



ESCAPE

European Science Cluster of Astronomy &
Particle physics ESFRI research Infrastructures

Data services at KIS SDC as a prototype for EST

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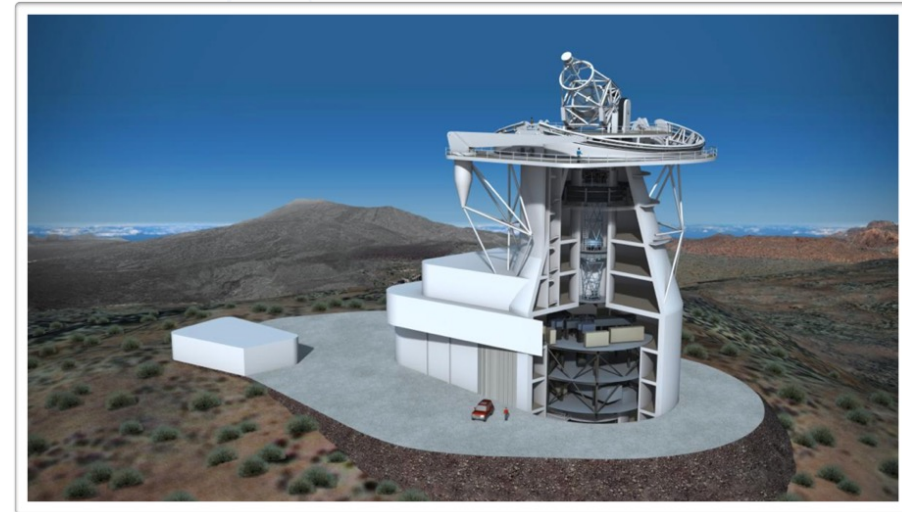
and the KIS SDC Team: J. Beck, S. Berdyugina, A. Bühner, P. Caligari, A. Gorobets, M. Günter,
A. Hochmuth, L. Hohl, P. Kehusmaa, M. Knobloch, S. Müller, S. Patel, T. Yakobchuk

Leibniz Institute for Solar Physics (KIS), Freiburg, Germany



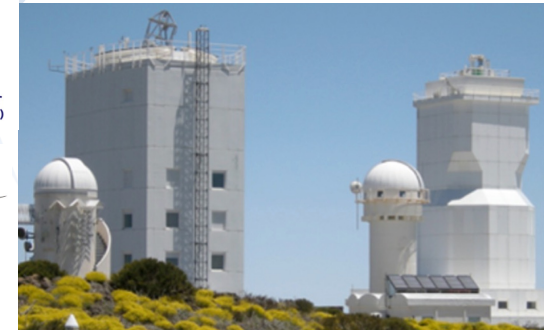
The European Solar Telescope (EST)

- ESFRI Infrastructure since 2016
- In preparatory phase
- To be built in the Canary Islands
- EST engages 23 solar institutions from 17 European countries led by Spain (IAC)
- Leibniz-Institute for Solar Physics (KIS) contributes to EST Data Centre (EST DC)



Leibniz Institute for Solar Physics (KIS)

- Observatorio del Teide, Tenerife:
 - **GREGOR** – 1.5m telescope
 - **VTT** – 70cm Vacuum Tower Telescope
 - **ChroTel** – 35cm Chromospheric Telescope



- 4m Daniel K. Inouye Telescope, **DKIST** (NSO, Maui)
KIS Contribution to DKIST
 - Visible Tunable Filter (VTF)
a spectropolarimetric imager

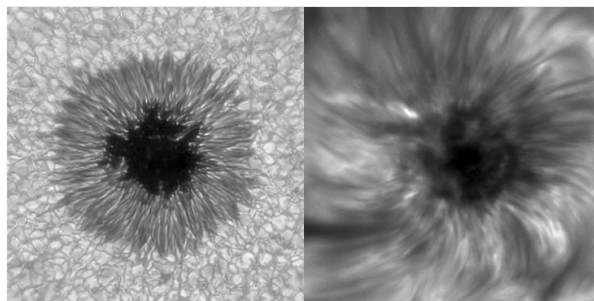
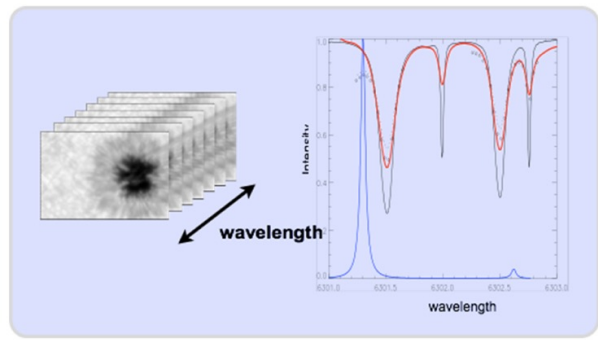


- 4m European Solar Telescope **EST**
KIS Contribution to EST
 - VTF-like instrument
 - Data Centre (EST DC)

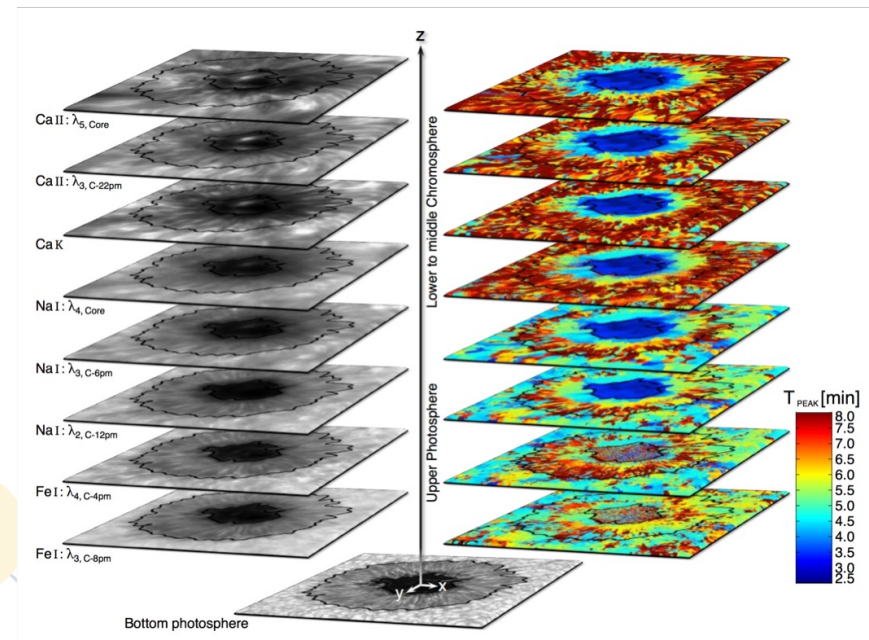


Ground-based Solar Observations

- Studying the dynamic Solar atmosphere
- Mult-instrument/multi-wavelength (explore different atmospheric layers of the Sun)
- Full-Stokes Polarimetry: I, Q, U, V
- High spatial, spectral and temporal resolution data

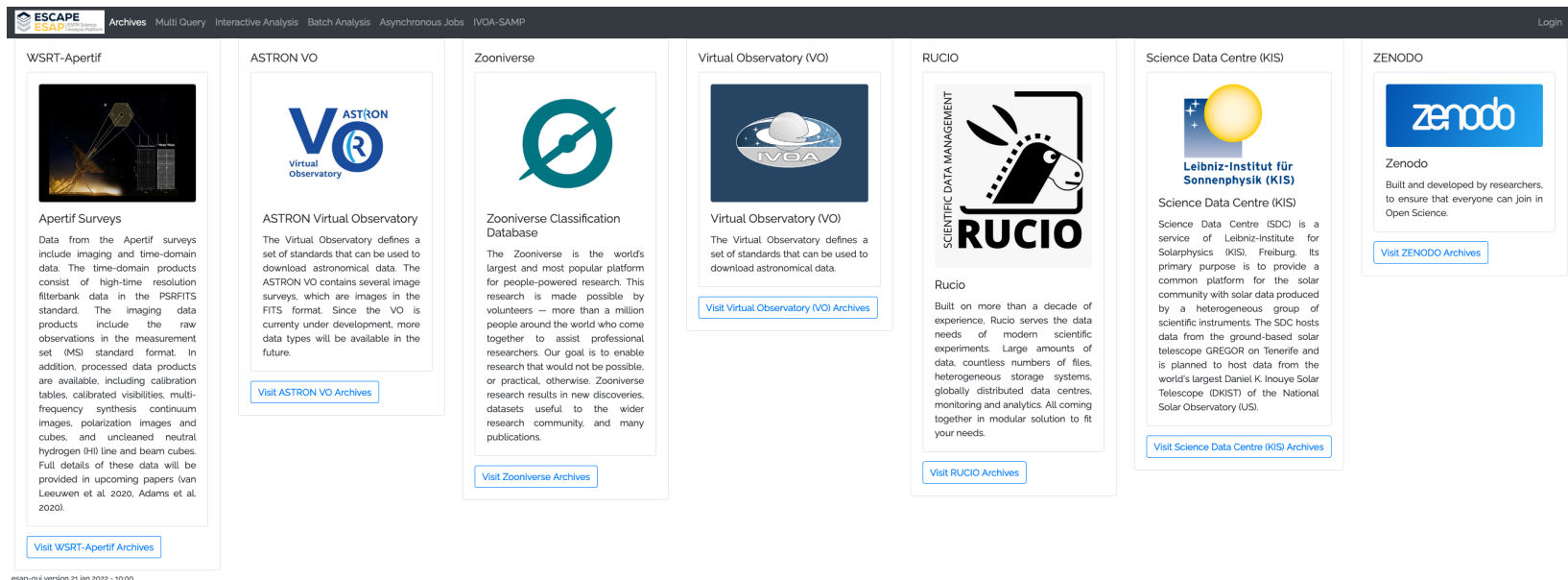


IBIS/DST & ROSA/DST data (J. Löhner-Bötcher, KIS)



Science Data Centre (KIS) in ESAP

- Dataset (2012 -): GRIS@GREGOR, LARS@VTT, ChroTel full-disk data
- Provide access to high-level solar data and tools
- Now available on ESAP (REST API access to KIS SDC)



The screenshot shows the ESAP Archives interface with a navigation bar at the top containing: ESAP Archives, Multi Query, Interactive Analysis, Batch Analysis, Asynchronous Jobs, IVOA-SAMP, and a Login link. The main content area displays seven data source cards:

- WSRT-Apertif**: Includes an image of a radio telescope and text describing Apertif Surveys. A button at the bottom says "Visit WSRT-Apertif Archives".
- ASTRON VO**: Features the ASTRON Virtual Observatory logo and text. A button at the bottom says "Visit ASTRON VO Archives".
- Zooniverse**: Shows a circular logo with a magnifying glass and text about the Zooniverse Classification Database. A button at the bottom says "Visit Zooniverse Archives".
- Virtual Observatory (VO)**: Displays the IVOA logo and text. A button at the bottom says "Visit Virtual Observatory (VO) Archives".
- RUCIO**: Shows the RUCIO logo and text. A button at the bottom says "Visit RUCIO Archives".
- Science Data Centre (KIS)**: Features the Leibniz-Institut für Sonnenphysik (KIS) logo and text. A button at the bottom says "Visit Science Data Centre (KIS) Archives".
- ZENODO**: Shows the Zenodo logo and text. A button at the bottom says "Visit ZENODO Archives".

At the bottom left of the screenshot, it says "esap-iga version 21 Jun 2022 - 10:00".

Thanks: Klaas Kliffen, Nico Vermaas, John Swinbank and the team



Science Data Centre (KIS) in ESAP

- Dataset (2012 -): GRIS@GREGOR, LARS@VTT, ChroTel full-disk data
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Login
Archives Multi Query Interactive Analysis Batch Analysis Asynchronous Jobs IVOA-SAMP

Science Data Centre (KIS) Archive

Catalog*	Instruments*	Observation Start Date*	Observation End Date	Observation Start Time	Observation End Time
Science Data Centre (KIS)	GRIS@GREGOR	2016-05-14 <small>*required (e.g. 2016-05-15)</small>	2016-05-16	HH:MM (optional)	HH:MM (optional)
Begin Heliocentric Angle [theta]	End Heliocentric Angle [theta]	Begin Heliocentric Angle [mu]	End Heliocentric Angle [mu]	Target	
[theta] (optional)	[theta] (optional)	[mu] (optional)	[mu] (optional)	e.g. Sunspot, Quiet Sun (option)	

[Submit](#)

Query results for Science Data Centre (KIS)

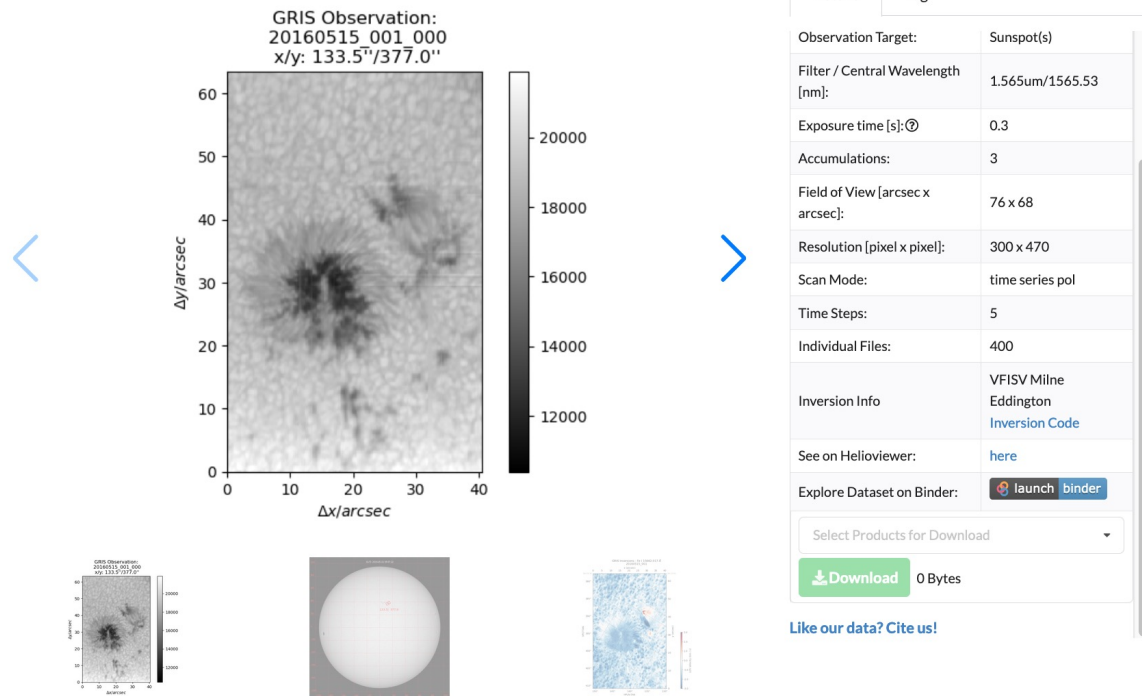
Date	Start time (UTC)	End time (UTC)	Target	Wavelength range (nm)	Heliocentric angle (θ)	Observation details	Heliviewer
2016-05-14	08:55:06	10:57:54	Pore	1563.50 - 1567.54	24.33' (μ = 0.91)	Link	Link
2016-05-14	11:35:05	13:37:52	Sunspot(s)	1563.50 - 1567.54	23.87' (μ = 0.91)	Link	Link
2016-05-14	14:02:00	16:04:51	Pore	1563.50 - 1567.53	24.27' (μ = 0.91)	Link	Link
2016-05-15	08:59:30	09:15:45	Sunspot(s)	1563.51 - 1567.55	24.82' (μ = 0.91)	Link	Link
2016-05-15	09:20:47	09:32:57	Sunspot(s)	1563.51 - 1567.56	24.79' (μ = 0.91)	Link	Link
2016-05-15	09:41:21	09:57:38	Sunspot(s)	1563.52 - 1567.55	25.73' (μ = 0.90)	Link	Link
2016-05-15	09:58:02	10:10:12	Sunspot(s)	1563.51 - 1567.56	24.88' (μ = 0.91)	Link	Link

Shopping basket not available, instead link to the dataset/preview/analysis



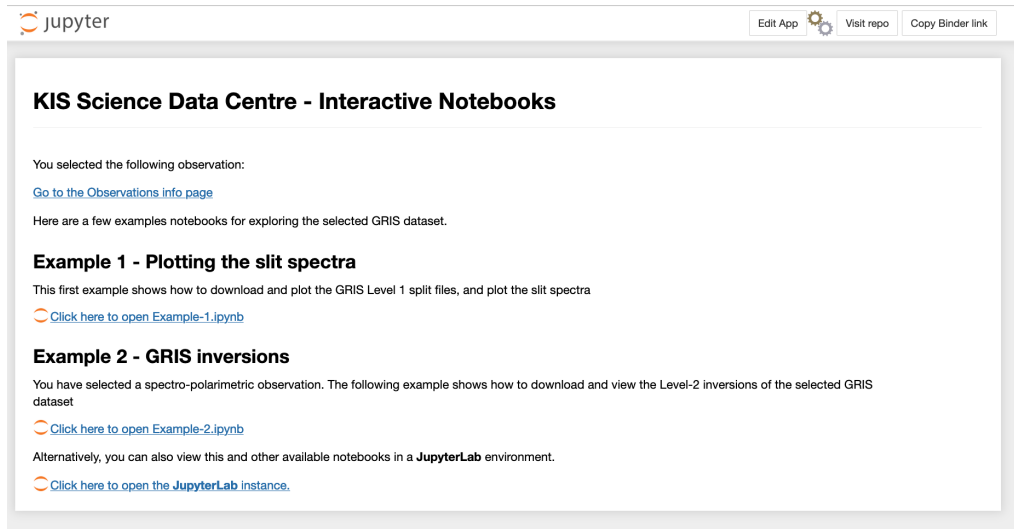
Science Data Centre (KIS) - Archive

- Calibrated data (Level 1: Spectra)
- Physical parameters (Level 2: Velocity, Magnetic field etc.) from Stokes inversions
- Preview and context information (including heliviewer)
- Interactive analysis via myBinder



Interactive analysis

- Explore individual dataset via myBinder
- Start page based on data selected
- Appmode, pass parameter to the repo
- Autofill the notebook with appropriate data
- Issues:
 - L1 data (couple of GBs)
 - Download speeds (6-12MB/s)
 - Available memory (usually 2GB, sometimes 10GB)



KIS Science Data Centre - Interactive Notebooks

You selected the following observation:
[Go to the Observations info page](#)

Here are a few examples notebooks for exploring the selected GRIS dataset.

Example 1 - Plotting the slit spectra
 This first example shows how to download and plot the GRIS Level 1 split files, and plot the slit spectra
[Click here to open Example-1.ipynb](#)

Example 2 - GRIS inversions
 You have selected a spectro-polarimetric observation. The following example shows how to download and view the Level-2 inversions of the selected GRIS dataset
[Click here to open Example-2.ipynb](#)

Alternatively, you can also view this and other available notebooks in a **JupyterLab** environment.
[Click here to open the JupyterLab instance.](#)



Example 1 - Exploring the GRIS slit data

This Jupyter notebook is intended as an example to get you started with the GRIS data. If you are directed here from an info page, the observation detail is automatically filled for you.

For other GREGOR observations, please visit:
[KIS Science Data Centre - Archive](#)

To run all cells, go to top menu and select: Cell/Run > Run All/Run All Cells.
 Or, press **Shift-Enter** to execute individual cell.

Alternatively, you can also view this and other available notebooks in a **JupyterLab** environment.
[Click here](#) to open the **JupyterLab** instance.

Firstly, import the required python packages

```
In [ ]: import tarfile
import utils
import warnings
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.colors as colors
from astropy.io import fits
import astropy.units as Unit
from astropy.wcs import WCS, FITSFixedWarning
from sunpy.map import Map

# suppress fits obsgeo warnings
warnings.filterwarnings("ignore", category=FITSFixedWarning)
```

```
In [ ]: #Set the default to unverified SSL
import ssl
ssl.create_default_https_context = ssl.create_unverified_context
```

Example 2 - Exploring the GRIS inversion results

This Jupyter notebook is intended as an example to get you started with the GRIS data. If you are directed here from an info page, the observation detail is automatically filled for you.

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```

Downloading the data

You selected the following observation:

```
In [ ]: # Parameters:
ObjectID = 'See109af7133d5a7d3e3de549'
```



Next Steps

- Migration to RUCIO
 - Testing phase (end of 2022)
- Integration: the ESCAPE Datalake
 - Issues: Authentication
- Provide compute infrastructure
 - Issues: Authentication



Thank you

