

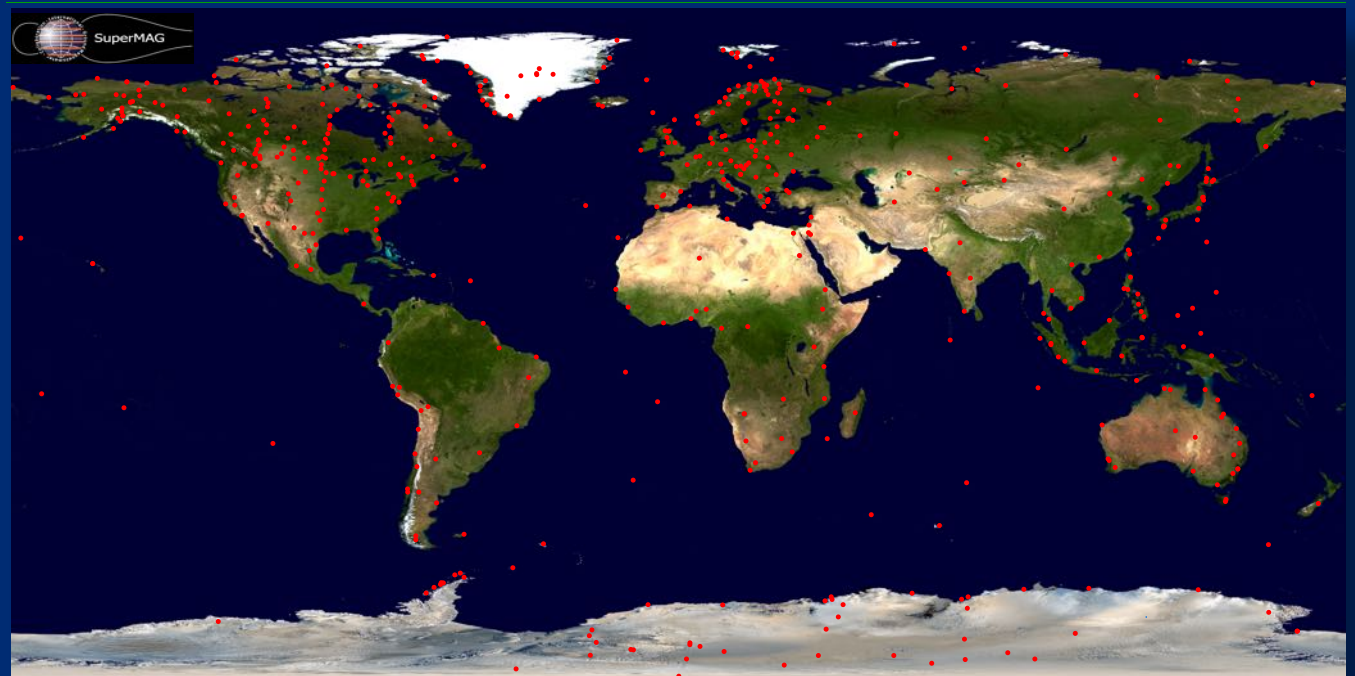


# SuperMAG

R.J.Barnes

# SuperMAG - Overview

- SuperMAG provides access to ground based magnetometer data
  - 49 years of data from 1969-2018
  - 487 ground stations
  - 36 contributors

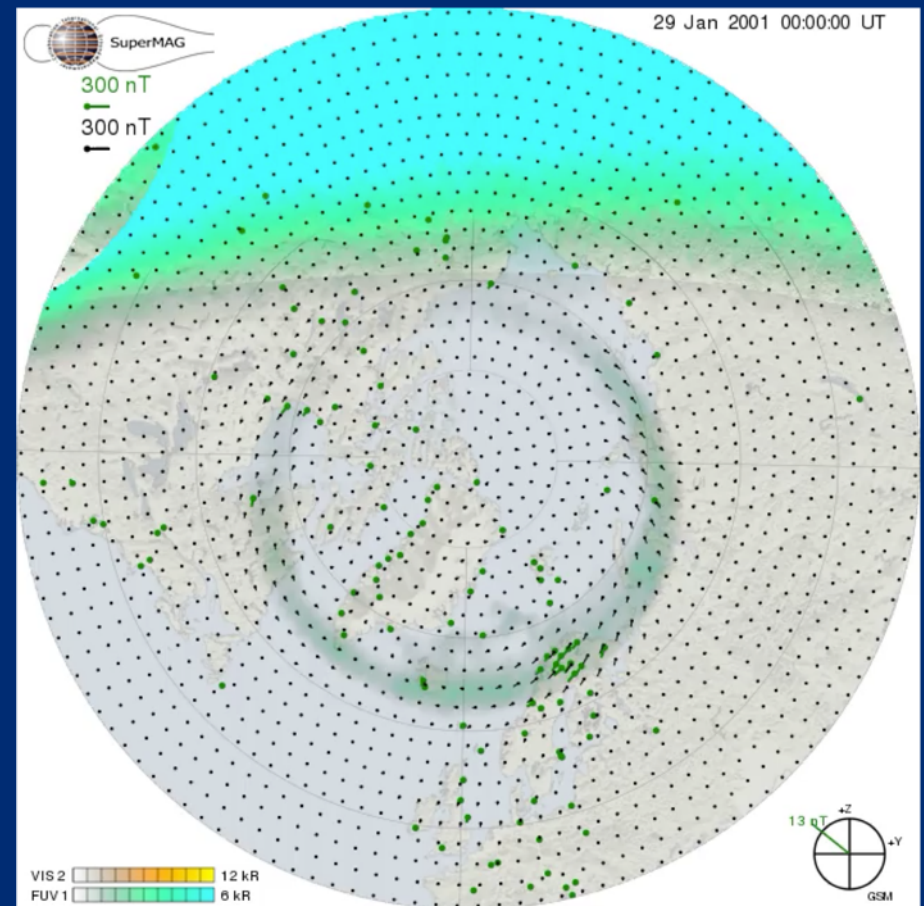


# SuperMAG - Overview

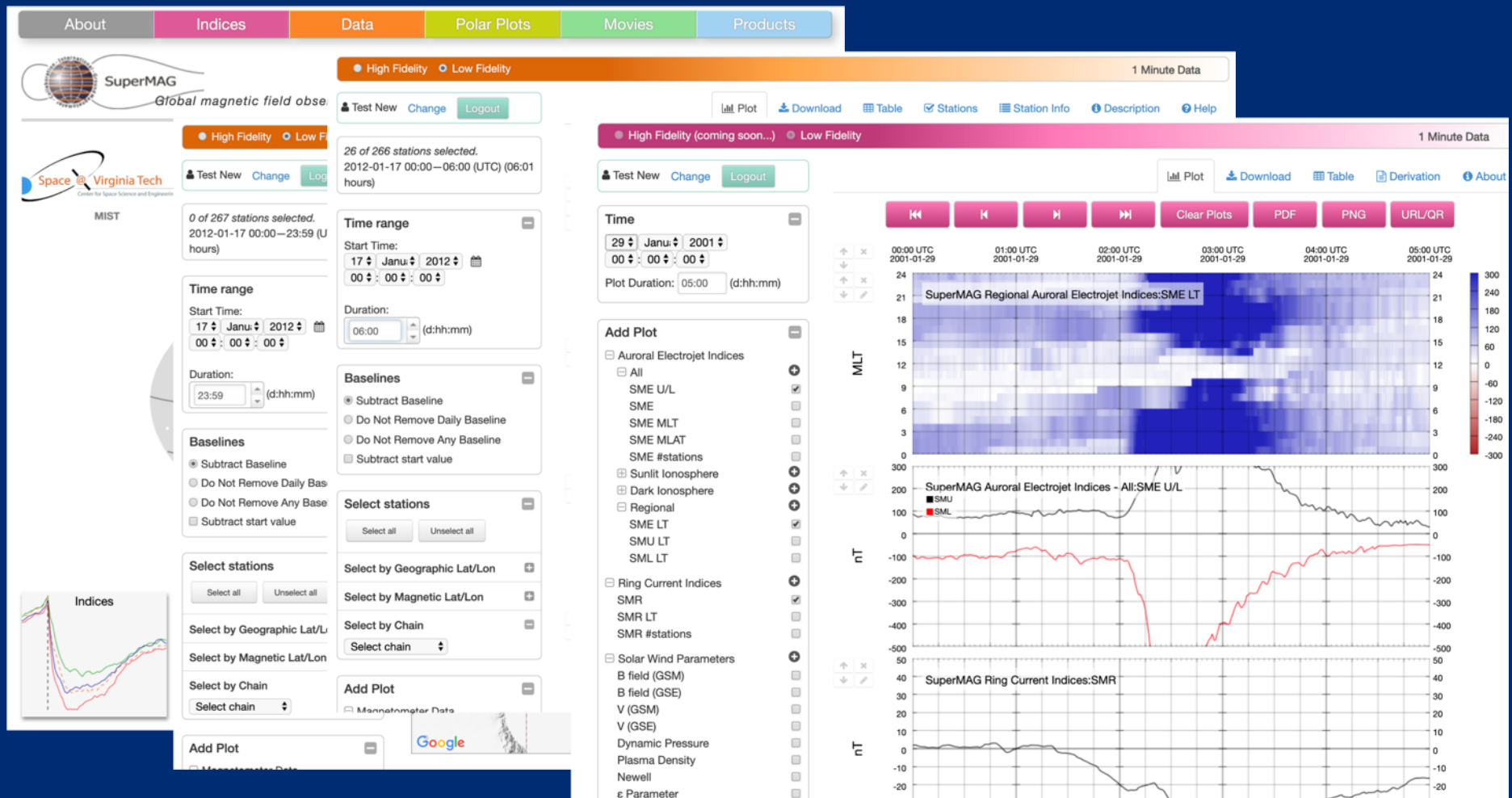
- SuperMAG is not a data provider
  - We do not serve the raw mag data
- SuperMAG is a data curator
  - SuperMAG cleans the data removing abnormalities
  - Baseline subtraction (yearly, daily)
  - Coordinate transformation into NEZ magnetic coordinate system
  - Consistent for all stations
- SuperMAG provides higher level data products
  - Fitted (Gridded) estimates of ground level magnetic field perturbations
  - Geophysical indices (SME,SMR, Solar wind parameters)
  - Derived ULF parameters PC2,PC3,PC4,PC5

# SuperMAG – Overview

- SuperMAG has had a huge impact
  - 2000 registered users
  - 100 publications a year
  - 10 thesis per year
  - 3500 active users per month



# http://supermag.jhuap.edu





# http://supermag.jhuapl.edu

High Fidelity Low Fidelity 1 Minute Data

Test New Change Logout

Small (2x3) Large

About Indices Data

SuperMAG

Products

Table Download Derivation About

## Substorm Database

The following comprehensive list of substorms have been derived using a simple automated algorithm to identify substorm expansion phase onsets from the SML index which is the SuperMAG equivalent of the well-known AL index.

[Description of the SuperMAG indices.](#)

## Caveat

The substorm list is updated as stations are added to the SuperMAG archive. Thus, this list is never final and a date of creation is included in the downloadable ASCII file. See the references below for a validation of this substorm list as well as the SML index.

### News and Updates

- July, 2019  
SuperMAG expands to include 1-sec data for the years 2012-2013.
- July, 2019  
300 Billion calculated ULF parameters for Pc2-Pc5 bands are released.
- July, 2019  
A few updates to web interface.

[supermag@listserv.jhuapl.edu](mailto:supermag@listserv.jhuapl.edu)  
Principal investigator: Jesper W. Gjerloev  
Website design and development: Brage Forland, Rob Barnes, Matt Potter and Tove Dehn

The purpose of SuperMAG is to help scientists, teachers, students and the general public have easy access to measurements of the Earth's magnetic field.  
SuperMAG is funded by NSF, NASA and ESA.

SuperMAG is a worldwide collection of geomagnetic ground station data and provides innovative products and services. All raw data is sourced from institutes around the world operating magnetometers and SuperMAG thanks these institutes and their funding bodies. SuperMAG data are not equivalent to the original data.

DATA PRODUCTS

- [Line Plots and Data](#)
- [Download](#)
- [Polar Plots](#)
- [Magnetic Indices](#)
- [Substorm Event List](#)
- [Movies](#)
- [Inventory](#)

ABOUT SUPERMAG DATA

- [Coordinate System and Baseline](#)
- [Magnetic Indices](#)
- [Station Information](#)
- [Solar Wind Data](#)
- [Global Auroral Images](#)
- [ULF Waves](#)
- [Substorm Database](#)
- [Acknowledgements](#)
- [Caveats](#)

USING SUPERMAG DATA

- [Rules of the Road](#)
- [Publications](#)
- [Frequently Asked Questions](#)
- [For Contributors](#)

ORGANIZATION

- [About SuperMAG](#)
- [Organization Overview](#)
- [Steering Committee](#)
- [Contact Information](#)
- [Newsletter Archive](#)
- [Maps and Logos](#)

Time

29 Jan 2001

02:30 (hh:mm)

Time Step: 1 Minute

Projection

North South Both

Geomagnetic Geographic

Stereographic (40° min.lat)

Fixed Local Time 0

Vectors rotated 90° clockwise

Magnetometer Vectors

Ground Magnetometer Vectors

Reference Vector

Scale: auto fixed 300

Line width: 2

Vector color: Green

Fitted Magnetometer Vectors

Fitted Ground Magnetometer Vectors

Fitted Reference Vector

Grid: MLT AACGM

Scale: auto fixed 300

Line width: 1

Vector color: Black

Time Range

Start Time: 29 Jan 2001 02:30:00

End Time: 18 July 2003 02:30:00

Duration (max 12 hours): 06:00 (hh:mm)

Projection

North South Both

Geomagnetic Geographic

Stereographic (50° min.lat)

Fixed Local Time 0

Vectors rotated 90° clockwise

Magnetometer Vectors

Ground Magnetometer Vectors

Reference Vector

Scale: auto fixed 300

Line width: 2

Vector color: Green

Fitted Magnetometer Vectors

Fitted Ground Magnetometer Vectors



# http://supermag.jhuapl.edu

The screenshot shows the SuperMAG Magnetometer Data website. The top navigation bar includes links for About, Indices, Data, Polar Plots, Movies, and Products. The main header features the SuperMAG logo and the APL logo. Below the header, there are tabs for High Fidelity and Low Fidelity data, and a 1 Minute Data option. The left sidebar contains a 'Test New' button, a 'Change' button, and a 'Logout' button. It also displays a message: '0 of 175 stations selected. 2001-01-29 02:30—08:30 (UTC) (06:01 hours)'. The 'Time range' section allows users to select a start time (29 Jan 2001 02:30:00) and a duration (06:00). The 'Baselines' section has options for 'Subtract Baseline', 'Do Not Remove Daily Baseline', 'Do Not Remove Any Baseline', and 'Subtract start value'. The 'Select stations' section includes 'Select all' and 'Unselect all' buttons. The 'Download options' section includes checkboxes for 'Include MLT and MLAT', 'Include Declination from IGRF Model', and 'Include Solar Zenith Angle (SZA)'. It also has a 'Download Duration' section with options for 'Full year' and '06:00 (d:hh:mm)'. The 'Format' section has options for 'ASCII (self documented)' and 'CSV (comma separated)'. A 'Rules of the Road' section provides information about data usage. At the bottom, there is a 'Download Magnetometer Data' button and a 'Security Code' field.

SuperMAG Magnetometer Data

High Fidelity Low Fidelity 1 Minute Data

Test New Change Logout

0 of 175 stations selected.  
2001-01-29 02:30—08:30 (UTC) (06:01 hours)

Time range

Start Time:  
29 Jan 2001  
02:30:00

Duration:  
06:00 (d:hh:mm)

Baselines

☒ Subtract Baseline  
☐ Do Not Remove Daily Baseline  
☐ Do Not Remove Any Baseline  
☐ Subtract start value

Select stations

Select all Unselect all

Select by Geographic Lat/Lon

Select by Magnetic Lat/Lon

Download options

☒ Include MLT and MLAT  
☒ Include Declination from IGRF Model  
☒ Include Solar Zenith Angle (SZA)

Download Duration:

☐ Full year  
☒ 06:00 (d:hh:mm)

Format:

☒ ASCII (self documented)  
☐ CSV (comma separated)

By downloading data from SuperMAG you agree to follow the Rules of the Road

Enter Security Code:  
8QCS

Download Magnetometer Data

Rules of the Road

SuperMAG is made possible by the generous contribution of data by numerous collaborators. To ensure their continued operation the user must follow the below rules-of-the-road. Data, plots or derived data products are provided under the limitations of "fair use" and cannot be redistributed. Contact the individual instrument PI and the SuperMAG PI for requests that are in conflict with these restrictions.

The user is requested to acknowledge individual collaborators and SuperMAG when original data, derived data, movies, or data products are used in publications and/or presentations.

Show full text

# http://supermag.jhuapl.edu

- Hybrid system using a mixture of client and server side software
- Extensive use of HTML5 (JavaScript)
- Based on software from the Van Allen Probes Science Gateway
  - <http://rbspgway.jhuapl.edu/>
- Runs on stock browsers – does not require any extensions/software downloads
- Server side software does the heavy lifting
- Parallel operations for speed
- What you see is what you get – data downloads reflect what you have plotted.



# <http://supermag.jhuapl.edu>

- Higher level data products:
  - Geophysical indices derived from SuperMAG data
  - Gridded (Fitted) maps of ground magnetic field perturbations
  - Substorm database derived from SuperMAG observations
  - Publication quality plots, custom movies

# <http://supermag.jhuapl.edu>

- SuperMAG supports digital download of data
  - ASCII file for indices and magnetometer data
  - netCDF files for fitted data
- Web services interface
  - Custom implementation to fit our unique data set

# Lessons learned

- The three click rule
  - If you are more than three clicks from a useful product you've failed
  - User interface must be intuitive
  - Be responsive – web site must provide immediate feedback to users

# Lessons Learned

- Versioning of data is important
  - SuperMAG data is reprocessed on a near continuous basis
  - Currently yearly updates are added at the start of the year – this will change
  - SuperMAG has developed a deployment strategy
    - Data is staged on the server (sandbox)
    - Data is versioned and inspected
    - Data is deployed

# Lessons Learned

- Attribution is important
  - SuperMAG is dependent on the good will of data providers
    - We have no agency mandate
  - Data providers need to know how and who are using their data
  - Data providers often request consultation and credit when their data is used
    - Co-authorship or citation

# Lessons Learned

- SuperMAG “Rules of the Road” clearly state how SuperMAG products should be referenced in publications
- SuperMAG has a simple user registration system for logging purposes
  - Only required for download of plots/movies/data
- We record detailed logs of all activity on the web sit
- Each data provider has a private page on the SuperMAG web site that lists statistics on their data use
- SuperMAG has appointed a steering committee for governance



# Going forward

- Implement standard web service interfaces such as HAPI
- Improve download capability to support more data standards
- Build python interface to the data system



JOHNS HOPKINS  
APPLIED PHYSICS LABORATORY