europlanet 2024 Research Infrastructure

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 (340k products)
- HFC1AR/HFC1T3: heliophysics features: active regions, radio bursts (1.25M events)
- NRH: Nançay Radio Heliograph: images, movies (18k products)
- ORFEES: Nançay solar monitoring antenna: dynamic spectra (1k products)
- NDA: Nançay Decameter Array: dynamic spectra (Sun and Jupiter) (20k products)
- MASER (Voyager/PRA, Cassini/Kronos, Wind/Waves, Juno/Waves…): dynamic spectra, events, times-series (Sun and planets) (>1.5M products)
- ExPRES: modelled dynamic spectra (Jupiter) (40k products)

- **Update:** Move to DaCHS 2.5, add datalink support, new metadata ingestion methods…

Updates and new features

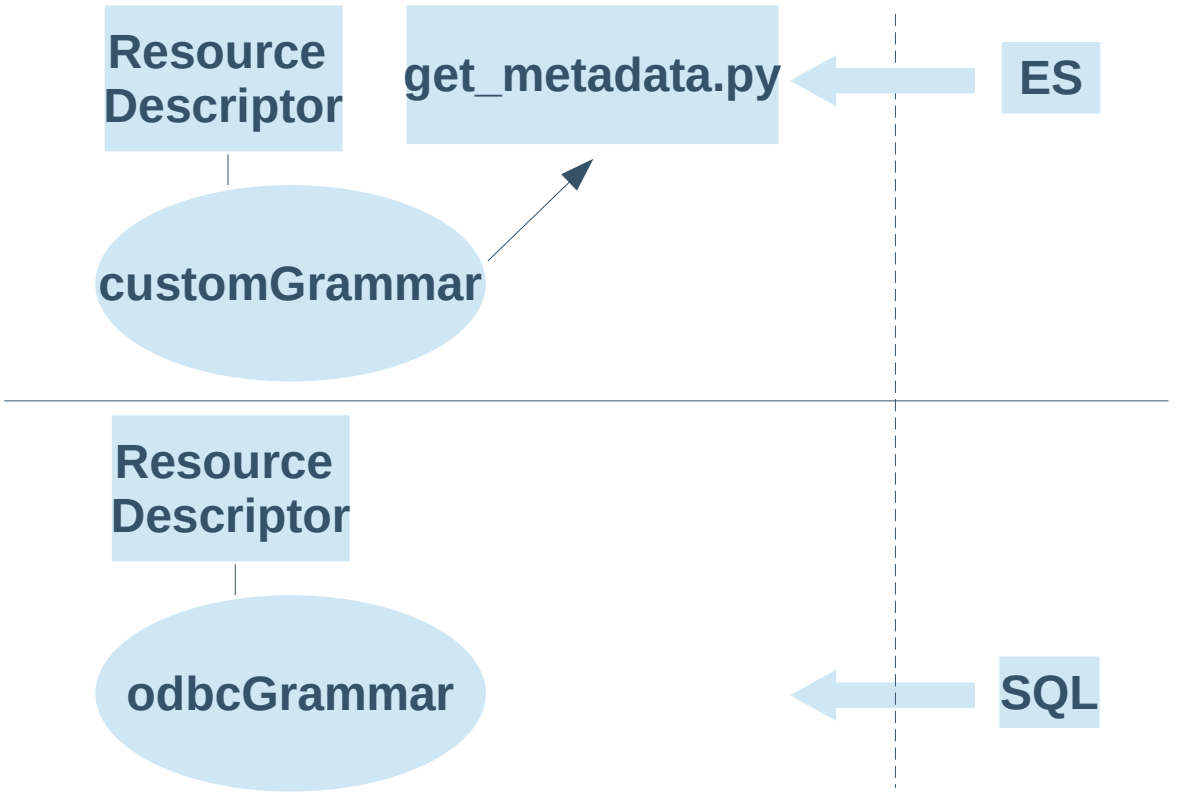
- Using new metadata ingestion method.
- Using datalink when possible, to link with:
  - progenitor data
  - quicklooks (often several formats available)
  - documentation / metadata
  - data access API (see below)
- Data access API for time-series and dynamic spectra (data streaming):
  - HAPI (Heliophysics 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

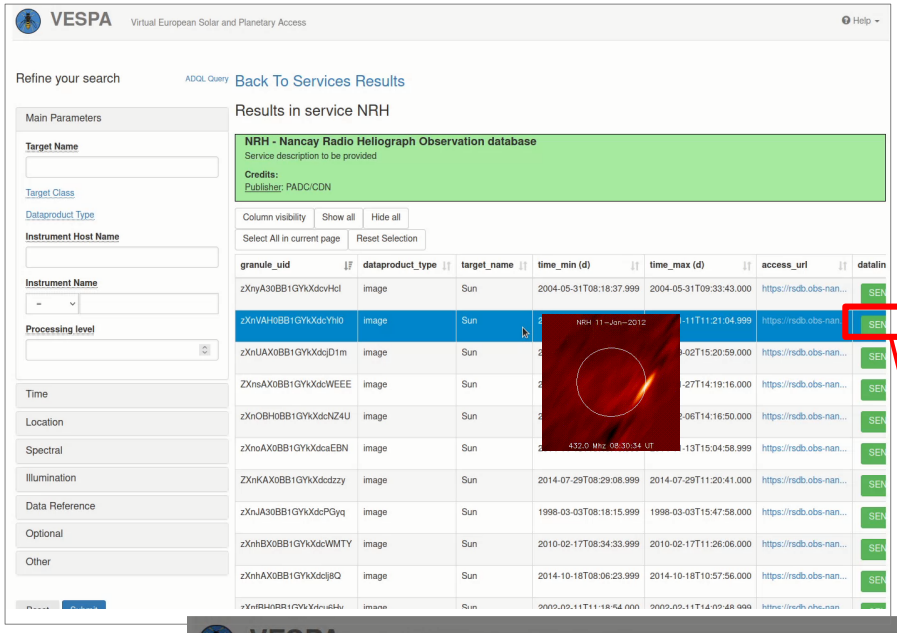
Gathering metadata

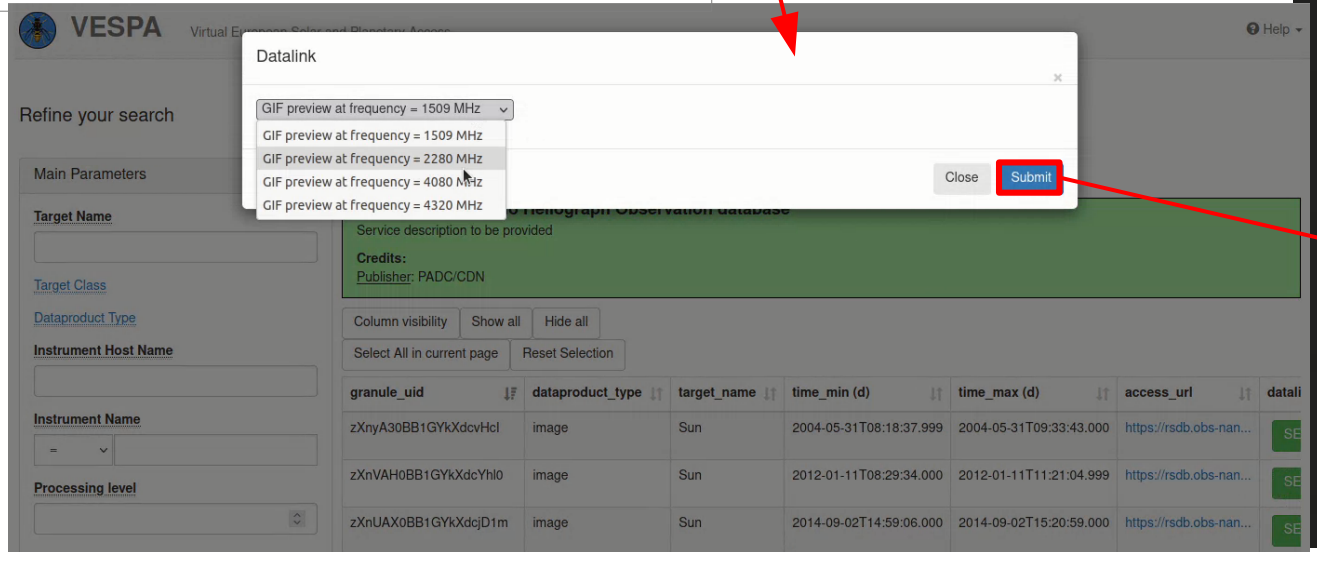
- CustomGrammar calls the get_metadata.py
- Json containing query parameters
- Elsaticsearch.helpers.scan
  - To iterate over query result

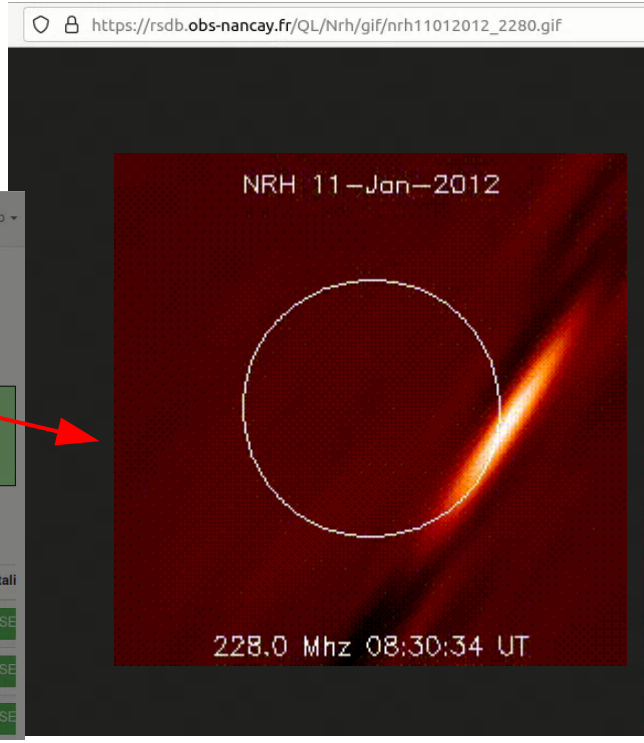
Extract of get_metadata.py

```
class RowIterator(CustomRowIterator):
    def _iterRows(self):
        with open(self.sourceToken, 'r') as f:

            rsdb_search_params = json.load(f)
            headers={'Content-type' :'application/json'}

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


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


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

                yield md
```

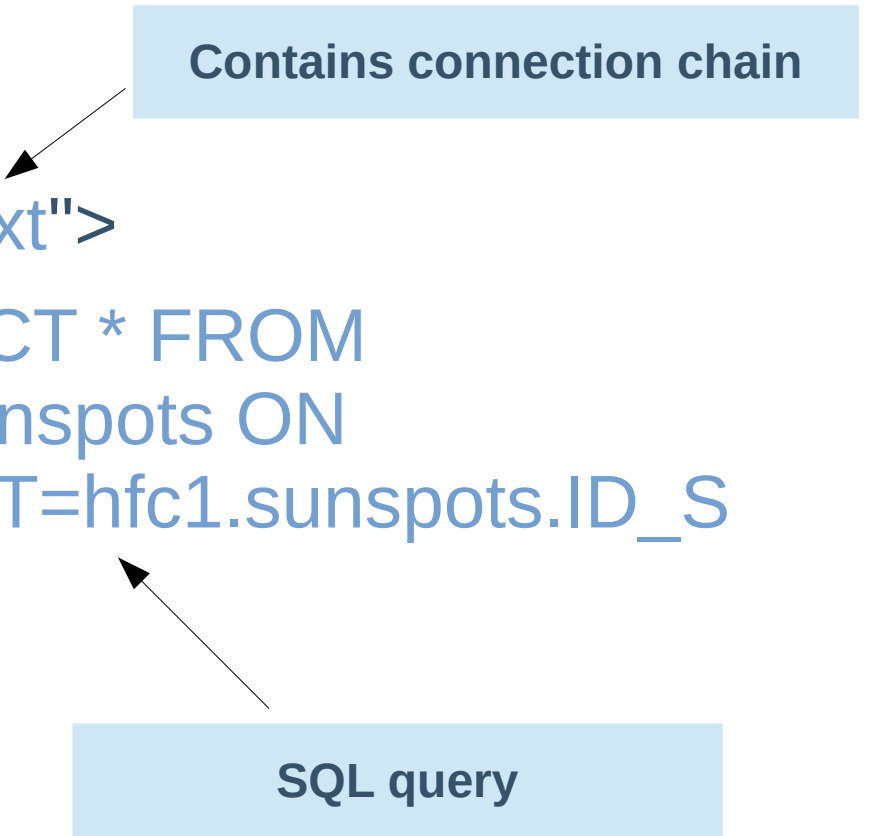
NRH thumbnails / datalinks







Bass2000, hfc1ar, hfc1t3
odbcGrammar



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`

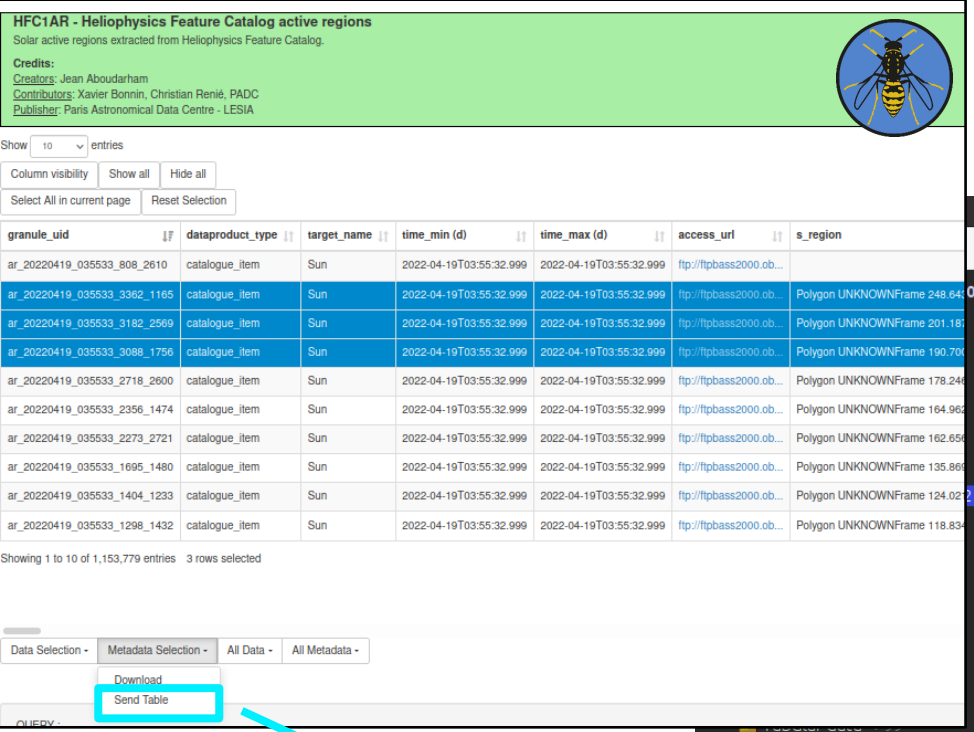
`astropy.coordinates.SkyCoord`
`transform_to`
`sunpy.coordinates frames`

s_region

- Transform (lon,lat) pairs into s_region polygons
- Only simple polygons allowed

  shapely.is_simple funtion
  - 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

s_region

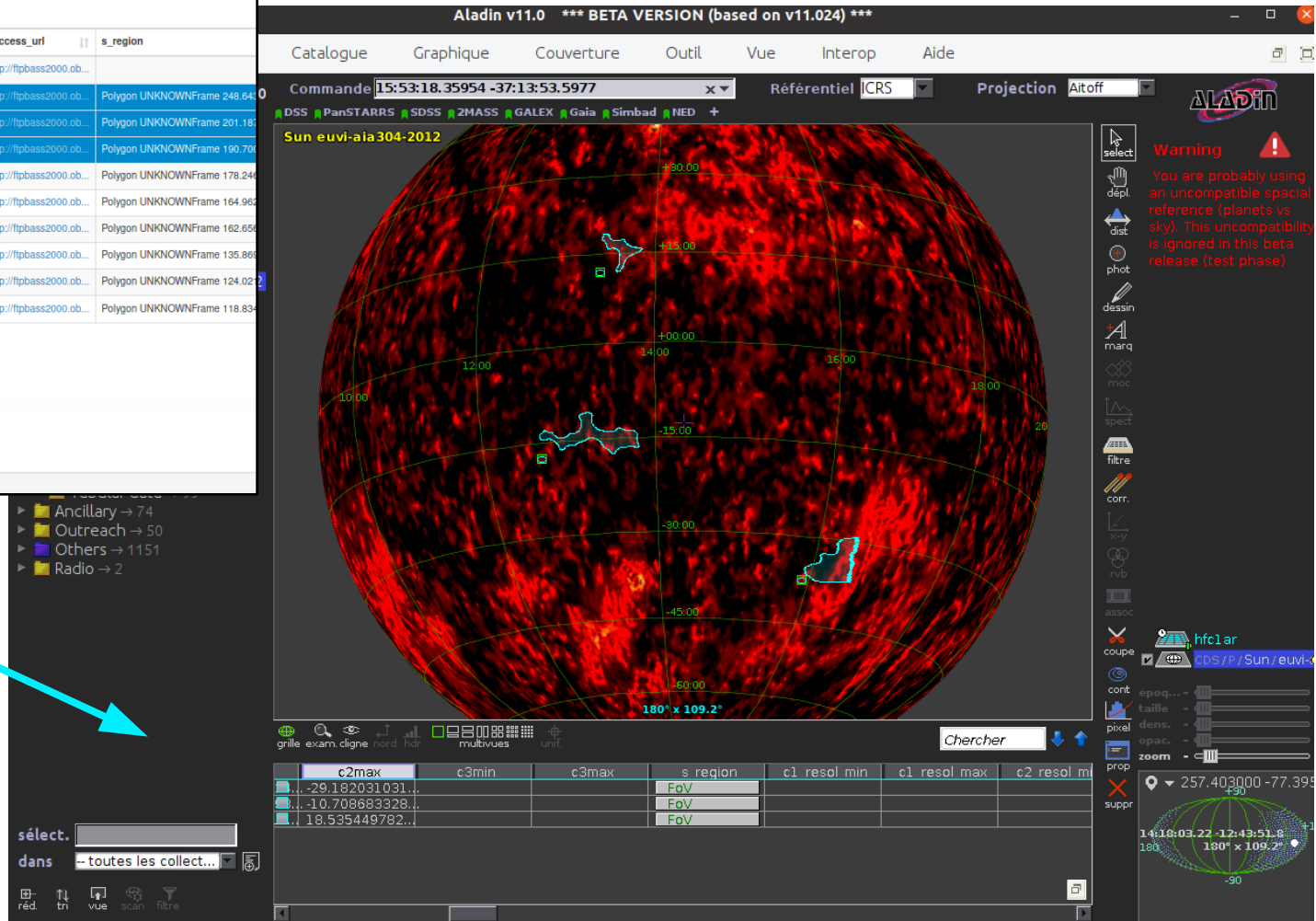


SAMP

VESPA

↓

Aladin Beta



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 + jdfrac) >= {}".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>
```

Access the posgtgres database of the service – previously imported

Build a fragment of the odbc query

Return the final odbc query
Default : query without fragment

Daily cron with service import

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