

Substorm Zoo

A browser-based tool for research,
teaching and social data analysis

Eija I. Tanskanen
Finnish Meteorological Institute,
Eija.Tanskanen@fmi.fi

Why Zoo?

The web site is called Substorm Zoo, because the aim is to present events in a variety of data series. In a sense, these events are the animals of heliospheric wild life. Hence the zoo.

The goal

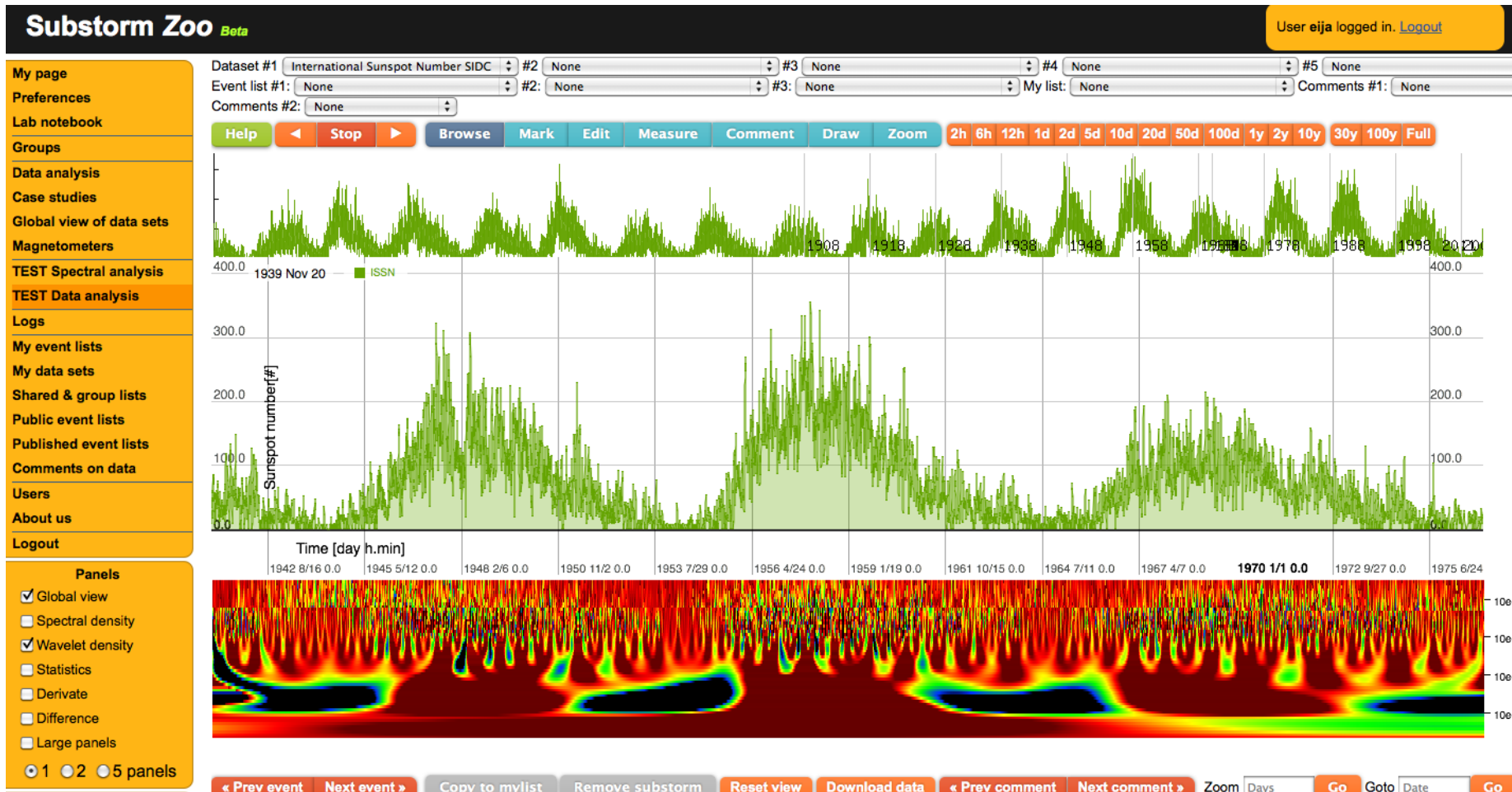
Substorm Zoo provides a browser-based tool for time-series analysis of data. Particular interest is in the identification of geo-effective and other important structures.

The web site enables the social data analysis by providing a possibility to create discussion groups, share event lists, upload own events, share the comments to the data etc.

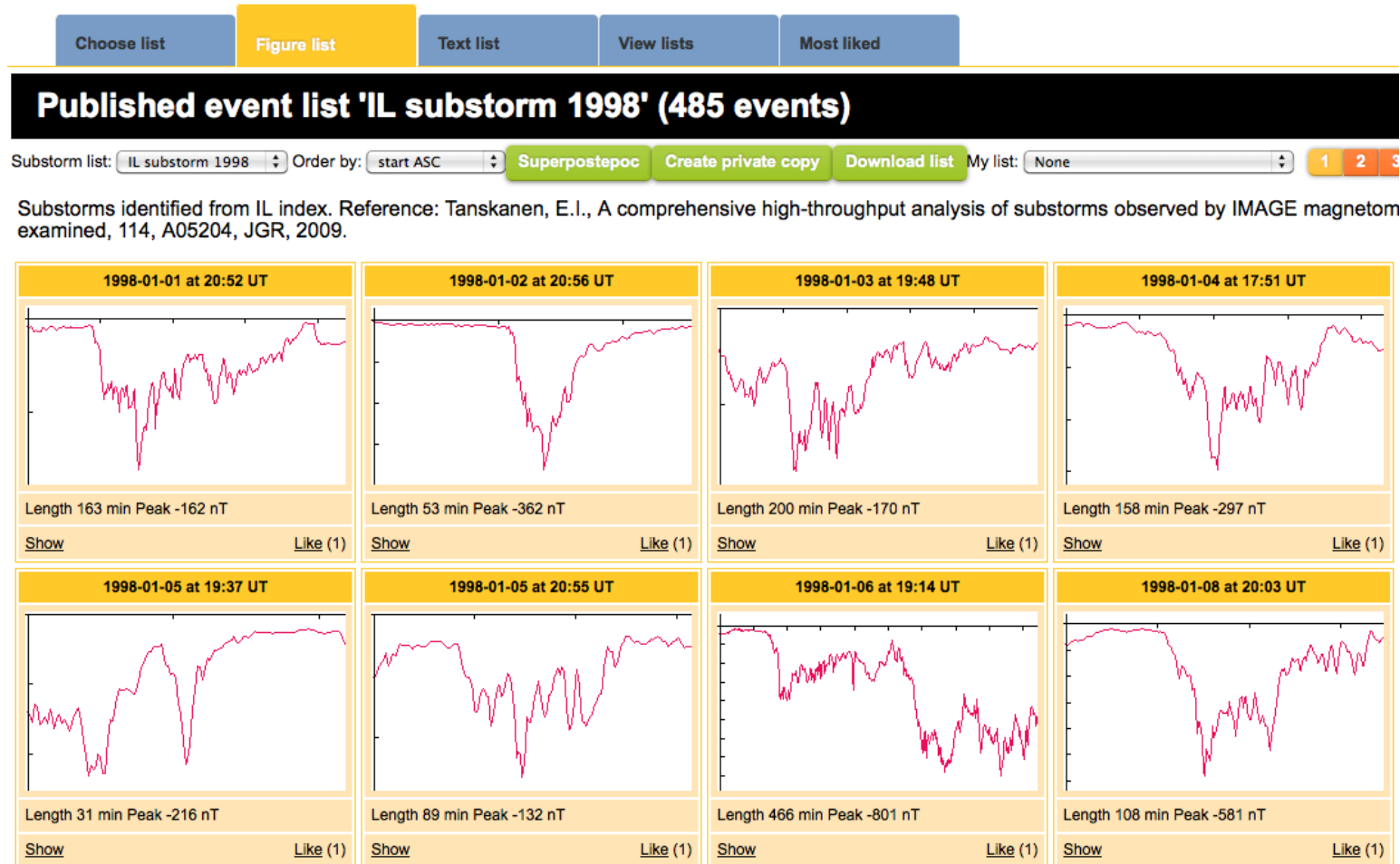
Online tools for science



Powerful analysis methods



Libraries of pre-identified events



Tools for social data analysis

Substorm Zoo Beta

User eiJa logged in. [Logout](#)

- My page
- Preferences
- Lab notebook
- Groups
- Data analysis
- Case studies
- Global view of data sets
- Magnetometers
- TEST Spectral analysis
- TEST Data analysis
- Logs
- My event lists
- My data sets
- Shared & group lists
- Public event lists
- Published event lists
- Comments on data
- Users
- About us
- Logout

Recent updates

[All updates](#) [Public](#) [Group](#) [Personal](#) [Prev page](#) [1](#) [3](#) [4](#) [5](#) [8](#) [Next page](#)

New message [Share »](#)

Photo missing [Hulda Fadnes](#) joined group AGF345_2011 [like](#) · [send a message](#) · [comment](#) 1 month ago

Photo missing [PHYS352 Student 3](#) [like](#) · [send a message](#) · [comment](#) 1 month ago
wrote comment 'What has happened here?' on [dataset IL-indeksi 2000 at 16066341](#).

Photo missing [Christine Johnsen](#) [like](#) · [send a message](#) · [comment](#) 1 month ago
According to the all sky cameras, there were som aurora around 19 UT last evening, and later that night around 4 o'clock. The magnetometer measurements show the first event as a strong drop in the H component in Longearbyen, and later in the magnetometers further south. The event later that night is not so easy to detect from the magnetometer measurements.

[PHYS352 Student 3](#) likes this update. 1 month ago

Photo missing [Christer van der Meeren](#) [like](#) · [send a message](#) · [comment](#) 1 month ago
wrote comment 'Difference between IL and AL is often largest outside of the substorms; AL surpasses IL here. This is natural since IL is only local, while AL is a global index.' on [dataset IL-index 1999 at 15263112](#).

Photo missing [PHYS352 Student 3](#) [like](#) · [send a message](#) · [comment](#) 1 month ago
UIB student

Photo missing [Christine Johnsen](#) joined group AGF345_2011 [like](#) · [send a message](#) · [comment](#) 1 month ago

Status


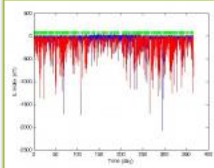

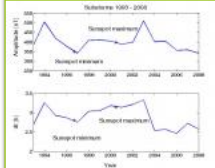


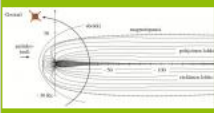


Visit to Ann Arbor University 12.-19 Dec, 2011 [Change »](#)

Random event



Random event from [IL substorms1999](#) 1999-08-09 [Show »](#)

Discussion groups

<p>Case5nov2001 (Owner) Examines the spacecraft charging on 5th Nov 2001.</p>	<p>Guo_etal_study (Owner) Statistical substorm study in IMAGE UT-sector.</p>	<p>Bugs Squash the bugs!</p> 	<p>Workshop13April (Owner) Workshop on 13th April 2012 at FMI about data analysis of magnetic measurements.</p>	<p>Elja's test group (Owner) No description</p> 	<p>COST TOSCA (Owner) A discussion group for COST ES-1005 action called TOSCA.</p>	<p>HISSI FMI (Owner) Academy project HISSI</p>	<p>Science questions (Owner) A set of science questions</p>
<p>Aalto space weather (Owner) Basics of space weather and observational methods.</p>	<p>Thierry's group (Owner) This group is intended for educational purposes in University of Orleans.</p>	<p>Jim's group (Owner) This discussion group is to generated to deliver science questions and tasks to the students.</p> 	<p>FP7_elja (Owner) Discussion about the FP7 project led by ET.</p> 	<p>Hands-on-data (Owner) Hands-on-data course during the COST School Sun2Climate.</p> 	<p>Sun2Climate_test (Owner) No description. Please update.</p>	<p>Russian community (Owner) Discussion of the Substorm Zoo data.</p> 	<p>RamboRainbow Charades in the solar storms</p>
<p>Sun2climate school Discussion group of Sun2climate school</p>	<p>Space Climate/HY2013 (Owner) Avaruusilmasto Helsingin yliopistolla 2013</p> 	<p>NASA GSFC group (Owner) NASA Goddard SFC</p> 	<p>AGF-345 2013 (Owner) Substorm course in UNIS</p> 				

Tools for public outreach

Index comparisons

Solar storms

Historical events

Educational

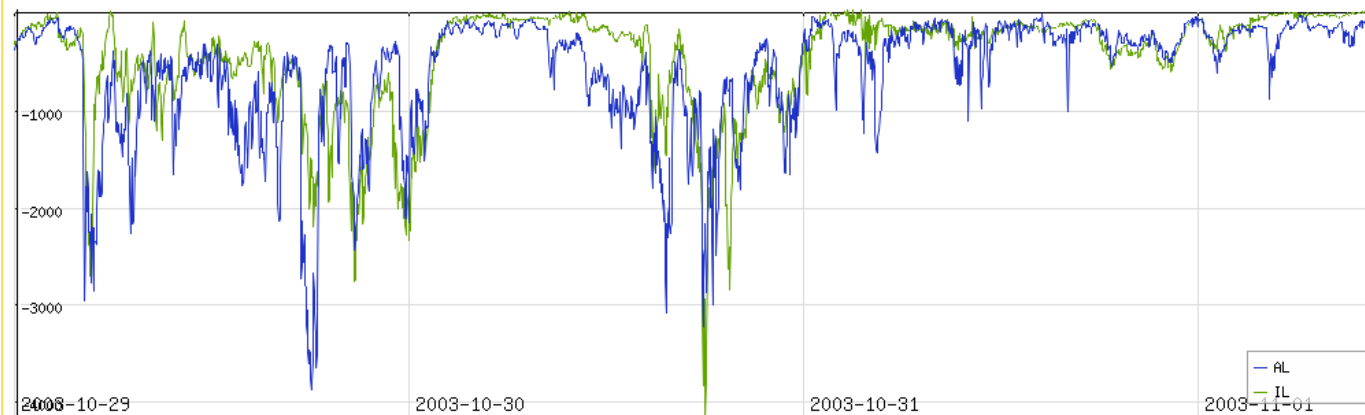
Outreach

Data issues

Satellites

Solar storms

A few of the Solar storms in the observation history.

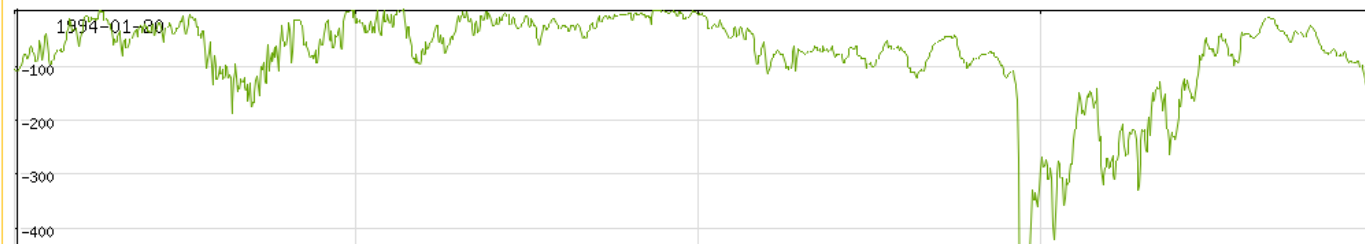


Halloween storms of 2003

Halloween storm on Oct 31, 2003 was a particularly significant event. Energetic storms began two to three years after solar maximum, when solar activity was on the decline. During this time few sunspots are visible, an outbreak of 17 major flares erupted on the sun.

The flares caused the sun's magnetic field lines to stretch then suddenly snap like a rubber band stretched beyond its limit. The result was coronal mass ejections, enormous explosions on the sun's surface that can blast billions of tons of electrified gas and subatomic particles into space at speeds up to 5 million miles per hour. This 'space weather' can and does affect Earth.

[Go »](#)



January 1994 Solar storm

January 20, 1994, a geomagnetic storm temporarily disabled two Canadian communication satellites, Aniks E1 and E2 and the international communication satellite Intelsat

Tools for teaching

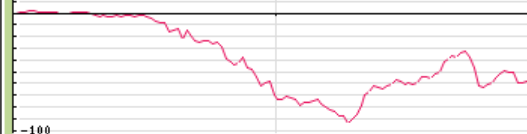
Substorm Zoo Beta

- My page
- Preferences
- Lab notebook
- Groups
- Data analysis
- Case studies
- Global view of data sets
- Magnetometers
- Realtime analysis
- TEST Data analysis
- Logs
- My event lists
- My data sets
- Shared & group lists
- Public event lists
- Published event lists
- Comments on data
- Users
- About us
- Logout

Lab notebook of Eija Tanskanen

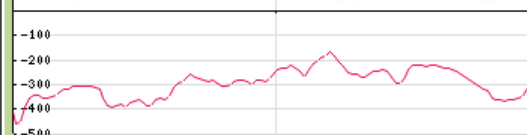
Failed to log in on 2012-5-22 13:28.12.
24 seconds ago (2012-05-22 13:28:17)

Wrote private comment "\What is this?" on dataset IL index at [1998-10-03 23:04](#).



1 hour ago (2012-05-22 12:21:45)

Wrote private comment "\Recovery phase of a large substorm." on dataset IL index at [2003-08-24 20:38](#).



1 hour ago (2012-05-22 11:49:59)

Failed to log in on 2012.5.21 13.49.19.
23 hours ago (2012-05-21 13:49:24)

Created a new event list [ClusterNSC03_05il](#).
6 days ago May 16, 2012 (2012-05-16 13:00:27)

Created a new event list [ICMEbegin96_2011il](#).
6 days ago May 16, 2012 (2012-05-16 12:57:48)

Created a new event list [ICMEbegin96_2011](#).
6 days ago May 16, 2012 (2012-05-16 12:57:06)

Created a new event list [ClusterNSC2005_sc1](#).
6 days ago May 16, 2012 (2012-05-16 12:16:07)

Created a new event list [ClusterNSC2004_sc1](#).
6 days ago May 16, 2012 (2012-05-16 12:13:53)

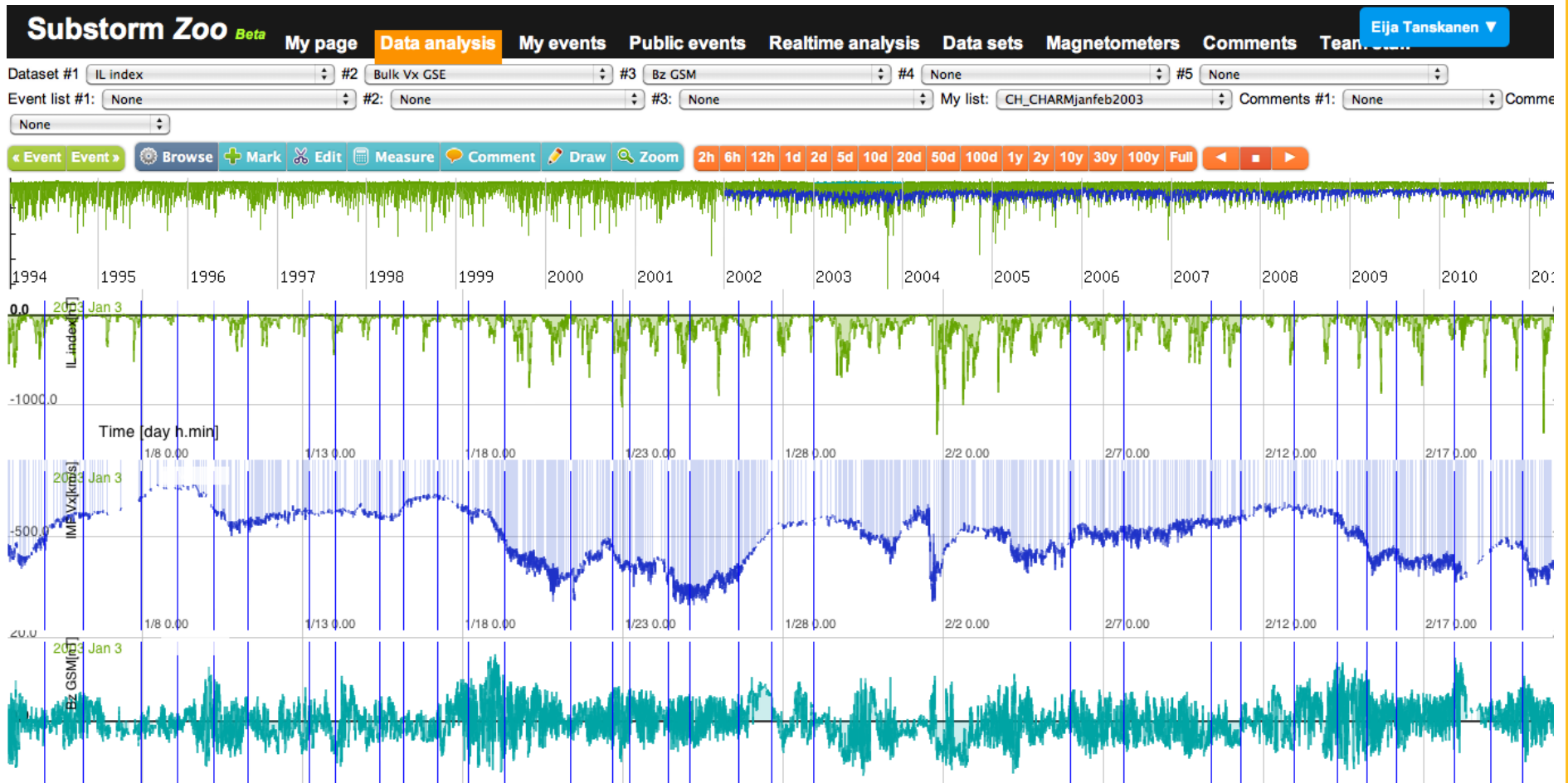
Created a new event list [Cluster_sc1](#).
6 days ago May 16, 2012 (2012-05-16 12:09:49)

Created a new event list [Cluster_test](#).
6 days ago May 16, 2012 (2012-05-16 11:32:30)

Wrote private comment "\Cluster neutral sheet crossing ends." on dataset IL index at [2004-10-15 15:52](#).

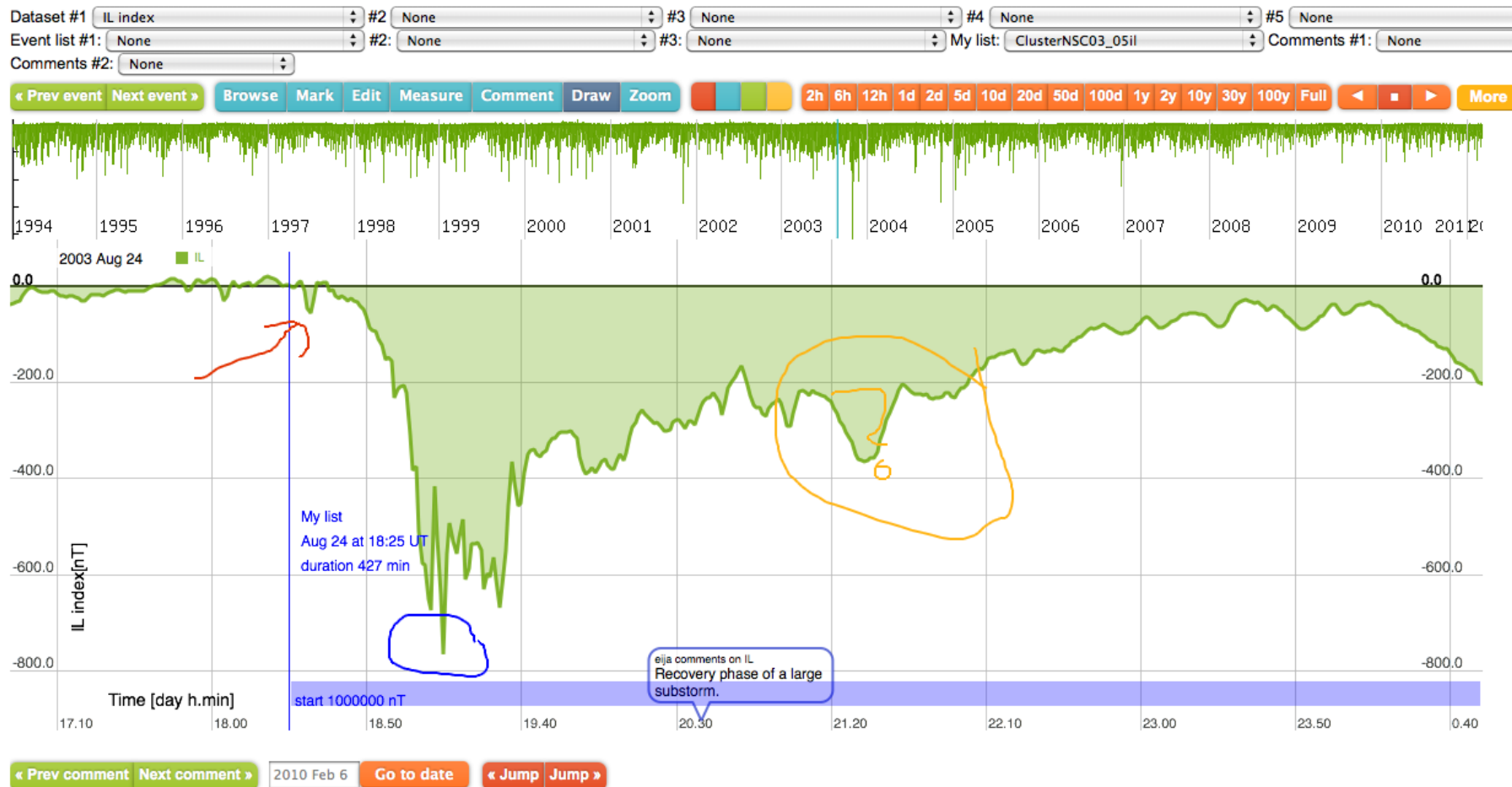


HELIO collaboration



Vertical blue lines: CH, CHARM list

Browse, mark, edit, measure, comment and draw modes



Easy comparison of data sets

Substorm Zoo Beta User eija logged in. [Logout](#)

Dataset #1: IL-indeksi 2002 #2: SuperMAG 2002 #3: AL_2002 #4: None #5: None
Event list #1: None #2: None #3: None My list: None Comments #1: None
Comments #2: None

Help Stop Browse Mark Edit Measure Comment Draw Zoom 2h 6h 12h 1d 2d 5d 10d 20d 50d 100d 1y 2y 10y 30y 100y Full

2001 Dec 31
Magnetic field [nT]
Time [day h.min]
Difference between the time-series against time-series #1

« Prev event Next event » Copy to mylist Remove substorm Reset view Download data « Prev comment Next comment » Zoom Days Go Goto Date Go

Jump »

Copyright (c) Eija Tanskanen and Antti Tanskanen, 2011 [Privacy policy](#) [Terms of use](#)

My page
Preferences
Lab notebook
Groups
Data analysis
Case studies
Global view of data sets
Magnetometers
TEST Spectral analysis
TEST Data analysis
Logs
My event lists
My data sets
Shared & group lists
Public event lists
Published event lists
Comments on data
Users
About us
Logout

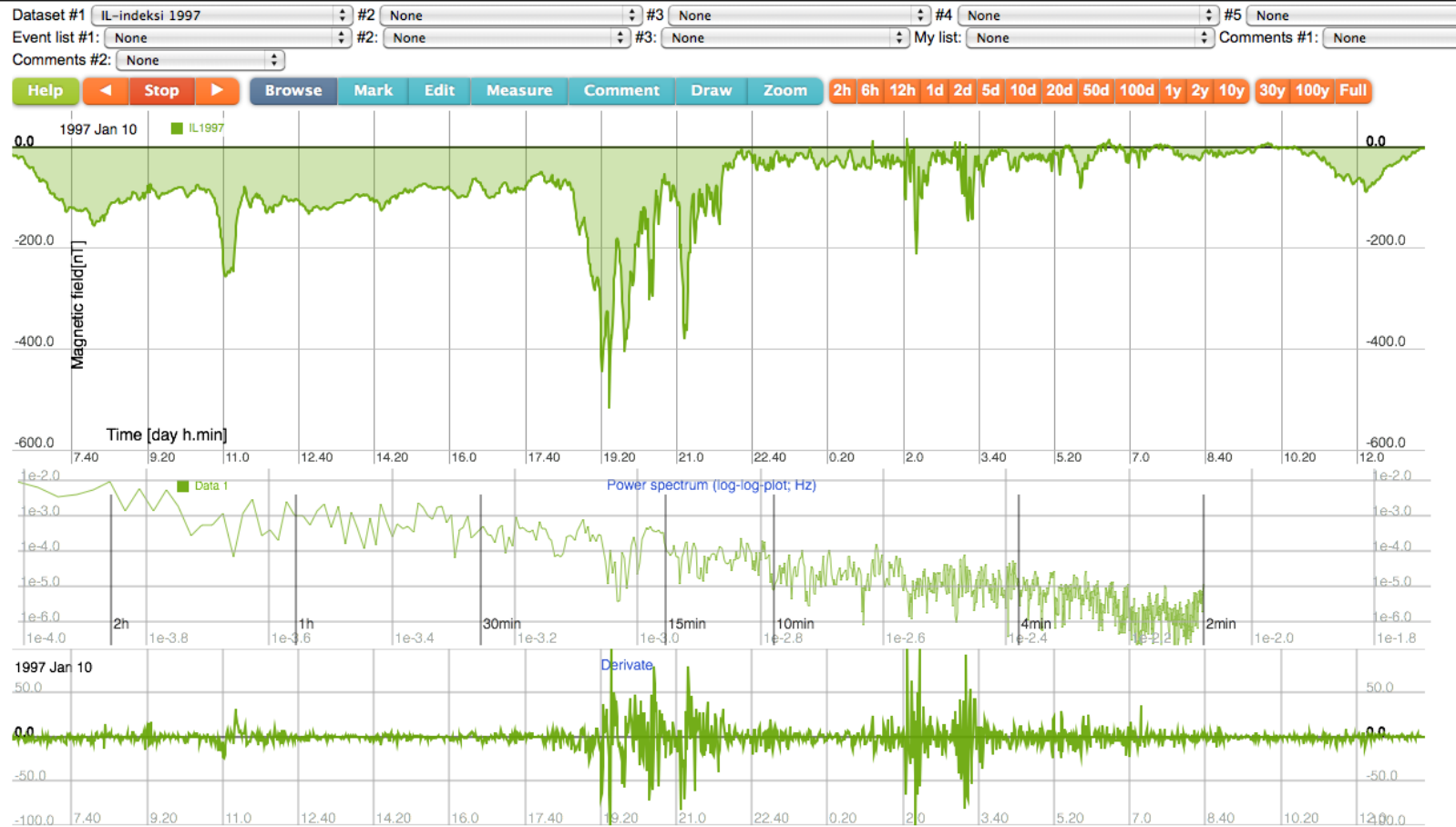
Panels
 Global view
 Spectral density
 Wavelet density
 Statistics
 Derivate
 Difference
 Large panels
 1 2 5 panels

Powerful analysis methods

Substorm Zoo Beta

User eija logged in. [Logout](#)

- My page
- Preferences
- Lab notebook
- Groups
- Data analysis
- Case studies
- Global view of data sets
- Magnetometers
- TEST Spectral analysis
- TEST Data analysis
- Logs
- My event lists
- My data sets
- Shared & group lists
- Public event lists
- Published event lists
- Comments on data
- Users
- About us
- Logout



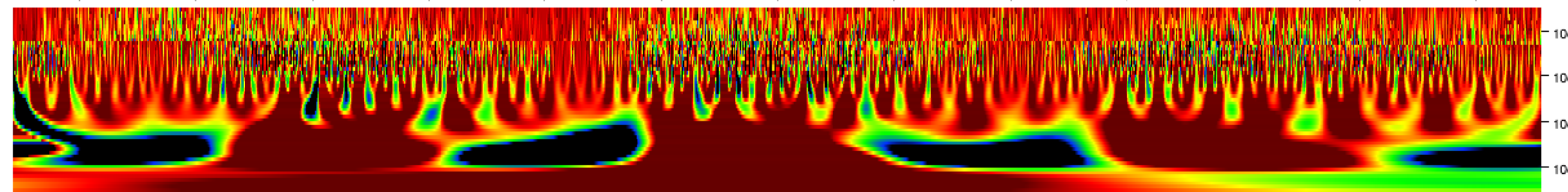
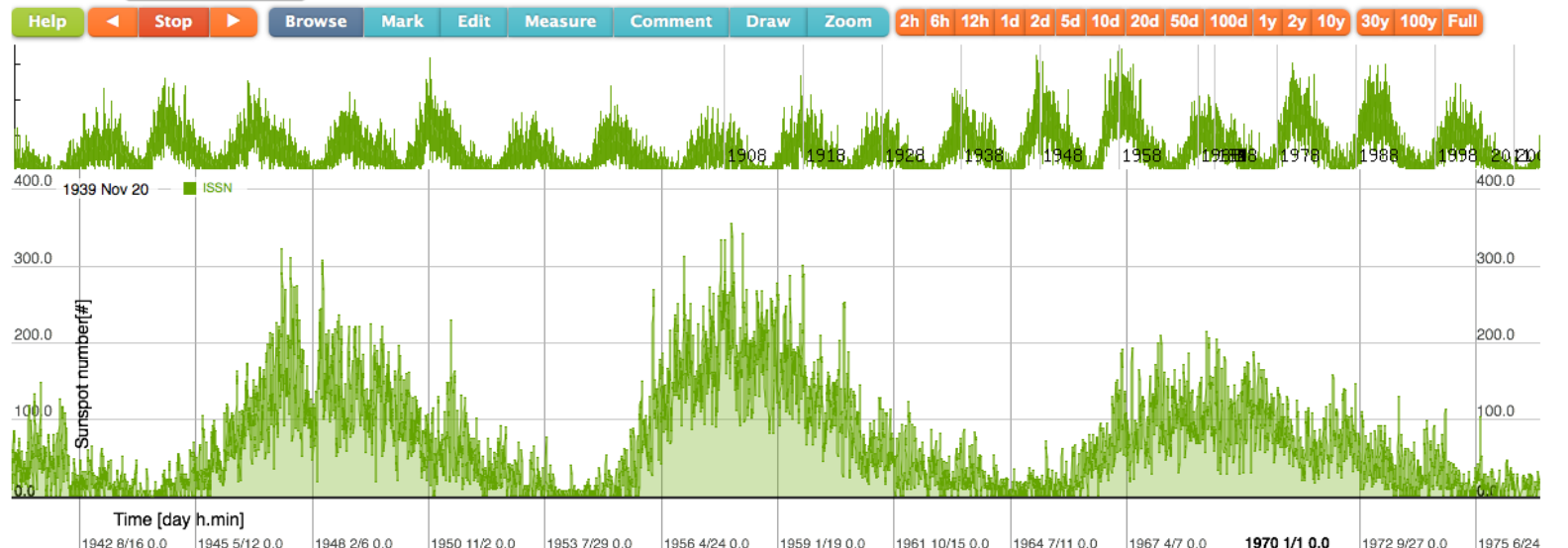
Tools for analysis of long-time series

Substorm Zoo *Beta*

User eija logged in. [Logout](#)

- My page
- Preferences
- Lab notebook
- Groups
- Data analysis
- Case studies
- Global view of data sets
- Magnetometers
- TEST Spectral analysis
- TEST Data analysis
- Logs
- My event lists
- My data sets
- Shared & group lists
- Public event lists
- Published event lists
- Comments on data
- Users
- About us
- Logout

Dataset #1: International Sunspot Number SIDC #2: None #3: None #4: None #5: None
Event list #1: None #2: None #3: None My list: None Comments #1: None
Comments #2: None



- Panels
- Global view
 - Spectral density
 - Wavelet density
 - Statistics
 - Derivate
 - Difference
 - Large panels
- 1 2 5 panels

« Prev event Next event » Copy to mylist Remove substorm Reset view Download data « Prev comment Next comment » Zoom Days Go Goto Date Go

Tools for statistical analysis

Choose list

Figure list

Text list

Most liked

Published list 'IL substorms2003' (699 events)

List: Display: [Download list](#) [Create private copy](#) [Superpostepoc](#) My list: [1](#) [2](#) [3](#) [7](#) [Next page](#)

Substorms identified from IL index. Reference: Tanskanen, E.I., A comprehensive high-throughput analysis of substorms observed by IMAGE magnetometer network: years 1993 - 2003 examined, 114, A05204, JGR, 2009.

ID	Start date	Start (UT)	Onset (UT)	Peak (UT)	End (UT)	Length (min)	Start value (nT)	End value (nT)	Peak value (nT)	Drop value (nT)	Type	Likes	Actions
14564	2003-01-01 at 20:09 UT	20.09	20.27	23.22	00.40	271	-11	-86	-447	88	0	Show	Copy to mylist Like
14565	2003-01-02 at 23:21 UT	23.21	23.43	00.10	01.35	134	-23	-46	-233	86	0	Show	Copy to mylist Like
14566	2003-01-03 at 16:00 UT	16.00	16.05	16.19	17.30	90	-122	-178	-905	83	0	Show	Copy to mylist Like
14567	2003-01-03 at 19:52 UT	19.52	20.36	20.46	22.56	184	-35	-107	-571	84	0	Show	Copy to mylist Like
14568	2003-01-03 at 23:14 UT	23.14	23.19	01.22	03.00	226	-56	-164	-595	84	0	Show	Copy to mylist Like
14569	2003-01-04 at 16:02 UT	16.02	16.25	16.52	17.23	81	-91	-62	-319	82	0	Show	Copy to mylist Like
14570	2003-01-04 at 18:46 UT	18.46	19.03	19.38	20.46	120	-55	-98	-498	90	0	Show	Copy to mylist Like
14571	2003-01-04 at 21:53 UT	21.53	22.23	23.25	02.12	259	-26	-57	-287	81	0	Show	Copy to mylist Like
14572	2003-01-05 at 20:05 UT	20.05	20.16	21.45	22.21	136	-62	-97	-527	81	0	Show	Copy to mylist Like
14573	2003-01-06 at 21:11 UT	21.11	21.43	22.32	23.57	166	-11	-74	-374	82	0	Show	Copy to mylist Like
14574	2003-01-07 at 17:48 UT	17.48	18.04	18.25	19.09	81	-44	-95	-528	81	0	Show	Copy to mylist Like
14575	2003-01-07 at 20:38 UT	20.38	21.05	22.11	22.50	132	-8	-34	-177	83	0	Show	Copy to mylist Like
14576	2003-01-08 at 21:29 UT	21.29	21.39	21.54	23.14	105	-21	-25	-127	93	0	Show	Copy to mylist Like
14577	2003-01-10 at 17:47 UT	17.47	18.12	23.37	00.53	426	-49	-84	-442	90	0	Show	Copy to mylist Like
14578	2003-01-11 at 2:23 UT	02.23	02.48	02.58	03.00	37	-30	-196	-216	84	0	Show	Copy to mylist Like

Kinetic scrolling and customized views

Substorm Zoo *Beta*

User eija logged in. [Logout](#)

- My page
- Preferences
- Lab notebook
- Groups
- Data analysis
- Case studies
- Global view of data sets
- Magnetometers
- TEST Spectral analysis
- TEST Data analysis
- Logs
- My event lists
- My data sets
- Shared & group lists
- Public event lists
- Published event lists
- Comments on data
- Users
- About us
- Logout

Personal info

Data analysis

Privacy

My page

Preferences for data analysis

Options

Autoscale Show values Show comments Time in minutes Global view substorms Flat time scale Show min & max Fill mode

Spectral options

Autoscale spectra Show wavelet values Normalize spectra Autoscale wavelet

Wavelet type: Mexhat Morlet

Panels

Large subpanels Spectral density Wavelet density Statistics Derivate Difference Global view

Data panels

Number of data panels: 1 2 5

Datapanel size

Size:

These preferences are loaded at login.

[Save](#)

Default data set

Default dataset:

This data set is shown if no other data set is chosen.

[Save](#)

Substorm Zoo

Request a user account

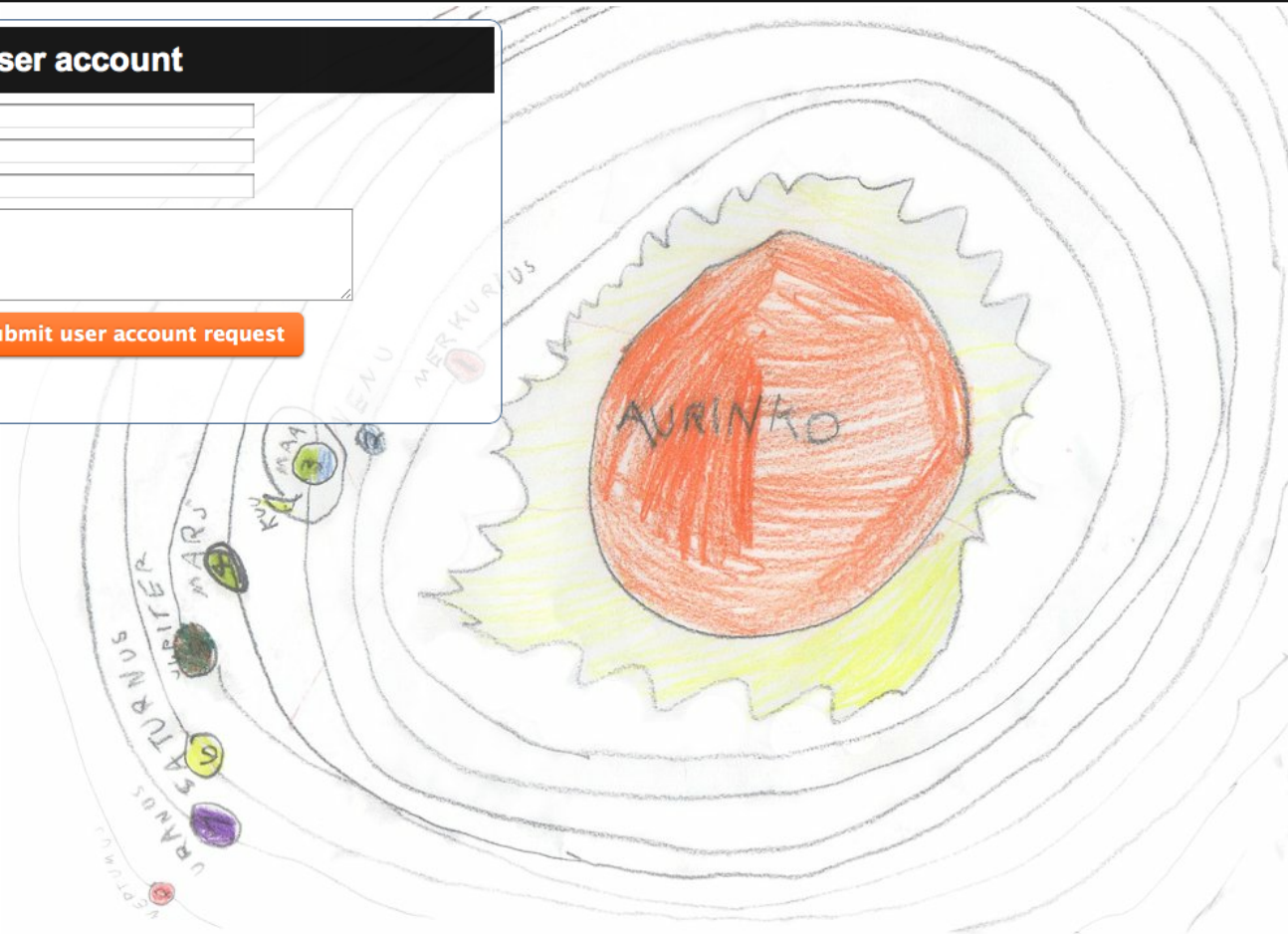
Name:

E-mail:

Organization:

A brief description of
the intended use:

[Submit user account request](#)



Welcome to Substorm Zoo

Our mission is to provide a best-in-class, browser-based tool for time-series analysis of data derived from magnetometer measurements, satellites and other instrument that provide time-series data of interest to the space science community. The aim is to provide a tool that is best suited for preliminary analyses, rapid data checks and comparisons of various data sets, not for all-encompassing comprehensive analyses.

In addition to data analysis, the website allows identification of important events in the data. The website is dedicated to the analysis of zoo of magnetospheric substorms and other meaningful events. For an account, please see [More information](#).

[To the login page!](#)

[More information](#)



<http://www.substormzoo.org>

www.substormzoo.org

Acknowledgements and courtesy to:

Substorm Zoo co-founder and co-developer, Antti Tanskanen, EK, Finland

MIRACLE/IMAGE of IL index.

Kyoto World Data Center of AL and Dst indices.

SuperMAG initiative of SLM index.

SIDC Belgium and NOAA of sunspot numbers.

DTU and Tromsø about individual magnetometer data.

ESA for Cluster data.

Oulu and Kiel universities of cosmic ray data.

ICME lists to E. Kilpua, I. Richardson.

CDAWeb, iSWA and

Illustration of the Sun and planets by Elsa Tanskanen.

We warmly thank all the other data providers not mentioned above and last, but not least

ALL THE USERS ABOUT THE USEFUL COMMENTS AND SUGGESTIONS!