

Accessing Madrigal data via python

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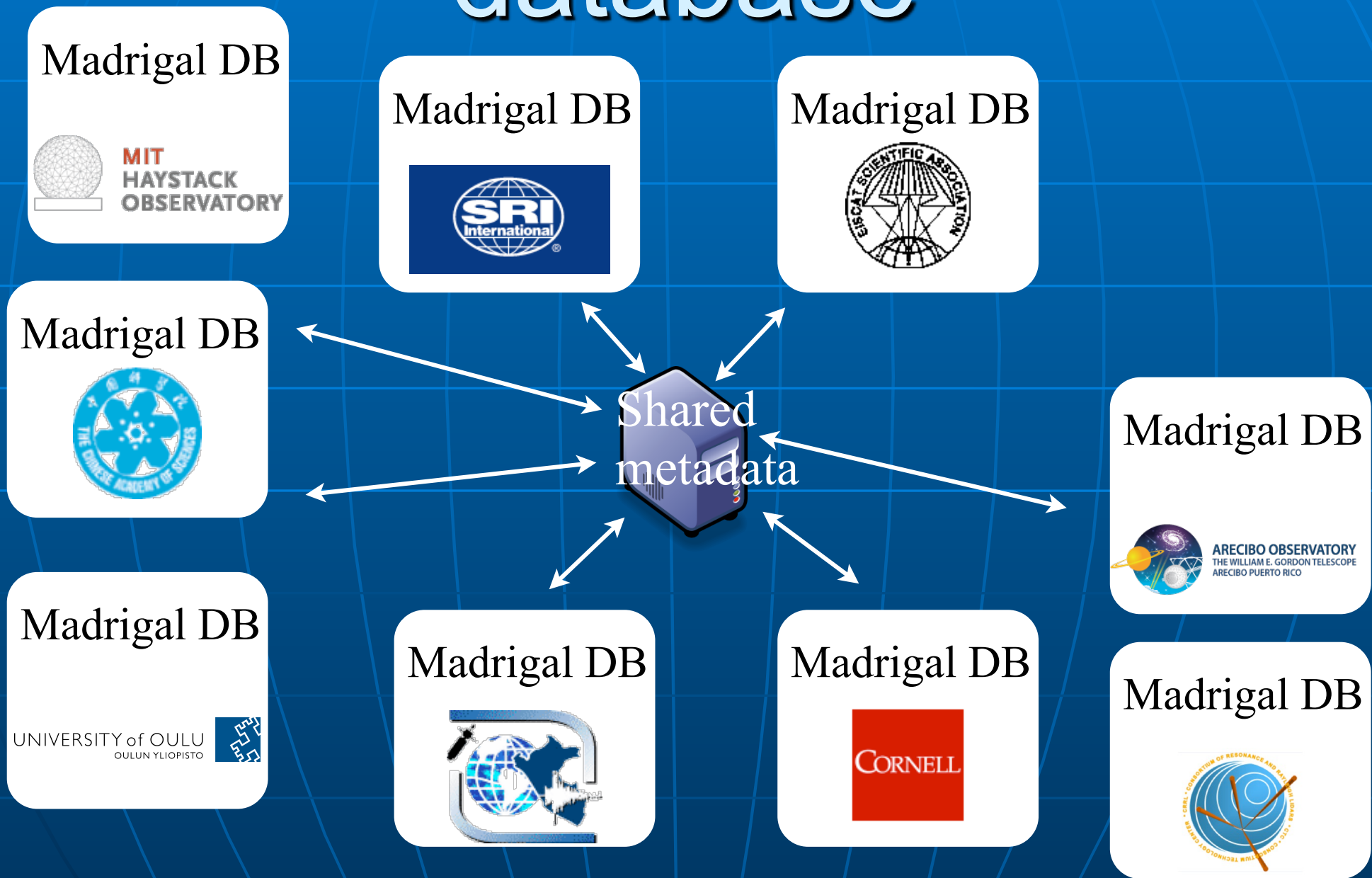
CEDAR workshop
2016

Outline

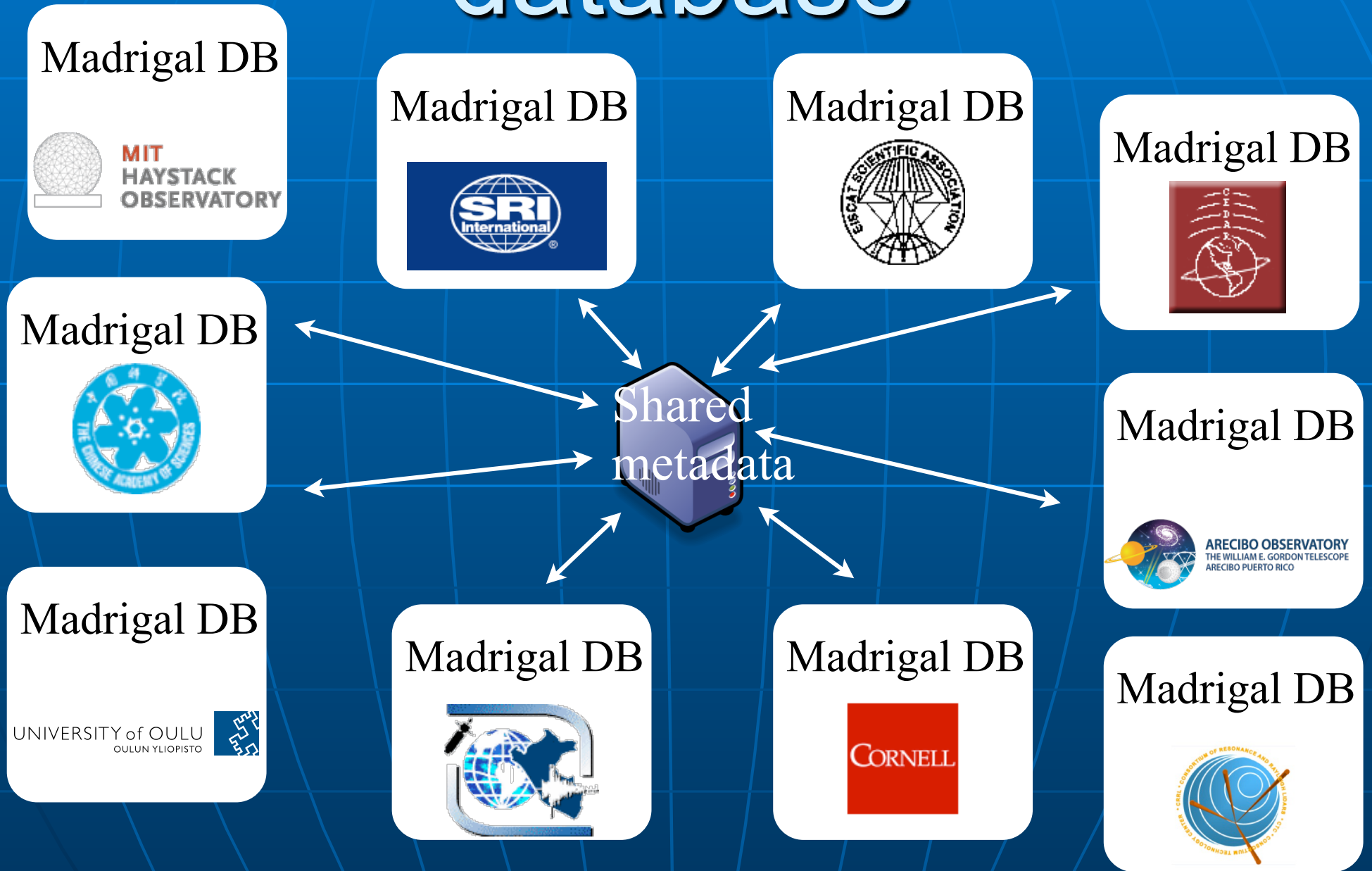
- What is Madrigal?
- Generating python commands via the web interface
- Calling the API with your own python script

What is Madrigal?

Madrigal is a distributed database



Madrigal is a distributed database



Cedar Madrigal archive imports all data weekly

Madrigal DB



Madrigal DB



Madrigal DB



Madrigal DB



Madrigal DB



Madrigal DB



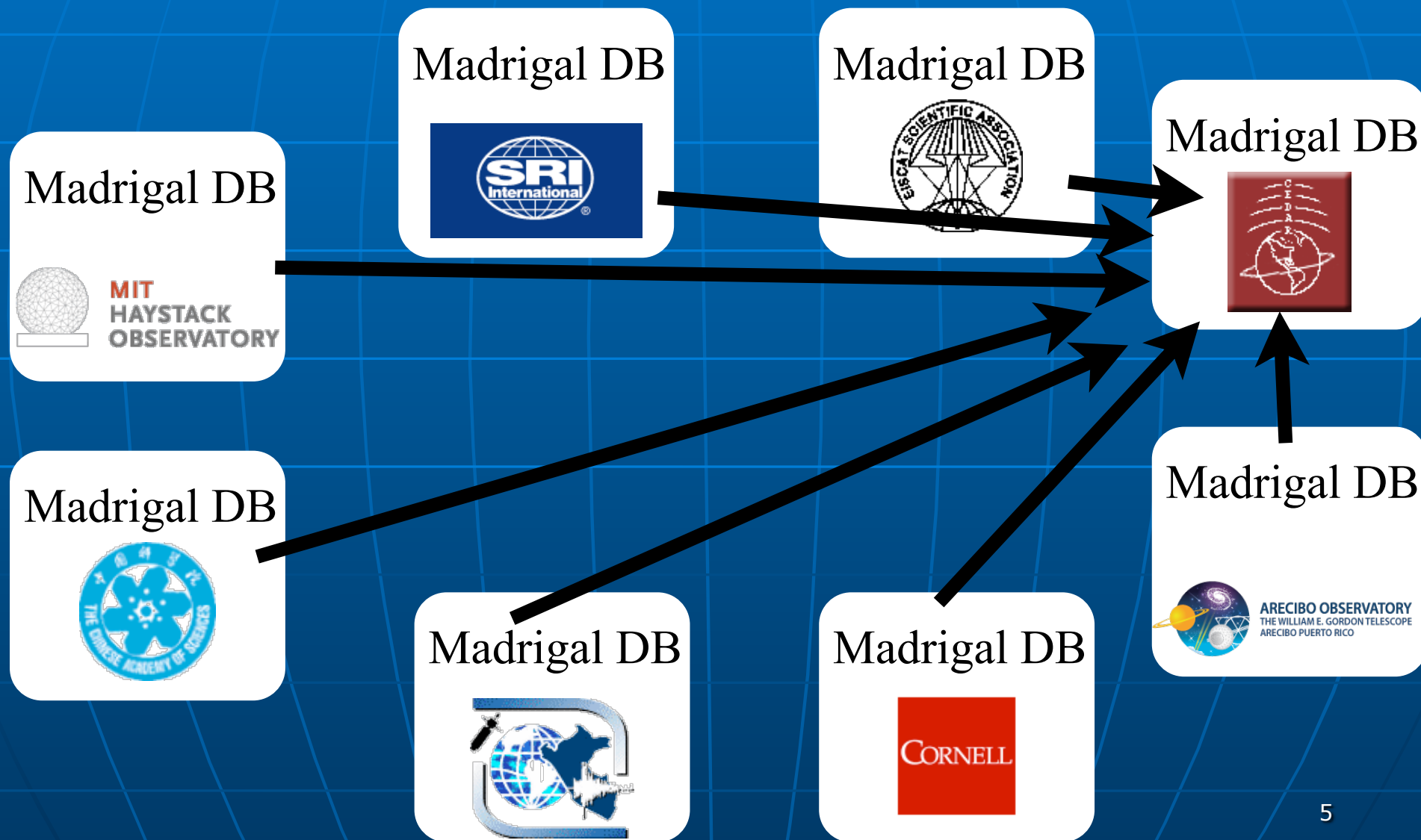
Madrigal DB



Madrigal DB



Cedar Madrigal archive imports all data weekly



The Madrigal database stores data from a wide variety of upper atmosphere research instruments

Incoherent Scatter Radar



TEC via GPS



MF Radar



Number of instruments in Madrigal:

- Incoherent scatter radars: 22
- MST radars: 3
- MF radars: 16
- Meteor radars: 7
- FPI: 23
- Michelson Interferometers: 6
- Lidars: 4
- Photometers: 4

Madrigal is open-source

Madrigal Database

http://www.openmadrigal.org/

The Open Madrigal Initiative

- [What is Madrigal?](#)
- [Download/update Madrigal](#) - includes Madrigal server and client APIs
- [Documentation](#)
 - [Web access](#)
 - [Script access](#)
- [Empirical Ionospheric Models](#)
- [Subversion Source Control](#)
- [Mailing Lists](#)
- [Administering OpenMadrigal](#)

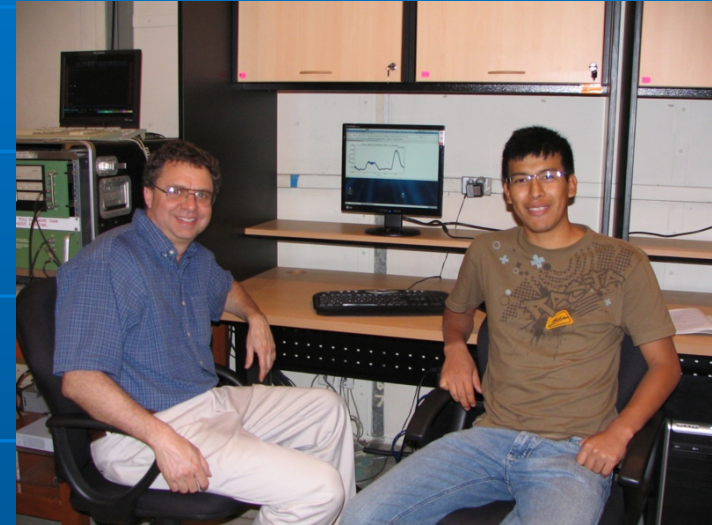
The OpenMadrigal project seeks to develop and support an on-line database for geospace data. The project has been led by [MIT Haystack Observatory](#) since 1980, but now has active support from [Jicamarca Observatory](#) and other community members. Madrigal is a robust, World Wide Web based system capable of managing and serving archival and real-time data, in a variety of formats, from a wide range of ground-based instruments. Madrigal is installed at a number of sites around the world. 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 from any Madrigal site.

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 instruments. Data can be accessed from the Madrigal sites at [Millstone Hill, USA](#), [EISCAT, Norway](#), [SRI International, USA](#), [Arecibo, Puerto Rico](#), [Cornell University, USA](#), [Jicamarca, Peru](#), the [Institute of Geology and Geophysics](#), the Chinese Academy of Sciences, and the [CEDAR Madrigal archive](#) using standard Web browsers; and directly, using APIs which are available for python, Matlab, and IDL.



Suggestions and comments should be directed to madrigal@haystack

Link to Subversion (source code)



Madrigal Database Access

http://cedar.openmadrigal.org/cgi-bin/gSimpleUIAccessData.py

Madrigal home page

Selected Instrument: Experiment : 2006-03-09 00:05:37 - 2006-03-10 00:02:12

Selected date: 2006-03-09

Choose instrument type: Incoherent Scatter Radars

Sendrestrom IS Radar [1983-2012]

Sendrestrom IS Radar

PI: Anja Stromme - please contact before using this data

son060309g.003-ACPORT - FITTED GATE DATA (A16) FROM DWELLS - acport-060309-20s-

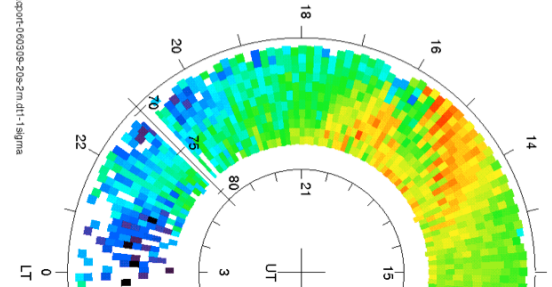
Download data | Print data | View info | Show Plots | More parameters

Year: 2006

Month: March

March 2006

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		01	02	03	04	
05	06	07	08	09	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	



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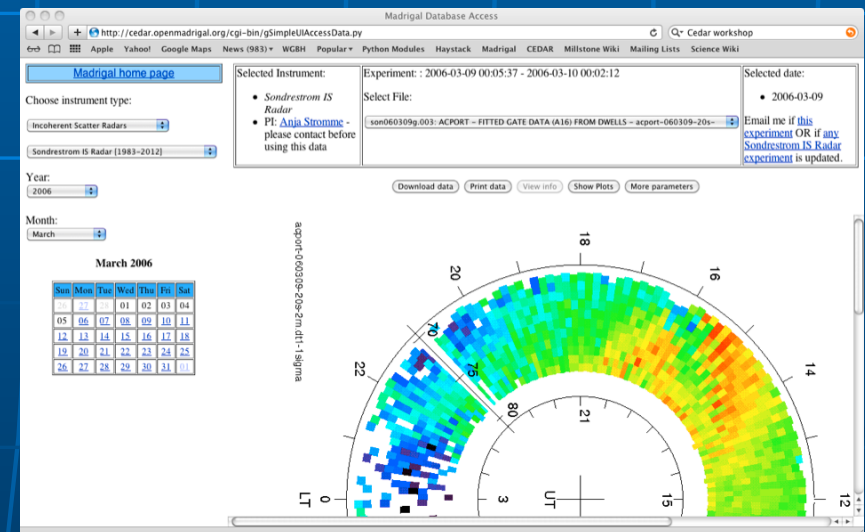
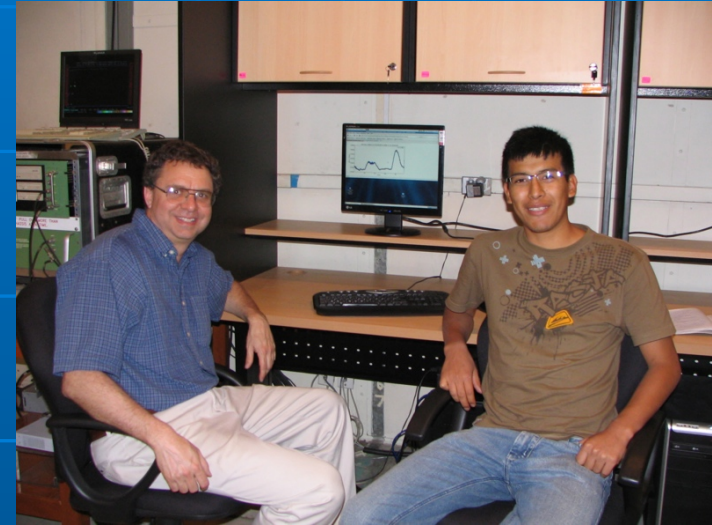
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Suggestions and comments should be directed to madrigal@haystack

Link to Subversion (source code)



Generating python commands via the web interface

Millstone3 Home Access data ▾ Access metadata ▾ Run models ▾ Documentation Other Madrigal sites ▾ OpenMadrigal

- List experiments
- Select single experiment
- Create a command to download multiple experiments
- FTP-like access

Madrigal3 CEDAR Database

Madrigal is an upper atmosphere data system available 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. 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 from any Madrigal site.

To see a list of all Madrigal sites, use the *Other Madrigal sites* pull down menu. Data can also be accessed directly, using [APIs](#) which are available for several popular programming languages (Matlab, python, and IDL). A Subversion archive of all Madrigal software and documentation is available from the [Open Madrigal](#) Web site. The latest version of Madrigal and the remote API's may also be downloaded from there.

Use of the Madrigal Database is generally subject to the CEDAR Rules-of-the-Road . 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-supplying organizations along with an offer of co-authorship to scientists who have provided data. This offer may be declined. The Database and the organizations that contributed data must be acknowledged in all reports and publications, and whenever this data is made available through another database. If you have any questions about appropriate use of these data, contact brideout@haystack.mit.edu

[Download software \(first time only\)](#)[Why do I need to download software first?](#)

Select what kind of command to create

[Download a group of files as is](#)[Download data with selected parms/filters](#)

Create a script command to download a series of existing Madrigal files in the format of your choice

Choose an instrument category if desired:

Start date



Choose one instrument *(Year range shows data available)*:

End date



File format to download: **Hdf5** **Space-delimited ascii**

netCDF4

Choose scripting language: **python** **Matlab** **IDL**

Optional filters: kinds of data, experiment names, file status

[Generate command](#)

Create a script command to download a series of existing Madrigal files in the format of your choice

Choose an instrument category if desired:

Fabry-Perots ▾

Choose one instrument *(Year range shows data available)*:

Arecibo Imaging Doppler Fabry-Perot [2012-2016] ▾

File format to download: **Hdf5** **Space-delimited ascii**

netCDF4

Choose scripting language: **python** **Matlab** **IDL**

Start date

1950-01-01



End date

2016-12-31



Optional filters: kinds of data, experiment names, file status ☰

Choose one or more kinds of data:

All kinds of data
Red line (630.0 nm) Doppler imaging FPI
Red line FPI higher level vector wind data

Filter experiments by name:

Filter files by description:

Generate command

```
globalDownload.py --verbose --url=http://madrigal3.haystack.mit.edu/ --outputDir=/tmp --user_fullname="Bill+Rideout" --user_email=brideout@haystack.mit.edu --user_affiliation="MIT" --format="hdf5" --startDate="01/01/1950" --endDate="12/31/2016" --inst=5370 --kindat=7100
```

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Select what kind of command to create

[Download a group of files as is](#)[Download data with selected parms/filters](#)

Create a script command to download Madrigal data with selected parameters and filters

Choose an instrument category if desired:

Start date



Choose one instrument *(Year range shows data available)*:

End date



File format to download: **Hdf5** **Space-delimited ascii**

netCDF4

Choose scripting language: **python** **Matlab** **IDL**

Select parameters (required) ≡

Optional filters: kinds of data, filter by parm, experiment names, etc ≡

[Generate command](#)

Create a script command to download Madrigal data with selected parameters and filters

Choose an instrument category if desired:

Fabry-Perots ▾

Choose one instrument (*Year range shows data available*):

Arecibo Imaging Doppler Fabry-Perot [2012-2016] ▾

File format to download: **Hdf5** **Space-delimited ascii**

netCDF4

Choose scripting language: **python** **Matlab** **IDL**

Start date

1950-01-01



End date

2016-12-31



Select parameters (required) ☰

Madrigal Hdf5 Prolog Parameters

MONTH **DAY** **HOUR** **MIN** **SEC**

YEAR **UT1_UNIX** **UT2_UNIX** **KINST** **RECNO**

KINDAT

Time Related Parameter

BYEAR **CSEC** **BMD** **BMONTH** **BDAY**

MD **DAYNO** **BHM** **BHHMMSS** **EHHMMSS**

HM **UTH** **UTS** **B_UTH** **INTTMS**

Choose scripting language: python Matlab IDL

Select parameters (required) ≡

Optional filters: kinds of data, filter by parm, experiment names, etc ≡

Choose one or more kinds of data:

- All kinds of data
- Red line (630.0 nm) Doppler imaging FPI
- Red line FPI higher level vector wind data

Filter experiments by name:

Filter files by description:

Select data from only a part of the year by changing the values below:

Optional seasonal start day/month:

Optional seasonal end day/month:

Add optional filters based on parameter values below:

Optional filters using any parameter mnemonic for this instrument	Lower limit (leave blank if no lower limit)	Upper limit (leave blank if no upper limit)
<input type="text" value="ELM"/>	<input type="text" value="45"/>	<input type="text"/>
<input type="text" value="None"/>	<input type="text"/>	<input type="text"/>
<input type="text" value="None"/>	<input type="text"/>	<input type="text"/>

Generate command

Create a script command to download Madrigal data with selected parameters and filters

Choose an instrument category if desired:

Fabry-Perots

Choose one instrument (*Year range shows data available*):

Arecibo Imaging Doppler Fabry-Perot [2012-2016]

File format to download: Hdf5 Space-delimited ascii

netCDF4

Choose scripting language: python Matlab IDL

Start date

1950-01-01



End date

2016-12-31



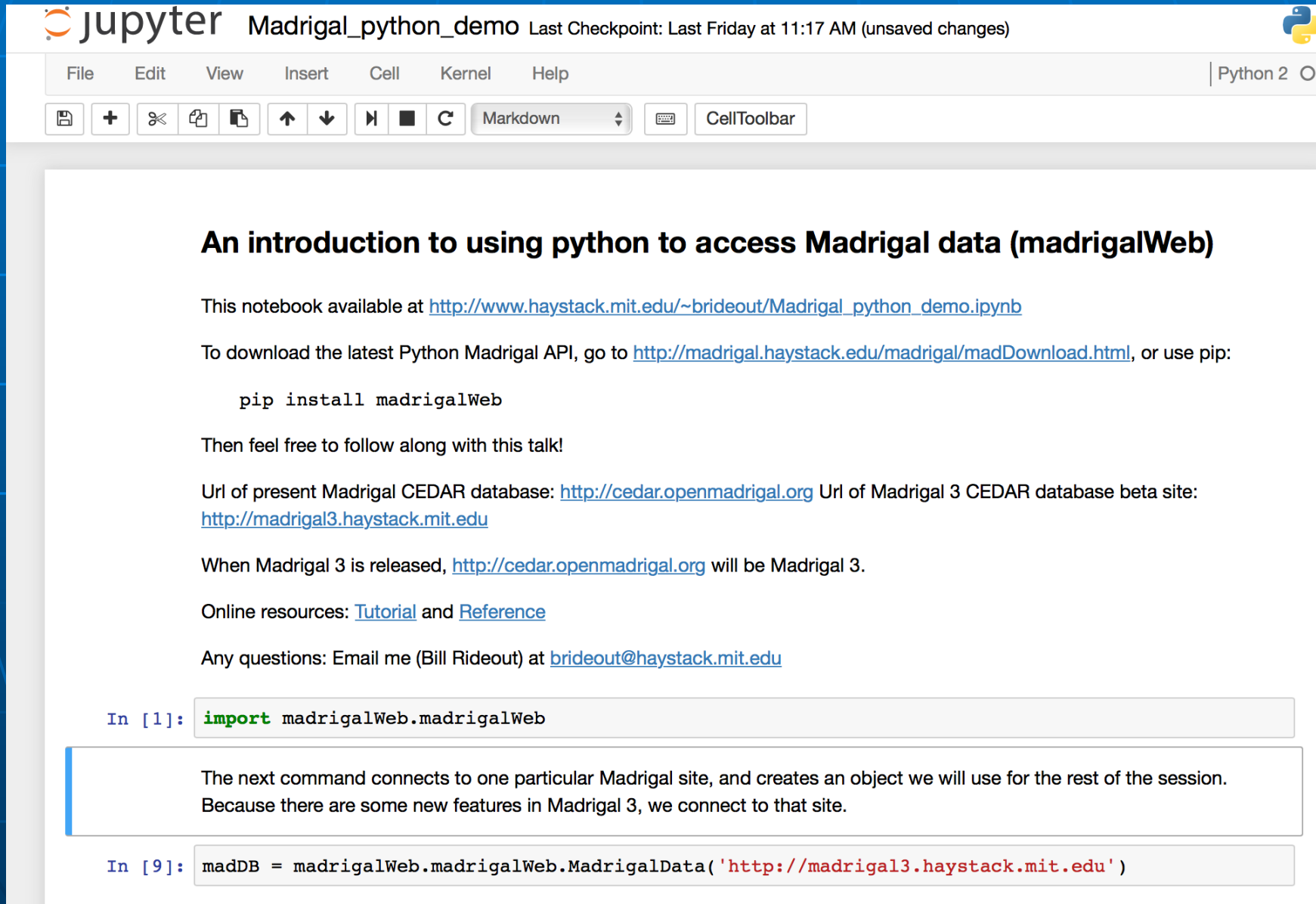
Select parameters (required) ≡

Optional filters: kinds of data, filter by parm, experiment names, etc ≡

Generate command

```
globalIsprint.py --verbose --url=http://madrigal3.haystack.mit.edu/ --parms=MONTH,DAY,HOUR,MIN,SEC,YEAR,VN1,DVN1,WAVLEN -  
-output=example.txt --user_fullname="Bill+Rideout" --user_email=brideout@haystack.mit.edu --user_affiliation="MIT" --star  
tDate="01/01/1950" --endDate="12/31/2016" --inst=5370 --filter=ELM,45,
```

Calling the API with your own python script



The screenshot shows a Jupyter Notebook window titled "Madrigal_python_demo" with a last checkpoint from "Last Friday at 11:17 AM (unsaved changes)". The interface includes a menu bar (File, Edit, View, Insert, Cell, Kernel, Help) and a toolbar with icons for saving, adding, deleting, and running cells. The notebook content is as follows:

An introduction to using python to access Madrigal data (madrigalWeb)

This notebook available at http://www.haystack.mit.edu/~brideout/Madrigal_python_demo.ipynb

To download the latest Python Madrigal API, go to <http://madrigal.haystack.edu/madrigal/madDownload.html>, or use pip:

```
pip install madrigalWeb
```

Then feel free to follow along with this talk!

Url of present Madrigal CEDAR database: <http://cedar.openmadrigal.org> Url of Madrigal 3 CEDAR database beta site: <http://madrigal3.haystack.mit.edu>

When Madrigal 3 is released, <http://cedar.openmadrigal.org> will be Madrigal 3.

Online resources: [Tutorial](#) and [Reference](#)

Any questions: Email me (Bill Rideout) at brideout@haystack.mit.edu

In [1]: `import madrigalWeb.madrigalWeb`

The next command connects to one particular Madrigal site, and creates an object we will use for the rest of the session. Because there are some new features in Madrigal 3, we connect to that site.

In [9]: `madDB = madrigalWeb.madrigalWeb.MadrigalData('http://madrigal3.haystack.mit.edu')`