

5.1 HOW TO ACCESS DATA THROUGH ESPAS

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Abstract. The homogenized access to data from the near-Earth space environment that are archived in different data repositories is the fundamental use case of the ESPAS platform. The access is provided through the ESPAS portal at <https://www.espas-fp7.eu/portal>, which was carefully designed in accordance to the users requirements. This chapter introduces the main functionalities of the system and elaborates examples of relevant data requests. The aim is to provide a brief guidance on how the end-user can search and download data by exploiting the platform's capabilities.

5.1.1 Introduction

The access to the data starts with the submission of metadata search requests. The compilation of a search query is supported by dynamic workflows that help the end-user to refine the search request based on a set of criteria that includes the following options:

- Time period: the time period when the observations were acquired
- Assets: the instruments and models that were used for the generation of the observations
- Observed properties: the observed properties that were measured in the observations
- Observation collections: the collections that the observations belong to

The end-user is able to initiate a metadata/data search query by any of these criteria and to complete the query through any combination of them. Each of them filters the previous one helping the user to conclude on the desirable set of data. The metadata search is open to all users with no registration required, while the data download service is available to registered users.

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5.1.2 Search and Download

To initiate the metadata/data search, the user should reach the Search and Download page of the portal (see Fig. 5.1.1) in order to select one of the available options reported in the previous section, i.e. time period, assets, observed properties or observation collections.

The screenshot shows the ESPAS Search and Download page. At the top, there is a navigation bar with the ESPAS logo and links for HOME, SEARCH, BROWSE, ESPAS POLICIES, VALUE ADDED SERVICES, and SUPPORT. Below the navigation bar, the page is titled "Search & Download" and includes a welcome message. The main content area is divided into two main sections: "Progressive Search" and "Spatial/temporal Search".

Progressive Search is described as filtering search with different options as you go along (real-time). It includes four sub-options: Time Period, Assets, Observed Properties, and Observation Collections. Each sub-option has a corresponding icon and a brief description. Below this section, there is a "Metadata search" section with a detailed description and a link to a video tutorial. A "Data download" section follows, explaining how to download selected datafiles or values.

Spatial/temporal Search is described as filtering search by time and location (off-line). It includes a sub-option for Location, which has a corresponding icon and a brief description. Below this section, there is a "Metadata search" section with a detailed description and a link to a video tutorial. A "Data download" section follows, explaining how to download selected datafiles or values.

A yellow note at the bottom of the page states: "NOTE - for the location search and for the download of extracted data values, a maximum of 30 days can be selected." At the very bottom, there are four icons representing NEWS, EVENTS, PARTNERS, and DATA PROVIDERS.

Fig. 5.1. 1. The Search and Download starting page. The end-user can start the query by clicking on any of the available search options/criteria.

In each of the steps one may follow, the selected criteria will be recorded in the top part of the pages, in the Current Selections area in order to help the users keep track of their preferences.

5.1.2.1 Time period

In the *From date* and *To date* fields the user may define the time period of interest in UTC timezone. Moreover, one may specify the subset of day in UTC (this will apply for all days in the selected time period) by using the fields *Subset start* and *Subset end* (see Fig. 5.1.2).

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HOME SEARCH BROWSE ESPAS POLICIES VALUE ADDED SERVICES SUPPORT

Current Selections
none

Time Period Assets Observed Properties Observation Collections

Back Submit

Start New Search | Need Help?

Search by time period

Select a period of the observations [Option: specify the time of day to narrow down your results] Clear

Time period [start to end in UTC] Subset of day [if any]

From date: 2018/07/19 11:30 To date: 2018/07/19 11:30

Subset start: 00:00 Subset end: 23:59

The availability of all or part of the requested observations is not guaranteed for the selected time period, due to the existence of data gaps. The actual observations are displayed after the submission of your request.

NEWS EVENTS PARTNERS DATA PROVIDERS

Fig. 5.1. 2. Selecting the Time Period.

5.1.2.2 Assets

Within ESPAS, an asset corresponds to an Instrument or a Model or a software package that was used to generate an observation. Entering the corresponding page, there is a list of all the assets (in alphabetical order) that are associated with observations grouped as Instruments and Models. The user may scroll down this list and select the assets to be included in the metadata query. The buttons Select All or Deselect All are able to select and deselect all the options respectively. In the left part of the page there are also some filters (Instrument type, Platform, Project) that the user may use to narrow down or facilitate the selection of assets presented in the right part. A hierarchical view of each filter is provided. Note also that the selection of an option automatically selects all its siblings in the hierarchy (see Fig. 5.1.3).

5.1.2.3 Observed Properties

Entering the Observed Properties page, in the right part there is a list of all the observed properties (in alphabetical order) that are associated with observations. The user may scroll down this list and select the observed properties to be included in the metadata query. The buttons Select All or Deselect All are able to select and deselect all the options, respectively. In the left part there are some filters

The screenshot displays the ESPAS E-Infrastructure website interface. At the top, the ESPAS logo is on the left, and navigation links (LOG IN, REGISTER, ESPAS Project, Contact Us) are on the right. Below the logo, the tagline 'near earth space data infrastructure for e-science' is visible. A navigation bar contains links for HOME, SEARCH, BROWSE, ESPAS POLICIES, VALUE ADDED SERVICES, and SUPPORT. The 'Current Selections' section shows 'none'. Below this, there are buttons for 'Time Period', 'Assets' (highlighted), 'Observed Properties', and 'Observation Collections'. A 'Back' and 'Submit' button are also present. The main content area is titled 'Search by assets' and includes instructions on how to use the filter options. The 'Filter by' section on the left shows a hierarchy for 'Asset Type' with 'Instrument types' expanded to show 'In Situ Sensing Instrument' and its sub-items. The 'Assets' section on the right shows a search input, 'Select All' and 'Deselect All' buttons, and a list of instruments under the 'Instruments' category, including ACE Magnetometer, ACE SWEFAM, Alouette 1 Topside Sounder, Alouette 2 Topside Sounder, Andøya Magnetometer, Athens Digisonde, Bergen Magnetometer, Bjernøya Geomagnetic Observatory Magnetometer, Castello Tesino Scalar Magnetometer, Castello Tesino Vector Magnetometer, Dombås Geomagnetic Observatory Magnetometer, and Dønna Magnetometer. At the bottom, there are four icons representing NEWS, EVENTS, PARTNERS, and DATA PROVIDERS.

Fig. 5.1. 3. Selecting the Assets.

(Phenomenon, Measurand, Qualifier) that the user may use to narrow down or facilitate the selection of observed properties presented in the right part. A hierarchical view of each filter is provided. Note also that the selection of an option automatically selects all its siblings in the hierarchy (see Fig. 5.1.4).

5.1.2.4 Observation Collections

By entering the Observation Collections page, in the right part there is a list of all the observation collections (in alphabetical order) that are associated with at least one observation. The user may scroll down this list and select the observation collections to be included in the metadata query. The buttons Select All or Deselect All are able to select and deselect all the options, respectively. In the left part there are some filters (Region of Space, Dimensionality) that the user may use to

The screenshot displays the ESPAS web interface. At the top, the ESPAS logo is on the left, and navigation links (LOG IN, REGISTER, ESPAS Project, Contact Us) are on the right. Below the logo, the text 'near earth space data infrastructure for e-science' is visible. A navigation bar contains 'HOME', 'SEARCH', 'BROWSE', 'ESPAS POLICIES', 'VALUE ADDED SERVICES', and 'SUPPORT'. Under 'Current Selections', it shows 'none'. A row of buttons includes 'Time Period', 'Assets', 'Observed Properties' (highlighted), and 'Observation Collections'. Below these are 'Back' and 'Submit' buttons, and links for 'Start New Search' and 'Need Help?'. The main content area is titled 'Search by observed properties' and includes a 'Filter by' section with a tree view for 'Phenomenon', 'Measurand', and 'Qualifier'. The 'Observed Properties' section on the right has a search input, 'Select All', and 'Deselect All' buttons, followed by a list of properties with checkboxes: Electron Density (Ne), Total Electron Content (I), Total Vertical Electron Content (I), Ion Composition (I/I), O/Ne Composition (I/O I(e-)), Ion Density (Ni), Proton Density (N), Ion Drift Velocity (Vi), Proton Drift Velocity (V), Ion Temperature (Ti), Proton Temperature (T), Magnetic Field (B), and Magnetic Field NED Eastward Component (Y).

Fig. 5.1. 4. Selecting the Observed Properties.

narrow down or facilitate the selection of the observation collections presented in the right part. A hierarchical view of each filter is provided. Note also that the selection of an option automatically selects all its siblings in the hierarchy (see Fig. 5.1.5).

5.1.2.5 Data Download

The download of data (files or values) is a service that is available only from the Results page that is reached after the submission of a metadata search request. This service requires registration and log in the ESPAS portal. To be able to exploit the Download option, the user should select a time period up to 30 consistent days in a specific request.

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HOME SEARCH BROWSE ESPAS POLICIES VALUE ADDED SERVICES SUPPORT

Current Selections
none

Time Period Assets Observed Properties Observation Collections

Back Submit

Start New Search | Need Help?

Search by observation collections

Select Observation Collections on the right [Filter with available options on the left]

Observation Collections that are not related to an observation, are not displayed in this form. For a complete list of all the Observation Collections registered in ESPAS you can visit the Browse -> Metadata section

Clear

Filter by

Region of Space

Start typing to select options...

Select All Deselect All

- Earth
 - Earth's Near Surface
 - Ionosphere
 - Plasmasphere
 - Thermosphere
 - Earth L1

Dimensionality

Observation Collection

Start typing to select options...

Select All Deselect All

- ACE IMF data (realtime)
- ACE SWEPAM data (realtime)
- Alouette 1 Electron Density Profiles
- Alouette 2 Electron Density Profiles
- Andenes Magnetometer Data
- Athens Digisonde SAO files (autoscaled)
- Automatically Prospected IMAGE RPI Plasmagram Images
- Bergen Magnetometer Data
- Bjornøya Magnetometer Data
- CTS 1 minute XYZF variations
- DEMETER IAP - Characteristics of Low Energy Ions in Burst Mode (DMT_N1_1139)
- DEMETER IAP - Characteristics of Low Energy Ions in Survey Mode (DMT_N1_1140)
- DEMETER ISL - Langmuir Probe Results (Plasma Parameters) in Burst Mode (DMT_N1_1142)

NEWS EVENTS PARTNERS DATA PROVIDERS

Fig. 5.1. 5. Selecting the Observation Collections.

5.1.3 Examples

5.1.3.1 Ionospheric data: observed and modeled foF2

The screen shots that appear in Fig. 6 to 11 aim to describe how the end user can search and download modeled and observed values of the foF2 critical frequency. In favor of simplicity, we assume that one is looking for foF2 values obtained over Athens and Rome for a specific time interval, e.g. June 2006. The proposed workflow is:

1. Select the time interval (see Fig. 5.1.6)
2. Select the observed property (see Fig. 5.1.7)
3. Select the assets: Instruments and Models (see Fig. 5.1.8 and Fig. 5.1.9)
4. Select the observation collections and submit (see Fig. 5.1.10)
5. Download data (see Fig. 5.1.11)

The screenshot displays the ESPAS web interface. At the top, there is a navigation bar with links for LOG IN, REGISTER, ESPAS Project, and Contact Us. Below this is the ESPAS logo and the tagline 'near earth space data infrastructure for e-science'. The main navigation menu includes HOME, SEARCH, BROWSE, ESPAS POLICIES, VALUE ADDED SERVICES, and SUPPORT. The current selection is 'Current Selections' with 'Time Periods: 2006-06-01 00:00 - 2006-06-30 23:00 [00:00 - 23:59] UTC'. Below the navigation, there are four icons: Time Period, Assets, Observed Properties, and Observation Collections. A search form is present with fields for 'Time period' (start to end in UTC), 'Subset of day' (if any), 'Subset start', and 'Subset end'. The 'Time period' field contains '20060601 00:00' and '20060630 23:00'. The 'Subset of day' field contains '00:00' and '23:59'. A 'Clear' button is located below the search form. A blue banner at the bottom of the search form states: 'The availability of all or part of the requested observations is not guaranteed for the selected time period, due to the existence of data gaps. The actual observations are displayed after the submission of your request.' At the bottom of the page, there are four icons: NEWS, PARTNERS, EVENTS, and DATA PROVIDERS.

Fig. 5.1. 6. The time period from 01/06/2006 to 30/06/2006 has been selected. Click on the Observed Property button in the top right corner.

The screenshot displays the ESPAS web interface. At the top, there is a navigation bar with links for LOG IN, REGISTER, ESPAS Project, and Contact Us. Below this is a header with the ESPAS logo and the text "near earth space data infrastructure for e-science". A secondary navigation bar includes HOME, SEARCH, BROWSE, ESPAS POLICIES, VALUE ADDED SERVICES, and SUPPORT. The main content area is divided into several sections. On the left, there are buttons for "Time Period", "Assets", "Observed Properties", and "Observation Collections". A "Submit" button is highlighted in blue. Below these buttons are links for "Start New Search" and "Need Help?". The central part of the page features a "Filter by" section with a "Phenomenon" dropdown and a list of filter options: Activity, Solar Activity, Field, Electric Field, Magnetic Field, and Particle. To the right of this is an "Observed Properties" section with a "Select All" button and a list of property options, including E-layer Z-mode Critical Frequency (fZE), Electric Potential (V), Electron Flux (Fe), Electron Temperature (Te), E-layer Blanketing Frequency (fBEs), E-layer Critical Frequency (fEs), E-layer Type (Type-Es), F1-layer Critical Frequency (fF1), F1 layer peak height (hmF1), F2-layer Critical Frequency (fF2), F2 layer half-density height (zhalfNm), F2 layer peak height (hmF2), F2-layer X-Mode Critical Frequency (fXF2), and F2-layer X-Mode Top Frequency (fXT).

Fig. 5.1. 7. The F2-layer critical frequency has been selected. Click on the Assets button in the top right corner.

The screenshot displays the ESPAS web interface. At the top, there is a navigation bar with links for 'LOG IN', 'REGISTER', 'ESPAS Project', and 'Contact Us'. Below this is the ESPAS logo and the tagline 'near earth space data infrastructure for e-science'. The main navigation menu includes 'HOME', 'SEARCH', 'BROWSE', 'ESPAS POLICIES', 'VALUE ADDED SERVICES', and 'SUPPORT'. The 'SEARCH' tab is active, showing a search bar and a 'Submit' button. Below the search bar, there are filters for 'Time Period' and 'Assets'. The 'Assets' filter is expanded, showing a list of instruments with checkboxes for selection. The 'Filter by' section is also expanded, showing options for 'Asset Type', 'Instrument Types', and 'Model Types'. The 'Assets' list includes Athens Digisonde, ESCAT Tromse Dynasonde, Gblimanna AIS INGV Ionosonde, Rome AIS INGV Ionosonde, and Sodanlylla Ionosonde (SO166). The 'Filter by' section shows 'Instrument Types' with 'Ionosonde' and 'Vertical Ionosonde' selected, and 'Model Types' with 'Assimilative Model' and 'Autocalled' selected. The 'Platform' and 'Project' filters are also visible. On the right side, there are icons for 'NEWS', 'EVENTS', 'PARTNERS', and 'DATA PROVIDERS'.

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Time Period Assets Observed Properties Observation Collections

Back Submit Start New Search Need Help?

Current Selections
Time Periods: 2006-06-01 00:00 - 2006-06-30 23:00 [00:00 - 23:59] UTC
Observed Properties: F2-layer Critical Frequency
Assets: Athens Digisonde, Rome AIS INGV Ionosonde

Search by assets
Select Assets on the right (Filter with available options on the left)
Assets (and their respective filter options) that are not related to an observation, are not displayed in this form. For a complete list of all the Assets (Instrument and Computations), Platforms and Projects registered in ESPAS you can visit the Browse -> Metadata section

Filter by

Asset Type

Select All Deselect All

Instrument Types

- Ionosonde
- Vertical Ionosonde

Model Types

- Assimilative Model
- Autocalled

Platform

Project

Select All Deselect All

Instruments

- Athens Digisonde
- ESCAT Tromse Dynasonde
- Gblimanna AIS INGV Ionosonde
- Rome AIS INGV Ionosonde
- Sodanlylla Ionosonde (SO166)

NEWS

EVENTS

PARTNERS

DATA PROVIDERS

Fig. 5.1. 8. The Athens and Rome Digisondes have been selected. Scroll down to move to the Models part.

The screenshot displays the ESPAS web application interface. At the top, there is a navigation bar with links for 'LOG IN', 'REGISTER', 'ESPAS Project', and 'Contact Us'. Below this is the 'near earth space data infrastructure for e-science' logo. The main navigation menu includes 'HOME', 'SEARCH', 'BROWSE', 'ESPAS POLICIES', 'VALUE ADDED SERVICES', and 'SUPPORT'. A secondary menu on the right contains 'Time Period', 'Assets', 'Observed Properties', and 'Observation Collections'. The 'Assets' section is active, showing 'Current Selections' for the time period '2006-06-01 00:00 - 2006-06-30 23:00 [00:00 - 23:59] UTC' and observed properties 'F2-layer Critical Frequency' and 'Assets: IRI (International Reference Ionosphere), SIRMUP'. A 'Search by assets' section provides instructions on how to filter results. The 'Filter by' section shows 'Asset Type' as 'Instrument types' and 'Model types'. The 'Assets' list on the right shows the following items selected:

- ARTIST
- CCR F peak model
- DSND
- Interpret
- Ionobrowse
- IRI (International Reference Ionosphere)
- SIRM
- SIRMUP
- URSI F peak model

At the bottom of the page, there are icons for 'NEWS', 'EVENTS', 'PARTNERS', and 'DATA PROVIDERS'.

Fig. 5.1. 9. The IRI and the SIRMUP models have been selected (see Chapter 3.6 for a description of the models and the corresponding output that is available through ESPAS). Click on the Observation Collections button in the top right corner.

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Time Period Assets Observed Properties Observation Collections

Back Submit Start New Search Need Help?

ARTWORKS

Current Selections
 Time Periods: 2006-06-01 00:00 - 2006-06-30 23:00 [06:00 - 23:59] UTC
 Observed Properties: F2-layer Critical Frequency
 Assets: Athens Digisonde, Rome AIS IINGV Ionosonde, ...
 Observation Collections: Athens Digisonde SAO files (autoscaled), DIAS daily F-plots of fminToF2 from Athens Digisonde, ...

Search by observation collections
 Select Observation Collections on the right. (Filter with available options on the left)
 Observation Collections that are not related to an observation, are not displayed in this form. For a complete list of all the Observation Collections registered in ESPAS you can visit the Browse -> Metadata section

Filter by

- > Region of Space
 - Select All
 - Deselect All
 - Ionosphere
- > Dimensionality

Observation Collection

- Select All
- Deselect All
- Athens Digisonde SAO files (autoscaled)
- DIAS daily F-plots of fminToF2 from Athens Digisonde
- DIAS SIRMUP nowcasting maps of foF2
- IRI foF2 grids - CCIR F peak model
- IRI foF2 grids - URSI F peak model
- Validated Values of the Ionospheric Characteristics Recorded at Rome from January 2005 to September 2012

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Fig. 5.1. 10. All observation collections have been selected. Click on Submit.

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HOME SEARCH BROWSE ESPAS POLICIES VALUE ADDED SERVICES SUPPORT

Current Selections
 Time Periods: 2006-06-01 00:00 - 2006-06-30 23:00 [00:00 - 23:59] UTC
 Observed Properties: F2-layer Critical Frequency
 Assets: Athens Digisonde, Rome AIS INGV Ionosonde, ...
 Observation Collections: Athens Digisonde SAO files (autoscaled), DIAS daily F-plots of fmin,foF2 from Athens Digisonde, ...

Time Period Assets Observed Properties Observation Collections

Back Submit

Start New Search | Need Help?

Results
 Select Download dataset files or data values (observed properties) and go to My Account to monitor their progress

Refine by

- Project
- Observation Collection
- Instrument
- Region of Space
- Platform
- Model
- Dimensionality Timeline
- Dimensionality Instance

Number of Observations : 155 Download Data Providers' status Share your results

Observation Collections

- Athens Digisonde SAO files (autoscaled)
- DIAS daily F-plots of fmin,foF2 from Athens Digisonde
- DIAS SIRMUP nowcasting maps of foF2
- IRI foF2 grids - CCIR F peak model
- IRI foF2 grids - URSI F peak model
- Validated Values of the Ionospheric Characteristics Recorded at Rome from January 2005 to September 2012

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Fig. 5.1. 11. In the Results page and through the Download option the user is able to download the requested datasets either as raw files provided by each data provider by selecting the Dataset files option or as extracted data values in ASCII or XML formats by selecting the option Data values. Following the Data values option, the user may be able to plot the data directly on the web portal (see the example that follows in Section 5.1.3.2 of this chapter).

5.1.3.2 Cluster and DEMETER satellite data

The Cluster and DEMETER satellite datasets are described in Chapter 3.2. For the WHISPER instrument onboard Cluster, the data are directly downloaded from the Cluster Science Archive (CSA: <http://www.cosmos.esa.int/web/csa/access>) through the ESPAS wrapper installed at IASB-BIRA in Belgium. For the ISL instrument, the data have been first downloaded from the “Centre de Données de la Physique des Plasmas” (CDPP: <https://sipad-cdpp.cnes.fr>) and then stored on a server at NOA (National Observatory of Athens), where they are accessed

through the ESPAS wrapper installed at NOA in Greece.

On the ESPAS web portal, both datasets can be accessed through the

- “Observation Collections” search: Select “DEMETER ISL - Langmuir Probe Results” and “WHISPER Electron Density”, or
- “Observed Properties” search: select “Electron Density” and “Electron Temperature”, or
- “Assets” search: select “ISL Langmuir probe on board DEMETER” and “WHISPER Instrument Onboard Cluster”.

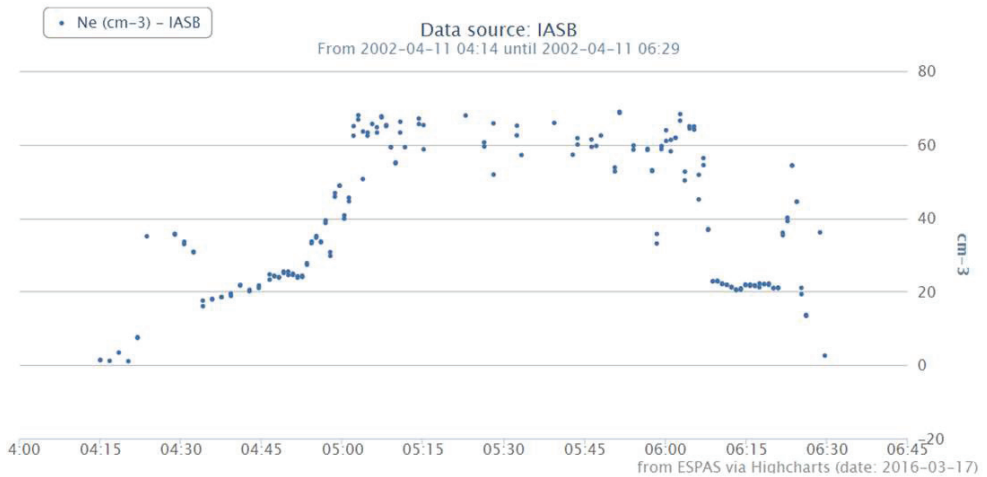


Fig. 5.1. 12. Electron density in cm^{-3} determined from WHISPER onboard C1 on 11 April 2002 during 2 hours and 45 minutes and plotted via the ESPAS user interface. (Courtesy of ESPAS)

After selecting the time period of the desired data, it is then possible to download the datafiles with the data in the format given by the data providers (ASCII file for WHISPER and binary file for ISL). For the WHISPER dataset, it is also possible to download data values with the extracted observed properties (in ASCII or XML format). Following the procedure visualized in Fig. 5.1.11, it is possible to plot directly the extracted values on the web portal. An example is shown on Fig. 5.1.12 with the electron density determined from WHISPER onboard C1 during the plasmasphere crossing of the event shown in Fig. 3.2.4 of Chapter 3.2 and plotted as a function of time. The plume crossings during the inbound and outbound passes are clearly seen on this density plot, as well as the higher density inside the main plasmasphere during perigee crossing near the equator.