# Summary of the E-SWAN School 2023 in Toulouse, France

---


## Abstract

There are two major summaries as data access and space weather lectures.



**Full name**: Phimmasone Thammavongsy_________________________


## 1. Data access

Participation of the ESWW 2023 and the first E-SWAN school in Toulouse during 17 – 24 November 2023. On Nov 17, 2023, the IRAP researchers had given lectures on space weathers with database access of various parameters. All the database resources can be publicly accessed as follows:

To be able to access the space weather data software, you need to install Java on your computer.

1.1 The 3D views (to download software: http://3dview.cdpp.eu/)

The 3D views are a science tool designed and owned by CNES. The 3D view tool produces the 3D visualization of spacecraft position and attitude, planetary ephemerides, as well as scientific data (observations, simulations and models) representation. Orbits and attitudes are handled through SPICE kernels and related files from ESA or NASA repositories.

Tutorial: http://3dview.irap.omp.eu/other/3DVIEW_Tutorial_2_0.pdf

User guide: http://3dview.irap.omp.eu/other/3DVIEW_Users_Guide_2_2.pdf

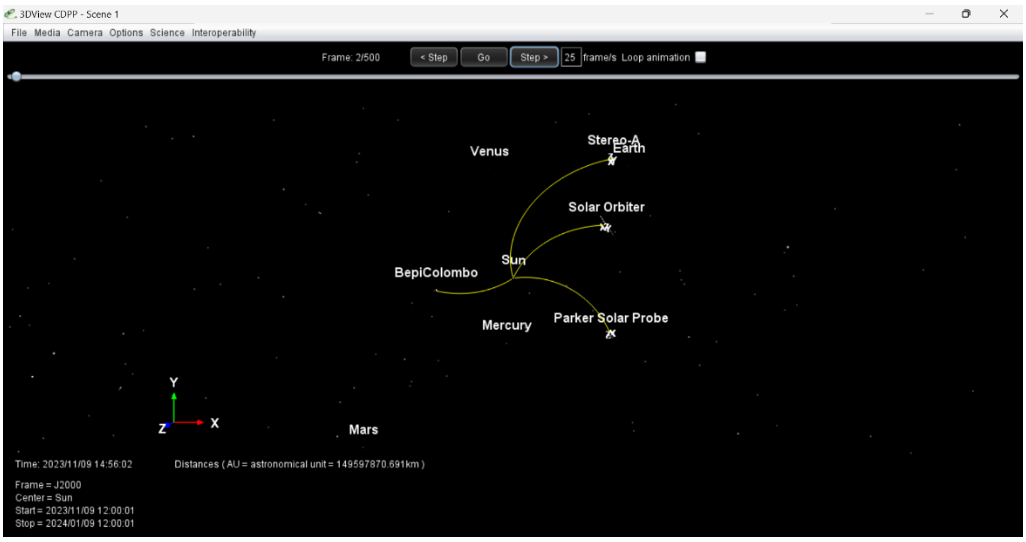



Figure 1: Screen snapshot of the 3DViews.

1.2 JHelioviewer (to download software: https://www.jhelioviewer.org/index.html or http://swhv.oma.be/download/)

This is a space weather JHelioviewer tool which is an output of the ESA. It is High Performance Distributed Solar Imaging and Processing System - run at the Solar Influences Data Analysis Center (SIDC, https://sidc.be) of the Royal Observatory of Belgium (ROB) under the supervision of Space Environments and Effects section of ESA (ESTEC/TEC-EES, https://space-env.esa.int/).

The JHelioviewer solar data visualisation tool has been overhauled with a strong focus for space weather usage. The viewer is able to display solar image data, and one-dimensional and two-dimensional solar timeline data.

User manual: http://swhv.oma.be/user_manual/

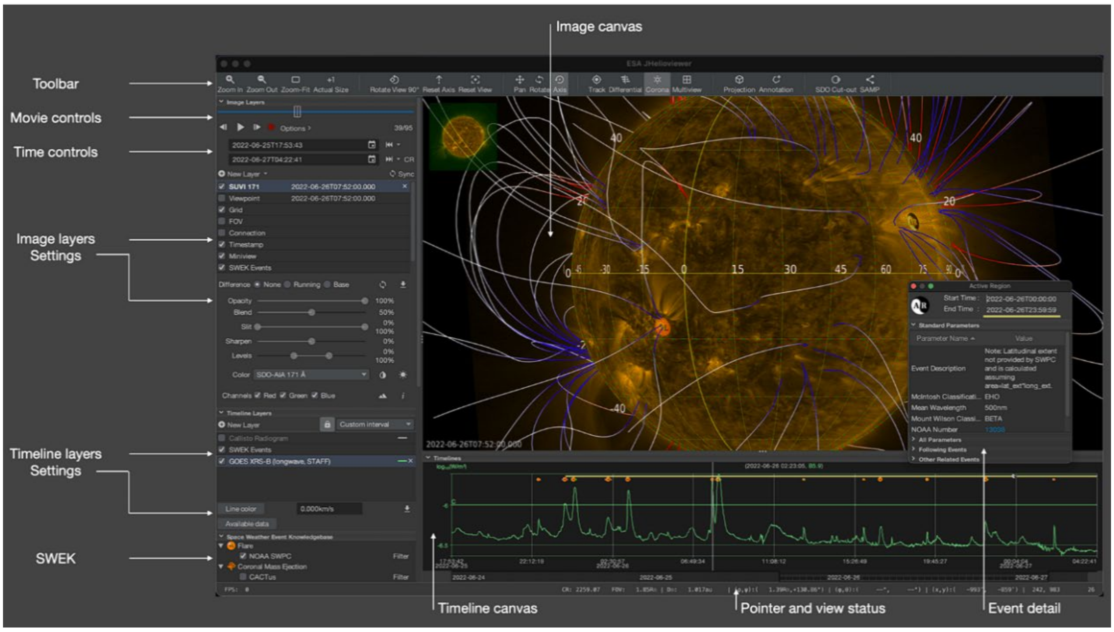



Figure 2: User interface.

Fundamental description of the solar images with different types of the wavelength (https://soho.nascom.nasa.gov/data/realtime/image-description.html) is given below

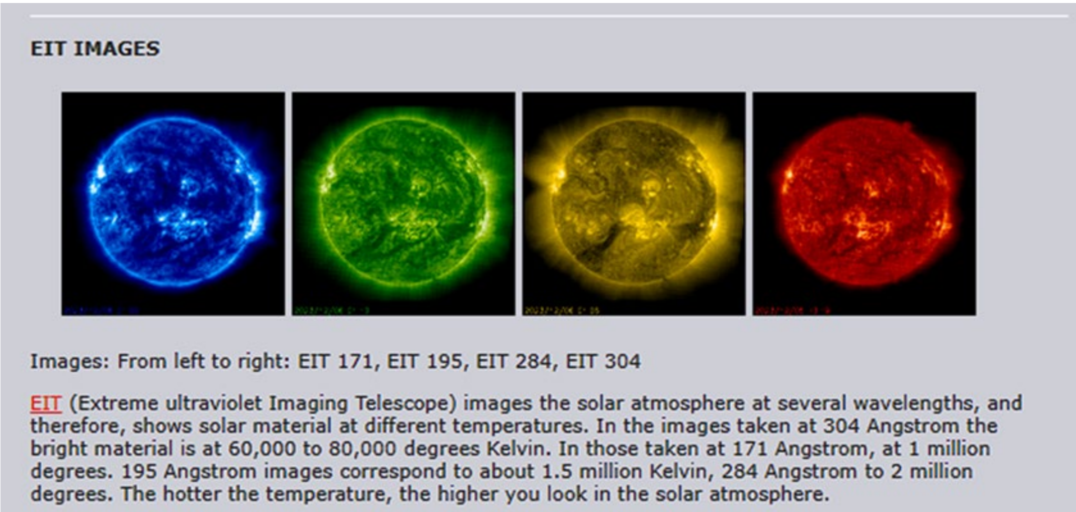
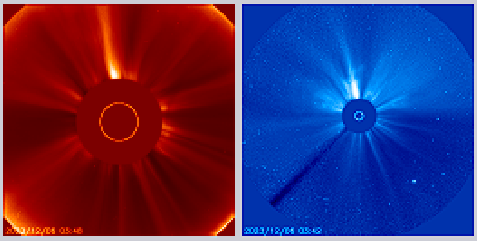



Figure 3: EIT images.

**LASCO IMAGES**



Images: LASCO C2 (left). LASCO C3 (right).

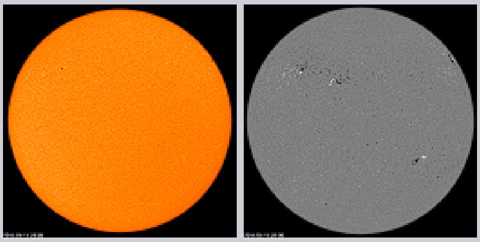
LASCO (Large Angle Spectrometric Coronagraph) is able to take images of the solar corona by blocking the light coming directly from the Sun with an occulter disk, creating an artificial eclipse within the instrument itself. The position of the solar disk is indicated in the images by the white circle. The most prominent feature of the corona are usually the coronal streamers, those nearly radial bands that can be seen both in C2 and C3. Occasionally, a coronal mass ejection can be seen being expelled away from the Sun and crossing the fields of view of both coronagraphs. The shadow crossing from the lower left corner to the center of the image is the support for the occulter disk.

**C2 images** show the inner solar corona up to 8.4 million kilometers (5.25 million miles) away from the Sun.

**C3 images** have a larger field of view: They encompass 32 diameters of the Sun. To put this in perspective, the diameter of the images is 45 million kilometers (about 30 million miles) at the distance of the Sun, or half of the diameter of the orbit of Mercury. Many bright stars can be seen behind the Sun.

Figure 4: LASCO images.

**MDI IMAGES**



Images: MDI Continuum (left). MDI Magnetogram (right).

The MDI (Michelson Doppler Imager) images shown here are taken in the continuum near the Ni I 6768 Angstrom line. The most prominent features are the sunspots. This is very much how the Sun looks like in the visible range of the spectrum (for example, looking at it using special 'eclipse' glasses: **Remember, do not ever look directly at the Sun!**). The magnetogram image shows the magnetic field in the solar photosphere, with black and white indicating opposite polarities.

Figure 5: MDI images.

### 1.3 Transplanet (to download data: http://transplanet.irap.omp.eu/create.html)

The model is basically a one dimensional model, which has been built in a modular way, leading to a core model that is independent from the planet. This core model corresponds to the part delimited by the red line in below figure. In order to be able to run, it requires some inputs, which are related to the characteristics of the planet.

The planet is determined by its orbitography and a potential magnetic field that may constrain the geometry; this dependecy is represented by the two green boxes in below figure. Without magnetic field, the grid used in the model is a vertical grid. But if a magnetic field is present, the grid used for the model is a field aligned grid, which can be an interhemispheric grid.

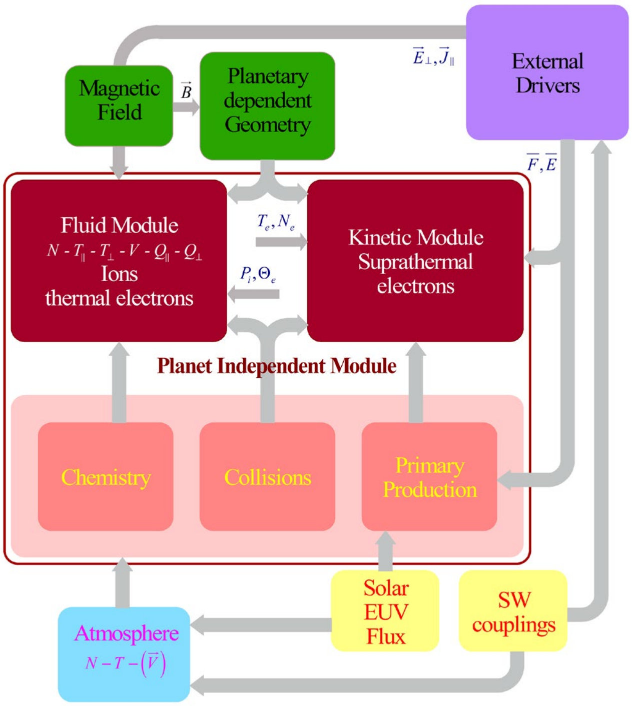



Figure 6:

1.4 AMDA (to download and plot data: [https://amda.irap.omp.eu/](https://amda.irap.omp.eu/))

The Amda is a space tool for space physics, multi dataset visualization, automated event search, data mining, catalogue generation and exploitation, data model, and image centres.

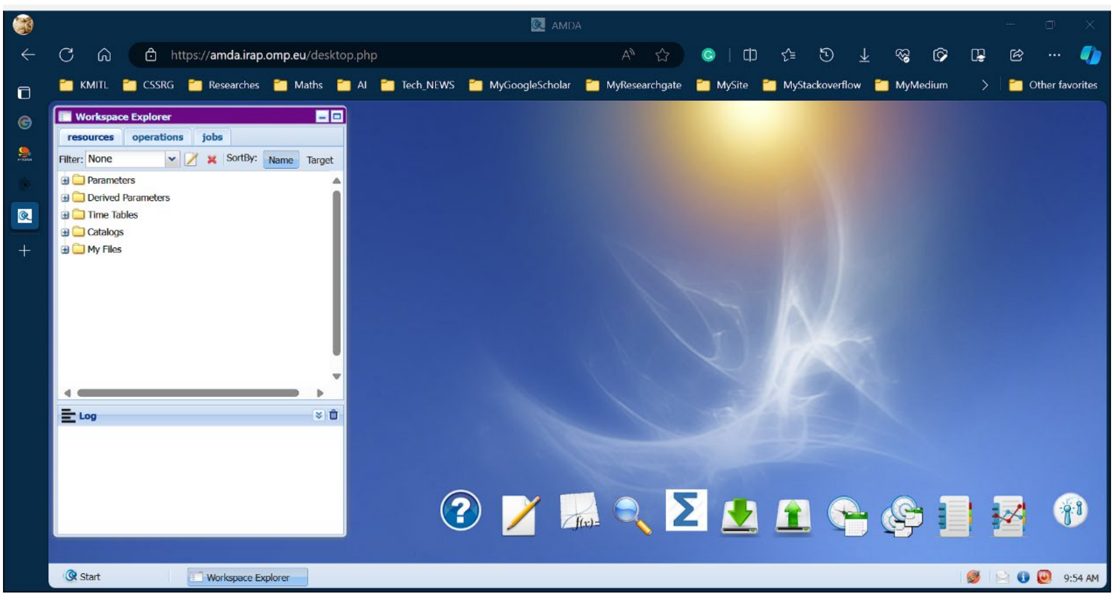



Figure 7: Amda virtual desktop.

1.5 The propagation tool (to download and access data: http://propagationtool.cdpp.eu/)

This propagation tool is runnable with the required installation on your computer. The propagation tool allows users:

- To propagate solar eruptions (CMEs) radially sunward or anti-sunward (Radial Propagation)
- To propagate corotating structures (CIRs) in the heliosphere (Corotation)
- To propagate solar energetic particles along magnetic fields lines sunward or anti-sunward (SEP Propagation)

In addition, you can use these maps to:

- cross check your ballistic calculation of CME/CIR propagations,
- carry out your own calculations of CME/CIR trajectories in the ecliptic plane via a few clicks on the map (simple use),
- use pre-calculated CME trajectories to check if a transient emerged from the Sun and impacted a planet or probe


Figure 8: GUI interface of the propagation tool.

1.5 The magnetic connectivity tool (to download data: http://connect-tool.irap.omp.eu/)

This tool allows us to access the magnetic data and its forecasting data.

Tutorial: http://connect-tool.irap.omp.eu/tutorial

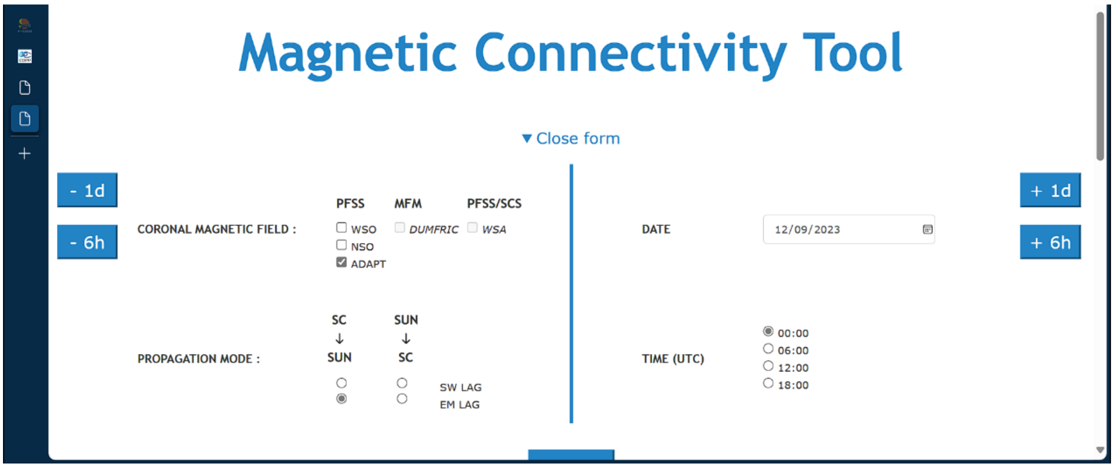



Figure 9: Web interface of the Magnetic Connectivity Tool.

1.6 Sola wind prediction (to download and check data: http://heliocast.irap.omp.eu/)

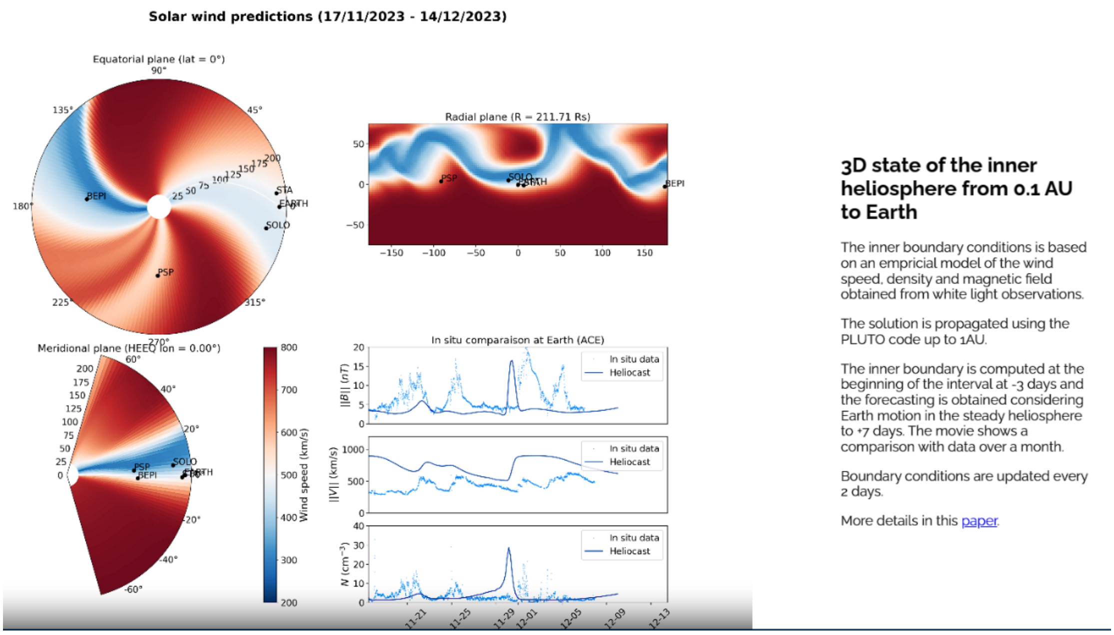



Figure 9: Web interface.

1.7 CACTUS (to download and monitor data: https://www.sidc.be/CACTUS/)

This CACTUS autonomously detects coronal mass ejections (CMEs) in image sequences from LASCO.

| # CME | t0 | dt0 | pa | da | v | dv | minv | maxv | halo? |
|---|---|---|---|---|---|---|---|---|---|
| 0038 | 2023/12/08 16:24 | 02 | 301 | 140 | 0496 | 0117 | 0315 | 0868 | II |
| 0037 | 2023/12/08 10:12 | 01 | 238 | 018 | 0204 | 0045 | 0137 | 0258 | |
| 0036 | 2023/12/08 09:24 | 02 | 233 | 008 | 0217 | 0004 | 0209 | 0220 | |
| 0035 | 2023/12/08 07:24 | 00 | 316 | 010 | 0422 | 0052 | 0322 | 0459 | |
| 0034 | 2023/12/08 03:24 | 03 | 342 | 054 | 0322 | 0208 | 0103 | 0928 | |
| 0033 | 2023/12/08 01:36 | 02 | 219 | 048 | 0504 | 0385 | 0221 | 1303 | |
| 0032 | 2023/12/07 23:24 | 01 | 104 | 006 | 0712 | 0456 | 0258 | 1488 | |
| 0031 | 2023/12/07 20:24 | 05 | 235 | 128 | 0416 | 0086 | 0186 | 0589 | II |
| 0030 | 2023/12/07 13:48 | 01 | 214 | 010 | 0635 | 0595 | 0152 | 1843 | |
| 0029 | 2023/12/07 13:36 | 04 | 300 | 122 | 0330 | 0151 | 0178 | 0651 | II |
| 0028 | 2023/12/07 08:36 | 02 | 104 | 014 | 0379 | 0281 | 0209 | 1075 | |
| 0027 | 2023/12/07 07:36 | 02 | 272 | 010 | 0293 | 0035 | 0260 | 0367 | |
| 0026 | 2023/12/07 07:00 | 01 | 190 | 006 | 0284 | 0066 | 0264 | 0416 | |
| 0025 | 2023/12/07 06:24 | 01 | 229 | 016 | 0211 | 0100 | 0156 | 0452 | |
| 0024 | 2023/12/07 06:12 | 02 | 249 | 084 | 0336 | 0037 | 0269 | 0446 | |
| 0023 | 2023/12/07 03:48 | 01 | 117 | 012 | 0363 | 0123 | 0209 | 0520 | |
| 0022 | 2023/12/07 03:36 | 04 | 068 | 054 | 0246 | 0026 | 0201 | 0318 | |
| 0021 | 2023/12/07 00:00 | 01 | 343 | 020 | 0269 | 0051 | 0181 | 0332 | |
| 0020 | 2023/12/07 00:00 | 03 | 348 | 078 | 0303 | 0067 | 0183 | 0446 | |
| 0019 | 2023/12/06 23:12 | 02 | 305 | 036 | 0233 | 0170 | 0113 | 0679 | |
| 0018 | 2023/12/06 19:24 | 03 | 063 | 056 | 0273 | 0047 | 0192 | 0355 | |
| 0017 | 2023/12/06 17:36 | 03 | 063 | 040 | 0132 | 0019 | 0101 | 0175 | |
| 0016 | 2023/12/06 15:48 | 01 | 158 | 022 | 0418 | 0141 | 0169 | 0626 | |
| 0015 | 2023/12/06 08:00 | 02 | 339 | 032 | 0206 | 0026 | 0172 | 0262 | |
| 0014 | 2023/12/06 02:48 | 02 | 228 | 014 | 0255 | 0092 | 0153 | 0443 | |
| 0013 | 2023/12/05 23:24 | 02 | 002 | 062 | 0504 | 0072 | 0339 | 0606 | |
| 0012 | 2023/12/05 19:36 | 02 | 296 | 054 | 0367 | 0145 | 0262 | 0726 | |
| 0011 | 2023/12/05 17:00 | 01 | 168 | 018 | 0664 | 0073 | 0573 | 0781 | |
| 0010 | 2023/12/05 11:36 | 00 | 352 | 018 | 1736 | 0228 | 1302 | 1838 | |
| 0009 | 2023/12/05 10:00 | 01 | 284 | 010 | 0237 | 0041 | 0153 | 0281 | |
| 0008 | 2023/12/05 10:00 | 07 | 067 | 056 | 0114 | 0028 | 0097 | 0205 | |
| 0007 | 2023/12/05 07:36 | 01 | 236 | 030 | 0322 | 0764 | 0100 | 1838 | |
| 0006 | 2023/12/05 07:36 | 05 | 247 | 120 | 0380 | 0059 | 0239 | 0520 | II |

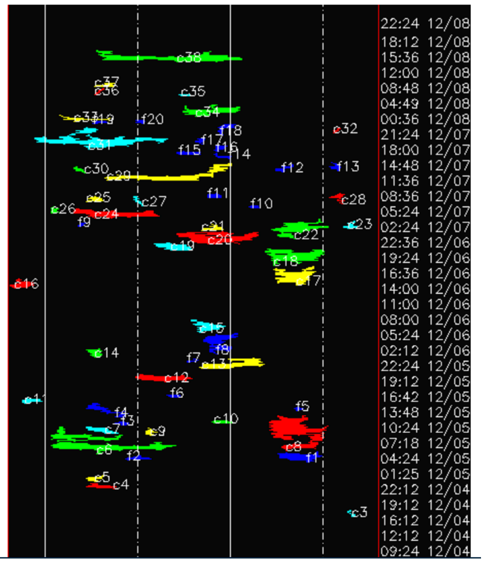



Figure 10: The detective information of the CMEs near real-time on website.

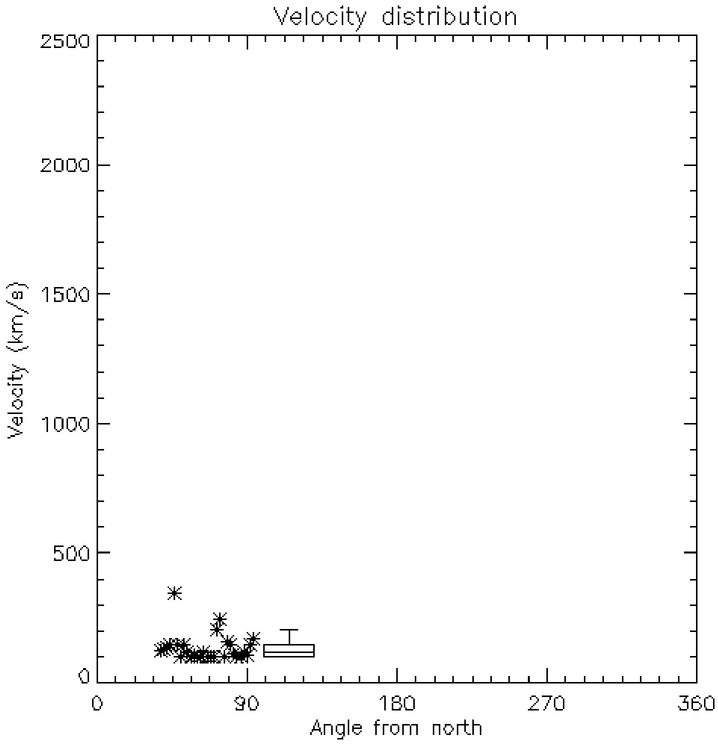



Figure 11: Velocity distribution.

(E. Erdogan et al., 2021), VTEC was represented by the B-spline expansions embedded into a Kalman filter. B-splines. B-splines were used to form a highly sparse structure in the filter measurement model due to the local feature. The result of generated VTEC maps outperforms those provided by the other IGS analysis centers.

## 2. E-SWAN 2023 school

All the lectures are shared in this link ashttps://events.spacepole.be/event/184/. The E-SWAN 2023 school give basics of space weather, space weather data, models, indices, alerts, forecasts and products.

The useful links are given as follows

- Space weather news, info and courses: https://www.stce.be/
- predictions (ursigram), alerts and automated detections, data and news: https://www.sidc.be/
- K_Belgium, MUF, ionosonde data: http://ionosphere.meteo.be/index.php
- SRB alert, VTEC data: https://gnss.be/
- Forecasting bulletin and alerts: current Bulletins and forecasts (https://events.spacepole.be/event/184/), and SIDC alert (https://www.sidc.be/index.php/services/real-time-alerts)
- Data sources: SDO AIA and HMI data browser (https://sdo.gsfc.nasa.gov/data/aiahmi/), SOHO/LASCO movie maker (SOHO Movie Theater (nasa.gov)), and STEREO Science Center (https://stereo-ssc.nascom.nasa.gov/cgi-bin/images)