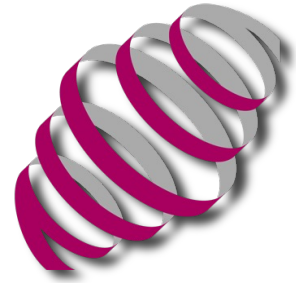




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LOFAR

Development of the LOFAR Science Data Centre

Hanno Holties

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Station cabinet

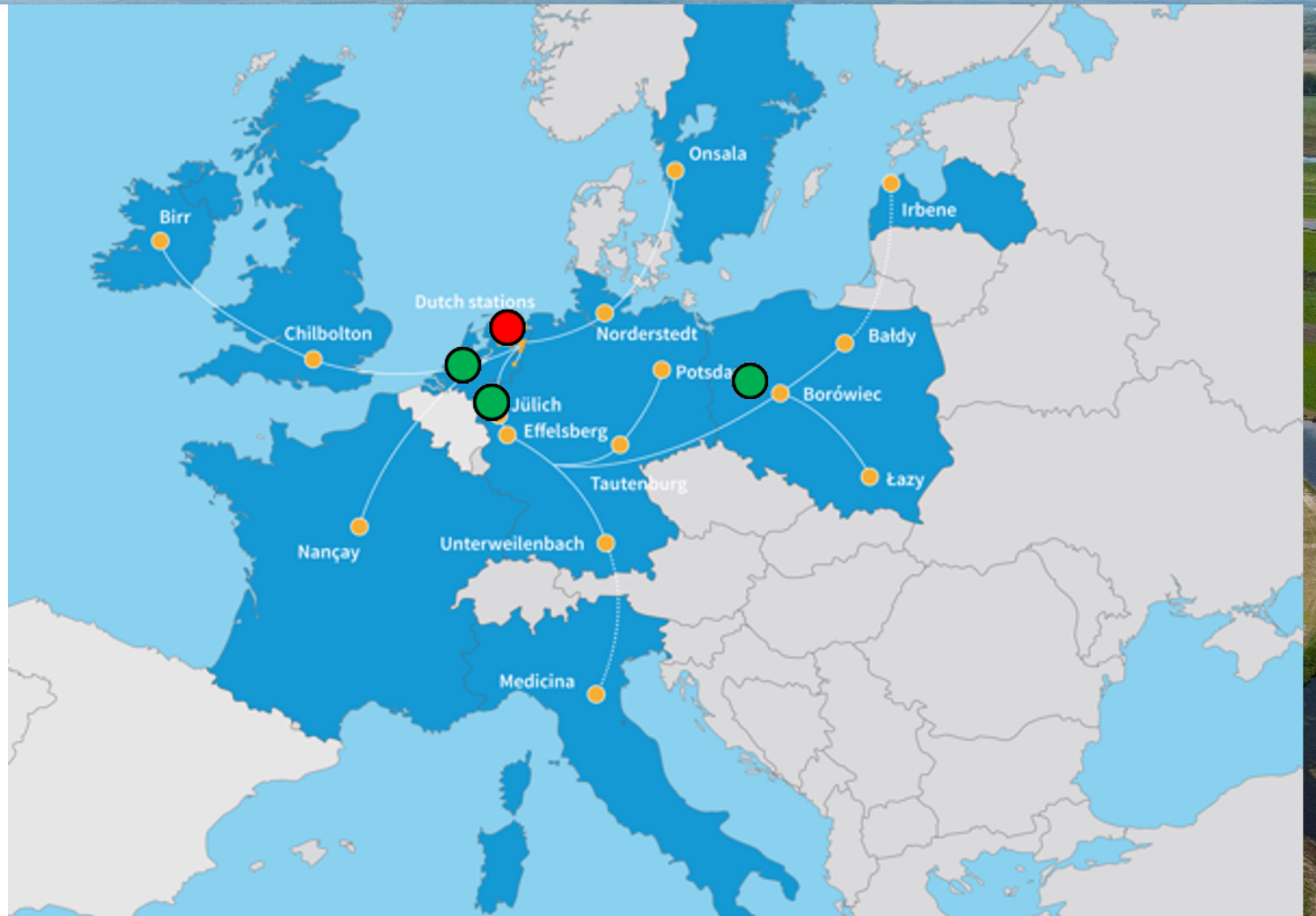


Credit: Onsala Space Observatory/Leif Helldner

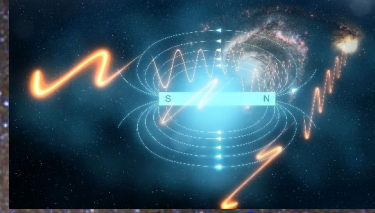


Credit: Alison Delaney, Birr Castle

- Central Processing
 - RUG (Groningen, NL)
 - (Near) real-time processing
 - GPU & CPU clusters
 - 3+ PB temporary storage
- Long-term archive
 - PSNC (Poznań, PL)
 - FZJ (Jülich, DE)
 - SURF (A'dam, NL)
 - 50+ PB nearline storage



Cosmic magnetism



Supermassive black holes



Early Universe

Supernovae



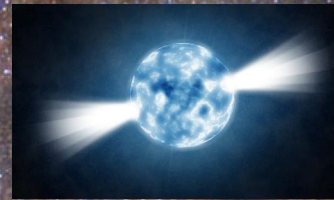
Galaxy clusters



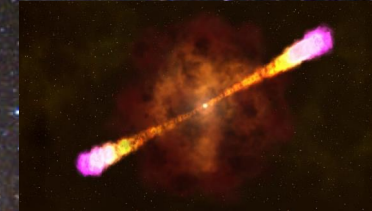
Sun



Pulsars



Gravitational wave events



Solar System Planets



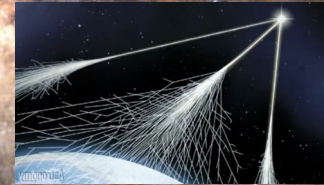
Nearby galaxies



Meteors



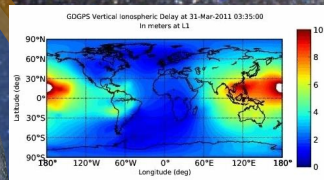
Cosmic rays



Interstellar medium



Ionosphere



Lightning

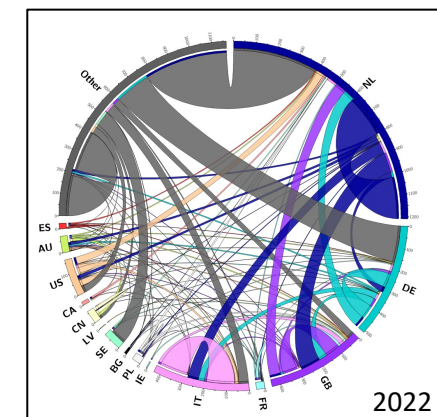
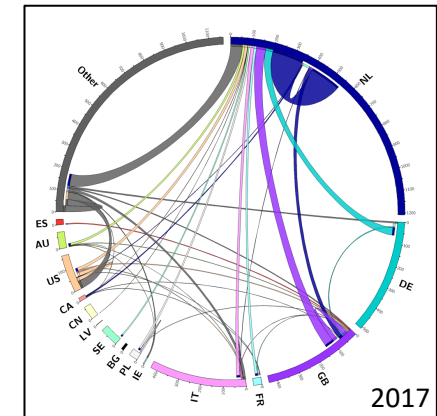
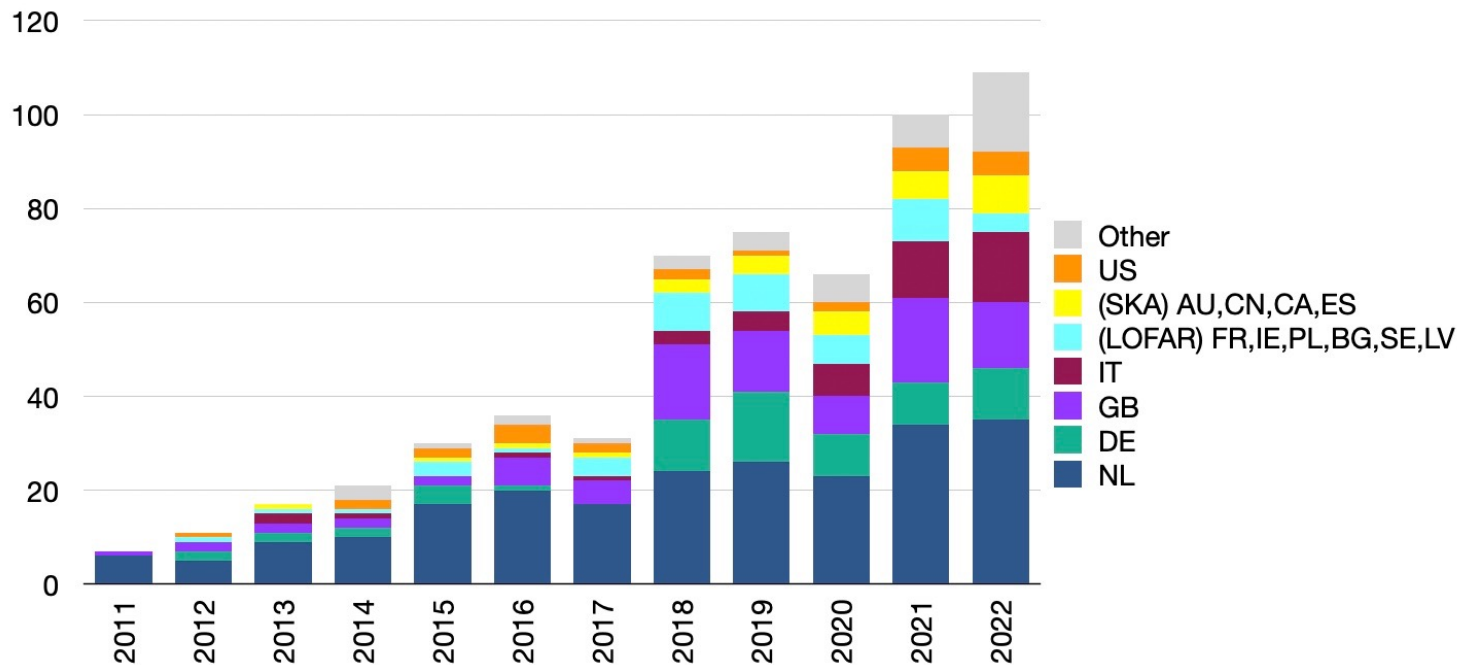


Space weather



LOFAR - growing impact

- Community is becoming more diverse
- Publications increase by over 3x in a five year period
- From 2017 to 2022, the size of the LOFAR community has increased by a factor of 3 to over 2000
- A factor of 7 increase in the number of collaborations




Courtesy of J. Dempsey

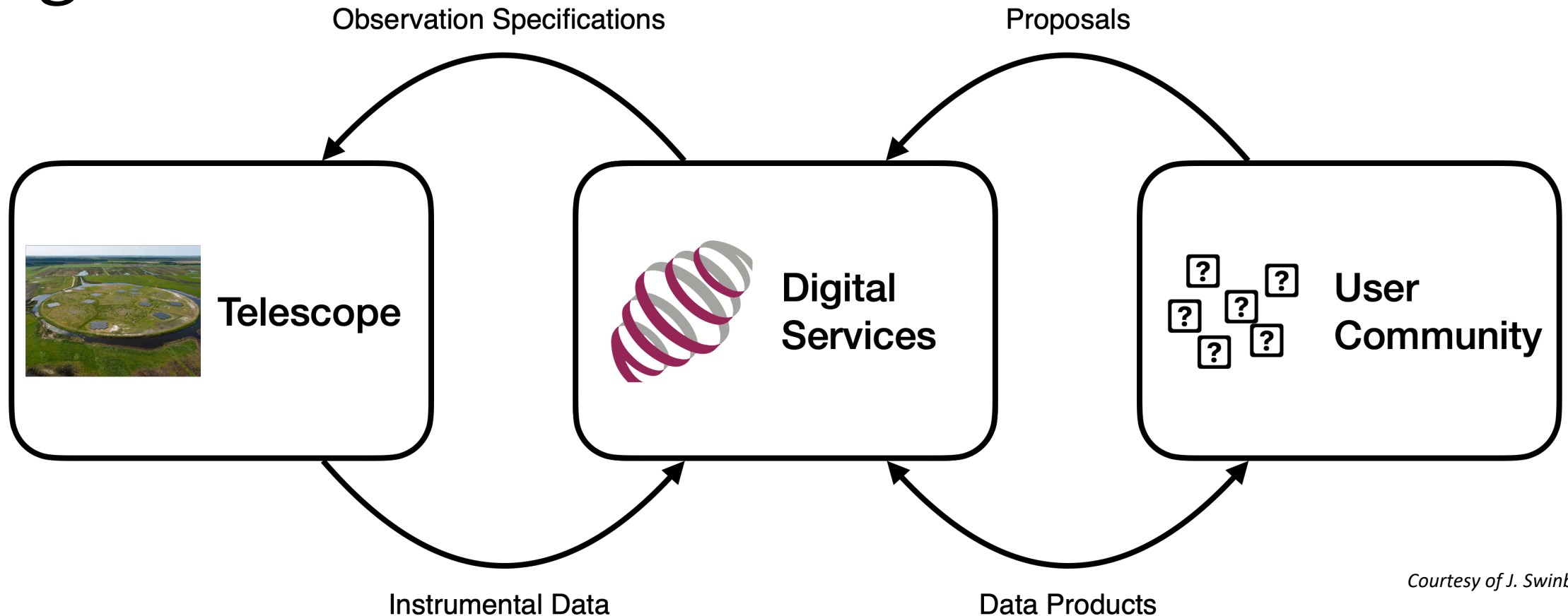
2024 - Upgrade to LOFAR2.0

- More receivers and processing capacity at the stations, enabling
 - Simultaneous LBA-HBA observing, or
 - Double the LBA or HBA beams x bandwidth

Station capability	LOFAR1	LOFAR2.0
NL	48 LBA or 48 HBA	96 LBA and 48 HBA
International	96 LBA or 96 HBA	96 LBA and 96 HBA

- Distribution of a central clock to all NL stations (White Rabbit)
 - Simultaneous observations for multiple science cases
-  Significant increase of data generated by the telescope

Enter the LOFAR Science Data Centre Digital Services



Courtesy of J. Swinbank


“Services to process, archive, and distribute LOFAR2.0 Data Products. These services, deriving from development effort, operational activities, and infrastructure capacity contributed by various partners, will be provided to end users under the management of the ASTRON Science Data Centre.”

LOFAR2.0 Data Management Capabilities; <https://www.lofar.eu/lofar2-0-documentation/>


 Proposal Management

 Archiving & Curation

 Scientific Pipelines

 Digital Services

 Managed Processing

 Discovery & Access

 Interactive Data Analysis

 User Pipeline Execution

Courtesy of J. Swinbank


NOT PRESENTED HERE


 Proposal Management

 Archiving & Curation

 Scientific Pipelines

 Digital Services

 Managed Processing

 Discovery & Access

 Interactive Data Analysis

COMING LATER

 User Pipeline Execution

COMING LATER

Courtesy of J. Swinbank



Archiving & Curation

Product Type	Example	Retention Period
Raw	Unprocessed visibilities	Not retained
Instrumental	Flagged & compressed visibilities	Limited
Intermediate	Direction-independent calibrated visibilities	Limited
Advanced	Image cubes	Indefinite
Special Cases	Unique observations that cannot be repeated	Per case decision

- LTA retains only instrumental data products with high legacy value indefinitely.
- LTA support for advanced data products, which are retained indefinitely.
- Ability to ingest advanced products generated by the wider community.
- Including management of data rights.
- The ambition to become a “hub” for access to advanced LOFAR products, wherever they are generated.



Scientific Pipelines

- Key pipeline components provided and supported.
- Pipelines building on those components provided.
- These pipelines provide a default “science grade” imaging capability.
- Other pipelines remain community-developed & supported at a “best efforts” level by the SDC.

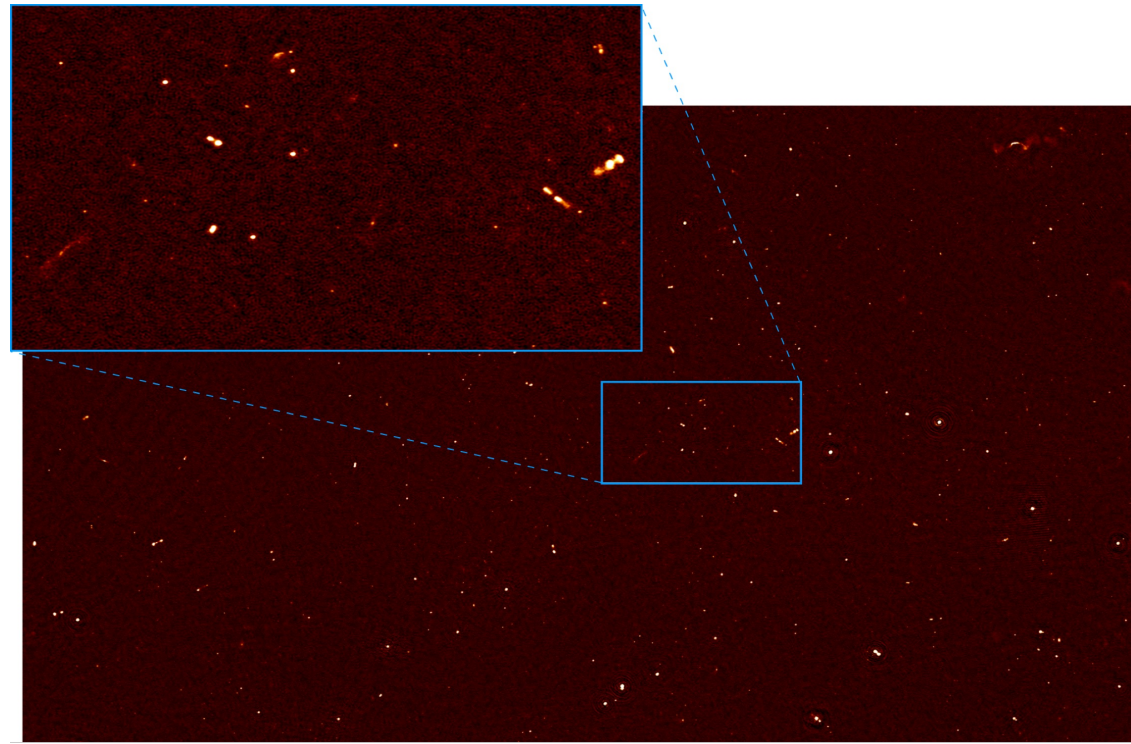


Image: André Offringa

RAPTHOR

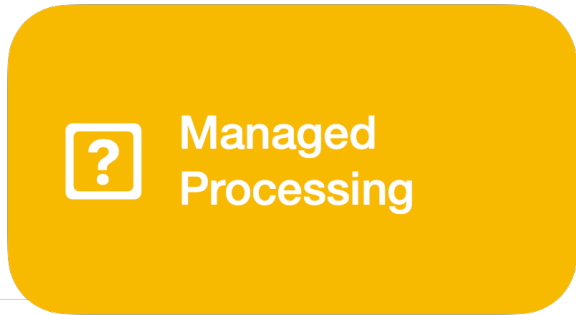


Release
1.0

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LOFAR Data Valorization



- Evolution of LTA and LTA Operations
- Plus:
 - Reduce data volume at the LTA to reduce operational costs
 - Streamline data processing operations at the LTA
 - Prepare ASTRON for LOFAR2 surveys
- LDV Operations started early 2023 after development of execution systems

LOFAR Long Term Archive

HOME SEARCH DATA BROWSE PROJECTS HELP

LC1_027

Observation 1 to 100 (showing 100 of total 387) -

Averaging Pipeline (total 0) -

Calibration Pipeline (total 0) -

Imaging Pipeline (total 0) -

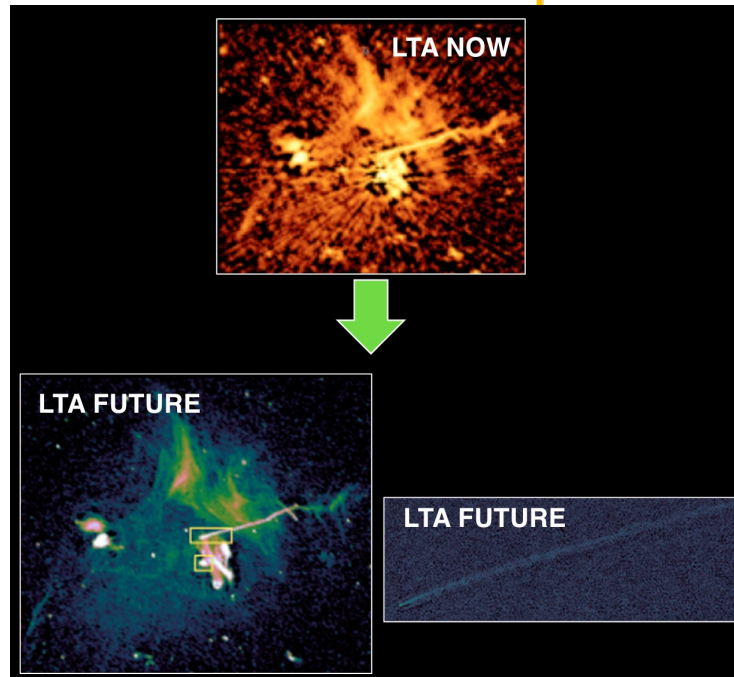
Long Baseline Pipeline (total 0) -

Pulsar Pipeline 1 to 100 (showing 100 of total 387) -

edit columns

first previous 1 2 3 4 next last

Line Name	Pipeline Version	SAS Id	Pulsar Selection	doSinglePulseAnalysis	Strategy Name	convertRawTo8bit	subintegrationLength [s]	Source DataProduct	All Dataproducts	Quality	Pulsars
4+4937/PULP	n/a	1027091	Pulsars in observation specs, file or SAP	0	Pulsar Pipeline	0	-1.0	show	show	Good	0
37+25/PULP	n/a	1027069	Pulsars in observation specs, file or SAP	0	Pulsar Pipeline	0	-1.0	show	show	Good	0
33+16/PULP	n/a	1027047	Pulsars in observation specs, file or SAP	0	Pulsar Pipeline	0	-1.0	show	show	Good	0
4-0719/PULP	n/a	1027025	Pulsars in observation specs, file or SAP	0	Pulsar Pipeline	0	-1.0	show	show	Moderate	0

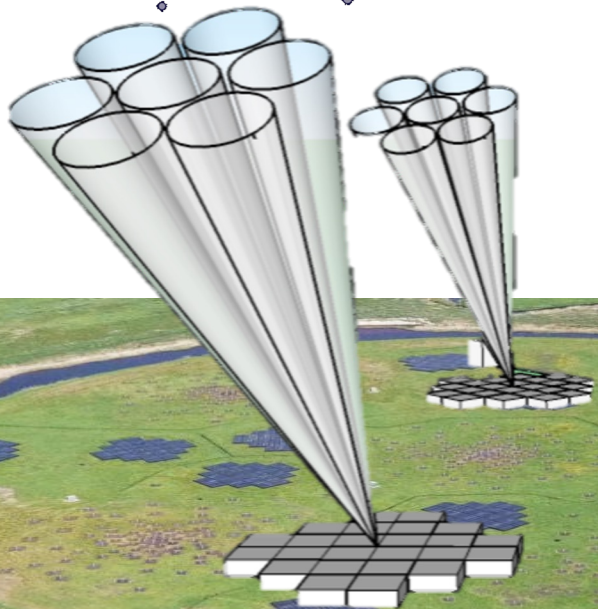
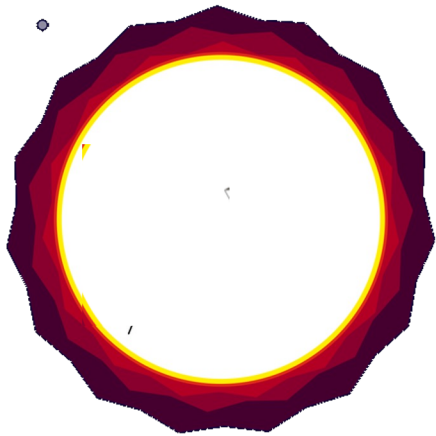


Scientific Case: IDOLS LOFAR Space-Weather



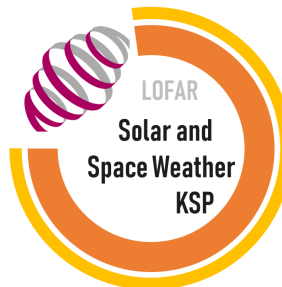
Managed
Processing

- Real time Radio Dynamic Spectrum
- Solar Energetic Particles Probability based on radio monitoring
- Ionosphere Scintillation index
- Daily Imaging Snapshot catalogue
- Radio Bursts Detection and list



IDOLS

ASTRON

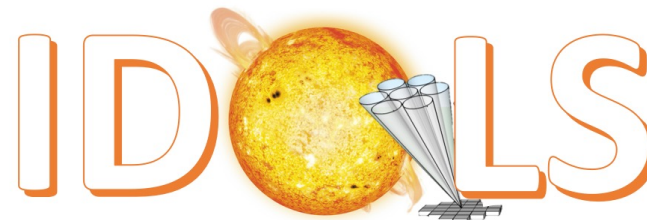
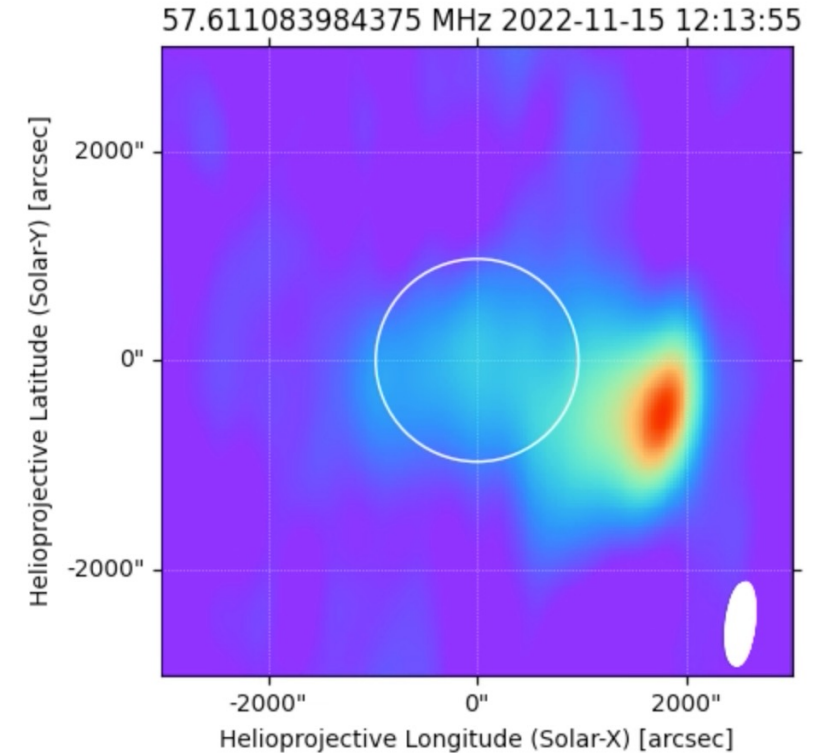
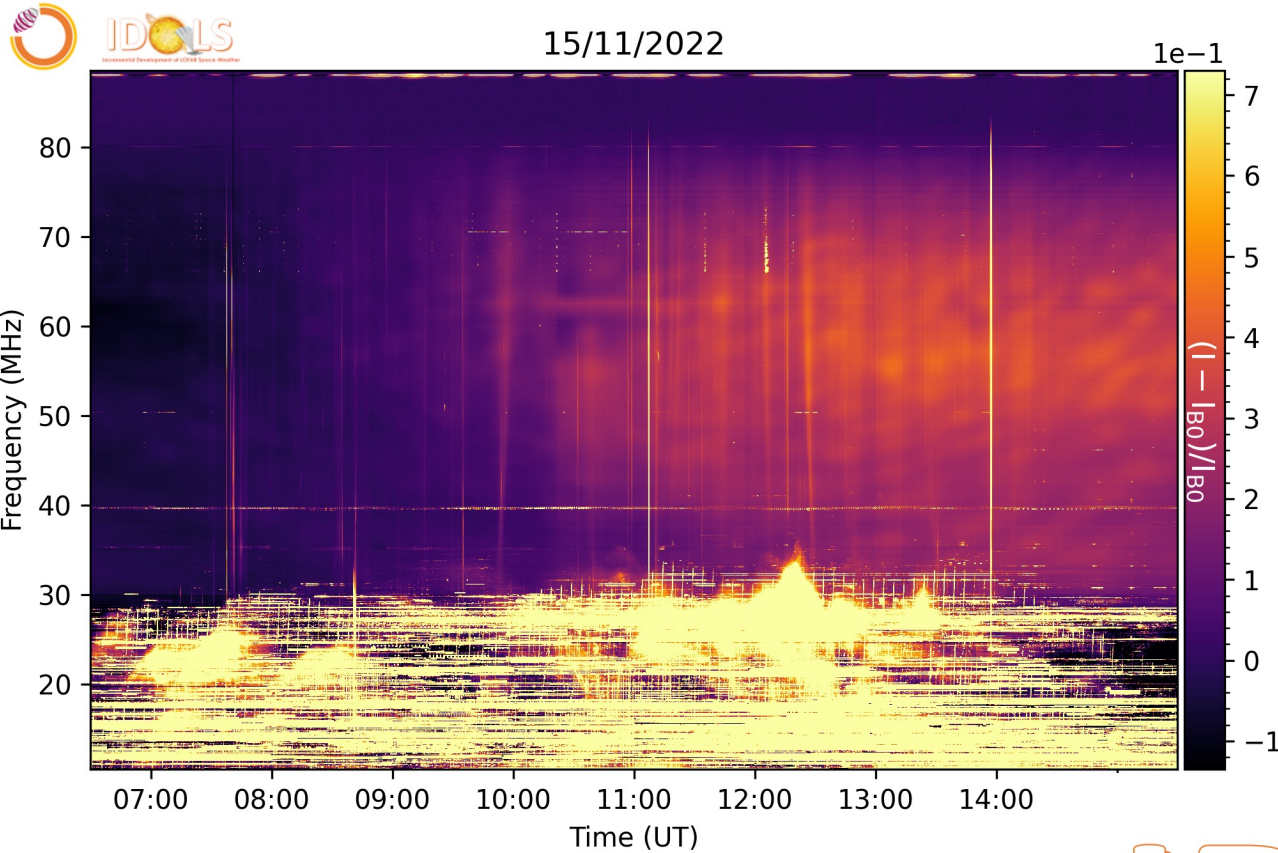


Scientific Case: IDOLS LOFAR Space-Weather



Managed
Processing

Sponsored by



Courtesy of P. Zucca



Discovery & Access

- All products available through Virtual Observatory interfaces (community standard for astronomy).
- New, friendly, accessible, modernized, data discovery portal.
- Ambition is for the archive to be fully FAIR-compliant.
- Move to FAAI & Token based access

The image displays several overlapping screenshots of astronomical data discovery and access interfaces. The top-left screenshot shows the 'ASTRON DATA EXPLORER' 'SkyView' interface, featuring search filters for Survey (aperitif_dri), Color Map (native), Frequency (10 to 1430), and Coordinates (RA: 340, Dec: 34, FoV: 15). The top-right screenshot shows a 'Discovery & Access' dashboard with cards for 'WSRT-Apertif', 'ASTRON VO', 'Zooniverse', 'Virtual Observatory (VO)', and 'CTAO'. The bottom-left screenshot shows a configuration panel for 'ADEX-labs SkyView (dev)' with options for Backend (SURF Research Cloud), Background Survey (HiPS), Collection (focus), DataProduct Type (Science Sky Map), and DataProduct SubType (continuumMF). The bottom-right screenshot shows a 'SkyView' interface displaying a star field with a crosshair and a 'FOV: 14.89'' label.

Credits

- Jessica Dempsey
- Wim van Capellen
- John Swinbank
- Roberto Pizzo
- Pietro Zucca
- LOFAR2 & SDC Programs
- IDOLS Project

