EISCAT getting data Thomas Ulich

Scientist's Day

Inave a project, but now I need to:

- Search numerous websites for data
- Figure out their parameters, units
- Figure out their co-ordinate system, date format
- Figure out how to determine data quality
- For EISCAT, For EISCAT, solution! MADRIGAL is the solution! Write code to dewnload data, or download manually
- Write code to convert to your format
- Finally, do science

Madrigal?

www.openmadrigal.org

- Database designed to hold one group's data
- Open source
- Web based
- Designed for a wide variety of instruments
- Built on the CEDAR database format

Madrigal Data Model

Madrigal Site

(typically a facility with scientists and a Madrigal installation)

Instruments

(ground-based typically with a set of locations)

Experiments

(typically of limited duration)

Data shared among all Madrigal sites

Experiment Files

(data from one analysis of the experiment)

Records

(measurement over one period of time)

Data unique to one Madrigal site

Madrigal Records

A record is a measurement over one period of time.Three types:

- Catalogue record
 - describes entire experiment
- Header record
 - describes one section of the experiment
- Data record
 - Stores values
 - Parameters defined by CEDAR database standard
 - Contains 3 parts: Prolog, 1D records, 2D records

Madrigal Data Records

Prolog

- Start and end time
- Instrument ID
- Kind of data ID
- ID records (scalar)
 - Single-value parameters
- 2D records (vector)
 - Multiple-value parameters
 - All parameters must have the same number of rows ("matrix")
 - Not meant for time variation conflicts with Prolog!

CEDAR/Madrigal Database

All parameters in file defined here:

http://cedarweb.hao.ucar.edu/documents/parameters_list.txt

- Ranges of parameters for each instrument
- Data stored in one or two 16-bit integers
- Error parameters:
 - Mnemonics start with D
 - Code is negative of parameter code

	http://cedapweb.bao.ucar.edu/decument	s / paramotor	e liet tyt		Concerto	
	mtp.//ceuarweb.nao.ucar.eou/document	s/parameter	s_list.txt			
http://cedarweb	hao.ucar.edu/do					4
The parame	ter codes list is given twice, fi	rst sorte	d by as	cending		
numeric VA	LUE, then sorted alphabetically b	y abbrevi	ation.			
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(Time Related	Codes +)					
(IIMe Kelaced	codes:)					
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10 Year	universal time)	1.	yr	year		
15 Year	UT) of analysis date	1.	yr	yranal		
19 Beginn	ing month/day (universal time)	1.	mmdd	bmd		
20 Month	day (universal time)	1.	mmdd	md		
21 Day nu	mber of year (universal time)	1.	day	dayno		
22 Model	Day number of year (UT, 1=Jan 1)	1.	day	mdano		
25 Month	day (UT) of analysis date	1.	mmdd	mdanal		
28 Begini	ing hour/min (universal time)	1.	hhmm	bhm		
29 Begini	ing additional increment to hhmm	1.E-02	S	bhmi		
30 Hour/i	in (universal time)	1.	nnmm	nm hmi		
31 Centis	econds (UT, increment to nnmm)	1.E-02	s	nmi		
34 Time p	ast 0000 01	1.E=03	nour	utn		
37 Addit	onal increment to time past 0 UT	1.E-03	2 0	uts		
42 Local	solar time diff (=SLT_UT) +E lon	1.1-05	hhmm	sltmut		
44 Local	solar time	1.E-03	hour	slt		
47 Local	solar time at conjugate point	1.E-03	hour	sltc		
54 Magnet	ic local time	1.E-03	hour	Tmlt		
60 Integ	ation time for these data	1.	S	inttms		
61 Integ	ation time for these data	1.	min	inttmm		
62 Integr	ation time for these data	1.	day	datntd		
66 Time	ncrement between rows	1.	s	dtrow		
70 Sampli	ng interval (time between sampls)	1.	s	smpint		
72 UT of	Moonset (from US Naval Obs)	1.E-03	hour	tmset		
73 UT of	Moonrise (from US Naval Obs)	1.E-03	hour	tmris		
74 UT of	Civil sunset (szen=96 deg)	1.E-03	hour	tssc		
75 UT of	Civil sunrise (szen=96 deg)	1.E-03	hour	tsrc		
76 UT of	Nautical sunset (szen=102 deg)	1.E-03	hour	tssn		
77 UT of	Nautical sunrise (szen=102 deg)	1.E-03	hour	tsrn		
78 UT of	Astronomical sunset (szen=108 deg) 1.E-03	hour	tssa		

CEDAR/Madrigal Database

Special values

- missing
- assumed (error value only)
- knownbad (error value only)
- Defined in
 - http://download.hao.ucar.edu/archive/cedar/cedar.fmt.pdf

Derived Parameters

Madrigal contains many "derived only" parameters
Not in CEDAR standard

Derivation engine derives information from records

- Time from prolog
- Position either as 1D or 2D
- etc

Engine determines all parameters that can be derived

Classes of Derived Param's

Space, Time

- E.g.: local time, ...
- Geophysical
 - E.g.: Kp, Dst, IMF, F10.7, SSN, ...

Magnetic

- E.g.: Bmag, Magn conjugate lat/long, Tsyganenko magnetic equatorial plane intercept, ...
- MSIS

E.g.: Tn, neutral composition

Using Madrigal

There are two ways to use Madrigal:

- Web interface
- API
 - Matlab
 - Python
 - IDL (beta stage)
 - Download here:

http://madrigal.haystack.mit.edu/madrigal/madDownload.html

Getting Data



Welcome to the Madrigal Database at EISCAT

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Access Data

Run Models

• Documentation

 <u>Open</u> Madrigal 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 <u>National Science Foundation</u> supported Coupling, Energetics and Dynamics of Atmospheric Regions (CEDAR) program, which maintains a <u>CEDAR Database</u> 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 <u>Millstone Hill</u>, USA, <u>Arecibo</u>, Puerto Rico, <u>EISCAT</u>, Norway, <u>SRI</u> <u>International</u>, USA, <u>Cornell University</u>, USA, <u>Jicamarca</u>, Peru, <u>The Institute of Solar-Terrestrial Physics</u>, Russia, and Wuhan Ionospheric Observatory, the Chinese Academy of Sciences. and directly, using <u>APIs</u> which are available for several popular programming languages. A CVS archive of all Madrigal software and documentation is available from the <u>Open Madrigal</u> Web site. The latest version of Madrigal may also be downloaded from there.



Revised Anril 20 2009



This link allows you to print and plot local EISCAT Madriga]

^{da} Individual Experiments^{ss}

parameters or searching over an macingar servers. Click liere for a tutorial.

Browse for Individual Madrigal Experiments

Use this link to search available experiments. You can search either all Madi You can choose See next slide! AT database. g derived parameters, and can inter the data using any parameter. Click here for a tutorial.

Global Madrigal Database Report

This link allows you to concrete a report on multiple local

Data Across Experiments

matching your criteria will be returned in a single report. Click here for a tutorial.

Plot Data from Instruments

This link allows you to amote new plats from one or more we Plot Across Experiments ick here for a tutorial.

User: Thomas Ulich Email: thu@sgo.fi	Affliliation: SGO	Click here to modify
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Use of the Madrigal Database is generally subject to the <u>CEDAR Database Rules-of-the-Road</u>. Prior permission to access the data is not required. However, the user is required to establish early contact with any organization whose data are involved in the project to discuss the intended usage. Data are often subject to limitations which are not immediately evident to new users. Before they are formally submitted, draft copies of all reports and publications must be sent to the contact scientist at all data-



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Madrigal Experiment List

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Madrigal Experiment List

Madrigal global experiment selector

		Return to Madrigal hom	epage Tu	utorial on this p	age	Rett	irn to acces	s data page
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	Site	Exp start	Exp end	Instr	rument name	в	Inst Id	Exp name
					2	-		
GO	EISCA	2009-01-16 09:34:23	2009-01-16 09:35	EISCAT	Svalbard .	IS R	95	beata_60
GO	EISCA	2009-01-17 05:01:35	2009-01-17 11:58	S:23 EISCAT	Svalbard .	IS R	95	beata_120
GO	EISCA	2009-01-18 04:00:39	2009-01-18 11:59	1:09 EISCAT	Svalbard .	IS R	95	islopes_60
GO	EISCA	2009-01-19 04:00:35	2009-01-19 11:31	EISCAT	Svalbard	IS R	95	beata_90
GO	EISCA	2009-01-20 04:00:09	2009-01-20 11:59	0:04 EISCAT	Svalbard .	IS R	95	islopes_60
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GO	EISCA	2009-01-25		:35 EISCAT	Svalbard 1	IS R	95	beata_90
GO	EISCA	2009-01-26		24 EISCAT	Svalbard 1	IS R	95	islopes_60
GO	EISCA	2009-01-17 04:02:54	2009-01-27 10:00	:18 EISCAT	Svalbard 1	IS R	95	beata_90
GO	EISCA	2009-01-28 04:00:19	2009-01-28 10:59	29 EISCAT	Svalbard 1	IS R	95	islopes_60
<u>GO</u>	EISCA	2009-02-04 08:00:29	2009-02-05 00:00	:59 EISCAT	Svalbard 1	IS R	95	beata_60
GO	EISCA	2,09-02-05 00:00:59	2009-02-06 00:00	:59 EISCAT	Svalbard 1	IS R	95	beata_60
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GO	EISCA	2009-02-26 19:01:11	2009-02-27 00:01	:53 EISCAT	Svalbard 1	IS R	95	steffe_120
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GO	EISCA	2009-03-24 12:26:11	2009-03-25 00:00	:29 EISCAT	Svalbard 1	IS R	95	beata_ant
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Madrigal Experiment /opt/madrigal/experiments/2009/lyr/20feb09

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Madrigal Experiment /opt/madrig...

EISCAT Svalbard IS Radar Longyearbyen

ipy_60

Return to Madrigal homepage

Tutorial on this page

Return to access data page

Scroll Dowr

Start Time: 02/20/2009 00:00:59 End Time: 02/20/2009 18:59:29

CEDAR Format Datasets:

No link here, so no catalogue or header records.

- NCAR_2009-02-20_ipy_60_42m.bin default file for GUISDAP Fitted Parameters status: Final
 - Print file as ascii (isprint) Choose parameters (and optional filters) to print standard method to access data
 - One-step file print Click to print entire file in one step using parameters in file (no derived parameters or filters)
 - · Print individual records Lists individual records, allows printing each record separately
 - <u>Download file</u> Download NCAR_2009-02-20_ipy_60_42m.bin in selected Ascii or Cedar format

Additional information:

derived parameters with filtering.

isprint - browse measured and

These data are the intellectual property of the EISCAT Scientific Association. Except where clearly noted as Commom Progremme (CP), use of these data is restricted to the original experimenter (as noted in the description file available through the schedule system at www.eiscat.se/schedule/schedule.cgi) for one year from the date of the experiment. Otherwise, these data may be used freely or the purpose of illustration for teaching and for non-commercial scientific research, provided that the source is acknowledged and to the experiment by the non-commercial purpose to be achieved. Substantial use of these data should be discussed at an early stage with knowledge able scientists within the EISCAT Scientific Association in order to clarify matters of use, calibration and potential co-authorship. Ingemar H aggstrom, at EISCAT Headquarters, can provide advice on suitable contacts. Any further distribution of these data, including installation is any database, must be accompanied by this statement and subject to the same conditions of use.



Madrigal Experiment /opt/madrigal/experiments/2009/lyr/20feb09

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Madrigal Experiment /opt/madrig...

Start Time: 02/20/2009 00:00:59 End Time: 02/20/2009 18:59:29

CEDAR Format Datasets:

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IMAGES

2009-02-20_ipy_60_42m .pdf .png .jpg .jpeg

Notes

Add to these notes

Notes can be added to every experiment.





isprint



New version of isprint on the web! (Comprehensive)

音 http://www.eiscat.se/madrigal/cgi-bin/madDataBrowse?fileName=/opt/madrig 🖒

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New version of isprint on the web...

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Print file as ascii (isprint)

Experiment: ipy_60 File: NCAR_2009-02-20_ipy_60_42m.bin Type of data: GUISDAP Fitted Parameters

Return to experiment list	Return to Madrigal homepage	A tutorial on how to use this page	Return to access data page
	In	structions	

- 1. If you want to filter the data, use the first section: Available Filters. Skip the filter section to get all data.
- 2. In the next section (Avaliable Parameters), select the parameters you want to print. The parameters printed in bold are the ones in this file, while the others are derived from those parameters. Click on the parameter to see its definition.
- 3. At the bottom are some optional output formatting options.
- 4. Click Display Data.

2009-02-20 00:00:59 - 2009-02-20 18:59:29 : EISCAT Svalbard IS Radar Longyearbyen

Available Filters - Using default or manually entered selections

 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: Feb 20 2009 Start time: H: 0 M: 0 S: 59 Start date: 	Set data filters manually, or	use a saved filter and parameter selection:
Start date: Feb 20 2009 Start time: H: 0 M: 0 S: 59	 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 <u>Explanation of Filters</u> 	Saved filters:
Start time: H: 0 M: 0 S: 59 View or delete filters	Start date: Feb 🗘 20 🗘 2009	
	Start time: H: 0 M: 0 S: 59	View or delete filters

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New version of isp	rint on the web		
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Note: Az from -18 [lower az, upper of	0 to 180. <u>Az range is clockwise,</u> 12] = [170, -170], range goes th	<u>so if (eg.):</u> rough 180 degrees.	select them with one click!
Min azimuth:	-180.0 Max azimuth:	180.0	
Min elevation:	0.0 Max elevation	90.0	
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Additional az, el ro	unges (Data is inclu	uded if in either ran	ge)	
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□ <u>BMONTH</u>	□ <u>B_UTH</u>	CONJ SUNRISE I	H CONJ SUNSET H	DAY
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Global Search



Simple Madrigal Data Access

This link allows you to print and plot local EISCAT Madrigal data easily. Use the other three Madrigal interfaces to access more powerful capabilities, such as displaying derived parameters or searching over all Madrigal servers. Click <u>here</u> for a tutorial.

Browse for Individual Madrigal Experiments

Use this link to search available experiments. You can search either *all* Madrigal databases, or just the local EISCAT database. You can choose which parameters to print, including derived parameters, and can filter the data using any parameter. Click <u>here</u> for a tutorial.

Global Madrigal Database Report

This link allows you to generate a report on multiple local EISCAT experiments at once. Experiments can be filtered in a number of ways. Data from the local Madrigal database matching your criteria will be returned in a single report. Click <u>here</u> for a tutorial.

Plot Data from Instruments

This link allows you to create new plots from one or more instruments and/or Madrigal experiments versus time on a single web page. The data comes from the local EISCAT database. Click <u>here</u> for a tutorial.

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	User: Thomas Ulich	Email: thu@sgo.fi	Affiliation: SGO	Click here to modify
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Use of the Madrigal Database is generally subject to the <u>CEDAR Database Rules-of-the-Road</u>. Prior permission to access the data is not required. However, the user is required to establish early contact with any organization whose data are involved in the project to discuss the intended usage. Data are often subject to limitations which are not immediately evident to new users. Before they are formally submitted, draft copies of all reports and publications must be sent to the contact scientist at all data-

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Madrigal Global Search	ge=maurarmustas C Q Google
Madrigal Global Search	
EISCAT Madrigal databas	se global search
Return to Madrigal homepage Tutorial on this page	Return to access data page
is page allows you to search the entire local EISCAT Madrigal database at server capacity. Download the script globalIsprint.py to run at	once. The amount of data you can request may be limited by n unlimited search from your local computer.
Select instrument(s)	Select date range
EISCAT combined IS Radars 1986-2005	Start dd/mm/yyyy 1 1 1 1990
EISCAT Tromso UHF IS radar 1984-2010 EISCAT Sodankyla UHF IS Receiver 1984-2010 EISCAT Tromso VHF IS radar 1990-2010	End dd/mm/yyyy 31 12 2010
EISCAT Svalbard IS Radar Longyearbyen 1997-2009 Interplanetary Mag Field and Solar Wind 1963-2010 Geophysical Indicies 1950-2010	
Select kinds of data	Select seasonal filter
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CP-2-D CP-2-E	End dd/mm 31 12
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Madrigal Global Search CP-3-G er complete or partial experiment name: Leave blank to accept all experiment names. up filters using any <u>Madrigal parameter(s)</u>
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Select parameter(s) to display
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Please send any comments or suggestions to the Open Madrigal Users Mailing List.

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+1

Get Email

The following is a summary of your requested query:

Instruments: EISCAT Sodankyla UHF IS Receiver Kinds of Data: CP-3-G Experiment Name: All experiment names accepted StartDate = 1/1/1990 EndDate = 31/12/2010 Seasonal filter = 1/1 - 31/12 (no seasonal filter) Data filters: No filters entered

Parameters displayed: UT, AZM, ELM, NEL, DNEL

Hit cancel to modify your query.

Please enter your email address below and your requested report would be sent to your mail box. After you hit OK, an estimate of the time needed to run your query will be displayed, and then you will be returned to the main global search page.

thu@sgo.fi		
Cancel	ОК	

▶ 🕼 + 🚼 http://www.	eiscat.se/madrigal/cgi-bin/genMadReport?callingpage=madSearch
Generating Report	
	Initializing global search
ank you. Your requested return than 38 minutes and than 38 minutes and than 38 minutes and the second secon	eport is being generated. A total of 19 files are being searched for data, which should take les utes to complete. (Typical time is 3.8 minutes.) Please check your email then.
	You will be redirected to the global query page in 15 seconds.

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Date: Sun, 29 Aug 2010 11:48:40 +0200 (CEST) From: Background_Madrigal_Query@mh.eiscat.se To: thu@sgo.fi Subject: Madrigal Global Query on 29 Aug 2010: Success

The report you requested is now available at the following url:

http://www.eiscat.se/madrigal/tempReports/mad1297893.txt

It will be available for at least 10 days.

MsgIndex

ViewAttch

Help

OTHER CMDS >

This report was generated using the following criteria:

Report requested from the Madrigal Database Search Query by thu@sgo.fi 8/29/2010 Instruments: EISCAT Sodankyla UHF IS Receiver Kinds of Data: CP-3-GExperiment Name: None StartDate = 1/1/1990EndDate = 31/12/2010 = 1/1 - 31/12Yearly filter Data filters: Parameters displayed: ['UT', 'AZM', 'ELM', 'NEL', 'DNEL']

Local rules of the road for data access: These data are the intellectual property of the EISCAT Scientific Association. Except where clearly noted as Commom Programme (CP), use of these data is restricted to the original experimenter (as noted in the description file available through the schedule system at

PrevMsg

NextMsg

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16.129 16.160 16.192	265.90 284.70 297.20	46.30 43.80 40.30	11.511 11.508 11.428	9.859 9.765 9.822		
16.217 16.244 16.279	306.30 312.70 320.09	36.30 32.69 27.70	11.412 11.321 11.256	9.820 9.701 9.736		
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Plotting Data



Simple Madrigal Data Access

This link allows you to print and plot local EISCAT Madrigal data easily. Use the other three Madrigal interfaces to access more powerful capabilities, such as displaying derived parameters or searching over all Madrigal servers. Click <u>here</u> for a tutorial.

Browse for Individual Madrigal Experiments

Use this link to search available experiments. You can search either *all* Madrigal databases, or just the local EISCAT database. You can choose which parameters to print, including derived parameters, and can filter the data using any parameter. Click <u>here</u> for a tutorial.

Global Madrigal Database Report

This link allows you to generate a report on multiple local EISCAT experiments at once. Experiments can be filtered in a number of ways. Data from the local Madrigal database matching your criteria will be returned in a single report. Click here for a tutorial.

Plot Data from Instruments

This link allows you to create new plots from one or more instruments and/or Madrigal experiments versus time on a single web page. The data comes from the local EISCAT database. Click here for a tutorial.

User: Thomas Ulich	Email: thu@sgo.fi	Affliliation: SGO	Click here to modify
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Use of the Madrigal Database is generally subject to the <u>CEDAR Database Rules-of-the-Road</u>. Prior permission to access the data is not required. However, the user is required to establish early contact with any organization whose data are involved in the project to discuss the intended usage. Data are often subject to limitations which are not immediately evident to new users. Before they are formally submitted, draft copies of all reports and publications must be sent to the contact scientist at all data-

 Select instruments to plot

 Image: Select instruments to plot

 Select instruments to plot

 Add new plot(s)

This page allows you to add plots to make a collection of stacked plots, all with the same time scale. If you want to add a series of plots with the same parameters from more than one instrument, just select more than one instrument. If you want to stack plots with different parameters, just add one plot at a time. Each time you add a new plot, you will have the chance to view the ones you have created, and either add more, or start over.

Return to main Madrigal page

Tutorial on this page

Select instrument(s)

EISCAT combined IS Radars 1986-2005 EISCAT Kiruna UHF IS Receiver 1984-2010 EISCAT Tromso UHF IS radar 1984-2010 EISCAT Sodankyla UHF IS Receiver 1984-2010 EISCAT Tromso VHF IS radar 1990-2010 EISCAT Svalbard IS Radar Longyearbyen 1997-2009 Interplanetary Mag Field and Solar Wind 1963-2010 Geophysical Indicies 1950-2010 DST Index 1957-2007 SOUSY Svalbard MST Radar Longyearbyen 2001-2001

Select time period

Show ALL times data available for these instruments

Select time range to plot data:

Start:	Year	2010	Month	8	Day	29
	Hour	0	Min	0	Sec	0
End	Year	2010	Month	8	Day	29
	Hour	23	Min	59	Sec	59









Choose parameter to plot

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Choose parameter to plot

Choose a single parameter to plot for the selected instruments

The parameter you choose will be plotted as a poolor plot versus altitude and the time period you selected.

Click on any parameter name to see a full description.



00		Choose par	ameter to plot		
+ + + http://	//www.eiscat.se/madrig	al/cgi-bin/plotParame	tersSelect.py?callingpa	ge=pl 🖒 🔍 Google	
Choose parameter to	plot				+
Interplanetary Mag	netic Field				
○ <u>BIMF</u>	O BXGSE	O BXGSM	BYGSE	BYGSM	
O <u>BZGSE</u>	O BZGSM	⊖ <u>SWDEN</u>	○ <u>SWQ</u>	○ <u>SWSPD</u>	
Data Quality Param	eter				
O CHIP3	O CHISQ	O GFIT	O POWER	○ <u>SYSTMP</u>	
O WCHSQ					

Filter Data

Set limits for the parameter you selected (leave blank for all data)	Lower	Upper	
Set altitude range (leave blank for all altitudes)	Lower	Upper	

Optional - filter data using other parameters	Parm (use a name from list above)	Lower	Upper	
Optional - filter data using other parameters	Parm (use a name from list above)	Lower	Upper	
Optional - filter data using other parameters	Parm (use a name from list above)	Lower	Upper	

Create pcolor plot of altitude versus time

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Play with it!

Remote API

- Available in
 - Matlab
 - Python
 - IDL (beta stage)
 - Contribute your own... (later)



Madrigal Database Documentation - Download Madrigal

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Q- Google

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Programmers guide to accessing ...

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Remote Matlab API and Examples

Madrigal Database Documentatio...

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Download Python or Matlab or IDL API's to remotely access Madrigal

Madrigal is now easy to access from any platform remotely using web services. Details of <u>how this works</u> are available, along with documentation on the <u>remote Python API</u> and the <u>remote Matlab API</u> that have been written to use these web services. Documentation for the beta release of the <u>remote IDL API</u> is also available. Since these API's have been tested on both Windows and Unix, they are available both as tar files and zip files:

- Download remote python Madrigal API This latest release includes a method to trace magnetic field lines and to run the Madrigal calculator at a collection of unrelated geodetic points in space and/or time with one call. These two additional calls (madCalculator2 and madCalculator3) require Madrigal2.6, and for now only run on the Millstone Madrigal server. Also includes updated documentation.
 - remotePythonAPI-1.0.5.tar.Z (last updated July 16, 2010)
 - remotePythonAPI-1.0.5.zip (last updated July 16, 2010)
- Download remote Matlab Madrigal API This latest release includes a more robust isprintWeb, a fully-featured global search
 method globalIsprint.m, and a method to download files locally. Also fixes a bug in globalIsprint found in some versions of Matlab.
 - remoteMatlabAPI-1.1.1.tar.Z (last updated July 27, 2010)
 - remoteMatlabAPI-1.1.1.zip (last updated July 27, 2010)
- Download remote IDL Madrigal API (beta release) This first beta release (July 2010) release includes the full capability of the
 python and Matlab version. Please let <u>Bill Rideout</u> know if you discover any issues. Fixes issues discovered at ISR school.
 - remoteIDL API-0.1.1.tar.Z (last updated July 27, 2010)
 - remoteIDL API-0.1.1.zip (last updated July 27, 2010)

Download Madrigal 2.5 - Released Feb. 2, 2009

Madrigal 2.5 is now released (download below). Version 2.5 includes some simplifications to the user interface, and a number of improvements to make Madrigal easier to install and administer. For a full list of new features, see the <u>Madrigal What's New page</u>. This release of Madrigal is now official. Please contact <u>Bill Rideout</u> with any questions or problems.

Complete instructions for installing Madrigal for the first time, or for upgrading to the latest release, are available in the documentation.



Remote access using Matlab

This page describes the remote Matlab API, and gives two <u>examples</u> of using this API. The first example uses all the basic methods, and outputs text. The second example creates a simple pool plot.

The remote Matlab API is organized in the same way as the <u>Madrigal data model</u>, from Instrument at the highest level, down to the level of data values. Readers who are not familiar with the Madrigal data model should read the material in that section before proceeding with this tutorial.

This API and example have been tested on both Windows and Linux, and require only access to the internet and Matlab 5 or greater to run. It is available for download here.

4 1 7

Remote Matlab methods

- getMadrigalCgiUrl converts the Madrigal url to the cgi form required by the other methods
- · getInstrumentsWeb returns a list of all instruments in Madrigal database
- · getExperimentsWeb returns a list of experiments for a given instument(s) and date range
- · getExperimentFilesWeb returns a list of files in a given experiment
- · getParametersWeb returns a list of measured parameters in a file, and derived parameters available
- · isprintWeb returns data from a file as an array of doubles using user specified parameters and filters
- · madDownloadFile downloads a Madrigal file to local computer in various formats
- · madCalculatorWeb returns derived parameters for a given time and set of spatial locations
- · globalIsprint returns user-specified data from multiple experiments

```
Remote access using Matlab
              + http://madrigal.haystack.mit.edu/madrigal/rt_matlab.html
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                                     Remote Matlab API and Examples
   Programmers guide to accessing ...
                                                                         Remote access using Matlab
                                                                                                                         44
Two examples are given below. The first example uses all the methods, and outputs text. The second example creates a simple peolor plot.
Simple Example - text output
This simple example Matlab script uses most of the methods discussed above.
% demo program of madmatlab running on a pc or linux
% first, get url of installation to test
madurl = input('Enter the url of the home page of the Madrigal site to test:', 's');
cgiurl = getMadrigalCgiUrl(madurl)
'List all instruments, and their latitudes and longitudes:'
instArray = getInstrumentsWeb(cgiurl);
for i = 1:length(instArray)
    [s,errmsg] = sprintf('Instrument: %s, at lat %f and long %f', ...
             instArray(i).name, ...
             instArray(i).latitude, ...
             instArray(i).longitude);
     s
end
% now list all experiments from local Madrigal site with mlh (code 30) in
% 1998 - should be data if default files installed ...
startdate = datenum('01/01/1998');
enddate = datenum('12/31/1998');
expArray = getExperimentsWeb(cgiurl, 30, startdate, enddate, 1);
for i = 1:length(expArray)
    [s,errmsg] = sprintf('Experiment name: %s, at url %s and id %i', ...
             expArray(i).name, ...
             expArray(i).url, ...
             expArray(i).id);
     s
end
% now list all files in the first experiment
                                                                                                                    4 +
```





Remote access using python

This page describes the remote Python API, and gives some examples of using this API. These examples have been tested on both Windows and Linux, and require only access to the internet and python 2.3 to run. It is available for download <u>here</u>.

The remote Python API is organized in the same way as the <u>Madrigal data model</u>, from Instrument at the highest level, down to the level of data values. Readers who are not familiar with the Madrigal data model should read the material in that section before proceeding with this tutorial.

The basic object in the remote Python API is the *MadrigalData*, found in the madrigalWeb module. To initialize *MadrigalData* requires only the url of the home page on any Madrigal 2.3 (or above) site as an argument. Calling the methods of this object will return all possible information from one Madrigal site. The other objects in madrigalWeb are simply there to hold returned information - for example, the *MadrigalExperiment* object holds information about one experiment.

MadrigalData has the following methods:

- getAllInstruments returns a list of all MadrigalInstrument objects at all Madrigal sites
- getExperiments returns a list of all MadrigalExperiment objects that meet the criteria you set at any Madrigal site
- getExperimentFiles returns a list of all default MadrigalExperimentFile objects for a given experiment id
- getExperimentFileParameters returns a list of all measured and derivable parameters in file
- *isprint* returns as a string the isprint output given file, parms, filters without headers or summary. This is the method that accesses the raw data in a Madrigal data file.
- madCalculator returns derived parameters for a range of latitudes, longitudes, and altitudes at a given time. Note that this method does
 not returned measured values from a file use isprint for that. Instead, it is useful for accessing parameters available via the Madrigal
 derivation engine, such as magnetic field or MSIS parameters.
- madTimeCalculator is similar to madCalculator, except that it returns data from a range of times, but only returns parameters such as Kp that are independent of position.

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	Remote access using n	thon	
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Programmers guide to accessing	Remote Matlab API and Examples	Remote access using python	+
Simple regression test			[
This simple script calls the following Ma	drigalData methods:		
 getAllInstruments getExperiments getExperimentFiles isprint madCalculator 			
To use this regression test, cd to the exam	ples directory in the installation director	y, and type:	
python	testMadrigalWebServices.py http://www	.haystack.mit.edu/madrigal	
<pre>import sys import string import difflib if len(sys.argv) < 2: print 'usage: python testMad sys.exit(-1)</pre>	rigalWebServices.py <madrigal ma<="" th=""><th>in url>'</th><th></th></madrigal>	in url>'	
madrigalUrl = sys.argv[1]			
<pre>outFile = open('testMadrigalWebS</pre>	ervices.out', 'w')		
<pre># create the main object to get testData = madrigalWeb.madrigalW</pre>	all needed info from Madrigal eb.MadrigalData(madrigalUrl)		
<pre>instList = testData.getAllInstru</pre>	ments()		
<pre># print out Millstone for inst in instList: if inst.code == 30:</pre>			1
if inst.code == 30:			

Again: play with it!

Take the on-line examples and work through them!

Contributing...

Extending Madrigal

- Madrigal is open source!
- CVS at www.openmadrigal.org
- Code is in C, Python and some Tcl
- Extending the Madrigal Derivation Engine is simple

Extending...

Simply a list of methods with
input Madrigal parameters
output Madrigal parameters
Register parameters in list
Details here:

http://madrigal.haystack.edu/madrigal/extendingMaddata.html



How to add new derived parameters

This document gives you the background information you need and detailed instructions for how to extend the made library to derive new parameters.

Background

The madDeriveMethods module contains all logic used in maddata to derive Madrigal parameters. It is basically a list of methods, all with the same signature:

Each method takes a list of Madrigal parameters as doubles, and derives a list of Madrigal parameters as doubles. Errors are indicated by nonzero return codes, and messages can be written to the errFile.

The order of these methods is defined in the CompiledExt data structures called gCompExtList (global compiled extention list). This data structure tells the madDeriveEngine which Madrigal parameters this method wants as inputs, and which it produces as outputs. This global is defined in madDeriveEngine.c.

Note that the order of the methods as defined in gCompExtList is significant. The madDeriveEngine will use the first method it finds that it can call successfully to derive a given parameter; a later method that derives the same parameter will be ignored. Note also that those parameters derived by methods before a given method in the list will be available to that method as input parameters - methods are always called in the order they appear in gCompExtList (if they are called at all). For this reason, the safest approach is to always add new methods to the end of the list - this ensures that all previous derived parameters are available to it.

Detailed instructions

The following are the steps required to extend the derived methods in maddata:

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Programmers guide to accessing Madrigal remotely

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Programmers guide to accessing Madrigal remotely

With the release of Madrigal 2.3, Madrigal now exposes all the information and capabilities it has as web services, which allows easy access to Madrigal from any computer on the internet using any platform (Unix, Windows, Mac, etc). Madrigal's web services are basically cgi scripts with simple output that allows easy parsing of the information. Any language that supports the HTTP standard can then access any Madrigal site. We have written remote API's using python and Matlab, but almost any language can be used.

Note that this approach of remotely accessing Madrigal data has been always possible before by parsing the html output meant to be displayed in a web browser (this general programming method is referred to as "screen scraping"). However, not only is this parsing difficult; but the code often breaks when the user interface is modified in any way. With web services the returned cgi scripts are designed to be both simple to parse and stable.

The web services are not implemented according to the SOAP or XMLRPC standard since not all scripting languages have support for these standards (or for XML parsing). Instead they use the simple approach of returning data requested via a query as a delimited text file.

Note that the remote access examples written in python and Matlab work on any platform that python and/or Matlab supports.

If you are interested in accessing the capabilities of Madrigal via some other language than Matlab or python, read the following section on Madrigal web services. Also, you might want to read the section on Madrigal web services if you find something you want to add either the remote python or Matlab API's. Otherwise, you can go directly to the section on the remote Matlab API or the remote python API below. These API's are available for <u>download</u> from the <u>OpenMadrigal</u> site.

- · Madrigal web services overview and tutorial
- Remote Matlab API and Examples
- Remote Python API and Examples

Revised: Jan 14, 2005

Want More?

Contains more examples and exercises.

- http://www.haystack.mit.edu/cgi-bin/asg_science/science.cgi/ Using_Madrigal_practically_and_productively
- Please work through these.

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ich group will do the following exercises:	REU		
1. Go through the web interface exercises below	Worksho	Workshops	
2. Install one (or more) remote APIs (python, Matlab, or IDL)	Mailing Lists		
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 <u>Millstone Madrigal</u> web site 			
 <u>> OpenMadrigal</u> web site 		User	

Thanks!