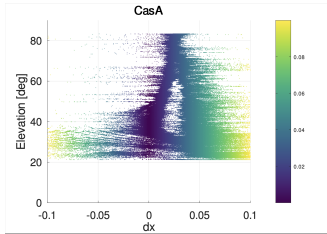
Position-shifts



← West East →

← North South →

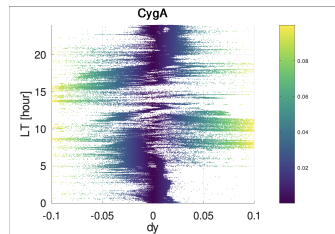
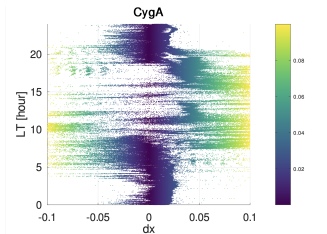
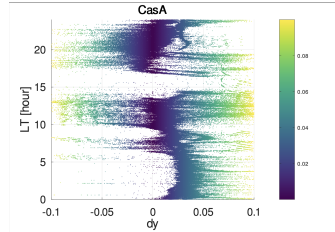
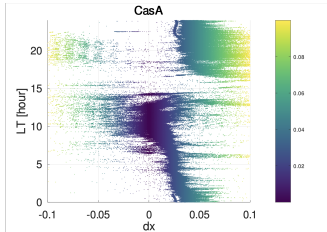
Elevation



← West East →

← North South →

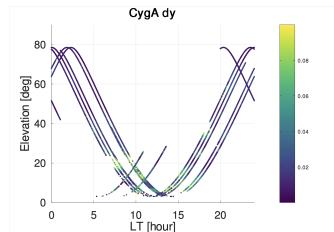
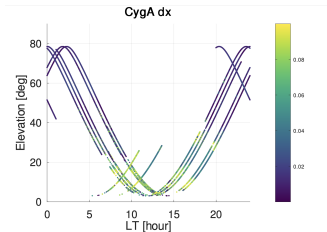
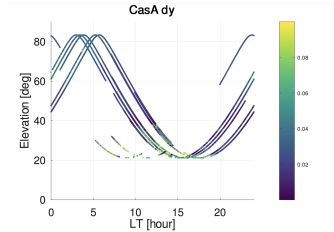
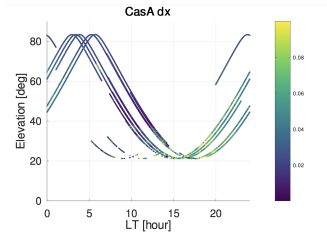
Local time dependence



← West East →

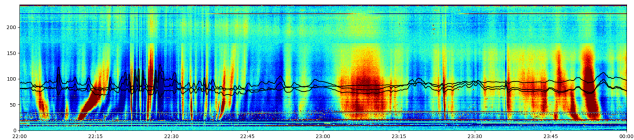
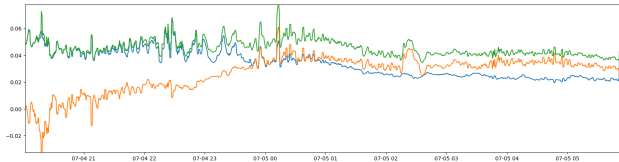
← North South →

Local time and elevation



Small scale gradients

CasA



Conclusion

- deviation in the position of radiosources are due to the ionosphere: mostly transients of different scale;
- the deviations grows with decreasing elevation of the source - due to the possible overlapping structures;
- the deviations have a tendency to be South-East directed.

Future plans

- 1-sec all sky LBA from all LOFAR stations
 - will improve statistical analysis in general
 - better spatial coverage
- improvements of the fitting procedure.

THANK YOU !!!