

# Low cost GNSS receivers Workshop on data processing

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African Capacity Building Workshop on Space  
Weather and Ionospheric Research

30th October 2024

Abdus Salam International Center for Theoretical Physics  
Trieste, Italy



## Workshop content

30' The AMIC project: Affordable Monitoring of the Ionosphere and observable Characterization

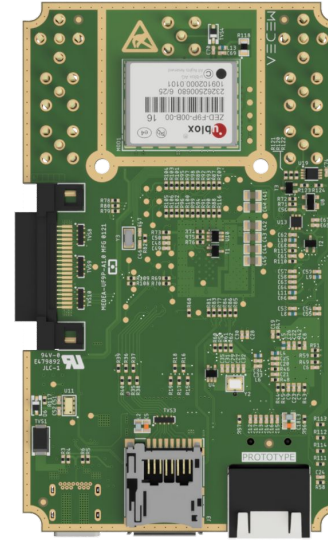
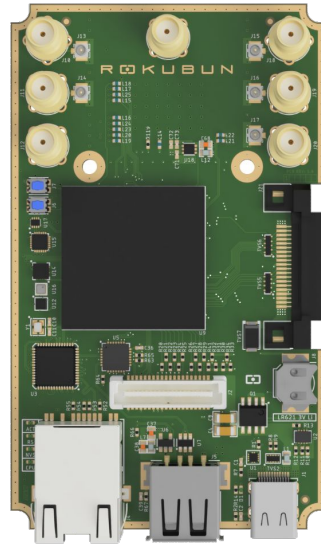
30' Presentation of the workshop, [Python and pandas](#)

Coffee break

30' GNSS observables from [affordable receivers](#)

30' Application example: [ROTI computation](#)

## Affordable receivers: MEDEA



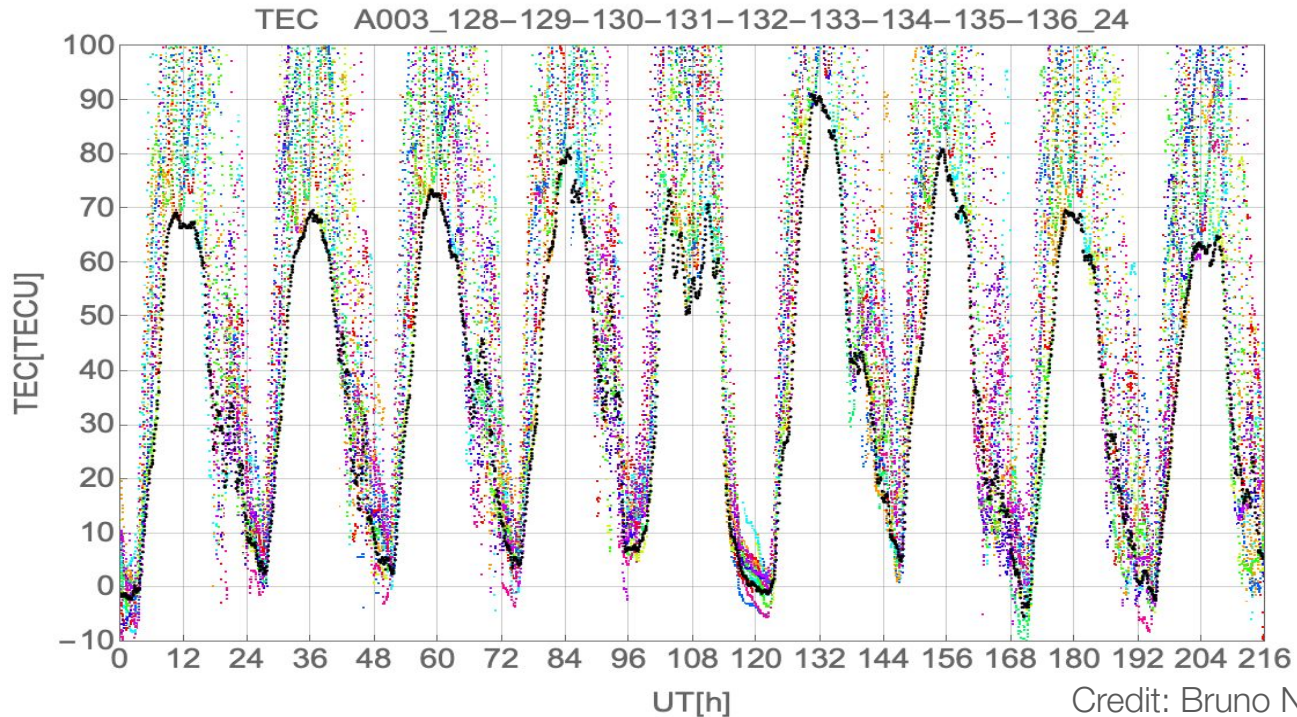
## ACORN: Affordable Continuously Operating Receiver Network

Network deployed in the context of the ESA project AMIC, implemented by ICTP and Rokubun



## Ionosphere and affordable receivers? VTEC monitoring

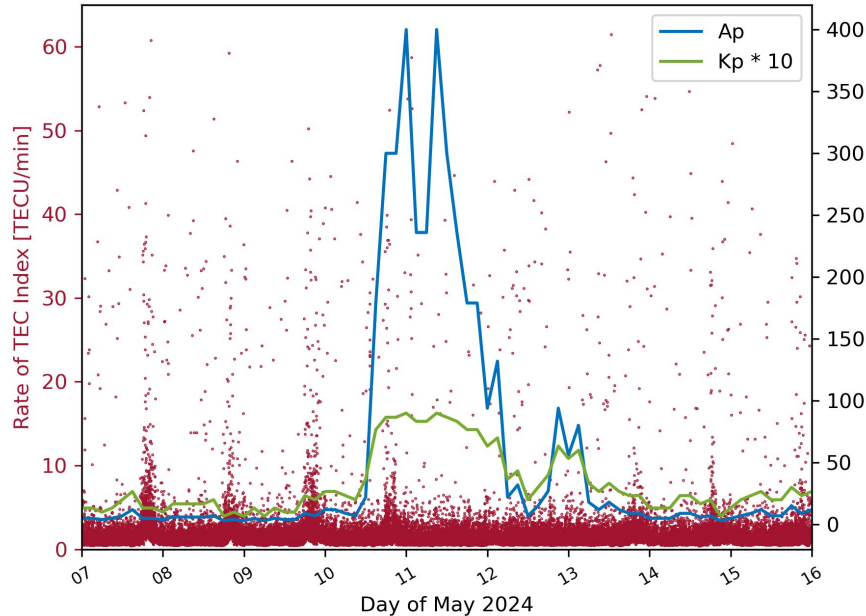
Calibrated VTEC during May 2024 ionospheric storm (during the period 7-15 May 2024.)



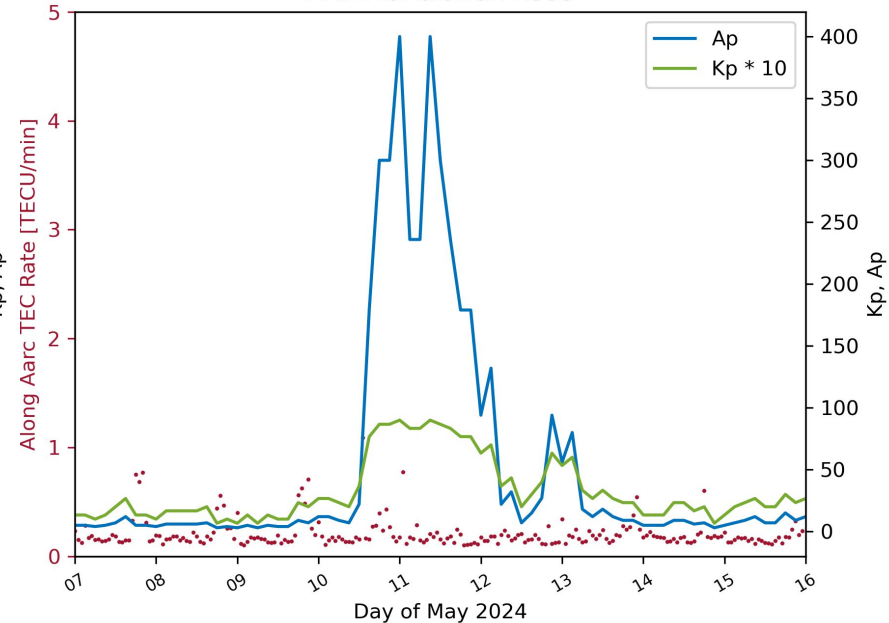
## Ionosphere and affordable receivers? Scintillation

ROTI during May 2024 ionospheric storm (during the period 7-15 May 2024.)

ROTI for station A003



AATR for station A003



## Show me the data!

Data is publicly and freely available at ESA's GSSC now server (<https://gssc.esa.int/portal>)

The screenshot displays the ESA GSSC Now portal interface. The browser address bar shows the URL <https://gssc.esa.int/portal/?vuePage=1&size=20&mode=map&sortOption=recent&coll...>. A notification banner at the top indicates an IT intervention scheduled for 8 July from 18:00 until 9 July at 09:00. The main header includes the text "ESA GSSC Science Support Centre | GSSC Now [BETA]" and navigation tabs for "EXPLORER", "DATASETS", "DATALABS", and "ANONYMOUS".

On the left side, there is a "Filters" panel with the following categories and counts:

- Science Domain
- Collection
  - CORS (208,123,728)
  - ILRS (2,341,687)
  - ACORN (84,075)
  - GOCE (69,329)
  - SWARM (48,155)
  - More
- Dataset
- Resource Class
- Resource Type
- Resource Format
- Resource Period
- Observed Constellation
- Observed Satellite
- Observation Code
- Station / Platform
- Sampling Rate
- Network / Organisation
- Source

The main area features a map of the Americas with a search bar containing "Lat1" and "Long1" and "Lat2" and "Long2" fields, and an "Apply" button. Below the map, it shows "1 - 20 of 84,075 filtered by Collection = ACORN" with a "Clear Filter" button. A table below the map displays the filtered data:

<input type="checkbox"/>	Expand	Description	Filename	FTP Path	Collection	Network / Organi...	Ob. Constellation
<input type="checkbox"/>	...	GNSS observables	A00700NGA_U_202...	/esa/amic/data/highr...	ACORN	ESA, ACORN	BeiDou Galileo GPS ...
<input type="checkbox"/>	...	GNSS observables	A00100TA_U_2024...	/esa/amic/data/highr...	ACORN	ESA, ACORN	BeiDou Galileo GPS ...
<input type="checkbox"/>	...	GNSS observables	A01000PER_U_202...	/esa/amic/data/highr...	ACORN	ESA, ACORN	BeiDou Galileo GPS ...

## Hands on?

We will start here 

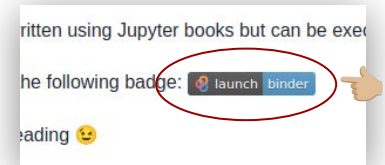
[https://rokubun.github.io/gnss\\_tutorials/](https://rokubun.github.io/gnss_tutorials/)

If internet connection is available, make sure you click  
the Binder icon

[Jupyter Book](#)



All content (Python code and documents)  
is free and publicly available in a  
[github repository](#)

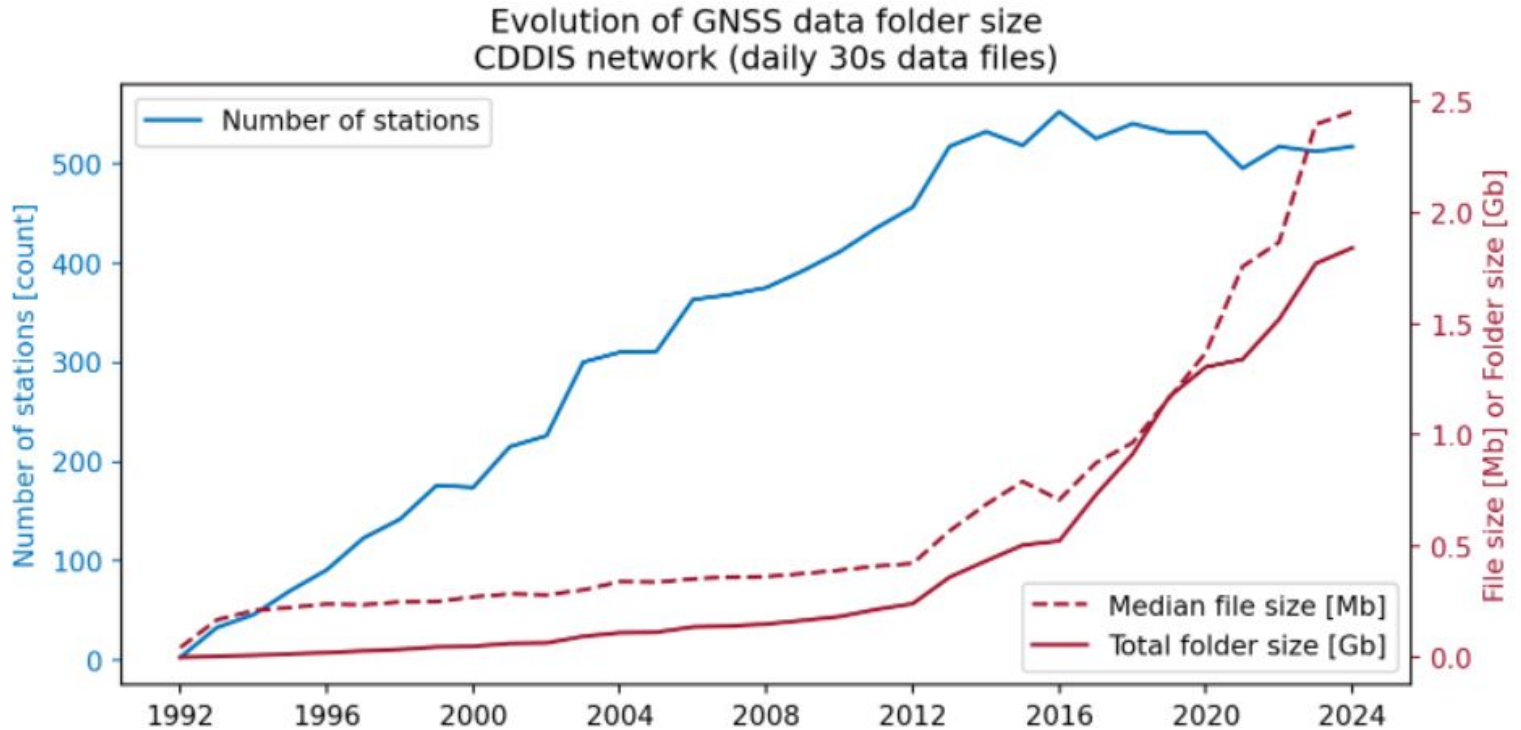


Interactive data processing using  
[Jupyter notebooks](#)





## Evolution of GNSS data volume



# Thanks!

Further questions?

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