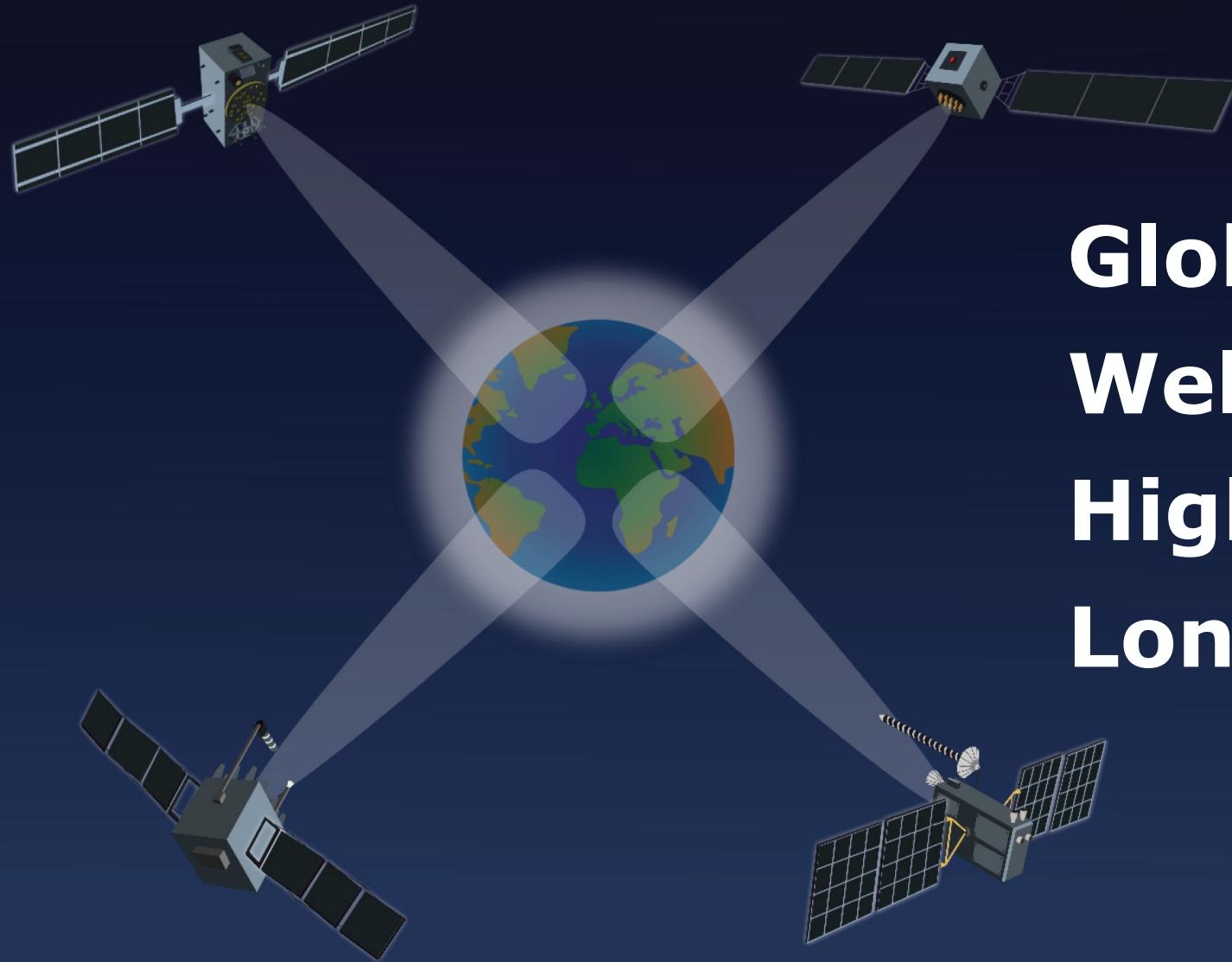




# GSSC Now ESA GNSS Digital Platform for Open Science

V. Navarro, N. Castrillo, S. del Rio, J. Prados,  
L.A. Gomez, L. Mendes, J. Ventura-Traveset  
IGS Symposium , 01.07.2024, Bern, Switzerland



**Global Coverage**  
**Well-Characterised**  
**Highly-Monitored**  
**Long-Term Archiving**

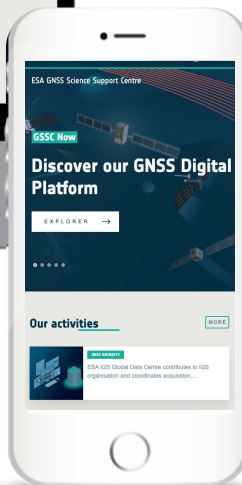
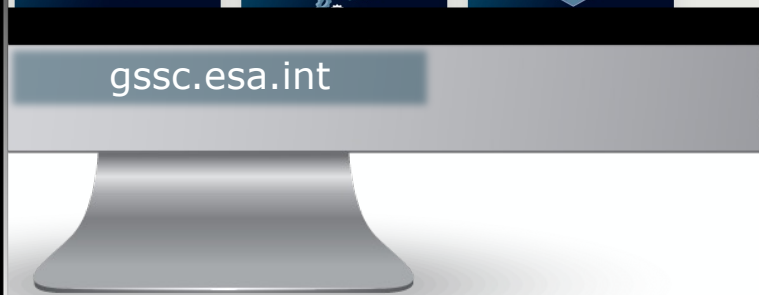
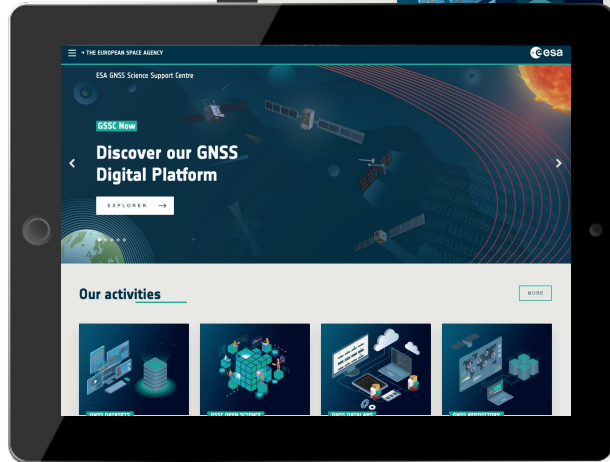
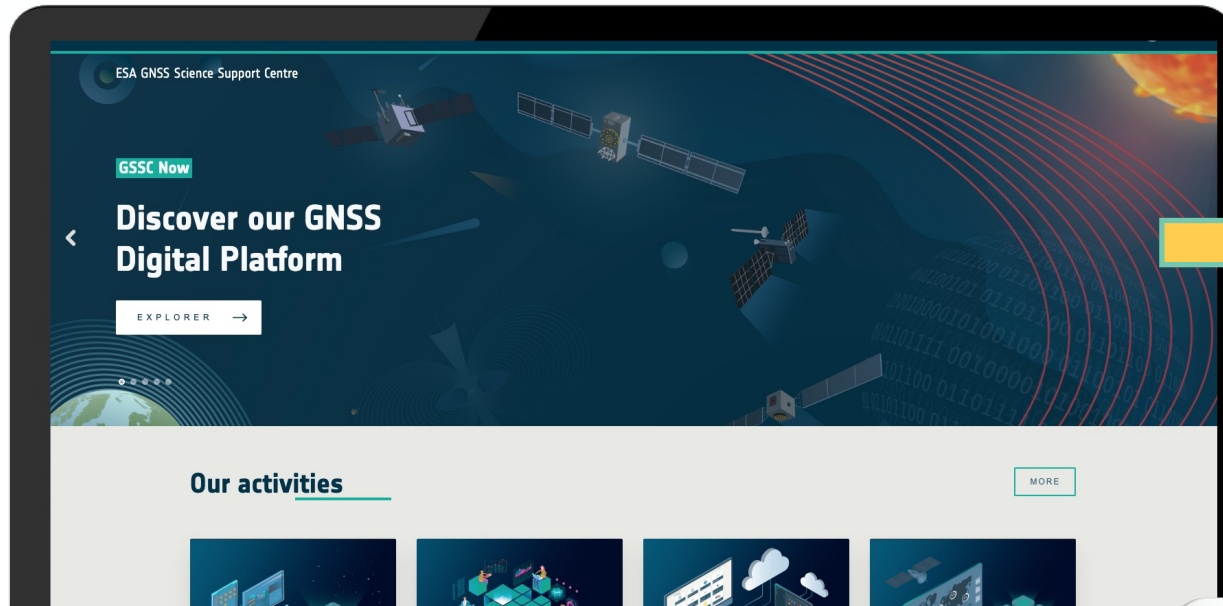


GSSC Operations & Integration Room (ESAC, Madrid - Spain)

GSSC strategy pivots around five key goals



# GSSC Home Portal



GNSS Science



All Images Videos News Books Maps Flights More Tools

European Space Agency  
https://gssc.esa.int

## GSSC Home

GNSS Science Support Centre fosters collaboration across scientific communities through the provision of GNSS science-based products and services.

### About GSSC

The Global Navigation Satellite System (GNSS) Science ...

### Earth Sciences

GNSS is also a powerful tool for the analysis of the ionosphere ...

### Discover GNSS Data

This global and permanent GNSS infrastructure constitutes a ...

### GSSC Now

... enable it to continue. X. ESA GNSS Science Support ...

### GNSS Science

... Science Real-time spacecraft navigation based on ...

... results from esa.int »





<sftp://gssc.esa.int>

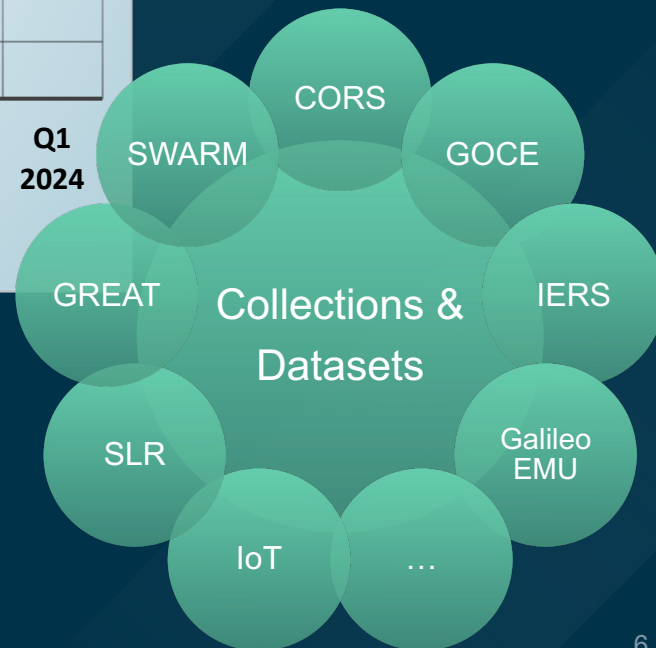
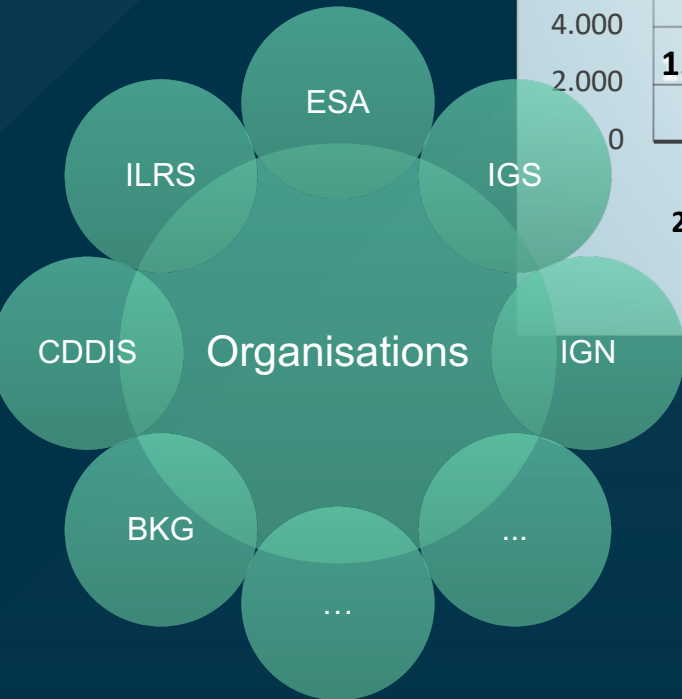
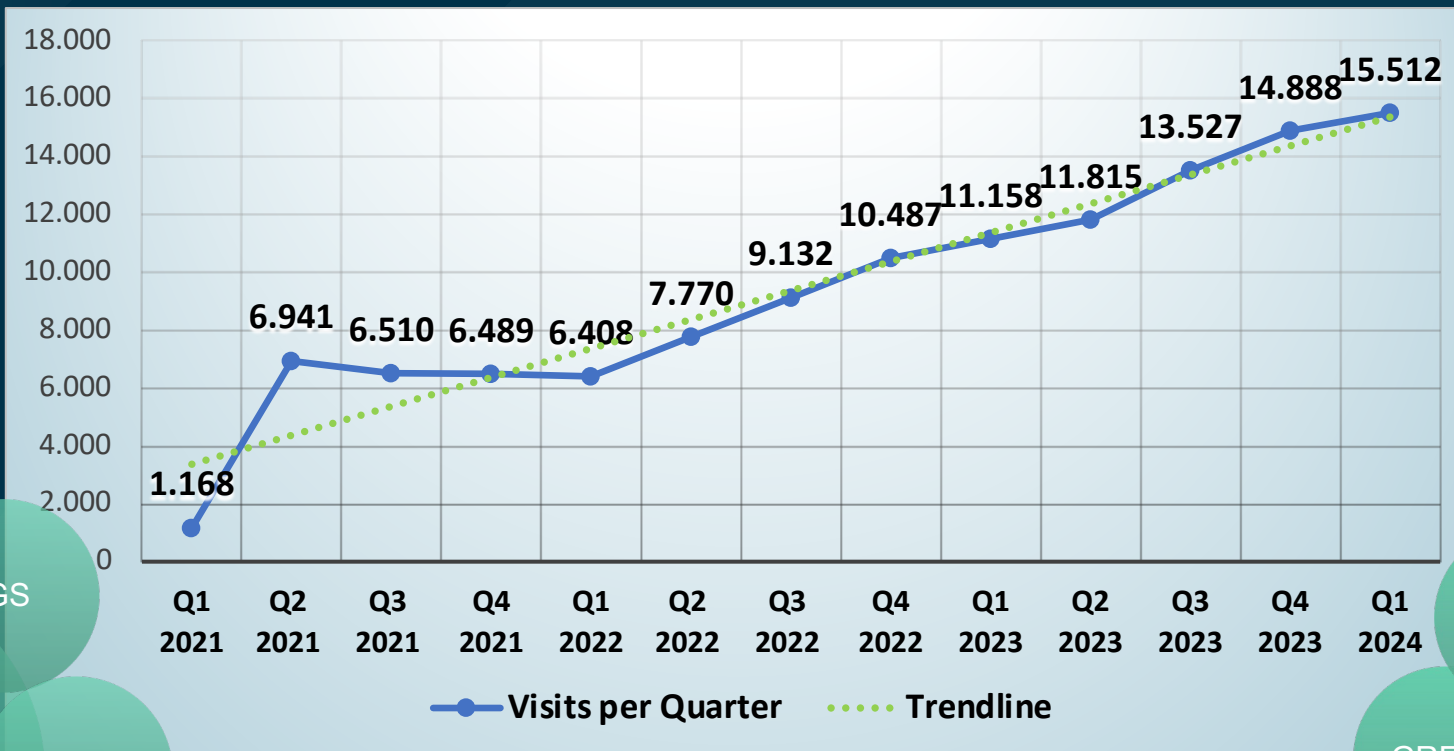
<http://gssc.esa.int/webftp>



Name	Date Modified
> bkg	25 May 2021 at 00:00
> cddis	28 Jun 2022 at 08:06
> crowdsourcing	24 Jan 2020 at 00:00
▼ esa	18 Jul 2022 at 14:02
> camaliot1	18 Jul 2022 at 14:56
> colloquium	9 Mar 2020 at 00:00
> galileo_3d_models	15 Mar 2021 at 00:00
> gesta	26 Mar 2021 at 00:00
> gmid	19 May 2022 at 10:42
> great	26 Mar 2021 at 00:00
> pulchron	21 Jan 2020 at 00:00
> gnss	31 May 2021 at 00:00
> iers	25 Oct 2019 at 00:00
> ign	6 Jun 2022 at 14:46
> igs	6 Oct 2021 at 00:00
> processing-assets	4 Jul 2022 at 06:43
▼ satellite	24 Jan 2022 at 10:58
> champ	15 Dec 2020 at 00:00
> goce	31 Mar 2022 at 11:26
> icesat	15 Dec 2020 at 00:00
> jason	15 Dec 2020 at 00:00
> sac-c	15 Dec 2020 at 00:00
> swarm-a	2 Dec 2020 at 00:00
> swarm-b	15 Dec 2020 at 00:00
> swarm-c	16 Dec 2020 at 00:00
▼ slr	21 Apr 2021 at 00:00
> cpf_predicts	1 Jan 2022 at 16:12
> data	13 Apr 2021 at 00:00
> predicts	10 Apr 2021 at 00:00
> products	8 Apr 2021 at 00:00
> slrreport	2 Jan 2022 at 15:00
> slrmail	5 Jul 2022 at 15:00
> specs	12 Mar 2021 at 00:00

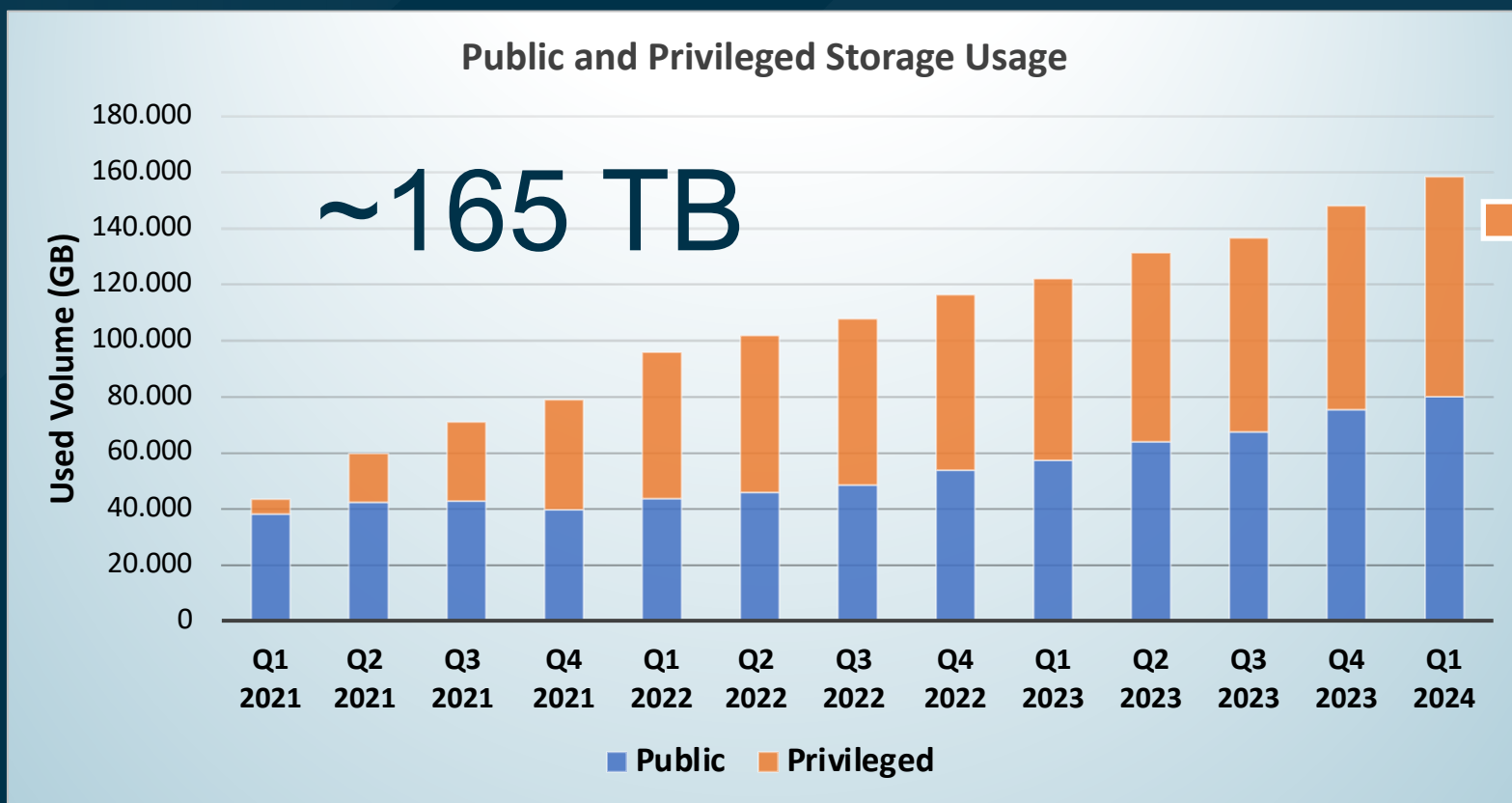
Goal → Quick access and long term preservation for ESA and non-ESA GNSS data

# GSSC Repository: Contributors & Users



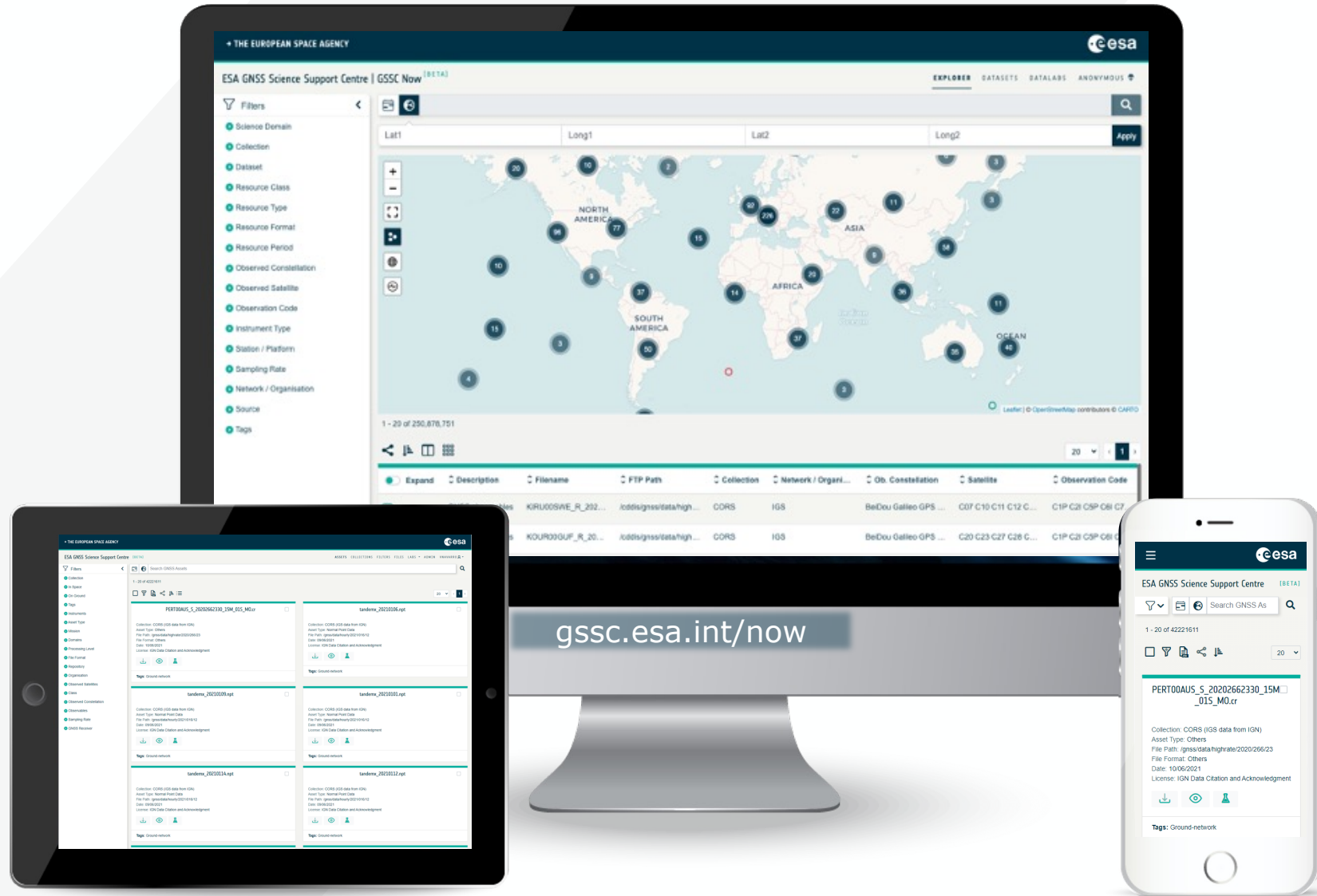
↓ 10 TB / Quarter

# GSSC Repository: Public & Privileged Data





# GSSC Portals - GSSC Now, ESA GNSS Digital Platform



# GSSC Now Explorer for Data Discovery

→ THE EUROPEAN SPACE AGENCY esa

ESA GNSS Science Support Centre | GSSC Now <sup>[BETA]</sup> EXPLORER DATASETS DATALABS ANONYMOUS

Filters

- Science Domain
- Collection
- Dataset
- Resource Class
- Resource Type
- Resource Format
- Resource Period
- Observed Constellation
- Observed Satellite
- Observation Code
- Instrument Type
- Station / Platform
- Sampling Rate
- Network / Organisation
- Source
- Tags

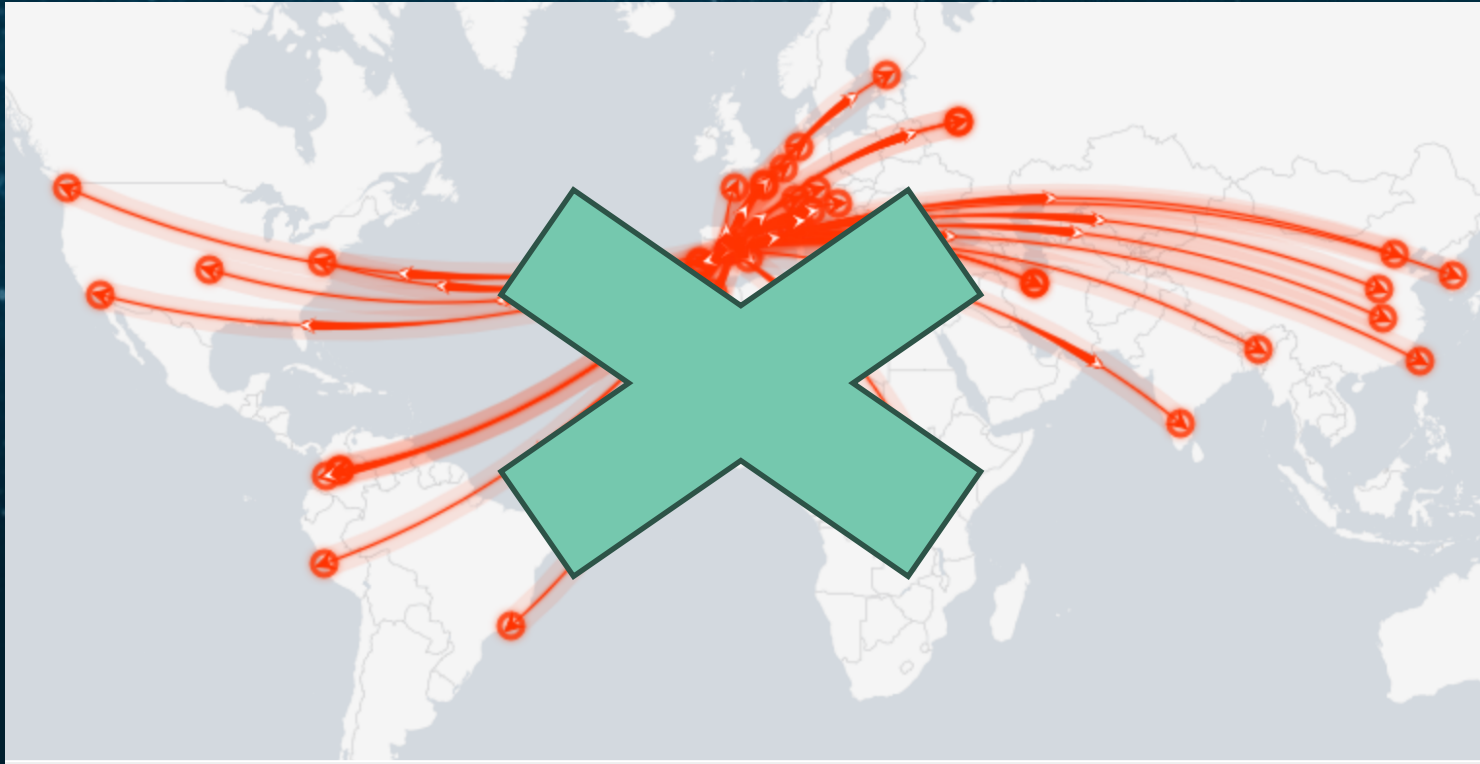
Lat1 Long1 Lat2 Long2 Apply

1 - 20 of 250,878,751

<input type="checkbox"/> Expand	Description	Filename	FTP Path	Collection	Network / Organi...	Ob. Constellation	Satellite	Observation Code
<input type="checkbox"/>	GNSS observables	KIRU00SWE_R_202...	/cddis/gnss/data/high...	CORS	IGS	BeiDou Galileo GPS ...	C07 C10 C11 C12 C...	C1P C2I C5P C6I C7...
<input type="checkbox"/>	GNSS observables	KOUR00GUF_R_20...	/cddis/gnss/data/high...	CORS	IGS	BeiDou Galileo GPS ...	C20 C23 C27 C28 C...	C1P C2I C5P C6I C7...

Goal → Seamless browsing of +200 million GNSS assets

Data  Insights

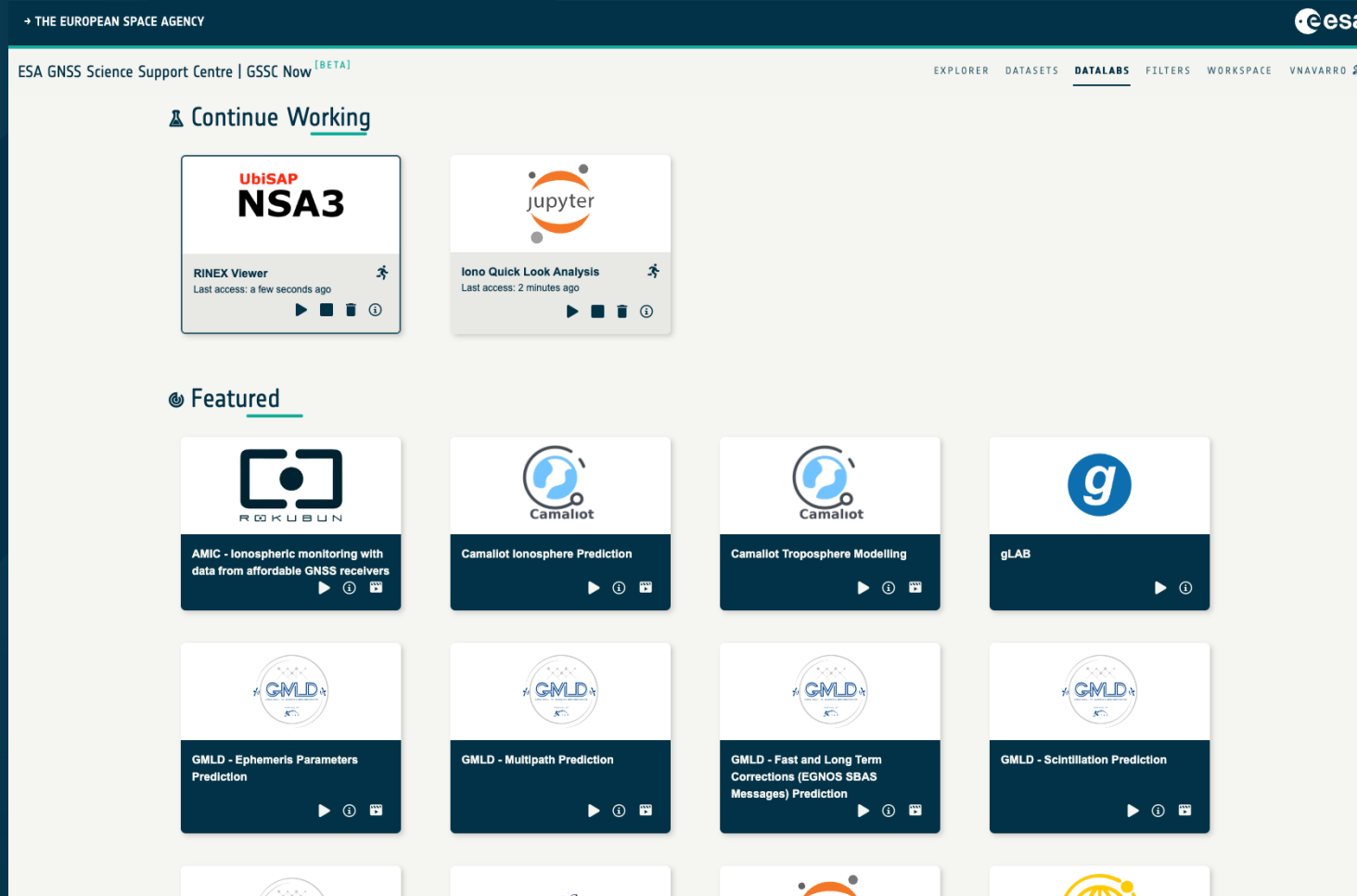


*From bring the data to the user*

*To bring the user to the data*

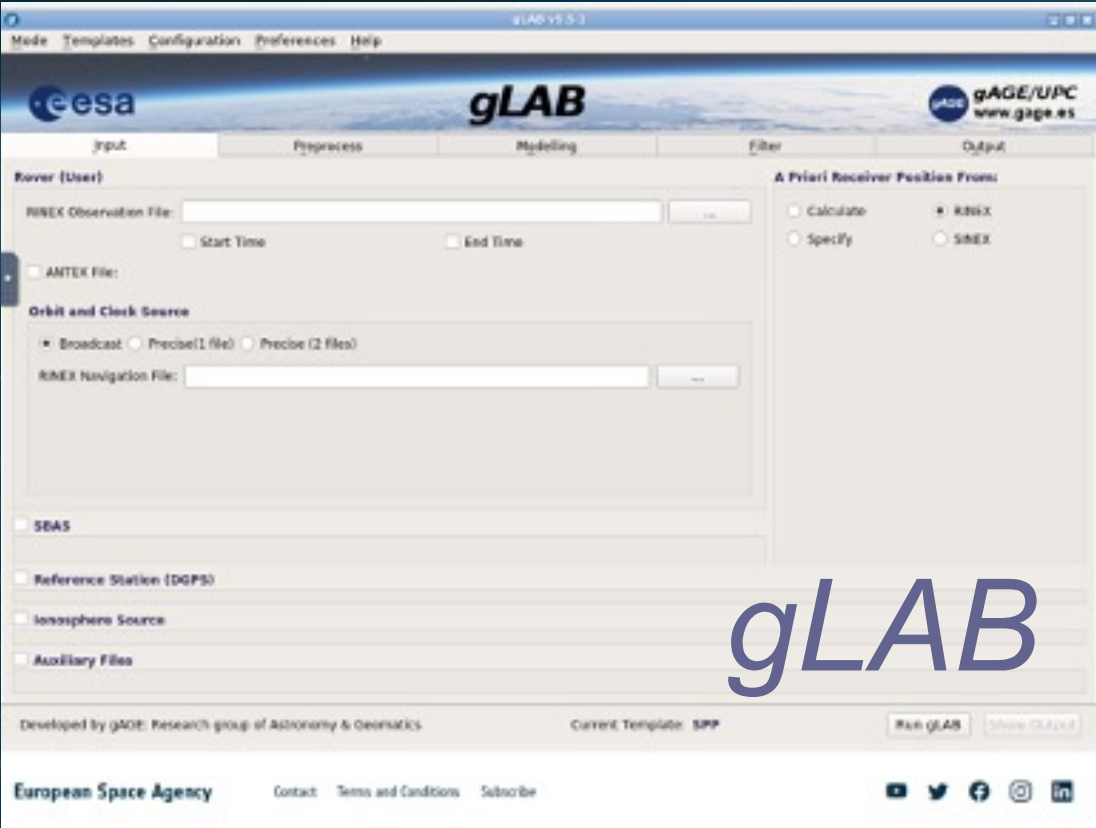


# GSSC Now Datalabs Marketplace



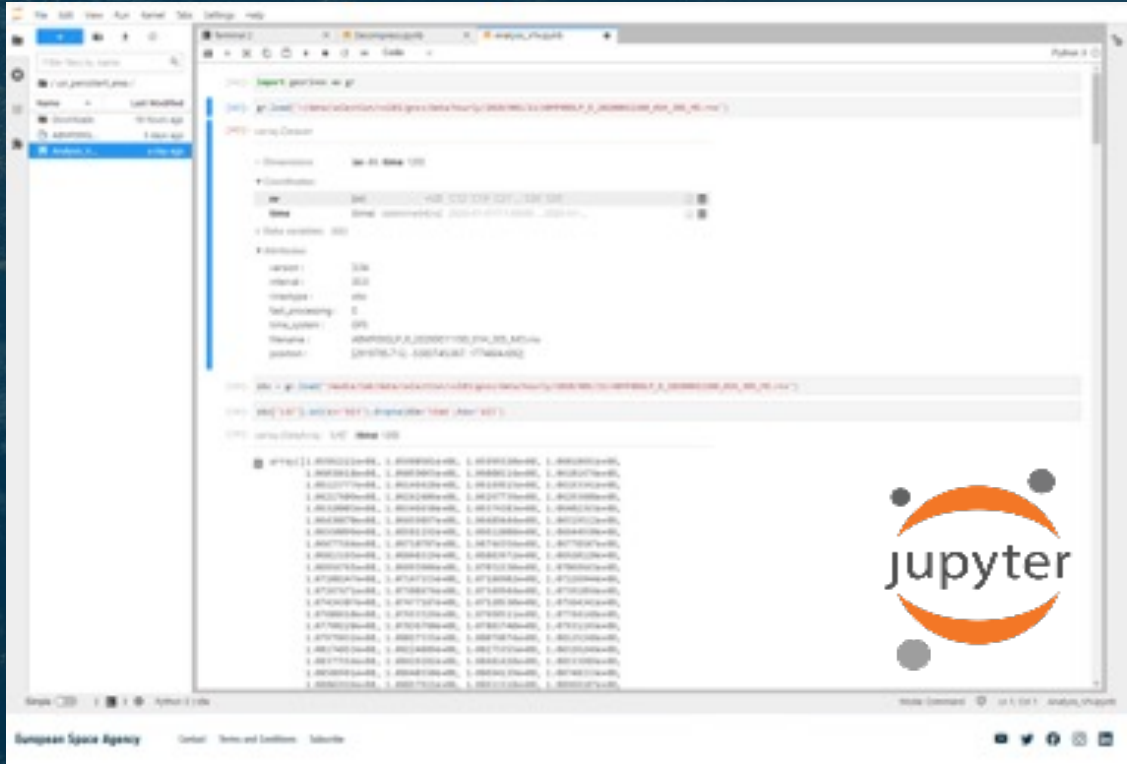
Goal → Zero config & download, data-centric GNSS innovation

# Datalabs for GNSS Interactive Analysis as a Service



gLAB

Web-Based



Desktop-Based



# Datalabs and Data Co-location: GSSC Repository



→ THE EUROPEAN SPACE AGENCY esa

ESA GNSS Science Support Centre | GSSC Now <sup>[BETA]</sup> EXPLORER DATASETS **DATALABS** FILTERS WORKSPACE VNAVARRO

File Edit View Run Kernel Tabs Settings Help

/ data /

Name	Modified
gssc	7h ago
gssc-privileged	7h ago
selection	7h ago
ubisap	last yr.

```
[2]: # Create Basic Plots
import plot as plot

pseudorange_fig = plot.obs_time_plot(obs_frame, 'C')
carrier_phase_fig = plot.obs_time_plot(obs_frame, 'L')
doppler_fig = plot.obs_time_plot(obs_frame, 'D')
signal_strength_fig = plot.obs_time_plot(obs_frame, 'S')

pseudorange_fig.show()
carrier_phase_fig.show()
doppler_fig.show()
signal_strength_fig.show()
```

Pseudorange (m)

Signal/Satellite

- C1C G01
- C1C G08
- C1C G10
- C1C G11
- C1C G20
- C1C G27
- C1C G28
- C1C R02

Simple 0 Python3.9 UbiSAP | Idle Mode: Command Ln 1, Col 1 nsa3\_rinex\_visualisation.ipynb 1

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# Datalabs and Data Co-location: Your Own Workspace



ESA GSSC Science Support Centre | GSSC Now [BETA]

EXPLORER DATASETS **DATALABS** FILTERS WORKSPACE VNAVARRO

```
[2]: # Create Basic Plots
import plot as plot

pseudorange_fig = plot.obs_time
carrier_phase_fig = plot.obs_time
doppler_fig = plot.obs_time

pseudorange_fig.show()
carrier_phase_fig.show()
doppler_fig.show()
signal_strength_fig.show()
```

Pseudorange (m)

Name	Size	Last modified
Camaliot1_out	—	2 months ago
DataScienceDemo	—	2 months ago
Downloads	—	3 months ago
my_data	—	5 months ago
my_notebooks	—	2 months ago
Test	—	4 months ago



# Find and launch your datalab

The image illustrates the process of finding and launching a datalab. It features several key components:

- Find:** A grid of datalab cards, each with a logo and name (e.g., gLAB, GSSC Datalab Demonstrator 1, UbiSAP NSA1-3, UbiSAP FLAMINGO Processor, UbiSAP RINEX PPK Processor, UbiSAP RINEX Viewer, UPC Clocks Viewer).
- Launch:** A 'Datalab Launcher' dialog box with fields for Name (e.g., Multipath Processing), Type (e.g., GSSC Datalab Demonstrator 1), and Description, with a 'Launch' button.
- Switch:** A 'Running' section showing a grid of active datalab cards.
- Use:** A JupyterLab interface displaying Python code for geospatial data analysis, including imports for georinex and gr, and data loading and processing commands.

# Select data, find and launch your datalab

The screenshot displays the ESA GSSC Now interface, which is used for selecting GNSS data and launching a datalab for analysis. The interface is divided into several sections:

- Search GNSS Assets:** A search bar with filters for Science Domain, Collection, Dataset, Resource Class, Resource Type, Resource Format, Resource Period, Observed Constellation, Observed Satellite, Observation Code, Instrument Type, Station / Platform, Sampling Rate, Network / Organisation, Source, and Tags. A map shows the distribution of GNSS assets across the globe, with numbered markers indicating specific locations.
- Data Selection:** A table showing selected GNSS observables. The table has columns for 'Expand', 'Description', 'Filename', and 'FTP Path'. Two rows are visible, both representing GNSS observables from different stations (CEBR00ESP and KIRU00SWE).
- Open in Datalab:** A modal dialog box that prompts the user to select a running Datalab or click 'New'. The selected Datalab is 'Datalab GSSC Lab - Running'.
- Datalab Interface:** A JupyterLab interface showing a file browser with a 'selection' folder highlighted. The main area displays a plot of 'Signal Strength (dBm)' over time (Feb 1, 2020). The plot shows multiple colored lines representing different satellites, with signal strength fluctuating between approximately 35 and 50 dBm.

Green arrows indicate the flow of the process: from the data selection table to the 'Open in Datalab' dialog, and from the dialog to the datalab interface.

Bringing discovery and analysis goals together



# Enabler for Navigation AI and Digital Twin

ESA GNSS Science Support Centre | GSSC Now <sup>[BETA]</sup>

EXPLORER DATASETS **DATALABS** FILTERS WORKSPACE VNAVARRO

### Featured

 AMIC - Ionospheric monitoring with data from affordable GNSS receivers	 Camaliot Ionosphere Prediction	 Camaliot Troposphere Modelling	 gLAB
 GMLD - Ephemeris Parameters Prediction	 GMLD - Multipath Prediction	 GMLD - Fast and Long Term Corrections (EGNOS SBAS Messages) Prediction	 GMLD - Scintillation Prediction
 GMLD - TEC Map Prediction	 GSSC PVT & DOC/DOP Map	 GSSC Lab	 Spatial Interpolation of VTEC
 Spatial Interpolation of ZWD	 UbiSAP Binary to RINEX	 UbiSAP RINEX PPK Processor	 UbiSAP RINEX Viewer



Goal → Short time-to-market for the deployment of AI-based Navigation solutions



First name\*

Surname\*

E-mail Address\*

Country\*

Organisation\*

Organisation Type\*

Research and education

Industry and commercial

International / national organisation

Other:

Describe the datasets or datalabs you would like to contribute\*

I would like to subscribe to your Newsletter

I agree with the [Terms and Conditions](#)

## What?

- Datasets
- Datalabs

## How?

- Native integration
- Federated integration

Goal → Maximise visibility and realise the potential of GNSS community contributions

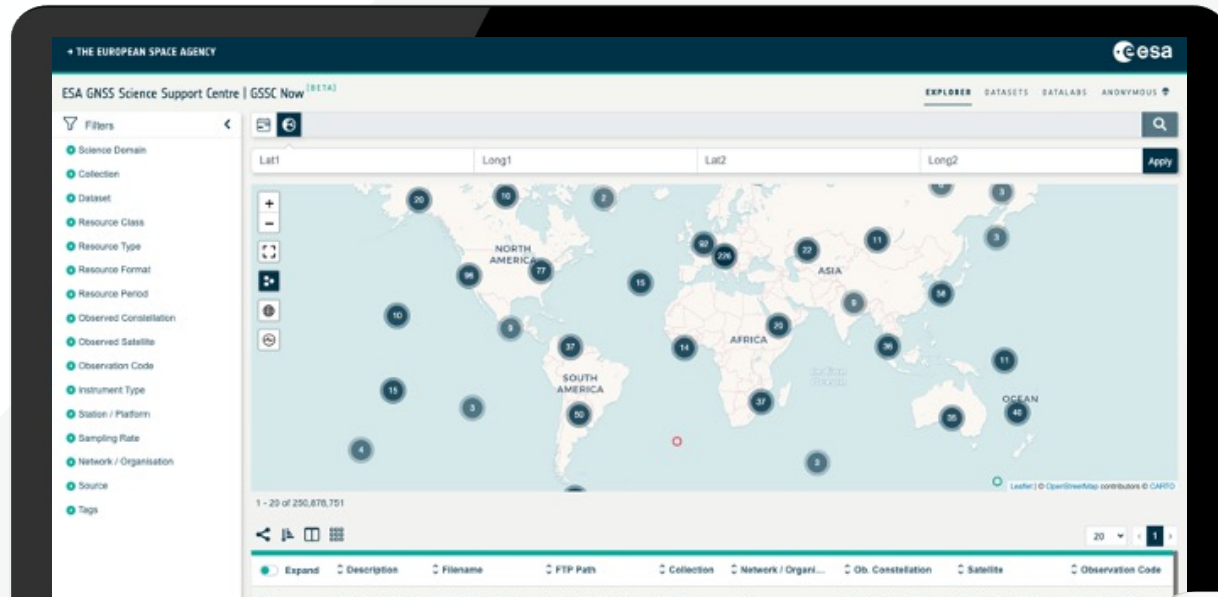
The screenshot displays the 'ESA GSSC Now' interface. On the left is a metadata sidebar with sections for Identifier, Language, DOI (Digital Object Identifier), Landing page, and Instrument. The main area shows a table of data with columns for Collection, Dataset, Description, and DOI. A green box highlights the first two rows of the table.

Collection	Dataset	Description	DOI
GREAT	GREAT Experiment (...)	Public dataset of the ...	<a href="https://doi.org/10.577...">https://doi.org/10.577...</a>
CAMALIOT	CAMALIOT - Brazil	The CAMALIOT data...	<a href="https://doi.org/10.577...">https://doi.org/10.577...</a>
ICESAT	ICESAT Mission	ICESat (Ice, Cloud,a...	Not Available
JASON	JASON Mission	GNSS data from JA...	Not Available

ESA Minted Digital Object Identifiers (DOIs) for Datasets and Datalabs (in-progress)



# Open Platform in Beta – Moderated Registration Process

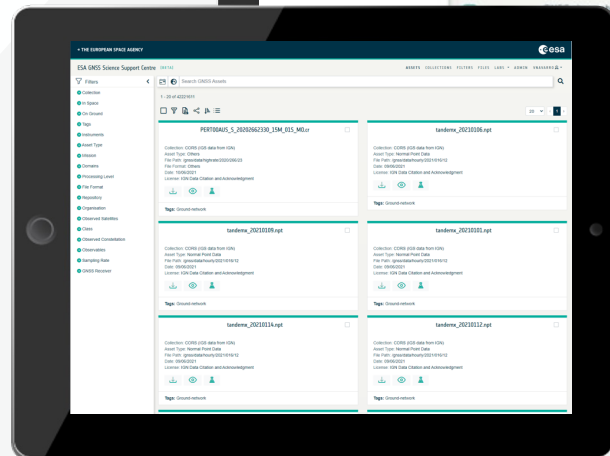


✓ Public Access

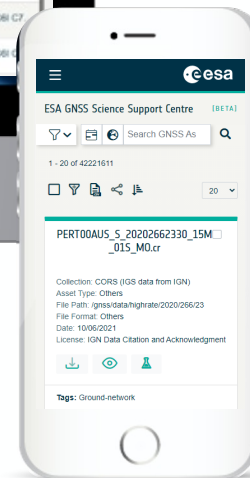
✓ Preview Access

→ Invitation Code IGS2024

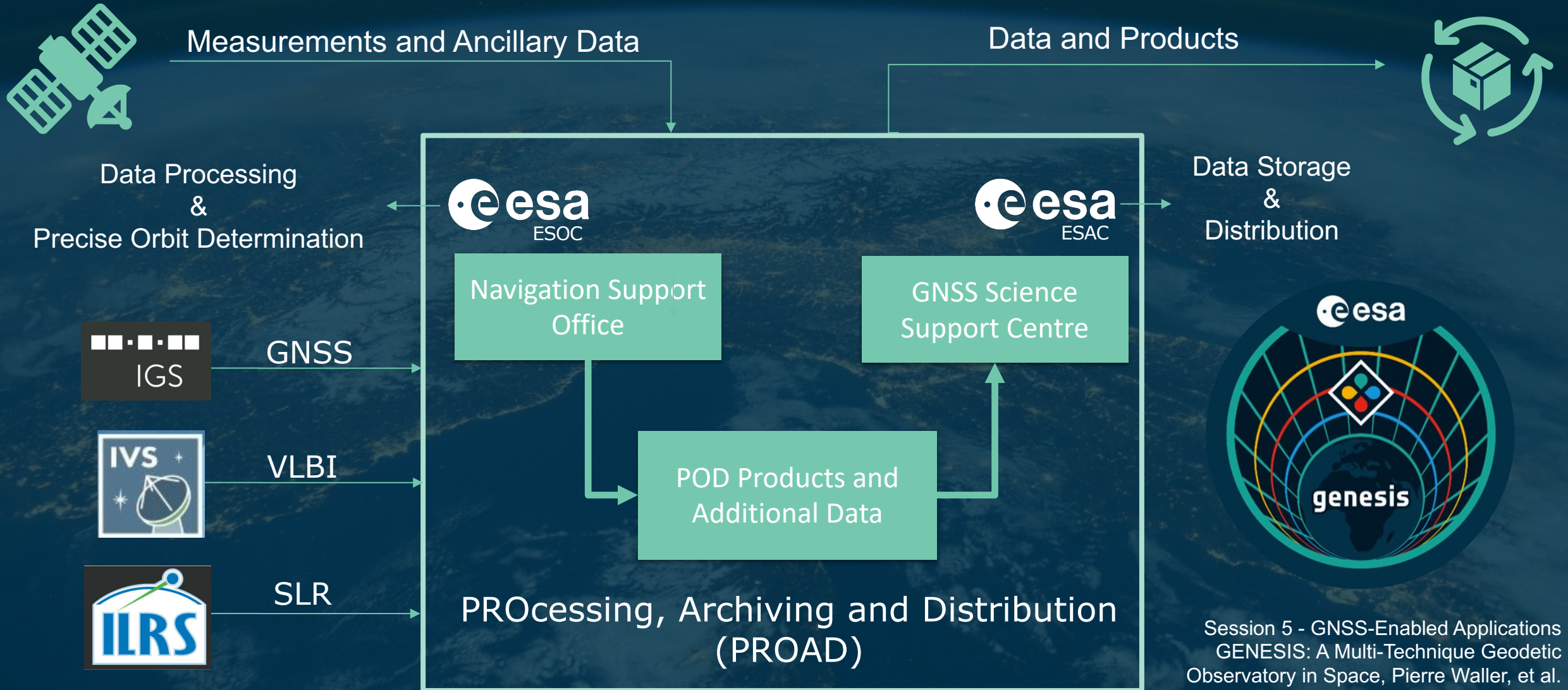
# +200 Users



[gssc.esa.int/register](https://gssc.esa.int/register)



# GENESIS PROAD: Collaborating across ESA



Session 5 - GNSS-Enabled Applications  
GENESIS: A Multi-Technique Geodetic  
Observatory in Space, Pierre Waller, et al.





# Five Goals Strategy Summary



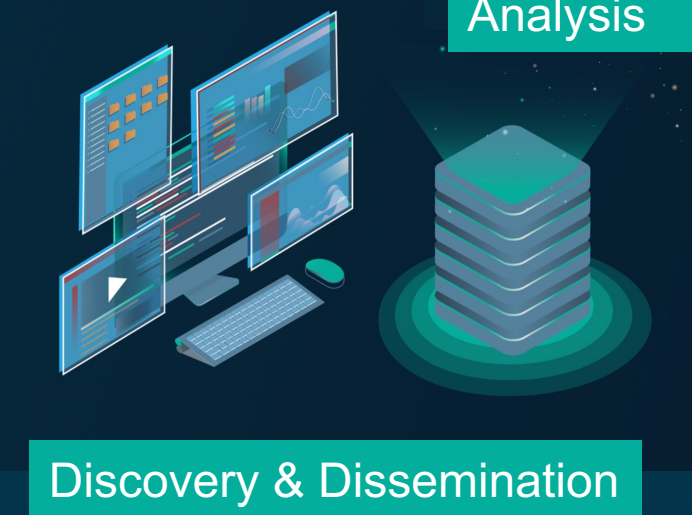
Repository



Analysis



Open & Citizen Science



Discovery & Dissemination



AI, IoT, Crowdsourcing & Digital Twin



Thank You!

This is not a journey  
about impacting  
technology ...



... this is a journey  
about impacting  
gnss

Invitation code **IGS2024**

Find us at **gssc.esa.int**

