



# Updated heliophysics services in VESPA: science products, service design and capabilities

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# Heliophysics services in VESPA

## (Virtual European Solar and Planetary Access)

- Heliophysics:  
*Solar physics, interplanetary medium, planetary magnetospheres/plasma*
- Remote sensing: images, spectra, dynamic spectra, events, cubes  
In-situ: time-series, dynamic spectra, events  
Modelled: images, spectra, time-series, dynamic spectra, events, cubes
- VESPA: TAP table compliant with EPNcore dictionary
- Updated services from ObsParis and Nançay

# Updated Heliophysics Services

- BASS2000: daily solar images at various wavelengths
- HFC1AR/HFC1T3: heliophysics features: active regions, radio bursts
- NRH: Nançay Radio Heliograph: images, movies
- ORFEES: Nançay solar monitoring antenna: dynamic spectra
- NDA: Nançay Decameter Array: dynamic spectra (Sun and Jupiter)
- MASER (Voyager/PRA, Cassini/Kronos, Wind/Waves, Juno/Waves...): dynamic spectra, events, times-series (Sun and planets)
- EXPRES: modelled dynamic spectra (Jupiter)
  
- **Update:** Move to DaCHS 2.5, add datalink support, new metadata ingestion methods...

# Updates and new features

- Using new metadata ingestion method.
- Using datalink when possible, to link with:
  - progenitor data
  - quicklooks (often several formats available)
  - documentation / metadata
  - data access API (see below)
- Data access API for time-series and dynamic spectra (data streaming):
  - HAPI (Heliophysics API: <https://github.com/hapi-server>)
  - Das2 (temporal resampling on the y: <http://das2.org>)
- Serve catalogues of spectral-temporal features (using TFCat format)
- Serve collections and datasets associated to recent publications (e.g., supplementary material)

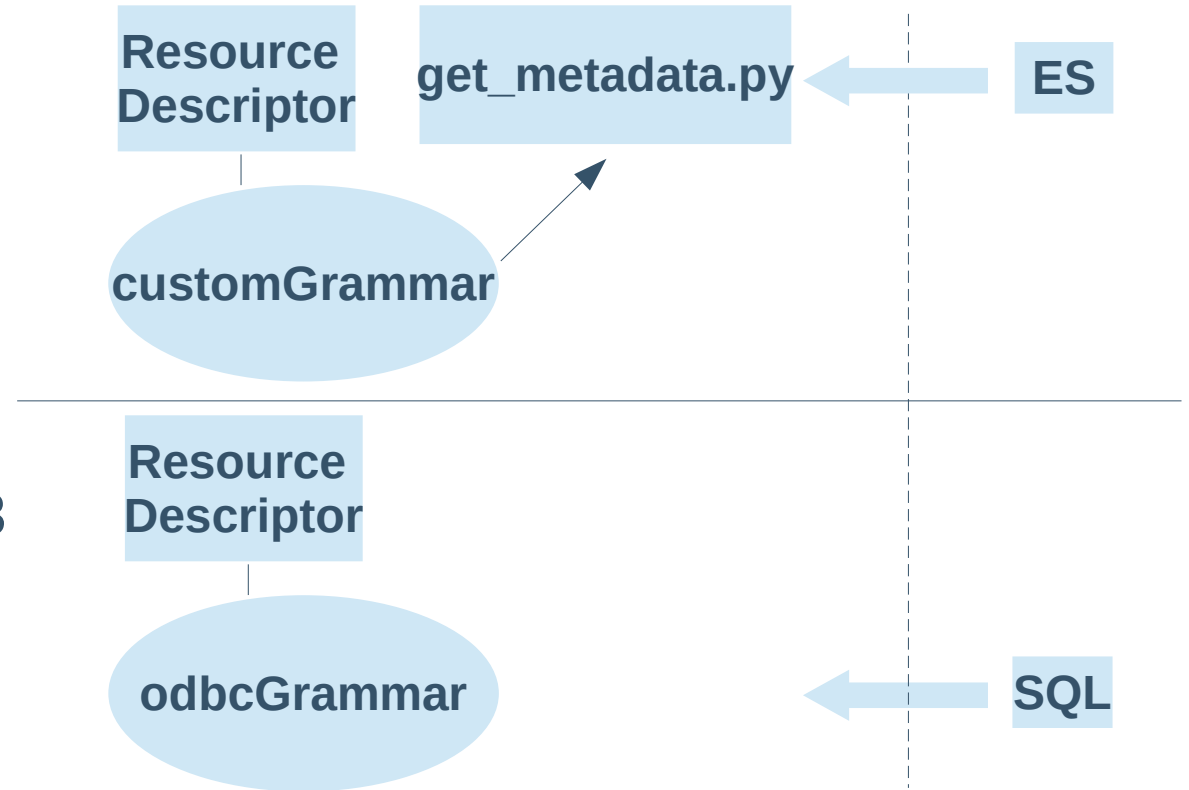
# EPN-TAP Helio Services

## Technical aspects

DaCHS

EPN-TAP standard

- NRH / ORFEES
  - CustomGrammar
    - Elasticsearch
- bass2000, hfc1ar, hfc1t3
  - odbcGrammar



# NRH/ORFEES

## CustomGrammar

### Gathering metadata

- CustomGrammar calls the `get_metadata.py`
- Json containing query parameters
- `Elasticsearch.helpers.scan`
  - To iterate over query result

```
class RowIterator(CustomRowIterator):
    def _iterRows(self):
        with open(self.sourceToken, 'r') as f:
            rdsb_search_params = json.load(f)
            headers={'Content-type' : 'application/json'}

            es = Elasticsearch(rdsb_search_params['query_url'], verify_certs=False)

            results = elasticsearch.helpers.scan(es,
                index="nrh",
                query= rdsb_search_params['query_data'])

            for item in results:
                #print(item["_source"])
                md = my_metadata(item['_id'], item['_source'])

                yield md
```

[Extract of get\\_metadata.py](#)

# NRH thumbnails / datalinks

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Refine your search [ADQL Query](#) [Back To Services Results](#)

Main Parameters

Target Name

Target Class

Dataproduct Type

Instrument Host Name

Instrument Name

Processing level

Time

Location

Spectral

Illumination

Data Reference

Optional

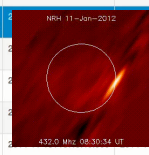
Other

### Results in service NRH

**NRH - Nancy Radio Heliograph Observation database**  
Service description to be provided  
Credits:  
Publisher: PADC/CDN

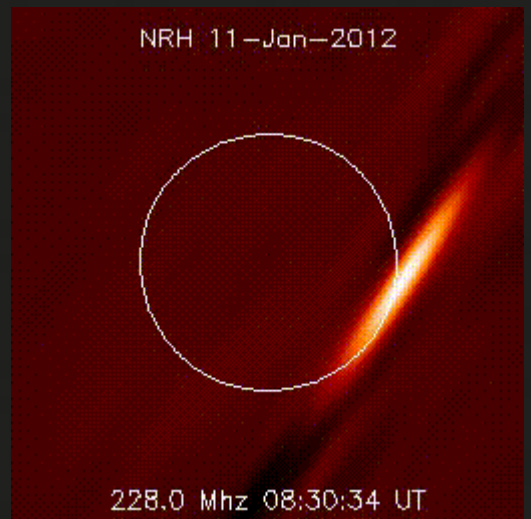
Column visibility Show all Hide all  
Select All in current page Reset Selection

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url	datalink
zXnyA30BB1GYkXdcvHcl	image	Sun	2004-05-31T08:18:37.999	2004-05-31T09:33:43.000	https://rsdb.obs-nan...	SEN
zXnVAH0BB1GYkXdcYhlo	image	Sun	2012-01-11T08:29:34.000	2012-01-11T11:21:04.999	https://rsdb.obs-nan...	SEN
zXnUA0BB1GYkXdcjD1m	image	Sun	2014-09-02T14:59:06.000	2014-09-02T15:20:59.000	https://rsdb.obs-nan...	SEN
ZXnsAX0BB1GYkXdcWEEE	image	Sun	2014-07-29T08:29:08.999	2014-07-29T11:20:41.000	https://rsdb.obs-nan...	SEN
zXnOBH0BB1GYkXdcNZ4U	image	Sun	2014-10-18T06:23.999	2014-10-18T10:57.56.000	https://rsdb.obs-nan...	SEN
zXnoAX0BB1GYkXdcseEBN	image	Sun	2009-09-11T11:18:46.000	2009-09-11T14:09:48.000	https://rsdb.obs-nan...	SEN
ZXnkAX0BB1GYkXdcdzzy	image	Sun	2014-07-29T08:29:08.999	2014-07-29T11:20:41.000	https://rsdb.obs-nan...	SEN
zXnJA30BB1GYkXdcPgyg	image	Sun	1998-03-03T08:18:15.999	1998-03-03T15:47:58.000	https://rsdb.obs-nan...	SEN
zXnhBX0BB1GYkXdcWMTY	image	Sun	2010-02-17T08:34:33.999	2010-02-17T11:26:06.000	https://rsdb.obs-nan...	SEN
zXnhAX0BB1GYkXdcj@Q	image	Sun	2014-10-18T06:23.999	2014-10-18T10:57.56.000	https://rsdb.obs-nan...	SEN
zXnVB40BB1GYkXdcvabku	image	Sun	2009-09-11T11:18:46.000	2009-09-11T14:09:48.000	https://rsdb.obs-nan...	SEN



SEN

https://rsdb.obs-nancy.fr/QL/Nrh/gif/nrh11012012\_2280.gif



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Refine your search

Main Parameters

Target Name

Target Class

Dataproduct Type

Instrument Host Name

Instrument Name

Processing level

### Datalink

GIF preview at frequency = 1509 MHz

GIF preview at frequency = 1509 MHz

GIF preview at frequency = 2280 MHz

GIF preview at frequency = 4080 MHz

GIF preview at frequency = 4320 MHz

Close Submit

**NRH - Nancy Radio Heliograph Observation database**  
Service description to be provided  
Credits:  
Publisher: PADC/CDN

Column visibility Show all Hide all  
Select All in current page Reset Selection

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url	datalink
zXnyA30BB1GYkXdcvHcl	image	Sun	2004-05-31T08:18:37.999	2004-05-31T09:33:43.000	https://rsdb.obs-nan...	SEN
zXnVAH0BB1GYkXdcYhlo	image	Sun	2012-01-11T08:29:34.000	2012-01-11T11:21:04.999	https://rsdb.obs-nan...	SEN
zXnUA0BB1GYkXdcjD1m	image	Sun	2014-09-02T14:59:06.000	2014-09-02T15:20:59.000	https://rsdb.obs-nan...	SEN

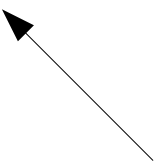
# Bass2000, hfc1ar, hfc1t3 odbcGrammar

Contains connection chain



```
<sources pattern="data/driver.txt">
```

```
<odbcGrammar query="SELECT * FROM  
hfc1.view_sp_hqi JOIN hfc1.sunspots ON  
hfc1.view_sp_hqi.ID_SUNSPOT=hfc1.sunspots.ID_S  
UNSPOT LIMIT 100">
```



SQL query




# Hfc1ar : s\_region active regions


- From Chaincode to s\_region

- Chaincode : contour of the active region
  - Each number in the chain defines the location of next pixel
- Coordinate conversions :
  - Pixels , original record referential
    - chaincode

- Helioprojective : center of the sun, angular radius
  - Pairs of coordinates (x,y)

- Carrington : spherical coordinates in an absolute referential
  - Pairs of coordinates (lon,lat)

 `sunpy.net.helio.chaincode`

 `astropy.coordinates.SkyCoord  
transform_to  
sunpy.coordinates frames`

# s\_region

- Transform (lon,lat) pairs into s\_region polygons
- Only simple polygons allowed
  - shapely.is\_simple function
    - Simple polygons
      - « Polygon lon1 lat1 lon2 lat2 ... »
    - Multi polygons
      - Shapely.make\_simple function returns a list of shapes
        - Several polygons : regroup in one, small circle to make the union
        - Other shapes : (eg : line, multipolygon) solutions to be found

Show 10 entries

Column visibility: Show all Hide all

Select All in current page Reset Selection

granule_uid	dataproducit_type	target_name	time_min (d)	time_max (d)	access_url	s_region
ar_20220419_035533_808_2610	catalogue_item	Sun	2022-04-19T03:55:32.999	2022-04-19T03:55:32.999	ftp://fpbass2000.ob...	
ar_20220419_035533_3362_1165	catalogue_item	Sun	2022-04-19T03:55:32.999	2022-04-19T03:55:32.999	ftp://fpbass2000.ob...	Polygon UNKNOWNFrame 248.64
ar_20220419_035533_3182_2569	catalogue_item	Sun	2022-04-19T03:55:32.999	2022-04-19T03:55:32.999	ftp://fpbass2000.ob...	Polygon UNKNOWNFrame 201.18
ar_20220419_035533_3088_1756	catalogue_item	Sun	2022-04-19T03:55:32.999	2022-04-19T03:55:32.999	ftp://fpbass2000.ob...	Polygon UNKNOWNFrame 190.70
ar_20220419_035533_2718_2600	catalogue_item	Sun	2022-04-19T03:55:32.999	2022-04-19T03:55:32.999	ftp://fpbass2000.ob...	Polygon UNKNOWNFrame 178.24
ar_20220419_035533_2356_1474	catalogue_item	Sun	2022-04-19T03:55:32.999	2022-04-19T03:55:32.999	ftp://fpbass2000.ob...	Polygon UNKNOWNFrame 164.96
ar_20220419_035533_2273_2721	catalogue_item	Sun	2022-04-19T03:55:32.999	2022-04-19T03:55:32.999	ftp://fpbass2000.ob...	Polygon UNKNOWNFrame 162.65
ar_20220419_035533_1695_1480	catalogue_item	Sun	2022-04-19T03:55:32.999	2022-04-19T03:55:32.999	ftp://fpbass2000.ob...	Polygon UNKNOWNFrame 135.86
ar_20220419_035533_1404_1233	catalogue_item	Sun	2022-04-19T03:55:32.999	2022-04-19T03:55:32.999	ftp://fpbass2000.ob...	Polygon UNKNOWNFrame 124.02
ar_20220419_035533_1298_1432	catalogue_item	Sun	2022-04-19T03:55:32.999	2022-04-19T03:55:32.999	ftp://fpbass2000.ob...	Polygon UNKNOWNFrame 118.83

Showing 1 to 10 of 1,153,779 entries 3 rows selected

Data Selection - Metadata Selection - All Data - All Metadata -

Download  
Send Table

SAMP

VESPA



Aladin Beta

s\_region

Aladin v11.0 \*\*\* BETA VERSION (based on v11.024) \*\*\*

Catalogue Graphique Couverture Outil Vue Interop Aide

Commande: 15:53:18.35954 -37:13:53.5977 Référentiel: ICRS Projection: Aitoff

Sun evui-aia304-2012

Warning: You are probably using an incompatible spatial reference (planets vs sky). This incompatibility is ignored in this beta release (test phase).

c2max	c3min	c3max	s_region	c1 resol min	c1 resol max	c2 resol m
..-29.182031031..			FoV			
..-10.708683328..			FoV			
..18.535449782..			FoV			

Chercher

257.403000 -77.399

14:18:03.22 -12:43:51.8

180° x 109.2°

# hfc1ar: update

Heavy database

odbcGrammar with **update** : new **<makeQuery>** element (DaCHS 2.5.5)

```
<table id="epn_core" onDisk="True" adql="True" primary="id_ar" dupePolicy="dropOld" >
<data id="import" updating="True">
  <sources pattern="data/driver.txt"/>
  <odbcGrammar>
    <makeQuery>
      <code>
        try:
          with base.getTableConn() as conn:
            print(next(conn.query("SELECT MAX(time_min) FROM \schema.epn_core"))[0])

            localMax = next(conn.query("SELECT MAX(time_min) FROM \schema.epn_core"))[0]
            fragment = " WHERE (jdint + jdfraction) >= {}".format(escapeSQL(localMax))
            fragment=str(fragment)
            print(fragment)

          except base.DBError as msg:
            base.ui.notifyWarning(f"{msg} while harvesting: full re-harvest")
            fragment = ""

        return f"SELECT * FROM hfc1.view_ar_hqi JOIN hfc1.activeregions USING (id_ar) {fragment}"

      </code>
    </makeQuery>
  </odbcGrammar>
</data>
</table>
```

**Build a fragment of the odbc query**

**Access the postgres database of the service – previously imported**

**Return the final odbc query  
Default : query without fragment**

Daily cron with service import



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