

# Introduction to EUI data analysis with IDL

Please send a questions: [krzysztof.barczynski@pmodwrc.ch](mailto:krzysztof.barczynski@pmodwrc.ch)

## Retrieving and looking at data

### HRI LYA

```
IDL> a = vso_search(date='2022/03/06T18:00-2022/03/06T18:10', inst='eui', wave='1216 Angstrom') ; select data
```

```
Records Returned : SDAC_SO : 20/20
```

```
IDL> a=a[WHERE(a.info EQ 'L2')] ;define the data level
```

```
IDL> print_struct, a ;print data structure
```

#	DETECTOR	INSTRUMENT	SOURCE	PROVIDER	INFO	PHYSOBS	FILEID	SIZE	EXPTIME	DARK	ECLIPSE	PERCENTD	URL
0	EUI	SO	SDAC_SO	L2	intensity	data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180030287_V01.fits	1403.	5.000	0	0	0.000		
1	EUI	SO	SDAC_SO	L2	intensity	data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180130287_V01.fits	1406.	5.000	0	0	0.000		
2	EUI	SO	SDAC_SO	L2	intensity	data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180230287_V01.fits	1232.	5.000	0	0	0.000		
3	EUI	SO	SDAC_SO	L2	intensity	data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180330287_V01.fits	1415.	5.000	0	0	0.000		
4	EUI	SO	SDAC_SO	L2	intensity	data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180430287_V01.fits	1418.	5.000	0	0	0.000		
5	EUI	SO	SDAC_SO	L2	intensity	data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180530287_V01.fits	1415.	5.000	0	0	0.000		
6	EUI	SO	SDAC_SO	L2	intensity	data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180630288_V01.fits	1409.	5.000	0	0	0.000		
7	EUI	SO	SDAC_SO	L2	intensity	data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180730288_V01.fits	1406.	5.000	0	0	0.000		
8	EUI	SO	SDAC_SO	L2	intensity	data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180830288_V01.fits	1392.	5.000	0	0	0.000		
9	EUI	SO	SDAC_SO	L2	intensity	data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180930288_V01.fits	1389.	5.000	0	0	0.000		

```
IDL>
```

```
IDL> b = vso_get( a ) ;download data
```

```
% VSO_GET: This will download 10 file(s)
```

```
1 : https://vso1.nascom.nasa.gov/data/so/eui/L2/2022/03/06/solo\_L2\_eui-hrilya1216-image\_20220306T180030287\_V01.fits
```

```
% SOCK_GET_MAIN: 1437120 bytes of solo_L2_eui-hrilya1216-image_20220306T180030287_V01.fits copied in 1.36 seconds.
```

```
2 : https://vso1.nascom.nasa.gov/data/so/eui/L2/2022/03/06/solo\_L2\_eui-hrilya1216-image\_20220306T180130287\_V01.fits
```

```
% SOCK_GET_MAIN: 1440000 bytes of solo_L2_eui-hrilya1216-image_20220306T180130287_V01.fits copied in 1.31 seconds.
```

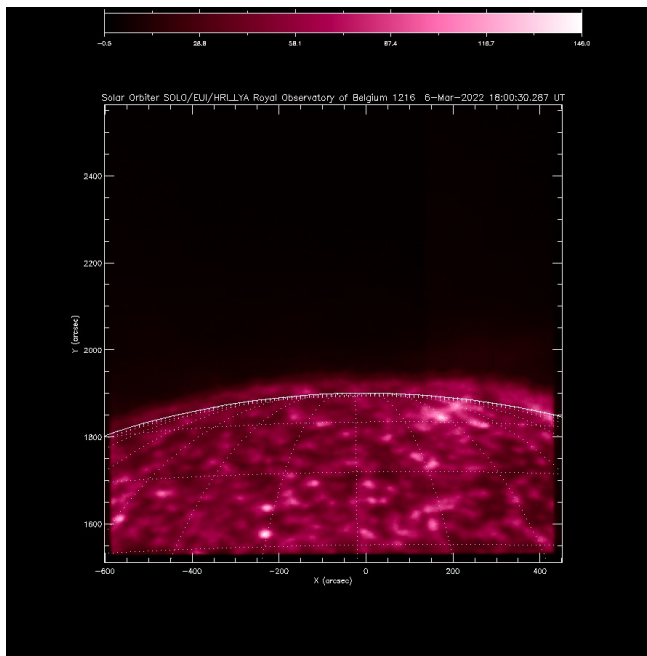
```
3 : https://vso1.nascom.nasa.gov/data/so/eui/L2/2022/03/06/solo\_L2\_eui-hrilya1216-image\_20220306T180230287\_V01.fits
```

```
% SOCK_GET_MAIN: 1261440 bytes of solo_L2_eui-hrilya1216-image_20220306T180230287_V01.fits copied in 1.29 seconds.
```

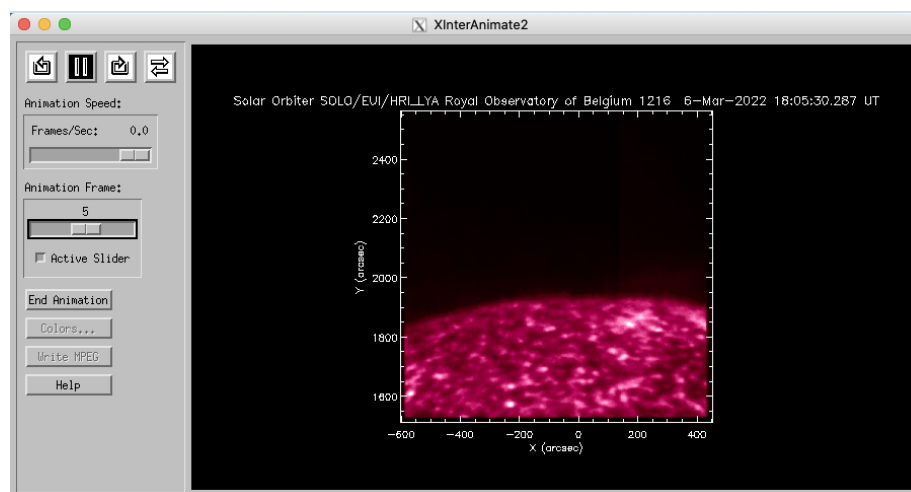
```
4 : https://vso1.nascom.nasa.gov/data/so/eui/L2/2022/03/06/solo\_L2\_eui-hrilya1216-image\_20220306T180330287\_V01.fits
```

```
% SOCK_GET_MAIN: 1448640 bytes of solo_L2_eui-hrilya1216-image_20220306T180330287_V01.fits copied in 1.32 seconds.
```

```
5 : https://vso1.nascom.nasa.gov/data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180430287_V01.fits
% SOCK_GET_MAIN: 1451520 bytes of solo_L2_eui-hrilya1216-image_20220306T180430287_V01.fits copied in 1.35 seconds.
6 : https://vso1.nascom.nasa.gov/data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180530287_V01.fits
% SOCK_GET_MAIN: 1448640 bytes of solo_L2_eui-hrilya1216-image_20220306T180530287_V01.fits copied in 1.42 seconds.
7 : https://vso1.nascom.nasa.gov/data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180630288_V01.fits
% SOCK_GET_MAIN: 1442880 bytes of solo_L2_eui-hrilya1216-image_20220306T180630288_V01.fits copied in 1.32 seconds.
8 : https://vso1.nascom.nasa.gov/data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180730288_V01.fits
% SOCK_GET_MAIN: 1440000 bytes of solo_L2_eui-hrilya1216-image_20220306T180730288_V01.fits copied in 1.31 seconds.
9 : https://vso1.nascom.nasa.gov/data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180830288_V01.fits
% SOCK_GET_MAIN: 1425600 bytes of solo_L2_eui-hrilya1216-image_20220306T180830288_V01.fits copied in 1.32 seconds.
10 : https://vso1.nascom.nasa.gov/data/so/eui/L2/2022/03/06/solo_L2_eui-hrilya1216-image_20220306T180930288_V01.fits
% SOCK_GET_MAIN: 1422720 bytes of solo_L2_eui-hrilya1216-image_20220306T180930288_V01.fits copied in 1.31 seconds.
% VSO_GET: Downloading completed
IDL>
IDL> file_list=file_search('*fits') ; search for downloaded data
IDL> fits2map, file_list, map_hri1216, /USE_WCS ;read fits file to SSW maps, /USE_WCS -the maps use WCS coordinate system
IDL>
IDL> ; HRILYA color Table
IDL> ; Starting from the "red temperature" color table in IDL, we add a bit of blue to make it violet
IDL> loadct, 3, rgb_table=rgb ; 3= red temperature
IDL> factor=indgen(256)/256.
IDL> r=rgb[* ,0]
IDL> g=rgb[* ,1]
IDL> b=rgb[* ,0]*factor
IDL> b=bytsc1(b)
IDL> tvlct, r,g,b ; optional
IDL>
IDL> device, retain=2
IDL> window, 0, xs=900, ys=900
IDL> plot_map, map_hri1216[0], /cbar, /grid, /limb, GRID_SPACING=10 ; create HRI1216 maps with limb and grid, the grid spacing is equal 10 deg
IDL>write_png, 'map_hri1216_0.png', TVRD(/TRUE) ;save window to .png file
```



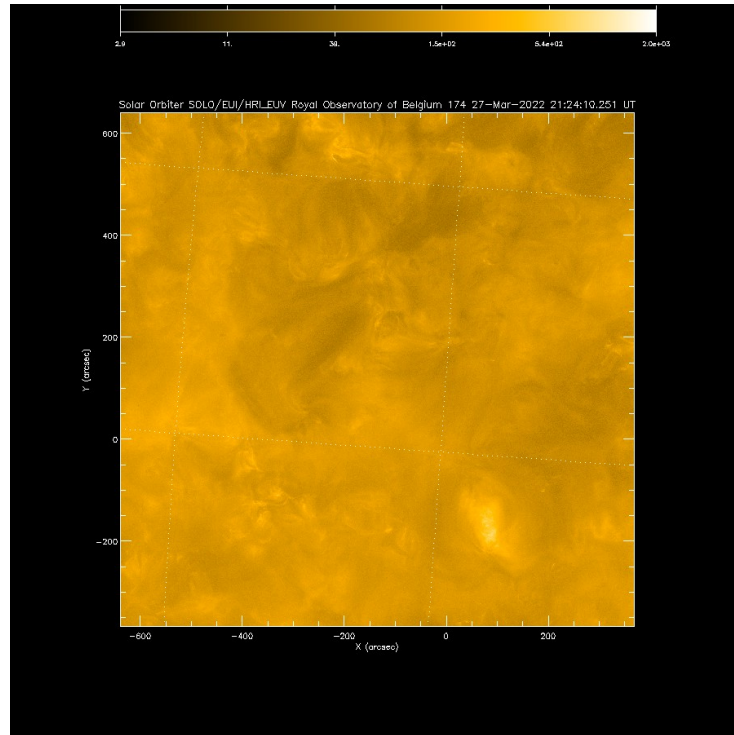
IDL>movie\_map, map\_hri1216, dmin=0, dmax=120 ;generate animation with defined intensity range 0-120 DN/s



## HRI EUV

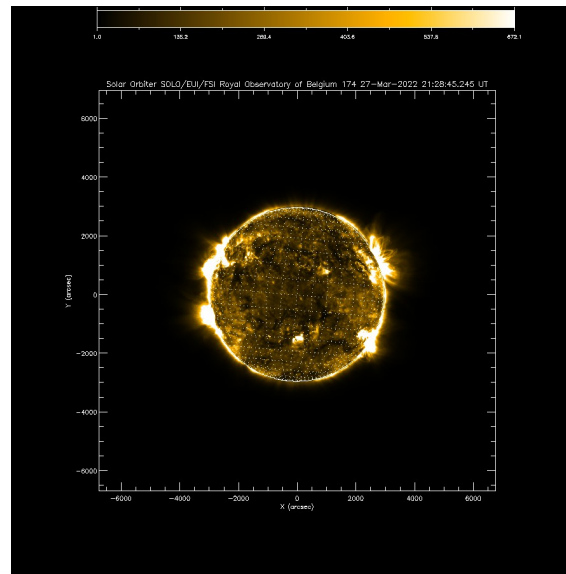
```
IDL>
IDL> a = vso_search(date='2022/03/27T21:24-2022/03/27T21:50', inst='eui', wave='174 Angstrom') ; select data
Records Returned : SDAC_SO : 58/58
IDL> a=a[WHERE(STRMATCH(a.FILEID, '*solo_L2_eui-hriev174*', /FOLD_CASE) EQ 1.0)] ;define the data level
IDL>
IDL> print_struct, a ;print data structure
# DETECTOR INSTRUMENT SOURCE PROVIDER INFO PHYSOBS FILEID SIZE EXPTIME DARK ECLIPSE PERCENTD URL
GETINFO
0 EUI SO SDAC_SO L2 intensity data/so/eui/L2/2022/03/27/solo_L2_eui-hriev174-image_20220327T212410251_V01.fits 6112. 2.800 0 0 0.000
1 EUI SO SDAC_SO L2 intensity data/so/eui/L2/2022/03/27/solo_L2_eui-hriev174-image_20220327T212510251_V01.fits 6308. 2.800 0 0 0.000
...
24 EUI SO SDAC_SO L2 intensity data/so/eui/L2/2022/03/27/solo_L2_eui-hriev174-image_20220327T214810254_V01.fits 6429. 2.800 0 0 0.000
25 EUI SO SDAC_SO L2 intensity data/so/eui/L2/2022/03/27/solo_L2_eui-hriev174-image_20220327T214910254_V01.fits 6008. 2.800 0 0 0.000

IDL> b = vso_get( a ) ;download data
IDL> file_list=file_search('*solo_L2_eui-hriev174*.fits') ; search for downloaded data
IDL> fits2map, file_list, map_hri174, /USE_WCS
IDL> aia_lct,wave=171,/load
IDL> device, retain=2
IDL>
IDL> window, 0, xs=900, ys=900
IDL> plot_map, map_hri174[0], /cbar, /grid, GRID_SPACING=10,dmin=0, dmax=2000.0, /log ; create HRI174 maps with grid, the grid spacing is equal 10 deg;
IDL> WRITE_PNG, 'map_hri174_0.png', TVRD(/TRUE) ;save window to .png file
```



## FSI 174 EUV

```
IDL>a = vso_search(date='2022/03/27T21:24-2022/03/27T21:34', inst='eui', wave='174 Angstrom') ; select data
IDL> a=a[WHERE(STRMATCH(a.FILEID, '*solo_L2_eui-fsi174*', /FOLD_CASE) EQ 1.0)] ;define the data level
IDL> b = vso_get(a) ;download data
IDL> file_list=file_search('*solo_L2_eui-fsi174*.fits')
IDL> fits2map, file_list, map_fsi174, /USE_WCS
IDL> aia_lct,wave=171,/load
IDL> device, retain=2
IDL> window, 0, xs=900, ys=900
IDL> plot_map, map_fsi174[0], /cbar, /grid, /limb, GRID_SPACING=10.0, dmin=1.0, dmax=percentiles(map_fsi174[0].data,value=[0.99]), square_scale=1.0 ; create fsi174 maps with limb and grid, the grid spacing is equal 10 deg;
```



## FSI 304 EUV

```
IDL> a = vso_search(date='2022/02/15T22:00-2022/02/15T22:34', inst='eui', wave='304 Angstrom') ; select data
Records Returned : SDAC_SO : 28/28
IDL> a=a[WHERE(STRMATCH(a.FILEID, '*solo_L2_eui-fsi304*', /FOLD_CASE) EQ 1.0)] ;define the data level
IDL> b = vso_get(a) ;download data
IDL> file_list=file_search('*solo_L2_eui-fsi304*.fits') ; search for downloaded data
IDL> fits2map, file_list, map_fsi304, /USE_WCS
IDL> aia_lct,wave=304,/load
IDL> aia_lct,wave=304,/load
IDL> movie_map, map_fsi304, dmin=0, dmax=300, /log
```

