Improvements to the Virtual Solar Observatory

We present the updated web-based user interface to the Virtual Solar Observatory (VSO), and the current state of user interfaces to VSO.

We look forward to feedback from the solar and heliospheric physics community on the current and planned functionality to help us set our priorities for the coming year.

Access from Python

The VSO has a robust API that allows creation of clients in multiple programming languages. The SunPy team received funding from the ESA Summer of Code in Space to support a summer intern, who added querying and retrieval of data using the VSO API. SunPy has two clients to search the VSO:

**VSOClient:** for automated queries; can be subclassed and methods overridden.

**InteractiveVSOClient:** for interactive queries; will prompt for input as needed.

The interactive client has a `query_legacy` function that replicates the IDL `vso_search` command, to allow existing IDL users to get up to speed quickly. You can also use the `search` function, which will route between the `query` and `query_legacy` functions as appropriate.

**Special Features:**
- Hierarchical directory building by giving a path template, eg:
  ```python
  client = sunpy.net.vso.InteractiveVSOClient
  queryResponse = client.search(\(...\)
  client.get(queryResponse, path='/tap/[source]/[instrument]/[file]/\')
  ```
- Asynchronous (background) retrieval of files. You can append `.wait()` to the retrieval call to have the procedure only return after the downloads have completed:
  ```python
  client.get(queryResponse).wait()
  ```
- Boolean `or` support to specify more than one of a given parameter via the pipe (`|`) character:
  ```python
  ```

For more information or to download SunPy, visit their website: [http://www.sunpy.org/](http://www.sunpy.org/)

**STATUS:** Complete, available from the SunPy website

### Web User Interface Rewrite

We now have a special exemption from NASA to be allowed to use cookies to save user preferences, but some other rules changes have delayed the full deployment of the new interface.

We announced the testing of the new interface in SolarNews, but the server used for testing went down shortly afterwards, so we’ll still be interested in feedback:


**STATUS:** Available for testing; requires backend changes before moving into production.

### SDO/EVE Data Access

After much too long of a delay, we have fully tested EVE (Extreme Ultraviolet Variability Experiment) irradiance data, but we needed updates to the VSO web user interface to fully support them.

**STATUS:** In testing; should be available by AGU

### Lower Latency AIA NRT Data

The AIA Synoptic Near Real Time data is using an alternate pipeline that does not rely on large batch processing. This means that we can typically serve the AIA NRT (1024x1024, 3 min. cadence) images about 10 to 15 minutes after they are taken.

It can be selected in the IDL interface by specifying `pix=1024`; or via the web interface by selecting AIA under the ‘SDAC’ provider.

The VSO will only show the NRT data for the last 7 days, so when searching for earlier times, you will only get one data set: the fully calibrated data, full resolution (4096x4096), full cadence (12sec for EUV), level 1 data.

**STATUS:** Complete

### VSO Help within IDL

As the VSO uses a series of wrappers around a main object, and the use of tovar to pass values, many IDL commands to tell you what the appropriate variables are don’t return anything useful. Therefore, we have a command `vso_help` that gives information about the VSO IDL commands:

```idl
IDL> vso_help
IDL> vso_help, /search : docs for the vso_search command
IDL> vso_help, /get : docs for the vso_get command
IDL> vso_help, /info : docs for the vso_info command
```

In addition, the `vso_*` commands now support a `help` parameter:

```idl
IDL> a = vso_search(/help)
IDL> a = vso_get(/help)
IDL> a = vso_info(/help)
```

**STATUS:** Done; will be in SolarSoft by AGU

### VSO Registry Search in IDL

As new series are made available through VSO, users need to be able to easily find what datasets and options are available.

```idl
IDL> vso_info /help
```

Print a listing the instruments available through VSO:

```idl
IDL> vso_info /instruments
```

Print a listing of instruments and their associated observatory:

```idl
IDL> vso_info /instrument, /sources
```

Return an array of records (anonymous structures) of physical observables, without printing to the screen:

```idl
IDL> vso_info /output, /output, /physobs, /quiet
```

**STATUS:** Done; will be in SolarSoft by AGU

### SDO Caching Nodes

SDAC and UCLan are now operating as caching nodes for AIA and HMI data, along with NSO, SAO and ROB.

If using IDL, instead of using the `site` keyword with `vso_get`, you can now set the environmental variable:

`VSO_DEFAULT_SITE`

**STATUS:** Complete, in SolarSoft

### Staging for SDO/AIA & HMI Data

Support for ‘staging’ of tarballs of data from AIA (Atmospheric Imaging Assembly) and HMI (Helioseismic and Magnetic Imager), rather than the streaming of tarballs. For users with unreliable connections, this means that the download can continue from when it was interrupted, rather than restarting from the beginning.

There have also been a number of updates to the software behind the scenes to improve the speed and reliability of the distribution and caching of AIA and HMI data.

**STATUS:** Almost done; may be available by AGU

### Current VSO Priorities

Due to the efforts that have gone into getting AIA & HMI data available through the VSO in a reliable manner, other efforts have been delayed for the last couple of years, but we will be focusing our attention in the new year on:

- **New Data Providers**
  - CLIMSO, PROBA-II, DOT, PSPF, SOKS, SORCE, Koronas, ISIOON, DLSP, YNET, SMART, Wendelstein, etc.
- **Updates to Existing Data Providers**
  - Fixing slow or troubled sevices, adding support for ‘sample’, ‘near’ and other options that have been added since those providers were first written.
- **Shopping Cart API**
  - A redesign of the VSO Shopping Cart to allow access from IDL and other interfaces.
- **New features**
  - Spatial searching, searching by class of instrument (eg, coronagraph, photometer), HEK and improved catalog access, etc.

### Mailing Lists

We have created mailing lists to keep people updated on new features and give people a place to discuss proposed changes:

For IDL users: [http://groups.google.com/group/vso-idl](http://groups.google.com/group/vso-idl)

For programmers using the API: [http://groups.google.com/group/vso-api](http://groups.google.com/group/vso-api)

### Support Email Addresses

Have a question or something just doesn’t seem right? There’s now a single e-mail address, and we’ll route your question to the right person:

help@virtualsolar.org

Are there any features that you’d like, or data that you want us to prioritize getting into the VSO?

requests@virtualsolar.org

### Acknowledgements

Funding was provided by ESA through their ESA Summer of Code in Space (SOCIS) and by the Solar Data Analysis Center at NASA’s Goddard Space Flight Center.