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Project 780118

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Editor	Fabrizio Pacini
Brief Description	This document provides a description of the adaptations applied to the H-TEP to support the OHFA and in particular multi-lingual support, upload and ingestion of user data, the knowledge base and support functionalities, the on-demand and systematic processing for the generation of flood forecast information and its distribution via multiple distribution channels.
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Project 780118

Contents

1 Executive Summary

FANFAR uses the Hydrology-TEP platform (H-TEP - https://hydrology-tep.eu/) as its operational production Cloud platform to operate the Operational Hydrological Forecasting and Alert (OHFA) system for West Africa. H-TEP is part of a larger exploitation platforms ecosystem developed and validated with the support of the European Space Agency (ESA). It consists of three main sections: the system platform, the service platform and the community platform:

- The system platform is a cloud workspace to access, process, visualize and compare data
- The service platform provides tools to process data into water-relevant information, such as water level, water extent, and river discharge (from e.g. the Niger-HYPE hydrological model)
- The community platform provides a way to share information, results, knowledge, algorithms, tools, etc. within a community in a secure manner.

According to that, key activities in FANFAR in relation to the H-TEP platform are its operations to ensure stable and efficient running of the forecasting and alert system and all its components as well as its adaptations/improvements to best meet user needs. The specific requirements identified and prioritized by the co-design committee during the course of the FANFAR project and addressed by the consortium, have been:

- Supporting of two operating modes:
  - (a) Forecast-on-demand,
  - (b) Scheduled automatic execution of the forecasting chain based on saved settings (including monitoring and failure-notification). This includes enabling users to store forecast settings on the platform for scheduled execution or later forecast-on demand runs.
- Distribution of information through multiple different distribution channels
- Enabling user upload of e.g. streamflow data for inclusion in the forecast processing chain (interactively and scheduled from e.g. an external FTP site)
- Adoption of standardised data formats for efficient handling of large data sets coming in and out of the platform.

This deliverable describes the outcome of the activities carried out by the FANFAR consortium in the context of WP3 in order to define, design and implement the Hydrology-TEP (H-TEP) extended capabilities indicated above, for realising the working environment for West African National Forecasting services. These are:

- The **upload of user data** on the platform
  The platform provides functionalities to ingest user provided data (e.g. hydrological stations measurements such as water level and streamflow data), water bodies definitions, meteorological hindcasts and forecasts) for inclusion in the forecast processing chain. This is possible interactively and through regular/scheduled harvesting from external repositories via pre-agreed standardised data formats.
- The **Data Processing Pipelines**
  At the core of the FANFAR forecasting system are the data processing pipelines that ensure the automatic, daily flood forecast production feeding the main FANFAR distribution channels with forecast maps and alerts. The two main pipelines that have

been setup and deployed in operations are the Water Level data pipeline streaming altimetry data over water bodies for the production of EO-based water level time series and the Forecast Data Pipeline streaming daily forecast processing for different models and configurations and assimilating the water level time series.

- The support for **multiple distribution channels** for the generated forecast information
  One of the last fundamental steps in the FANFAR forecasting chain supported by the Hydrology-TEP, is the distribution of information to users. A range of potential distribution channels exist (e.g. web visualisation, SMS, email, social media etc.), each requiring different types of data, and several of these channels are / will be operated in order to reach different type of users with tailored information as well as to provide redundancy, and thereby increase the chances that the information actually reaches the users. During the first FANFAR workshop it was decided that the following distribution channels should be developed: web visualisation, SMS and email. Some distribution channels are open to the general public (e.g. web visualization), while others are restricted to subscribers (e.g. flood alerts bulletins via email or SMS) or invited organizations (e.g. approved by data owners).
- The tools and procedures for **user support**
  FANFAR offers user support on several levels through several channels. A support system has been created to provide help for users of the FANFAR forecasting system and Hydrology-TEP platform. This consists of three components: the Knowledge base, Forum and Help Desk. The technical back-end of each of these components have now been set up. The Knowledge base is organized into an open, searchable and browsable format using accessible web-technologies allowing intra-user-community contributions. The FANFAR partners are now regularly filling the Knowledge Base with appropriate content such as user guides, tutorials, exercises, example code and technical documentation. The Forum is also operational and provides an arena for anyone to ask questions and provide responses. Tagging capabilities aid classification of the questions, and ease searches to ensure easy access to previously asked questions and answers. The Help Desk is also technically set up and configured for the 1st line support to handle support requests.
- The **multilingual support**
  FANFAR provides multilingual support (i.e. English, French and Portuguese) in some of the main areas of the system accessed by the forecasters and downstream stakeholders (website, Help Desk, Knowledge Base, Forum) that has been implemented parlty leveraging the native support provided by some of the adopted solutions. Multilingual support is also planned, and has been analysed and designed, for other areas of the system such as the visualization portal, the community pages and Thematic Apps on the Hydrology-TEP as well as for the processing services interface and parameters. However since the related implementation requires relevant brand new developments, it will be subject to prioritization with other activities according to the analysis of feedbacks collected at the three held FANFAR workshops.

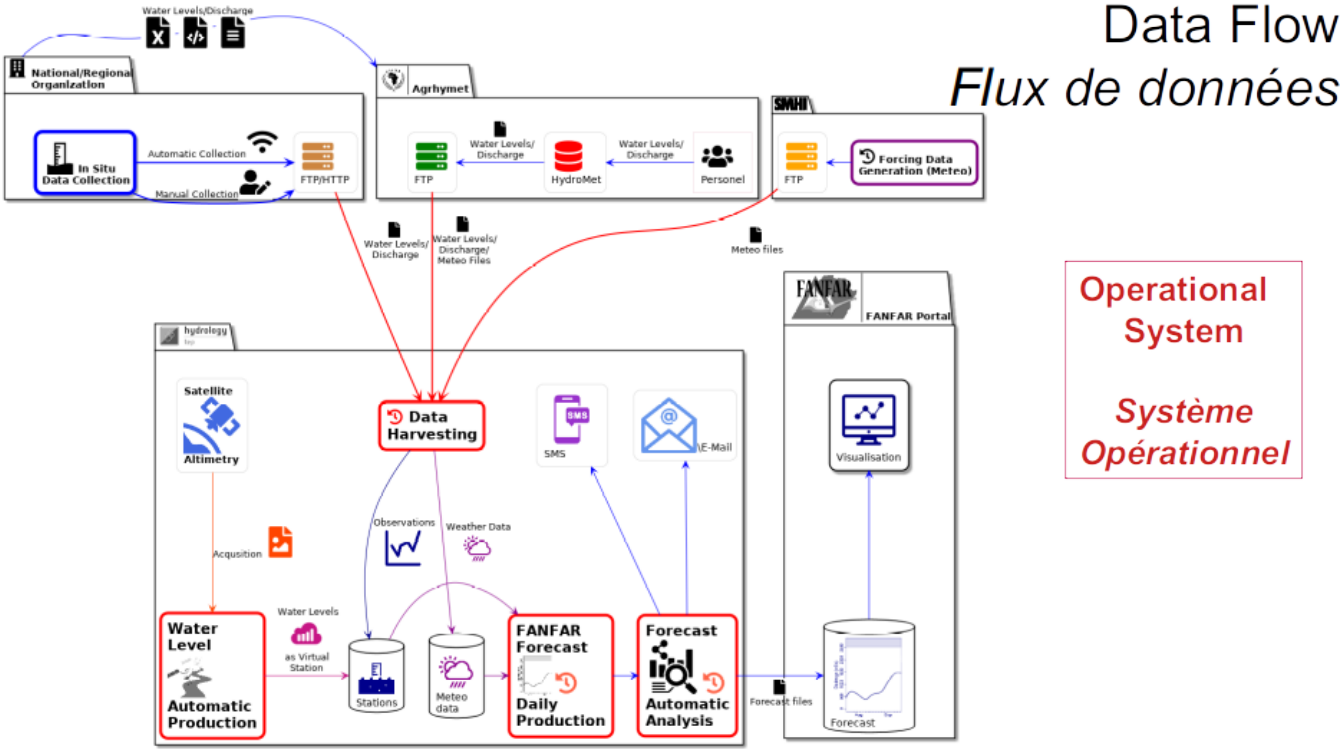
2 Introduction

This technical note reports the outcome of the activities carried out by the FANFAR consortium in the context of WP3 in order to define, design and implement the working environment for West African National Forecasting services within the Hydrology-TEP, in terms of extended capabilities such as

- the upload of user data on the platform (e.g. streamflow data for inclusion in the forecast processing chain)
- the support for multiple distribution channels for the generated forecast information
- the tools and procedures for user support
- the multi-lingual support for the main areas of the platform accessed by the forecasters and downstream stakeholders

For each of them the related achievements and on-going/planned actions are reported in the following sections.

The following diagram gives an overview of the data flow in the Hydrology-TEP for the entire FANFAR project. It helps understand the central role of the TEP platform.



3 Data Collections

The earth observation satellite-based altimetry datasets provided on the Hydrology-TEP for the services related to the Water Level processing services are the following:

- Sentinel 3 Altimetry land products (SR_2_LAN)
- Jason 2 & 3 Altimetry products
- SARAL/Altika Altimetry product

In addition to those data collections, more datasets are harvested and stored on the platform for being used either by the water-level service or the HYPE forecasting processor.
The next sections describe each of those datasets with their specifications and their harvesting method in the platform

3.1 Potential Water bodies

This dataset is the "baseline" for the production of water level products from the altimetry data. Indeed, they define the areas where the water level could be calculated with the data acquired by the satellite.
IsardSat generated a comprehensive database of those water bodies by crossing the altimetry missions (Sentinel-3, Jason-2 & 3, SARAL/Altika) nominal orbit tracks[1] with a JRC dataset describing the water presence frequency. The result of this process is provided as a set of polygons in the ESRI shapefile format. This dataset has been uploaded to the Hydrology-TEP platform and then analyzed by the recasting component. This analysis consists in:

1) Features extraction from the shapefile. Each feature and its related polygon becomes a dataset entry.
2) Reverse Geocoding (Address Lookup) of each entry. using the Google reverse geocoding API[2], the analyzer shall assign an address to each entry with a place ID[3] and a human readable location as far as it is possible
3) Catalogue entries generation in a feed

The produced feed out of the analysis is then recorded in the catalogue as a collection. This collection is browsable in the FANFAR App on the Hydrology-TEP portal. The following screenshot illustrates the visualisation of one of the water body from the catalogue with the location name.

[1] https://www.aviso.altimetry.fr/en/missions/current-missions/sentinel-3a/orbit.html
[2] https://developers.google.com/maps/documentation/geocoding/intro#ReverseGeocoding
[3] https://developers.google.com/places/place-id

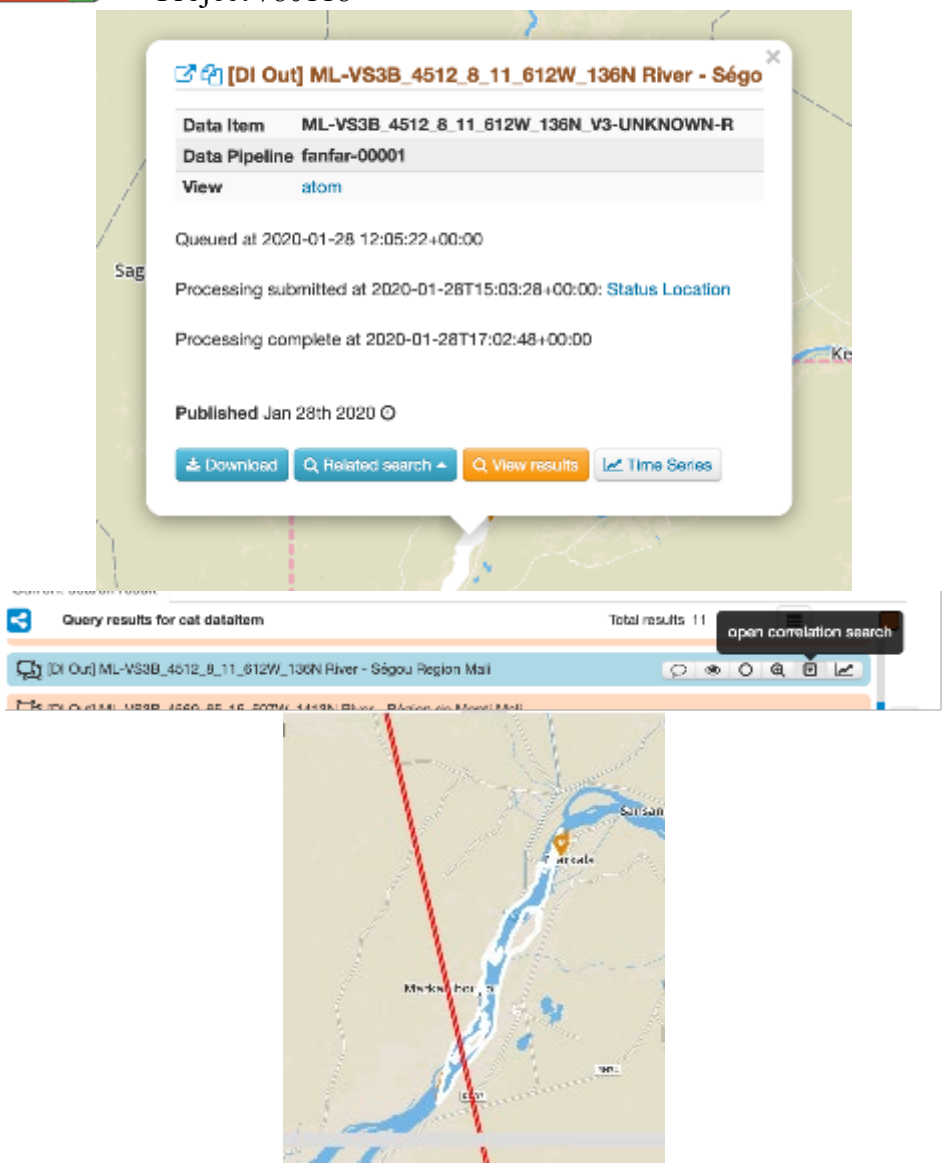


Figure 1: example of Water Body on the H-TEP

3.2 Hydrological stations measurements

The observations and measurements made on the field using the hydrological stations are the most valuable and important data for the forecasting. This includes in-situ observations of streamflow (discharge), water level, and rating curves. In the FANFAR project, a common process and format for collecting and harvesting those datasets shall be defined. SMHI, Terradue, AGRHYMET and NIHSA are in the process of defining the appropriate standard data format for this type of data (see Deliverable 3.1).

Once the hydrological station data is produced operationally at AGHRYMET and NIHSA and made available on their FTP site, the data files will be harvested by the Terradue Cloud Platform hosting the Hydrology-TEP system from the designated FTP server of the data provider. As per the water bodies, once retrieved, those datasets are analyzed by the system the following way:

1) Each data file is associated with a station (existing or new one) and completes a time series of measurements for the station.
2) The analyzer shall assign a geolocation to each new station based on their coordinates. The list of locations will be defined in advance with an ID and a name.
3) A catalogue entry is created or updated in the index with the latest time series data.

The produced feed out of the incremental regular analysis of the new measurements is then recorded in the catalogue in a collection. This collection is browsable in the FANFAR App on the Hydrology-TEP portal. The following screenshots illustrate the visualisation of one of the stations from the catalogue with the location name and the associated time series.

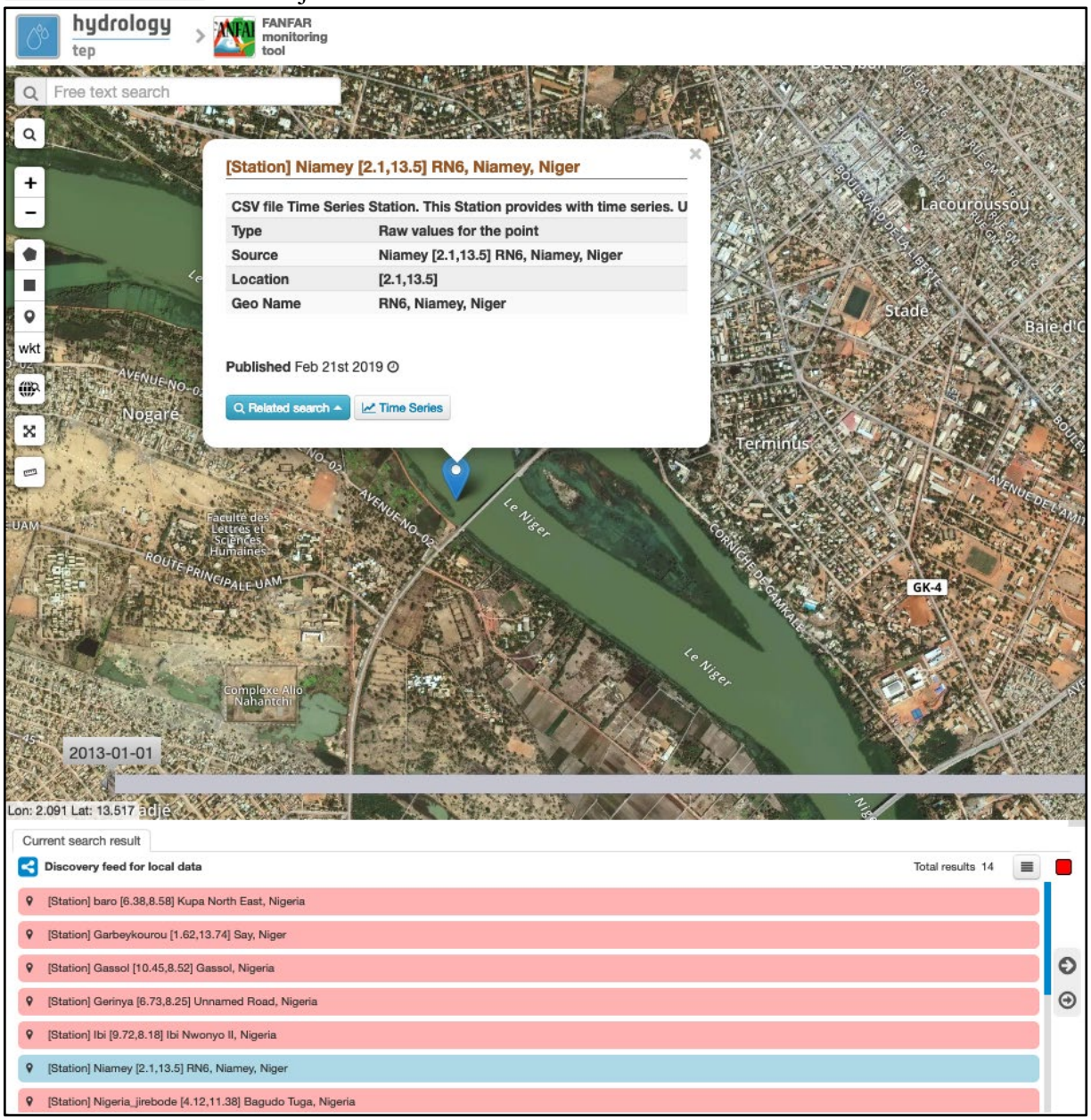


Figure 2: visualisation of one station from the catalogue. Information in the current popup describes the geolocation of the station using coordinates [lat,lon] and an address from the reverse geolocation process. This shall be improved in future version

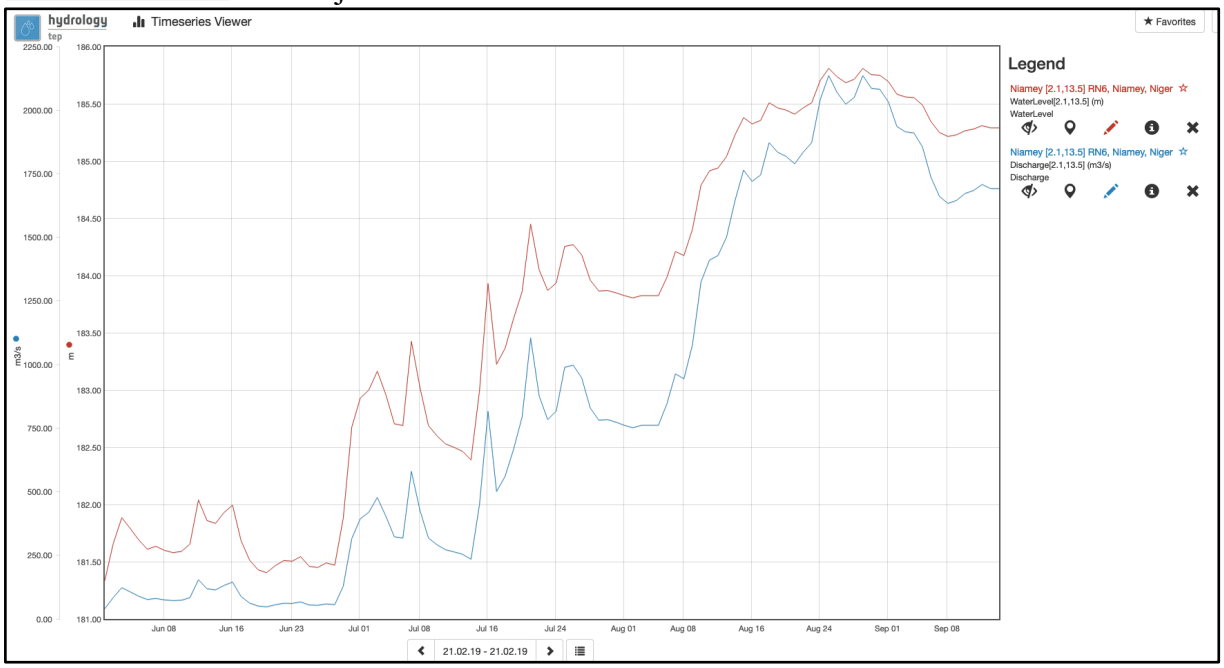


Figure 3: visualisation of the time series associated to the station. Information on the right describes the geolocation of the station using coordinates [lat,lon] and an address from the reverse geolocation process. This shall be improved in future version

3.3 Meteorological hindcast and forecast

The meteorological datasets are essential for running the forecasting processor. The datasets are produced by both SMHI and AGRHYMET. They are regularly harvested by a scheduled service from the producers FTP server on their premises and copied on the Hydrology-TEP platform where they are catalogued and stored. The details of the meteorological datasets from SMHI and AGRHYMET respectively is provided in Deliverable 3.1. Currently the meteorological data from SMHI is already being harvested on a regular schedule, while the data from AGRHYMET is still awaiting full operational production at AGRHYMET's system.

4 Data Processing Pipelines

4.1 Water level data pipeline

The first data and processing pipeline for the FANFAR project has been developed and deployed in production. This pipeline streams altimetry data over water bodies (defined in the previous section) for production of EO-based water level time series. These water levels are intended to be assimilated in the forecasting model for flood forecast production.

4.1.1 Implementation

The queuing function of this pipeline is not trivial because it must put (pipe) each new altimetry dataset that crosses one of the defined water bodies in the processing queue. The python "script" integrated as a data pipeline queue application has been initially developed and tested using Jupyter notebook in the Terradue Cloud Platform as shown in the screenshot below.

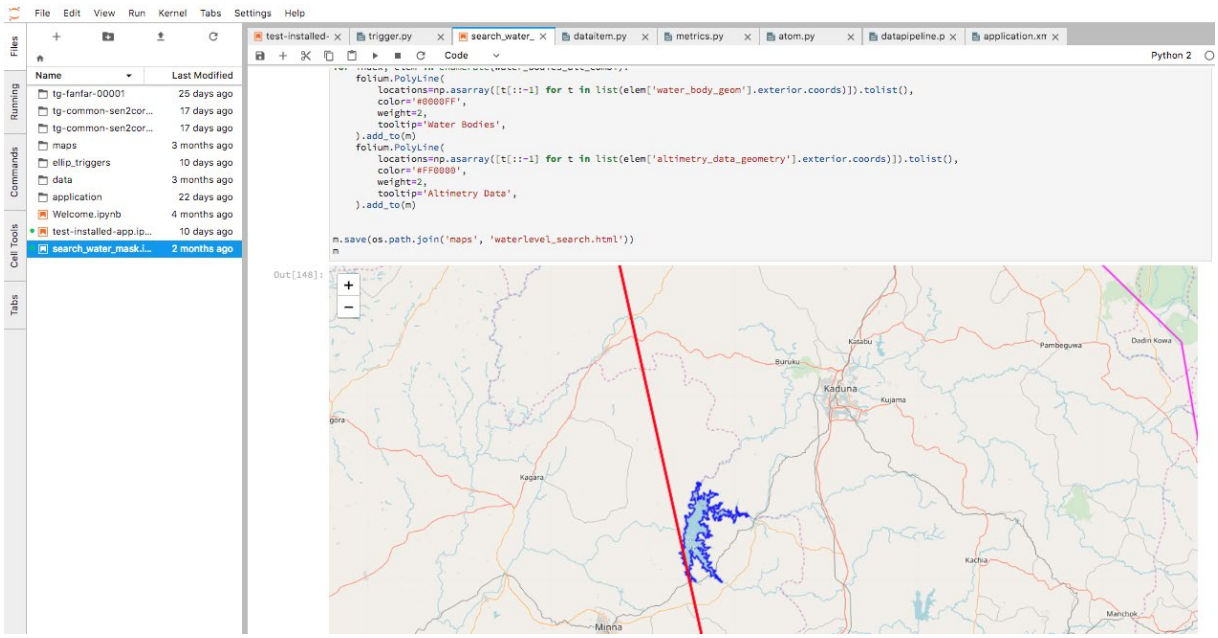


Figure 5: Data pipeline queue application on Jupyter notebook

Then, the same logic tested for search for new altimetry data over water bodies has been integrated in the "Terradue Trigger Framework" that will power the systematic processing of the water level.
The logic of this framework applied to water level production is described in the following diagram.

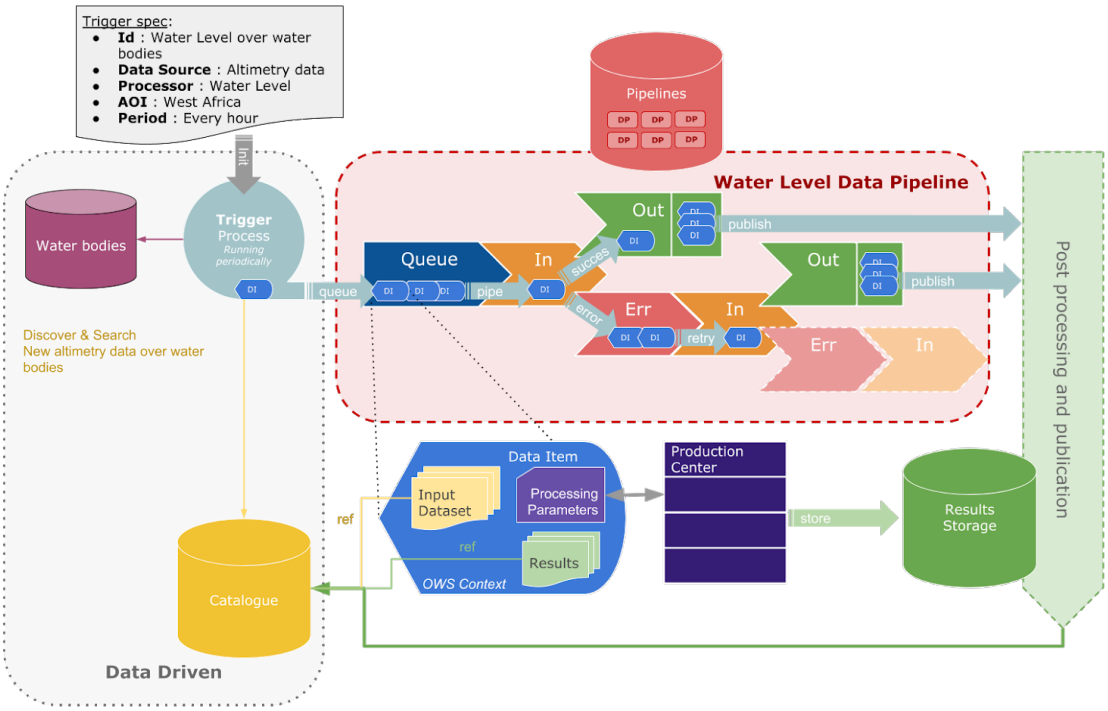


Figure 6: Systematic water level production – logic diagram

The trigger initial process **queues** new data items to be processed. In this case, every data item is a combination of a new altimetry data discovered in the catalogue and a crossing water body. Once queued in the data pipeline, the data item (DI) will be piped automatically according to the resources allocation. When piped, the predefined processing job associated is submitted to the production center for execution. If the processing is successful, the results are automatically post-processed for visualization as a time series and sent to the persistent storage in the FANFAR repository. In case of error, the data item will be re-submitted for processing another time.

4.1.2 Deployment and scheduling

The trigger implemented for the water level production is already deployed in production. It shall be activated and fully operational when the water bodies collection will be complete.

Indeed, as described in the diagram. The trigger is initialized with a trigger specification that specifies the systematic production order. In this case:

- **Id**: identification of the production order
- **Data sources**: Altimetry data. In our case, it is initially data-driven over the new Sentinel-3 Copernicus data acquisition available in the catalogue. This collection can also be extended to the other altimetry data such as Jason, SARAL/Altika.
- **Processor id**: This defined the id and the version of the water level processor to be executed for the production. In case of an update of the processing service deployed in the system, this information is passed as a parameter.
- **AOI**: Area of interest for the water bodies selection. Only the water bodies within this area shall be selected as a mask for processing.

- **Period and Time**: Time span over which the processing is performed and the period a new data is searched in the catalogue. For instance, For a spec as "From May 2017 to May 2019 every day", the trigger shall queue every day every new combination of altimetry data and water bodies of the previous 24 hours from May 2017 up to May 2019. For the date before the current date, it will "reprocess" existing data and for future days, it will run to discover new data.

4.1.3 Testing and reproducing

As described in the previous sections, the trigger frameworks handles all the functions to properly execute and monitor the systematic production of the water levels. Every execution is traced thanks to the data items recording all the information needed for reproducing or testing the processing chain. The following data are recorded in the data items:

- **Reference data**: Data that has been selected during a trigger run. In this case, this is the combination of the altimetry data and the water body. Those references are absolute and persistent and thus can be reused.
- **Processing parameters**: According to the trigger specification (AOI, time period) and the reference data (catalogue ref, date…) the processing parameters are recorded for every job submission in the production center.
- **Job submissions**: All jobs submitted from this data item are recorded and dated in order to trace the executions.
- **Results reference**: Once the processing completes, the results are referenced in the data item in order to be able to inspect individual results of a single processing job.

All data items thus record all information and historical activities of the production. With that information, the FANFAR operator shall be able to test or resubmit a similar job with different parameters. The app described in section 4 will include later in the project UI functions to re-submit automatically those jobs.

4.2 Forecast data pipeline

The second data and processing pipeline for the FANFAR project has been developed and deployed in production. This pipeline streams daily forecast processings for different models and configuration. These forecasts are the main products of the FANFAR project as they feed the main fanfar.eu portal with forecast maps.

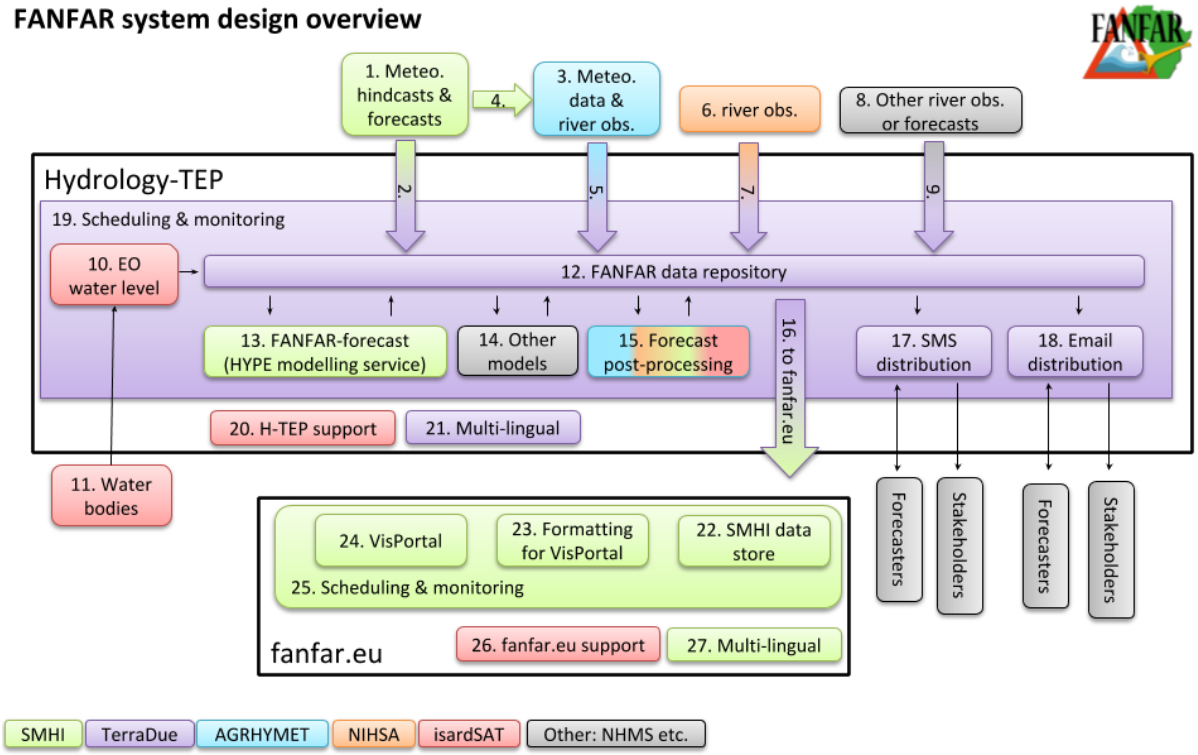


Figure 7. Overview of the FANFAR ICT system design and the scope for the scheduling and monitoring tool at H-TEP.

4.2.1 Implementation

The queuing function of this pipeline is pretty simple as it triggers a new forecast processing on a daily basis. The python "script" integrated as a data pipeline queue application has been initially developed and tested using Jupyter notebook in the Terradue Cloud Platform.

Then, the same logic tested for search for new altimetry data over water bodies has been integrated in the "Terradue Trigger Framework" that will power the systematic processing of the water level.
The logic of this framework applied to water level production is described in the following diagram.

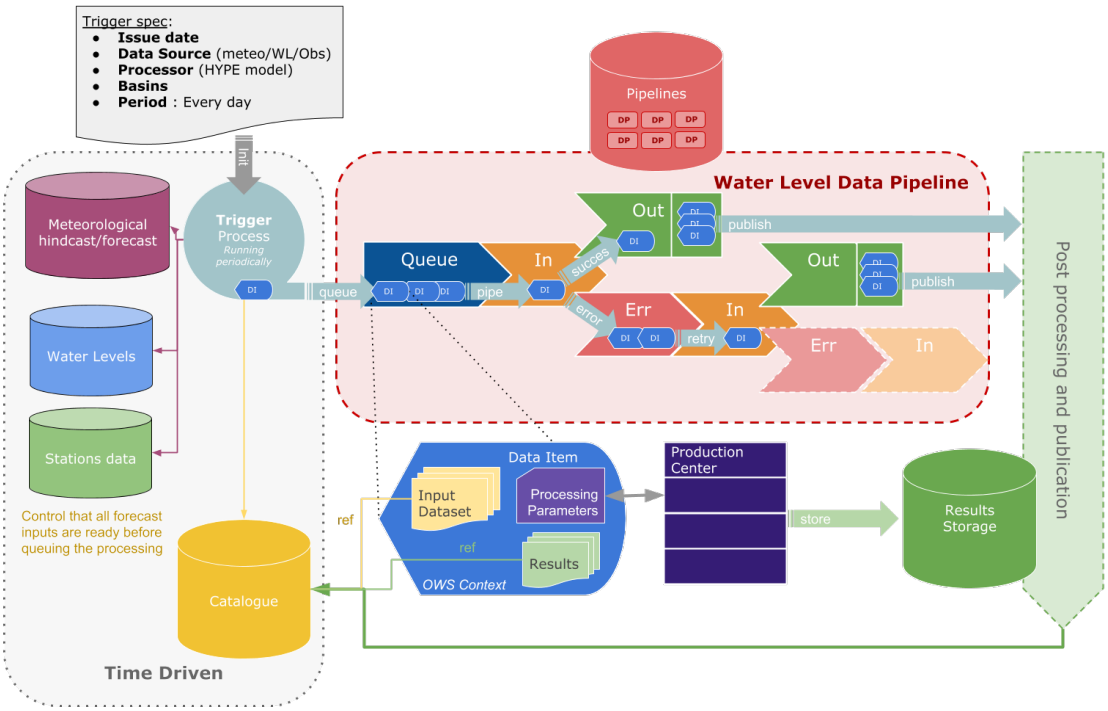


Figure 6: Systematic forecast production – logic diagram

The trigger initial process **queues** new data items to be processed. In this case, every data item is a daily forecast with a specific model and configuration. Once queued in the data pipeline, the data item (DI) will be piped automatically according to the resources allocation. When piped, the predefined processing job associated is submitted to the production center for execution. If the processing is successful, the results are automatically post-processed for visualization and sent to the persistent storage in the FANFAR repository. In case of error, the data item will be re-submitted for processing another time.

4.2.2 Deployment and scheduling

The trigger implemented for the forecast production is already deployed in production with 2 configuration:

- Niger-HYPE + GFD1.3 + ECOPER
- WorldWide-HYPE + GFD2.0 + ECOPER

Additional models and configuration may be added any time to the existing production.

Indeed, as described in the diagram. The trigger is initialized with a trigger specification that specifies the systematic production order. In this case:

- **Id**: identification of the production order
- **Data sources**:
  - Meteorological data harvested by the system (see section 3.3 Meteorological hindcast and forecast).
  - Hydrological station measurements (see section 3.2 Hydrological stations measurements)

- Water Levels from altimetry data (see section 4.1 Water level data pipeline)

- **Processor id**: This defined the id and the version of the HYPE forecast processor to be executed for the production. In case of an update of the processing service deployed in the system, this information is passed as a parameter.
- **Model**: Model used by the HYPE forecast processor (e.g. Niger-HYPE 2.23, WorldWide-HYPE 1.3.6). Practically, this model identifier defines an archive with all the files that define the model.
- **Issue Date**: Timestamp representing the issue date of the forecast.

4.2.3 Testing and reproducing

As described in the previous sections, the trigger frameworks handles all the functions to properly execute and monitor the systematic production of the water levels. Every execution is traced thanks to the data items recording all the information needed for reproducing or testing the processing chain. The following data are recorded in the data items:

- **Reference data**: Data that has been selected during a trigger run. In this case, this is the combination of the hydrological, meteorological and water level data. Those references are absolute and persistent and thus can be reused.
- **Processing parameters**: According to the trigger specification (Model, issue date) and the reference data (catalogue ref, date…) the processing parameters are recorded for every job submission in the production center.
- **Job submissions**: All jobs submitted from this data item are recorded and dated in order to trace the executions.
- **Results reference**: Once the processing completes, the results are referenced in the data item in order to be able to inspect individual results of a single processing job.

All data items thus record all information and historical activities of the production. With that information, the FANFAR operator shall be able to test or resubmit a similar job with different parameters. The app described in section 4 will include later in the project UI functions to re-submit automatically those jobs.

5 Distribution channels

After every production of a daily forecast for the whole western africa region or for a specific area, a post-processing analysis is performed on the forecast results to assess whether there is a risk of high streamflow/flooding in the area. The risk is expressed in relation to its severity as defined by specific risk level thresholds for each catchment and severity class (currently streamflow at different return periods). The primary distribution channel of this information is online visualisation. In addition, the system shall send a notification to a given set of recipients by Email & SMS.

5.1 Transfer to fanfar.eu visualisation portal.

In this case, an SMHI service pulls data daily from H-TEP over HTTPS. It uses the OpenSearch Atom feed mechanism to discover new forecasts. Multiple forecasting chains are scheduled to run simultaneously on H-TEP, each with its own Atom feed. So far two forecasting chains are scheduled, but more will be added when the necessary components become available.

For each entry in the feed corresponding to a daily forecast issue, a status category provides the information about the forecast processing status ("queued", "processing", "complete"). Each forecast entry in the feed contains:

a. the information about the forecasting setup (e.g. meteorological hindcast and forecast type used, water level or in situ data assimilation)
b. a link the root folder of the forecast results for a direct download of the result files
c. a link to a secondary atom feed with an entry for each dataset of a forecast result. Each entry may contain options to utilize augmented features such as a map server or a time series viewer
d. a detailed information set about the processing itself (start, end, status, error logs in case of failure)

5.2 Email distribution

For this distribution channel and the SMS, it is the recasting component of the Hydrology-TEP platform that is in charge of distributing the forecasting and related flood risk notifications.
Indeed, along with the forecasting results, a set of files specifies if the results must be send to a given set of recipients allowing for different parameterizations for each organisation/country/user role (e.g. one distribution list to Forecasters or Forecasters in country X, another to downstream stakeholders in country X).

The subscribed users receive an email notification about (a) flood risks or (b) operational processing failures. Emails are constructed based on a template and containing information such as the current flood risk notification, the forecast model, the issue date, the area, and the link to the results visualisation on the Hydrology-TEP portal.

The current data pipeline running daily the forecasts already analyses the forecast results to produce visualisation maps on the Hydrology-TEP portal as shown in the screenshot below. The Email distribution is part of the same results processing step.

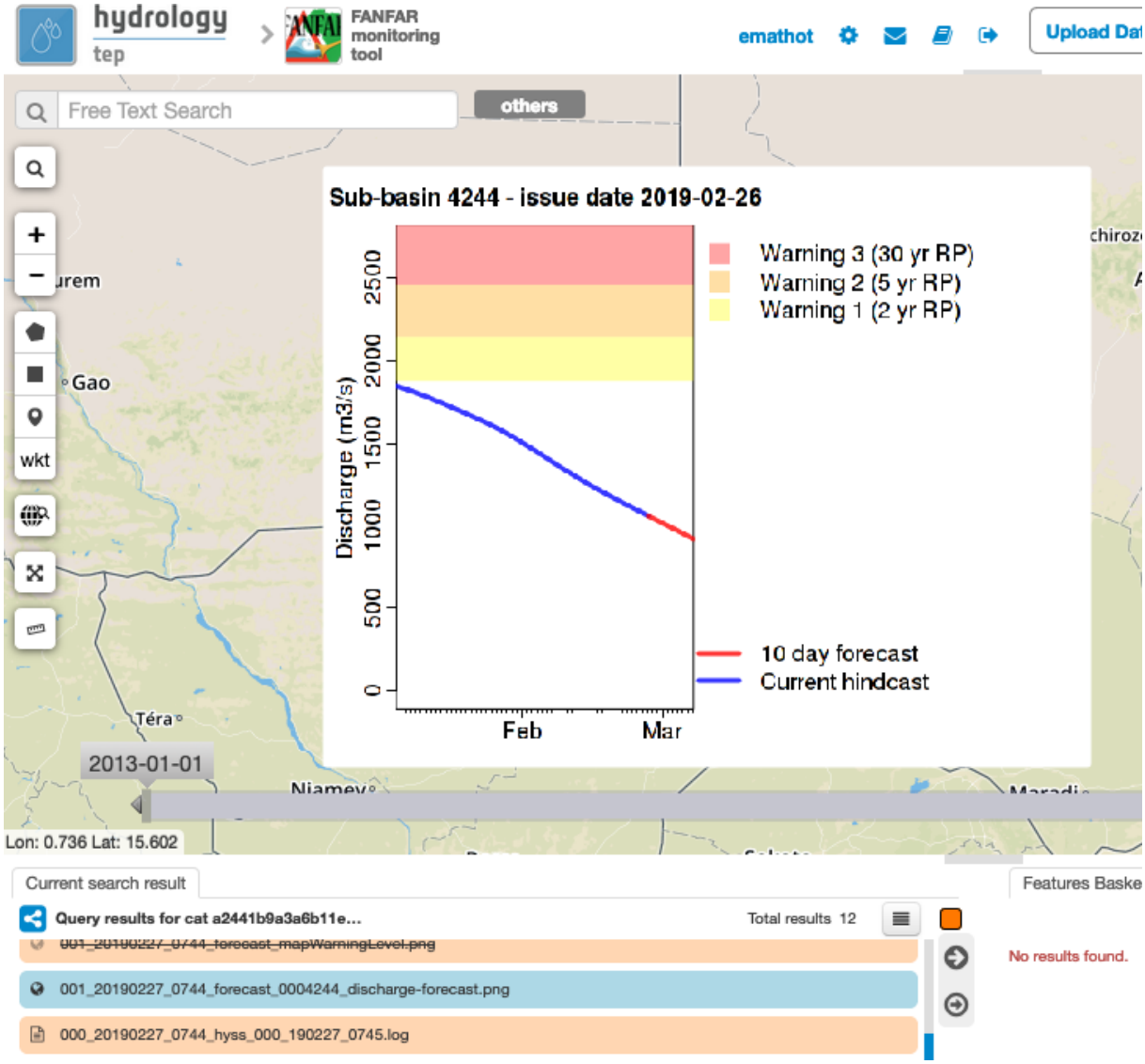


Figure 4: visualisation of the discharge forecast generated on 26th Feb 2019 by Niger-Hype service for Sub-basin 4244

5.3 SMS distribution

The same principle as for the Email distribution applies for the SMS. The constraint of that channel is the limited number of characters that may be sent with a SMS. An initial prototype SMS template contains information about the number of sub-basins exceeding key risk level thresholds in a given area/model configuration. This is now operational for the Niger-HYPE model, such that in the event of flood risks exceeding a certain set of defined rules, an SMS is sent to the defined recipients. This template will be elaborated further during the process of adjusting the risk level information to the needs in West Africa, and extended to all of West Africa as soon as the post-processing service becomes operational.

A mechanism to embed a shortened link to the Hydrology-TEP portal for visualisation is included.
The online service https://www.allmysms.com/ costing ca 5 cent (€) per SMS is used for sending the SMS.

6 Support functionalities

FANFAR offers user support aimed at developing human capacity on how to utilize, operate, customize, and maintain the system, how to access and interpret its outputs, and how to contribute with improvements. Support is provided through several channels as depicted in Figure 4 below, and will leverage the related functionalities made available by the Hydrology-TEP platform.

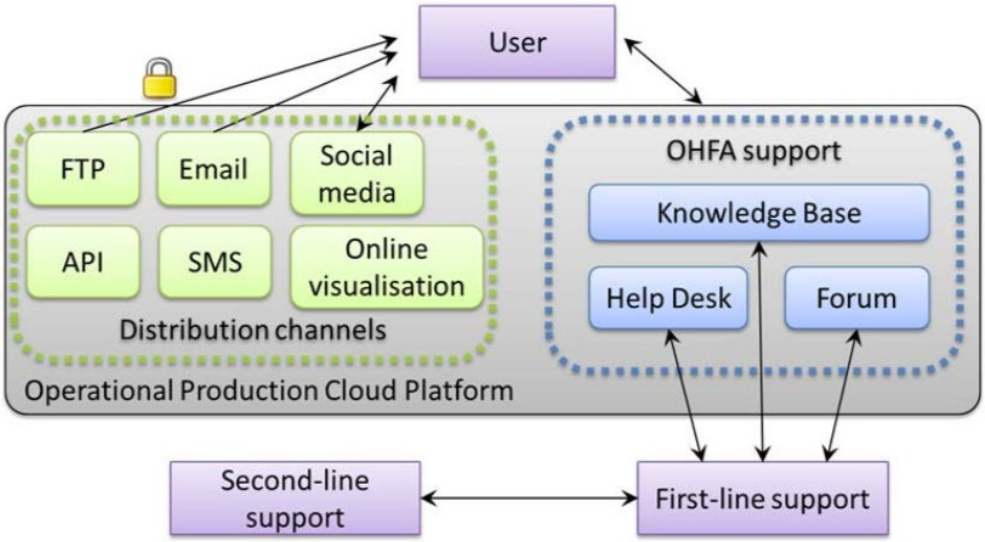


Figure 4: Overview of user support in FANFAR through the H-TEP platform

A support system has been created and linked to the FANFAR website to provide help for FANFAR service users. The system consists of three main components:

- Knowledge base
- Help Desk
- and Forum

These are described in more detail here below.

6.1 FANFAR Knowledge Base

The **Knowledge Base** is implemented by means of the Atlassian Confluence software (https://www.atlassian.com/software/confluence). Confluence is a content collaboration tool used to help teams to collaborate and share knowledge efficiently. With Confluence, users can create pages and blogs which can be commented on and edited by all members of the team. Users can also attach files, presentations and videos and display them on a page for more convenience.
Confluence has also been designed to integrate with Jira (that as described later is the tool adopted for the Help Desk) and they have many integration points, giving Confluence users the ability to view, interact with, and reference Jira issues from a wiki page.

The Knowledge Base of FANFAR is available at this URL https://knowledge.terradue.com/display/FANFAR and contains user guides, tutorials, exercises, example code and technical documentation. It is organized in sections for the different types of users approaching the platform and provides an open and easily browsable and searchable content sharing area. The FANFAR KB is accessible to the public in read-only mode; users registered to the Hydrology-TEP platform will also have the rights to contribute/modify content. Currently, the Knowledge Base is only open to the FANFAR development team until it has been populated with appropriate content. The FANFAR Knowledge Base is linked both from fanfar.eu and from the West African community page on Hydrology-TEP.

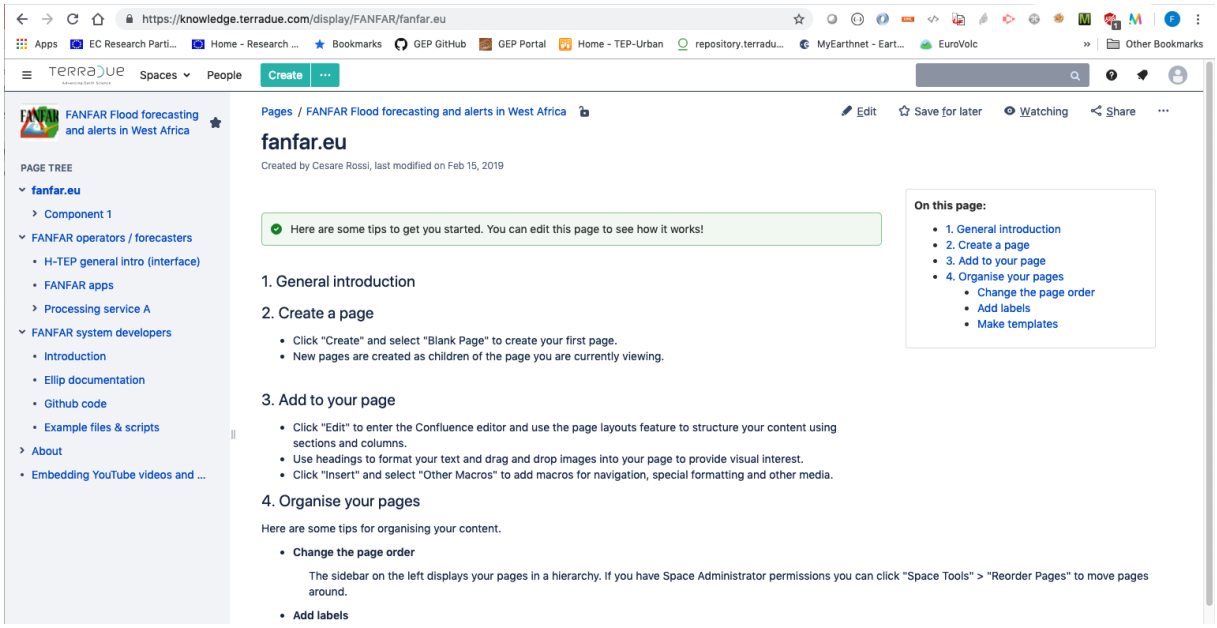


Figure 5: FANFAR Knowledge Base home page

The FANFAR Knowledge Base will be subject to regular (full, differential and incremental) backups whose copies will be made available to the consortium coordinator SMHI.

In addition it is possible at any time to do exports of the full KB in different (non-proprietary) formats as reported in the page below: https://confluence.atlassian.com/doc/export-content-to-word-pdf-html-and-xml-139475.html.

6.2 FANFAR Help Desk

The support **Help Desk** is aimed at providing FANFAR participants, associated organizations and more generally all users, with a dedicated support channel for both technical and thematic questions in order to ensure that they do not get stuck on particular issues, to clarify any ambiguities that may arise, and to explain system functionalities etc. The Help Desk will

respond to specific support requests from users both live during physical meetings and remotely when users will be able to contact the Help Desk via email and/or the web.

The solution adopted for the Help Desk is Jira Service Desk (https://www.atlassian.com/software/jira/service-desk). It is a helpdesk request tracker that allows receiving, tracking, managing and resolve requests from users. The app comes with a self-service web portal where users fill out forms to ask for help. Jira Service Desk is very well integrated with the Confluence tool used for the FANFAR KB. The FANFAR support team has created a knowledge base of articles that the users can read and help themselves before requesting support.

In FANFAR, users registered to the H-TEP will be automatically associated with an account on the Jira Service Desk and will able to submit their help requests to the support team through the Help Desk customer portal (https://helpdesk.terradue.com/servicedesk/customer/portals) or via email. The customer portal (in Jira Service Desk end users are referred to as customers) is linked from fanfar.eu and from the West African community page at Hydrology-TEP.

Help Desk agents work on users requests, tracked as issues in a queue. All requests and the related answers will be tracked in a dedicated support space with each request status transition also notified by email.

Non-Registered users will also be able to submit help requests via the public contact form at http://fanfar.eu/contact/ that will trigger the creation of Help Desk tickets in a general queue. In this case feedback will be provided only by email or pointing to information available in the KB and forum.

The FANFAR Help Desk will be subject to regular (full, differential and incremental) backups whose copies will be made available to the consortium coordinator SMHI.

In addition it is possible at any time to do exports of the Help Desk content in different formats such as RSS, CSV, XML, word.

The members of the IsardSAT and AGRHYMET partners of the FANFAR consortium are configured as Help Desk agents, i.e. the persons in charge of the first-line support that have the ability to access queues, move issues through workflows, and make user-facing comments.

The first-line support will monitor the support channels (email, web, Forum, and Knowledge Base), moderate the Forum and Knowledge Base, prioritise support requests, respond to all requests to the extent of their ability, and will forward the request to the appropriate FANFAR participant when the request is beyond their capacity. The second-line of support, involving all FANFAR partners, will address the issues beyond the capacity of the first-line support (including investigation, debugging, solving potential problems, and responding to users). All relevant Help Desk questions and answers will be published online on the KB to facilitate other users with a similar question to find an answer without having to ask a separate

question. Beyond the direct answers to the questions, a support request can also generate suitable follow-up tasks, such as modifying user guides and adding more tutorials.

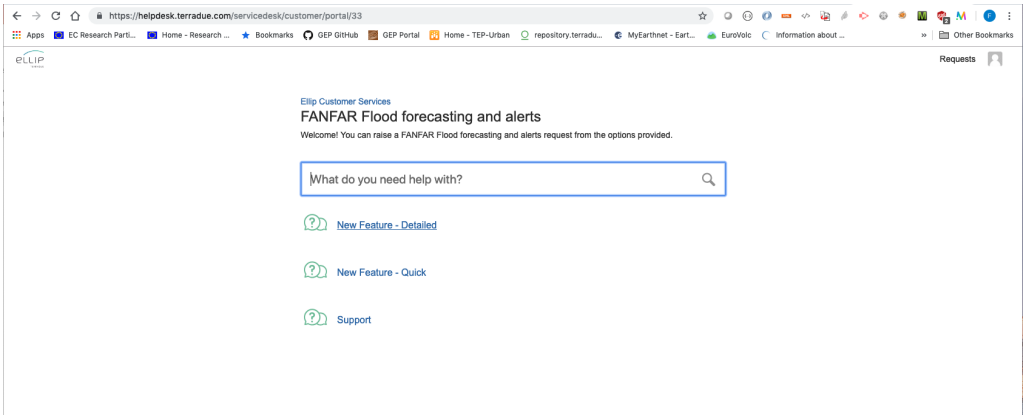


Figure 6: FANFAR Help Desk customer portal

6.3 FANFAR Forum

The **FANFAR Forum** (http://discuss.terradue.com/c/fanfar) is implemented as a dedicated category of the H-TEP discussion forum and provides an arena for anyone to ask questions and provide responses. It is based on the well known open source Internet forum Discourse (https://www.discourse.org/). Discourse is a simple, flat forum, where replies flow down the page in a line. From a usability perspective, Discourse breaks with existing forum software by including features recently popularized by large social networks, such as infinite scrolling, live updates, expanding links, and drag and drop attachments.However, its focus is on social aspects rather than technical ones, to improve online discussion quality through improved forum software. It supports tagging that will aid classification of the questions and allow efficient searches and easy access to previously asked questions and answers.
Discourse is natively designed for high resolution touch devices with a built-in mobile layout and has a wide range of features available for users. These receive immediate notifications when another member replies to them directly, quotes them, mentions their name, sends a private message, or links to their post. New posts and topics appear automatically on screen in real time. Creating or replying to a topic is done via an overlay editor which allows for uninterrupted reading, even if the user navigates to a different topic. Discourse auto-saves draft replies and topics to the server in the background to prevent the loss of a work in progress. Topics can be pinned to the top of all topic lists, or to a single category, with a brief summary of the content. Images can be uploaded, dragged and dropped, or pasted. Large images are automatically thumbnailed and lightboxed.

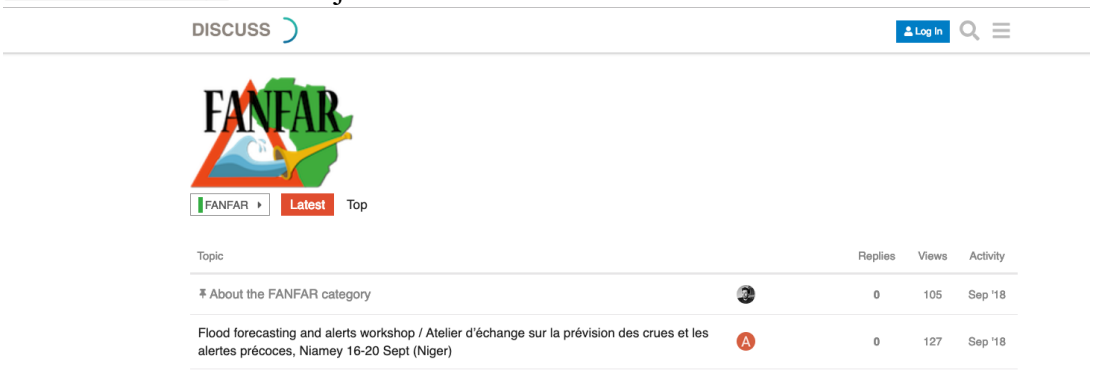


Figure 7: FANFAR Forum home page

The FANFAR forum is open in read/write mode to FANFAR users registered to H-TEP platform. These will be allowed to create topics and posts as well as to answer to contribute to discussions started by other users. Instead it will be open in read mode only to anonymous users. FANFAR partners in charge of first level support will be assigned with moderator role in Discourse and hence will have the rights to create/remove subcategories and topics and more in general will have the responsibility to oversee the forum, ensuring that users and content are in line with the project rules/guidelines.

The FANFAR Forum will be subject to regular backups whose copies will be made available to the consortium coordinator SMHI. The forum is managed on the cloud, thus specific backups can be also requested to the service provider (discoursehosting.com).

In addition it is possible to do exports of the Forum content through the Data Explorer plugin that allows to do queries SQL on the underlying DB. The output formats are JSON or CSV.

7 Multi-lingual capabilities

The FANFAR system is being gradually equipped with multi-lingual support (i.e. French and possibly Portuguese in addition to English) in the main areas accessed by users of the platform. These are:

- the FANFAR website (http://fanfar.eu/)
- the FANFAR support sections (see section 6)
- the FANFAR Community page and Thematic Applications on the H-TEP (https://hydrology-tep.eu/#!communities/details/westafrica-hm)
- the FANFAR processing service interface and parameters on H-TEP.

At current stage the multi-lingual support is available for the FANFAR website and the FANFAR support sections. For the other indicated areas its implementation in the remaining months of the project will be subject to prioritization with other activities according to the outcomes of the 3rd FANFAR workshop.

Here below is reported the analysis that has been performed to address the multilingual capability requirements as well as the solutions that have been (or will be) adopted.

7.1 Website, H-TEP and processing services

Currently there are several points in which a text (in English) is shown:

1. in the dynamic html pages views
2. directly in the code (e.g. for an alert or a message)
3. in some text message coming from the back-end server

7.1.1 Pages views

Two possible solutions have been identified:

1. The more obvious is to have different html pages for different languages. The advantage is the simplicity of creation, reading and editing of the html pages. The html structure is the same and only the text will change. The downside is that it is important to maintain consistency among the same html view files in different languages.
2. Another solution is to have the one html page and include some helpers to dynamically map sentences in the chosen language (using i18n pattern). The upside is to have one single page view to maintain, the translation is thus moved to a central document containing all translations. The downside is a sensible reduction of readability for editing/creation of the html pages.

It has been decided to use both strategies depending on the type of view being used. Some html pages views contain very long static text: in this case it's better to have different pages for different languages. Instead other html pages are strongly dynamic, containing more components than text: in this case the dynamic helpers are the best solution.

To orchestrate this two solutions pattern the idea is to have:

- a configuration settings to map all html views having a complete html view translation in a language
- a translation database document containing all sentence to translate

An improvement for the translation database is to have the english sentence as "key" (considering the variables too, such as e.g. "Hello $(name), Welcome to our portal"). This strategy is a good trade off to have one view with the default English language.

7.1.2 Text messages in the code

This case is simpler to manage. We can simply use the second strategy described above, and use a translation function applied to each sentence. The translation database will contain all these sentences.

7.1.3 Text messages coming from the H-TEP back-end

This is the case e.g. of the processing services interfaces and parameters. It has been decided to implement this feature directly in the back-end. The front end append to each request the

information about the preferred language. The back-end will handle the request according to this parameter and return messages already translated in the requested languages leveraging a translation database.

7.1.4 Language setting

All browsers offer tools to detect the browser language, so the language can be set automatically to the user language. Moreover, users may want to switch to another language. The idea is to have a small language chooser in the top-right of the web page. The chosen language will be saved as cookie or local storage data, to lock the same language also for other sessions.

7.1.5 H-TEP Home page structure

Since the H-TEP portal is a SPA (Single Page Application), it has a static index.html for all pages, containing only the portal structure, including the header, the empty main container and the footer. This is static, so at least initially it will remain in English only. We consider this will not represent an issue since the only part involved is the footer text, that is not rich of sentences. The main menu is instead dynamic and will allow having multilingual menu items.

7.2 Support sections

The solutions adopted for the support sections (see section 5) all provide natively multi-lingual support. In particular:

- Knowledge Base: confluence provides multi-language support
  - for the menus automatically by detecting the browser language or by configuration setting in the user profile
  - for the contents, via the plugin https://wiki.bitvoodoo.ch/display/BVLANGUAGE/Language+Macros+for+Confluence that presents to the users pre-packaged translations according to their preferred language
- Help Desk: JIRA Service Desk provides multi-language support
  - for the menus automatically by detecting the browser language or by configuration setting in the user profile
  - for answers to the tickets, these will be provided in English and in the original request language
- Forum: Discourse provides multi-language support
  - for the UI, the user will be allowed to choose the preferred language within his profile settings
  - For the content as a general rule topics and posts will be kept in their original language only. In specific cases posts made by the FANFAR team could be provided in multiple languages (within the same post).