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Abstract (for dissemination)

DIAS prototype is the first release of the DIAS server. Access is provided to registered users. URL: http://213.203.172.83:8080/dias/servlet/dias.servlet.DIASLogonFormServlet
The products and services provided through DIAS prototype are:
Real time ionograms from DIAS stations
Maps describing the ionospheric conditions over Europe based on the foF2 and M(3000)F2 parameters for nowcasting and long term prediction purposes
Frequency plots of the most important parameters characterising radio propagation conditions in Europe.

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1 Introduction

The purpose of the DIAS server is to provide value added products and services of a European digital data collection on the upper atmosphere. The definition of these products is derived by the user needs, and driven by the research in the field. In the first section of this document, we present a description of the functionalities provided, focusing on the ones that have already been implemented for the prototype. In the last section we give a short description of the internal architecture of the system and the technologies used.

For the prototype DIAS server, the data is contributed by the following ionosonde stations:

Ionosonde Station name	Location	Acronym
National Observatory of Athens, Greece	Athens	NOA
Rutherford Appleton Laboratory	Chilton	CCLRC
Leibniz Institute of Atmospheric Physics	Juliusruh	IAP
National Institute of geophysics & volcanology	Rome	INGV
Swedish Institute of Space Physics	Lycksele	IRF
Space Research Centre, Polish Academy of Sciences	Warsaw	SRC
Ebre Observatory	Ebre	Ebre
Institute of Atmospheric Physics, Czech Republic	Pruhonice	UFA

2 Products – Services

2.1 Ionograms

Ionograms are generated by DIAS as soon as the participating stations complete their soundings and the data is collected, based on a 15 min interval (at 00, 15, 30, 45 minutes past the hour). For a consistent and harmonized look, ionograms from different stations are plotted with homogeneous characteristics. As a result, users are able to easily compare ionospheric conditions over different areas in Europe:
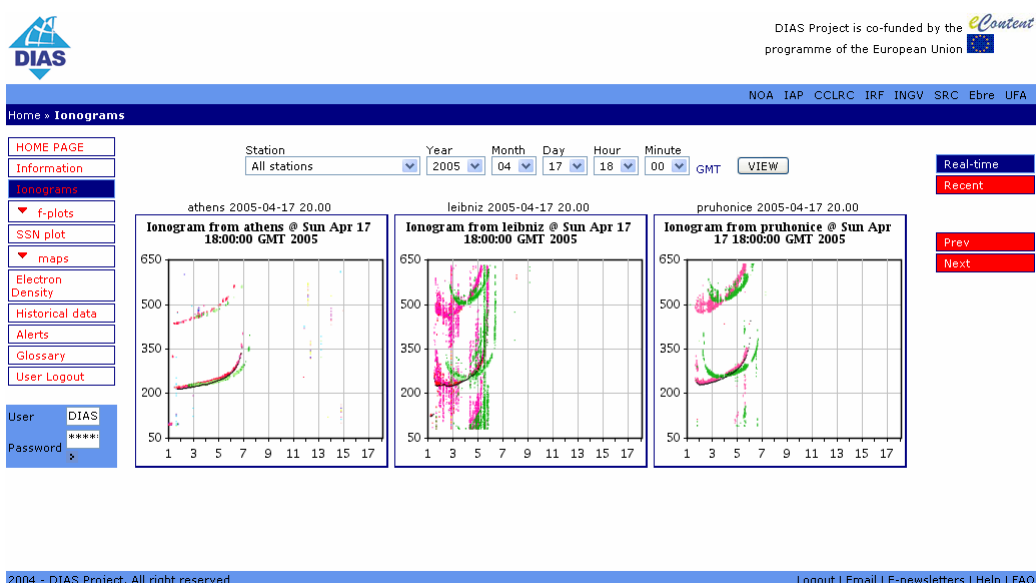

Figure 1 Real-time Ionograms provided by the DIAS Server

Depending on the sounding equipment/hardware used, the participating stations provide the ionogram data primarily in two formats:

- **MMM / SBF / RSF**: three sequential upgrades of Digisonde systems support these three formats. Currently DIAS is working only with the latest two versions. *NOA-Athens, INGV-Rome* & UFA-Pruhonice are suppoting the RSF format. *CCRLC-Chilton* and *Ebre* Digisondes support the MMM format. *IAP-Juliusruh* supports the SBF format. An implementation of the earlier MMM format is within the DIAS plans, scheduled by the end of the project.
- **b_g.**: this format is supported by the Dynasonde type operated by *IRF-Lycksele* and is currently the only participating station using this equipment. It is within DIAS' next six months' plans to support this format.

In this prototype version of the DIAS server, only the *NOA-Athens*, *IAP-Juliusruh* and *UFA-Prohonice* ionograms are displayed (*INGV-Rome* is currently updating its Digisonde equipment)

How to navigate: By selecting the Ionograms item in the navigation menu, you can select a view of the latest ionograms, from a list of stations (one or all). In the next screen you can make a selection for a different station and/or time/date.

The functionality of the buttons on the right	
Real-time	to view the latest ionogram(s)
Recent	to view the eight (8) most recent ionogram for the selected station
Prev & Next	to view the previous or next ionogram for the selected station in chronological order

Note: On the upper right hand corner the ___km, ___MHz, ___Density fields are scheduled to be filled with values of the height, frequency, and density (up to the height of maximum ionisation), which correspond to mouse movement over the ionogram.

2.2 Ionospheric Maps

2.2.1 foF2 & M(3000)F2 maps

DIAS offers nowcast, short-term and long-term forecast maps of foF2 and M(3000)F2 over Europe. Data is currently contributed by the following stations: *IAP-Juliusruh*, *IRF-Lycksele*, *NOA-Athens*, *CCRLC-Chilton*, *UFA-Pruhonice* & *Ebre Observatory*. The *INGV-Rome* and *SRC-Warsaw* stations will contribute data as soon as their stations are in full operation.

- **Nowcast Maps**: Given the observed values of foF2 and M(3000)F2 from participating stations, a best fit algorithm *(SIRMUP: Simplified Ionospheric Regional Model Updated with Real Time Observations)* is applied, and maps of the ionospheric conditions over Europe are generated. These maps are generated on a 15 minute interval.
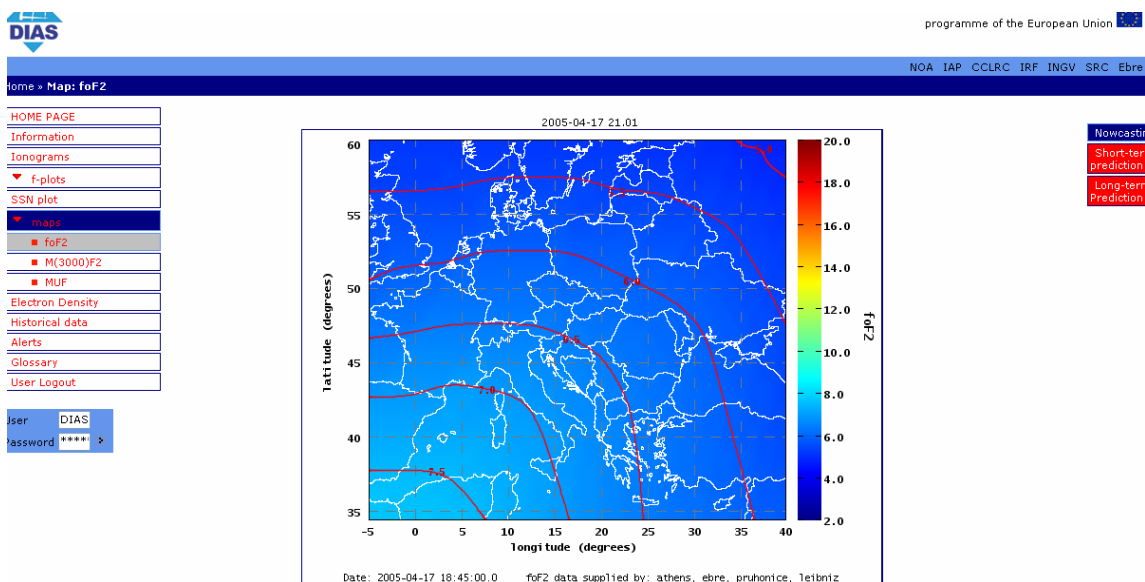
Figure 2   foF2 nowcast over Europe

- **Long-term forecasts:** Given the predicted value of the sunspot number, published by SIDC of Belgium World Data Center, DIAS generates 24 forecast maps for the current month, one for each hour within the day based on the SIRM algorithm. *The functionality of the server will be enhanced so that up to three (3) months' forecasts can be provided.*
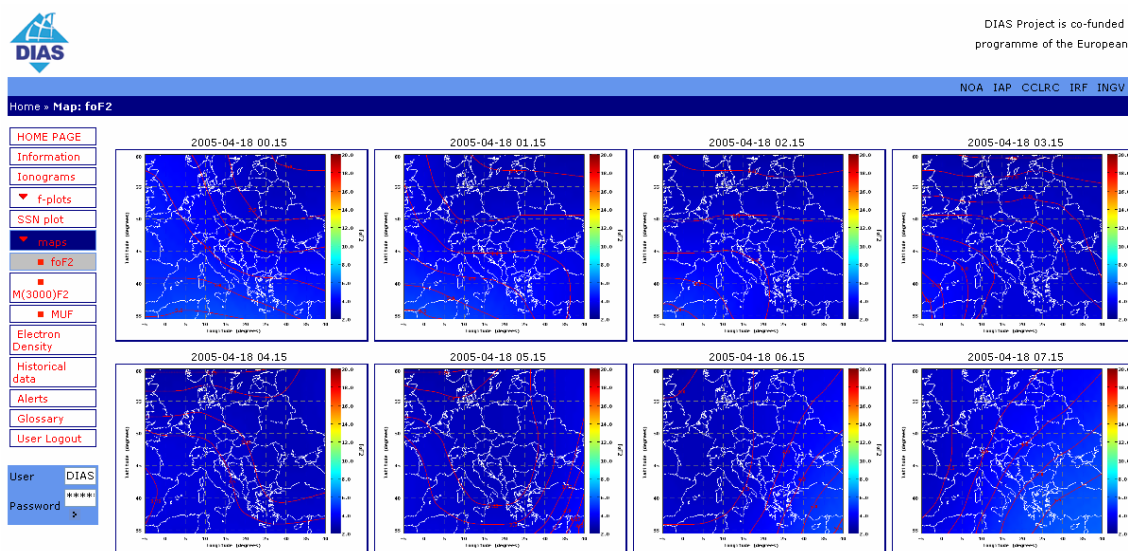

Figure 3   foF2 long term forecasting over Europe for the current month

- **Short-term forecasts** *for foF2 (ONLY) (under development)***:** it is based on the recent 96 values of foF2, the prediction of Ap index (NOAA) and correlation coefficients extracted from the analysis of past foF2 observations and Kp index records. The methodology applied is extracted by the *"GCAM - Geomagnetically Correlated Auto Regression"* model by Kutiev, Muhtarov & Cander, generates the next 24 hours' ionospheric conditions over Europe.

How to navigate: By selecting the "**Map: foF2"** or **"Map: M(3000)F2"** item in the navigation menu, you will immediately view the latest nowcast map. On the bottom caption of the map you can

see which stations contributed to the generation of the map.

The functionality of the buttons on the right	
Nowcasting	to view the latest map
Short Term Prediction	(foF2 only) to view the short-term forecasting maps *(under development)*
Long Term Prediction	to view the 24 long-term forecast maps of the current month, one for each hour of the day

Note: On the upper right hand corner the ___Latitude, ___Longitude, ___MHz fields are scheduled to be filled with values of the coordinates on the map, and the value of foF2, which correspond to mouse movement over the map.

2.2.2 MUF maps *(under development)*

The DIAS server has been designed taking into consideration the generation of MUF maps (both nowcasts and long term forecasts). They are scheduled to be produced on an hourly basis, with a selection of predefined locations in Europe regarded as the central, transmitting points.

Future services may also include on demand MUF map generation, assigning any site in Europe as the transmitting point.

2.2.3 Electron Density Maps *(under development)*

The DIAS server will be able to generate nowcast maps of electron density over Europe, based on scaled data from soundings. The results will be presented in the following ways:

- **isoline maps** for predefined heights in the bottomside ionosphere (i.e. 100, 200 km etc). Maps with smaller height resolution (10 km) will be produced on demand
- **graph** of height/electron density over each single participating station

The map generation interval will be 15 min.

2.3 Plots

DIAS offers daily plots of the main characteristics of the incoming soundings. Again, the data is currently contributed by the following stations: *IAP-Juliusruh*, *IRF-Lycksele*, *NOA-Athens*, *CCRLC-Chilton*, *UFA-Pruhonice* & *Ebre Observatory*. The INGV-Rome and SRC-Warsaw stations will contribute data as soon as their stations are in full operation.

1. foF2 observed values for each station
2. fmin observed values for each station
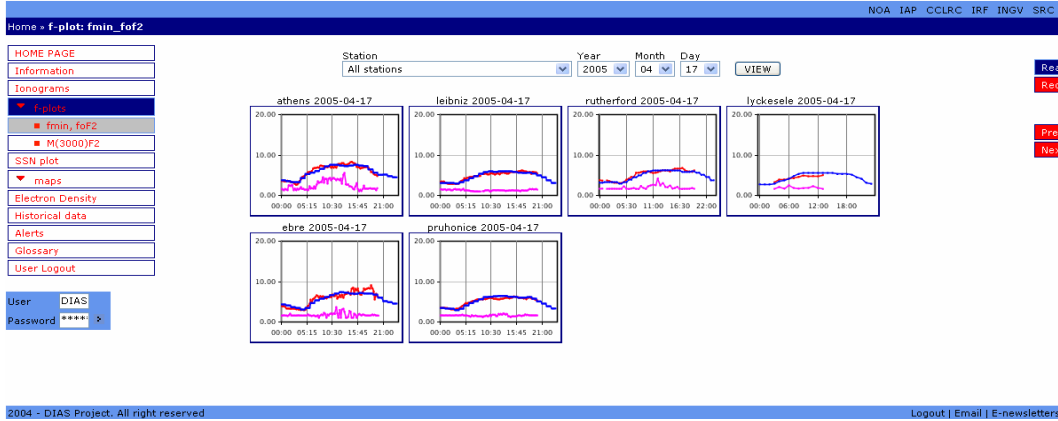3. foF2 long-term predicted values (f_{SIRM}) for each station

Figure 4   Daily foF2, fmin, f(SIRM) plots of all stations

4. M(3000)F2 observed values for a station
5. M(3000)F2 long-term predicted values for a station [M(3000)F2$_{SIRM}$]
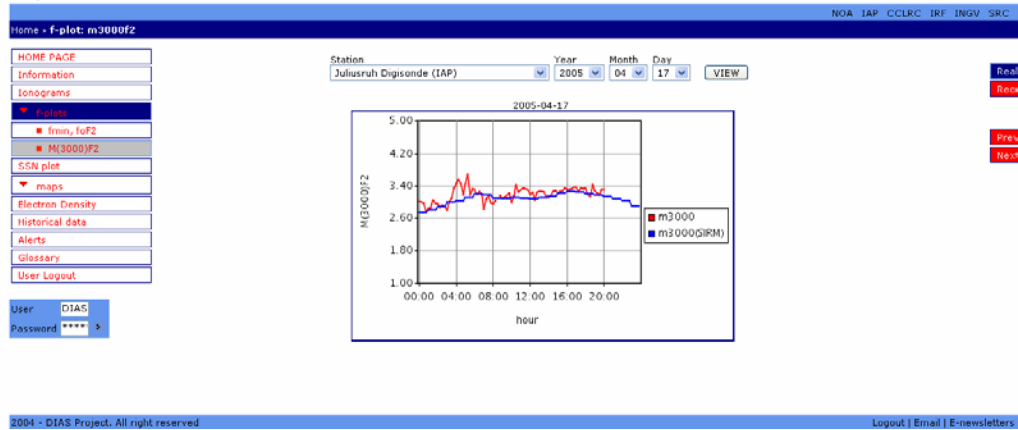
Figure 5   M(3000)F2 daily plot from Juliusruh

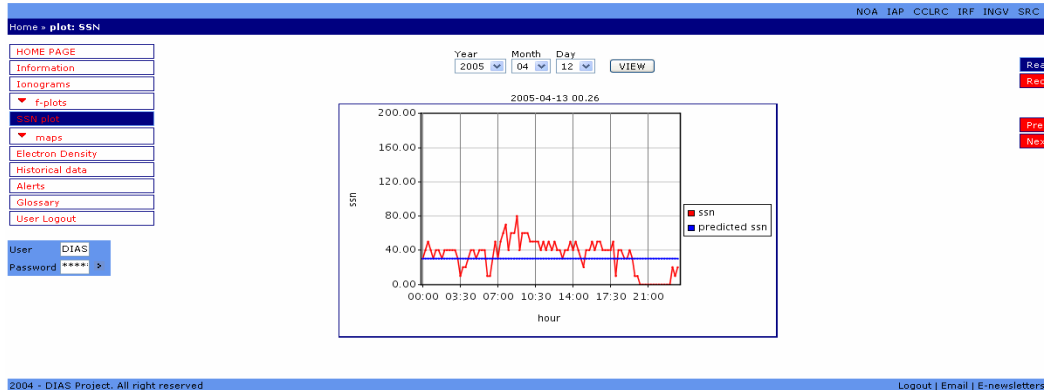6. R$_{eff}$, effective Sun Spot Number (SSN) over Europe

Figure 6   Reff over Europe for 12-04-2005

Short-term daily forecast plots of foF2 are under development. This service will tie in with the completion of the short-term forecast product.

How to navigate: By selecting the **"f-plots: foF2,fmin"** or **"f-plots: M(3000)F2"** or **"SSN plot"** item in the navigation menu, you can view the latest plots of the selected station(s). On the next screen you can pick another date and/or station to view.

The functionality of the buttons on the right	
Real-time	to view the latest plot
Recent	to view the eight (8) most recent plots
Prev & Next	to view previous or next day's plots

Note: On the upper right hand corner the ___Time, ___MHz fields are scheduled to be filled with values of the time and the value of foF2/fmin/M(3000)F2, which correspond to mouse movement over the plot.

2.4   Alerts *(under development)*

The service of issuing ionospheric alerts is one of the main DIAS products and will essentially consist of the following characteristics:

The alerts and warnings will be based on the introduction of new ionospheric indices.

In parallel, a user subscription service will be maintained, for registered users.

2.5   Historical Data *(under development)*

One other functionality that DIAS will be offering to its users, relates to the dissemination of the data that is available to the system. Here are some examples of data that users might be interested in:

- scaled information stored in the system database (for instance, values of foF2 for a particular station over a period of time)
- raw files (SAO, RSF, etc.) that DIAS is collecting from individual stations (if authorization from the corresponding station is granted)
- data produced by the services/products of the system (images, plots, maps, variable values) both in image and textual form

Again, a user subscription service will be maintained, with registered users being able to enter personalized criteria for periodic data downloads. DIAS will be sending out the data using HTTP/FTP protocols.

3 DIAS server architecture

3.1 Overall Architecture

In this section we provide a short description of the internal architecture of the DIAS server. The following figure displays the layers which form the system, together with their subcomponents.
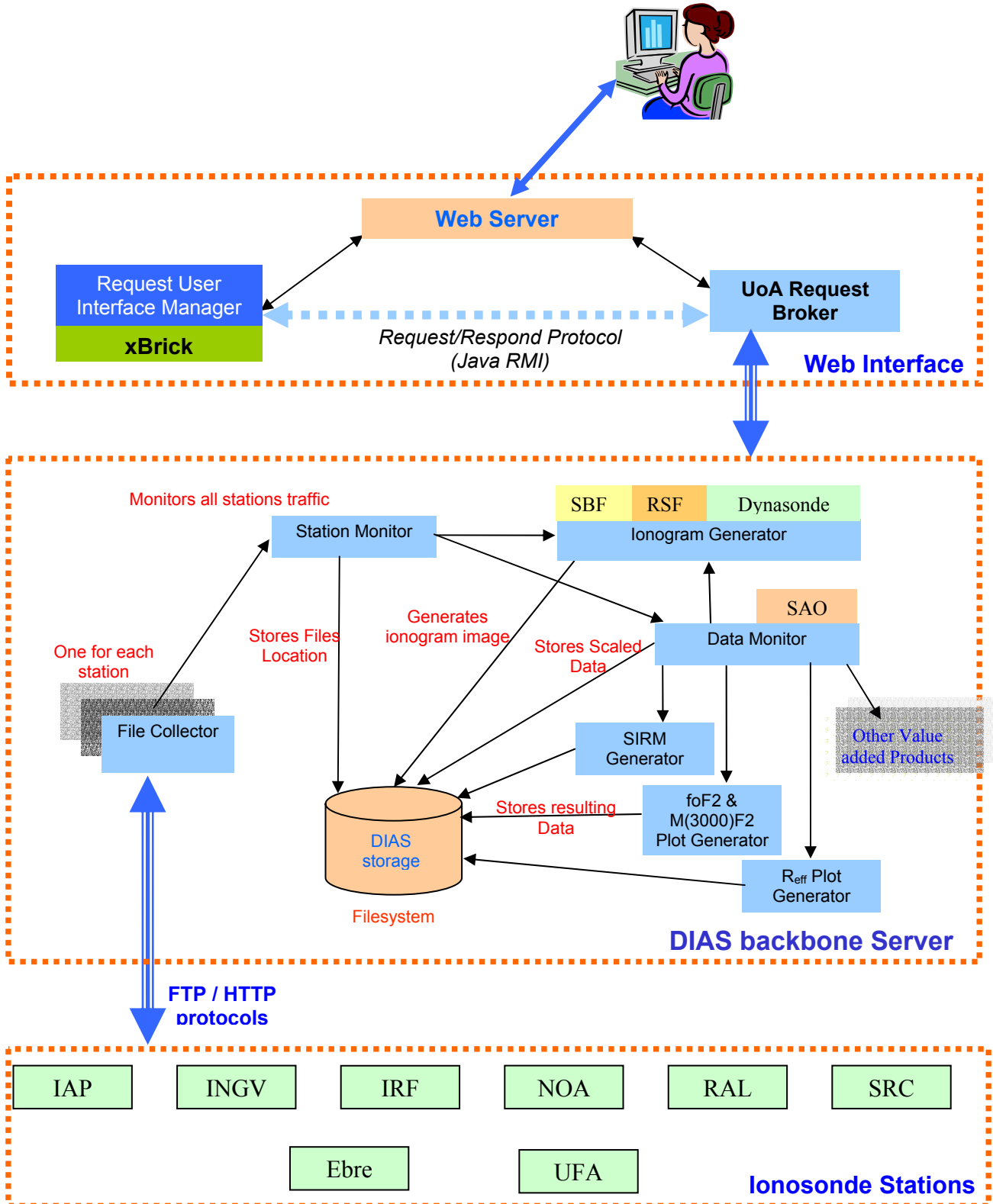
Figure 7 Internal DIAS architecture

Ionosonde Stations layer: The participating stations continue to operate autonomously, having the additional task of placing the sounding data on one or more predefined FTP or HTTP servers.

DIAS Backbone Server layer: The *File Collector* is the subcomponent responsible for collecting the data from the repository locations, as well as for triggering a number of tasks inside the DIAS server. As soon as a file is collected, the corresponding file location is stored into the system database *(Station Monitor)*, and depending on the type of the file the appropriate task is activated. In the case of raw ionogram data, the *Ionogram Generator* module creates the ionogram images and stores the newly created files into the system database. If files containing scaled data (SAO) are coming in, then the *Data Monitor* is activated, initially storing the parameters in the database, and, subsequently calling the subcomponents responsible for the production of nowcast/forecast maps *(SIRM Generator)* and daily plots *(foF2 / M(3000)F2 Plot, R_{eff} Plot Generator)*. Any additional value added products will similarly be set off from this location.

Web Interface layer: This layer is divided into three main parts: *access control*, *layout management*, and *service integration* which are based on the **xBrick** framework. Access control regulates access to maps, plots, or other products to users that are authenticated with a valid username/password combination. Numerous layout components are used to define the functionality and aesthetics of the site, offering both interface consistency and web layer code reusability. Services actually retrieve the requested information for the final user; in particular, the services can use the resources available or interact with the *DIAS Request Broker* subcomponent which can provide remote information.

4 Miscellaneous

The DIAS server and its web interface were built using state of the art technology and tools:

Operating system: Linux

Database technology: MySql

Web server: Tomcat

Tools: Apache Torque, Ant, Java 1.4 & 1.5

Other: proprietary web development framework *xBrick*

DIAS prototype server URL:
http://213.203.172.83:8080/dias/servlet/dias.servlet.DIASLogonFormServlet

Access is provided only to the members of DIAS users' network.
A special account has been set up for *eContent* use. The credentials are (case sensitive):
Username: DIAS24
Password: 53W26

Finally, we must emphasize that all user assessment is expected to come on line via the *Contact Us* link on the bottom bar found in all pages. Moreover, a link is provided to the DIAS project *Newsletter* at the same location.