GNSS LABORATORY: RESEARCH, ACADEMIC EDUCATION AND PROFESSIONAL ADVANCEMENT

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- Introduction
- Rationale for GNSS Laboratory establishment
- GNSS Laboratory at Faculty of Maritime Studies in Rijeka

Introduction

- Understanding the Space Weather and its impact on national infrastructure and daily life
- Need for research, academic education and professional advancement
- Recent developments at the Faculty of Maritime Studies

GNSS applications

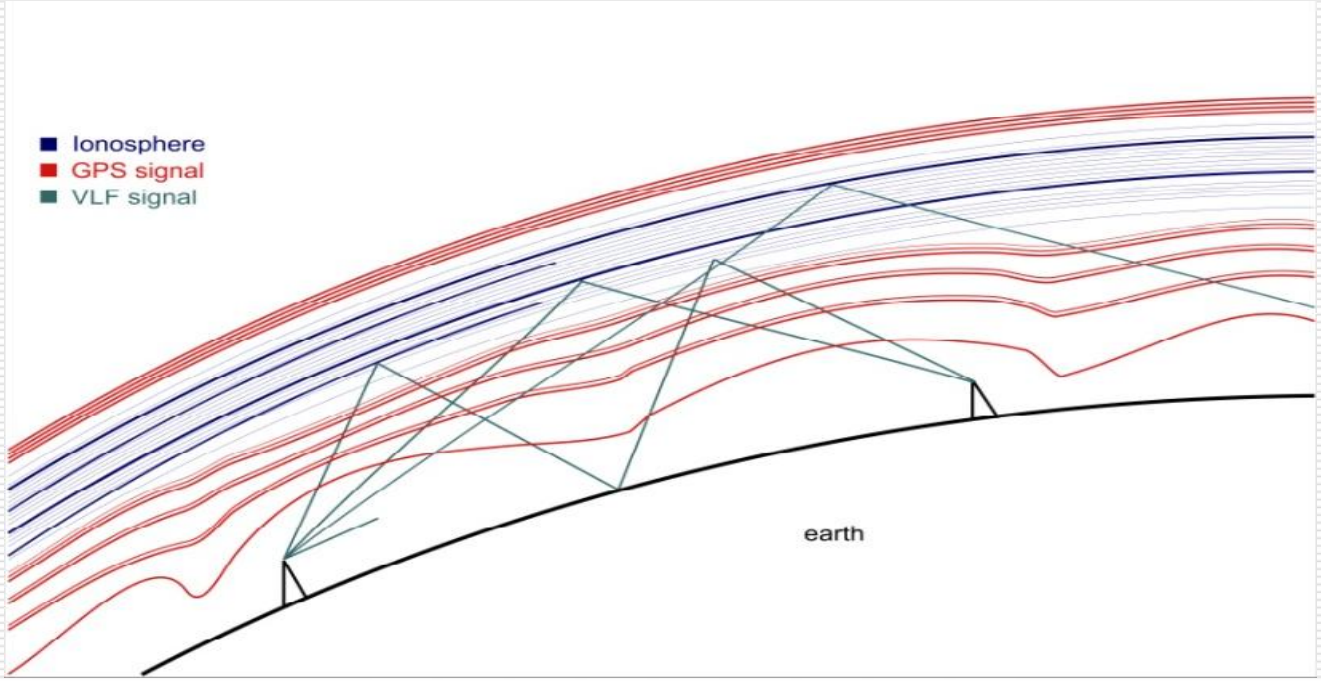
- Wide application spectrum
- Public and military services
- Communication and surveillance
- TRANSPORT AND NAVIGATION

Location

- The historic building of Faculty of Maritime Studies in Rijeka, Croatia

Navigational GNSS Laboratory

- Terrestrial segment
- Space segment



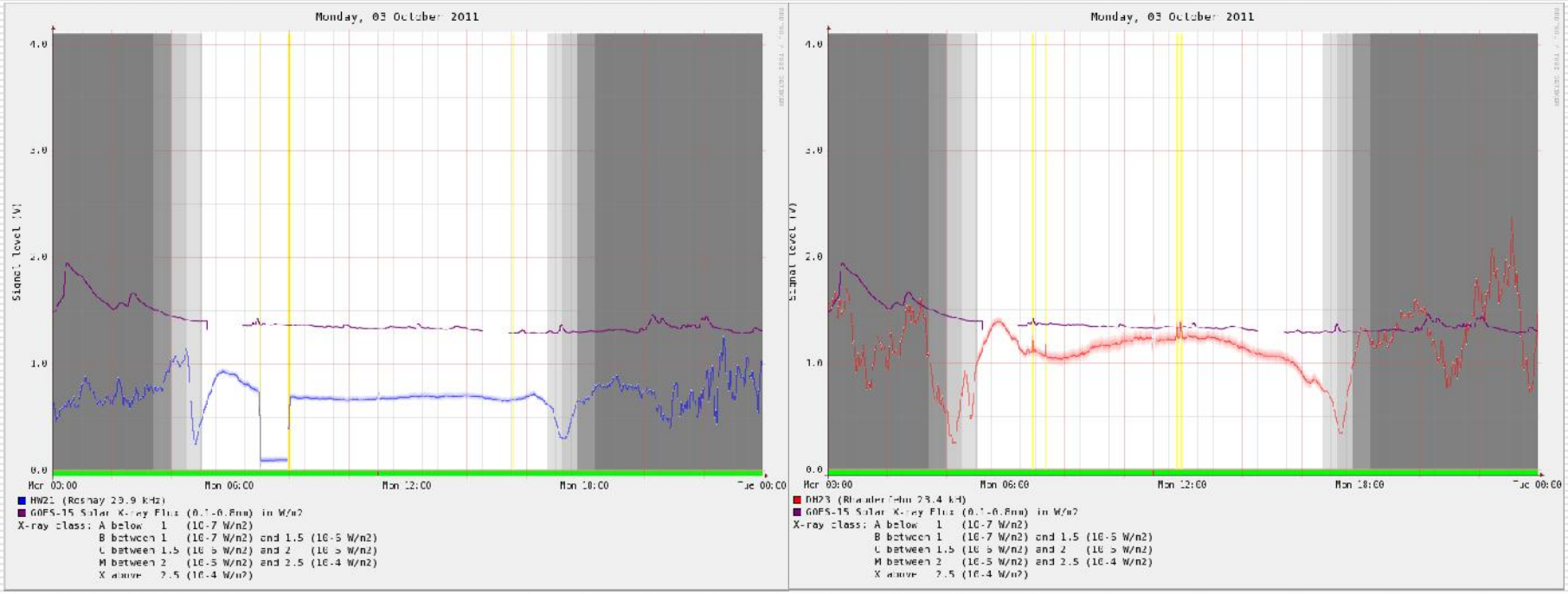
Space Weather Monitors

- Sudden Ionospheric Disturbance (SID) Monitoring
  - Lower layers Ionization
- VLF (Very Low Frequencies) signals
- 3 – 30 kHz

- Long waves – Ionosphere dependent

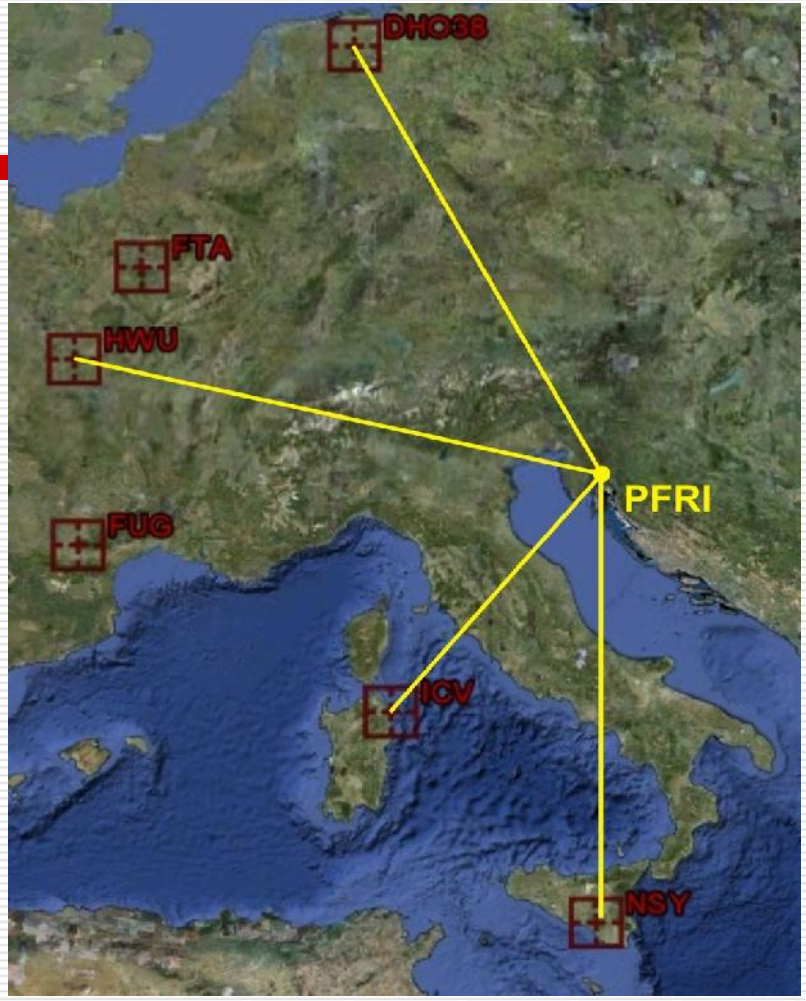
Space weather Monitors

- Real-time VLF Monitoring (SID)
- Solar x-ray flux (GOES)



SuperSID Monitors

- In cooperation with SARA (Society of Amateur Radio Astronomers) and Stanford University Solar Center



Rosnay, France – azimuth 278°
Rhauderfehn, Germany - azimuth 330°
Isola di Tavolara, Sardinia, Italy - azimuth 218°
Niscemi, Sicily, Italy - azimuth 180,5°

GNSS Receiver

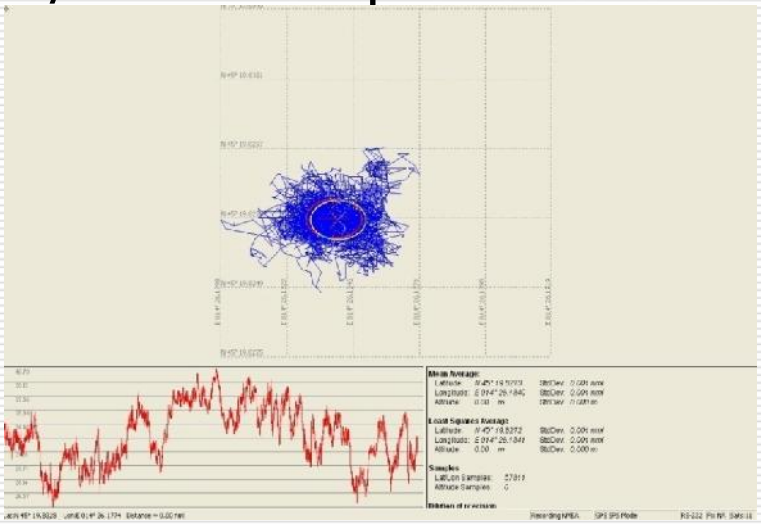
45°19'49.57105''N
14°26'11.00265"E
37.896 metres above sea

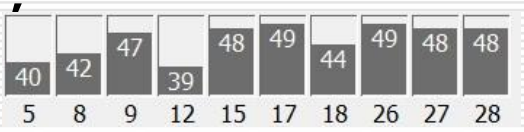
- Single frequency GPS receiver Garmin GPSMap 4010
- UHF – Ultra High Frequencies (1575,42 MHz)

- For high frequency GPS signal, Ionosphere represents a nuisance

GPS data monitoring

- Data provided (NMEA standard protocol & Visual GPS© software):
  - Graphical GPS status, signal quality, azimuth/elevation plot





  - GPS analysis, NMEA data monitoring, static position averaging and statistics

- www.ionosphere.hr

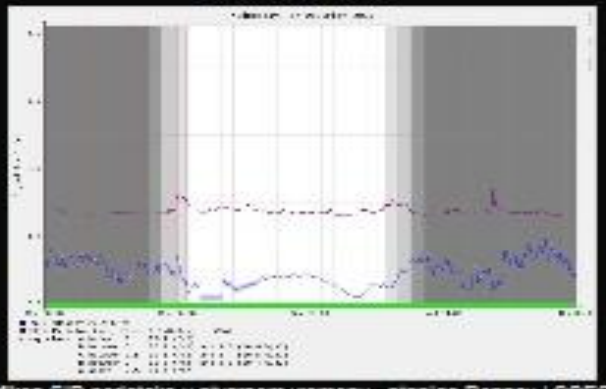
Step forward:
Official Space Weather FMS website

SVEMIRSKO VRIJEME – REPUBLIKA HRVATSKA

09 December, 2011 18:19:25 UTC / 19:19:25 LT

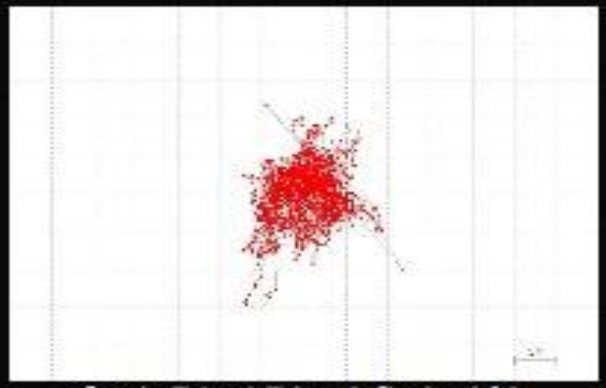
Svemirsko vrijeme je skup fizikalnih i kemijskih pojava vezanih za transfer energije u sustavu Sunce - Zemlja. Slično meteorološkim pojavama, svemirsko vrijeme utječe na rad brojnih tehničkih sustava (uključujući satelitske navigacijske sustave), djelujući na taj način na nacionalnu infrastrukturu, gospodarstvo i svakodnevni život.

Ažurirano: 08.12.2011



Grafikon SID podataka u stvarnom vremenu - stanica Rosney / GOES-15 grafikon solarnog x-zračenja

Ažurirano: 08.12.2011



Graz - kvaliteta satelitskog određivanja položaja

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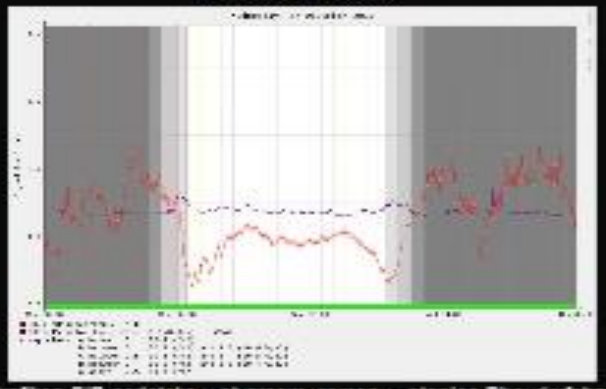

Grafikon SID podataka u stvarnom vremenu - stanica Rhauderfehn / GOES-15 grafikon solarnog x-zračenja

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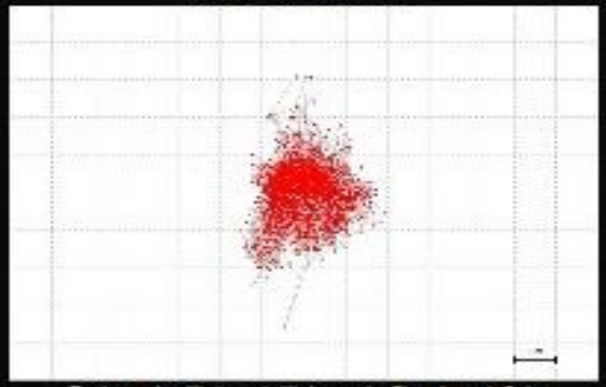


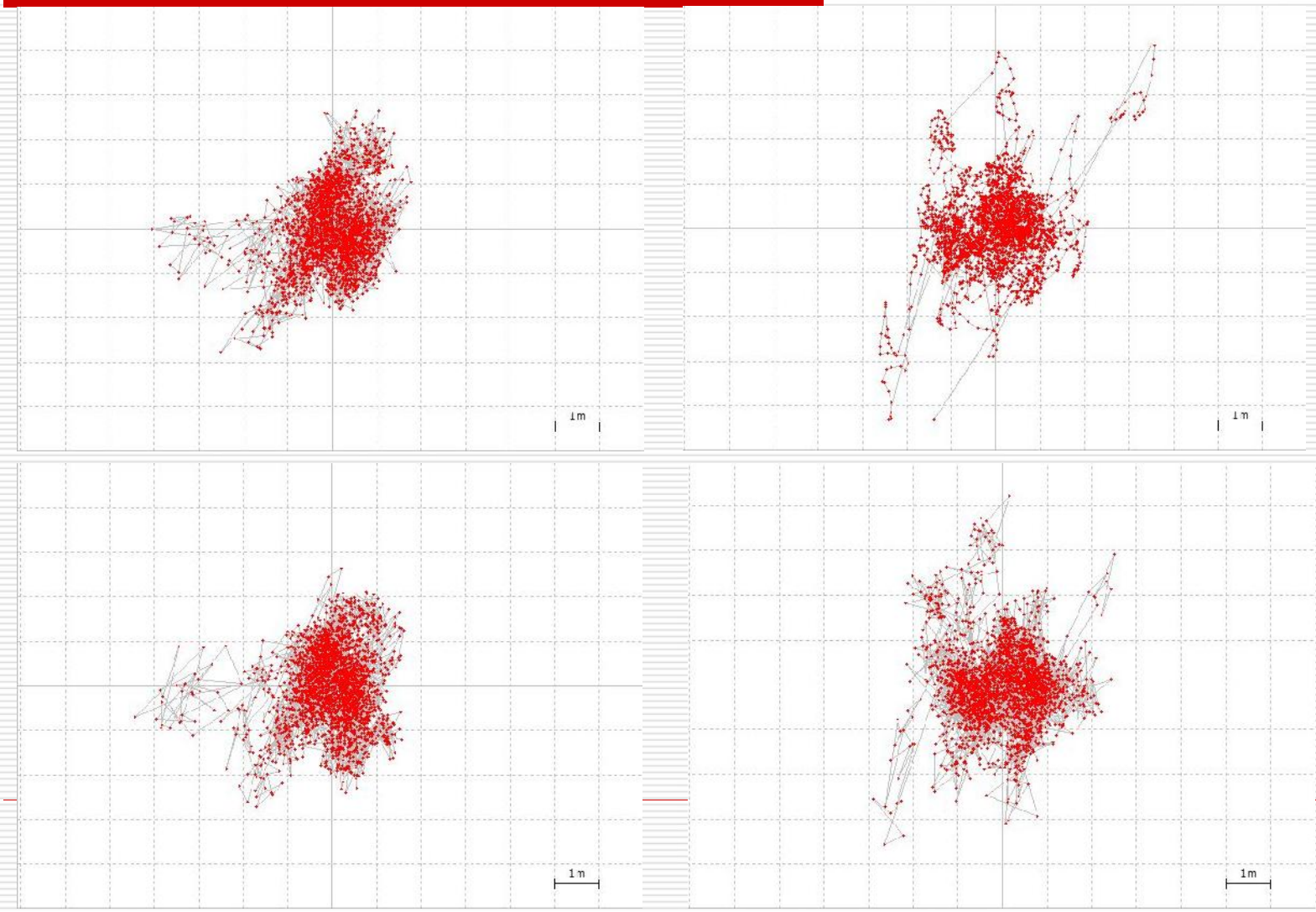
Padova - kvaliteta satelitskog određivanja položaja

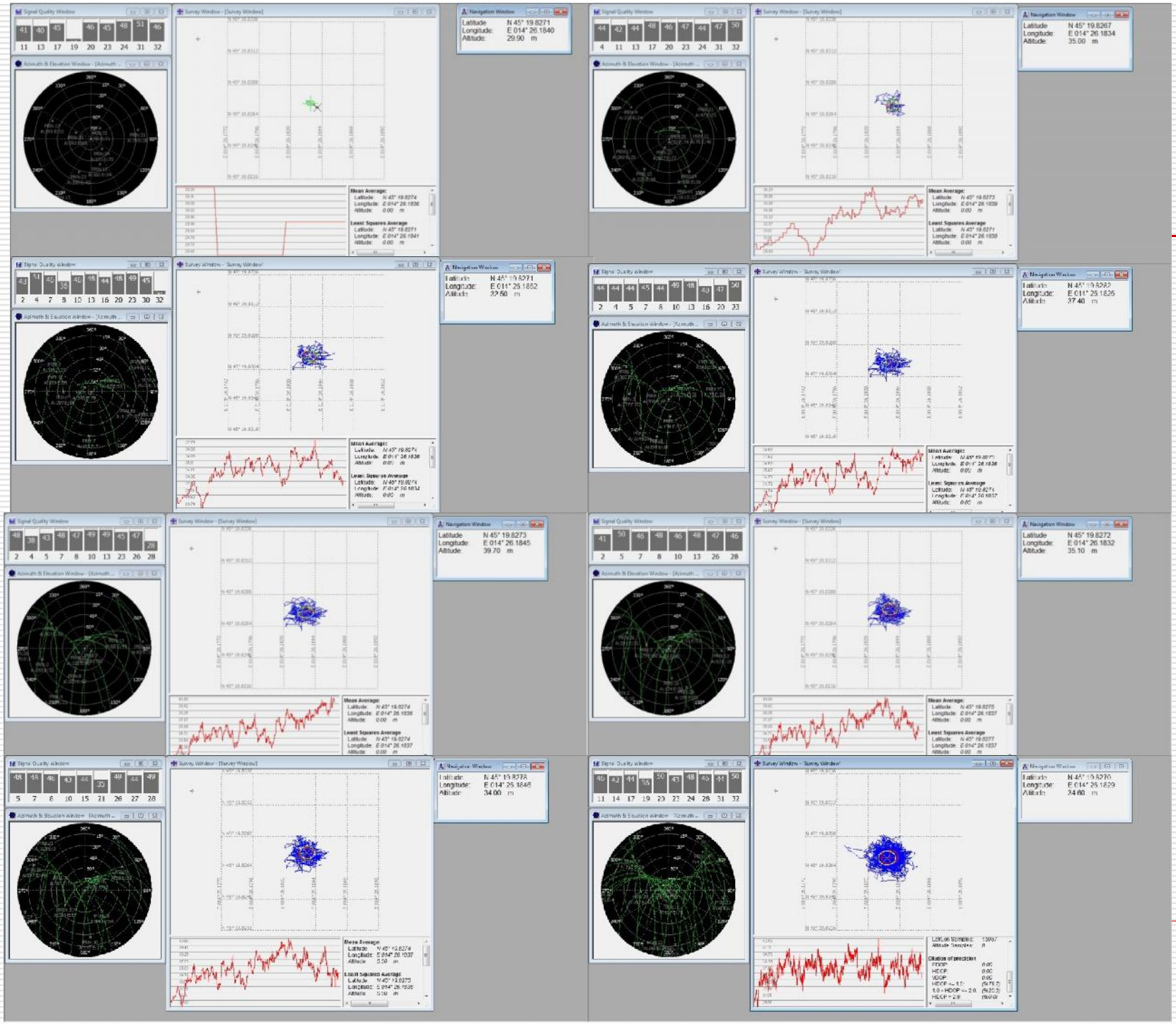
ARHIVA

www.ionosphere.hr: Tasks, aims and information provided

- Space Weather current conditions according to geomagnetic and ionospheric parametres
  - solar activity, layer ionization, position degradation
- Various reference stations TEC and Positioning Performance monitoring
- SID data and GOES plots
- Space Weather forecasts

Reference Stations: Dubrovnik - CRO, Graz - A, Osijek - CRO, Padova – ITA (among other permanent EPN Stations across Europe)




Navigation Window
Latitude N 45° 19.8271
Longitude E 014° 26.1840
Altitude 29.90 m
Navigation Window
Latitude N 45° 19.8267
Longitude E 014° 26.1834
Altitude 35.00 m
Navigation Window
Latitude N 45° 19.8271
Longitude E 014° 26.1852
Altitude 32.50 m
Navigation Window
Latitude N 45° 19.8282
Longitude E 014° 26.1826
Altitude 37.40 m
Navigation Window
Latitude N 45° 19.8273
Longitude E 014° 26.1845
Altitude 39.70 m
Navigation Window
Latitude N 45° 19.8272
Longitude E 014° 26.1832
Altitude 35.10 m
Navigation Window
Latitude N 45° 19.8278
Longitude E 014° 26.1846
Altitude 34.00 m
Navigation Window
Latitude N 45° 19.8270
Longitude E 014° 26.1829
Altitude 34.60 m

Activities expansion and further work

- Broad frequency spectrum coverage introducing various devices operating at various frequencies (AWESOME monitors (ELF), additional GNSS receivers/Glonass (UHF), Ionosonde (HF))
- Better understanding of sources of GNSS performance degradations and vulnerabilities
- Understanding Space Weather and local ionospheric effects on GNSS performance and operation

Thank You for Your attention!

Faculty of Maritime Studies

University of Rijeka
Croatia

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