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Monitoring for Environment and Security in Africa (MESA)

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eStation 2
User manual
Version 2.1.2

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Abstract / Résumé

This document provides instructions for the exploitation of the eStation 2 system, including the visualization/analysis component.

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### ACRONYMS and DEFINITIONS

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<td>ACMAD</td>
<td>African Centre of Meteorological Applications for Development</td>
</tr>
<tr>
<td>AGRHYMET</td>
<td>Centre Régional de Formation et d’Application en Agrométéorologie et Hydrologie Opérationnelle</td>
</tr>
<tr>
<td>AU</td>
<td>African Union</td>
</tr>
<tr>
<td>BDMS</td>
<td>Botswana Department of Meteorological Services</td>
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<tr>
<td>CICOS</td>
<td>Commission Internationale du Bassin Congo-Oubagui-Sangha</td>
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<td>EUMETCast</td>
<td>EUMETSAT’s primary dissemination mechanism for the near real-time delivery of satellite data and products</td>
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<td>File Transfer Protocol</td>
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1. **Introduction**

1.1 **Scope of the document**

This document describes the functionalities of eStation 2 application and explains how the final User can benefit from its features. It is meant mainly for the thematic expert making use of the system, and describes both the ‘processing’ and ‘visualization/analysis’ components.

1.1 **Document organization**

The present document is structured into the following chapters:

- **Chapter 2: Overview of the eStation 2**

  This is the basic introduction to the eStation 2, which provides application’s rational, an overview of the GUI, some essential notions to understand the system functioning and an overview of the existing services. It is meant for the thematic User, but reference to this section is done also from other documents (e.g. the [RD-1] – Administration Manual).

- **Chapter 3: eStation 2 User Interface**

  It describes all functionalities that can be controlled through the GUI by the User, namely the Dashboard, Acquisition, Processing, Data Management, Analysis, System and Help panel.

  This is intended for the Thematic User, in order to understand how to control and modify the operations of the application, and how to perform the analysis on the EO datasets.

- **Chapter 4: Reference Guide**

  It contains a detailed description of the services and is meant for Advanced Users (the Basic User should be able to manage the system – without addition of customized treatments) e.g. the people in the RICs. Here we go in the detail of what the services do, and all the tables used for their customization.

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1 Note that the ‘Analysis’ panel contains the visualization tools that represented the ‘EMMA’ tool in eStation 1.0.
### 1.1 APPLICABLE AND REFERENCE DOCUMENTS

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Table 1: Applicable documents

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Table 2: Reference documents
2. Overview of the eStation 2

2.1 System Concept

Near-real time observation has a long history in Africa. It started in the 1980’s with the development of cheap HRPT ground station (High Resolution Picture Transmission) able to read the NOAA’s AVHRR (Advanced Very High Resolution) data. The PUMA (Preparation for the Use of MSG in Africa) project equipped all Meteorological services with a EUMETCast receiving station and trained hundreds of staff on meteorological applications, over the period 2001-2005.

In the AMESD (Africa Monitoring for Environment and Sustainable Development) project (2007-2013), it was decided to provide a companion system to the PUMA stations. Then the eStation was born. The idea is to acquire data not only from the EUMETCast data stream but also from the Internet. The EUMETCast data stream was initially dedicated to MSG (Meteosat Second Generation) 15-minute observations. With AMESD the portfolio of broadcasted datasets quickly expanded, adding indicators based on the MSG observations and new series of satellites. The MESA (Monitoring of Environment and Security in Africa) project (2013-2017) builds on the results of PUMA and AMESD, which includes consolidating activities initiated with AMESD.

For environmental purpose, time syntheses are preferred to 15-minute or daily observations. Because of cloud screening, which can be quite persistent in equatorial regions, accumulating observations over a period of several days gives more chances to find cloud-free pixels, and thus an actual land observation, in the time series. Secondly, time syntheses are more relevant for the activities of the environmentalist.

In this context, the eStation has three main tasks: decoding the various data format received (from MSG and other sources), computing time synthesis immediately after data reception (that’s why we talk about near real time data processing),.

The PUMA receiving station is continuously receiving data and has a limited capacity to retain the huge amount of daily dataset received. The eStation should be running 24/7, getting data from the receiving antenna and processing them immediately after reception. The total work load of the eStation can increase significantly when adding more high temporal frequency data to acquire.

The eStation 2 is the evolution of the system delivered to beneficiaries of the AMESD project, and is mainly intended to provide the MESA2 Regional and Continental Implementation Centres (RICs/CIC) and National Focal Points (NFPs) with hardware and software to receive, process and display Earth Observation data for environmental monitoring and climate services. The design of the eStation 2 has been based on the lessons learned from the AMESD project, and on Users’ feedback; as a result, the main purposes of the system are:

- Ensuring continuous reception of EO data, and support easy collection of missing data
- Facilitating the post-processing and the link with other tools (e.g. QGIS, SPIRITS)
- Facilitating user interaction (UI rather than coding)
- Ensuring Hardware redundancy
- Proposing customized functions for data analysis.

---

2 See http://rea.au.int/mesa/
In this respect, the eStation 2 is meant to be a processing server for EO datasets, rather than a stand-alone GIS platform (like QGIS or similar solutions). The functioning of the application is organized around a number of Services, as displayed in Figure 2, namely:

- **Get Services**: systematically acquire EO data from PC1 (Receiving Station) and from remote servers, either through FTP or HTTP protocols. Therefore, there are two ‘get’ services that can be configured and controlled independently:
  - Get EUMETCast (data from PC1)
  - Get Internet (data from remote FTP and HTTP servers)
- **Ingestion Service**: to convert the files from the format under which the files are acquired in (the so called ‘native’ format) into GeoTIFF, also called ‘pivot’ format. Optionally, this operation includes geographical re-projection and clipping to a specific region of interest;
- **Processing Service**: to derive from the input data additional products, like long term statistics, anomalies, and other added-value indicators;
- **System Service**: to run a number of ‘house-keeping’ and background tasks, including managing the data-synchronization between PC2 and PC3, the database backup, some monitoring and diagnostic operations.
Once properly configured by the user, these Services are meant to run continuously without supervision on the eStation 2. According to the type of installation (on two computers as a ‘Full Station’, as depicted on Figure 2, or on one single computer) and to the PC role (PC2 or PC3) and the mode of each computer (Nominal or Recovery mode), some Services will be enabled (i.e. they can be started or stopped). For instance, when both computers are in Nominal Mode, the Get, Ingest and Processing services will be enabled on PC2 only (see Table 23 for the full list).

Also note that the Visualization functionalities, including the time series analysis, are performed on the fly, and there is no service associated to them.
2.2 System Structure and Configurations

The eStation 2 services and the processing components are written in python; the visualisation and GUI component are written in JavaScript (using ExtJS 5 library). A PostgreSQL database stores the EO products definition, settings to access server storing data through the internet (for the ‘get internet’ service) and all relevant user configurations (see Chapter 4 of Administration Manual for DB description).

Several software and libraries are required, including the GDAL library and its python wrapper for geoprocessing, Mapserver for maps rendering, and a series of non-standard python modules, such as Ruffus a computation pipeline library, for the processing engine.

For the MESA project, the eStation 2 application is integrated into the Linux CentOS 6.6 Operating System (OS) and all its dependencies are part of the default installation. The integration in Windows OS is also considered, though it is not presented in this User Manual.

2.3 Application Overview

A web interface, found at the address http://localhost/ allows controlling the eStation 2. It folds different controls in separate tabs, namely:

- **Dashboard**, depicted on Figure 3, presenting the overall status of the MESA Station, and offering to control all the enabled services.
- **Acquisition**: to view and control the status of the services for retrieving and ingesting the EO data; it represents and gives access to the ‘Get’ and ‘Ingestion’ Services, represented in Figure 2: Overview of the Services running on the eStation 2.
- **Processing**: to start and stop the processing of new products, e.g. to control the ‘Processing’ Service.
- **Data Management**: lists available data sets, both those acquired and processed by the eStation 2, showing the completeness of time series (and thus listing missing datasets).
- **Analysis**: to perform the data analysis and generate images for bulletins/reports. It replaces the former EMMA application of the version 1.0; note that this tab is not displayed on PC2 in Nominal Mode, and therefore is not shown in Figure 3.
- **System**: to control the application settings (Thema region, log level, and working directories paths), and to generate system reports.
- **Help**: to read system help files: allows downloading the pdf files and access reference web sites.
Figure 3: Overview of eStation 2 GUI
2.4   eStation 2 Essential Concepts

This section defines concepts underpinning the design and implementation of the eStation 2; whenever possible, definitions make use of examples, and reference to international standards is made.

2.4.1   EO Products

An Earth Observation (EO) product is a bio-geophysical quantity describing the status of a component of the Earth (land surface, atmosphere or radiation budget) as derived by satellite observations and numerical modelling. The ‘Burnt Area’, ‘Dry Matter Productivity’, ‘FAPAR’ and Leaf Area Index are, among others, EO datasets made available by the Copernicus Global Land Service (Figure 4).

A ‘Product’ is characterized by its geographical footprint (the Earth area covered by the images), the images geographic or projected co-ordinate system, the time frame for synthesis images (daily, 10-day or longer synthesis) and the product update frequency (15-minute, daily, 10-day). These parameters generally depend on the satellite type and the on-board sensor characteristics.

Other characteristics must also be considered, such as the file format (grib2, netcdf, HDF4 or HDF5), the data distribution policy, or the distribution mean (digital radio broadcast such as EUMETCast or the Internet).

Figure 4: EO datasets on the Copernicus web site

2.4.2   Version

A product’s version identifies a specific collection of images, depending mainly on the algorithm used for their computation; the various versions of the Copernicus products are displayed in Figure 5 under the column ‘Algorithm version’. For the ‘incoming’ products on the eStation, the version is the one defined by the data provider, and might be set as ‘undefined’ if it is unique and there is no clear reference on the documentation or traceability about it in the documentation.
2.4.3 Subproducts

An acquired product might contain more than a single variable or layer. For example, Spot-Vegetation NDVI has 2 layers: the NDVI itself and a Status Map showing a quality flag for each pixel. Furthermore, starting from the incoming product several added-value products and indicators can be generated, such as long term statistics and anomalies. In order to keep a clear reference to the ‘native’ product, it was decided to have a ‘two-level’ identification approach so that more than one subproduct can be associated to the same product. More specifically, for each product on the eStation there will be:

- One ‘native’ product, which has exactly the same name of the product with the ‘_native’ suffix, and refers to the ‘incoming’ EO product. This ‘subproduct’ cannot be visualized in the eStation, it is actually a ‘reference’ for the incoming dataset, i.e. to the files received on the eStation before their ingestion;
- One or more ‘ingested’ products, according to the number of layers that are extracted from the incoming dataset;
- Zero, one or more ‘derived’ products, computed on the eStation by the processing Service.

For example (Figure 6) the subproducts for ‘fewsnet-rfe’ (version 2.0) are displayed: a single ‘native’ is defined - as it is always the case – named ‘fewsnet-rfe_native’; a single ‘ingested’ product exists, as the incoming dataset has no any ancillary information (and the rainfall estimate), while several subproducts are generated on the system.

---

**Figure 5: Version of Copernicus GL products**
In the case of the sensors Vegetation VGT and PROBA-V, the situation is more articulated, as we consider four different versions on the eStation 2: Spot Vegetation-1 and 2 collections, the PROBA-V collections in version 2.0 (not operational) and version 2.1. Therefore, four ‘native’ subproducts are defined, one for each version. In ingestion, two sub-products are extracted from the Spot-V products (NDVI and SM, the Status map), while only the NDVI is present in PROBA-V versions, as the quality information is embedded in the data byte.

**Figure 6:** Sub-products existing for the ‘fewsnet-rfe’ product, 2.1 version.

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<td>2.0</td>
<td>JRC</td>
<td>FALSE</td>
<td>rainfall Derived</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fewnet-rfe-10median</td>
<td>2.0</td>
<td>JRC</td>
<td>FALSE</td>
<td>rainfall Derived</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fewnet-rfe-10median</td>
<td>2.0</td>
<td>JRC</td>
<td>FALSE</td>
<td>rainfall Derived</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 7:** Sub-products existing for the Spot/PROBAV NDVI

<table>
<thead>
<tr>
<th>productcode</th>
<th>subproductcode</th>
<th>version</th>
<th>defined_by</th>
<th>activated</th>
<th>category_id</th>
<th>product_type</th>
</tr>
</thead>
<tbody>
<tr>
<td>vgt-ndvi-vgt-ndvi-native</td>
<td>spot-v2</td>
<td>JRC</td>
<td>FALSE</td>
<td>vegetation Native</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vgt-ndvi-vgt-ndvi-native</td>
<td>spot-v2</td>
<td>JRC</td>
<td>FALSE</td>
<td>vegetation Native</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vgt-ndvi-vgt-ndvi-native</td>
<td>spot-v1</td>
<td>JRC</td>
<td>TRUE</td>
<td>vegetation Native</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vgt-ndvi-vgt-ndvi-native</td>
<td>spot-v2.1</td>
<td>JRC</td>
<td>TRUE</td>
<td>vegetation Native</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vgt-ndvi-vgt-ndvi-native</td>
<td>spot-v2.0</td>
<td>JRC</td>
<td>FALSE</td>
<td>vegetation Native</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vgt-ndvi-sm</td>
<td>spot-v2</td>
<td>JRC</td>
<td>FALSE</td>
<td>vegetation Ingest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vgt-ndvi-sm</td>
<td>spot-v1</td>
<td>JRC</td>
<td>TRUE</td>
<td>vegetation Ingest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vgt-ndvi-sm</td>
<td>spot-v1</td>
<td>JRC</td>
<td>TRUE</td>
<td>vegetation Ingest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vgt-ndvi-sm</td>
<td>spot-v2.1</td>
<td>JRC</td>
<td>TRUE</td>
<td>vegetation Ingest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vgt-ndvi-sm</td>
<td>spot-v2.0</td>
<td>JRC</td>
<td>FALSE</td>
<td>vegetation Ingest</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2.4.4 Dataset

A *dataset*, in eStation jargon, is an ensemble of images related to the same *EO products*, for a given geographic extent and temporal window. The concepts of ‘dataset’ and ‘product’ are close; a ‘dataset’ stresses the idea of having an ensemble of files generated for the same product for a given region and a given period of time.

### 2.4.5 Mapset

The ‘mapset’ is the ensemble of information defining a map representation of an EO product, using the following characteristics:
1. Spatial Reference System (SRS) - defined through the SRID\(^3\) and referring, by default, to the EPSG authority. It logically includes:

1.1 Geographic Coordinate System (GCS), including Datum.
1.2. Map Projection (if any - name and parameters).

2. Pixel size (unit, value)
3. Boundary Box (ULx/y, LRx/y) or ‘Extent’ or ‘Origin’
4. Raster size (Xsize, Ysize)

The ‘mapset’ replaces the concept of ‘ROI’ (existing on eStation 1.0) and offers the possibility to have all geo-referencing information in a single object, which is stored in a single table of the database, and is convenient for direct re-projection of an image from an original to a target ‘mapset’.

In Figure 8 the mapsets defined in the first release of eStation2 are listed. As you can see, they have different spatial resolution (pixel size from 30m to 8 km), and they refer to the full continent or for one of the Regions, which are identified after normally the name of the Regional Economic Communities (ECOWAS, IGAD, IOC and so on).

\(^3\) see http://en.wikipedia.org/wiki/Spatial_reference_system

---

**Figure 8: eStation 2 defined mapsets**
### 2.4.6 Sources of datasets (or Data source)

Datasets of the eStation are retrieved mainly from the EUMETCast dataflow (*i.e.* from PC1, the Receiving Station) and from remote servers by internet (HTTP or FTP). EUMETCast and the Internet are the two ‘Datasets sources’, or simply *data sources*. In order to be retrieved by the ‘Get’ Services, each product need to have a datasource defined.

The ‘EUMETCast’ sources are described in a database table (*eumetcast_source*) that contains all metadata as existing in the EUMETSAT Product Navigator\(^4\). The most relevant fields being are a unique identifier of the source itself (*eumetcast_id*) and a regular expression to select dataset by their filenames, among all the other ones (*filter_expression_jrc*). The service is described in full detail in the 4.2.1 paragraph.

The ‘internet’ sources include some additional elements needed to access the remote servers and repositories, such as the base URL of the data provider, login credentials (username/password), the regular expression to filter the datasets names, and a time frame defined through ‘start’ and ‘end’ dates.

**Additional information for managing the datasource in defined in the  *datasource_description* table, which contains elements to describe the ‘incoming’ files in terms of:**

- File naming rules and file extension, which allows the ‘get’ services to identify and manage the incoming files, *e.g.* by extracting the date/time of the image.
- The geo-reference, *i.e.* geographic coverage (*e.g.* global) and native mapset; note that in some cases the information on the geo-reference is coded in the incoming file itself, and there is no need to fill this field.
- The pre-processing type to be applied during the ingestion, which varies according to the file format (HDF, GTiff, NetCDF) and the tiles organization (see 4.3.1 for more detail)

---

\(^4\) See http://navigator.eumetsat.int/discovery/Start/Explore/Quick.do?jsessionid=03AF8AD82E5C74242E359DCEE525A326
2.4.7 Services

The following Services are implemented on the system (see also Figure 2):

- Get EUMETCast: to copy data from PC1 to eStation 2
- Get Internet: to copy data from remote servers to eStation 2
- Ingestion: to convert the incoming products into GeoTIFF format, and optionally re-project to the defined ‘mapset’.
- Processing: to derive from the incoming products additional indicators.
- System: to manage all background operations, such as data/database synchronization between PC2/3, database dump, system diagnostic.

The Services are executed on the eStation as ‘daemons’, e.g. as a detached process that runs in the background: they are permanently active.

The normal operations to be executed by the User to control the Services are:

- Define/verify the settings on the eStation for each of the services (e.g. control that the ‘get’ and ‘ingest’ for a given product is activated)
- Activate the Service from the GUI and monitor its execution.
- Optionally modify the Settings on the fly (no need of re-starting the Service)
- Optionally stop or restart a Service in case of unforeseen circumstances.

In nominal conditions of the MESA Station, the Services and the ‘Analysis’ option should be activated on PC2 and PC3 as in the following table:

<table>
<thead>
<tr>
<th>Service</th>
<th>Status on PC2</th>
<th>Status on PC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get EUMETCast</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Get Internet</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Ingestion</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Processing</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>System</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

Table 3 Services defaults status on PC2 and PC3 (nominal configuration)
2.4.8 eStation 2 standard format conventions

The files ingested on the eStation2, or generated by the processing service, present some common characteristics that are been defined to facilitate the exploitation of the Users, not only on the eStation but also in third-party software. There characteristics include a common file format (GTIFF), a unique convention for scaling the physical values in digital number and for encoding the ‘no-data’, and a list of metadata, written as ‘tags’ in the GTIFF file.

Data coding

All raster files contain ‘digital values’ coded over bytes, integers or float types. In order to convert these numbers in physical quantities, the following equation is applied:

\[
Phys. Value = DN \times scale_{factor} + scale_{offset}
\]

On the eStation the following convention is adopted:

- \(scale_{factor} = 10^N\) when \(N\) is an integer, positive or negative
- \(scale_{offset} = 0\)

This convention facilitates the User in understanding the contents of the raster files, while looking at them from third-party software (like QGIS).

Nodata encoding

The ‘nodata’ value is a numeric value used to indicate that no observations are available over some pixels of the image. It is coded in the metadata of the image. On eStation 2 the nodata encoding is standardized, so that for the simplest data types (BYTE, INT16 and UINT16) it depends on the data type, as shown in the following table:

<table>
<thead>
<tr>
<th>Data type</th>
<th>Nodata value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYTE</td>
<td>255</td>
</tr>
<tr>
<td>INT16</td>
<td>-32767/8</td>
</tr>
<tr>
<td>UINT16</td>
<td>65536</td>
</tr>
</tbody>
</table>

Table 4: Nodata coding for data type

For the other data types (INT32, UINT32, FLOAT32 and FLOAT64), which are by the way rarely used in the system, there is more freedom in the nodata coding, and we normally adopt the same value as in the incoming images.

List of metadata

The images in eStation 2 format contain a standard list of metadata that are produced during the ingestion or the processing as GeoTIFF tags. They are visible, e.g., by doing ‘gdalinfo’ command followed by the name of the image.

The role is twofold:

- For the User: to extract information from the image, e.g. in order to see when it has been produced, on the basis of which input files, or what are the scaling factor and offset.
For the eStation itself: to extract information (e.g. the product, version, subproduct, mapset) needed to place the image in the correct director.

<table>
<thead>
<tr>
<th>Name</th>
<th>Typical value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>eStation2_category</td>
<td>rainfall</td>
<td>Category of the product (as in the GUI, in Acquisition, Processing and Data Management Tabs).</td>
</tr>
<tr>
<td>eStation2_comp_time</td>
<td>2015-04-23 14:17:21</td>
<td>Time of computation of the image (local time, taken from the PC)</td>
</tr>
<tr>
<td>eStation2_conversion</td>
<td>Phys = DN * scaling_factor + scaling_offset</td>
<td>Fixed (see ‘data coding’ above)</td>
</tr>
<tr>
<td>eStation2_date</td>
<td>20100101</td>
<td>Time of the EO product</td>
</tr>
<tr>
<td>eStation2_date_format</td>
<td>YYYYMMDD</td>
<td>Format of the date</td>
</tr>
<tr>
<td>eStation2_defined_by</td>
<td>JRC</td>
<td>Who has defined the product (JRC or User)</td>
</tr>
<tr>
<td>eStation2_descr_name</td>
<td>TAMSAT RFE</td>
<td>Descriptive name of the product</td>
</tr>
<tr>
<td>eStation2_description</td>
<td>TAMSAT Rainfall estimates</td>
<td>Longer description of the product</td>
</tr>
<tr>
<td>eStation2_es2_version</td>
<td>2.1.0</td>
<td>eStation 2.1 version</td>
</tr>
<tr>
<td>eStation2_frequency</td>
<td>e1dekad</td>
<td>Frequency of the product</td>
</tr>
<tr>
<td>eStation2_input_files</td>
<td>/data/ingest/rfe2010_01-dk1.nc</td>
<td>List of input files used to generate the product. It might be a list of ‘native’ products (as in the example here) or eStation 2.1 products</td>
</tr>
<tr>
<td>eStation2_mac_address</td>
<td>6c:ae:8b:52:77:d2</td>
<td>Unique identifier of the machine where the product has been generated.</td>
</tr>
<tr>
<td>eStation2_mapset</td>
<td>TAMSAT-Africa-4km</td>
<td>Product mapset (see 2.4.5).</td>
</tr>
<tr>
<td>eStation2_nodata</td>
<td>-32768</td>
<td>Nodata value coding (see above)</td>
</tr>
<tr>
<td>eStation2_product_version</td>
<td>2.0</td>
<td>Product Version</td>
</tr>
<tr>
<td>eStation2_provider</td>
<td>TAMSAT - JRC</td>
<td>Provider of the data. It might be a Space Agency, a Project, JRC or a RIC.</td>
</tr>
<tr>
<td>eStation2_scaling_factor</td>
<td>1.0</td>
<td>Scaling factor for DN to physical value conversion (see above)</td>
</tr>
<tr>
<td>eStation2_scaling_offset</td>
<td>0.0</td>
<td>Scaling offset for DN to physical value conversion (see above)</td>
</tr>
<tr>
<td>eStation2_subdir</td>
<td>tamsat-rfe/2.0/TAMSAT-Africa-4km/tif/10d/</td>
<td>Subdirectory where the product is located on eStation, to be added to the data processing base dir (/data/processing by default).</td>
</tr>
<tr>
<td>eStation2_subProduct</td>
<td>10d</td>
<td>Name of the subproduct</td>
</tr>
<tr>
<td>eStation2_unit</td>
<td>mm</td>
<td>Physical Unit of the product (once the conversion to physical value is applied)</td>
</tr>
</tbody>
</table>

Table 5: List of standard eStation 2 metadata in GeoTIFF
2.4.9 Importing datasets

On the eStation 2 several mechanisms to acquire data exist. The ‘standard’ mechanism is to retrieve data in their ‘native’ format and it is composed by the ‘Get’ (from EUMETCast and Internet) and ‘Ingestion’ services. Besides this mechanism, it is also possible to feed the system with data in eStation format (see 2.4.8), which are pre-computed and made available to the Users with different mechanism.

Acquisition of ‘native’ datasets

The ‘standard’ mechanism is to ‘get’ the data from PC1 (through the ‘Get EUMETCast’ service) and from http/ftp servers (‘Get Internet’ service). The files are retrieved on the machine in their original (‘native’) format, as generated by the data provider, and subsequently ingested. This mechanism is monitored and controlled from the ‘Acquisition’ interface (see 3.5).

Acquisition of eStation datasets

The eStation 2 defines a specific standard for EO products, as GeoTIFF files with standard naming and metadata (see 2.4.8). These datasets can be delivered to an eStation in order to initialize, update or complete the local datasets. Three main options exist, according to the modalities of the dissemination, and they are described below.

Files disseminated through EUMETCast

In the scenario of the THEMA services implementation, the JRC and the RICs have the responsibility to provide and disseminate some products to the National Focal Points (NFTs); this approach derives from the complexity of the computation of this products, the need of having them quality-checked before exploitation, or the need of very long time series that cannot be installed and maintained on each machine. This data typically represents either:

- Temporal synthesis of high temporal frequency products (e.g. LST, ET)
- Long-term statistics that are computed over a long time series, which is not fully present on the MESA Stations.

These files are uploaded by JRC or the RICs to EUMETSAT, and disseminated to MESA stations exactly as the ‘native’ datasets. The peculiarities of these files are:

- They are already in the eStation 2 format, with a slightly different naming
- They are not selected singularly in the ‘Acquisition’ interface, but, for sake of simplicity, through a single command (see 3.5.1)

Archives

At the moment of the installation of the eStation 2, the machine has to be fed with historical datasets in order to provide the thematic User with time series for its analysis. These datasets represent several tenths of Gb, and they are a collection of files in eStation 2 format that are ‘packed’ into a zipped tar file (.tgz).

The archive has to be mounted to the eStation computer on a location that corresponds to the ‘Archive Dir’ path specified in the system setting (see 3.10.1). Then a specific routine is activated (see AdminManual for more details) to parse the archive and copy to the local machine the datasets of interest for the User, according to the ‘Acquisition’ and ‘Processing’ settings.

Requests
While the ‘Archive’ mechanism existed in eStation 1.0 as well, the ‘request’ is new in release 2.1, and represents an evolution of the former mechanism, in the sense that it is an ‘ad-hoc’ archive created on the request of the User, to complete its dataset. The request is generated from the Data Management tab (see 3.7), and is basically a list of images missing on the local machine. The request is sent to another eStation, which created the ad-hoc archive to be ingested by the User. This archive is then delivered to the user, who subsequently ingests it on its machine.

The following table provides an overview of the various mechanisms and detail the format of data involved (either ‘native’ or eStation 2), the physical delivery mechanism that can include more than one option, the entity in charge of preparing and disseminating the datasets, and the type of datasets that are foreseen to be included in each mechanism.

<table>
<thead>
<tr>
<th>Name</th>
<th>Format of data</th>
<th>Mechanism of delivery</th>
<th>Who creates the data</th>
<th>Type of data</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native</td>
<td>Native</td>
<td>EUMETCast Internet (ftp/http)</td>
<td>Space Agencies</td>
<td>NRT or re-processed EO Products</td>
<td></td>
</tr>
<tr>
<td>eStation 2 - EUMETCast</td>
<td>eStation 2</td>
<td>EUMETCast</td>
<td>JRC, RICs</td>
<td>LT Statistics Advanced products</td>
<td></td>
</tr>
<tr>
<td>eStation 2 - Archives</td>
<td>Media/ftp</td>
<td>JRC, RICs, any user</td>
<td>Historical Archives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eStation 2 - Requests</td>
<td>Ftp/media</td>
<td>JRC, RICs</td>
<td>Specific datasets on User request</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Mechanism of datasets retrieval
3. USER’S GUIDE

In the eStation 2 system most of functionalities are accessed through the user interface (GUI) and no integration in the CentOS menu has been implemented. The current chapter describes all the operations that can be performed from the User Interface.

3.1 LOGIN TO PC2 AND PC3

The following Users are defined on the MESA computers of the eStation 2 (PC2 and PC3):

<table>
<thead>
<tr>
<th>Name</th>
<th>Descriptive Name</th>
<th>Password</th>
<th>Role</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>adminuser</td>
<td>Adminuser User</td>
<td>mesadmin</td>
<td>Manages the installation, the upgrades and ensures maintenance of the system</td>
<td>He/she is expected to be an IT System Administrator.</td>
</tr>
<tr>
<td>analyst</td>
<td>eStation Thematic User</td>
<td>mesa2015</td>
<td>Thematic Expert using the system to perform environment monitoring.</td>
<td>He/she is expected to be an Environmental Analyst.</td>
</tr>
</tbody>
</table>

Table 7: Login interface

The following figure displays the page the User is presented at the computer start in order to log in.

![Login Interface](Image)

3.2 ACCESSING THE USER INTERFACE

The GUI can be opened from PC2 or PC3, each with its own IP address or hostname.

- To access the user interface locally from PC2 or PC3, open the installed browser Mozilla Firefox and go to the following address:
  - http://localhost (User interface locally on PC2 or PC3)
  - http://MESA-PC2 (User interface on PC2)
  - http://MESA-PC3 (User interface on PC3)

- To access the user interface from a different machine on the network, open a browser (Mozilla Firefox, Google Chrome, Internet Explorer) and go to the following address:
Access the user interface on PC2 from any computer in the network:
- http://MESA-PC2

Access the user interface on PC3 from any computer in the network:
- http://MESA-PC3

If your network has been configured with a domain name, then the url address will have the form:
http://<name-machine>.<domain.name>

For example if your domain name is domain.name.org you can reach the user interface on PC2 and PC3 respectively as follows:
http://MESA-PC2.domain.name.org
http://MESA-PC3.domain.name.org

On PC2 (http://MESA-PC2) the “home page” should look as follows:

If the page is not correctly displayed, you should refer to the Administrator Manual, section 5.1 and involve the System Administrator of the MESA Station in the analysis.
3.3 AVAILABLE FUNCTIONALITY

The functionalities available on the system are presented in the following pages (tabs):

- **Dashboard**: presents an overview of a MESA Full eStation and gives control over the services;
- **Acquisition**: to view and control the status of the services for retrieving and ingesting the EO data;
- **Processing**: to start and stop the processing of new products;
- **Data Management**: lists available data sets, both those acquired and processed by the eStation, showing the completeness of time series (and thus listing missing datasets);
- **Analysis**: to perform the data analysis and generate images for bulletins/reports. It replaces the former EMMA application of the version 1.0;
- **System**: to control the application settings (recovery or nominal mode, Thema region, log level, Ethernet IPs, and working directories paths), and to generate system reports;
- **Help**: to read system help files: allows downloading the pdf files and access reference web sites.

The primary role of PC2 is **Acquisition, Ingestion and Processing server** and the primary role of PC3 is **Analysis server** of the on PC2 gathered and generated data products.

3.3.1 Functionality available on PC2 in nominal mode

Of the above functionalities, on **PC2 in nominal mode**, are available the Dashboard, Acquisition, Processing, Data Management, System and Help pages.

3.3.2 Functionality available on PC3 in nominal mode

Of the above functionalities, on **PC3 in nominal mode**, are available the Dashboard, Analysis, System and Help pages.

3.3.3 Functionality available on a PC in recovery mode

In **recovery mode** a PC will have all functionalities available.
3.4 Dashboard

The dashboard presents an overview of a MESA Full eStation (or MESA Light eStation). It shows the status and gives control over the various services on each machine (PC2 and PC3).

When opening the User Interface of the eStation in a web-browser, the Dashboard page is shown first, and it is meant to be accessed for the verification of basic functionality and initial diagnostic operations.

3.4.1 Dashboard on PC2

A panel representing the status of the three PCs is displayed. The grey background of a PC makes evident the machine the User is connected to (PC2, in case of Figure 9).

In nominal mode all services are running on PC2 and can be controlled only from the GUI of PC2. In this case, all the services except the System service are disabled on PC3 (see Figure 10 below).

To refresh the Dashboard, click on the button.
3.4.2 Dashboard on PC3

A panel representing the status of the three PCs is displayed. The grey background of a PC makes evident the machine the User is connected to (PC3, in case of Figure 10). In nominal mode only the System service is enabled on PC3, and it is by default activated.

![Dashboard on PC3 of a MESA Full eStation](image)

Figure 10: Dashboard on PC3 of a MESA Full eStation

3.4.3 Services control

As described in Table 3, there are 5 services running on the estation:

- Get Eumetcast: Get (copy) data from the receiving station (PC1) for all activated products that have an activated Eumetcast data source defined
- Get Internet: Get (copy) data from internet sources (FTP or HTTP) for all activated products that have one or more activated Internet data sources defined.
- Ingest: pre-process incoming raw data, by transforming the file format into the pivot format (GTiff), and optionally re-projecting
- Processing: runs all defined processing chains that are activated to derive from the incoming products additional indicators
- System: manages all background operations, such as automatic data and database synchronization.
The following two background operations of the System service will automatically turn off in recovery mode:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Synchronization</td>
<td>Synchronizes all the data on PC2 with the data on PC3.</td>
</tr>
</tbody>
</table>
| DB Synchronization        | Synchronizes the database schema products on PC2 with the database schema products on PC3.  
                            | Synchronizes the database schema analysis on PC3, with the database schema analysis on PC2.  |

The services **Eumetcast, Internet, Ingest, and Processing** are controllable and can run only on one of the two machines, PC2 or PC3, depending on the PCs’ mode (nominal or recovery).

The **System** service is running and controllable on both PCs and ideally should always be running.

### 3.4.4 Connections between the three PCs

When two PCs can establish a connection between them, you will see a green arrow and a red arrow when they are not able to establish a connection between each other.

In the following situation, PC2 is connected to PC1 but not connected to PC3. Because PC2 cannot connect to PC3, you will see all the information in the PC3 panel grey.

#### 3.4.5 Services on PC1

PC1 (aka Receiving Station) is retrieving the products disseminated through EUMETCast and making them available on a directory for ftp copy. The main Services running on PC1 are:

- DVB: manages the Digital Video Broadcasting (DVB) card installed on PC1
- Tellicast: converts the incoming data flow in files
- FTS: dispatches the files
In the panel of PC1 the status of the following 3 services is given:

**DVB Status:**
- the DVB service on PC1 is **running**.
- the DVB service on PC1 is **down**.

**Telicast Status:**
- the *Telicast* service on PC1 is **running**.
- the *Telicast* service on PC1 is **down**.

**FTS Status:**
- the *FTS* service on PC1 is **running**.
- the *FTS* service on PC1 is **down**.
3.4.6 Functionality of PC2 and PC3 in the Dashboard

The primary role of PC2 is Acquisition, Ingestion and Processing server and the primary role of PC3 is Analysis of the gathered and generated data products.

In the dashboard both PCs have the same information and functionality available, depending on the mode a PC is in, as described above in paragraph 3.3.

Corresponding to the number in the above figure, the User can perform the following operations:

1. Services

The five services Eumetcast, Internet, Ingest, Processing and System can individually be started (Run), stopped or restarted and for each of them its log file can be viewed.

- By clicking on the arrow next to the name of a service, a menu will drop down with the items Run, Stop, Restart and “View log file”.

- If the service is running, the cog icon is green and red when the service is not running.

- You can refresh the status of all services by clicking on the title of any service menu button.
• When choosing “View log file” of a service, a window will be shown with the content of all the log files (.log, .log1, .log2, etc...) of the service, in reversed order with the latest date on top. Searching within the log file and text highlighting functionality are available.

2. Data and DB Synchronization

The Data Synchronization service is by default enabled to synchronize the data automatically every 30 minutes. The Data Synchronization will automatically be disabled in recovery mode.

When choosing “View log file” under the Data Synchronization menu, a window will be shown with the content of the log file of the Data Synchronization.

The DB Synchronization service is by default enabled to synchronize the database automatically. The DB Synchronization will automatically be disabled in recovery mode.

When choosing “View log file” under the DB Synchronization menu, a window will be shown with the content of the log file of the DB Synchronization.
3. Other information

For information only, in the PC2 panel under the services menu buttons you see the following info:

**Active version:** The version of the installed eStation on PC2.

**Mode:** Nominal mode, Recovery mode or Maintenance mode

**PostgreSQL Status:**
- the PostgreSQL database on PC2 is **running**.

- the PostgreSQL database on PC2 is **down**.

**Internet connection:**
- there is an Internet connection from PC2.

- there is **NO** Internet connection from PC2.
3.5 Acquisition

Under ‘Acquisition’ tab two main services are merged:

1. The Get of data from the Receiving Station (PC1) and the internet (Eumetcast and Internet services)

2. The Ingestion, the pre-processing that ingests(converts) the incoming raw data for a product to the pivot (GTiff ) format, and optionally re-project and subsets (clips) them to a specific defined ‘mapset’.

The Acquisition tab shows all activated products for each product category and allows the user to see and control the status of the services Eumetcast, Internet and Ingest, to check the status of completeness of the ingested datasets, activate or deactivate each individual Get and Ingest defined for a product and to display the log files associated to each individual Get and Ingest.

The acquisition page also gives the user the possibility to activate or deactivate a product, and to add a new User defined product and assign an existing or new created Get and Ingest definition.

3.5.1 Functionality

Corresponding to the number in the above figure, the User can perform the following operations:

1. Expand all product categories to see all their activated products by clicking on the “Expand all” button. Collapse all product categories by clicking on the “Collapse All” button.
2. **Expand or collapse each product category individually** by respectively clicking on categories title bar or on the + and – sign on the left of the title of a product category. The number between the brackets next to the title/name of a product category indicates the amount of active products within that product category.

3. Like in the Dashboard, the services **Eumetcast, Internet** and **Ingest** can individually be started, stopped or restarted and for each of them its log file can be viewed.

4. To refresh/reload the Acquisition page click on the refresh button 🔄.

5. View the log file for an individual ‘Get’ or ‘Ingest’ defined for a product, click on the 📜 icon next to a Get or Ingest. A new window will be shown with the content of all the log files (.log, .log1, .log2, etc...) of the Get or Ingest, in reversed order with the latest date on top.

6. **Activate/deactivate a single ‘Get’ source.**

   The ✅ icon means the ‘Get’ source is activated. Click on the ✅ icon to deactivate the ‘Get’ source. The icon will change to deactivated 🗑️.

   The 🗑️ icon means the ‘Get’ source is deactivated. Click on the 🗑️ icon to activate the ‘Get’ source. The icon will change to activated ✅.
7. Activate/deactivate a single ‘Ingestion’. An ingestion refers to the ‘Get’ data source(s) defined for the product, and specifically to a Mapset and Sub Product.

The ✔ icon means the ‘Ingestion’ is activated. Click on the ✔ icon to deactivate the ‘Get’ source. The icon will change to deactivated ☐.

The ☐ icon means the ‘Ingestion’ is deactivated. Click on the ☐ icon to activate the ‘Get’ source. The icon will change to activated ✔.

8. Check the status of completeness of ingested datasets. For each ‘Ingestion’ the Acquisition page shows a completeness chart, indicating the first date and the expected last date of the dataset, the total expected files for the dataset and the total of missing files.

By clicking on a dataset completeness chart, a list of all the periods of present, missing and permanent missing files pops up:

![Completeness Chart Example]

For products with a high frequency, for example every 15 or 30 minutes, the completeness chart is not created and a message “No display for 15 or 30 minute products” is shown.

9. Ingestion of the eStation 2 files disseminated from EUMETCast can be enabled or disabled. This refers to the ‘Acquisition of eStation datasets - Files disseminated through EUMETCast’ mechanism described in 2.4.9

10. Lock/unlock the Acquisition page. Certain functionality and information is hidden when the Acquisition page is locked. The ✎ icon indicates that the Acquisition page is locked. Click on the icon to unlock the page. Hidden functionality and information will be shown and the lock icon becomes an unlocked icon ✖. The following figure illustrates the Acquisition page unlocked. The numbers indicate the added information and functionality.
11. Acquisition page unlocked. Click on the icon to lock the Acquisition page and go back to the situation illustrated in Figure 11.

12. Deactivating a product. Remove a product from the Acquisition list, deactivating the product by clicking on the icon. The product will be removed from the Acquisition page.

13. Store Native column contains for every product data source a check box that indicates if the native raw data files will be stored or not. By default this is activated for the products having a low temporal resolution (10 days).

The icon means the storing of the native data is activated. The icon means the storing of the native data is deactivated.

14. Change the settings of an EUMETCAST data source. Click on the icon next to an EUMETCAST data source and a window will be opened where its settings can be changed.
Click on the “Save” button to save any changes made.

15. Change the settings of an INTERNET data source. Click on the icon 🗺 next to an INTERNET data source and a window will be opened where its settings can be changed.

Click on the “Save” button to save any changes made.
16. Adding a new Mapset\(^5\) for a Sub Product, to be ingested. Click on the icon next to a Sub Product to open a new window where a Mapset can be selected.

Select a Mapset and click on the “Save” button. The window will be closed and the selected Mapset will be added to the Acquisition page as a User defined Mapset ingestion for the sub product in question.

Click on the delete icon to delete the Mapset from the Sub Product. A confirmation window pops up, asking to confirm the deletion.

\(^5\) See 2.4.5 for the definition of Mapset.
17. All products listed in the Acquisition page are ‘Activated’ products, already defined in the system with assigned data sources and ingestions. For most products, especially those broadcasted through Eumetcast, the JRC has defined their definition, their GET (data source) and Ingestion definition and assignment. To activate an already defined deactivated product, click on the button. A window will be shown with a categorized list of deactivated products.

The ☐ icon (1) means the product is deactivated. Click on the ☑ icon to activate the product. The product will be removed from the list and added to the list of Active products in the Acquisition page.

Close the Activate Product window by clicking on the “Close” button (2).
3.6 **PROCESSING**

The processing page is the interface to the ‘processing’ service, e.g. to the generation of EO products derived from the locally available datasets.

The processing page allows the User to control the status of the processing service, and to activate/deactivate a single processing ‘chain’. All processing chains are created and defined by the JRC. In the processing page only the enabled processing chains are shown. The relevant processing chains for each Thema are automatically enabled at the installation by choosing a Thema under the System tab (see paragraph 3.10).

As illustrated in the figure below, a processing ‘chain’ is based on an Algorithm (‘Type + Options’ in the middle section) and has one or more subproducts as Input (left section) and one or more derived subproducts as Output (right section). For a description of the different algorithms see 4.3.3.

![Figure 13: Processing tab](image)

### 3.6.1 Functionality

1. Expand all product categories to see all the products with one or more processing chains defined, by clicking on the **Expand All** button and to collapse all product categories by clicking on the **Collapse All** button.

   Expand or collapse each product category individually by respectively clicking on categories title bar or on the + and – sign on the left of the title of a product category.
2. Like in the Dashboard, the Processing service can be started, stopped or restarted and its log file can be viewed. By clicking on the arrow next to the title, a menu will drop down with the items Run, Stop, Restart and “View log file”.

![Processing menu](image)

If the **service is running**, then the cog icon is **green** and **red** when the **service is not running**.

You can **refresh the current status of the Processing services** by clicking on the title of the service menu button.

![Processing menu](image)

3. To refresh/reload the Processing page click on the **refresh** button.

4. **Activate/deactivate a processing chain.**

The **✓** icon means the processing chain for the derived sub products is activated. Click on the icon to deactivate the processing.

The **☐** icon means the processing chain is deactivated. Click on the icon to activate the processing chain.

5. **View the log file for an individual processing ‘chain’, click on the **log** icon. A new window will be shown with the content of all the log files (.log, .log1, .log2, etc...) of the processing ‘chain’, in reversed order with the latest date on top. **

![Log file](image)
**3.7 Data Management**

The data management page is intended for having an overview and control over the completeness of the datasets existing on the eStation. The datasets shown are grouped by category, as in the previously discussed tabs, and all products 'enabled' on the station are displayed, together with their ingested and derived subproducts. It is important to note that here also the locally derived subproducts, generated by the Processing service, are represented, unlike in the Acquisition tab.

The data management page gives the possibility to complete datasets with missing files, by creating a request to be sent to JRC (or RICs) by email. In future versions of the eStation, it would be possible to automatically upload/send the request to a reference server (at JRC or RIC).

3.7.1 Functionality

1. Expand all product categories to see all the products with one or more processing chains defined, by clicking on the Expand All button and to collapse all product categories by clicking on the Collapse All button.

   Expand or collapse each product category individually by respectively clicking on the + or – sign on the left of the title of a product category.

To refresh/reload the Acquisition page, click on the refresh button.
2. Check the status of completeness of datasets. For each dataset the Data management page shows a completeness chart, indicating the first date and the expected last date of the dataset, the total expected files for the dataset and the total of missing files. By going over a dataset completeness chart with the mouse pointer, a list of all the periods of present, missing[^6] and permanent missing files pops up:

![Compleness chart example]

3. Send a request to complete all datasets of a product (3a), all datasets of a mapset of a product (3b) or a single dataset (3c).

Click on the download icon of interest and a popup window will be shown listing all the datasets with the amount of missing files that will be in the request.

![Popup window showing missing files]

Click on the ‘Save Request“ button to save the request file under a specific directory (by default /eStation2/requests/). Once downloaded, send the file by email to: estation@jrc.ec.europa.eu

[^6]: An image might be missing for various reasons, including MESA station outage periods. Though, it is normal the latest (or two latest) datasets are displayed as missing.
3.8 Register and Login

User settings can only be saved if the user is registered and logged in. It is then recommended to register for saving the following user functionality:

- Selected language
- Workspace templates with the different maps and graphs combination, see 3.9.3
- Map templates with their various properties (color, size, title, logo), see §3.9.4
- Graph templates with their properties (color, size, title, logo), see §3.9.5
- Layers added by the user and their different settings, see §3.9.6
- Colour palette added and edited by the users, see §3.9.7

Forgot password is not implemented because of the lack of an email server on the eStation 2. If the user forgets his/her password, he/she should contact the system administrator. Update account functionality will be implemented so that the user can change its account information when logged in.

Register and login can be found in the upper right corner next to the language selection.

3.8.1 Register

To register, click on the “Register” button in the upper right corner. The create account dialog will be shown.

Fill in the requested information and click on “Register”. All fields are mandatory!
The user will be prompted if the user name already exists, otherwise the dialog will be closed and the user will be logged in, as shown in the upper right corner.

### 3.8.2 Login

To login, give your user name and password in the fields in the upper right corner.

When logged in, the full user name will be shown next to a “Logout” button.

You will remain logged in also after closing the browser.
To logout, click on the “Logout” button.
3.9 Analysis

The Analysis tool is the entry point for the eStation data visualization and analysis.
It is a user-friendly interface to display any available products
- as map over space and time with appropriate legend and vector overlay or
- as graphs to visualise the time series data aggregated from any polygon of interest.

The registered user can save any MAP and GRAPH composition as templates. One of the major change in this version is the development of a WORKSPACE where the user can display multiple maps and graphs and save the multiple object combinations as workspace templates, and retrieved them at a later stage.

The management of the different objects is made through five components:
- Workspace
- Map
- Graph
- Legend
- Layers

3.9.1 Workspace functionalities

In this version to facilitate the analysis and interpretation of the EO data a new way to organise the different maps and graphs has been introduced through the development of a workspace environment. This work panel can be populate with various existing or new maps and graphs. The user can distribute and resize the different objects as needed and then save this workspace as a template. The user can generate various workspace templates dedicated to any specific thematic and focus on geographic area.

3.9.1.1 Workspace interface description

When opening the Analysis page, you will see a blank page with on the top a toolbar with
1. on the left the “DEFAULT WORKSPACE”
2. then below “NEW MAP”, “NEW GRAPH”, “LEGENDS” and “LAYERS” buttons,
3. on the right the “Show background layer”.

The eStation2 is supplied with one background layer. In future versions more background layers will be added. Click on the “Show background layer” button to view it in the centre area of the Analysis page. The button text will change to “Hide background layer”, which will hide the background layer when clicked.
The “NEW MAP” button open a Map window from where the user can visualize any available subproducts and make a composite with a specific colour palette, window and map size, vector layer, title, disclaimer, logo and scale, digitize polygon/line/points and export the composite as PNG file. Any new map window will be by default align to the background layer scale.

4. The “NEW GRAPH” button open the interface to display the time series interface to generate various type of graphs showing the aggregated subproducts over a period of interest from any selected polygon/point into the map viewer. The operator can define interactively the subproducts, time period, window dimension, colour, scale, font size, title and logo and export the composite as PNG or the resulting aggregated data set as EXCEL file.

5. The “LEGENDS” button open the legend administration window to copy, edit, delete any color palette and associated annotation attributes.

6. The “LAYER” button give access to the layers administration interface to add, delete, display in a menu/submenu, and define the layer to load by default.

It is recommended to log in in order to be able to save workspaces, maps, graphs, colour palettes and layers. When login four new buttons appear into the interface:

7. “MY WORSPACES” button give access to the different workspace templates previously saved
8. “MY MAPS” manage the different map templates prepared by the user
9. “MY GRAPHS” to display any graph templates
10. “SAVE AS” icon to save the current workspace.
3.9.1.2 Adding a map or graph object in a Workspace

When you want to create a new workspace, start by selecting the “DEFAULT WORKSPACE”.

You can add a new map by selecting “NEW MAP” icon and create you own map window or select an existing template in “MY MAPS” (see §3.9.2 Mapview functionalities).

You can also add a new graph by clicking on “NEW GRAPHS” or add an existing Graph template with “MY GRAPHS” button as explained in §3.9.3 Graph view functionalities.

In your workspace, you can add several maps and or graphs considering that the limiting factor is the screen size and resolution.

3.9.1.3 Saving a Workspace

Any change in size, position, content of the different maps and graphs objects can be save in a workspace template. Click on the “SAVE AS” button then enter the name you want to give to the template then click OK.

A message “Workspace created!” will be displayed.

When saving the template you do not update the map and graph templates possibly opened to populate the workspace. They are considered as graphic objects composition specific for each workspace template.

You can also update the current template name by just clicking on the “SAVE WORKSPACE” icon.

3.9.1.4 Opening/deleting a Workspace template

Each template is only saved within the specific user session. Any saved template can also be retrieved within the same user session at a later stage. Click on “MY WORKSPACE” select the template of interest and use the button “OPEN SELECTED” to display the workspace.
If you want to delete a selected template, you have to click on the corresponding dustbin icon.

See below 2 workspace template examples:
3.9.1.5 Pin/Unpin a Workspace template

You can pin (in GREEN) or unpin (in RED) a workspace template by clicking on the pin icon of each loaded template (see below). Any template with a GREEN pin will be loaded when logged with the same user session. Then you just need to select anyone to display it.

The graph and map will be updated with the latest data when opening the template.

By double clicking on the workspace tab name you can edit the workspace name which is saved automatically.

3.9.2 Mapview functionality

3.9.2.1 Viewing a product in a Mapview

Open a new Mapview window by clicking on the “NEW MAPS” button. A new empty Mapview window will be opened.
To view a Product in a Mapview a product has to be chosen from the Product Navigator.

From each Mapview the Product Navigator can be invoked by clicking on the “PRODUCTS” button in the Mapview.
A product navigator window will be opened showing the list of available products for each category (1). Click on the product you are interested in.

On the right of the available products list, the available Mapsets for the chosen product are shown (2). Select a Mapset and you will see the list of available sub products (3).

Click on the sub product you are interested in to see its defined colour schemes (4) with the default colour scheme selected.

Choose the colour scheme you prefer and finally click on the “Add to map” button.

Steps to follow:
1. Select a product
2. Select a mapset
3. Select one of the available sub products
4. Chose a colour scheme (legend)
5. Click on the “Add to map” button

The Product navigator will close and the last available date of the selected product dataset will be shown in the Mapview window with the legend colour scheme and on the bottom of the Mapview its available timeline.
3.9.2.2 Product time line

When a product has been added to a Mapview, the time line of the (sub) product is shown on the bottom of the Mapview. All the possible dates within the products frequency are visualized chronologically as small coloured bars.

- A **green bar** for every date physically present in the file system.
- A **red bar** for every date missing.
- A **grey bar** for every date permanently missing.

3.9.2.2.1 Viewing a sub product’s date in the map area of a Mapview

Only the present dates with the **green bar** are clickable. When clicked, the map for the clicked date of the in the Product navigator selected (sub) product, will be rendered in the Mapview.

In the title bar of the Mapview the current date is shown.
3.9.2.2 Navigating through the timeline

Navigating through the timeline is mainly done using the slider on the bottom, which can be moved from right to left and vice versa and also made smaller or larger, to zoom in or out in the timeline.

Zooming can also be done through the 1m, 2m, 3m, 6m, 1y and YTD buttons in the left upper corner of the timeline or through the From/To fields in the upper right corner of the timeline. YTD will show the last available year. 1y will show the whole year that you currently are in on the timeline. The default zoom button depends on the product’s frequency. For example for a daily product, the 2m button is the default.

3.9.2.3 “Video” play the visible timeline of a Mapview

Showing all the dates visible in the timeline, like a video, can be done by clicking on the play icon . When clicked, the first date visible in the timeline of the sub product will be displayed in the Mapview. After the default interval of 3 seconds (3000 ms), the next date in the timeline will be displayed, etcetera, until the last visible date in the timeline, and then starts again with the first visible date.

When playing the visible timeline, the play icon changes into a stop icon . Click the stop icon to stop playing the timeline.

The interval can be changed by clicking on the small down arrow below the play icon. Using the small arrows will add or diminish 500 milliseconds to the interval.

3.9.2.4 Link or unlink the timeline of multiple Mapviews

Clicking on the green bar of a date in the timeline will show the clicked date of the sub product in its Mapview, but also in all other open Mapviews. By default all open Mapviews are “timeline linked”.

The same clicked date or the nearest available date of the sub product in other Mapviews will be taken.

Unlink a Mapview’s timeline by clicking on the timeline link button . The icon will change into the red icon with an unlinked chain , meaning that the timeline of the Mapview is unlinked.
When you “play” the timeline of a Mapview, also all open and timeline linked Mapviews are “Played”.

3.9.2.3 Link/unlink Mapview window from background layer

All Mapview windows are by default linked to the background layer (hidden or not).

Maps are linked means that when zooming or panning within a Mapview or the background layer, all the linked Mapview windows will equally zoom or pan. This default behaviour you can turn ON or OFF for each Mapview by clicking respectively on the un-link or link toggle button.

3.9.2.4 Legend colour scheme

When a product is added to a Mapview, the legend of the chosen colour scheme is shown within the Mapview in vertical layout.

To view the legend in horizontal layout, double-click on the legend. Toggle between horizontal and vertical view of the legend by double-clicking on the legend.

To hide or show the legend, click the toggle button in the “Mapview” toolbar.
Moving the legend frame within the Mapview can be done when you click, hold and drag the legend.

### 3.9.2.5 Navigation: zoom in/out and panning

The zoom tool gives the possibility to zoom in (+) or out (-).

The fasted way to zoom in or out is by using the mouse scroll wheel. Click within a Mapview and then use the scroll wheel on the mouse.

Panning is also done using the mouse. Click and hold the mouse button within a Mapview and then move the mouse to pan the map.

### 3.9.2.6 Zoom factor

The zoom factor slider is shown by clicking on the icon, found in the right corner of the map area of a Mapview window. Use the slider to change the zoom factor. Values go from 1 to 10, with value 1 meaning slow/smooth zooming and value 10 fast zooming. The default is 5. Changing the zoom factor in one Mapview will change the zoom factor also in all the other linked Mapviews.

### 3.9.2.7 Opacity slider

The opacity slider is shown by clicking on the opacity icon, found in the right corner of the map area of a Mapview window with a sub product. Use the slider to change the opacity of the product layer in steps of 10%.
3.9.2.8  Show/hide tool bar
To create more space in the map area of a Mapview, you can hide the tool bar with the tool buttons by clicking on the icon in the left corner of the header.

![Mapview window](image)

3.9.2.9  Collapse or expand a Mapview window
Because you can open many Mapview windows, it is good to be able to collapse Mapview windows and see only its header. Handy for organizing better the opened Mapview windows.

Click on the icon in the left corner of the header to collapse a Mapview window.

![Mapview window](image)

Move the header by clicking on it and hold the mouse button to be able to drag the collapsed Mapview window around the Analysis page in the browser. You can do this also when the Mapview window is expanded.

To expand a Mapview window, click again on the icon.

3.9.2.10  Full screen
A Mapview window can be resized to the maximum size available within the Analysis page by clicking on the icon in the right corner of the header of a Mapview window.
3.9.2.11 Add vector layer

In the tool bar of a Mapview, the layer menu button shows, when clicking on it, a menu of all the active vector layers included in the eStation 2. Vector layers can be activated/de-activated through the Layer administration (see paragraph 3.9.3).

Supplied vector layers are Gaul 2015-2014 Border layers, Marine layers (Fishing Areas and EEZ) and Other layers like Protected Areas.

The following Gaul 2015-2014 border layers are supplied:

<table>
<thead>
<tr>
<th>Region</th>
<th>Level 00</th>
<th>Level 0</th>
<th>Level 1</th>
<th>Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>AGRYMET</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>BDMS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CICOS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ICPAC</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>IGAD MESA</td>
<td>X</td>
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<td>X</td>
</tr>
<tr>
<td>MOI</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>University of Ghana</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

The Africa level 2 has been deactivated in version 2.1.1 because the vector layer is too big and gives problems in the browser when opened in 2 or more Mapviews.
Select a vector layer’s checkbox from the menu to add the layer to the map area of the Mapview. De-select a vector layer’s checkbox from the menu to remove the layer from the map area.
All polygons (area geometries) are interactive. Going over a polygon (or multi polygon) of an area, will highlight the area and will show the area name in the tool bar. Clicking on an area will select the area and the geometry of the area becomes red (the default is red for the selected feature outline colour, but can be changed. See paragraph 3.9.2.11 “Edit layer draw properties from menu” and paragraph 3.9.3 “Layer administration”). Also the name of the selected area will be shown in the Time series tool under “Selected region”. The time series tool is only working if an area has been selected (see paragraph 3.9.4 Time series charts).

When more than one vector layer has been added, priority is given to the layers for selecting an area with the highest priority (lowest priority number in the vector menu). Protected Areas have the highest priority, then level 2, then level 1, then level 0 and finally level 00. This means that when you have all 4 levels added, you will have to hide layers with higher priority to be able to select areas within a lower priority layer.

- Make level 0 areas selectable then hide the Protected areas layer and all level 1 and level 2 layers.
- Make level 1 regions selectable then hide the Protected areas layer and all level 2 layers.

Hide layers though the Layer switcher (see paragraph 3.9.2.12).

Double clicking on a polygon/feature will zoom to its extent.

3.9.2.12 Edit layer draw properties from menu

The draw properties of each vector layer can be edited individually through the layer menu by clicking on the icon next to the layer in the menu, which invokes the Edit layer draw properties tool.
The changes will not directly apply to the layer if it has already been added to the Mapview. If so, remove the layer from the Mapview and then add the layer again to see the changes made to the layer’s draw properties.

3.9.2.13 Layer switcher

Vector layers added to a Mapview can be hidden through the Layer switcher, present in the top right corner of the map area. Clicking on the Layer switcher will show a list of all the layers added. The product layer (if present) is the base layer and cannot be hidden.

Click on the checkbox next to a vector layer to hide or show the layer.
3.9.2.14 Draw geometries

3.9.2.14.1 Activating draw mode

Every Mapview has the draw geometry functionality. Clicking on the button, will show a menu and put the map area in draw mode.

From the menu you can select the geometry type you want to draw, save the drawn geometries as a layer and reset the draw layer by removing all the drawn geometries.

Geometry types are:
- Polygon
- LineString
- Point
- Square
- Box

The map area is in draw mode when you see a light blue dot following the cursor and the draw geometry button looks like this.

Turn off drawing mode by clicking on the button.
3.9.2.14.2 Drawing geometries

In draw mode click somewhere in the map area to start drawing the selected geometry type from the menu. Depending on the geometry type, click or double click in the map area to finish the drawing of the geometry in question.

3.9.2.14.3 Deleting a drawn geometry

You can delete a drawn geometry by turning off drawing mode and select the geometry to be deleted. Once selected, hit the “Delete” key on your keyboard to delete the geometry.
3.9.2.14.4 Save drawn geometries as a layer

Selecting “Save as layer…” from the menu will show a dialog asking to give a name to the layer.

Give a suitable name for your layer and click on OK.
All the drawn geometries are saved in a file in geojson format and added as a user layer on the eStation 2 with default settings. The saved layer is also opened, directly in the Mapview.

To share your drawn layer, the file is also downloaded to the download directory of your browser.

To change the default settings of the layer, go to the Layer administration and follow instructions as explained in paragraph 3.9.3.
3.9.2.15 Out masking a product

When a product and one or more vector layers have been added to a Mapview, the Out mask toggle button appears in the Mapview tool bar. When clicked, the toggle button becomes darker grey, which means that Out masking is turned on.

Selecting the feature/geometry of a region in the Mapview will now out mask the selected region. Turn off Out masking by clicking again on the toggle button.
3.9.2.16 Title, logo and disclaimer objects

There are three objects you can show and hide in the map area, the Title, Logo and Disclaimer objects.

To show the objects, click on the button. The button becomes green and the three objects are shown in the map area.

You can move and reposition all three objects by click and hold on an object and drag the object to reposition it. Also the scale object is repositionable.

3.9.2.16.1 Edit Title object

Double-click the Title object to edit it. The title editor is shown where by default the 3 dynamic fields are added. You can type any text around the dynamic fields or delete the dynamic fields if they are not desired. Format the text (and dynamic fields) using the available text formatting tools in the editor.
Dynamic fields are fields that are automatically filled in when used. There are 3 fields:

- `{selected_area}` – The name of the selected area/geometry of a layer in the Mapview.
- `{product_name}` – The name of the sub product shown in the Mapview.
- `{product_date}` – The date of the sub product shown in the Mapview.

When you have deleted dynamic fields, you can add them by typing exactly the field names in brackets as shown above or by using the dynamic field selection tool in the editor’s toolbar.
- To save your changes, click on the save button found in the header of the editor.

- The editor will close and the changes reflect in the title object of the Mapview.
3.9.2.16.2 Edit Disclaimer object

Double-click the Disclaimer object to edit it. The disclaimer editor is shown. You can type any text and format the text using the available text formatting tools in the editor.

- To save your changes, click on the save button found in the header of the editor.

The editor will close and the changes reflect in the disclaimer object of the Mapview.

3.9.2.16.3 Edit Logo object

Double-click the Logo object to edit it. The logo editor is shown.

The upper box contains the selected logo’s that will appear in the logo object. The lower box contains the available logo’s.

- Double-click on a logo in the selected logo’s box to remove the logo.
- Double-click on a logo in the available logo’s box to add the logo to the selected box.
- To save your changes, click on the save button found in the header of the editor.
3.9.2.17 Save map as PNG image

To save a map rendered in a Mapview click on the button present in the tool bar in the top of the Mapview. A snapshot of the all the visible layers in the map, the product legend (as shown in the map) and the title, disclaimer and logo objects will be made in PNG format and automatically downloaded in the download directory of the browser.

3.9.2.18 Map templates
### 3.9.2.18.1 Save Mapview as template

A map template is a by the user prepared Mapview saved in the database with a given name. A saved map template can be reopened exactly as the user prepared the Mapview (currently the saving of the open vector layers).

To save a prepared Mapview as a map template, the user must first login (see paragraph 3.8.2)

When logged in you will see a “MY MAPS” button next to the “MAPS” button in the toolbar of the Analysis tool.

Also you will see a “Save” button in each Mapview you open.

What will be saved in the map template?
- Mapview window size and position in the Analysis tool.
- Sub product added to the Mapview.
- Legend id.
- Legend visible or not.
- Legend position in the Mapview.
- Legend orientation (vertical or horizontal).
- Title object, Logo object and Disclaimer object visible or not.
- Title object, Logo object and Disclaimer object content and position in the Mapview.
- Scale bar object position in the Mapview.
- Vector layers opened in the Mapview.
- Zoom extent.
- The selected geometry.
- Out mask on or off.

When you have prepared a Mapview, save it as a map template by clicking on the “Save” button. You will be asked to give the map template a name. If a product is opened in the Mapview, the product name and version is proposed as the map template name.

Give the map template a suitable name and click on Ok.
The name given will appear in **orange** in the header of the Mapview, indicating that the Mapview is a map template.

Click on the “Save button to save any changes made to the map template.
Save a map template under another name by choosing “Save as...” under the “Save” button.
3.9.2.18.2 Open a map template

Click on the “MY MAPS” button in the toolbar of the Analysis tool. The list of all the user’s map templates will appear next to the button.

Select one or more (using the Ctrl key) map templates and click on “Open selected”.

The selected map template(s) will be opened.
Delete a map template by clicking on the icon next to the name of the map template.

### 3.9.3 Legends administration

The Legends administration tool is available to:
- View predefined legend definitions;
- Create a new legend;
- Copy a legend;
- Edit a user defined legend definition;

Open the Legends administration window by clicking on the button on the top left corner of the Analysis page. A full list is presented of the legends defined on the eStation2, of which most are supplied by the JRC.
3.9.3.1 View JRC defined legend definitions

Legends defined by the JRC cannot be changed or deleted. You see an eye 🍀 icon in front of JRC defined legends. To view a legend defined by the JRC, double click on the legend or click on the eye icon.

The legend definition window is opened in view mode.

A legend definition contains 4 sections:

1. Legend settings
2. Legend classes
3. Preview – the preview of the vertical legend definition
4. Assigned sub products – the list of sub products to whom the legend is assigned.

Legend settings

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive name</td>
</tr>
<tr>
<td>The descriptive name of the legend.</td>
</tr>
<tr>
<td>Title in legend</td>
</tr>
<tr>
<td>The title of the legend, which appears above the legend.</td>
</tr>
<tr>
<td>Min value</td>
</tr>
<tr>
<td>The min value, which is the “From” value of the first legend class.</td>
</tr>
<tr>
<td>Max value</td>
</tr>
<tr>
<td>The max value, which is the “To” value of the last legend class or a higher value.</td>
</tr>
</tbody>
</table>
### Legend classes

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
</tr>
<tr>
<td>From</td>
</tr>
<tr>
<td>To</td>
</tr>
<tr>
<td>Class label</td>
</tr>
<tr>
<td>Last label</td>
</tr>
</tbody>
</table>

#### 3.9.3.2 Create a new legend

To start creating a new legend, click on the **New legend** button. The legend definition window is opened in “new legend” mode.

Give the legend a descriptive name and fill in the fields “Min value”, “Max value” and “Title in legend”.

To create classes, click on the **New class** button as many times the legend needs. You will see a new class record appearing in the legend classes grid for each new class created, with the default values. To change the default values, click on a class field to edit the value manually. The classes are automatically sorted by the “From” field in ascending order and every change made will be reflected in the “Preview” area.

For the “Colour” field of each class, a colour picker is available. To open the colour picker, click on the icon.
Choose a colour from the colour picker and click on OK.

The colour picker will close and the selected colour will be filled in the colour field of the class in RGB format (with a space delimiter).
Instead of adding new classes by clicking on the “New class” button, you can also generate classes. Click on the button to open the window to setup the generation of classes.

Classes generation fields

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nr of classes</td>
</tr>
<tr>
<td>Start value</td>
</tr>
<tr>
<td>End value</td>
</tr>
<tr>
<td>Start colour</td>
</tr>
<tr>
<td>End colour</td>
</tr>
<tr>
<td>Apply class label</td>
</tr>
</tbody>
</table>

For example:
Click on the “Generate” button to generate the classes. The “Generate classes” window will close and you will see the generated classes in the “New legend” or “Edit legend” window.

Click on the button to delete all classes.

To save the legend, click on the “Save” button. Depending on the amount of classes, the saving might take some seconds. When the new legend is saved, a message will appear from the top of the browser. When the new legend is saved, the window title will change in “Edit legend”. 
3.9.3.3 Copy a legend

Select a legend from the list of existing legends and click on the \((\text{Copy legend})\) button.

The legend is copied and given the same name ending with – copy.
If you copied a JRC defined legend, the edit icon will appear next to the copied legend name and you can now edit the copy. Also the delete icon appears to delete the legend.

3.9.3.4 Edit a user defined legend definition

To edit a legend (not defined by the JRC), click on the icon next to the legend name in the legend administration window. The “Edit legend” window will be opened, where you can make any changes to the legend definition.
3.9.3.5 Assign legends to products

To assign a legend to a product, open the product navigator from any “Map view”, see paragraph 3.9.1.

Go to the product to which you want to assign a legend and click on the Assign legend button. A list of available legends will appear.

Select the legend you want to assign by clicking on the legend. To select more legends, hold the {Ctrl} key and select other legends. When you have selected the legends you want to assign to the product, click on “Assign selected legends”. The new assigned legend(s) will appear in the product navigator under the product’s colour schemes.
3.9.4  Layer administration

The Layer administration tool is available to:

- Edit a layer’s properties;
- Create a new layer;
- Upload a vector layer in .geojson format;
- Reorganize the layers under the layer menu button in Mapviews;
- Set layers to be automatically opened in a Mapview;

3.9.4.1  Open a layer

Open the Layer administration window by clicking on the button on the top left corner of the Analysis page.

In the Layer administration window you can quickly activate or de-activate a layer to be shown as an item under the layer menu button in Mapviews.

Under the “Load in Mapview” column you can quickly set a layer to be automatically loaded in a new Mapview. Setting too many (big) layers to be automatically loaded in a new Mapview, could crash the Browser! So it is advised to set maximum 3 layers to be loaded automatically.

3.9.4.2  Edit and add a layer

Edit a layer’s properties by clicking on the icon next to the layer.
Add a new layer by clicking on the **Add layer** button.
### Layer settings:

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Layer name</strong></td>
</tr>
<tr>
<td>The name of the layer as it appears in the menu.</td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>A description of the layer.</td>
</tr>
<tr>
<td><strong>Layer file name</strong></td>
</tr>
<tr>
<td>The name of the <code>.geojson</code> file present on the eStation2 under the directory <code>/eStation2/layers/</code> can only be selected from the list shown when clicking on the Select <code>.geojson file</code> button (see below).</td>
</tr>
<tr>
<td><strong>Feature display attributes</strong></td>
</tr>
<tr>
<td>A comma delimited list of feature attribute names that are present in the <code>.geojson</code> layer file. These attributes are shown in the tool bar area of a Mapview when going over a feature and in the Selected region under the time series area when selecting a feature. To find out which attributes are available in a vector layer file, open the file in QGIS and then open its attribute table.</td>
</tr>
<tr>
<td><strong>Provider</strong></td>
</tr>
<tr>
<td>The provider/creator of the layer. For example FAO Gaul 2015.</td>
</tr>
<tr>
<td><strong>Layer type</strong></td>
</tr>
<tr>
<td>The type of layer: Polygon, Line or Point.</td>
</tr>
<tr>
<td>Only support for Polygon layers has been implemented for now.</td>
</tr>
<tr>
<td><strong>Order index</strong></td>
</tr>
<tr>
<td>The priority given to the layer for selecting an area/feature. The highest priority is 1 and the lowest priority is 5 (e.g. for level 00 border layers).</td>
</tr>
<tr>
<td><strong>Layer menu</strong></td>
</tr>
<tr>
<td>The layer menu has 3 main menu items, Border layers, Marine layers and Other layers. A layer must belong to one of these main menu items.</td>
</tr>
<tr>
<td><strong>Sub menu</strong></td>
</tr>
<tr>
<td>Under the 3 main menu items sub menus can be defined. In this field you can give a name of the sub menu under which the layer will fall.</td>
</tr>
<tr>
<td><strong>Active</strong></td>
</tr>
<tr>
<td>A layer will appear in the layer menu when it is activated and will not appear in the layer menu when the layer is de-activated.</td>
</tr>
<tr>
<td><strong>Automatically open in new mapviews</strong></td>
</tr>
<tr>
<td>If this field is checked, the layer will automatically be loaded in a new Mapview.</td>
</tr>
</tbody>
</table>

Select a layer present on the eStation2 by clicking on the Select `.geojson file` button. A list is shown of all the `.geojson` files present under the directory `/eStation2/layers/` on the eStation2.
3.9.4.3 Import a layer

Import a layer file by clicking on the button. The layer has to be in .geojson format, which is the only format supported in a browser by the Javascript library Openlayers.
### 3.9.5 Graph view functionalities

In this version there are 4 types of graph available.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Profile</strong></td>
<td>To display the evolution(X axis) profile of a product value (Y axis) for a given period</td>
</tr>
<tr>
<td><strong>Cumulative</strong></td>
<td>To visualize the cumulated value(Y axis) of a product/indicator along the time (X axis)</td>
</tr>
<tr>
<td><strong>Ranking / Z-Score</strong></td>
<td>Sort the historical values of a product for a given period/year</td>
</tr>
<tr>
<td></td>
<td>Display the normalize value(y axis) of a product for a given period/year along the historical years(X axis)</td>
</tr>
<tr>
<td><strong>Matrix</strong></td>
<td>To display the seasonal(X-axis) value of a product along the historical years(Y-axis)</td>
</tr>
</tbody>
</table>

Each type has its own purpose, options and restrictions.

**IMPORTANT!**

To generate time series, visualized in a chart/graph, the user will have to select an area of interest from an added vector layer or a drawn geometry in one of the open Mapviews. The geometry of the selected area will be highlighted in **red** in the Mapview and its name shown in the “Selected region” box in the TIME SERIES GRAPHS panel.

#### 3.9.5.1 General steps to generate a time series graph

General steps to generate a time series graph, to be taken in the TIME SERIES GRAPHS panel on the right of the analysis tool:

1. Select an area of an added vector layer or a drawn geometry in one of the open Mapviews (See paragraph 3.9.2.10 Add vectorlayer).
2. Select one or more sub products.
3. Check the selected products and unselect the ones not needed.
4. Select a time frame
5. Click on the “Get timeseries” button

A new time series graph window will be opened, showing the chart type with the time series of the selected data sets, over the selected region of the chosen time frame.

All graphs are interactive and will show the time series values of each time series when moving the mouse of the chart.
3.9.5.2 Profile graph

Description

The profiles graph is used to display along the X axis time period from one to several Y axes products variables with different units and scales. The data can be displayed as a bar or line with different line thicknesses and colours...The font and styles of the titles and annotation can be interactively edited. The title can use the attributes name index of the entity (point/line/polygon) selected and from which the indicators value is calculated (count, average, cumulate, percentage, surface) as shown below.
Product selection

Multiple products can be selected from multiple product categories.
## Time frame selection

**Time frame**

<table>
<thead>
<tr>
<th>From: dd/mm/yyyy</th>
<th>To: dd/mm/yyyy</th>
</tr>
</thead>
</table>

**Available Years**

Multiple years can be selected from the list of available years of the selected sub products. In case of multiple years, the graph will show the time series of each sub products of each selected year.

Multiple years can be selected from the list of available years of the selected product. The checkbox near the “Available Years” title will select all the years.

<table>
<thead>
<tr>
<th>Available Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
</tr>
<tr>
<td>2016</td>
</tr>
<tr>
<td>2015</td>
</tr>
<tr>
<td>2014</td>
</tr>
</tbody>
</table>

**Compare seasons**

For the selected year(s) of interest give a season period in the “From-To” fields. The season period can span over 2 years, starting for example from 01/09 of the selected year(s) and ending on 01/05 of the following year.

<table>
<thead>
<tr>
<th>Compare seasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>From: 01/09</td>
</tr>
<tr>
<td>to: 01/05</td>
</tr>
</tbody>
</table>
### 3.9.5.3 Cumulative graph

**Description**

The graph displays the accumulation of the Y axis product variable from the first to the last dates selected on the X axis. It can be compared to another variable typically a specific year compared to the Long Term Average (or minimum or maximum) of the same variable. The positive difference is shown in green when the negative is red. Like for the profile graph it is possible to edit the line thickness and colour, the titles and axis fonts and colours.
Product selection

Multiple products can be selected from multiple product categories. All selected products will be a cumulative line in the time series graph.

In the table, you have the option to indicate what is the ‘Reference’ (Ref) product or the ‘Difference’ (Diff) product:

- when ‘Ref’ is below ‘Diff’ a RED color will be shown.
- when ‘Ref’ is above ‘Diff’ a GREEN color will appear.

Only one product is the Reference and one product the Difference.
Time frame selection

**Time frame**

<table>
<thead>
<tr>
<th>From – To</th>
<th>The “From-To” time frame can span over multiple years. Format dd/mm/yyyy.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
<td>Only one year can be selected from the list of available years of the selected products.</td>
</tr>
<tr>
<td><strong>Compare seasons</strong></td>
<td>For the selected year give a season period in the “From-To” fields. The season period can span over 2 years, starting for example from 01/08 of the selected year(s) and ending on 01/06 of the following year.</td>
</tr>
</tbody>
</table>

**Season**

| From: 01/08 | to: 01/06 |

| Year: 2015 |
3.9.5.4 Ranking / Z-Score graph

Description
To better compare the product value of a given period for a specific year with the historical time series it is possible to apply a ranking from the lowest to the highest corresponding value. It clearly shows the exceptional years with the highest or lowest values of the selected products.

Moreover, it is possible to display on the Y axis the Z-Score value $[(\text{Year value} - \text{Mean value})/\text{Standard deviation}]$ along the years X axis in a chronological order as shown below.
Product selection

Only one product can be selected for the Ranking / Z-Score.

For the selected product you have the option to visualize the Z-Score instead of Ranking.
### Time frame selection

**Available Years**

Multiple years can be selected from the list of available years of the selected product. The checkbox near the “Available Years” title will select all the years. With a Ranking and Z-Score graph you normally select all the years.

<table>
<thead>
<tr>
<th>Available Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
</tr>
<tr>
<td>2017</td>
</tr>
<tr>
<td>2016</td>
</tr>
<tr>
<td>2015</td>
</tr>
</tbody>
</table>

**Compare seasons**

For the selected years give a season period in the “From-To” fields. The season period can span over 2 years, starting for example from 01/01 of the selected year(s) and ending on 28/02 of the following year.

<table>
<thead>
<tr>
<th>Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>From: 01/01</td>
</tr>
<tr>
<td>To: 28/02</td>
</tr>
</tbody>
</table>
3.9.5.5 Matrix graph

Description

The Matrix graph (or HeatMap) is used to get a synoptic overview of the historical evolution of a specific product (like rainfall, temperature, NDVI...). It facilitated the identification of exceptional years and the inter years comparison. It displays on the X axis a specific seasonal value over the different historic year on the Y axis. To be consistent with the map the user can interactively select any existing map colour palette of a given product.

Full color palette display

Gradient color palette display
Product and colour scheme selection

Only one product can be selected for the Matrix graph.

Under the selected product you will find its available colour schemes, where the default colour scheme is selected. Choose the colour scheme you want to apply to the Matrix graph.

For the selected product you have the option to visualize the Matrix in gradient, which means that apart from the colour steps of the selected colour scheme, intermediate colours are generated. For colour schemes with more than 25 steps, the gradient still will automatically be taken.
**Time frame selection**

![Image of time frame selection]

<table>
<thead>
<tr>
<th>Available Years</th>
<th>Multiple years can be selected from the list of available years of the selected product. The checkbox near the “Available Years” title will select all the years.</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Available Years with checkmarks]</td>
<td>![Available Years with checkmarks]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compare seasons</th>
<th>For the selected years give a season period in the “From-To” fields. The season period can span over 2 years, starting for example from 01/09 of the selected year(s) and ending on 01/04 of the following year.</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Season from 01/01 to 01/05]</td>
<td>![Season from 01/01 to 01/05]</td>
</tr>
</tbody>
</table>
3.9.5.6 Chart zooming

You can also zoom in by selecting an area in the chart. The chart will change and show only the plot over the selected zoom.

To zoom out, click on the button in the chart.
3.9.5.7 Draw properties

To modify a graph you can edit the **draw** and the **chart** properties through two specific icons. For all the available time series datasets default **draw** properties are given. To change these **draw** properties, click on the icon on the top left of the graph window.

A new window will appear and to modify the **draw** properties of a specific products click on the corresponding icon .

The time series **draw** properties window will pop up for the dataset in question.
Yaxe ID

The Yaxe ID defines to which Yaxe the time series dataset belongs. When 2 or more time series datasets belonging to the same Yaxe ID are selected, then these datasets will fall under the same Yaxe in the chart. If the selected time series datasets belong to different Yaxe IDs, then for each Yaxe ID a Yaxe is created in the chart. Each Yaxe ID has common properties that can be changed in the chart properties (see paragraph 3.9.4.2).

<table>
<thead>
<tr>
<th>Name in legend</th>
<th>The name of the time series in the legend of the chart.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart type</td>
<td>The chart type, Line or Column.</td>
</tr>
<tr>
<td>Line style</td>
<td>The style of the line if chart type is Line. Styles are for example: Solid, Dot, Dash, DashDot, etc.</td>
</tr>
<tr>
<td>Line width</td>
<td>The width of the line if chart type is Line.</td>
</tr>
<tr>
<td>Colour</td>
<td>The colour of the time series dataset in the chart.</td>
</tr>
</tbody>
</table>

To apply the modification on the graph, click on the update button.

3.9.5.8 Chart properties

To open the chart properties, click on the button, found in the tool bar of a chart window.

Chart properties are the properties that apply to all charts generated, plus the properties of each X and Y Axis in the generated chart. Changing a property value will be applied immediately to the chart, except for the aggregation fields.

To apply the aggregation field changes, refresh the chart by clicking on the button.
Chart width (in px)  The width of the chart in pixels.

Chart height (in px)  The height of the chart in pixels.

Title  The chart title that by default is the name of the selected region.

Title colour  The colour of the chart title.

Title Font size  The font size of the chart title.

Sub title  The chart sub title that by default is the selected time period.

Sub title colour  The colour of the chart sub title.

Sub title Font size  The font size of the chart sub title.

Legend Font size  The font size of the chart’s legend items.

Legend Font colour  The font colour of the chart’s legend items.

xAxe Font size  The font size of the xAxe.

xAxe Font colour  The font colour of the xAxe.

yAxe # ID  The yAxe ID uniquely identifying the yAxe fields below. One or more time series datasets can have the same yAxe ID assigned, indicating that these datasets will appear on the same yAxe in the chart, when selected. This field cannot be edited here in the chart properties. You can change the yAxe ID for each time series dataset individually editing the time series draw properties (see paragraph 3.9.5.1 Time series draw properties).

yAxe # Title  The yAxe title.
### yAxe # Font size
The font size of the yAxe title and values.

### yAxe # Colour
The colour of the yAxe title and values.

### yAxe # Min
Set the yAxe minimum value to start with.

### yAxe # Max
Set the yAxe maximum value.

### yAxe # Opposite
If TRUE, the yAxe will be placed on the opposite/right side of the chart. If FALSE the yAxe will be placed on the left side of the chart.

### yAxe # Unit
The unit of the time series yAxe, shown in the yAxe title.

### yAxe # Aggregation type
Type of aggregation applied to compute the value at polygon level from pixels. Possible values are:

- **mean**: average of all valid values in the polygon. ‘Nodata’ values are excluded, while aggregation_min/max are not considered. Example: vegetation indicators (vgt-ndvi)
- **cumulate**: arithmetic sum of all valid values in the polygon; aggregation_min/max are not considered. Example: precipitation (fewsnet-rfe).
- **count**: returns the number of valid pixels in the polygon having values in the range aggregation_min to aggregation_max. Example: Active Fires (modis-firms)
- **percent**: returns the percent of valid pixels in the polygon having values in the range aggregation_min to aggregation_max. Example: in vegetation anomaly indicators, to identify strong anomalies.
- **surface**: geographic extension of the area – within the polygon – where pixels are in range aggregation_min to aggregation_max. Example: water bodies (wd-gee)

### yAxe # Aggregation min
Used for aggregation type ‘count’, ‘percent’ and ‘surface’ as described above.

### yAxe # Aggregation max
Used for aggregation type ‘count’, ‘percent’ and ‘surface’ as described above.

#### 3.9.5.9 Logo and disclaimer objects
Like for the map, the graph have Logo and Disclaimer objects that you can show and hide in the graph viewer.

To show the objects, click on the button. The button becomes green and the two objects are shown in the graph area.

---

7 In the current context, ‘valid’ means that we exclude the ‘nodata’ values.
You can move the two objects by click and hold on an object and drag it to reposition.

3.9.5.9.1 Edit Disclaimer object

Double-click the Disclaimer object to edit it. The disclaimer editor is shown. You can type any text and format the text using the available text formatting tools in the editor.

- To save your changes, click on the save button found in the header of the editor.

- The editor will close and the changes reflect in the disclaimer object of the Chartview.
3.9.5.9.2 Edit Logo object

Double-click the Logo object to edit it. The logo editor is shown.
The upper box contains the selected logo’s that will appear in the logo object. The lower box contains the available logo’s.

- Double-click on a logo in the selected logo’s box to remove the logo.
- Double-click on a logo in the available logo’s box to add the logo to the selected box.
- To save your changes, click on the save button found in the header of the editor.

- The editor will close and the changes reflect in the disclaimer object of the Chartview.

3.9.5.10 Dynamic/Static graph values

To explore the different values aggregated from the layer polygons/points the user can activate the exploratory mode icon from OFF to ON in the graph window tool bar.
When activated the user can select any polygon/point from the layer display in the mapview and the corresponding products values will be displayed interactively.

### 3.9.5.11 Download timeseries

To download the time series click on the “Download timeseries” button present in the tool bar of the “Time series chart” window.

The time series will be saved in XLS format and automatically downloaded in the download directory of the browser.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date/Time</td>
<td>NDVI</td>
<td>Rain</td>
<td>Rain 10 day LT</td>
</tr>
<tr>
<td>1/1/2002 00:00</td>
<td>0.34</td>
<td>11.25</td>
<td>6.05</td>
</tr>
<tr>
<td>1/11/2002 00:00</td>
<td>0.31</td>
<td>13.81</td>
<td>8.38</td>
</tr>
<tr>
<td>1/21/2002 00:00</td>
<td>0.34</td>
<td>4.37</td>
<td>8.05</td>
</tr>
<tr>
<td>2/1/2002 00:00</td>
<td>0.33</td>
<td>0.62</td>
<td>6.12</td>
</tr>
<tr>
<td>2/11/2002 00:00</td>
<td>0.29</td>
<td>10.59</td>
<td>7.80</td>
</tr>
<tr>
<td>2/21/2002 00:00</td>
<td>0.26</td>
<td>3.72</td>
<td>8.78</td>
</tr>
<tr>
<td>3/1/2002 00:00</td>
<td>0.25</td>
<td>48.48</td>
<td>14.55</td>
</tr>
<tr>
<td>3/11/2002 00:00</td>
<td>0.29</td>
<td>19.57</td>
<td>21.84</td>
</tr>
<tr>
<td>3/21/2002 00:00</td>
<td>0.12</td>
<td>28.63</td>
<td>33.64</td>
</tr>
<tr>
<td>4/1/2002 00:00</td>
<td>0.31</td>
<td>20.46</td>
<td>30.13</td>
</tr>
<tr>
<td>4/11/2002 00:00</td>
<td>0.30</td>
<td>54.86</td>
<td>41.44</td>
</tr>
<tr>
<td>4/21/2002 00:00</td>
<td>0.36</td>
<td>32.98</td>
<td>37.50</td>
</tr>
<tr>
<td>5/1/2002 00:00</td>
<td>0.42</td>
<td>75.63</td>
<td>38.13</td>
</tr>
<tr>
<td>5/11/2002 00:00</td>
<td>0.45</td>
<td>17.41</td>
<td>24.51</td>
</tr>
<tr>
<td>5/21/2002 00:00</td>
<td>0.44</td>
<td>9.05</td>
<td>21.01</td>
</tr>
<tr>
<td>6/1/2002 00:00</td>
<td>0.41</td>
<td>11.33</td>
<td>16.05</td>
</tr>
<tr>
<td>6/11/2002 00:00</td>
<td>0.31</td>
<td>29.43</td>
<td>13.91</td>
</tr>
<tr>
<td>1/21/2002 00:00</td>
<td>0.33</td>
<td>14.65</td>
<td>11.12</td>
</tr>
</tbody>
</table>
3.9.5.12 Save graph as PNG image

To export a time series chart click on the “PNG” button present in the tool bar of the “Time series chart” window.

A snapshot of the chart will be made in PNG format and automatically saved in the download directory of the browser.

3.9.5.13 Graph template

In this new eStation version the user as the possibility to save a graph as a template and manage a list of graph templates. The resulting template will keep the window size, the logo and disclaimer objects size and position, the chart and draw properties. There are two possibilities of saving a template: when it is a new graph or an existing one.

Like for the maps you must be logged in to have the possibility to save your graph templates.

- Save a new graph

When it is a new graph the user can save the graph with the button in the graph window toolbar.

A new window popup to type the name of the template as below:

![Graph Template Name](image)

The template will be saved in the template repository.

- Save an existing graph

If the graph exist already, the toolbar will show an extra button as below:
To just update the existing graph with the same name click on the “Save » icon

To use the display graph as template for further editing “Save as” icon in the tool bar. Then a window will pop up to enter a new graph template name.

And will be saved in the graph template repository.

3.9.5.14 Manage the graph templates

Like for the maps there is now a specific repository for the different graph templates call “MY GRAPHS”.

By selecting the line of interest, the user can

- load any existing template by using in the current workspace
- or delete it from the repository with icon.
### MY GRAPHS

<table>
<thead>
<tr>
<th>Graph template name</th>
<th>Delete</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST_ZSCORE</td>
<td></td>
</tr>
<tr>
<td>NDVI &amp; FIRE</td>
<td></td>
</tr>
<tr>
<td>RANK Congo</td>
<td></td>
</tr>
<tr>
<td>PP &amp; Kd</td>
<td></td>
</tr>
<tr>
<td>NDVI &amp; RFE - NAFR</td>
<td></td>
</tr>
</tbody>
</table>

[Open selected]
### 3.10 System

The ‘System’ page hosts a series of operations that belongs either to the ‘System Settings’ categories or to some ‘Diagnostic’ tasks.

#### Figure 14: System settings page overview

#### 3.10.1 Functionality

1. In this section for information only, the type of installation is displayed and the role of the machine (PC2 or PC3).

2. The mode in which the machine is in is shown for information only. Changing the mode from Nominal to Recovery and vice versa is possible through the CentOS menu: System → Mesa - Puma.

3. To change from the current version to a different (older or newer) version of the eStation, already installed on the machine, click on the ‘Modify’ button next to it. A small popup window will be shown where the version can be changed. Select a different version in which the machine
is already in and the Save button will be enabled. Click on the Save button to change the selected version.

![Change version]

4. To change from the Active Theme to a different Theme, click on the ‘Modify’ button next to it. A small popup window will be shown where the list of predefined CIC/RICs is displayed, and the Theme can be changed. Select a different Theme than the active Theme and the Save button will be enabled. Click on the Save button to change to the selected Theme.

**IMPORTANT NOTE:** in normal operations is NEVER foreseen to change the machine from one Theme to another, which has an high impact on the datasets enabled/disabled on the machine.

![Change Theme]

5. To change from the Active Log level to a different Log level, click on the ‘Modify’ button next to it. A small popup window will be shown where the Log level can be changed. Select a different Log level than the active Log level and the Save button will be enabled. Click on the Save button to change to the selected Log level.
6. Create the System Report by clicking on its button ![Create System Report](image). The System Report will instantly be created and downloaded (saved in the download directory of the browser).

7. Create the Install Report by clicking on its button ![Create Install Report](image). The Install Report will instantly be created and downloaded (saved in the download directory of the browser).

8. In this section, various important directory settings can be changed. Click on the Save button (11) to save any changes made,

9. For information only the database settings are shown.

10. To go back to the factory settings of the various important directory settings, click on the ‘Reset to factory settings’ button.

11. Save the changes.

12. Ingest Archive runs on the “Archive” directory set next to the ![Ingest Archive](image) button. First put the archive you want to ingest in the “Archive” directory or change the “Archive” directory to the directory where you have put the archive to ingest on the eStation 2.

By clicking on the small arrow pointing down, a menu will appear where you can:
- Run the ingestion
- Stop the ingestion when it’s running,
- Restart the ingestion
- View the ingest archive log file.
When the ingestion of the archive is running, a circling icon in the “Ingest Archive” button will indicate that the ingestion is running.

The ingestion might take a long time, but will not stop when you close your browser. If you reopen your browser you will still see that the ingestion is running by the circling icon in the “Ingest Archive” button.
3.11 Help


In addition, some links to useful web sites and specific Notes documentation are available on the Help page.

Clicking on a User document or Note will open the file in a new browser tab. Clicking on a Useful link will open the link in a new browser tab.

The current chapter provides more insights on the functioning of the eStation, and it is especially meant for Advanced Users aiming at strongly customize the application, e.g., for generating additional derived products.

It is composed by two sections:

- **Different types of Installation**: all existing options for installing eStation 2 are described, including the pro/cons evaluation.

- **Detail of Services**: the ‘behind-the-scenes’ execution of the services is explained, in order to allow the Users a better understanding of the application functioning. This is a mandatory step before further customization of the system.
4.1 Different Types of Installation

The MESA users received the eStation 2 as part of the MESA station: the application is installed on PC2 and PC3, and we are in the ‘Full MESA’ case (see 4.1.1 below). Additional cases are described here, which might be of interest for the MESA beneficiaries for additional installations (beyond the MESA station) or for User outside the MESA Project.

4.1.1 Full MESA eStation (default case)

The MESA beneficiaries will receive dedicated HW for the installation of the eStation, consisting of 3 computers (see Figure 1): PC1 (aka ‘Receiving Station’), which is connected to the external antenna, and PC2 and PC3 for the installation of eStation 2.

eStation 2 is therefore installed on 2 computers, and the various tasks are shared between the machines, in order to ensure load share. In this case, the OS of the machines is CentOS 6.6. The connection to the Internet – when available in the Institution - enables the system to access additional data sources (see get internet Service) and makes Remote User support also feasible.

Note that an identical configuration can be reached by installing the new eStation 2 software on the PC2/3 of the AMESD station.

4.1.2 Single Computer (or Light eStation)

The eStation 2 can also be installed on a single computer under CentOS 6.6, and all processing/visualization functionalities can be activated, with the exception of the ones related to the hardware redundancy (i.e. the data backup to PC3 and the activation of the Recovery Mode).

This option is foreseen for all the Users who do not receive the ‘Full MESA Station’, and who intend to use a single computer for the eStation, limiting the HW investment. Connection to the EUMETCast Receiving
Station and to the internet will be activated whenever possible; the resulting system is not recommended for implementing the MESA operation services, rather for associated Users like University, students, thematic experts.

### 4.1.3 Live USB key/HD

An external USB device (disk/key) can be used as a ‘boot’ device for an existing computer (either desktop or laptop) by modifying the BIOS settings, and without modifying the original hosting machine. With this approach, which is somehow similar to replacing temporarily a disk of the computer for a limited amount of time, the User can keep both the eStation application and datasets on a single external disk, and ‘run’ it from different machines, when necessary. It is therefore suggested for non-operational use of the eStation (demo, training, travelling), similarly to AMESD ‘StandAlone’ application, but with the benefit of having all features of the system available.

### 4.1.4 Virtual Machine

Various ‘virtualization’ environments exist (including VM-ware and Oracle Virtual Box) for providing the User with the option of running, e.g., a CentOS ‘virtual machine’ on a Windows computer. In such an environment, the eStation 2 can be installed and run, with some limitations of the performances and disk space. Similarly to the Live USB solution, Virtual Machine installation is suggested for demonstration and testing purposes rather than normal operations.

Table 1 summarizes the options of the various above-described installations, in terms of number of computers, operating system, connection to EUMETCast and the Internet and expected usage.

<table>
<thead>
<tr>
<th>Installation</th>
<th>Number of PCs (for eStation only)</th>
<th>OS</th>
<th>EUMETCast connection</th>
<th>Internet connection</th>
<th>Foreseen Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Station</td>
<td>2</td>
<td>CentOS 6.6</td>
<td>yes</td>
<td>whenever possible</td>
<td>This is the default case for the ‘official’ MESA beneficiary Institutions, included in the list of the Supply Contract - Lot 1</td>
</tr>
<tr>
<td>Single PC</td>
<td>1</td>
<td>CentOS 6.6</td>
<td>whenever possible</td>
<td>whenever possible</td>
<td>This case is envisaged for ‘additional’ Users of the MESA project, or external Users, willing to exploit a single PC for the application, e.g. partner Universities.</td>
</tr>
<tr>
<td>Live USB</td>
<td>1</td>
<td>any(^8)</td>
<td>whenever possible</td>
<td>whenever possible</td>
<td>Demonstration of the tool, analysis by thematic User on additional PCs (e.g. while travelling).</td>
</tr>
<tr>
<td>VM</td>
<td>1</td>
<td>any</td>
<td>whenever possible</td>
<td>whenever possible</td>
<td>Demonstration of the tool, analysis by thematic User on additional PCs (e.g. while travelling), tests of the installations.</td>
</tr>
</tbody>
</table>

\(^8\) The USB device (key/disk) will be connected to a computer to be re-booted from the device; therefore the OS of the PC is not relevant.
4.2 Detail of Services

As explained in section 2.1, the eStation is mainly an EO data processor, and three main types of Services exist for processing data: the data retrieval (or ‘Get’ services), the format conversion (‘Ingestion’ service) and the generation of derived products (‘Processing’ service).

For each service we describe in the current section what is its role and goal (‘What it does’), its functioning mechanism (‘How it works’) and how its configuration is managed (‘Configuration’). The last part refers to the database tables containing the settings related to the service. An additional paragraph (‘References’) contains specific references to the filesystem components (input and directories, temporary working repositories, lock files and so on) managed by the service.

As already mentioned in section 2.4.7, there are two distinct services for retrieving external datasets on the eStation, from the PC1 (Get EUMETCast) and from remote servers (Get Internet). They have some commonalities, being the latter slightly more complex for the need of accessing various and different directories structures.

4.2.1 Get EUMETCast Service

What it does

The service copies files that are made available by Tellicast and FTS services in a directory of PC1, which is accessed through ftp by PC2 (or by PC3 in Recovery mode). This is a ‘pull’ approach and it does not take care of the house-keeping of the files in the original directory (see Figure 16)

![Input directory (by default '/eumetcast/')](image)

![Output directory (by default '/data/ingest/')](image)

Figure 16: Get EUMETCast Service

As anticipated in paragraph 2.4, a location containing files belonging to the same EO product is defined as a ‘data source’. The ‘data sources’ are processed independently from each other, and they can be activated/deactivated while the Service is running, so that they are taken into consideration at the next process cycle without need of a re-start.

How it works

The service should also ensure that a file in the input directory is copied to the output directory only once, and not continuously overwritten; therefore, a list of the already copied files is created and maintained for each of the data sources. Note that the files removed from the input directory are also removed from the list.

---

9 This file is called ‘get_eumetcast_processed_lists’.
and, consequently, if a file is re-disseminated after having been deleted from input dir\(^{10}\), it will be copied again by the Service.

The overall organization of the Get EUMETCast service can be represented as below:

Loop over all active EUMETCast data sources and, for each of them:

- Create a list of files in input directory that match the EUMETCast source (i.e. a regular expression\(^{11}\)).
- Generate list of files to be copied, i.e. the existing ones not yet copied.
- For each of the files to be copied:
  - Copy from ‘input’ to ‘output’ directory
  - Add the file to the list of copied files
- Check if all files in the list still exists in the filesystem (and clean the list accordingly)
- Save the list

**Configuration**

The Service is configured and controlled by two tables in the postgresql database (see also Chapter 4 of the Administration Manual).

The `eumetcast_source` table contains the description of all products disseminated by EUMETCast: Figure 17 displays a subset of the table, including the columns `eumetcast_id` (used to identify uniquely the source) and the `filter_expression_jrc`, used for associating the source the input files.

![Figure 17: eumetcast_source table.](image)

A specific EUMETCast source is associated to an eStation product though the `product_acquisition_data_source`, which is displayed in Figure 18. In order to uniquely identify the native subproduct, the triplet `product/subproduct/version` is specified in the table. Note also that this table is common between the two ‘get’ services (EUMETCast and Internet).

---

\(^{10}\) Retention time of input directory is normally 1 week.

\(^{11}\) A ‘regular expression’ (see [https://en.wikipedia.org/wiki/Regular_expression](https://en.wikipedia.org/wiki/Regular_expression)) is a string containing characters that can match several strings, e.g. several similar filenames.
The configuration of the Get EUMETCast Service consists in two main steps:

1. Defining (modifying/adding) the sources in *eumetcast_source table*.
2. Associating the source to the products in the *product_acquisition_data_source* table.
3. Activating/Deactivating the single source in the *product_acquisition_data_source* table.

The first two steps are pre-set in the eStation 2 by JRC for all the products proposed to the Users, and need to be done only for additional products (Advanced Users). The activation/deactivation might be modified by the User according to its thematic needs and some specific operational constrains. The procedure for performing these operations though the GUI is described in Section 3.

**References**

Table 9 contains all the elements in the filesystem, both files and directories, that are relevant for the Service implementation, and is meant as a Reference for advanced Users.

<table>
<thead>
<tr>
<th>Element</th>
<th>Directory</th>
<th>File</th>
<th>Example/Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Dir</td>
<td>/eumetcast/</td>
<td>-</td>
<td>-</td>
<td>Input directory of the service.</td>
</tr>
<tr>
<td>Output Dir</td>
<td>/data/ingest/</td>
<td>-</td>
<td>-</td>
<td>Output directory of the service.</td>
</tr>
<tr>
<td>Process</td>
<td>&lt;BASE_DIR&gt;*/eStation2/apps/acquisi</td>
<td>get_eumetcast_py</td>
<td>-</td>
<td>Python module that implements the Service.</td>
</tr>
<tr>
<td>Process pid file</td>
<td>/tmp/eStation2/services/</td>
<td>get-eumetcast.pid</td>
<td>-</td>
<td>Stores the pid(^\text{13}) of the service.</td>
</tr>
<tr>
<td>Processed list</td>
<td>/eStation2/get_lists/get_eumetcas</td>
<td>get_eumprocessed_list_&lt;source_id&gt;.list</td>
<td>get_eum_processed_list_&lt;source_id&gt;.list</td>
<td>List of the files already copied for a specific source.</td>
</tr>
</tbody>
</table>

\(^\text{12}\) The base directory of the eStation installation.

\(^\text{13}\) Process Identifier, a unique integer number associated to the Linux process.
### 4.3 Get Internet

**What it does**

The service copies files available on remote ftp/http servers to the local machine, into a directory that is by default the input directory of the ingestion service.

**How it works**

The main differences in the mechanism of the Get Internet Service with respect to the Get Internet are:

1. In addition to the location of the remote files (a URL address), user credentials have to be provided (username and password).
2. On the remote server a complex directory structure can exist (see examples below).
3. Unlike for the Near Real Time (NRT) dissemination of EUMETCast, a full collection of data normally exists on the remote server, which potentially covers a large time-window; therefore time sub-setting has normally to be considered.

Note also that when a file is removed from the remote source, its name is not removed from the list of the processed file. As a consequence, files removed and re-inserted on the remote server are not downloaded a second time: the only option for re-downloading files is to manually clean the processed list.

The overall process for the Get Internet service is described below:
Loop over active Internet sources

- Create a list of files on the remote server that match the internet source definition (either type 1 or 2).
- Compute list of files to be copied, i.e. the ones available but not yet copied
- For each file to be copied:
  - Download the file to the local target dir.
  - Add the file to the list
- Save the list

Configuration

The Get Internet service takes into account the existence of both ftp servers, whose directory tree can be ‘navigated’ to search for the requested files, and http servers, where the exact location and naming of the files has to be known in advance. The two cases are described separately hereafter.

Type 1: ftp servers

Let’s start from an example and consider the NOAA ftp server at the address ftp://ftp.cpc.ncep.noaa.gov, which is possibly a very rich and articulated site we access for retrieving, e.g., the CMORPH V 1.0 dataset. The specific dataset we are interested in (8 km resolution, 30 minute repeat cycle raw data) is located under the directory:

ftp://ftp.cpc.ncep.noaa.gov/precip/CMORPH_V1.0/RAW/8km-30min/

This address is therefore the starting point of our search in the server: as displayed in Figure 20, data are organized in subdirectories named after the year. The filename is like CMORPH_V1.0_8km-30min_201103.tar.

![Index of /precip/CMORPH_V1.0/RAW/8km-30min/](image)

Figure 20: Example of ftp server (CMORPH dataset)

The idea is to identify the files to be downloaded through a regular expression, composed by two parts:

- A fixed prefix that represent the starting point of the search. It is called ‘url’ and in our example is:

  url = ftp://ftp.cpc.ncep.noaa.gov/precip/CMORPH_V1.0/RAW/8km-30min/
• A variable part for identifying all subdirectories and filenames we are interested in. In our example is:

\[
\text{include\_files\_expression} = [12][0-9][0-9][0-9]/\text{CMORPH\_V1.0}.*
\]

Note that the part ‘[12][0-9][0-9][0-9]/’ corresponds to the ‘year’ subdirectory, and CMORPH_V1.0.* matches all files, regardless to their date.

These two variables are sufficient to define the ‘internet source’ for the ftp servers.

**Type 2: http servers**

Unlike for the ftp servers, on the http servers there might be restrictions in reading the contents of a directory, so that it is possible to access and download a given file, but not to ‘walk’ the directory tree down to that file. Consider as an example the Ocean Colour datasets distributed by GSFC-NASA at the address [http://oceandata.sci.gsfc.nasa.gov/cgi/getfile/](http://oceandata.sci.gsfc.nasa.gov/cgi/getfile/): entering in a browser this address the remote directory is not displayed, while it is possible to download the files by indicating the full name, e.g.:

[http://oceandata.sci.gsfc.nasa.gov/cgi/getfile/A2015048.L3m\_DAY\_CHL\_chlor\_a\_4km.bz2](http://oceandata.sci.gsfc.nasa.gov/cgi/getfile/A2015048.L3m_DAY_CHL_chlor_a_4km.bz2)

As a consequence, we cannot read the contents of the remote directories and match it with some regular expression; the full filename has instead to be known in advance, including the variable part related to the observation date. The approach adopted for the http servers is therefore slightly more complicated than for the ftp servers, and is based on 3 elements, as described below.

• A fixed ‘url’ is provided as the initial part of the URL address, e.g.:

\[
\text{url} = \text{http://oceandata.sci.gsfc.nasa.gov/cgi/getfile/}
\]

• A ‘template’ is provided to define the remaining part of the path (subdirectories and filename), which depends on the date. This part is still called ‘include\_files\_expression’, as for ftp servers, but its definition is different. It is not anymore a ‘regular expression’, rather a template containing %type elements that represents part of a date field (e.g. year, month, day of the month), and for the CHL source of our example will be:

\[
\text{include\_files\_expression} = A\%Y\%j.L3m\_DAY\_CHL\_chlor\_a\_4km.bz2
\]

Note that the same notation as in UNIX date function is adopted\(^\text{14}\): in the following table we reproduce the format fields most commonly used:

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>%Y</td>
<td>4-digit year</td>
<td>2015</td>
</tr>
<tr>
<td>%m</td>
<td>2-digit month</td>
<td>12</td>
</tr>
<tr>
<td>%d</td>
<td>2-digit day of</td>
<td>01</td>
</tr>
<tr>
<td>%H</td>
<td>2-digit hour</td>
<td>23</td>
</tr>
<tr>
<td>%M</td>
<td>2-digit minute</td>
<td>59</td>
</tr>
</tbody>
</table>

\(^{14}\) See e.g. [http://www.cyberciti.biz/faq/linux-unix-formatting-dates-for-display/](http://www.cyberciti.biz/faq/linux-unix-formatting-dates-for-display/)
Table 10: Date formats

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>%j</td>
<td>3-digit day-of-year (from 1 to 366)</td>
<td>121</td>
</tr>
<tr>
<td>%{dkm}</td>
<td>1 digit dekad of month</td>
<td>1, 2, 3</td>
</tr>
</tbody>
</table>

- Three fields are defined to define all dates in a given period, namely:
  - start_date, end_date of the period
  - frequency, i.e. the repeat cycle of the product (every day, every 30 minute)

On the basis of the 'start_date', 'end_date' and frequency, all possible dates are computed and for each of them the corresponding filename is derived by using the expression defined through the `include_file_expression`. This filename is added to the initial path specified at point a, in order to have the full path.

**Configuration**

The Service is configured and controlled by two tables in the postgresql database (see also chapter 4 of the Administrator Manual). The ‘internet_source’ table contains the information necessary to identify the remote source and the files to be retrieved from it; in Table 11 a description of the columns relevant for the current discussion is provided.

---

15 This format is a specific implementation on the eStation, and represent the ‘decade’ in the range 1..36.
<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
<th>Example/List</th>
</tr>
</thead>
<tbody>
<tr>
<td>internet_id</td>
<td>Unique Identifier, user defined</td>
<td>GSFC:CGI:MODIS:CHLA:1D</td>
</tr>
<tr>
<td>defined by</td>
<td>Who has defined the field (either JRC or the user)</td>
<td>JRC</td>
</tr>
<tr>
<td>descriptive Name</td>
<td>A descriptive name to identify the source</td>
<td>MODIS 4km Chla Daily</td>
</tr>
<tr>
<td>description</td>
<td>A (possibly more detailed) description</td>
<td>MODIS 4km Chla Daily</td>
</tr>
<tr>
<td>username</td>
<td>User name for server access</td>
<td>anonymous</td>
</tr>
<tr>
<td>password</td>
<td>Password</td>
<td>anonymous</td>
</tr>
<tr>
<td>type</td>
<td>Type of server to be accessed (ftp or http)</td>
<td>ftp: type 1 above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>http_tmpl: type 2</td>
</tr>
<tr>
<td>include_filter_expression</td>
<td>Expression to match the variable part of the full path. It is a ‘regular expression’ for ftp servers and a ‘template’ for http ones.</td>
<td>A%Y%j$L3m_DAY_CHL_chlor_a_4km.bz2</td>
</tr>
<tr>
<td>files_filter_expression</td>
<td>Expression for matching the downloaded files in the ingestion phase. It is always a regular expression (also for the http) and refers only to the filename (not subdirectories).</td>
<td>.*.$L3m_DAY_CHL_chlor_a_4km.bz2</td>
</tr>
<tr>
<td>status</td>
<td>Status of activation of the source: it should always be on, unless the source is obsolete or still under test. Note that the activation of the get for the source is done in pads table.</td>
<td>True</td>
</tr>
<tr>
<td>pull_frequency</td>
<td>The string identifying the repeat cycle (or frequency) of the dataset to be retrieved. It applies only to http server.</td>
<td>e1dekad (i.e. every ‘dekad) e1month (i.e. every month)</td>
</tr>
<tr>
<td>frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>start_date</td>
<td>Start date of the period to be considered, in format YYYYMMDD. It applies only to http server.</td>
<td>20150101</td>
</tr>
<tr>
<td>end_date</td>
<td>End date of the period to be considered, in format YYYYMMDD. It applies only to http server.</td>
<td>20150631</td>
</tr>
</tbody>
</table>

Table 11: Contents of Internet source table (partial)

One, or more, specific sources can be associated to a ‘native’ subproduct though the ‘product acquisition data table’, which is displayed in Figure 18. Note that the table is common between the two ‘get’ services.
Figure 21: product acquisition datasource table

References

Table 12 contains all the elements in the filesystem, both files and directories, that are relevant for the Service implementation, and is meant as a Reference for advanced Users.

<table>
<thead>
<tr>
<th>Element</th>
<th>Directory</th>
<th>File</th>
<th>Example/Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Dir</td>
<td>/eumetcast/</td>
<td>-</td>
<td>-</td>
<td>Input directory of the service</td>
</tr>
<tr>
<td>Output Dir</td>
<td>/data/ingest/</td>
<td>-</td>
<td>-</td>
<td>Output directory of the service</td>
</tr>
<tr>
<td>Process</td>
<td>&lt;BASE_DIR&gt;/eStation2/apps/acquisition/</td>
<td>get_eumetcast_py</td>
<td>/srv/www/eStation2/apps/acquisition/get_eumetcast.py</td>
<td>Python module in charge of the service</td>
</tr>
<tr>
<td>Process pid file</td>
<td>/tmp/eStation2/services/</td>
<td>get-eumetcast.pid</td>
<td></td>
<td>Stores the pid(^{16}) of the service.</td>
</tr>
<tr>
<td>Processed_list</td>
<td>/eStation2/get_lists/get_eumetcast/</td>
<td>get_eum_processed_list_&lt;source_id&gt;.list</td>
<td>get_eum_processed_list_&lt;source_id&gt;.list</td>
<td></td>
</tr>
<tr>
<td>Ancillary Info</td>
<td>/eStation2/get_lists/get_eumetcast/</td>
<td>get_eum_processed_list_&lt;source_id&gt;.info</td>
<td>get_eum_processed_list_&lt;source_id&gt;.info</td>
<td></td>
</tr>
</tbody>
</table>

Table 12: Filesystem elements relevant for get_eumetcast service

\(^{16}\) Process Identifier, a unique integer number associated to the Linux process.
4.3.1 Ingestion Service

What it does

The main goal of the ingestion Service is to extract from the retrieved files the subproducts needed by the thematic User, for the specific mapsets he has defined. These subproducts are therefore stored in the standard eStation format (GTIFF containing specific tags), and ready on the system for visualization and further processing.

The complexity of the ingestion service, with respect to the Get services, relies, a part from the geo-processing of various formats, on the fact that several subproducts can be extracted from the same files, and for more than one mapset. Furthermore, the same product might have been retrieved from different sources (e.g. EUMETCast and Internet, or different internet servers), having each source a different file naming and format.

How it works

To deal with the above described complexity, the overall service is organized in two main steps:

- Identify the files from a source to be processed for a specific product.
- Process the files to extract the subproducts for the defined mapset (or mapsets).

Step 1: select the files for a product/source

The overall mechanism of the ingestion loop is described in Figure 22. Its role is to select a list of files existing in the input directory to be passed to a specific routine that extracts from them the defined subproducts for the active mapsets.

As first action, the list of all products whose ingestion is active (see also Figure 11) is created. For each of them, the sources it has been retrieved from are identifying, and each source is treated separately, as the files coming from the various sources of the some product might be in a different format, or at least have a different filename.

Once a source is selected, it is possible to identify in the input directory all the files retrieved from that source, and to group them by date\(^{17}\). These files can subsequently be treated in order to extract from them one or more subproducts, for one or more mapsets.

---

\(^{17}\) For each date, one or more file can exist, depending on the policy adopted by the data provider. In same case, namely the low resolution products, a single file exist, having continental or global coverage. With higher spatial resolutions, the information is stored in various files, also known as tiles or regions.
Step 2: process the files to extract subproducts

A single file, or a list of files covering adjacent geographic areas, are passed to a routine to process them and extract the numerical value to be converted into physical values and stored in eStation2 format. Each of the file can be in various file format (e.g. GTIFF, HDF4, HDF5, netcdf, HRIT, grib) and can contain one or more layers. The operations performed in this step are listed in Figure 23.

A pre-processing is applied in order to have, as intermediate step, a set of GTIFF and geo-referenced files containing a single subproduct. According to the native format, the series of performed operation is different. In the most general case, the pre-processing does the following:

- Unzip the files (from .gzip, .tgz, .bz2)
- Extract the physical values for each subproduct, and do mosaicking
- Write the values in a GTIFF format
- Geo-reference the file.

This pre-processing highly depends on the nature of the input files: a set of pre-processing routines are defined in order to deal with the most common cases.

Once the intermediate files are generated in a temporary working space, the generation of the eStation2 standard files is performed by:

- Converting the digital numbers to physical values, and convert back to digital number with a standard convention (see 2.4).
- Apply the geographic clipping/re-projection to generate the output with the defined mapset (i.e. for a specific boundary box and projection)
- Write to the files the eStation2 metadata (see 2.4)
Configuration

Several tables are involved in the configuration of the ingestion mechanism, and their relationship is represented in Figure 24, in a simplified manner. The tables used for the Get services are also involved because, as already specific, the format and naming of files containing the some product can vary according to the source.

The Product table is the pivot table for the eStation2: therein all retrieved/processed and visualized products have to be defined. The Ingestion table establish the relationship between a product/subproduct\textsuperscript{18} and the mapset we will apply in the ingestion. The product\_acquisition\_data\_source table associate a product and a source, which can be of ‘EUMETCast’ or ‘Internet’ type. This table has been already described in previous paragraphs, as well as the Datasource\_Description (see 2.4.6), which mainly defines the rule adopted for the file naming. The Sub\_Datasource\_Description table contains the description of the contents of the input files (i.e. how many layers are present, what are the scale factor and offset, nodata coding). This table is directly

\textsuperscript{18} Always identified by the product/version/subproduct triplet.
linked to the Product table, to establish a relationship between the various layers in the files, and the associated subproducts.

Figure 24: DB tables for ingestion
4.3.2 Processing Service

What it does

The ‘processing’ service is devoted to compute EO products and indicators from the ones already existing in the system, i.e. to implement some algorithms and put them in operations. These algorithms can include re-projection functionalities, computation of temporal composition (e.g. from 10d to 1 month precipitations), computation of long term statistics and anomalies, or more complicated operations. For the implementation of the service we base on the ‘ruffus’ python library\(^{19}\), which is part of the eStation 2 installation.

How it works

As a first step, the ‘processing’ chain to be implemented is defined by detailing the starting product (or products) and all computed products generated from them, which can represent either an intermediate result or a final indicator to be used.

In Figure 25 the processing chain for ‘standard precipitation’ products is displayed. The starting product is the 10-day Rainfall estimate (RFE) from which we compute the inter-annual statistics: min, max, average and median (step 1). From the product and these statistics several ‘anomalies’ are computed in Step 2 (10ddiff, 10dperc, 10dNPcum). Then, in step 3.a, we restart from the 10d product and we compute the cumulated precipitation over the month (1monCum); subsequently, statistics (step 3.b) and anomalies (step 3.c) are derived at the monthly level.

![Figure 25: example of a processing chain](image)

This processing chain is coded in python by following the ruffus approach, i.e. by creating a ‘pipeline’ that receives in input the 10d product, and defines all products depending on it. The added value of the ‘ruffus’ library is that, once all dependencies between input and output products are defined, the code is able to determine autonomously which outputs are missing with respect to the available inputs, and to trigger the computation of these images only.

\(^{19}\) See [http://www.ruffus.org.uk/](http://www.ruffus.org.uk/)
On the eStation 2 release, a number of chains are defined, as described in Table 13; additional processing chains will be provided in the following releases.

<table>
<thead>
<tr>
<th>Algorithm name</th>
<th>Options</th>
<th>Inputs</th>
<th>Outputs (by group)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>std_precip</td>
<td>std_precip_prods_only&lt;br&gt;std_precip_stats_only&lt;br&gt;std_precip_all</td>
<td>A single precipitation product (e.g. 10d RFE)</td>
<td>10d stats&lt;br&gt;10d anomalies&lt;br&gt;1mon cumulate&lt;br&gt;1moncum stats&lt;br&gt;1moncum anomalies</td>
<td>The ‘stats_only’ option compute 10d-stats and 10d-cum-stats only. The ‘prods_only’ option compute 10d-anomalies and 1moncum and 1moncum-anomalies only. The ‘all’ stats computes everything. This processing chain is displayed in Figure 25</td>
</tr>
<tr>
<td>std_ndvi</td>
<td>std_ndvi_prods_only&lt;br&gt;std_ndvi_stats_only&lt;br&gt;std_ndvi_all</td>
<td>A single ndvi product (e.g. vgt-ndvi).</td>
<td>See</td>
<td></td>
</tr>
<tr>
<td>merge</td>
<td>-</td>
<td>Two or more products whose timeseries have to be joined (e.g. NDVI from SPOT-v1, SPOT-v2 and PROBA-V)</td>
<td>A single output (the merged timeseries from the inputs)</td>
<td>For each input product, the temporal window to be considered has to be provided.</td>
</tr>
<tr>
<td>std_fronts</td>
<td>-</td>
<td>A Sea Surface Temperature (SST) product.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 13: List of available processing chains

The full processing chain of ndvi is graphically represented in Figure 26 and Figure 27. The starting point is a single ‘NDV’ product, and the following steps are defined:

1. Compute the statistics (1.a) and anomalies (1.b) from NDVI.
2. Apply a two-steps filtering procedure to filter the cloud contaminated pixels (2.a), and on the basis of the final result (ndvi_filterx2):
   2.b Computed statistics
   2.c Compute a ‘baremask’ product (to filter out the non-vegetated areas)
   2.d Compute the anomalies (e.g. ICN, VCI)
3. From the filtered NDVI, compute the monthly product (3.a), and from it:
   3.b Compute statistics
   3.c Compute the monthly ‘baremask’ product
   3.d Compute the monthly anomalies
The detailed description of this chain (the most complex implemented in the application) goes beyond the scope of this Manual, and is treated in the training sessions.

**Configuration**

Once the processing chains have been coded and are available on the system, the configuration of the service, which loops over all active chain, is rather simple: it is enough the assign the input and output products to each chain, and say which ones are active.
This goal is achieved through two separate tables: the ‘processing’ and ‘process_product’ table. The former (see Figure 28) define, for each processing chain, an ‘id’, the ‘algorithm’ to be applied, and the ‘options’ (named ‘derivation_method’). Furthermore the ‘mapset’ is declared, which refers to the output products generated and the chain is enabled.

### Figure 28: ‘processing’ table

<table>
<thead>
<tr>
<th>process_id</th>
<th>defined_by</th>
<th>output_mapset</th>
<th>activated</th>
<th>derivation_method</th>
<th>algorithm</th>
<th>priority</th>
<th>enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>JRC</td>
<td>PERSIEN-Africa-4km</td>
<td>TRUE</td>
<td>std_precip_prod_only</td>
<td>std_precip</td>
<td>1</td>
<td>TRUE</td>
</tr>
<tr>
<td>2</td>
<td>JRC</td>
<td>SPOTV-Africa-1km</td>
<td>FALSE</td>
<td>std_precip_prod_only</td>
<td>std_navi</td>
<td>1</td>
<td>TRUE</td>
</tr>
<tr>
<td>3</td>
<td>JRC</td>
<td>CHIRPS-Africa-5km</td>
<td>FALSE</td>
<td>std_precip_prod_only</td>
<td>std_precip</td>
<td>1</td>
<td>TRUE</td>
</tr>
<tr>
<td>4</td>
<td>JRC</td>
<td>SPOTV-Africa-1km</td>
<td>FALSE</td>
<td>merge</td>
<td>merge</td>
<td>1</td>
<td>TRUE</td>
</tr>
<tr>
<td>5</td>
<td>JRC</td>
<td>SPOTV-Africa-1km</td>
<td>FALSE</td>
<td>std_navi_prod_only</td>
<td>std_navi</td>
<td>1</td>
<td>TRUE</td>
</tr>
<tr>
<td>6</td>
<td>JRC</td>
<td>TAMMAM-Africa-4km</td>
<td>TRUE</td>
<td>std_precip_prod_only</td>
<td>std_precip</td>
<td>1</td>
<td>TRUE</td>
</tr>
</tbody>
</table>

The inputs and outputs products of the processing are defined in the Table ‘process_product’ (see Figure 29) by specifying the usual triplet product/version/subproduct. The mapset is also specified, together with additional information:

- **Type**: either input or output
- **Activated**: a single output product might be activated/deactivated\(^{20}\)
- **Final**: it identifies which product are ‘final’, i.e. not ‘intermediate’
- **Date_format**: format of the date
- **Start_date and end_date**: they define the temporal window to be taken into consideration. If undefined, all existing files will be considered.

### Figure 29: process_product table

\(^{20}\) This option is not implemented yet in 2.1 version
4.3.3 System Service

What it does

The System service is in charge of all ‘background’ operations that are not directly involved in the other Services, but essential for the good functioning of the machine, e.g. the synchronization of the data and database between PC2 and PC3. These operations were scheduled through the crontab in version 1.0, while they are now included in a single service, which should always be active on both computers. In particular the service is in charge of the following operations:

1. Data synchronization
2. Database synchronization
3. Database dump
4. Cleaning temporary directories
5. Conversion of some selected datasets to SPIRITS format

How it works

The System service works as a continuous loop and iterates over the above-described operations and, for each of them:

- Determines if the operation has to be executed, according to the computer role (PC2 or PC3) and mode (Nominal or Recovery)
- Determines if the ‘time’ requirements for the operations are met: some operations are executed at a given hour, or every number of hour or minutes.
- Executes the operation.

Configuration

The service is not based on database settings, rather on configuration files, namely the ‘System Settings’ and ‘Factory Settings’ (see paragraph 4.1.2 of the Administration Manual).

The ‘System Settings’ file is parsed to determine the Role and Mode of the computer, which are defined at the installation (role) or modified in case of malfunctioning of one of the 2 computers.

The ‘Factory Settings’ that impact the System service are displayed in Table 14. On the 2.1 release they are not reported in the ‘System’ interface, and therefore not modifiable by the User.

<table>
<thead>
<tr>
<th>Parameter name</th>
<th>Default value</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>system_delay_data_sync_min</td>
<td>10</td>
<td>Delay time between executions of data sync</td>
</tr>
<tr>
<td>system_time_db_dump_hhmm</td>
<td>00:00</td>
<td>Time of the day for execution of the DB dump</td>
</tr>
<tr>
<td>system_time_spirits_conv</td>
<td>00:10</td>
<td>Time of the day for execution of the DB dump</td>
</tr>
<tr>
<td>system_sleep_time_sec</td>
<td>10</td>
<td>Delay time between execution of system loop</td>
</tr>
</tbody>
</table>

Table 14: Factory settings influencing System Service