ESPAS: Current functionalities of the Near-Earth space data infrastructure

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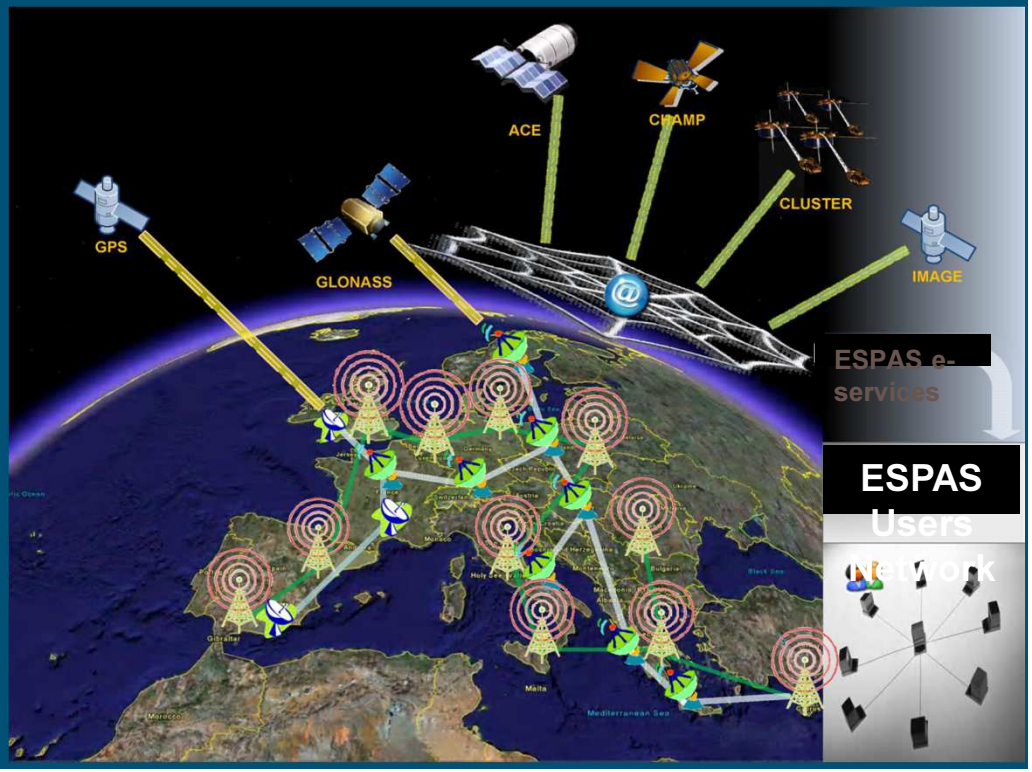
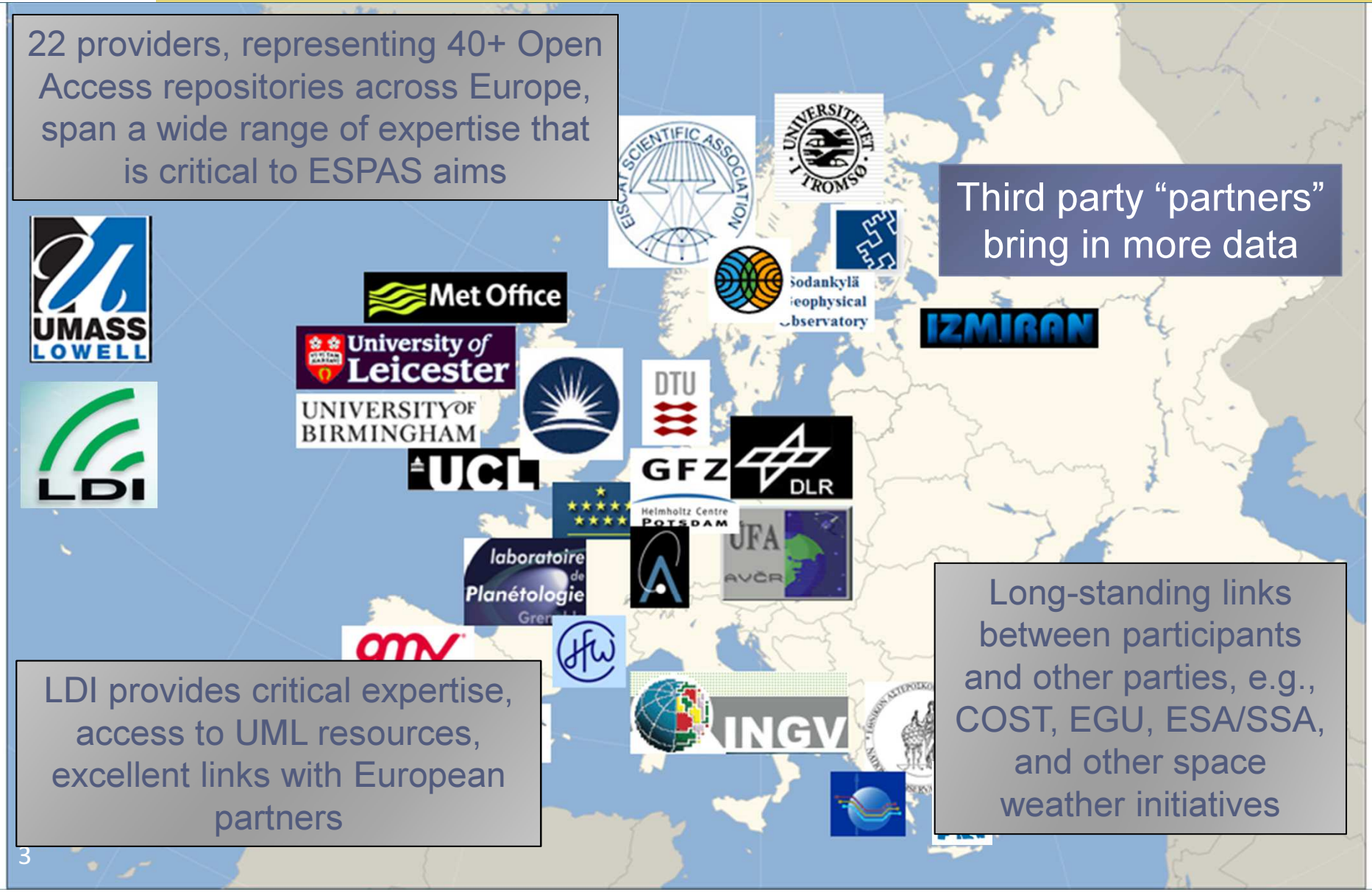
ESPAS Goals

- Integrated access to heterogeneous data on conditions in near-Earth space: ionised & neutral upper atmosphere, magnetosphere, …
- Encourage more systematic exploration of multi-point measurements in this region - homogeneous interfaces to diverse data
- Support for modelling:
  - New models that advance our understanding
  - Validation
  - Data assimilation
- Extensible to new datasets
- Link wider global community



Consortium overview

22 providers, representing 40+ Open Access repositories across Europe, span a wide range of expertise that is critical to ESPAS aims



Third party "partners" bring in more data

Long-standing links between participants and other parties, e.g., COST, EGU, ESA/SSA, and other space weather initiatives

LDI provides critical expertise, access to UML resources, excellent links with European partners

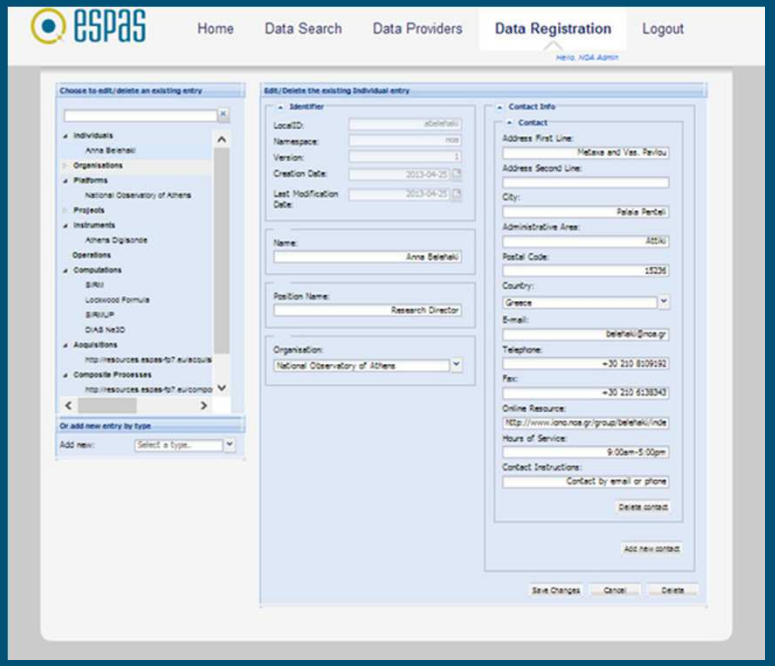
Homogenised searches across repositories

Why?

- Rich set of observational techniques => diversity
- In-situ and remote sensing, moving platforms (spacecraft, rotating Earth, …), global/regional products
- Diversity of terminology arising from range of communities and their history (developed since IGY in 1957)
- **Scientific progress requires combination of diverse datasets!**

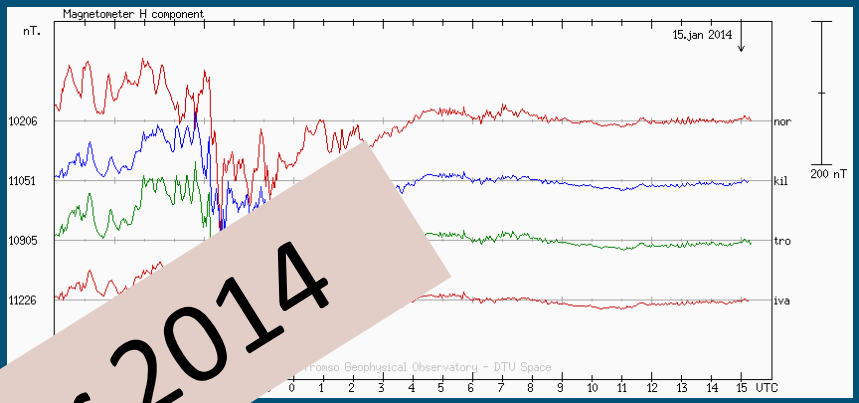
Underpinning concepts

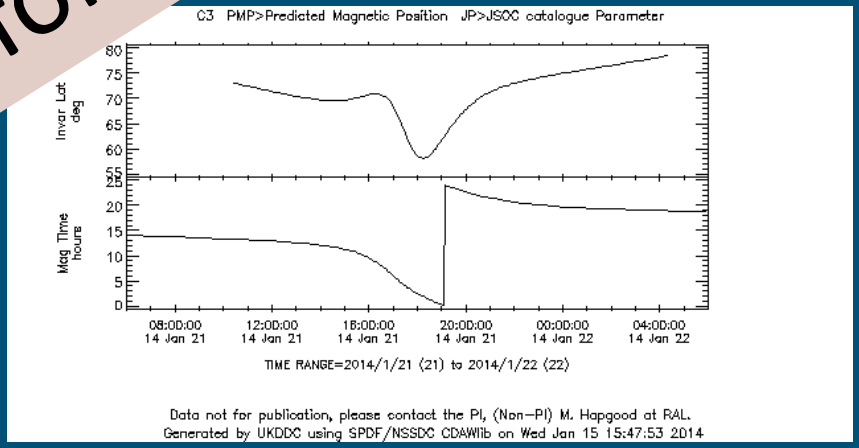
- **To facilitate homogenised searches, ESPAS is:**
  - Developing comprehensive & flexible **data model**
  - Supported by wide discussion on ontologies, vocabularies
  - Developing standards for **metadata** in this domain
  - *Helping scientists to help users produce metadata!*
  - Ensuring system will be **expandable**



Access to data, not just metadata

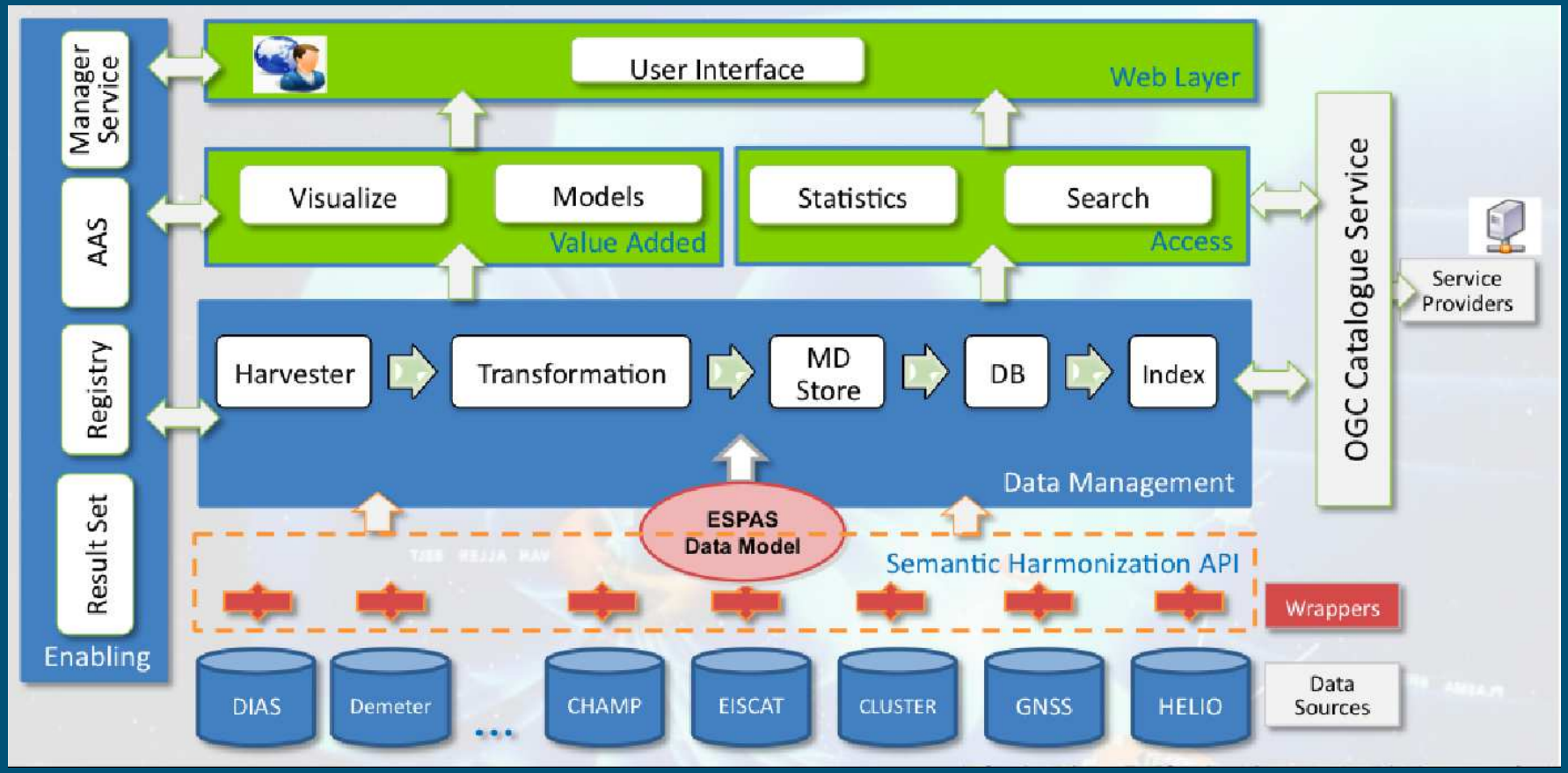
- Scientists want the data, not just metadata
- Search uses metadata to locate data, and download “raw” files
- Now exploring access to specific parameters
  - Focus on time series
- Vital for search … on for satellites … remote sensing
  - Location is part of dataset : maybe separate or embedded



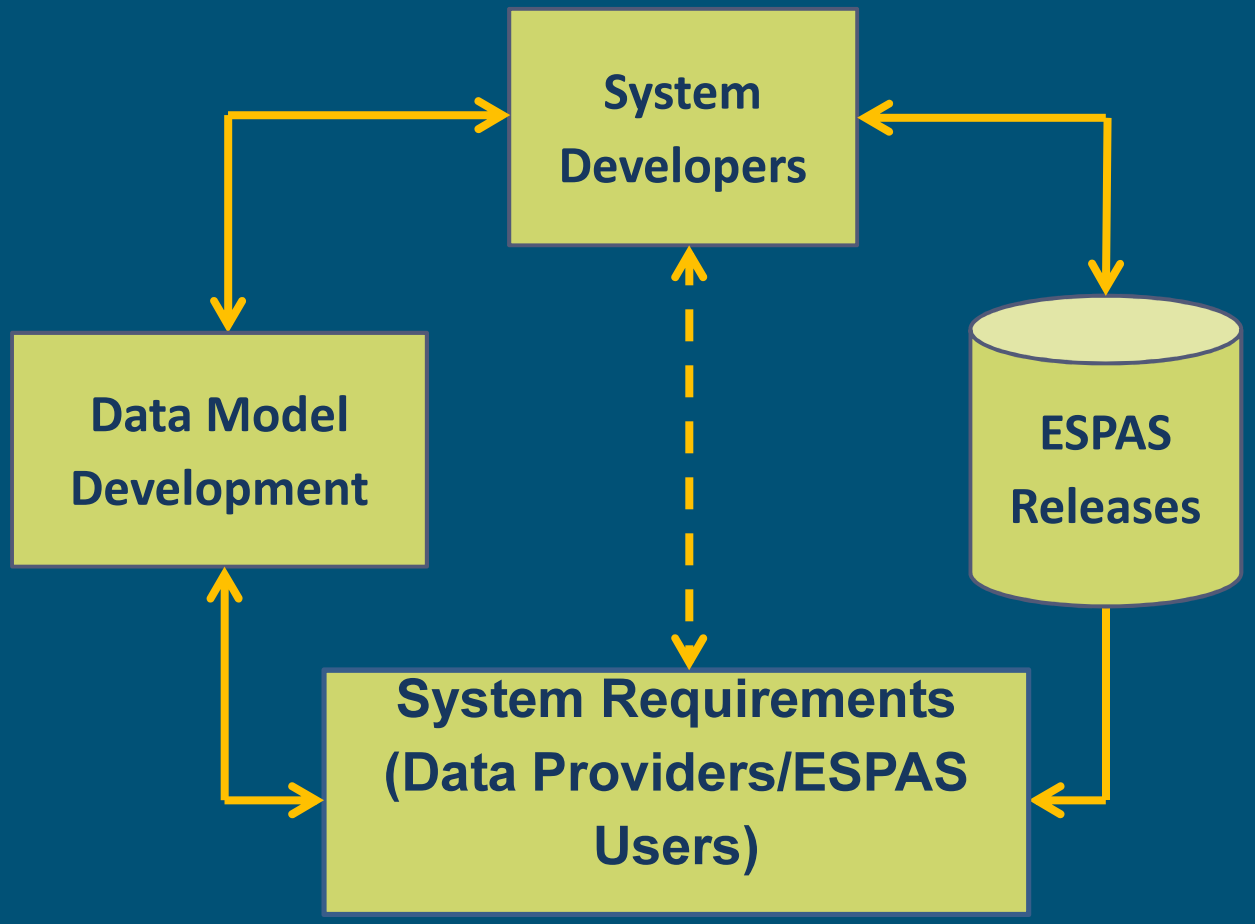


Key issue for 2014

General Architecture



ESPAS development cycles



ESPAS model – key principles

The Data Model is built **strictly** and **entirely** on ISO 19100 series geographic information standards, particularly the ISO 19156 Observations and Measurements (O&M) standard.

- A *process* is often an instrument or sensor but may be a process chain, human observer, an algorithm, a computation or simulator. Therefore, a process may consist of more than one component .

- A *CompositionProcess* represents processes consisting of more than one component. A component shall be either of acquisition or computation type.

The logical model

Metadata

"what was observed on 11/12/2012?"

Vocabularies

a.k.a. "the ontology"

Linked resources – using the web as infrastructure

Central platform and data nodes

XML schemas for metadata exchange format

ESPAS registered data overview (ongoing)

Data registered through Instruments (acquisitions)

- ACE Magnetometer
- Athens Digisonde
- DTU Space fluxgate magnetometer
- EISCAT Kiruna Receiver
- EISCAT Sodankylä Receive
- EISCAT Svalbard Dynasonde
- EISCAT Svalbard Radar
- EISCAT Tromsø Dynasonde
- EISCAT Tromsø UHF Radar
- EISCAT Tromsø VHF Radar
- CHAMP Fluxgate Magnetometer
- GNSS Receivers
- CHAMP GPS Receiver TRSR-2
- IAP on board DEMETER
- Ionosonde Juliusruh
- Ionosonde Tromsø
- ISIS 1 Topside Sounder
- ISIS 2 Topside Sounder
- ISL (Langmuir probe) on board DEMETER
- MEPED energetic particle instrument onboard METOP-02 NOAA/POES
- MEPED energetic particle instruments onboard NOAA-06, NOAA-07, NOAA-08, NOAA-10, NOAA-12, NOAA-15, NOAA-16, NOAA-17, NOAA-18, NOAA19
- CHAMP Overhauser Magnetometer
- Sodankylä Ionosonde (SO166)
- UCL FPI Keops Green Line
- UCL FPI Keops Red Line
- UCL FPI Sodankyla Red Line
- UCL FPI Svalbard Red and Green Lines
- WHISPER Instrument Onboard Cluster1
- WHISPER Instrument Onboard Cluster2
- WHISPER Instrument Onboard Cluster3
- WHISPER Instrument Onboard Cluster4

ESPAS registered data overview (ongoing)

Registered data resulted from computer codes/models (Computations)

- **ARTIST**
- **CCIR F peak model**
- **DIAS Ne3D**
- **EDAM (Electron Density Assimilation Model)**
- **IRI (International Reference Ionosphere)**
- **Lockwood Formula**
- **Scintillation Processor**
- **SIRM (Simplified Ionosphere Regional Model)**
- **SIRMUP (Simplified Ionosphere Regional Model Real Time Updated)**
- **Slab Thickness Processor**
- **SO166 Ionobrowse manual scaling software**
- **SO166 Realtime FM Chirp CW ionogram conversion**
- **TEC Map Processor**
- **URSI F peak model**

Support the development of value-added services

Why is this needed?
Users need:

- Physical parameters derived from raw data via models
- Validation of models
- Upgrade of models
- Fundamental basis for future services

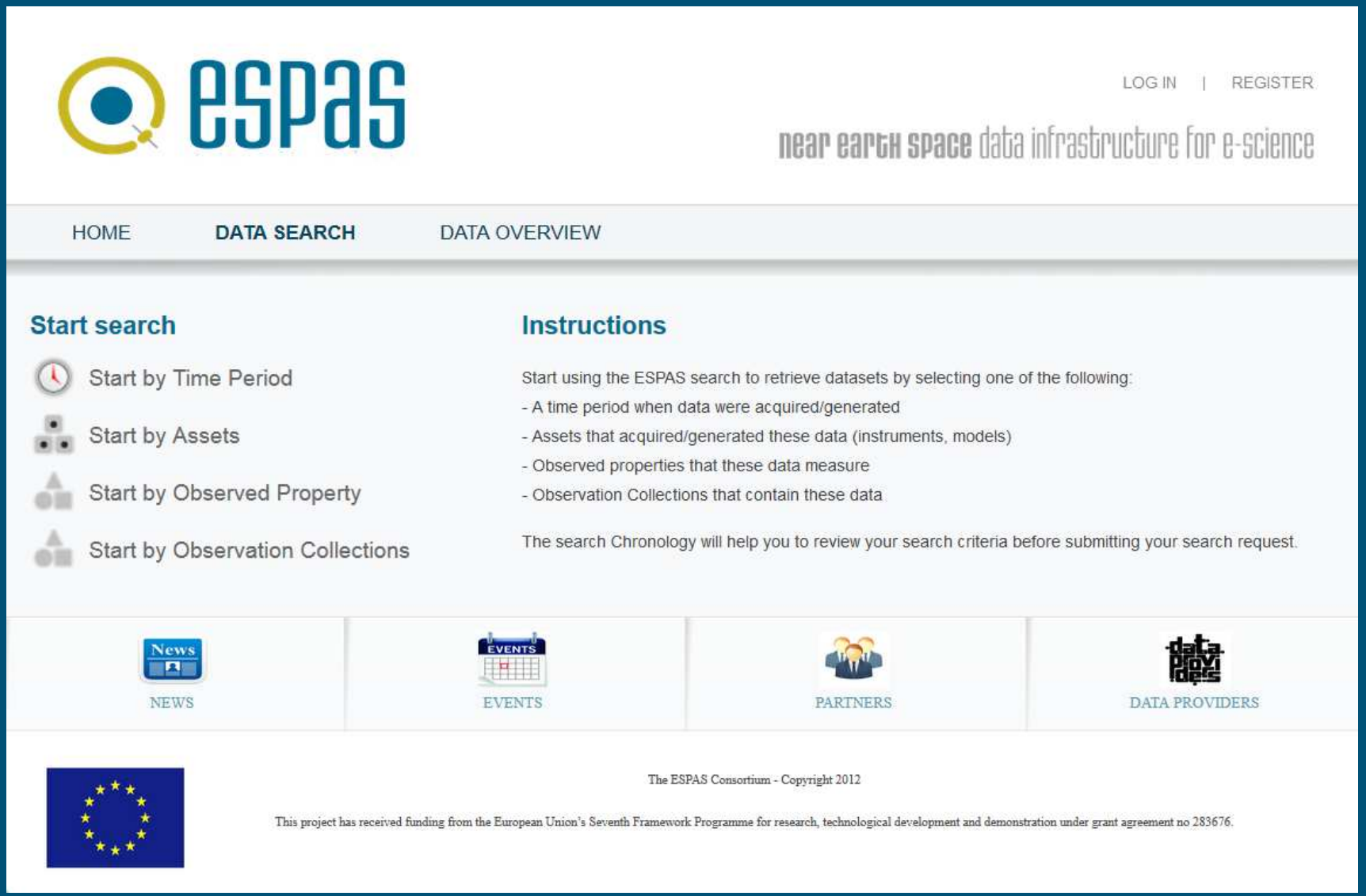
HOW TO ACCESS THE ESPAS PLATFORM

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

The ESPAS demonstrator (Release 2) is currently available at:
http://dl121.madgik.di.uoa.gr:8080/espas/Uoa_espas_gui.html

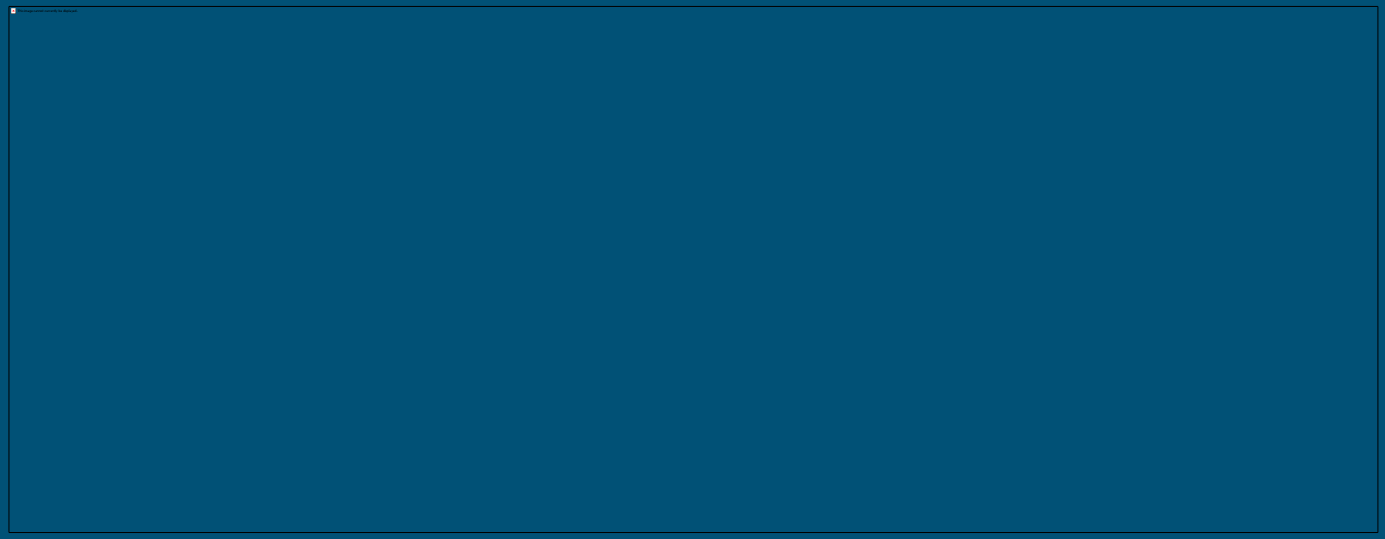
The "**Data Search**" page is the gateway for making queries using **the Time, the Assets the Observed Property and the Observation Collections**. The Search is implemented using dynamic workflows, which means that the user can start from any of the search criteria, choose any of the remaining criteria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

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

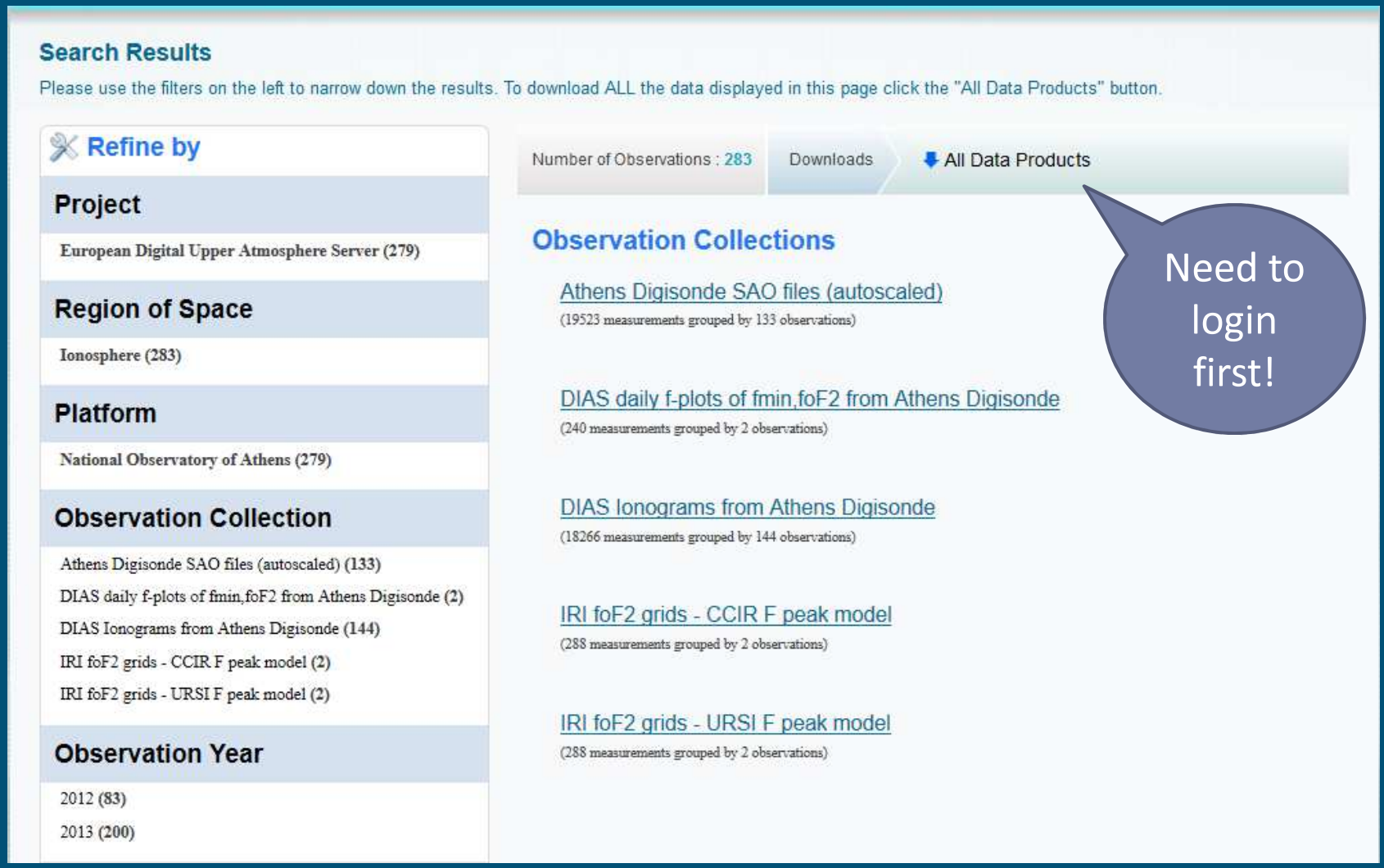


Design the query:

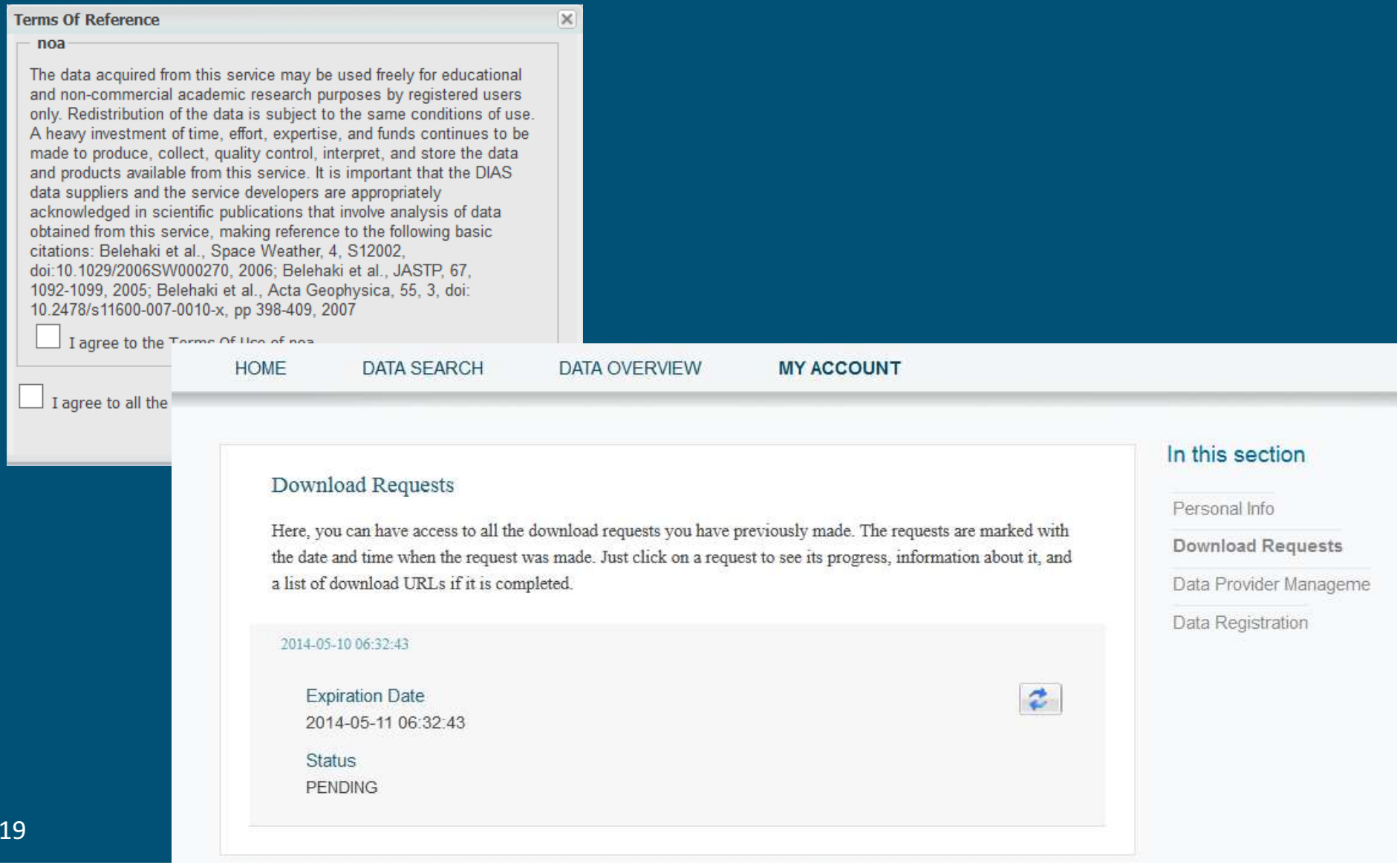
Search for foF2 parameters available from all possible sources (acquisitions and model-outputs)



Search results



Data Download



Download a zip file and extract files:

Name	Date modified	Type	Size
foF2globalIRI-CCIR-2012-11-12-00-00.txt	09/05/2014 11:32	TXT File	448 KB
foF2globalIRI-CCIR-2012-11-12-01-00.txt	09/05/2014 11:32	TXT File	448 KB
foF2globalIRI-CCIR-2012-11-13-00-00.txt	09/05/2014 11:32	TXT File	448 KB
foF2globalIRI-CCIR-2012-11-13-01-00.txt	09/05/2014 11:32	TXT File	448 KB
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foF2globalIRI-CCIR-2012-11-15-01-00.txt	09/05/2014 11:32	TXT File	448 KB
foF2globalIRI-CCIR-2012-11-16-00-00.txt	09/05/2014 11:32	TXT File	448 KB
foF2globalIRI-CCIR-2012-11-16-01-00.txt	09/05/2014 11:32	TXT File	448 KB
foF2globalIRI-CCIR-2012-11-17-00-00.txt	09/05/2014 11:32	TXT File	448 KB
foF2globalIRI-CCIR-2012-11-17-01-00.txt	09/05/2014 11:32	TXT File	448 KB

```
IRI2012 Model Results

Required input parameters
Year=2012,Month=11,Day=12,Hour=00,Minutes=00
Time_type = Universal
Coordinate_type = Geographic
Longitude = from 0 to 360 (step 1)(left to right column)
Latitude = from -90 to 90 (step 1)(bottom to top row)

Optional input parameters:
Sunspot number(Rz12) =not specified
F10.7 radio flux (daily)= not specified
F10.7 radio flux (81-day)= not specified
Ionospheric index(IG12) =not specified
Upper limit for Electron content = not specified
F peak model = CCIR
Ne Topside = NeQuick
foF2 Storm model = off
Bottomside Thickness = ABT-2009
F1 occurrence probability = Scotto-1997 no L
foE Storm model = off
D-Region Ne = IRI-95
Topside Te = TBT-2012
Ion Composition = RBV10/TTS03
A value of -1 indicates that the parameter is not available for the
specified range


FoF2 VALUES

  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271
5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271
5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271
5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271
5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271
5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271  5.271
```

IRI input parameters and output file format

ESPAS provides global grids of foF2 (IRI-2012) with 1 deg resolution in latitude and longitude and time resolution 1 hour.

Settings
Fpeak Model : URSI, CCIR
foF2 Storm model: Off
foE storm model: Off

Datasets for selected time intervals are currently registered in the central platform.
Generation of datasets for additional intervals and IRI parameters is ongoing.
Your recommendations are welcome!
Please send us an email at: belehaki@noa.gr