Madrigal database at Jicamarca: Upgrading and Unificating our Databases

M. Urco[1], B. Rideout[2]

1: Radio Observatorio de Jicamarca, Instituto Geofísico del Perú, Lima - Perú (murco@jro.igp.gob.pe)
2: MIT Haystack Observatory, Millstone Hill, MA – USA (brideout@haystack.mit.edu)

Radio Observatorio de
JICAMARCA
Radio Observatory

Introduction

Several instruments utilized under different operation modes at the Jicamarca Radio Observatory (JRO) have allowed the study of the equatorial atmosphere and ionosphere for many years. Among others we have: the Incoherent Scatter Radar (ISR), the Jicamarca Bistatic Radar (JBR), Magnetometer, Ionosonda and JULIA radar. All instruments generate a huge amount of information, either raw or derived data. Each operation mode has its own database and it can be freely accessed through the Internet by their respective link at: http://jro.igp.gob.pe/database/; the search options, graphics and visualization are different depending on the experiment.

JRO is under a process of data server upgrading, both software and hardware. This includes the unification of existing databases in Jicamarca, improving the search tools, access and visualization. The first stage of this process involves the transfer of Madrigal tools to the server: http://jro1.igp.gob.pe/madrigal which has a better performance and greater security, including the addition of new data and experiments to Madrigal.

In this work we describe the main features of our new designed database, as well as the improvements and new options added to Madrigal.

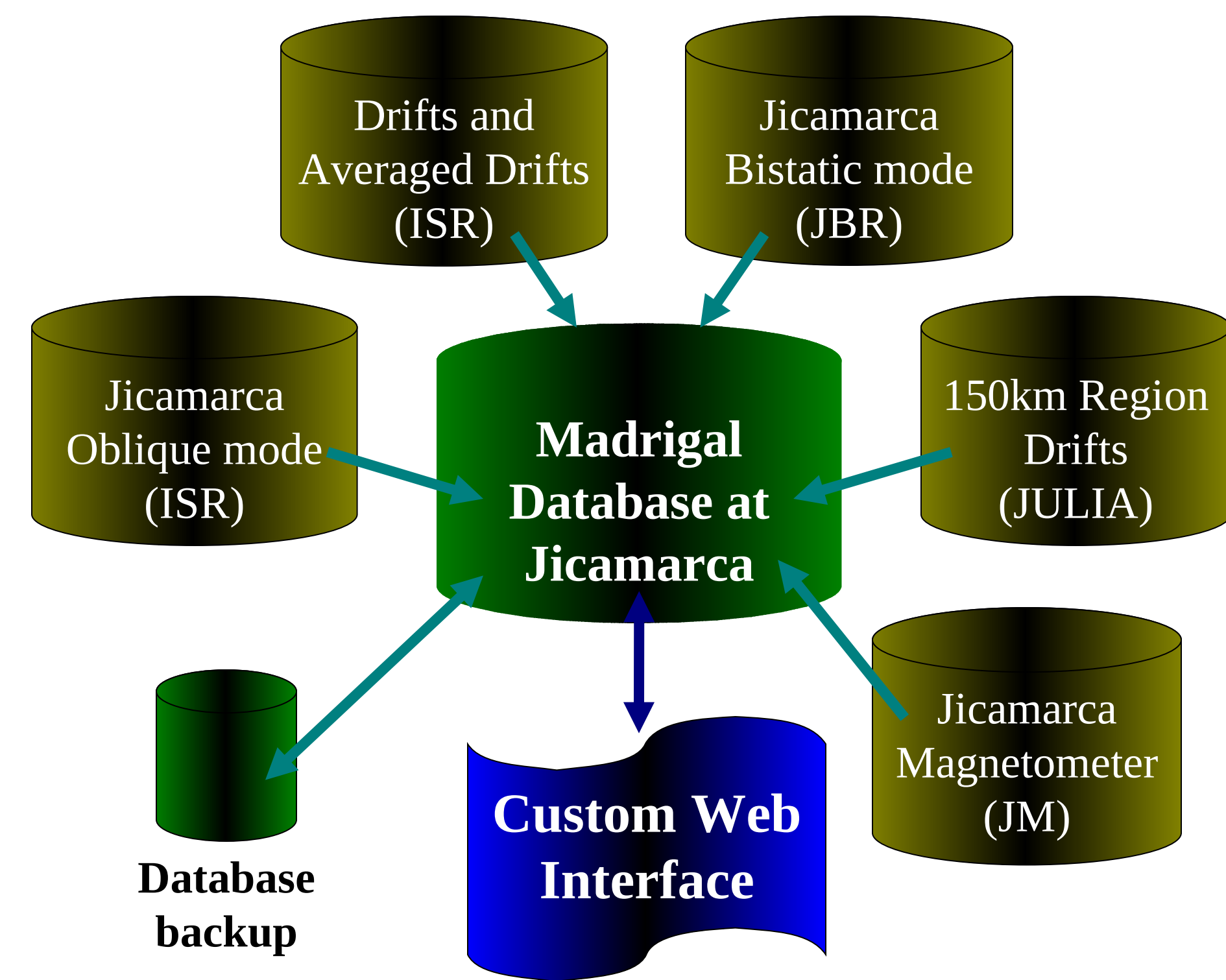### New experiments in Madrigal

1. Organization:

Figure 1: Main instruments and experiments added to Madrigal

The instruments included in Madrigal at Jicamarca are: Incoherent Scatter Radar (ISR), Jicamarca Bistatic Radar (JBR), Jicamarca Magnetometer (JM) and Jicamarca Unattended Long-term Investigations of the Ionosphere and Atmosphere (JULIA). In addition, Jicamarca has a backup of data from Madrigal database.

The main feature of our database is the addition of a custom web interface that allows access to data from Jicamarca easily. This interface includes plotting, displaying and downloading routines, all these developed in python.

2. Main parameters included into Madrigal:

INST	EXPERIMENT	PARAMETER	MADRIGAL CODE	HEIGHT RANGE (Km)
ISR	Drifts	Vertical velocity	Direction 5 Ion velocity (1252)	0 - 900
		Zonal velocity	Direction 4 Ion velocity (1241)	0 - 900
	Jicamarca Oblique mode	Electron density	Electron density (510)	100 - 700
		Ion temperature	Ion temperature (550)	100 - 700
		Electron temperature	Electron temperature (560)	100 - 700
JULIA	150km Region Drifts	Vertical velocity	Direction 5 Ion velocity (1252)	150
		Zonal velocity	Direction 4 Ion velocity (1241)	150
JBR	Jicamarca Bistatic mode	Electron density	Electron density (510)	90 - 120

Table 1: Main parameters into Madrigal

3. Search and plotting tools:

Madrigal Version 2.5.2 has four ways to access data: *Madrigal Simple Data Access, Browse for Individual Experiments Madrigal, Madrigal Database Global Report and Plot Data from Instruments*, these can to filter and to find information from anywhere Madrigal site. The easiest way to access data is via *Madrigal Simple Data Access* and it is necessary to follow at least three steps in order to display the desired data or graph.
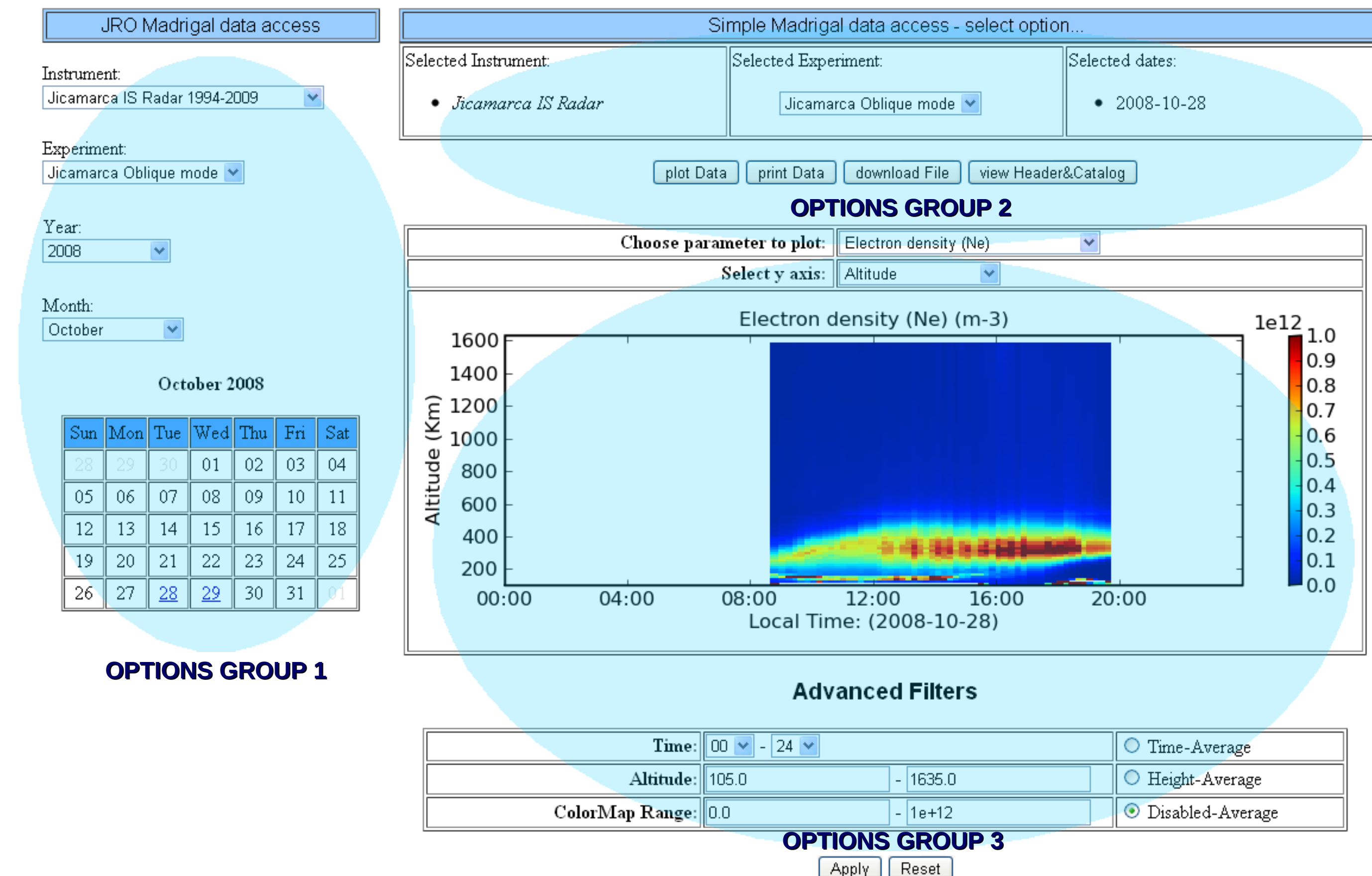
4. Custom Web Interface:

Figure 2: Electron density (NE) plot from ISR, date 28/10/2008. The interface have three options groups: Date option, file option and data option.

Options group 1:

- Selection of availabe instruments
- Selection of a experiment
- Selecting of the year, month and day through a calendar

Options group 2:

- *Plot Data*: Generates a graph of the selected parameter.
- *Prin Data*: Displays the values of all parameters.
- *Download Data*: Download the file belonging to the selected date in any of the five available formats: Madrigal, ASCCII NCAR, NCAR Binary, Unblock Blocked Binary and Binary.
- *View Cataog&Header:* Displays details of the experiment, such as: Parameters into file, description of the experiment, processing techniques employed, etc.

Options group 3:

- Selection of a parameter to plotting.
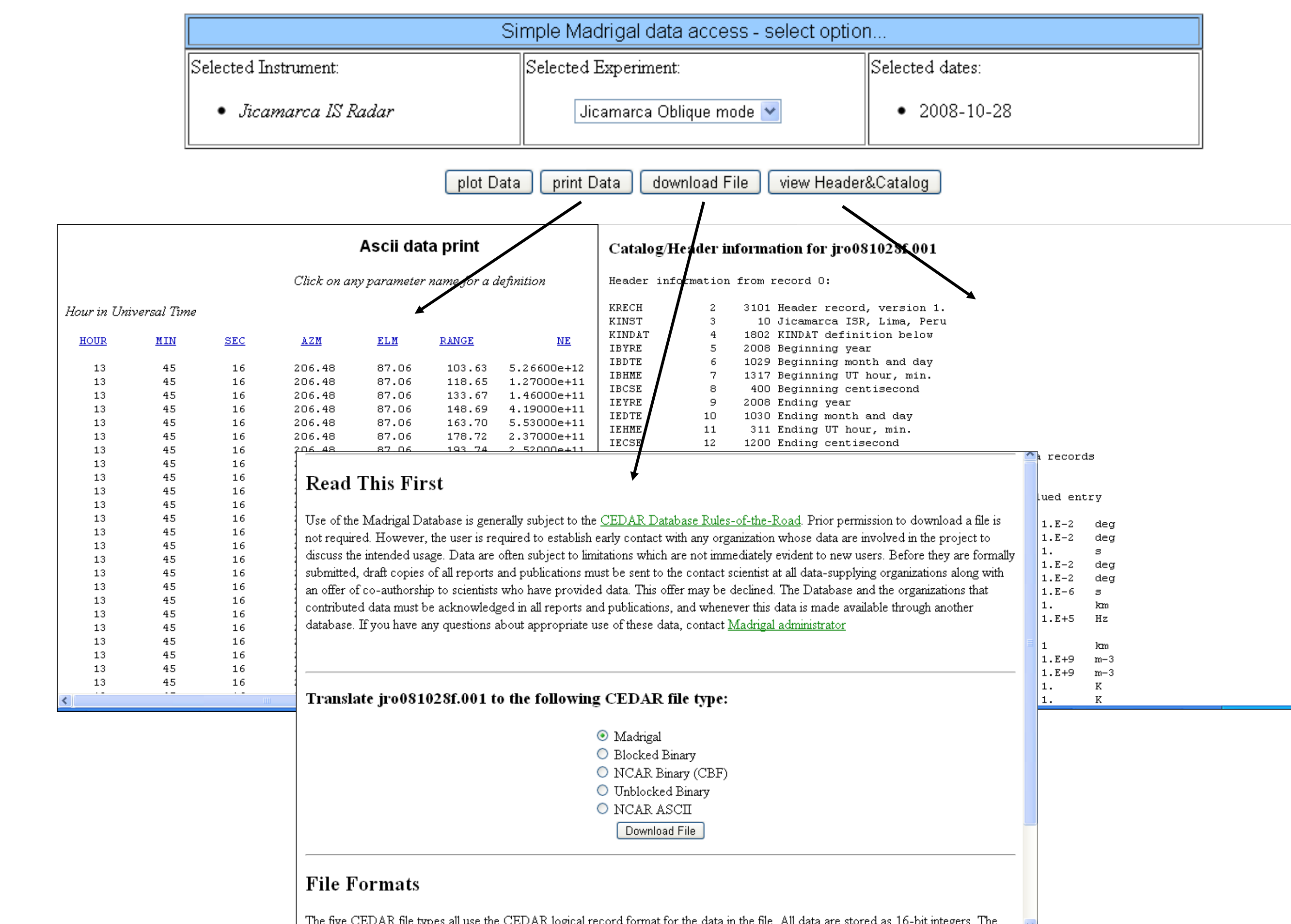- Advanced Filters: Selection of a time range, height or color scale

Figure 3: File Options: Print Data, Download File and View Catalog & Header

4.1. Plot Data (*Options to generate graphics*):

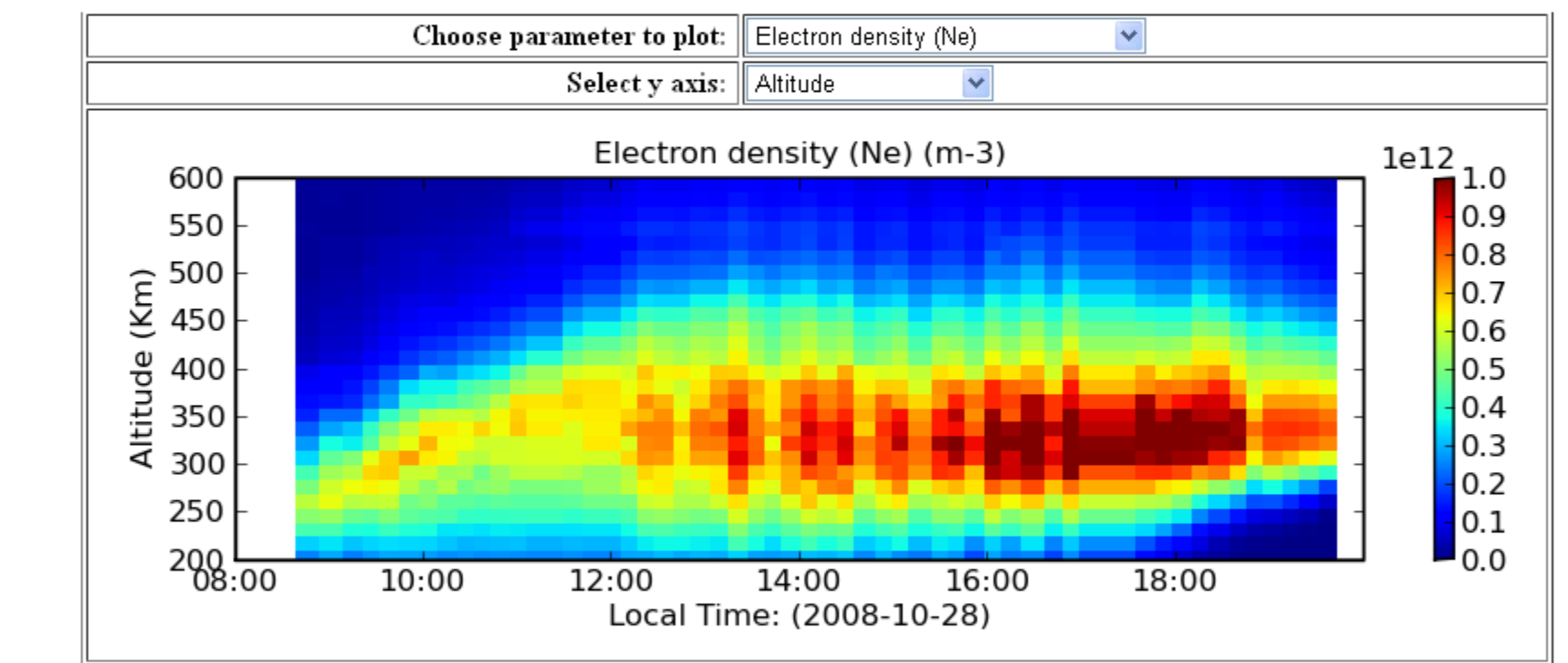b) *Setting a time range, height and color scale.*

Figure 4: Electron density plot from ISR, date 28/10/2008. Time range: 08-20 hours and height range: 200–600Km

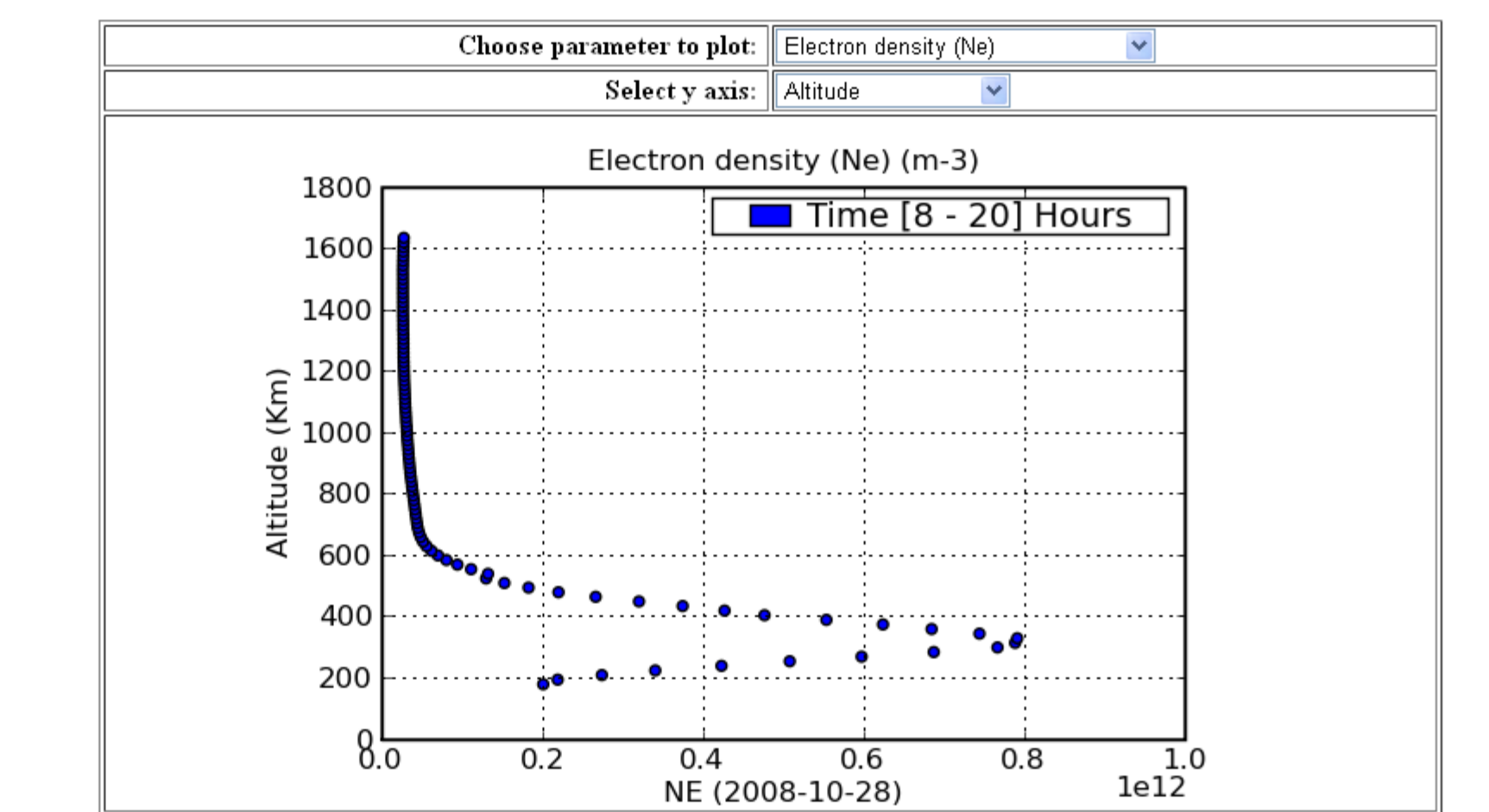k) *Time and height average*

Figure 5: Electron density plot from ISR, date 28/10/2008. Time average selected

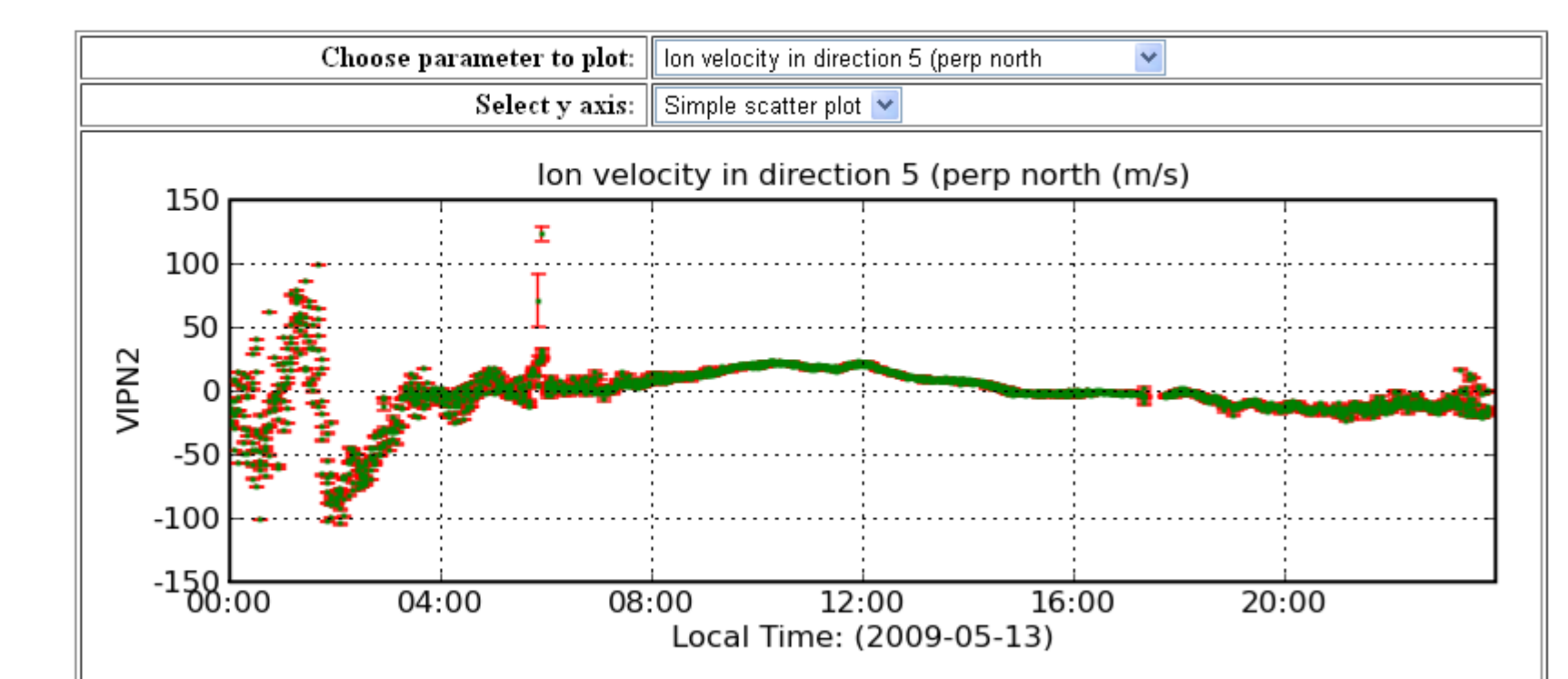u) *Displaying the parameter along with its error*

Figure 6: Vertical velocity plot from ISR, date 13/05/2009. The experiment selected is Averaged Drifts

ad) *Customizing the graph: choose a default colormap or range for each parameter*
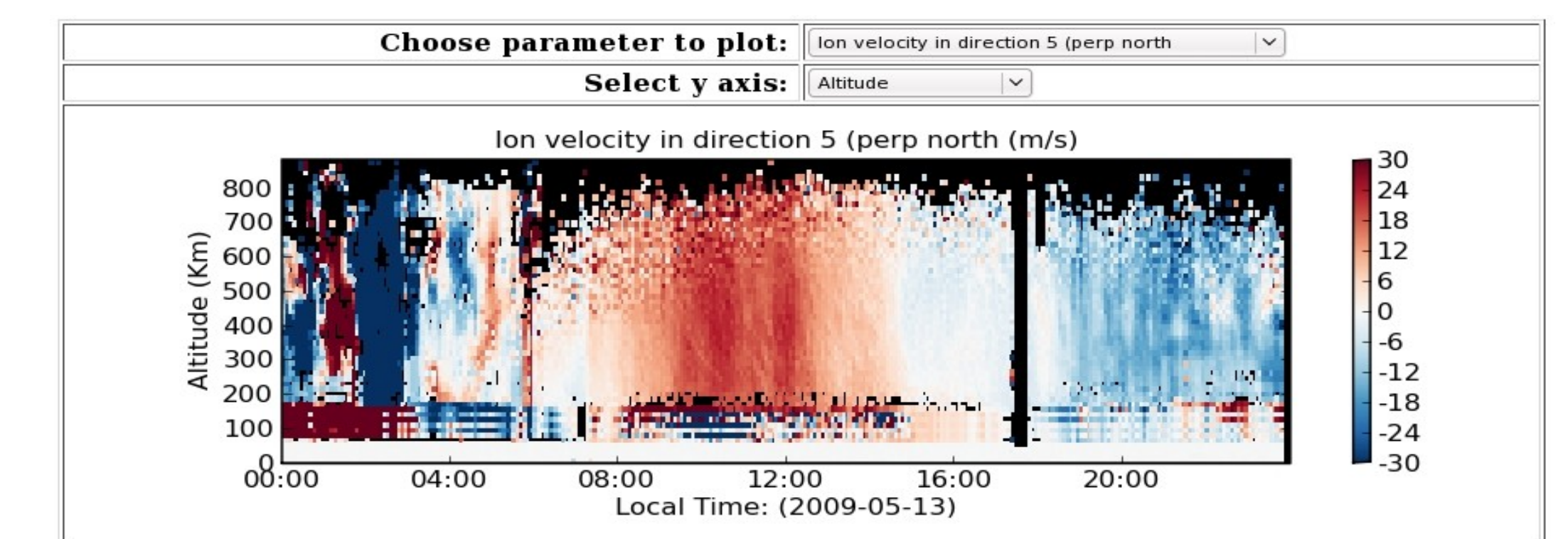

Figure 7: Vertical velocity plot from ISR, date 13/05/2009. The experiment selected is Drifts. We can choose a colormap, time range, height range, etc. for each parameter.

CONCLUSIONS

- The search engine through the custom web interface is simpler and quicker. All options are available in a single window.
- The addition of a calendar facilitates the location of data from a specific day.
- The visualization of the parameters with their error is a very important feature for users and provides them a greater reliability.
- The possibility of observing the behavior of some parameter through the time or height is another important feature for the user.
- The great advantage of the custom web interface is the possibility of graphing, display a detailed description of the experiment or downloads the file, all this in one step.

FUTURE WORK

- The next stage we will include the search and display experiments located at other sites Madrigal
- In the options of integration of time and height we will consider the propagation of errors for greater reliability.
- Madrigal will include a web interface for the placement of new data and experiments to the database.
- In addition, we will add data from other instruments and experiments of the Jicamarca Radio Observatory to Madrigal