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The design of value added services to serve ESPAS users

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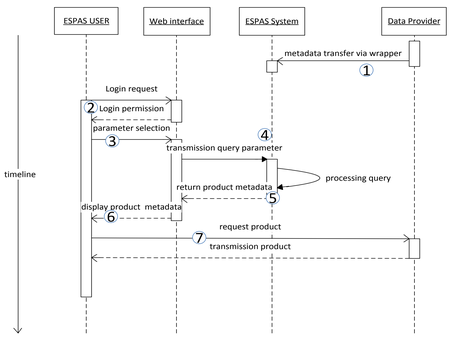
Abstract

The primary objective of ESPAS is to support the access to observations from the near-Earth space environment. This is a region that extends from the Earth's atmosphere up to the inner magnetosphere. Ground-based observing instruments that are linked to ESPAS include ionosondes, incoherent scatter radars, magnetometers, GNSS receivers, supplemented by a large number of space sensors and radars. The ESPAS platform supports the systematic exploration of multi-instrument multi-point measurements from near-Earth space through homogeneous access to diverse data residing in, supports data assimilation and provides tools for validation of models. ESPAS expects to be useful for researchers who wish to access complex data, to analyze them and to develop advanced models. Although the system development is in its early phase, the consortium has already formulated indicative scientific problems, whose study will be possible through the use of ESPAS services. The scientific advances resulting from these studies will lead to the development of validated scientific models and consequently to reliable predictions and related products and value-added services that will meet the needs of scientists, operators, decision makers, system developers, among others. An important piece of work done in this direction within the ESPAS project is the definition of several scientific scenarios called "use cases". The "use cases" express the expected user requirements on the ESPAS system, in other words they express "what" the system should be able to perform. These scenarios are exploring the required behaviour of ESPAS and form a solid basis for testing the system's behaviour as it responds to a request that originates from outside of the system. The following main groups of use cases are currently under analysis and first results are reported at the ESWW10: a) Homogenised access to the main ESPAS data repositories b) exploitation of ESPAS registered data repositories to develop space weather services c) tools to validate models.

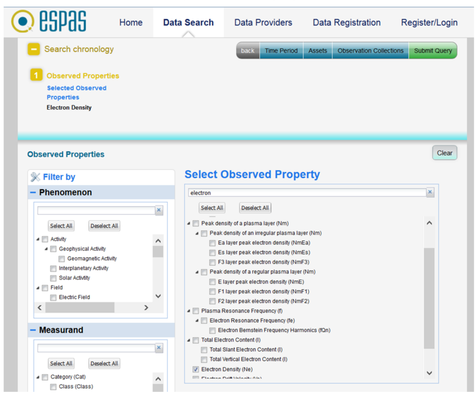
Use Case A: Data product search

As opposed to Use Cases B and C which describe scientific questions, Use Case A demonstrate the data search functionality. This search is a data product search, where the ESPAS system returns metadata information and download links for data products (images, files) that correspond to the query parameters to the END_USER.

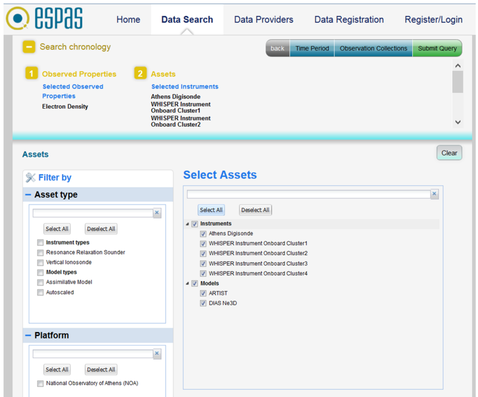


In the ESPAS platform this use case can be implemented with the following steps, based on the example for querying for Assets containing the Observed Property "Electron Density":

Step 1. Search for data with "electron density" in "Observed Property"



Step 2. Search for "Assets": here the system returns the list of assets with "electron density" in "Observed Property".



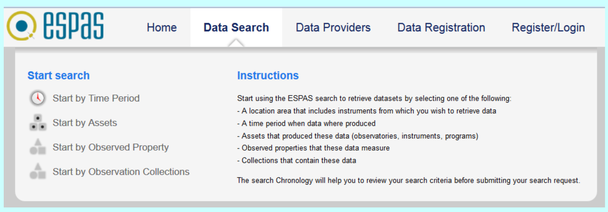
HOW TO ACCESS THE ESPAS PLATFORM

ESPAS project
http://www.espas-fp7.eu

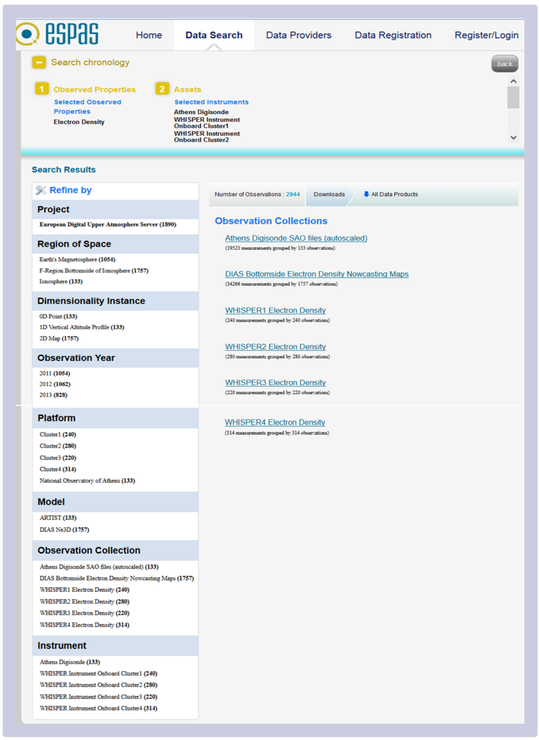
The ESPAS demonstrator (Release 2) is currently available at:

http://dl121.madgik.di.uoa.gr:8080/espas/index.html

The "Data Search" page is the gateway for making queries using the Time, the Assets the Observed Property and the Observation Collections. The Search is implemented using dynamic workflows, which means that the user can start from any of the search criteria, choose any of the remaining criteria as next step and submit the query at any step.



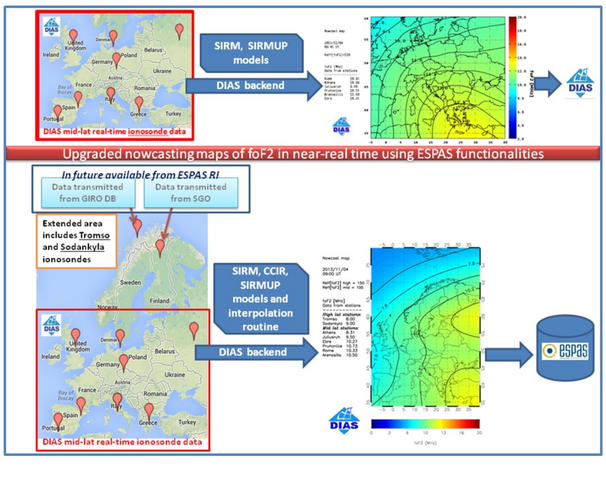
Step 3. "Submit Query": the system returns the list of "Observation Collections" with "electron density" observed property. Among the data files currently registered in ESPAS RI, the following 3 assets contain electron density data: the DIAS system, the Athens Digisonde and the Whisper experiment onboard Cluster satellites.



Use Case B: Improved techniques for the real-time mapping of ionospheric characteristics

Improved mapping of the ionospheric critical characteristics at the height of maximum density up to high latitudes is important for both HF communication system and systems relying on trans-ionospheric propagation, especially under disturbed space weather conditions. The purpose of this use case is twofold: first to use ESPAS ionospheric sounder data from European high latitudes to expand the maps of foF2 currently generated in DIAS, and second to assess the potential of ESPAS to provide these maps as a value-added service in real-time.

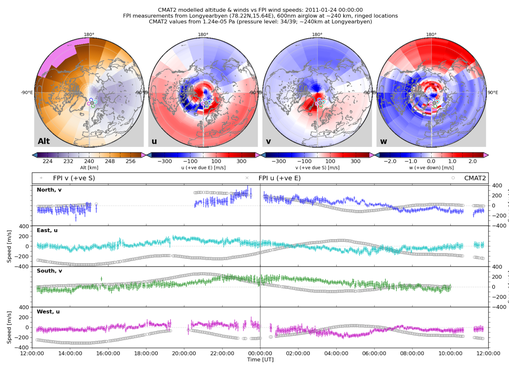
The DIAS maps are produced based on the SIRM and SIRMUP models analyzing foF2 parameters collected in real time from 8 mid-latitude Digisondes. Through ESPAS, data from two additional stations can be accessed: Tromso data (through the GIRO database) and Sodankyla data (SGO). The process has been simulated getting the new datasets directly from the data providers and the new maps have been generated applying the CCIR coefficients to map the region above 60 deg N, while in the buffer zone between 50 and 60 deg N an interpolation routine is applied. The new algorithm is running in DIAS and harvesting of the final products by ESPAS in real time is possible at a frequency specified by the service provider in the wrapper settings.



Use Case C: Validation of physical model data assimilation system

Exploitation of the ESPAS data infrastructure through a set of experimental cases in which the Coupled Middle Atmosphere and Thermosphere general circulation model (CMAT2) will ultimately run within a data assimilation system for an extended period of several weeks. Where ESPAS data types match those already used by the assimilation system, the objective is to use the independent dataset for direct validation.

CMAT2 has been run from a start point of 00:00UTC on 21st December 2010 through to 2nd February 2011 using observed 3-hourly values of a_P and daily $f_{10.7}$ for the period. These act as external forcings to CMAT2, which is otherwise running unconstrained at this point. The line-of-sight velocity components for the neutral atmosphere provided by the UCL Fabry-Perot Interferometer (FPI) dataset - through ESPAS - are compared against the model thermospheric zonal and meridional winds.



Initial results from this comparison for the Svalbard FPI (Longyearbyen – 78.2°N, 15.6°E) between 12:00UTC 23rd January and 12:00UTC 24th January 2011. The upper four polar stereographic plots show the measurement footprint for the pointing directions of the instrument at 00:00UTC on 24th January 2011 as located on the model fields for the 1.24E-05Pa pressure level of altitude and zonal, meridional, vertical wind components. The lower time series plot covers the 24-hour data period and compares model output (circles) and observation data for the different wind directions seen by the instrument. Relatively fine structure in the wind fields over polar regions illustrates the challenge for models aiming to match observed conditions. However, agreement in the meridional components particularly is seen to be close enough for the model results to lie within the estimated error for the observations