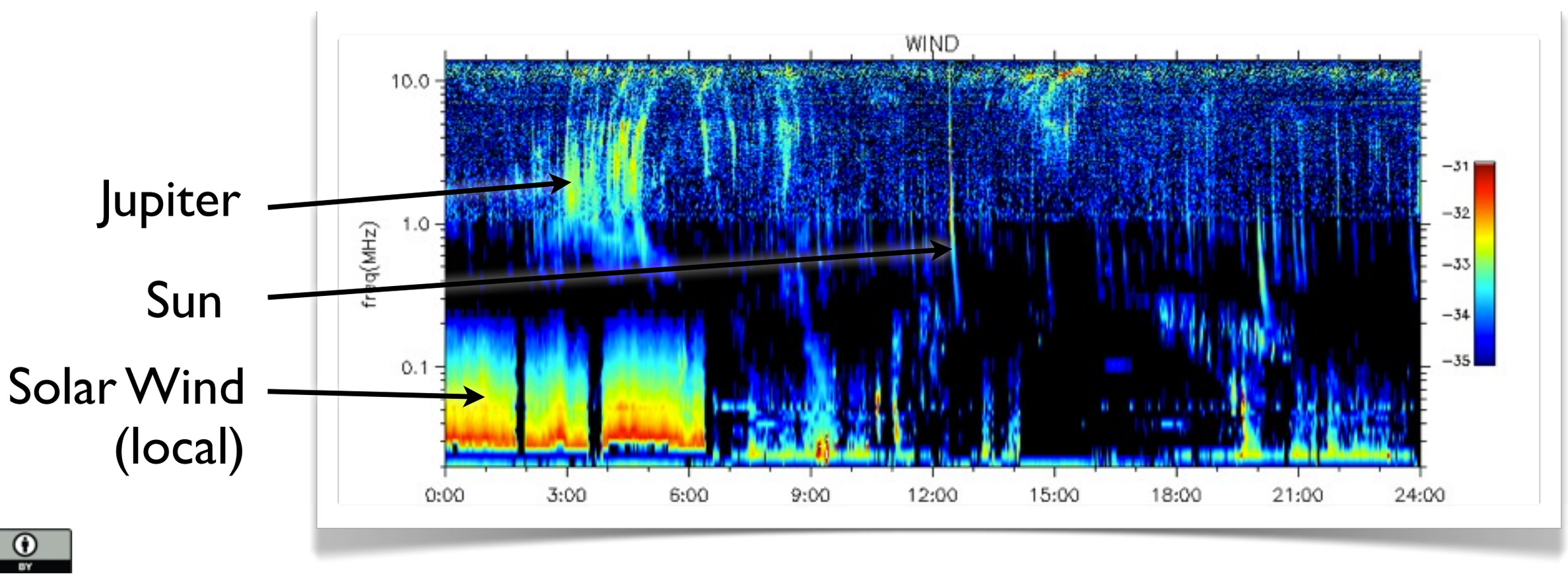
Low Frequency radio data

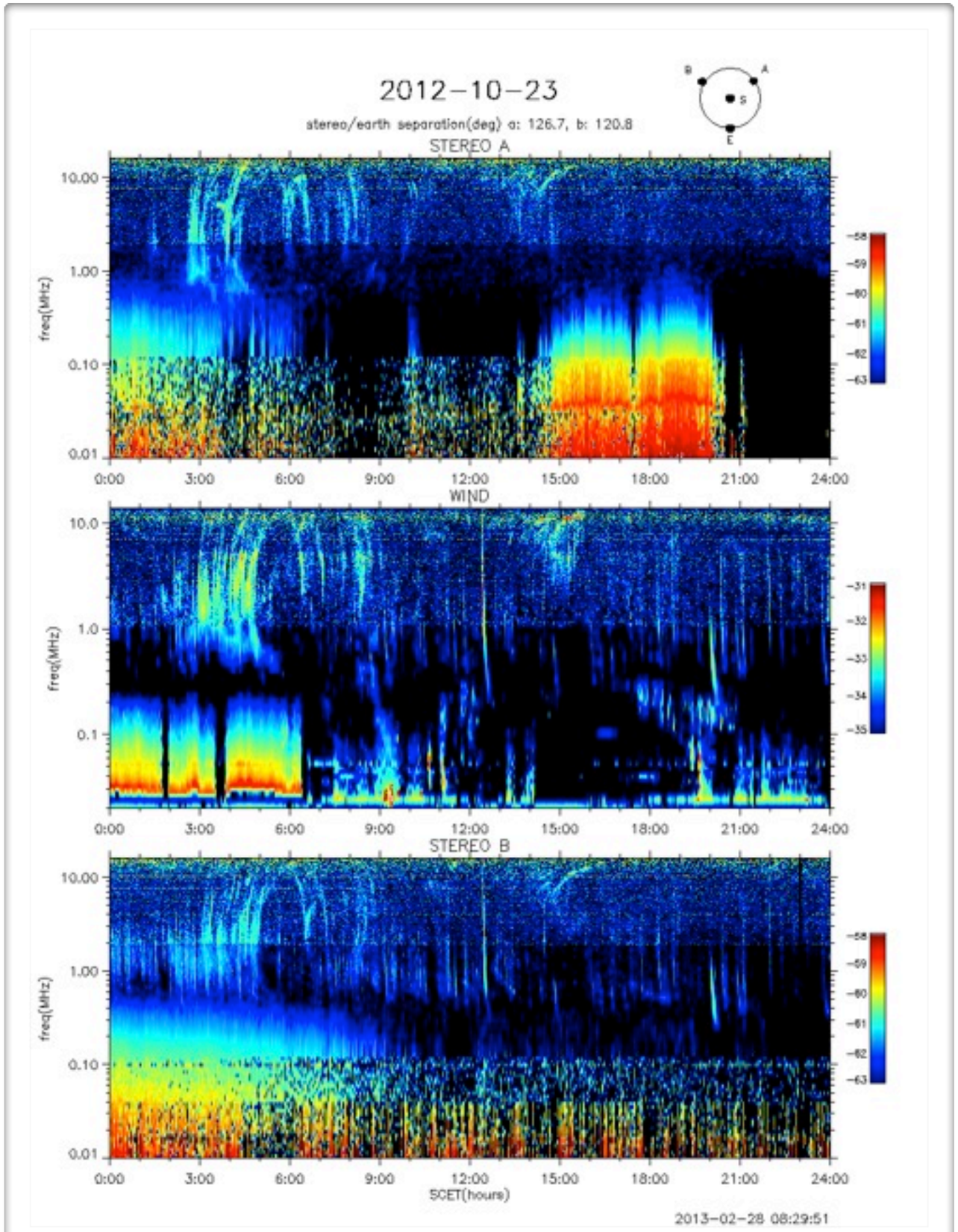
- Frequency band:
  - a few kHz to ~50 MHz
- Solar system sources:
  - magnetized planets (auroral emissions)
  - the Sun
- Data:
  - type: dynamic spectra
  - main physical parameters: spectral flux density, polarization degree



Description des émissions radio basses frequence

Low Frequency radio data

- Radio emissions are: sporadic and temporally variable
- Radio emissions are not isotropic ! Observer/Source geometry must be taken into account
- Time-Frequency shape is a characteristic of the radio emission physics (no fixed frequency lines!)



avantage des observations multipoint.

OV-Planeto
Observation Radio basse fréquence

Etat des lieux

- Type de données:
  - le plus souvent: spectre dynamique (spectrogramme temps/fréquence)
  - série temporelle (à une fréquence)
  - spectre (intégré en temps)
  - images, films (rarement, reconstruites ou interférométrie)

- Pas vraiment de format standard (natif [le plus souvent], FITS, CDF, HDF5, VOTable...)

- Aux USA, SPASE (Space Physics VO) décrit les données radio BF.

Existing databases

Agency	Science Objective	Archive (format)	Missions / Observatory	Access
NASA	Planetary	PDS (PDS, *CDF*)	Voyager, Galileo, Cassini, JUNO	HTTP, FTP
NASA	Sun-Earth	CDAweb (CDF)	WIND, STEREO	HTTP, WSDL
ESA	Planetary	PSA (PDS, *CDF*)	Bepi-Colombo/MPO, JUICE	HTTP, FTP, PDAP
JAXA	Earth, Planets	DARTS (CDF, PDS)	Geotail, Bepi-Colombo/MMO	HTTP, PDAP
CNES	All	CDPP (CDF, native)	Interball, Cluster, Viking (Swedish), Cassini, STEREO	HTTP, WSDL, EPN-TAP
Obs. Paris	Jupiter, Sun	RDN (Native, FITS, VOTable)	Nançay Decameter Array	HTTP, EPN-TAP
Tohoku Univ.	Jupiter, Sun	Iitate (FITS)	Iitate Observatory	HTTP
ETH Zurich	Sun	e-Callisto (FITS)	Plenty of stations all over the world.	HTTP
LOFAR	All	(HDF5)	LOFAR proposals	Not defined yet

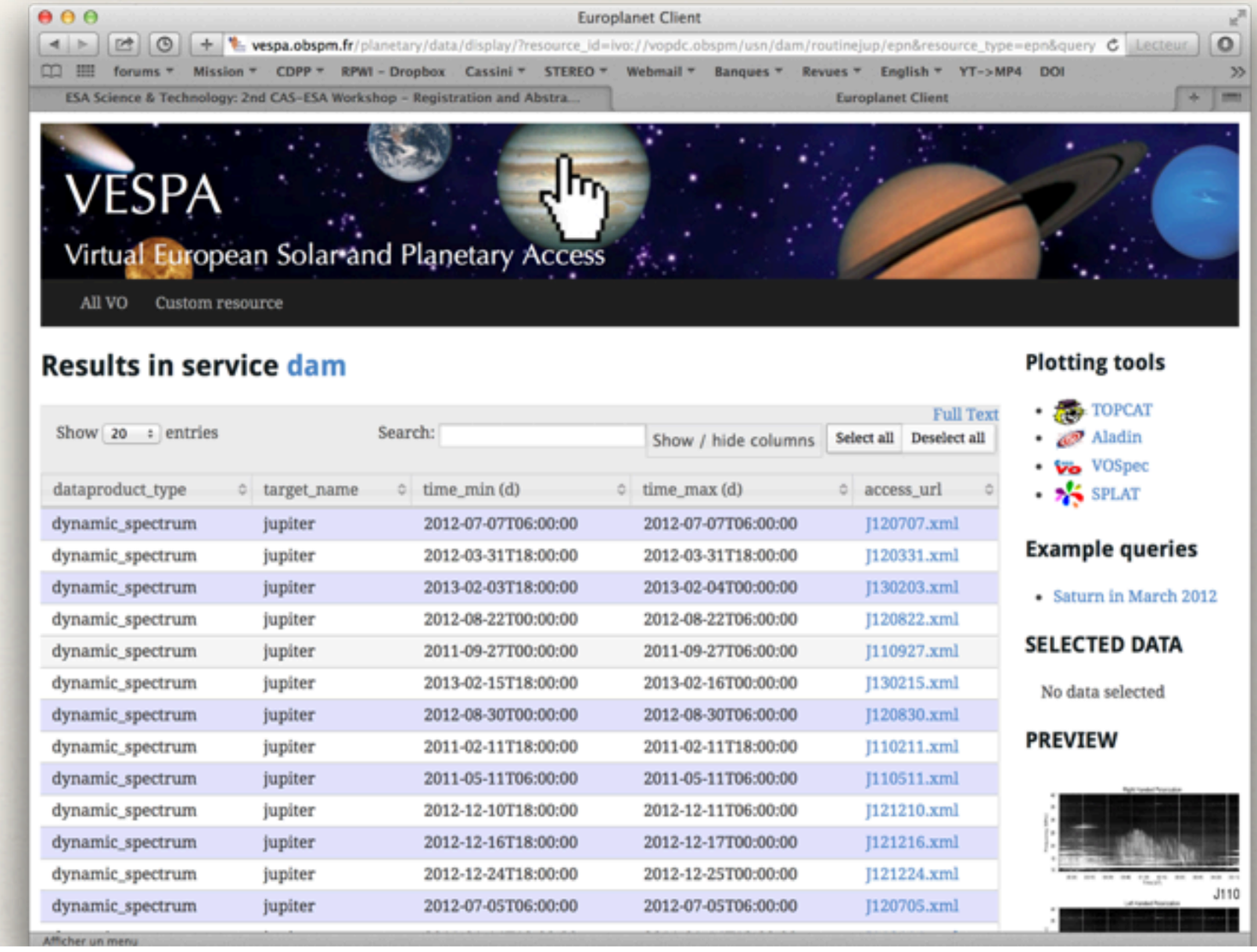
Tab. 1. List (non exhaustive) of existing databases providing low frequency radio data. Data formats in italics are for not yet approved formats in the corresponding database.

- Standard metadata format: PDS3, PDS4, SPASE, CDPP...
  Standard data format: Text, Binary, CDF, NetCDF, VOtable, HDF5, FITS...

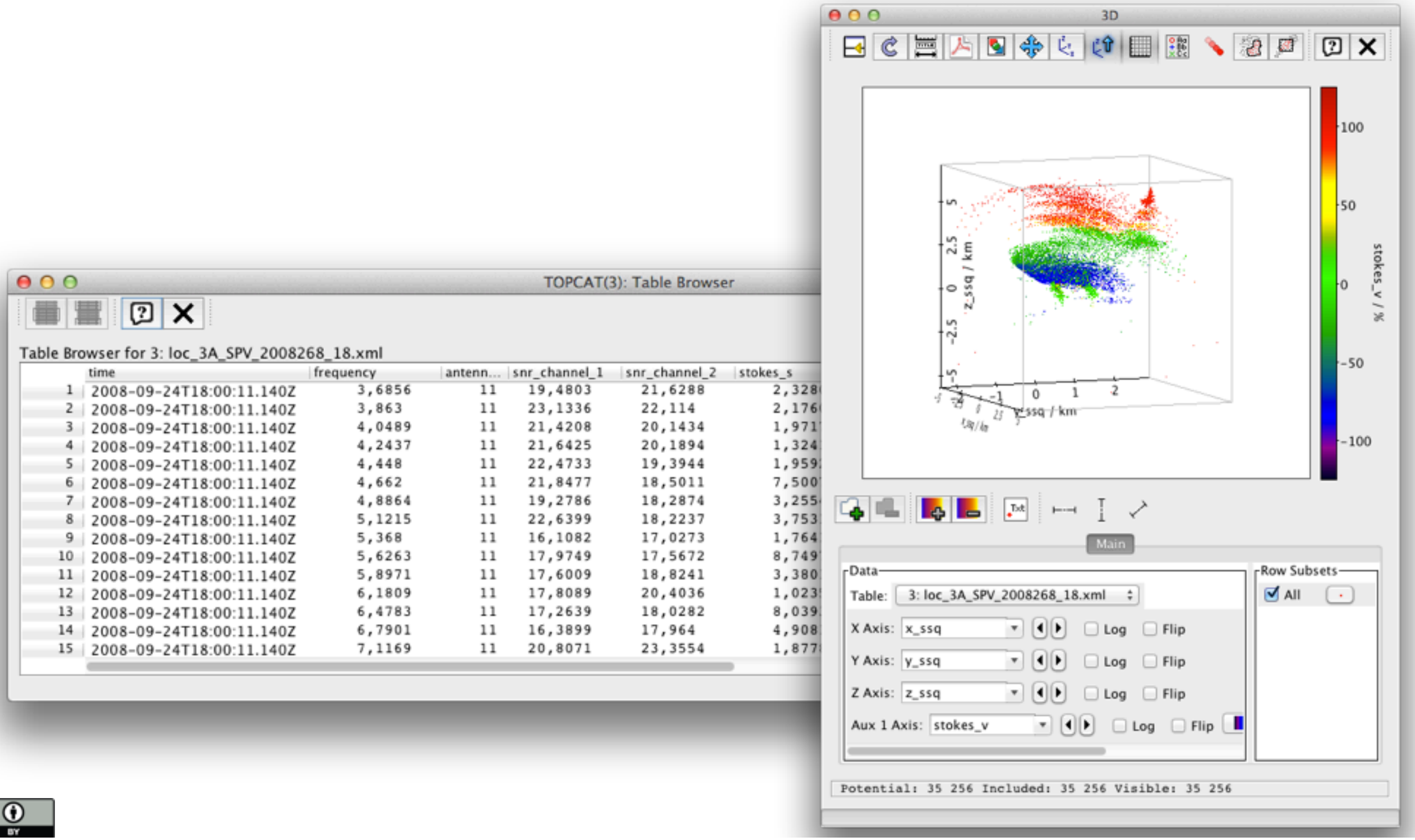
- Simulation database:
  - ExPRES (Exoplanetary and Planetary Radio Emission Simulator)

Données Radio Jupiter à Nançay

- Routine Décamétrique mise en ligne via VESPA



Cassini/RPWS VOTable data displayed in TOPCAT

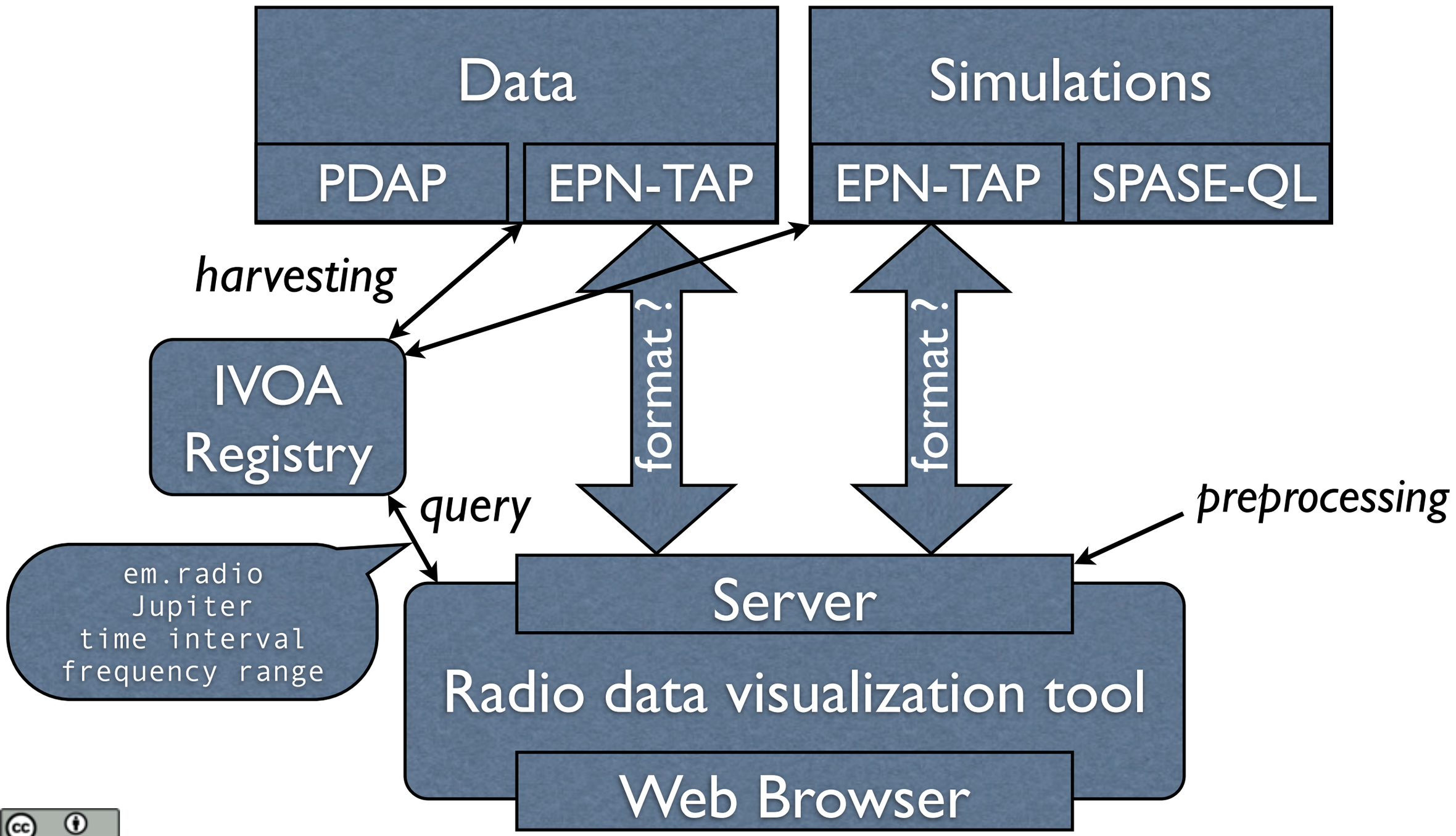


Projects and Prototype(s)

- Context: *The CDPP (french data centre for plasma physics) wants to propose tools to exploit radio datasets (especially those archived at CDPP). A «radio» tool, comparable to the AMDA/CDPP tool, is planned: ongoing definition phase, possible funding available within 2-3 years. This tool should:*
  - be interoperable, multi-instrument, multi-point,
  - contain selection tools adapted to the various radio observables (flux, polarization, location...)
  - allow light travel time correction
- A first prototype:
  Portal SACRED (*Simulated Auroral Cyclotron Radio Emission Database*).
  Use case: Comparison of simulations and observations, preparation of future missions…
  - SILFE tools (*Spectral Information for Low Frequency Emissions*):
    - at the moment access to local data only
    - observation and simulation data stored with VOTable format #1
    - close future: remote access (with EPN-TAP) + SAMP
    - formats: VOTable (soon FITS and NetCDF)
- Prototype demo:
  http://typhon.obspm.fr/maser/SILFE

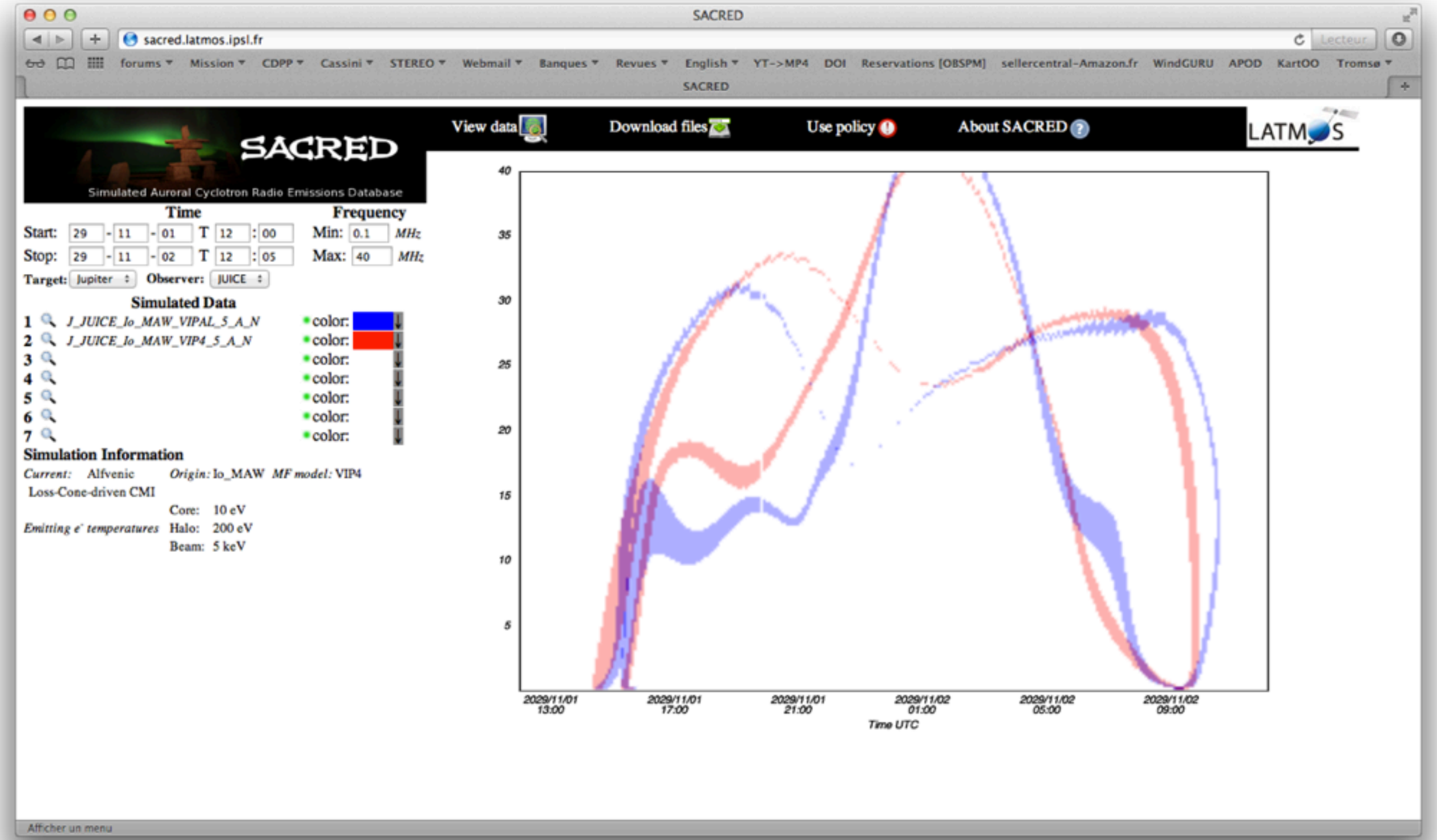
SILFE Architecture

(projet VOParis/LESIA/CDPP)



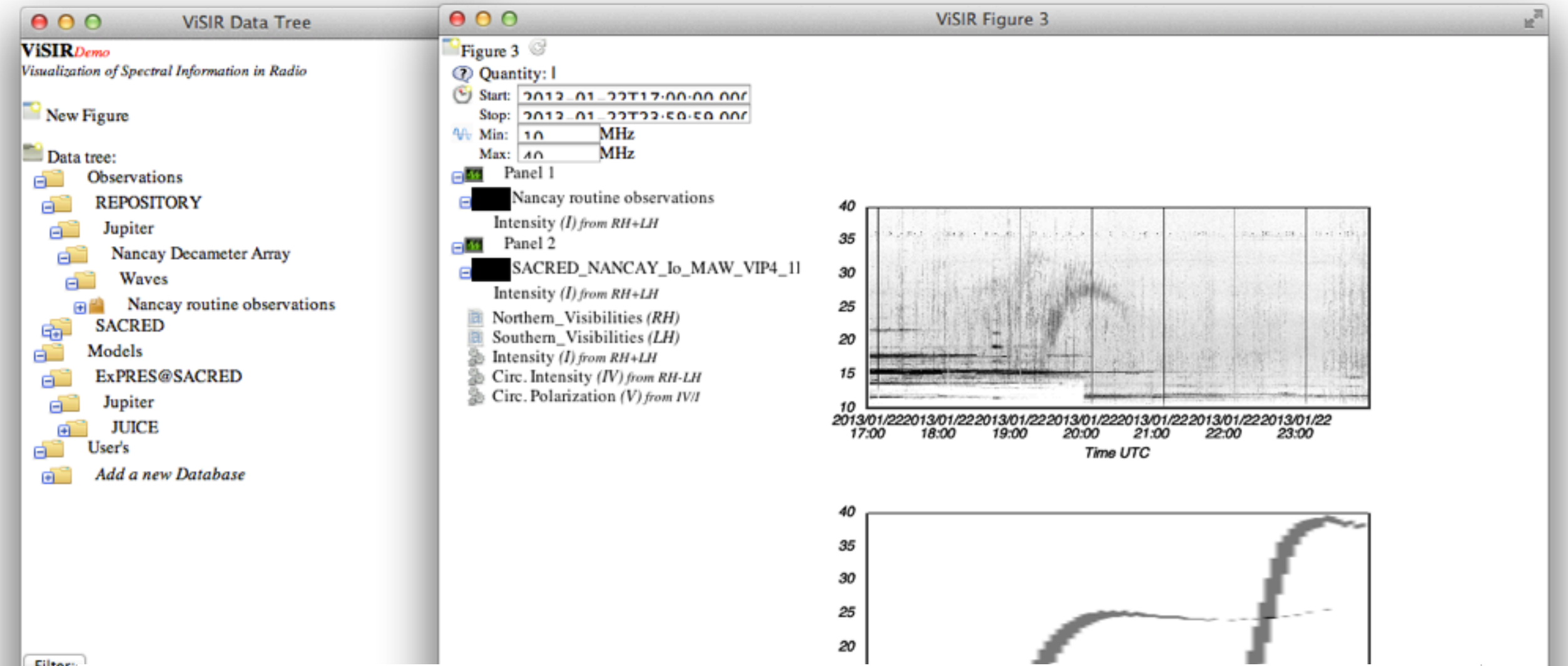
Projet SILFE: client web qui cause à un serveur (préparation des données: gros volumes à telecharger des serveurs de données => réduction avant de l'envoyer au client) utilisation de VESPA (IVOA registry + EPN-TAP)

Preparation of future missions



outil de planning de visibilité radio pour missions spatiales en préparation (ici JUICE, avec un flyby de ganymede (petites coupures verticales à ~20:00, 2029/11/01 = occultation radio par ganymede)

Comparison Simulation/Observations



Databases recently added:

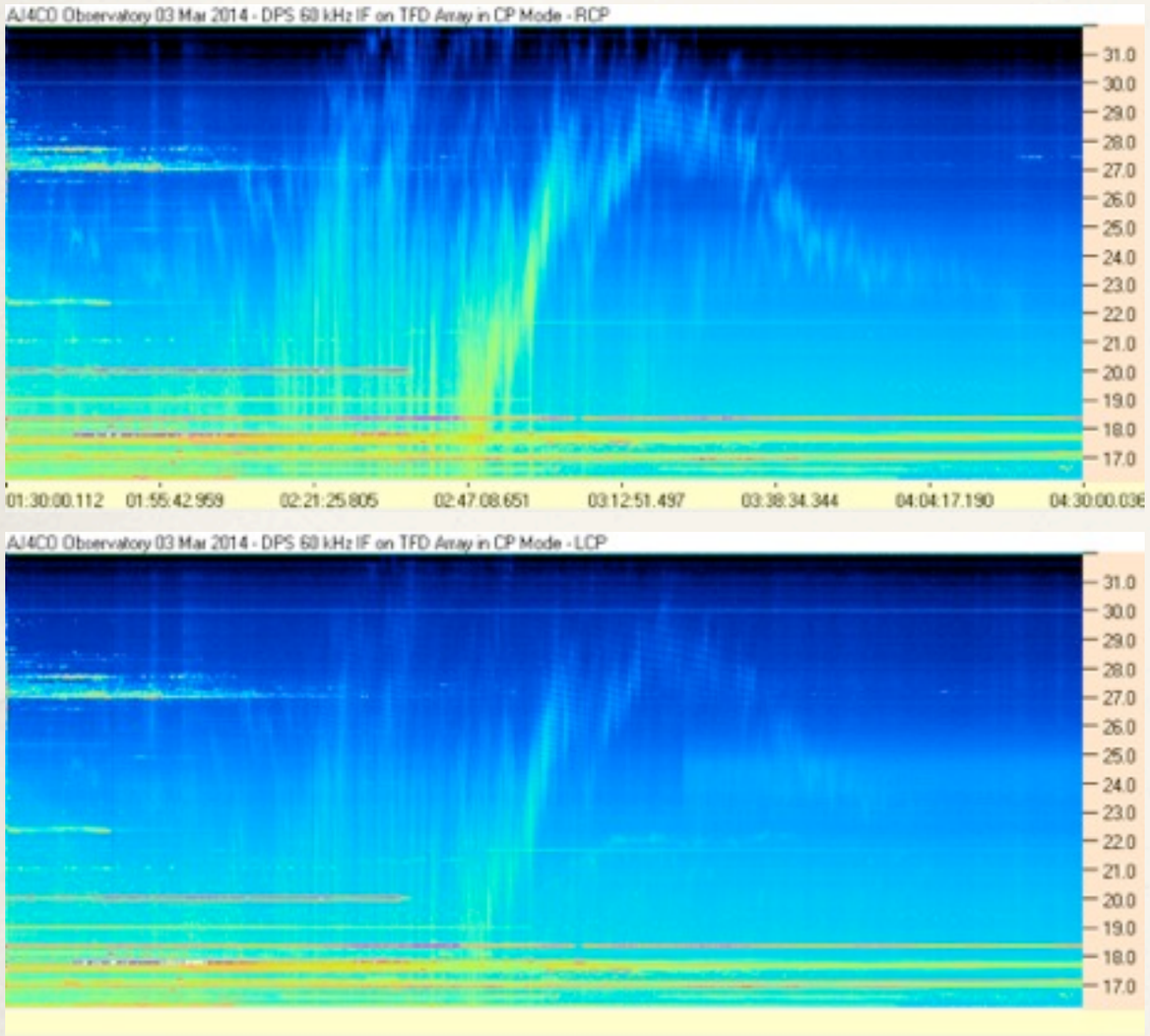
- NASA/PDS (Galileo/PWS, Voyager/PWS, Cassini/RPWS...)
- Iitate Observatory Radio Telescope (Japan)

Amateur radio data RadioJOVE

- Collaboration avec RadioJOVE
  - projet à visée éducative aux USA: kit antenna+recepteur+calibrateur à monter soit même.
  - plus de 1500 kits distribués à travers le monde
  - kit de base: série temporelle à 20.5 MHz
  - observation radio Solaire et Jupiter.
  - certains utilisateurs plus avancés fournissent des données «spectrogrammes» de très bonne qualité

- Partager les données du projet RadioJOVE dans VESPA
  - discussion en cours: format de données, métadonnées, volumes, présélection ?
  - Meeting la semaine dernière, réception très positive !

RadioJOVE data from D. Typinski (very clean data !!!)



à comparer à Nançay (pas le même jour)