PITHIA e-Science Centre

Prof Tamas Kiss
University of Westminster
3rd Innovation Day – 12/06/2024
Warsaw, Poland

What is the PITHIA e-Science Centre?

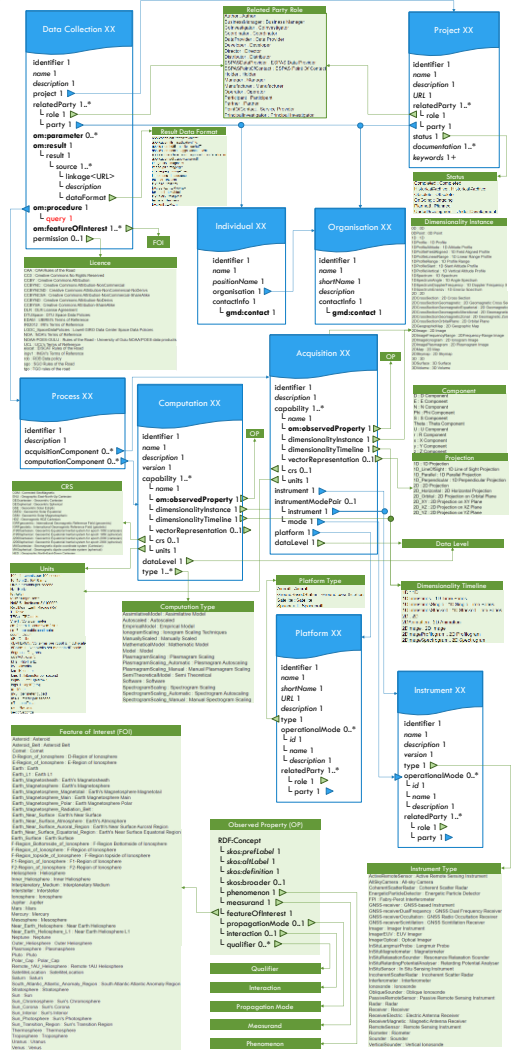
- A central web portal to provide a single point of entry to heterogenous and distributed resources (Data Collections)
  - Datasets
  - Models
  - Catalogues
  - Workflows
- Standardised metadata and ontology-based search
- Seamless interaction with all registered resources
- Usage is free and available for everyone – https://esc.pithia.eu

PITHIA Ontology and Metadata Structure

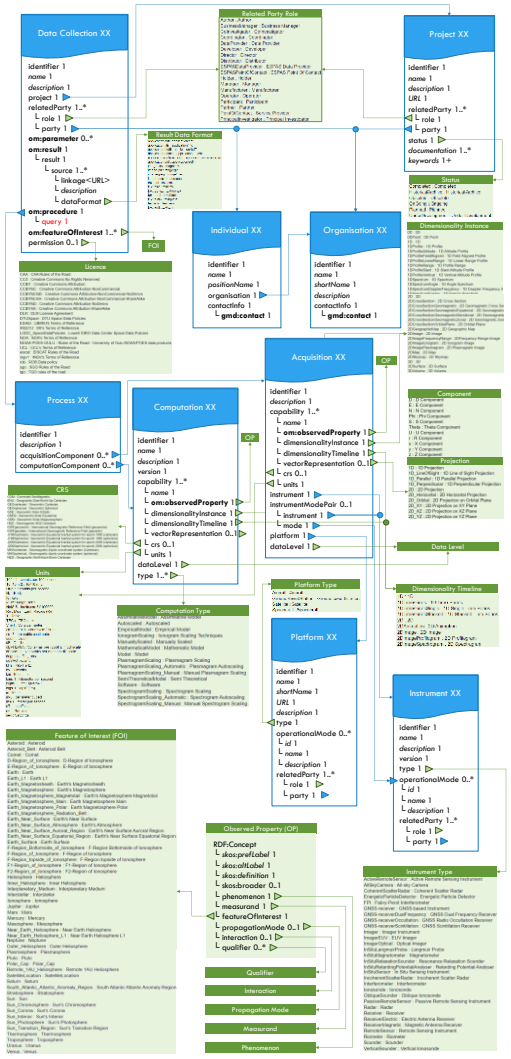
Registration to be completed in defined order considering dependencies

12. Collection
11. Process
10. Computation
9. Computation Capabilities
8. Acquisition
7. Acquisition Capabilities
6. Instrument
5. Operation
4. Platform
3. Project
2. Individual
1. Organisation

Acceptable values are defined by the PITHIA Space Physics Ontology

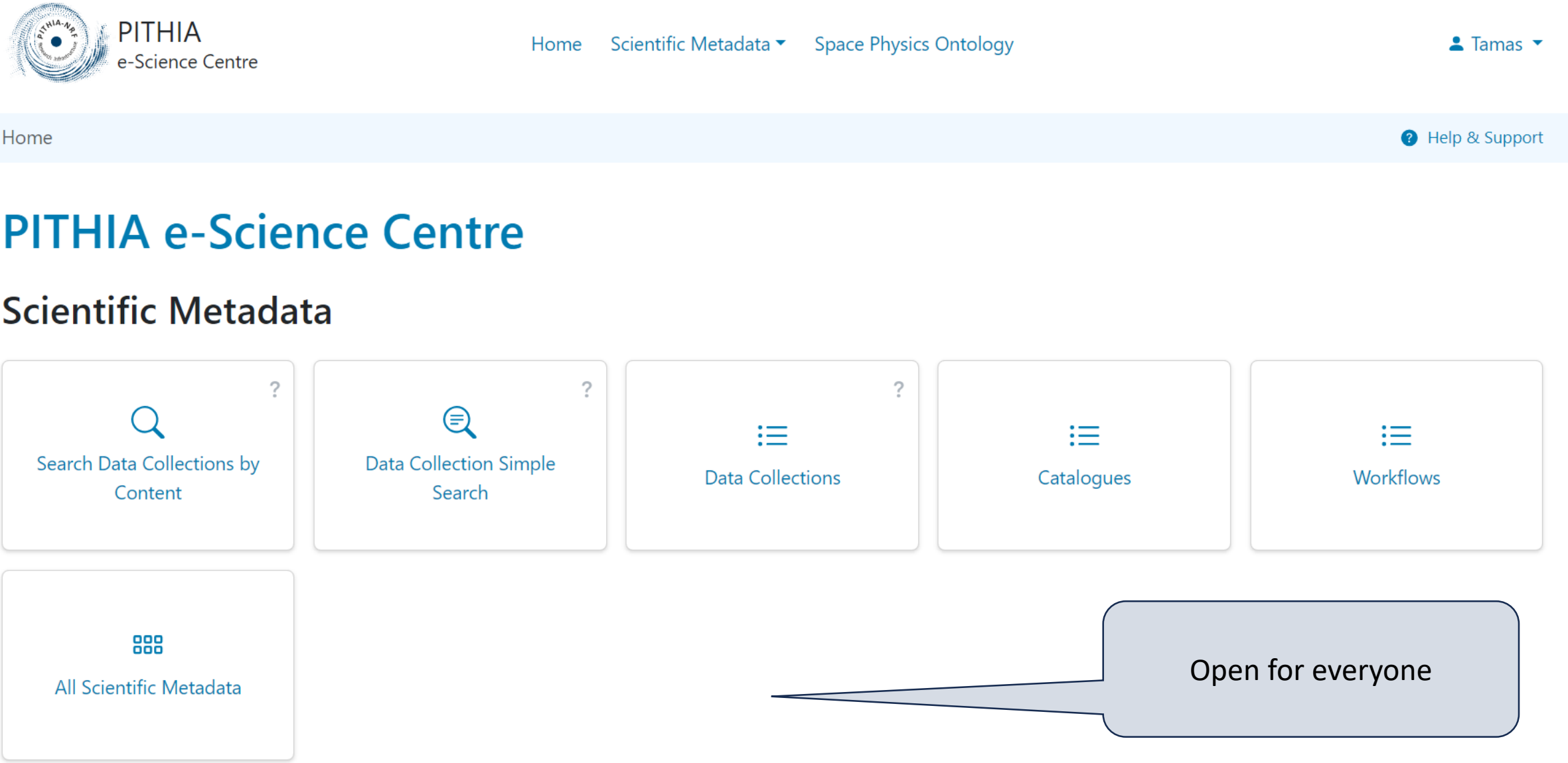


Yes, it looks complicated, **BUT**



- **Complication is for the provider**
  - Needs to describe its assets in XML format – only once
  - Templates, manuals, help and tools are provided for support
- **Gain is for the scientist (user)**
  - Gets very detailed and precise information about the assets
  - Can utilise very sophisticated ontology based search

eSC Generic Structure



eSC Generic Structure

Space Physics Ontology

Space Physics Ontology

Space Physics Ontology Guide

Open for everyone

University of Westminster

Data Registration

Data Resource Registration Guide

Manage Registrations

Metadata Models

Only after logging in

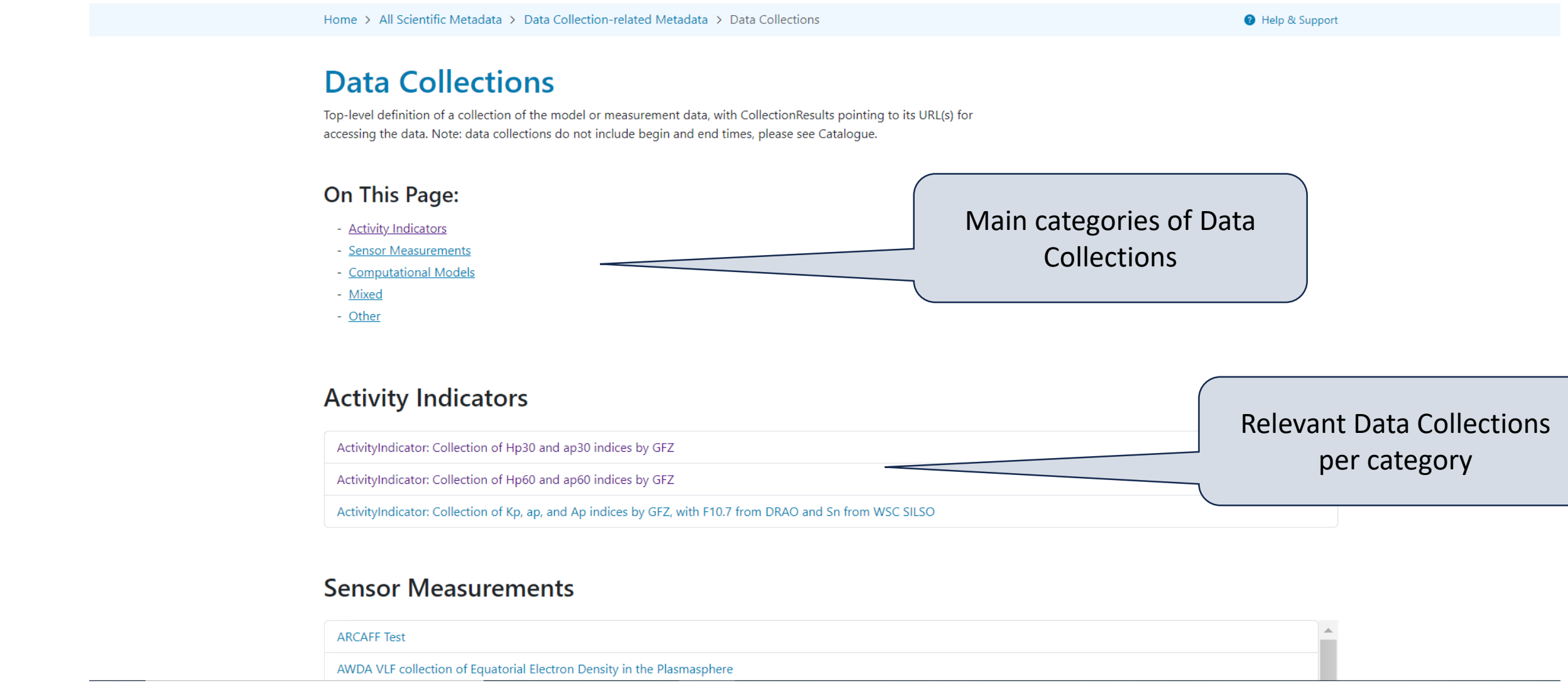
My Institutions

Register a New Institution

Join Another Institution

eSC Highlights – Search for Data Collections

Browse Data Collections



eSC Highlights – Search for Data Collections

Simple keyword-based search

Home > Data Collection Simple Search > Results

Help & Support

Results

kp index

Search

Exact match

Found 7 results for "*kp index*".

ActivityIndicator: Collection of Hp30 and ap30 indices by GFZ
No description

ActivityIndicator: Collection of Hp60 and ap60 indices by GFZ
No description

ActivityIndicator: Collection of Kp, ap, and Ap indices by GFZ, with F10.7 from DRAO and Sn from WSC SILSO
No description

The 1D EDD version of the TaD Model
The TSM-assisted Digisonde (TaD) Profiler (TaD model) is a topside profiler for the electron density profile based on empirical equations derived from topside sounding data of the Alouette/ISIS database and ingests the Digisonde observations at the height of the maximum electron density and the TEC parameters to adjust the profiler with the actual conditions of the ionosphere. The model has three components: (a) the Topside Sounders Model (TSM) subroutine (Kutiev and Marinov 2007; Kutiev et al. 2006) that provides the...

DTM2020-operational: semi-empirical thermosphere model
The Drag Temperature Model is the in-house developed semi-empirical model of the thermosphere. Its main application is in orbit determination and prediction. It provides point-wise predictions of total mass density, temperature, and partial densities of the main constituents (O2, N2, O, He). The solar driver is F10.7 and the geomagnetic driver of the model is Kp. The backbone of the data used to fit the model coefficients are the high-resolution and precision accelerometer-inferred densities of the GOCE, CHAMP and GRACE...

eSWua IONOWORLD tool: Long-term forecasting global TEC maps
This collection contains the Long Term Forecasting maps of the ionospheric Total Electron Content (TEC) [1] on a global scale (latitudinal and longitudinal ranges of 87.5°S–87.5°N and 180°W–180°E, respectively). The vTEC is estimated 24 hours in advance every 2 hours on a grid of 2.5° X 5° (lat x long). The proposed model is implemented through an algorithm consisting of two separate parts, working in cascade. The first part, termed "Single point TEC forecasting", focuses on the 24-h ahead prediction of vTEC on selected...

Search text / keyword

All data collections relevant to that keyword

eSC Highlights – Search for Data Collections

Content-based search using Space Physics Ontology

eSC Highlights – Interact with Data Collections

Get direct access to a Data Collection hosted externally

Index of /upc_ionex_GPSonly-RINEXv3

Name	Last modified	Size	Description
Parent Directory		-	
1996/	2022-10-09 15:56	-	
1997/	2020-04-08 10:56	-	
1998/	2020-04-08 10:56	-	
1999/	2020-04-08 10:56	-	
2000/	2020-04-08 10:56	-	
2001/	2020-04-08 10:56	-	
2002/	2022-10-09 16:23	-	
2003/	2020-04-08 10:56	-	
2004/	2020-04-08 10:56	-	
2005/	2020-04-08 10:56	-	
2006/	2022-10-09 16:22	-	
2007/	2020-04-08 10:56	-	
2008/	2020-04-08 10:56	-	
2009/	2020-04-08 10:56	-	
2010/	2020-04-08 10:56	-	
2011/	2020-04-08 10:56	-	
2012/	2020-04-08 10:56	-	

Access Data Collection on remote site

eSC Highlights – Interact with Data Collections

Run model or access data directly from the eSC (using API)

BSPM: 3D-Kinetic plasmasphere model

Royal Belgian Institute for Space Aeronomy

Description

The BSPM (Belgian SWIFF Plasmasphere Model) is a 3D-Kinetic semiempirical model of the plasmasphere developed by the Solar Wind Division of the Royal Belgian Institute for Space Aeronomy (Pierrard et al., 2021 for the last version). Based on physical mechanisms for the plasmapause formation and trajectories of particles trapped in the Earth's magnetic field, it provides the number density and the temperature of the electrons and protons inside and outside the plasmasphere, as well as the position of the plasmapause, as a function of the geomagnetic activity driven by the Kp index. During geomagnetic storms, the plasmasphere is eroded and structures like plasma plumes and channels can appear (Pierrard and Stegen, 2008). During quiet times, the ionosphere refills the plasmasphere. The model is coupled to the International Reference Ionosphere (IRI) model (http://irimodel.org/) used to determine the number density and temperatures of the particles between 60 and 700 km of altitude (Pierrard and Voiculescu, 2011). The values at 700 km are used as boundary conditions to provide the density and temperatures up to 10 Earth radii inside and outside the plasmasphere. The density in the plasmatrough region has recently been improved using observations of Van Allen Probes (Botek et al., 2021). The model is running in a near-real-time basis by the name of 'SPM' at the Space Situational Awareness site (https://swe.ssa.esa.int/bira-swiff-federated/) of ESA (European Space Agency) using a previous IDL-Fortran version that evaluates the electron density and temperature without the ionosphere coupling, and providing animations of the equatorial and meridian plasmasphere dynamics for all the archived dates since 2017. A PYTHON-Fortran version BSPM by the name of 'BPIM' is available in the frame of the ESA Virtual Space Weather Modeling Center (https://swe.ssa.esa.int/kul-cmpa-federated/) for on-demand executions. In the present implementation at the PITHIA eSC, a more updated version of the PYTHON-Fortran implementation is available providing the electron density of the plasmasphere, the ionosphere coupling as well as the electron density beyond the plasmapause, i.e., the plasmatrough for the requested day. Output of the model consists of text files and figures for every hour of a simulated day. The same BSPM version is also available at the Community Coordinated Modeling Center (https://ccmc.gsfc.nasa.gov/models/BSPM~2021/). References: Pierrard, V. and Stegen, K., 2008. A three-dimensional dynamic kinetic model of the plasmasphere. Journal of Geophysical Research: Space Physics, 113(A10); Pierrard, V. and Voiculescu, M., 2011. The 3D model of the plasmasphere coupled to the ionosphere. Geophysical Research Letters, 38(12); Pierrard V., E. Botek and F. Darrouzet, 2021. Improving Predictions of the 3D Dynamic Model of the Plasmasphere, vol. 8, p. 69, Front. In Astron. Space Sci., 8:681401, doi:10.3389/fspas.2021.681401; Botek, E., Pierrard, V. and Darrouzet, F., 2021. Assessment of the Earth's cold plasmatrough modeling by using Van Allen Probes/EMFISIS and Arase/PWE electron density data. Journal of Geophysical Research: Space Physics, 126(12).

Information

Owner	Royal Belgian Institute for Space Aeronomy
Version	1
Created	Tuesday 21st Feb. 2023, 23:40:00
Last Modified	Monday 6th Nov. 2023, 08:10:00

Download

View Original XML File

Find Data Collection (computational model)

eSC Highlights – Interact with Data Collections

Run model or access data directly from the eSC (using API)

BSPM API: 3D-Kinetic plasmasphere model

https://bspm.pithia.eu/openapi.json

The BSPM is a 3D-Kinetic semiempirical model of the plasmasphere developed by the Solar Wind Division of the Royal Belgian Institute for Space Aeronomy.

Start typing to filter sections...

Execute Run/Returns the status of execution by date: year-month-day

Execute the BSPM by passing the date.

Retrieve Executions Returns a list of executions completed by the user

Retrieve a list of user executions.

Plot Returns the plot image

Plot the output image by passing the execution date and hour.

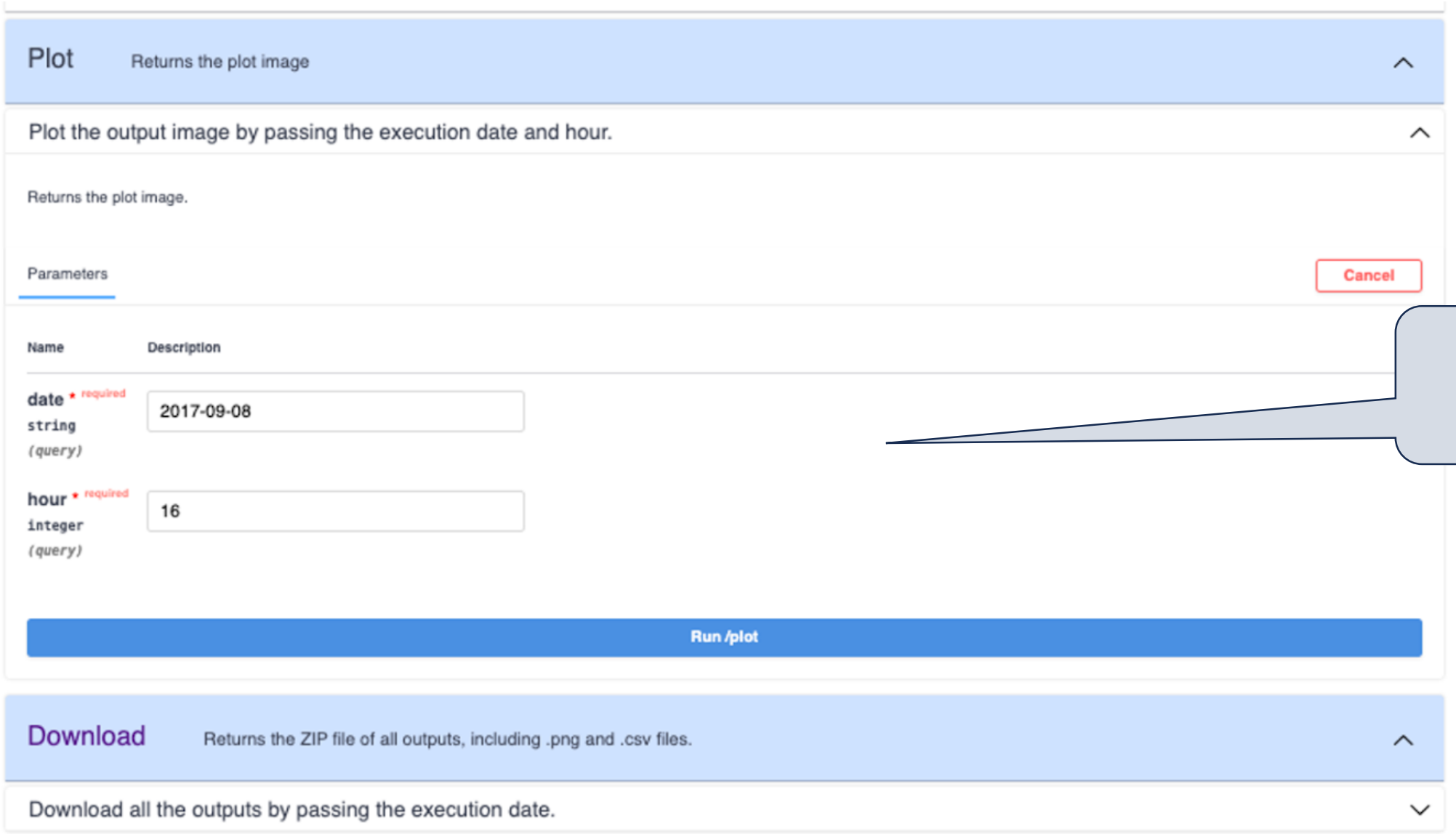
Download Returns the ZIP file of all outputs, including .png and .csv files.

Download all the outputs by passing the execution date.

Select desired functionality/operation

eSC Highlights – Interact with Data Collections

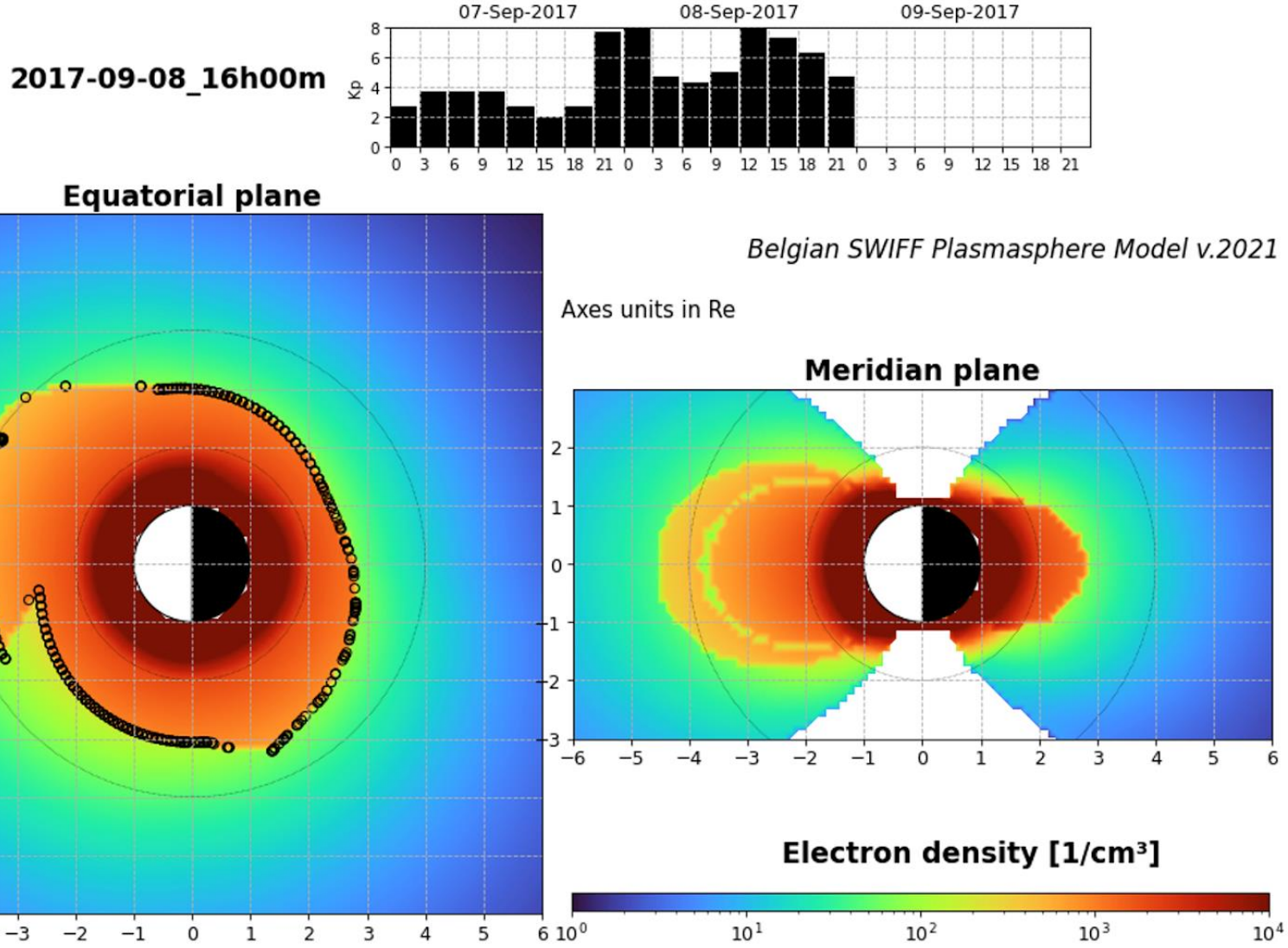
Run model or access data directly from the eSC (using API)



Provide input parameters

eSC Highlights – Interact with Data Collections

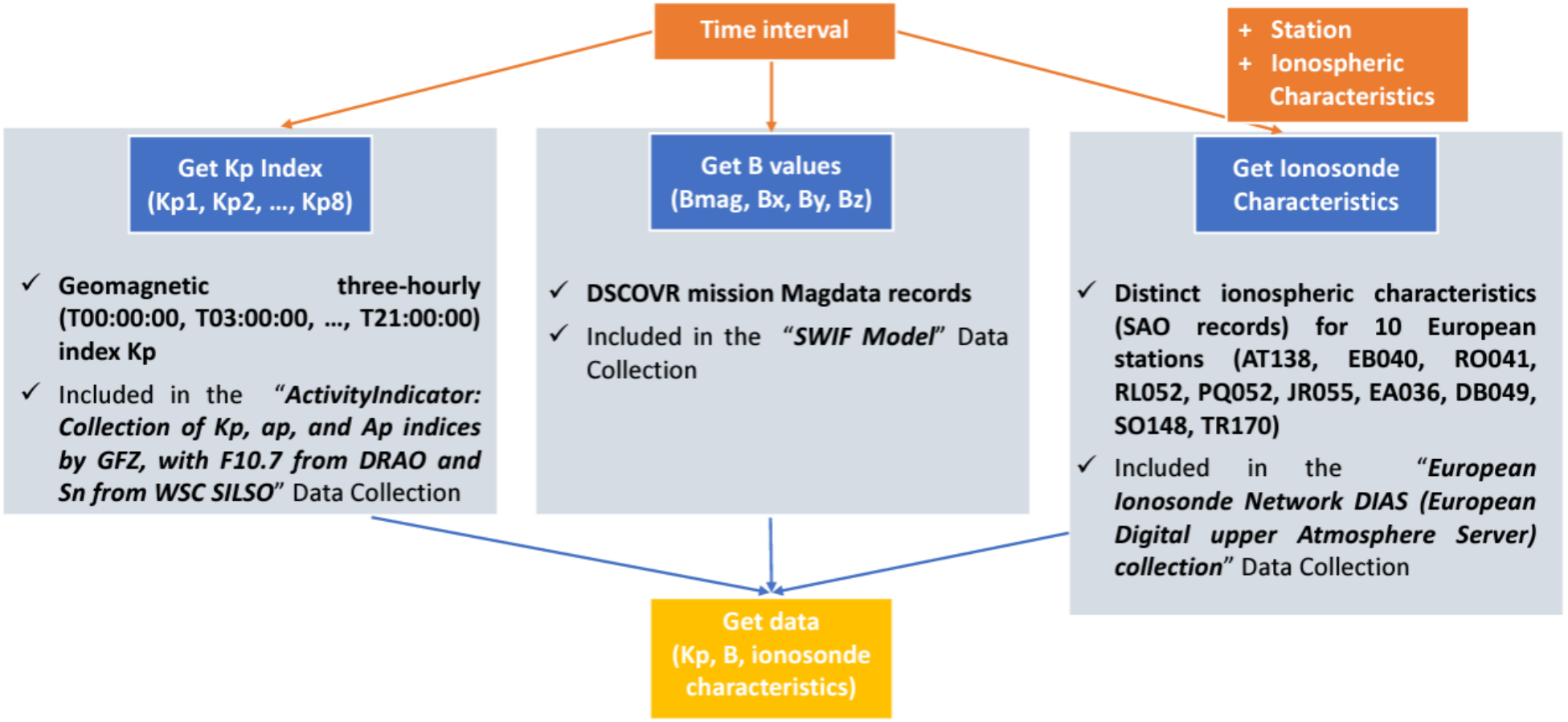
Run model or access data directly from the eSC (using API)



Observe results

eSC Highlights – Execute Workflows

Combine multiple Data Collections into one automated execution



eSC Highlights – Execute Workflows

Combine multiple Data Collections into one automated execution

Execute workflow and visualise results

Plot Data Plot the KP data, B data, and SAO metadata f

Plot the KP data, B data, and SAO metadata for selecte

Plot the KP data, B data, and SAO metadata.

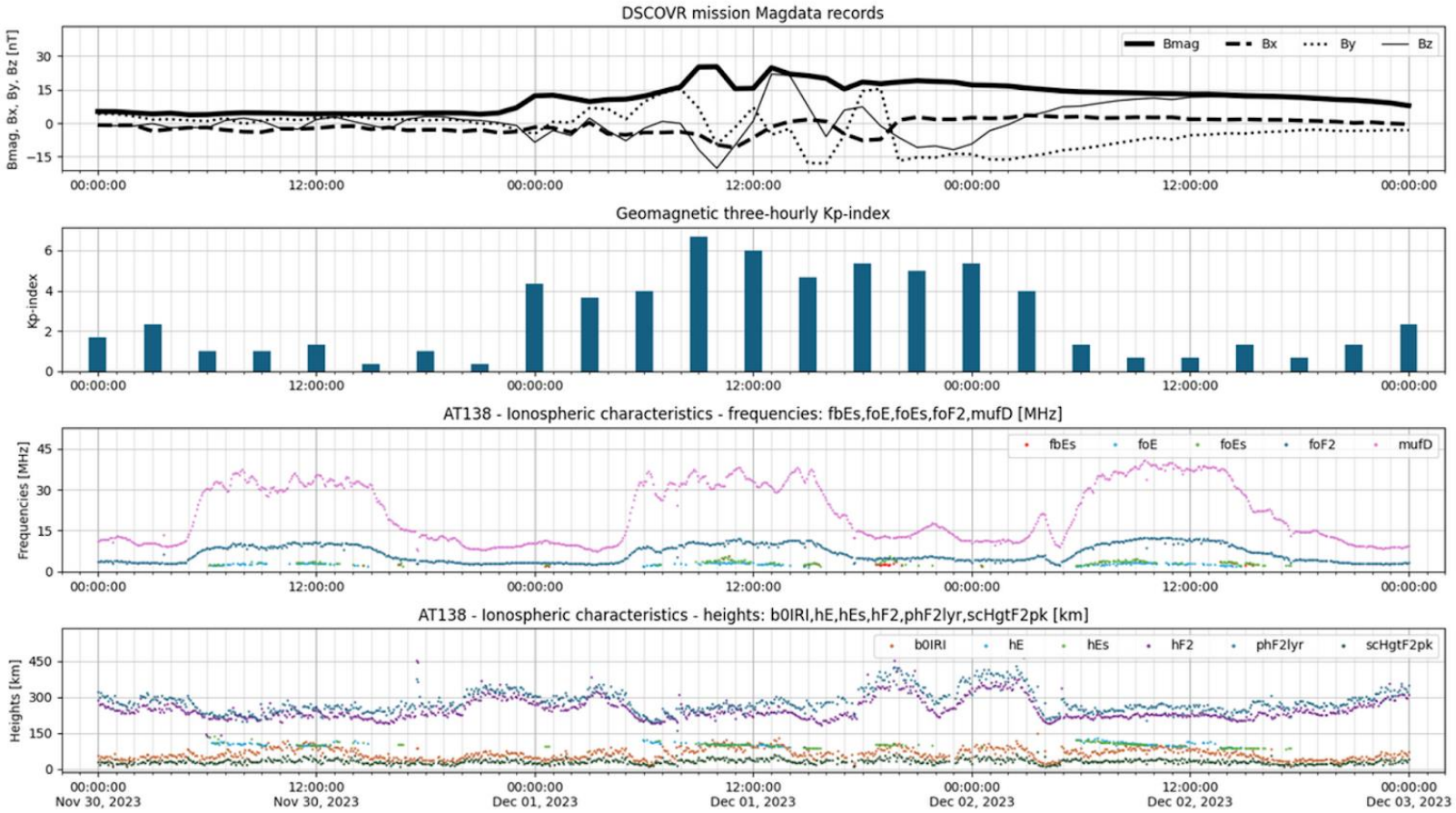
Parameters

Name	Description
date_of_interest * required string *(query)*	Date in the format 'YYYY-MM-DD', e.g. 2023-12-01
station * required string *(query)*	Select a station AT138
characteristics * required string *(query)*	Comma-separated list of characteristics b0IRI,fbEs,foE,foEs,foF2,hE,hEs,hF2,m Es,foF2,hE,hEs,hF2,mufD,phF2lyr,scH

Run /plot_data/

Responses

Details



eSC Highlights – Resource management

- Registered users can create, delete or modify resources under their institution
  - A resource can be a Data Collection, a Workflow or a Catalogue
  - Registering a Data Collection requires up to 12 steps
- Resource registrations are in XML format
- Two options for managing/creating XML files
  - Edit XML files off-line and upload them
  - Use registration wizard to generate XML automatically

eSC Highlights – Resource management

Registration Wizard

Metadata Sections

- Full Name and Organisation
- Identifier
- Description, Types, Features of Interest and Permissions
- Projects, Procedures and Sub-collections
- Collection Results
- Data Levels
- Quality Assessment
- Related Parties
- API (Optional)

New Data Collection

Data Collection Full Name *

Organisation Associated With the Data Collection *

The chosen organisation's short name will be used as this registration's namespace.
Note: This is not necessarily the same as the institution that you are logged in with.

Complete fields by typing in information directly

Select information from drop down box

Identifier

Local ID *

The local ID is automatically generated from the full name you give this registration. It must be unique, so if the local ID generated has already been taken a timestamp will be added to help ensure uniqueness. The local ID also cannot be changed once this form is submitted.

DataCollection_

Namespace *

This is automatically generated with the short name of the selected organisation.

Metadata Version *

The version number of the object being identified.

Some information in generated automatically so that user does not have to worry

eSC Highlights – Resource management

Registration Wizard

Metadata Sections

- Full Name and Organisation
- Identifier
- Description, Types, Features of Interest and Permissions
- Projects, Procedures and Sub-collections
- Collection Results
- Data Levels
- Quality Assessment
- Related Parties
- API (Optional)

API

Optional

A link to an OpenAPI specification (written in YAML or JSON) for interacting with the Data Collection can be provided below. A user interface will be generated from this specification and will be accessible from the details page of the Data Collection.

OpenAPI Specification URL

Description

Validation usually takes up to a minute to complete on a good internet connection.

Validate and Register

Once form completed, user can validate it and generate XML automatically

Thank you for your attention!

WEB:

https://www.pithia-nrf.eu

https://esc.pithia.eu/

The PITHIA-NRF project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101007599