

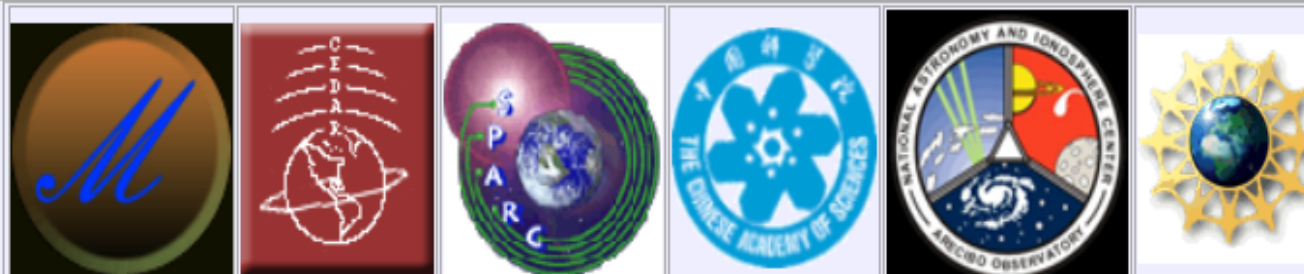
Welcome to the Madrigal Database at Haystack Observatory

Try the new Simple Madrigal Data Access link on the [Access Data](#) page.

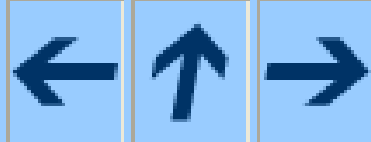
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- [Open Madrigal](#)
- [Space Science Resources](#)
- [Real-time Data Sources](#)

Madrigal is an upper atmospheric science database used by groups throughout the world. Madrigal is a robust, World Wide Web based system capable of managing and serving archival and real-time data, in a variety of formats, from a wide range of upper atmospheric science instruments. The basic data format is the same as that used by the [National Science Foundation](#) supported Coupling, Energetics and Dynamics of Atmospheric Regions (CEDAR) program, which maintains a [CEDAR Database](#) at the National Center for Atmospheric Research (NCAR). Data files are easily exchanged between the two sites, but Madrigal has a significantly different emphasis. Data at each Madrigal site is locally controlled and can be updated at any time, but shared metadata between Madrigal sites allow searching of all Madrigal sites at once.

Data can be accessed from the Madrigal sites at [Millstone Hill](#), USA, [Arecibo](#), Puerto Rico, [EISCAT](#), Norway, [SRI International](#), USA, [Cornell University](#), USA, [Jicamarca](#), Peru, [The Institute of Solar-Terrestrial Physics](#), Russia, and [Wuhan Ionospheric Observatory](#), the Chinese Academy of Sciences. and directly, using [APIs](#) which are available for several popular programming languages. A CVS archive of all Madrigal software and documentation is available from the [Open Madrigal](#) Web site. The latest version of Madrigal may also be downloaded from there.

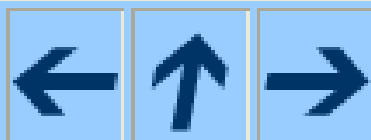


<http://madrigal.haystack.mit.edu/madrigal/>



Madrigal web tutorial - Table of contents

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- [2. How does Madrigal organize data?](#)
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Access Madrigal Data

There are four ways to access Madrigal data. Choosing *Simple Madrigal Data Access* will allow you to print and plot Madrigal data via an easy to use interface. However, this interface does not allow you to see derived parameters or to filter data. To look at the data from a particular Madrigal experiment using the full-featured Madrigal interface, choose *Browse for Individual Madrigal Experiments*. To get data in ascii format from a group of Madrigal experiments all at once, choose *Global Madrigal Database Report*. To plot data from one or more instruments and/or experiments, choose *Plot Data from Instruments*.

Simple Madrigal Data Access

The simple madrigal data access link allows new users of Madrigal to print and plot data easily. In order to make it easy to use, a number of Madrigal's capabilities are not available, including the ability to choose which parameters to print, the ability to display derived parameters, and the ability to filter data. Use the other three Madrigal interfaces below to access these more powerful capabilities. Click [here](#) for a tutorial on this way to access Madrigal data.

Browse for Individual Madrigal Experiments

Browse for individual Madrigal experiments displays a list of available experiments, subject to user-specified filters. One of the filters specifies the instruments you want to see. For several of the incoherent scatter radars, for example Millstone and EISCAT, there are several options corresponding to different antennas. As a rule, select the first option, which displays all data from that instrument. In addition to the filters, a number of options may be selected on the form. For example, it is possible to display a combined listing of experiments at all Madrigal sites, or only the experiments at the current site. Click [here](#) for a tutorial on this way to access Madrigal data.

Global Madrigal Database Report

This form allows you to generate a report on multiple experiments at once. Experiments can be filtered by instrument, kind of data, and date range or season. The data within any given experiment can be filtered using any parameter, measured or derived. Data from all experiments located in the local Madrigal database matching your criteria will be returned in a single report. Click [here](#) for a tutorial on this way to access Madrigal data.

Plot Data from Instruments

Simple Madrigal data access - select an instrument...

Click on the instrument you want to get data or plots from:

Select an instrument

- Jicamarca IS Radar
- Arecibo IS Radar - Linefeed
- MU IS Radar
- Millstone Hill IS Radar
- Millstone Hill UHF Zenith Antenna
- St. Santin IS Radar
- St. Santin Nançay Receiver
- Chatanika IS Radar
- ISTP Irkutsk Radar

[Tutorial on this page](#)

[Return to Access Data page](#)

[Return to Madrigal home page](#)

[How is the simple data access different?](#)

Please send any comments or suggestions to the [Open Madrigal Users Mailing List](#).



Simple Madrigal data access - select dates...

Selected Instrument: *Millstone Hill IS Radar*

Click on one or more dates you want data or plots from:

(Windows users: Hold down *Control* key to select more than one date)

2006-06-19	▲
2006-06-16	
2006-06-01	
2006-05-31	
2006-05-16	
2006-05-02	
2006-04-28	
2006-04-12	
2006-04-06	
2006-04-05	▼

Plot data

[Tutorial](#) on
this page

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Madrigal home
page](#)

[How is the simple
data access different?](#)

Please send any comments or suggestions to the [Open Madrigal Users Mailing List](#).

Simple Madrigal data access - select parameter and y axis for plotting...

Selected Instrument:

- *Millstone Hill IS Radar*

Selected dates:

- 2005-09-10

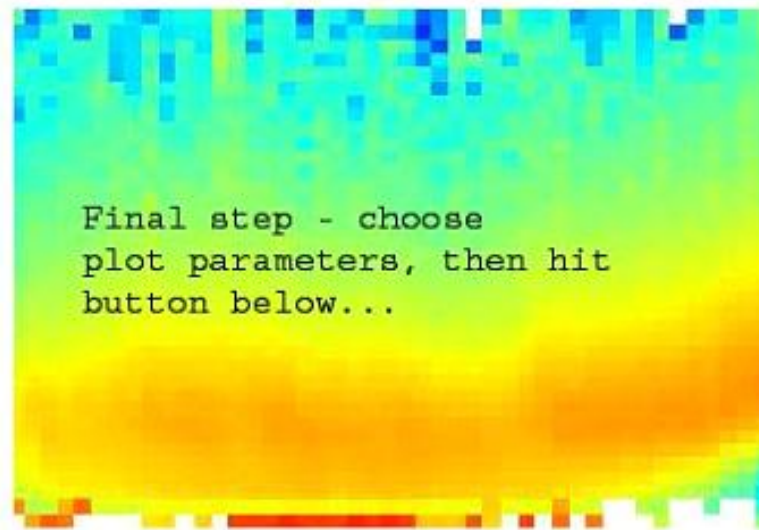
Create a new plot...

Choose parameter to plot:

Log10(uncorrected electron density)

Select y axis:

Altitude



Time

or, view existing plots and descriptions:

- 2005-09-10
 - [INSCAL Analysis notes for mlh 1142298092](#)
 - [Electron density summary plots](#)
 - [Electron temperature summary plots](#)
 - [Ion temperature summary plots](#)
 - [Ion velocity summary plots](#)

[Tutorial](#) on this

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[How is the simple data access](#)

Electron density summary plots for Millstone Hill Radar

Sep. 10, 2005

[Electron temperature summary
plots](#)

[Ion temperature summary
plots](#)

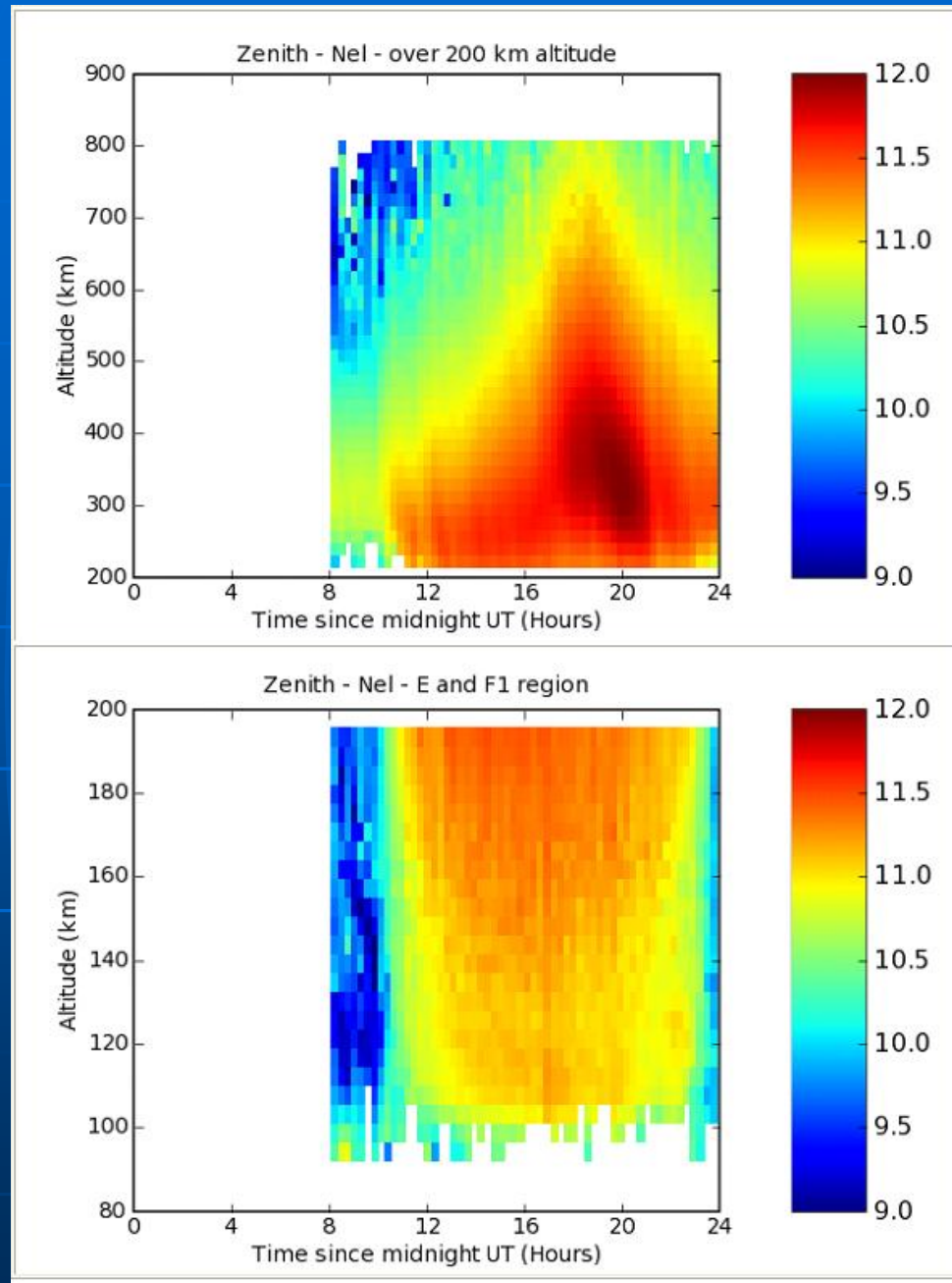
[Ion velocity summary
plots](#)

Rapid LTCS Experiment

This is an experiment designed to provide rapid time coverage of the E-region and F-region ionosphere. This experiment is useful for providing high altitude resolution in the E-region and F-region along with sufficient pointing directions using MISA to provide electric field measurements. The dwell time in a given position is 8 minutes to provide the possibility of a long integration if needed. The overall cycle time of the experiment is 65 minutes with a measurement triplet every 32 minutes.

This page has the following summary plots of electron density:

1. [Zenith antenna - altitudes above 200 km versus time using single pulse measurements](#)
2. [Zenith antenna - E and F1-region altitudes versus time using alternating code measurements](#)
3. [Misa antenna - Azimuth=0°\(North\), Elevation=45°, altitudes above 200 km versus time using single pulse measurements](#)
4. [Misa antenna - Azimuth=0°\(North\), Elevation=45°, E and F1-region altitudes versus time using alternating code measurements](#)
5. [Misa antenna - Azimuth=-90°\(West\), Elevation=45°, altitudes above 200 km versus time using single pulse measurements](#)
6. [Misa antenna - Azimuth=-90°\(West\), Elevation=45°, E and F1-region altitudes versus time using alternating code measurements](#)



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Plot Data from Instruments

Madrigal Experiment Selector

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[Tutorial on this page](#)

[Return to access data page](#)

Select instrument(s)

College Fabry-Perot
Sondre Stromfjord and Thule Fabry-Perots
Thule Fabry-Perot
Stockholm IR Michelson
CEDAR Iidar
USU CCD Imager
CEDAR Imager
MIO
All-sky cameras at Gaanaaq
World-wide GPS Receiver Network

Select list format

- Experiment ID
- Madrigal Site
- Start Date
- Start Time
- End Date
- End Time
- Instrument Code
- Instrument Mnemonic
- Instrument Name
- Experiment Name

Select date range

Start Day, Month, Year
 End Day, Month, Year

Options

Sort Order	Date Order	Date Format	File Selection	Show Experiments at
<input checked="" type="radio"/> Date	<input checked="" type="radio"/> Earliest first	<input checked="" type="radio"/> 03/21/1999	<input checked="" type="radio"/> Show Latest Files	<input checked="" type="radio"/> All Madrigal Sites
<input type="radio"/> Instrument	<input type="radio"/> Latest First	<input type="radio"/> 21.03.1999	<input type="radio"/> Show History Files	<input type="radio"/> This Madrigal Site

[List selected data](#)

Madrigal Experiment Listing

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[Return to access data page](#)

Site	Start Date	S Tm	End Date	E Tm	Inst	Experiment Name
GO Mills	09/10/2005	0000	09/10/2005	2355	gps	World-wide Vertical Total Electron Content
GO Mills	09/11/2005	0000	09/11/2005	2355	gps	World-wide Vertical Total Electron Content

World-wide GPS Receiver Network

World-wide Vertical Total Electron Content

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[Return to access data page](#)

Start Time: 09/10/2005 00:00:00 End Time: 09/10/2005 23:55:00

CEDAR Format Datasets:

- [gps050910g.001](#) - default file for Minimum Scallop TEC Processing - status: final
 - [View description from the catalog and/or header records](#)
 - [File Summary](#) - Record summary, list of parameters in file, etc.
 - [Data Browser \(isprint\)](#) - Flat-file listing of a user-selected portion of the file
 - [Download file](#) - Download [gps050910g.001](#) in selected format

Additional information:

- [TEC Maps](#)

Notes

[Add to these notes](#)

ISPrint Database Browser

Experiment: World-wide Vertical Total Electron Content

[Return to experiment list](#)

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[A tutorial](#) on how to use this page

[Return to access data page](#)

Sat Sep 10 00:00:00 2005 - Sat Sep 10 23:55:00 2005 : World-wide GPS Receiver Network

Available Filters - Using default or manually entered selections

Set data filters manually, or ...

- Data will be listed only if it falls within the range of the filter
- For azimuth and elevation, two separate ranges can now be used
- [Explanation of Filters](#)

Start date: Sep 10 2005

Start time: H: 0 M: 0 S: 0

End date: Sep 10 2005

End time: H: 23 M: 55 S: 0

[Optional free-form filters using any parameter mnemonic on this page](#)

...use a saved filter and parameter selection:

Public Directories:

Public filters:

You are not
logged in.

Available Parameters (Comprehensive)

- [Description of parameters](#)
- [ISPrint\(Short form\)](#)

(parameters with regular typeface are derived)

Time Related Parameter

<input type="checkbox"/> BDAY	<input type="checkbox"/> BEG UT	<input type="checkbox"/> BHHMMSS	<input type="checkbox"/> BHM	<input type="checkbox"/> BMONTH
<input type="checkbox"/> B UTH	<input type="checkbox"/> DAY	<input type="checkbox"/> DAYNO	<input type="checkbox"/> DUT21	<input type="checkbox"/> EHHMMSS
<input type="checkbox"/> FYEAR	<input type="checkbox"/> HOUR	<input type="checkbox"/> JDAYNO	<input type="checkbox"/> MD	<input type="checkbox"/> MIN
<input type="checkbox"/> MONTH	<input type="checkbox"/> RECNO	<input type="checkbox"/> SEC	<input type="checkbox"/> SLT	<input type="checkbox"/> UT
<input type="checkbox"/> UT1	<input type="checkbox"/> UT2	<input type="checkbox"/> UTH	<input type="checkbox"/> YEAR	

Geographic Coordinate

<input type="checkbox"/> GDLAT	<input type="checkbox"/> GLON	<input type="checkbox"/> SDWHT	<input type="checkbox"/> SZEN	
--	---	--	---	--

Geophysical Index

<input type="checkbox"/> AP	<input type="checkbox"/> AP3	<input type="checkbox"/> DST	<input type="checkbox"/> F10.7	<input type="checkbox"/> FBAR
<input type="checkbox"/> KP				

Interplanetary Magnetic Field

<input type="checkbox"/> BIMF	<input type="checkbox"/> BXGSE	<input type="checkbox"/> BXGSM	<input type="checkbox"/> BYGSE	<input type="checkbox"/> BYGSM
<input type="checkbox"/> BZGSE	<input type="checkbox"/> BZGSM	<input type="checkbox"/> SWDEN	<input type="checkbox"/> SWQ	<input type="checkbox"/> SWSPD

I. S. Radar Basic Parameter

Experiment: World-wide Vertical Total Electron Content

[Return to experiment list](#) [Return to Madrigal homepage](#) [A tutorial on how to use this page](#) [Return to access data page](#)

Sat Sep 10 00:00:00 2005 - Sat Sep 10 23:55:00 2005 : World-wide GPS Receiver Network

Available Filters

Set data filters manually, or ...

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- For azimuth and elevation, two separate ranges can now be used
- [Explanation of Filters](#)

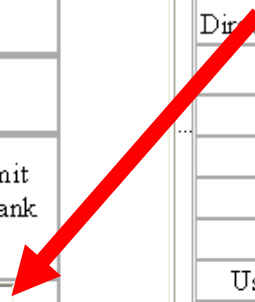
Start date:	Sep	10	2005
Start time:	H: 0	M: 0	S: 0
End date:	Sep	10	2005
End time:	H: 23	M: 55	S: 0

[Optional free-form filters using any parameter mnemonic on this page](#)

Mnemonic (or Mnem1 +, -, *, / Mnem2) (example: <u>gdalt</u> or <u>gdalt</u> - <u>sdwht</u>) Leave spaces between mnemonics and operator	Lower limit (leave blank if none)	Upper limit (leave blank if none)
<input type="text" value="gdlat"/>	<input type="text" value="40.0"/>	<input type="text" value="44.0"/>
<input type="text" value="glon"/>	<input type="text" value="150.0"/>	<input type="text" value="200.0"/>

...use a saved filter and parameter selection:

Public Directories:	<input type="text" value="jfoster:jfoster"/>
Public filters:	<input type="text" value="coherent1"/>
Private Directories:	<input type="text"/>
Filters:	<input type="text"/>
User:	<input type="text" value="ajc"/>



(parameters with regular typeface are derived)

Time Related Parameter

<input type="checkbox"/> <u>B</u> DAY	<input type="checkbox"/> <u>B</u> EG UT	<input type="checkbox"/> <u>B</u> HHMMSS	<input type="checkbox"/> <u>B</u> HM	<input type="checkbox"/> <u>B</u> MONTH
<input type="checkbox"/> <u>B</u> UTH	<input type="checkbox"/> <u>D</u> AY	<input type="checkbox"/> <u>D</u> AYNO	<input type="checkbox"/> <u>D</u> UT21	<input checked="" type="checkbox"/> <u>E</u> HHMMSS
<input type="checkbox"/> <u>F</u> YEAR	<input type="checkbox"/> <u>H</u> OUR	<input type="checkbox"/> <u>J</u> DAYNO	<input type="checkbox"/> <u>M</u> D	<input type="checkbox"/> <u>M</u> IN
<input type="checkbox"/> <u>M</u> ONTH	<input type="checkbox"/> <u>R</u> ECNO	<input type="checkbox"/> <u>S</u> EC	<input type="checkbox"/> <u>S</u> LT	<input type="checkbox"/> <u>U</u> T
<input type="checkbox"/> <u>U</u> T1	<input type="checkbox"/> <u>U</u> T2	<input type="checkbox"/> <u>U</u> TH	<input type="checkbox"/> <u>Y</u> EAR	

Geographic Coordinate

<input checked="" type="checkbox"/> <u>G</u> DLAT	<input checked="" type="checkbox"/> <u>G</u> LON	<input type="checkbox"/> <u>S</u> DWHT	<input type="checkbox"/> <u>S</u> ZEN	
---	--	--	---------------------------------------	--

Geophysical Index

<input type="checkbox"/> <u>A</u> P	<input type="checkbox"/> <u>A</u> P3	<input type="checkbox"/> <u>D</u> ST	<input type="checkbox"/> <u>F</u> 10.7	<input type="checkbox"/> <u>F</u> BAR
<input type="checkbox"/> <u>K</u> P				

Interplanetary Magnetic Field

<input type="checkbox"/> <u>B</u> IMF	<input type="checkbox"/> <u>B</u> XGSE	<input type="checkbox"/> <u>B</u> XGSM	<input type="checkbox"/> <u>B</u> YGSE	<input type="checkbox"/> <u>B</u> YGSM
<input type="checkbox"/> <u>B</u> ZGSE	<input type="checkbox"/> <u>B</u> ZGSM	<input type="checkbox"/> <u>S</u> WDEN	<input type="checkbox"/> <u>S</u> WQ	<input type="checkbox"/> <u>S</u> WSPD

I. S. Radar Basic Parameter

<input checked="" type="checkbox"/> <u>T</u> EC				
---	--	--	--	--

I. S. Radar Operation Parameter

<input type="checkbox"/> <u>F</u> OF2				
---------------------------------------	--	--	--	--

Live demo of Madrigal web page

- Start at any Madrigal server (e.g., <http://www.haystack.mit.edu/madrigal>)

Remote Access to Madrigal Data

- Built on web services
- Like the web, available from anywhere on any platform
- Complete Matlab and Python API written
- More APIs available on request or via contribution

Madrigal Web Services

- Simple delimited output via CGI scripts
- Not based on SOAP or XmlRpc since no support in languages such as Matlab
- CGI arguments and output fully documented at <http://www.haystack.edu/madrigal/remoteAPIs.html>

Matlab Remote API

- Methods
 - getInstrumentsWeb
 - getExperimentsWeb
 - getExperimentFilesWeb
 - getParametersWeb
 - isprintWeb
 - madCalculatorWeb
- Methods match Madrigal model

Simple Matlab example

```
filename = '/usr/local/madroot/experiments  
/2003/tro/05jun03/NCAR_2003-06-05_tau2pl_60_uhf.bin';
```

```
eiscat_cgi_url = 'http://www.eiscat.se/madrigal/cgi-bin/';
```

```
% download the following parameters from the above file: ut, gdalt, ti
```

```
parms = 'ut,gdalt,ti';
```

```
filterStr = 'filter=gdalt,200,600 filter=ti,0,5000';
```

```
% returns a three dimensional array of double with the dimensions:
```

```
%
```

```
% [Number of rows, number of parameters requested, number of records]
```

```
%
```

```
% If error or no data returned, will return error explanation string instead.
```

```
data = isprintWeb(eiscat_cgi_url, filename, parms, filterStr);
```

**Matlab
Madrigal
API call**



Simple Matlab example, continued

- See <http://madrigal.haystack.edu/madrigal/remoteMatlabAPI.html> for complete documentation and more examples

Live Matlab API demo

- See `/home/brideout/examples/demoMadrigalWebServices.m`

To run the Matlab demo:

1. `cd /opt/madrigal/bin/demo`
2. Start matlab
3. From the command window, run `"demoMadrigalWebServices"`.

Extending/contributing to Madrigal

- Madrigal is completely open source
- See www.openmadrigal.org for CVS
- All new code is C/Python, with some Tcl. Derivation methods sometimes in Fortran.

DEMOS

- DEMO GPS TEC MAPS

<http://madrigoal.haystack.mit.edu/cgi-bin/madrigoal/simpleChooseInstrument.py>

- DEMO CONVERSION TO GEOMAGNETIC COORDINATES

<http://madrigoal.haystack.mit.edu/cgi-bin/madrigoal/madInvent.cgi>

- DEMO DST FILTER (WITH EXPLANATION)

- DEMO MATLAB PROGRAMS TO LOOK AT GPS TEC