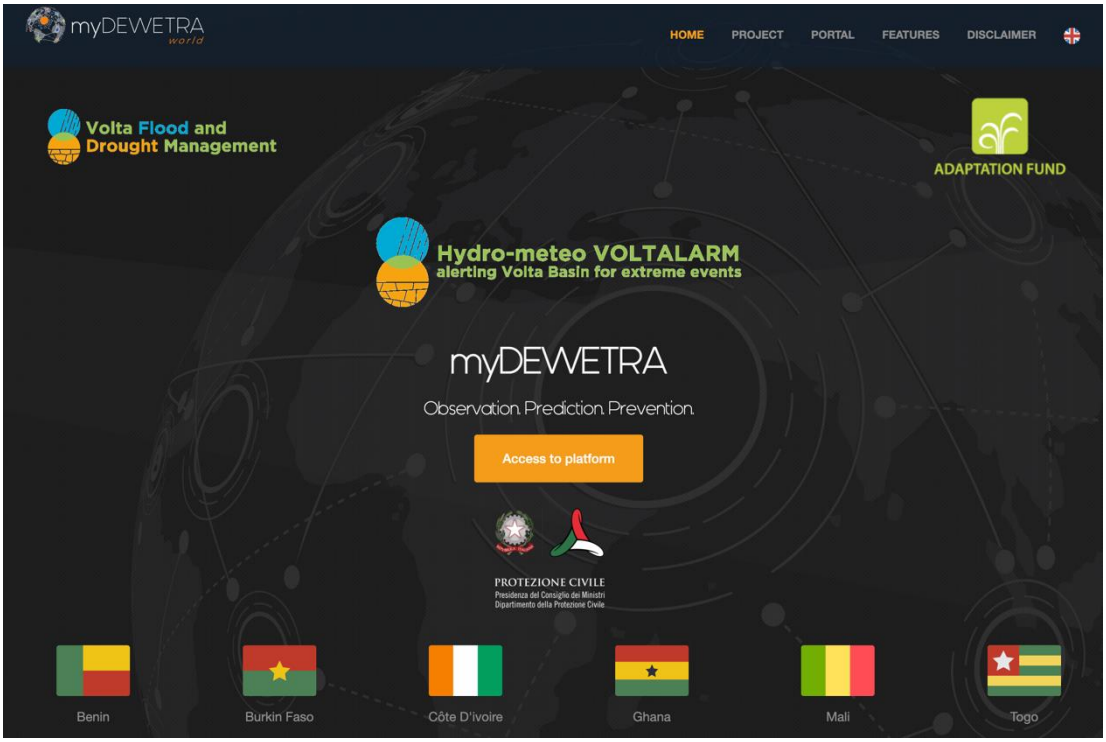
Volta Flood and Drought Management

User Guide of the flood and drought EWS platform myDewetra-VOLTALARM



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INTRODUCTION

Sendai Framework reinforced the need to improve risk understanding also by increasing the availability and accessibility of risk information to decision makers and the public. Very often, risk information is fragmented and distributed among many institutions, line-ministries and international actors and are not always conveyed to disaster management authorities.

In the last years, IT technologies have advanced rapidly and today systems are able to organize a large amount of data with different formats and make them available and accessible in real-time to decision makers. myDEWETRA-VOLTALARM is an Early Warning platform conceived for flood forecasting and drought monitoring at transboundary level for the Volta basin.

The development and operationalisation of the myDEWETRA -VOLTALARM EWS platform is part of the project "Integrating Flood and Drought Management and Early Warning for Climate Change Adaptation in the Volta Basin" (VFDM project), implemented by the World Meteorological Organization (WMO), the Volta Basin Authority (VBA) and the Global Water Partnership West Africa (GWP-WA) Consortium.

The platform is based on a central engine, called myDEWETRA, which is an integrated IT real-time system for hydro-meteorological forecasting and monitoring, designed to systematically organize multiple datasets and risk information form a broad range of providers, from local to national and international levels. The platform serves as a single access point for technicians from hydrological and meterological services, regional basin authorities, water resources and agriculture agencies and civil protection operators and it is the link between data producers and early warning operators. myDEWETRA -VOLTALARM allows operators to prepare a real time risk scenario, to monitor its evolution by using detailed data from multiple providers and to produce early warning bulletins.
The central engine myDEWETRA is a web-portal of the Italian Civil Protection Department (DPC), developed by CIMA Research Foundation and in operations at DPC and many other national and international centres. The platform consists of an integrated real-time system for hydro-meteorological and wildfire risk forecasting, monitoring and prevention based on the rapid availability of real-time geospatial data among multiple relevant institutional stakeholders. It improves the accessibility and comparability of hazard, exposure and risk information and data at multiple level.
Since 2012, WMO and DPC has signed an agreement that envisaged the possibilities for Countries to request DEWETRA system for improving multi-Hazard early warning system. More recently, DPC has launched the global initiative **myDEWETRA.world**; within the initiative, requesting Country

receives the access to the platform– in line with the possible configuration of paragraph 3- that contains **a set of open or freely available risk datasets.** myDEWETRA.world has the following main features:

- Interactive map on web gis platform,
- Charts,
- Maps animation,
- Automatic Warnings for forecasters,
- Spatial and temporal data synchronization,
- On-the-fly data aggregation,
- Open Source,
- International Standards,
- System in Cloud,
- Multi language,
- Multiple user profile,
- Intuitive and user-friendly graphical interface.

This document is a user guide describing contents and functionalities of myDEWETRA -VOLTALARM for all the various stakeholders involved in the VFDM project.

1. General description of the platform

MyDewetra-VOLTALARM platform is a technological platform for real-time early warning at transboundary level in the Volta basin. It is based on myDewetra.world which is an integrated system for hydro-meteorological and wildfire risk forecasting, monitoring and prevention based on the rapid availability of different data which help establish up-to-date and reliable risk scenarios. The application is technically and operationally certified; it provides, through a graphical interface, a high-resolution and continuously updated information, allowing the user to monitor weather events, to build detailed risk scenarios and evaluate the potential impact of the phenomena on communities and infrastructure.
One of the key requirements for facilitating data sharing in transboundarz context is to provide solutions that ensure accessibility to information without the physical transfer from data owners/producers. The system ensures the accessibility to selected users, according to their user profile. In this sense in is also possible to restrict the access to sensible data and information by profiling different users.

myDewetra.World has two main components:

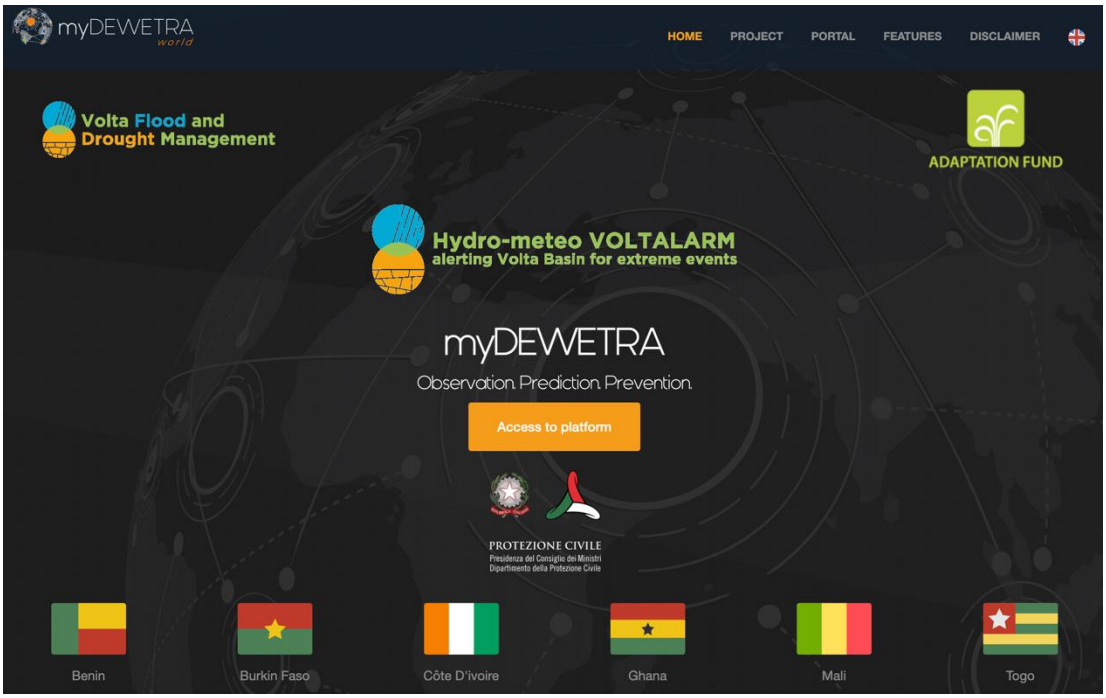
- myDewetra.World web application (Client)
- myDewetra.World data server (one for each node)

The web application is the core component of the system and allows to connect different nodes in the network and ensure the accessibility to real time data and maps. The myDewetra.World data servers are installed in each institution that is engaged in sharing data among the network. myDewetra.World Client is hosted on a dedicated cloud server.
The access to myDewetra.World is regulated by personalized username and password. Geospatial layers are classified in compliancy with INSPIRE Directive. The interface has been specifically designed to enhance navigation and search for information. The application manages both the data provided by several nodes of the system, as well as other geospatial data published as WMS (or WMS-T) services by other platforms.
Data are organized into three main categories: observations, forecast models and static layers. Each category is further structured in tags (a thematic classification, i.e. rain, thunderstorms, soil moisture et c.) and/or folders (by means of which the data are stored separately depending on their source: radar, satellite, weather stations et c.). The Observations menu usually contains all the real-time or near-real time information detected by remote sensors or weather stations of authoritative sources. Forecast models encompasses all the modeling suites and outputs provided by national weather services (for NWP models) and hydro-meteorological institutes (for hydrological/hydraulic) models. Normally quasi-static data, such as exposure data (population, structures, infrastructure, etc.), and

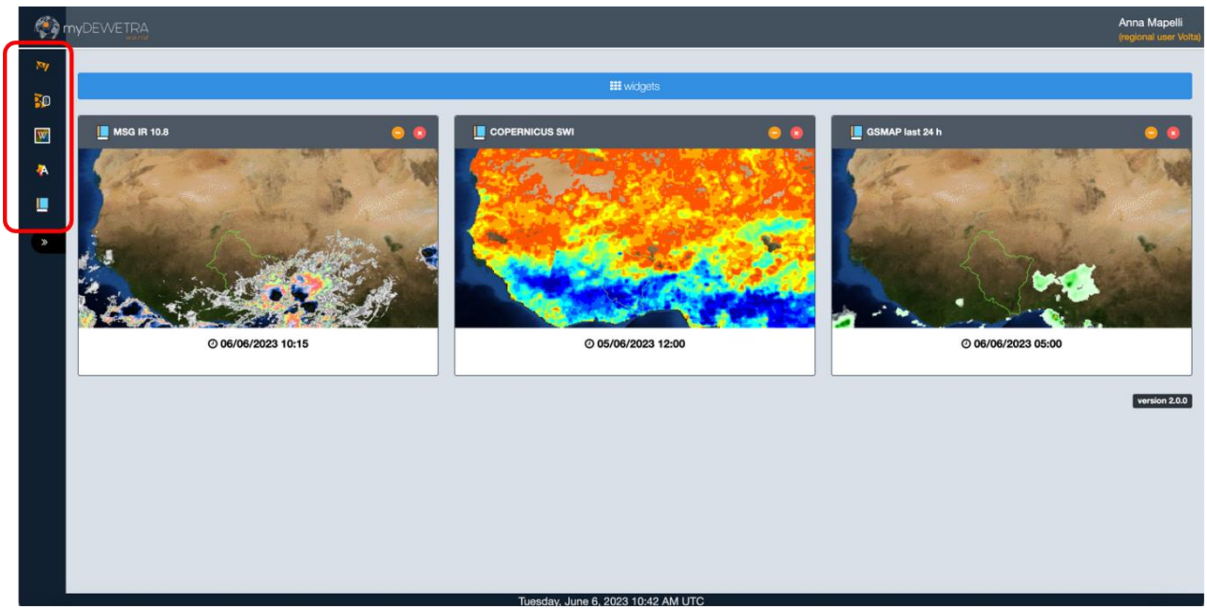
hazard layer (flood-prone areas for a given return period) are collected by the local National Spatial Data Infrastructure (when exists) and shared through the platform with other stakeholders to allow users to design specific risk scenarios.

1.1 Access to the platform

End users can access the web application from any personal computer connected to the Internet from the url: https://volta-staging.mydewetra.world



Click on “Access to platform”, then type your username and password, then press **Enter.**
The user is then prompted to the next tab in which the applications available in the portal are shown. This is the myDewetra-VOLTALARM Dashbord

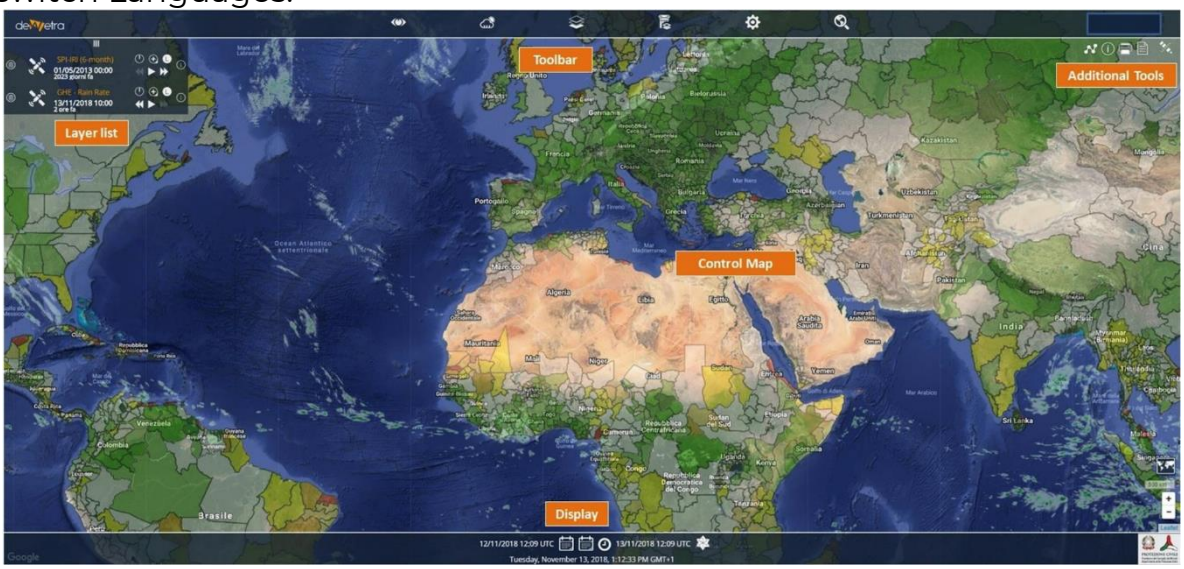


To enter the app Dewetra 2.0 users must click on the upper left icon (a black **W** on orange background) in the sidebar highlighted in red in the above image. The other icons are linking to additional apps functionalities such as the warning bulletins or user guides.

The current version is optimized for Google Chrome, freely available at: http://www.google.it/chrome/browser/desktop/

1.2 User interface

This section is devoted to give users a deeper insight about the main functionalities indicated in orange in the figure below, as well as how to switch Languages.



Switch Language

At present, myDewetra.World is offered in the following languages: English, French, Spanish, Portuguese, Albanian, Greek, Ethiopian and Italian (default).To change the default settings, click on your account at the top right corner. A menu will pop up (see figure below). Left click on the flag corresponding to the language you want to set: the system will update all the labels and menu accordingly.

Control Map

The **Control Map** of the application is managed by the open-source Java script library Leaflet. The control is instantiated as the system is started, using the Google Hybrid map provided by Google-Maps services as the background layer. The available background maps are:

- Google Map: consists of the world political map, toponyms are shown with respect to the zoom level.
- Google Satellite: consists of the world's physical map obtained from the composition of high-resolution satellite images.
- Google Terrain: world physical map in which are graphically displayed mountain ranges, lakes, rivers, depressions, etc.
- Google Hybrid (default): represents the combination of the two aforementioned maps.

In addition to these main options, the user can upload every background map released by open-source consortia (eg., OpenStreetMap) such as Standard, Cycle Map, Transport Map, MapQuestOpen, Humanitarian, et c.

The user can select the background map by moving the cursor on the action button located in the lower right of the screen, shown in the left figure. It is possible to pan the map by clicking the left mouse button and dragging it to the desired direction.

The zoom level may be controlled:

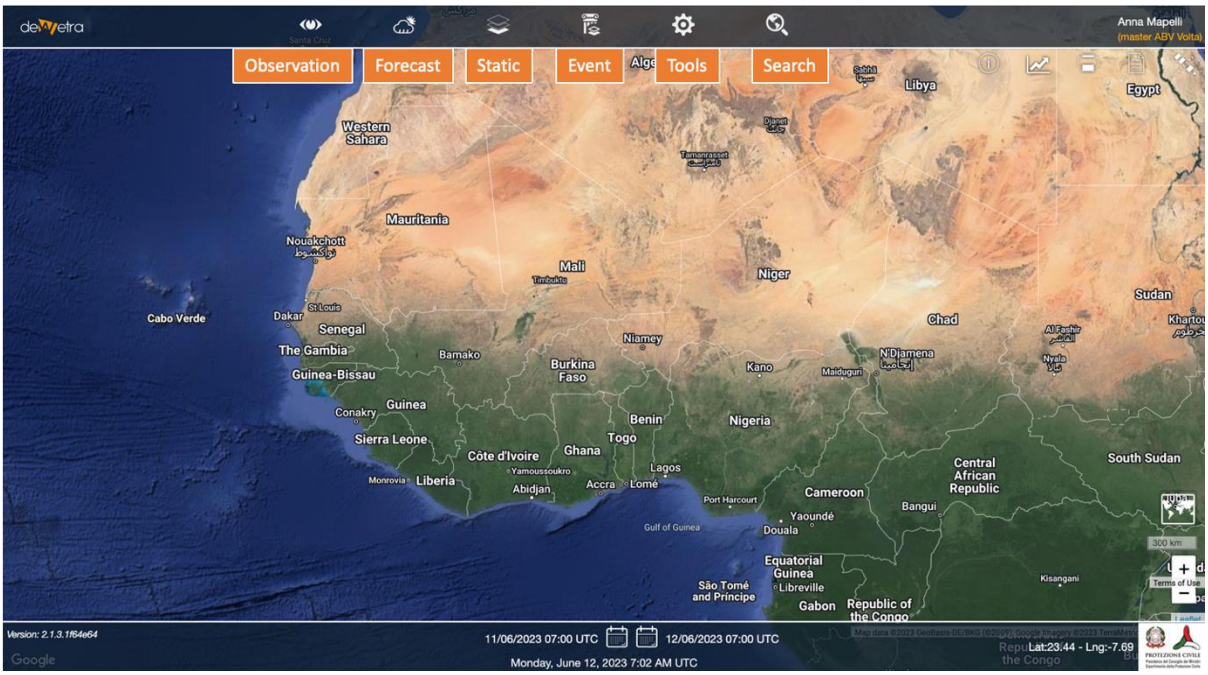
1. using the mouse wheel (scroll forward: increases level of zoom / scroll back: decreases zoom level)
2. by holding down the SHIFT key on the keyboard and drawing a rectangle with the mouse, holding the left mouse button clicked. In this way, the zoom will be related to the selected area

3. by the combination of CTRL and + buttons (Zoom In) or CTRL and - (zoom out)

Toolbar

The **Toolbar** contains many action buttons, depending on user's profile, like the following:

- **Observations**: is the section dedicated ot observational data and diagnostic models
- **Forecast Models**: lists all the available forecast systems (numerical weather prediction models, hydrological models, landslide susceptibility models;
- **Static Layers**: provides all the information needed to design a comprehensive risk scenario such as the exposures or the hazard maps
- **Events**: is the category that groups all the layers concerning disasters happened in the past such as floods, earthquakes, fires, et c.
- **Tools**: enables some ancillary functions such as Add a WMS, Risk Scenarios, et c.
- **Search**: is the tool allowing the users to search for any element visualized by the platform such as weather stations, toponyms, et c.



Display

The time range of the data the system is visualizing are shown in the **Display**. Within this area users may find:

- the initial date of the time range selected by the users
- the end date of the time range selected by the users

– the current date

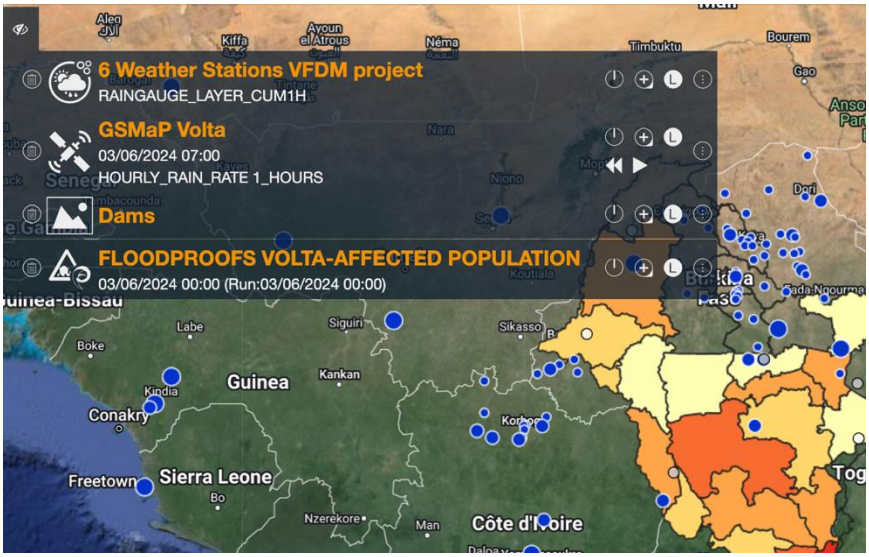
By default, the application will set the limits of the time range between "now" (i.e., current date and UTC time) and 24 hours before (which is assumed as the beginning of the period of the analysis).

In the display there are four action buttons:

– the two calendar icons allow the users to modify, respectively, the starting date and the end of the time range. By clicking on the buttons, you can set both start and end dates (minutes, hours, day, month and year) of any time window into the past and view the data available at that time (the so-called *deferred time* mode).
– the clock-shaped icon sets back the dates of beginning and end of the time range to the default mode

Layer list

Unlike the previous version of Dewetra, the Layer List is dynamically created whenever the user loads a static and / or dynamic layer. Everytime a layer is selected by the user, the Layer List -containing the layer name and the available options for it- is displayed in the top left corner.



Each element of the list can be turned on or off and therefore displayed or hidden on the map, by acting on the control menu next to the name. Its relative position on the list corresponds to the position of the layer on the map: usually, the latter layer that has been loaded overlaps the former ones. Anyway, users may change the priority of a layer, by left-clicking on the layer icon next to the name in the Layer List and dragging it up or down.

The available features for the dynamic layers (Observations and Forecast), for the Static Layers and for the Events are described in the dedicated sections.

Every time a layer is pulled on, the application uploads it in the **Control Map** and the **Layer List** (top left of the screen). If the cursor is left on the name of the layer in the **Layer List**, the user enables the tooltip function to open two windows:

1. the first one at the top right of the screen which shows the metadata of the layers, such as:
   - name of the layer
   - layer description
   - layer type

In the given example, the tooltip displays the available information about the European Digital Elevation Model.

2. the second one is placed immediately to the right of the **Layer List** and shows the layer type.

In the following example, a tooltip appears to the right of the **Layer List** for the European Digital Elevation Model.

On the left to the name of the layer listed in the **Layer List** users find the trash-can icon by means of which the previously loaded layer can be deleted. On the right to the layer's name the system offers to the user a set of buttons:

- **Turn on / Turn off** visualizes / deletes a previously loaded layer
- **Zoom to Layer** allows the user to bring the zoom back to the default level for that layer

- **Legend** displays the pop-up window showing the legend for the selected layer
- **Scroll** offers the user the option to display a set of successive time steps of a given variable within the time range set in the **Display**)
- **Expand** allows to display the buttons that activate some additional functions such as:

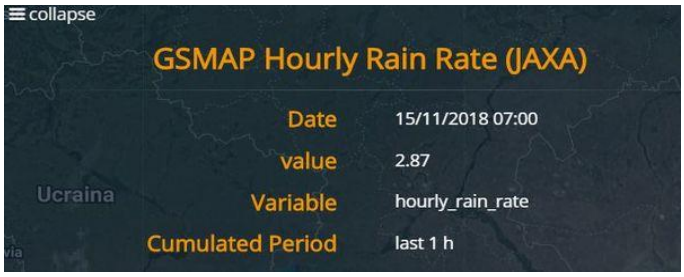
1. the **slider** adjusts the transparency / opacity of each layer
2. the **metadata** button that allows the user to view / download the metadata file associated to the layer

Additional tools

The Additional Tools button is placed in the upper right of the dashboard, immediately below the Toolbar and includes in order, from left to the right, the tools Info, Time Series and Measure.

- **Info**

info is activated by left clicking **i** icon and allows the user to pull on the information associated to each layer that has been previously loaded. In the following example, the application of **info** to the rainfall layer: the pop-up window opens in the upper right part of the screen displaying the rain depth of the point that has been clicked on.

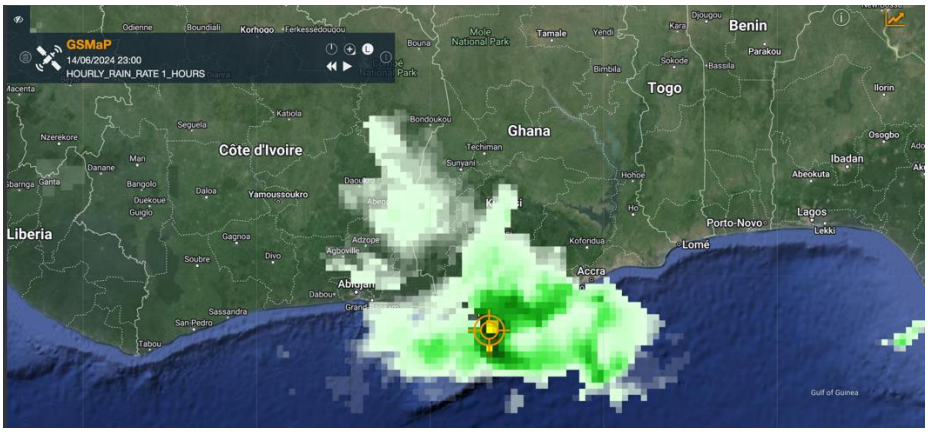


In the example, the pop-up window containing the rainfall depth value provided by the rainfall map layer.
If **info** is applied to a static layer, the pop-up window will show all the attributes available in the database for that layer. As an example, the next figure shows the result displayed in case a user clicked the Hospitals layer.

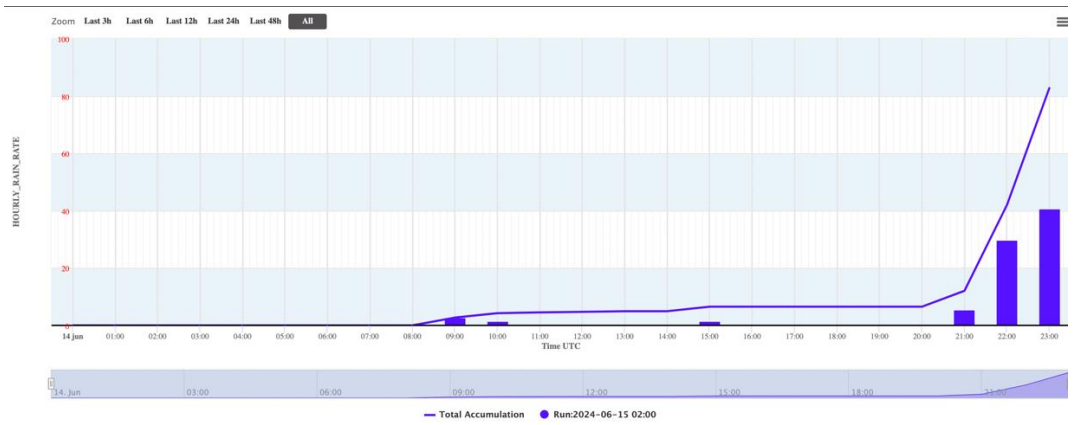
In the example, the pop-up window containing the attributes of the Hospitals layer. To disable the info and return to the navigation mode, left-click again on the **i** icon.

- **Time Series**

The **Time Series** button allows you to operate over raster maps of rainfall estimation by satellite or raster maps of variables forecasted by meteorological models. It is activated by left clicking on the arrow-graph icon and it allows the user to pull out, at a specific point in the map, the time evolution of the variable associated to each layer that has been previously loaded.

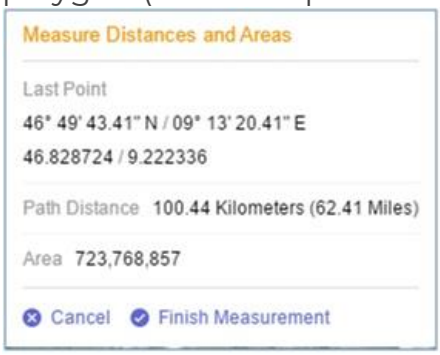


It opens a pop-up window with the graph of the time evolution of the variable both in the past (if the layer is coming from Observation menu) and in the future (if the layer is coming from Forecast menu).



Measure Distance and Areas

The **Measure** button allows you to open a drop-down menu through which you can choose to **Create a new measurement** by left-clicking on the corresponding button. In this way the user can draw a straight line or pinpoint the vertices of a polygon by left-clicking directly on the map. At the same time, through a pop-up window, the system provides information about the line's length (in both kilometers and miles) and the area of the polygon (in both square metres and miles).



In the example, the pop-up window containing the length of the line drawn by the user and the area of the polygon.
To complete the action, left-click on **Finish Measurement** inside the pop-up menu: in this way, the last point on the map set is automatically connected to the first. When the measurement is completed, the system displays the length of the solid line and area of the polygon. Also, user may choose whether to delete it or to centre the **Control Map** on the line (polygon) that has been previously drawn.

In the example, the pop-up window containing the information displayed by the system once the action has been completed by the user.

2. Observations data and products

The first action button of the **Toolbar** is the **Observations** menu, which provides access to all the observational datasets to the user. Once the user clicks on the menu, two different views are offered:
the **Tag** and **Folder** mode. The **Tag** mode shows the observational data as organized by thematic criteria, as shown in the following table.

Tag	Layer
Warnings	GDACS_RSS
Water Quality	Lake Water Quality (Copernicus)
Land Cover	Dry Matter Productivity (Copernicus)
	Lake Surface Water Temperature (Copernicus)
	Water Bodies (Copernicus)
Rainfall	6 Weather Stations VFDM project
	ACMAD – Daily Precipitation
	GHE
	GSMaP
	GSMaP Real Time
	IMERG-24hrs
	IMERG-30min
Fires	MODIS Hotspots
Drought	SPI Volta
	SPEI Volta
	SSMI Volta
	FaPAR Volta
	CDI Volta
	SPEI (Global)
	SPI-IRI (Global)
	Total Water Storage Anomaly Map
Soil Moisture	Soil Water Index (Copernicus)
Cloud Cover	MSG IR 10.8
FloodProofs Volta	FloodProofs Volta – Evapotranspiration
	FloodProofs Volta – Soil Moisture
Floods	Advisory Flags (GFM)
	Affected Landcover (GFM)
	Affected Population (GFM)
	Exclusion Mask (GFM)
	Observed Flood Extent (GFM)
	Observed Water Extent (GFM)

	Reference Water Mask (GFM)
	Uncertainty Values (GFM)
	VIIRS 1-day
	VIIRS 5-day
	VIIRS floodwater depth

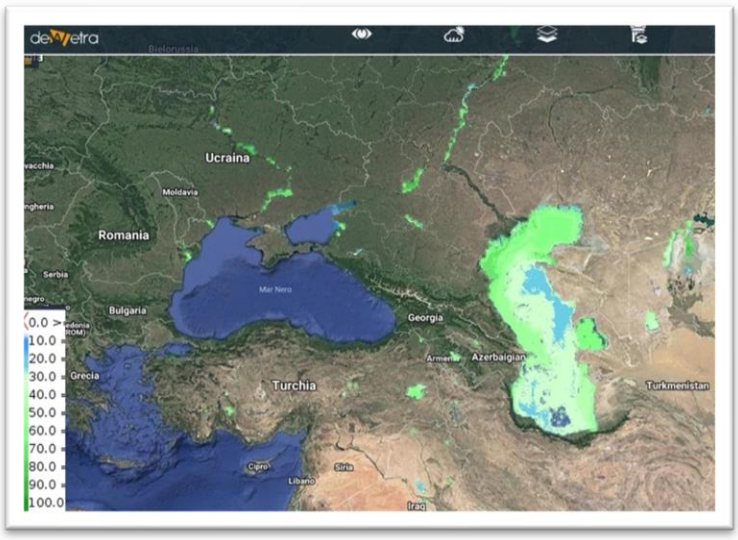
2.1. Warnings

GDACS Alert Service

Layer name	GDACS_RSS
Tag	Warnings
Source	GDACS
Description	Global Disaster Alert and Coordination System (GDACS) is a cooperation framework between the United Nations and the European Commission. It includes disaster managers and disaster information systems worldwide and aims at filling the information and coordination gaps in the first phase after major disasters. GDACS provides real-time access to web-based disaster information systems and related coordination tools. GDACS activities are presented and endorsed by the GDACS Advisory Board, which is currently chaired by the Joint Research Centre. Annual GDACS Advisory Group meetings are attended by disaster managers, scientists, map experts, webmasters and other professionals, to define standards for information exchange and a strategy for further development of related tools and services. The Activation and Coordination Support Unit (ACSU) or Emergency Response Support Branch (ERSB) in the United Nations Office for Coordination of Humanitarian Affairs (OCHA) in Geneva acts as GDACS Secretariat. The integrated GDACS website offers the following disaster information systems and online coordination tools, GDACS Disaster Alerts, which are issued and disseminated to some 25,000 subscribers immediately following sudden-onset disasters. The automatic estimates and risk analysis–the basis of the alerts –are provided by the European Commission Joint Research Centre (JRC). More info at: GDACS documentation on line
Available variables	Natural disasters happened in the last 24 hours

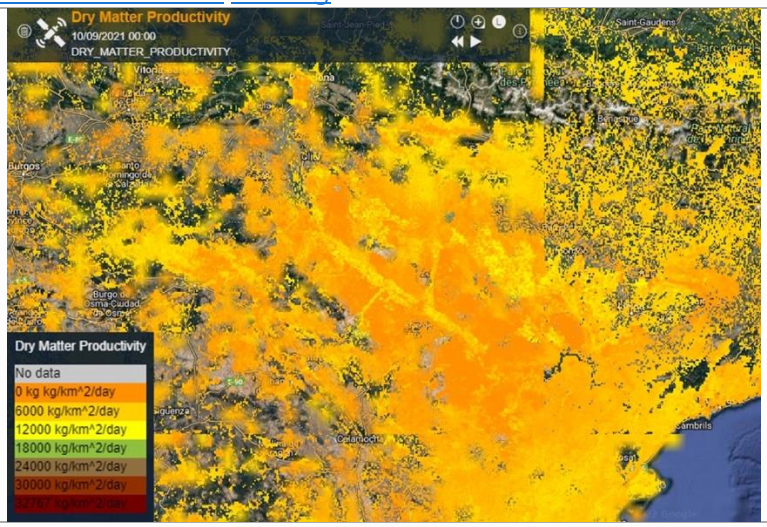
2.2. Water quality

Lake Water Quality (Copernicus)

Layer name	Lake Water Quality (LWQ)
Tag	Land Cover
Source	Copernicus Global Land Service
Description	Monitoring water quality in lakes and reservoirs is key in maintaining safe water for drinking, bathing, fishing and agriculture and aquaculture activities. Long-term trends and short-term changes are indicators of environmental health and changes in the water catchment area. Directives such as the EU's Water Framework Directive or the US EPA Clean Water Act request information about the ecological status of all lakes larger than 50 ha. Satellite monitoring helps to systematically cover many lakes and reservoirs, reducing needs for monitoring infrastructure (e.g. vessels) and efforts. The Lake Water Products (lake water quality, lake surface water temperature) provide a semi-continuous observation record for a large number (nominally 1,000) of medium and large-sized lakes, according to the Global Lakes and Wetlands Database (GLWD) or otherwise of specific environmental monitoring interest. Next to the lake surface water temperature that is provided separately, this record consists of three water quality parameters: The turbidity of a lake describes water clarity, or whether sunlight can penetrate deeper parts of the lake. Turbidity often varies seasonally, both with the discharge of rivers and growth of phytoplankton (algae and cyanobacteria). The trophic state index is an indicator of the productivity of a lake in terms of phytoplankton, and indirectly (over longer time scales) reflects the eutrophication status of a water body. More info at: Copernicus LWQ documentation on line
Screenshot	
Available variables	Turbidity, Trophic state

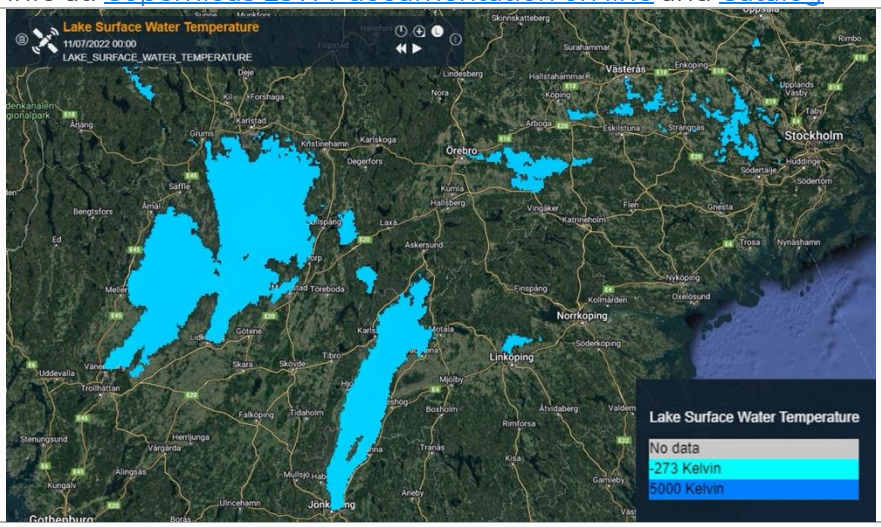
2.3. Land Cover

Dry Matter Productivity (Copernicus)

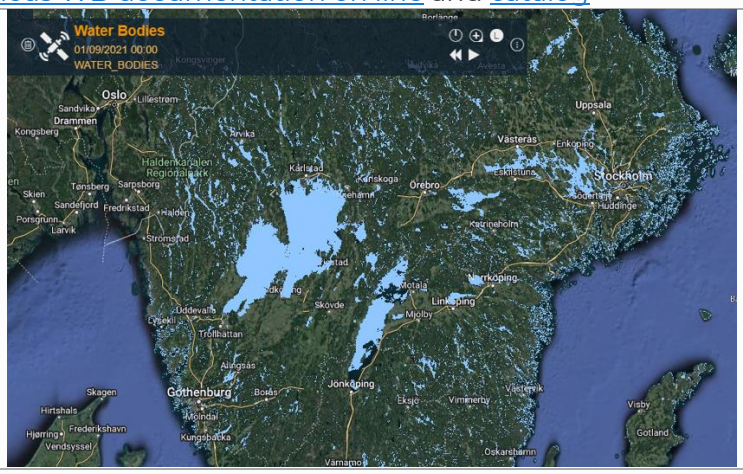
Layer name	Dry Matter Productivity DMP (Copernicus)
Tag	Land Cover
Folder	Eo Satellite
Source	DMP (Copernicus)
Description	Dry matter Productivity (DMP) represents the overall growth rate or dry biomass increase of the vegetation and is directly related to ecosystem Net Primary Productivity (NPP), however with units customized for agro-statistical purposes (kg/ha/day). Similarly the Gross Dry Matter Productivity (GDMP) is equivalent to Gross Primary Productivity (GPP). The main difference between DMP and GDMP lies in the inclusion of the autotrophic respiration. More info at: Copernicus DMP documentation on line catalog
Screenshot	
Available variables	Dry matter productivity

Lake Surface Water Temperature (Copernicus)

Layer name	Lake surface water temperature (LSWT) (Copernicus)
Tag	Land Cover
Folder	Eo Satellite
Source	LSWT (Copernicus)
Description	Lake surface water temperature (LSWT) describes the temperature of the lake surface every 10 days, one important indicator of lake hydrology and biogeochemistry. Temperature trends observed over many years can be an indicator of how climate change affects the lake. LSWT is recognized internationally as an Essential Climate Variable (ECV) and complements the Lake Water Quality information, in

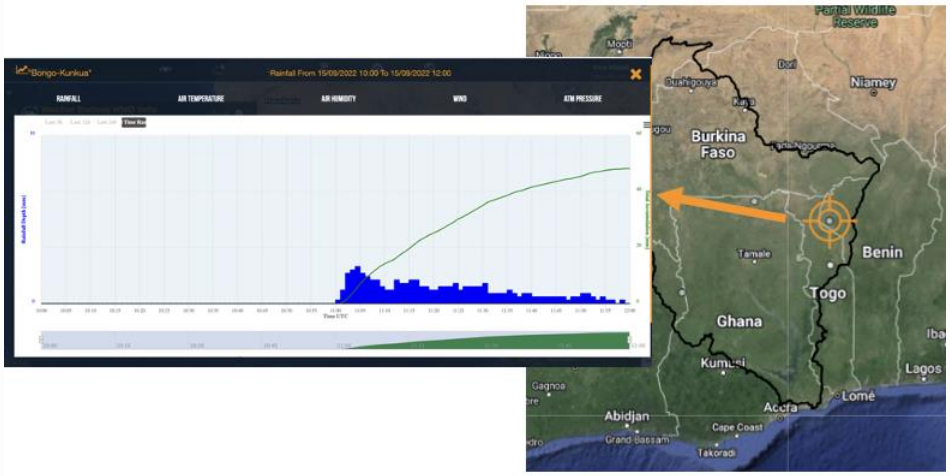
	environmental monitoring of a large number of lakes globally. More info at: Copernicus LSWT documentation on line and Catalog
Screenshot	
Available variables	Lake surface water temperature

Water Bodies (Copernicus)

Layer name	Water Bodies (LSWT) (Copernicus)
Tag	Land Cover
Folder	Eo Satellite
Source	LSWT (Copernicus)
Description	The Water Bodies product detects the areas covered by inland water along the year providing the maximum and the minimum extent of the water surface as well as the seasonal dynamics. The area of water bodies is identified as an Essential Climate Variable (ECV) by the Global Climate Observing System (GCOS). More info at: Copernicus WB documentation on line and catalog
Screenshot	
Available variables	Water Bodies and Water Bodies quality

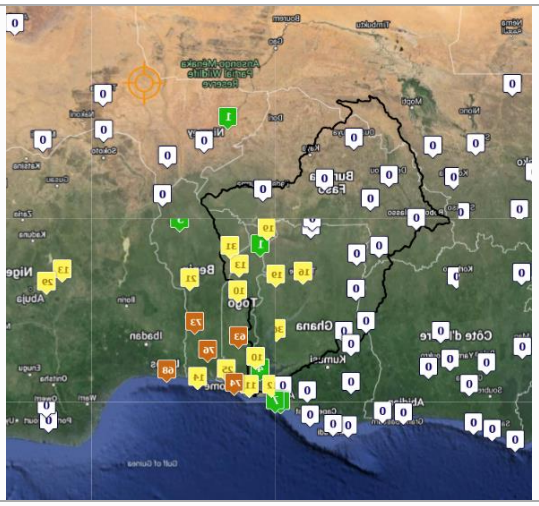
2.4. Rainfall

6 Weather Stations VFDM project

Layer name	6 Weather Stations VFDM project
Tag	Rainfall
Source	VFDM project
Description	Automatic ACRONET Weather Stations Installed In 6 Pilot Sites Over The Volta Basin (1 Per Country) Within The Framework Of The VFDM Project, Implemented By WMO, VBA And GWP-WA
Screenshot	
Available variables	Rain gauge (punctual measures and cumulation), Temperature, Air Humidity, Wind
Available accumulations	1, 3, 6, 12 and 24 hours (rainfall)
Interpretation and use	When hovering on one rain gauge station, the last 1, 3, 6, 12 and 24 hours cumulated precipitation are displayed in a table. By clicking on the station, the observed rainfall graph of last 24h is opening (punctual and cumulated measurements) and with the tabs menu the user can switch to visualisation of temperature, air humidity and wind. The graph can be reduced to last 12h and 3h with dedicated buttons top left of the graph and extended to various days and/or in past periods by using the 2 calendars below the graph. With the 3 lines button (Options) on the top right side of the graph, it's possible to choose the format for downloading data.

ACMAD – Daily Precipitation

Layer name	ACMAD – Daily Precipitation
Tag	Rainfall
Source	ACMAD
Description	Observed last 24 hours cumulative rainfall at synoptic and country meteorological stations in Africa, from the African Regional Climate Center (ACMAD)

Screenshot	
Available variables	Observed rainfall rate
Available accumulation	24 hours
Interpretation and use	Daily precipitation rates are indicated in mm in a box above each station. Colours indicates classes of precipitation rate, highlighting growing precipitation rate with a colour scale from white to orange. Historical daily precipitation rate can be consulted up to 5 months in the past.

GHE Rain Rate

Layer name	GHE
Tag	Rain
Source	NASA-OSPO
Description	NOAA Global Hydro-Estimator satellite-based precipitation estimates. The HE algorithm uses infrared (IR) brightness temperatures to identify regions of rainfall and retrieve rainfall rate, while using National Centers for Environmental Prediction (NCEP) Global Forecast System (GFS) model fields to account for the effects of moisture availability, evaporation, orographic modulation, and thermodynamic profile effects. Estimates of rainfall from satellites can provide critical rainfall information in regions where data from gauges or radar are unavailable or unreliable, such as over oceans or sparsely populated regions. Recently the HE has been extended to the entire globe equator-ward of 60 degrees to meet user community's need for support of global flash flood guidance efforts. The HE rainfall rate estimates are produced routinely every 15 minutes for the continental United States using the data from NOAA's Geostationary Operational Environmental Satellites (GOES), and also for the rest of the world using available geostationary data over Europe, Africa, and western Asia (METEOSAT), and eastern Asia (MTSAT). The global rainfall composite is then generated from those estimates from multiple satellites and updated every 30 minutes. The operational global HE products available include instantaneous rain rates and 1-hour, 3-hour, 6-hour, 24-hour and multi-day precipitation accumulations.

	More info at: GHE documentation on line
Screenshot	
Available variables	Observed rainfall rate
Available accumulations	Hourly
Spatial aggregation	World regions HydroShed basins level 4 and 5

GSMaP et GSMaP Volta

Layer name	GSMaP
Tag	Rain
Source	JAXA and NASA
Description	The GSMaP Project was sponsored by JST-CREST and is promoted by the JAXA Precipitation Measuring Mission (PMM) Science Team, and the GSMaP products were distributed by the Earth Observation Research Center, Japan Aerospace Exploration Agency. Global Satellite Mapping of Precipitation (GSMaP) provides a global hourly rain rate with a 0.1 x 0.1 degree resolution. GSMaP is a product of the Global Precipitation Measurement (GPM) mission, which provides global precipitation observations at three-hour intervals. Values are estimated using multi-band passive microwave and infrared radiometers from the GPM Core Observatory satellite and with the assistance of a constellation of other satellites. GPM's precipitation rate retrieval algorithm is based on a radiative transfer model. The gauge-adjusted rate is calculated based on the optimization of the 24h accumulation of GSMaP hourly rain rate to daily precipitation by NOAA/CPC gauge measurement. This dataset is processed by GSMaP algorithm version 6 (product version 3). GSMaP Volta the same product, with possible spatial aggregation at the level of the volta basin and administrative levels within the Volta basin boundaries. More info at: GSMaP documentation on line

Screenshot	
Available variables	Rain depth
Available accumulations	1, 3, 6, 12 and 24 hours

GSMaP Real Time

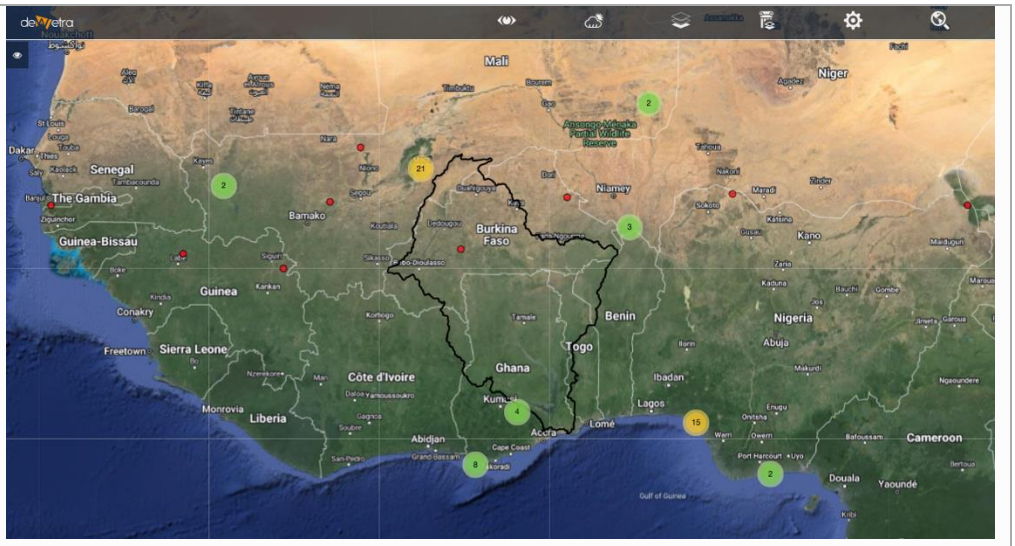
Layer name	GSMaP (Real Time)
Tag	Rain
Source	JAXA and NASA
Description	The JAXA Realtime Raindall Watch website is mainly for monitoring current precipitation distribution. It provides the quasi-realtime precipitation information and is updated every 30 minutes. GSMaP Realtime (GSMaP_NOW) had been provided within Asia-Pacific region (GEO-Himawari) since November 2015. The domain of it was extended to the Europe-Africa region (GEO-Meteosat) since November 2018, and then it has been available in whole globe including US region (GEO-GOES) since June 2019. To provide rainfall data in real time, the data available only within 30 minutes is used. Please refer here to the detail information for input data of GSMaP_NOW. More info at: GSMaP documentation on line
Screenshot	
Available variables	Rain depth
Available accumulations	Hourly

IMERG products

Layer names	IMERG 24-hours and IMERG 30-min
Tag	Rain
Source	NASA
Description	Integrated Multi-satellite Retrievals for GPM. This algorithm intercalibrates, merges and interpolates "all" satellite passive microwave precipitation estimates, together with microwave-calibrated infrared (IR) satellite estimates, monthly precipitation gauge analyses, and potentially other precipitation estimators at fine time and space scales for the TRMM and GPM eras over the entire globe. More info at: IMERG documentation on line
Screenshot	
Available variables	Rain depth
Available accumulations	30 minutes and 24 hours

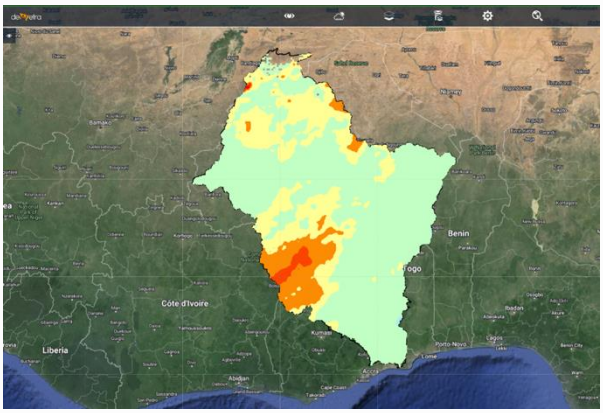
2.5. Fires

Layer name	MODIS HotSpots
Tag	Fires
Source	FIRMS-NASA
Description	The MODIS active fire product detects fires in 1-km pixels that are burning at the time of overpass under relatively cloud-free conditions using a contextual algorithm. Please see the MODIS Active Fire Product User's Guide for detailed information about the MODIS active fire product suite. More info at: MODIS HotSpots documentation on line

Screenshot	
Available variables	Hot spots (temperature anomalies observed by satellite data)
Available accumulations	24 hours, 48 hours, 1 week

2.6. Drought

Layer name	SPI Volta
Tag	Drought
Source	VFDM project
Description	The Standardised Precipitation Index (SPI) is the most commonly used indicator for detecting and characterizing meteorological droughts. The SPI measures precipitation anomalies at a given location, based on a comparison of observed total precipitation amounts for an accumulation period of interest, with the long-term historic rainfall record for that period. For any given region, increasingly severe rainfall deficits (i.e., meteorological droughts) are indicated as SPI decreases below −1.0, while increasingly severe excess rainfall are indicated as SPI increases above 1.0. Because SPI values are in units of standard deviation from the long-term mean, the indicator can be used to compare precipitation anomalies for any geographic location and for any number of time-scales. The SPI Volta layer is computed from CHIRPS precipitation data. More info at: https://climatedataguide.ucar.edu/climate-data/standardized-precipitation-index-spi and https://www.chc.ucsb.edu/data/chirps

Screenshot	
Available variables	Standardised Precipitation Index (SPI)
Available accumulations	cumulated rainfall over 1, 3, 6, 12 months
Interpretation and use	Values of SPI between -1 and +1 indicate normal precipitation conditions in the accumulation period. Negative SPI values indicate below average precipitation: periods with -1.5<SPI<-1 are considered moderately dry; when -1.5<SPI<-2, conditions are very dry; and SPI<-2 indicates extremely dry conditions. Conversely, positive SPI values of indicate above average precipitation in the accumulation period, periods with SPI > 1.5 are considered very wet and when SPI > 2, conditions are considered extremely wet. Additionally, since SPI can be calculated over different precipitation accumulation periods, the resulting different SPI indicators allow for estimating different potential impacts of a meteorological drought: when SPI is computed for shorter accumulation periods (e.g., 1 to 3 months), it can be used as an indicator for immediate impacts such as reduced soil moisture, snowpack, and flow in smaller creeks. when SPI is computed for longer accumulation periods (e.g., 3 to 12 months), it can be used as an indicator for reduced stream flow and reservoir storage.

SPEI Volta

Layer name	SPEI Volta
Tag	Drought
Source	VFDM project
Description	The Standardised Precipitation-Evapotraspiration Index (SPEI) expands on the SPI, by incorporating information about temperature increases in assessing the severity of drought conditions. It uses the difference between cumulative precipitation and potential evapotranspiration (calculated from temperature data using the Hargreaves-Samani formula) and measure its anomalies at a given location compared to the long-term historic rainfall and temperature records for that period. For any given region, increasingly severe droughts are indicated as SPEI decreases below –1.0, while increasingly severe excess wet conditions are indicated

	as SPEI increases above 1.0. Because SPEI values are in units of standard deviation from the long-term mean, the indicator can be used to compare conditions for any geographic location and for any number of time-scales. The SPEI Volta layer is computed from CHIRPS precipitation data and ERA5 temperature data. More info at: https://spei.csic.es/home.html, https://www.chc.ucsb.edu/data/chirps and https://www.ecmwf.int/en/forecasts/dataset/ecmwf-reanalysis-v5
Screenshot	*Same visualisation than SPI*
Available variables	Standardised Precipitation-Evapotraspiration Index (SPEI)
Available accumulations	cumulated rainfall-potential ET over 1, 3, 6, 12 months
Interpretation and use	Values of SPEI between -1 and +1 indicate normal conditions in the accumulation period. Negative SPEI values indicate that conditions are drier than usual: periods with -1.5<SPEI<-1 are considered moderately dry; when -1.5<SPEI<-2, conditions are very dry; and SPEI<-2 indicates extremely dry conditions. Conversely, positive SPEI values of indicate above average wetness in the accumulation period, periods with SPEI > 1.5 are considered very wet and when SPEI > 2, conditions are considered extremely wet. Additionally, since SPEI can be calculated over different accumulation periods, the resulting different SPEI indicators allow for estimating different potential impacts of a meteorological drought: when SPEI is computed for shorter accumulation periods (e.g., 1 to 3 months), it can be used as an indicator for immediate impacts such as reduced soil moisture, snowpack, and flow in smaller creeks. When SPEI is computed for longer accumulation periods (e.g., 3 to 12 months), it can be used as an indicator for reduced stream flow and reservoir storage.

SSMI Volta

Layer name	SSMI Volta
Tag	Drought
Source	VFDM project
Description	The Standardised Soil Moisture Index (SSMI) is used to detect and characterise agricultural drought. The SSMI measures soil moisture anomalies at a given location compared to the long-term historic conditions for that period. For any given region, increasingly severe soil moisture droughts are indicated as SSMI decreases below −1.0, while increasingly severe excess wet conditions are indicated as SSMI increases above 1.0. Because SSMI values are in units of standard deviation from the long-term mean, the indicator can be used to compare conditions for any geographic location. The SSMI Volta layer is computed from ERA5-Land soil moisture data. More info at: https://www.ecmwf.int/en/era5-land
Screenshot	*Same visualisation than SPI*

Available variables	Standardised Soil Moisture Index (SSMI)
Available accumulations	10-day
Interpretation and use	Values of SSMI between -1 and +1 indicate normal conditions. Negative SSMI values indicate that soil conditions are drier than usual: periods with -1.5<SSMI<-1 are considered moderately dry; when -1.5<SSMI<-2, conditions are very dry; and SSMI<-2 indicates extremely dry conditions. Conversely, positive SSMI values of indicate above average soil wetness, periods with SSMI>1.5 are considered very wet and when SSMI>2, conditions are considered extremely wet.

FAPAR Anomaly Volta

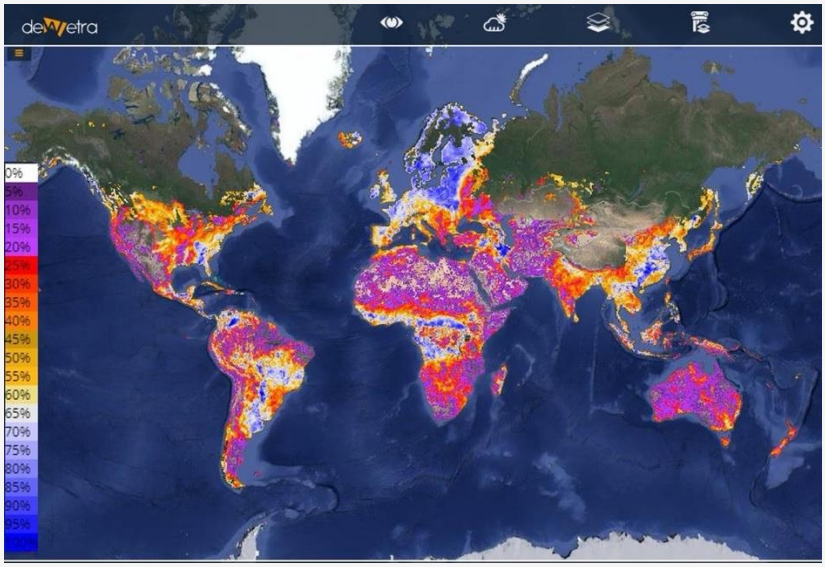
Layer name	FAPAR Anomaly Volta
Tag	Drought
Source	VFDM project
Description	The Fraction of Absorbed Photosynthetically-Active Radiation (FAPAR) is a measure of photosynthetic activity derived from satellite radiometry. The FAPAR anomaly shown in this layer is used to detect and characterise agricultural drought by estimating vegetation stress (low photosynthetic activity) in a given location compared to long-term historic FAPAR conditions for that period. For any given region, increasingly severe vegetation stress is indicated as FAPAR anomaly decreases below −1.0, while increasing photosynthetic activity is indicated as FAPAR anomaly increases above 1.0. Because anomaly values are in units of standard deviation from the long-term mean, the indicator can be used to compare conditions for any geographic location. The FAPAR anomaly Volta layer is computed from VIIRS FAPAR data. More info at: https://lpdaac.usgs.gov/products/vnp15a2hv002/
Screenshot	*Same visualisation than SPI*
Available variables	FAPAR anomaly (FAPARa)
Available accumulations	10-day
Interpretation and use	Values of FAPAR anomaly between -1 and +1 indicate normal conditions. Negative anomalies indicate that photosynthetic activity is lower than usual: periods with -1.5<FAPARa<-1 are considered to have significant vegetation stress; when -1.5<FAPARa<-2, photosynthetic conditions are extremely low; and FAPARa<-2 indicates extremely dry conditions. Conversely, positive FAPAR anomaly values of indicate above average photosynthetic activity and correlate with vegetation conditions that are lusher than normal for the period.

CDI Volta

Layer name	CDI Volta
Tag	Drought
Source	VFDM project
Description	The Combined Drought Indicator (CDI) is an indicator for drought early warning, specifically designed to monitor agricultural drought. Through the combination of spatial patterns of precipitation, evapotranspiration, soil moisture and vegetation greenness anomalies, the CDI identifies areas at risk of agricultural drought and areas where the vegetation has already been affected by drought. By integrating information from meteorological, hydrological and remote sensing vegetation data, a combined indicator can help reduce false alarms in drought assessment. The CDI Volta is derived by SPEI Volta, SSMI Volta and FAPAR Volta. More info at: https://doi.org/10.5194/nhess-21-481-2021
Screenshot	*Same visualisation than SPI*
Available variables	CDI
Available accumulations	10-day
Spatial aggregations	2-nd level administrative subdivisions (median)
Interpretation and use	The CDI in a given location can take four possible values representing increasingly severe drought conditions: no drought (0), normal conditions; watch (1), precipitation deficit onset; warning (2), soil-moisture drought, often linked to meteorological drought; alert (3), severe vegetation stress, often linked to severe soil-moisture and precipitation anomalies. When spatial data is aggregated using the median of the CDI numerical values (0-4), the resulting value represents the minimum condition covering at least half of the area of the administrative subdivision.

2.7. Soil moisture

Layer name	Soil Water index (SWI)
Tag	Soil Moisture
Source	Copernicus Global Land Service
Description	The Soil Water Index quantifies the moisture condition at various depths in the soil. It is mainly driven by the precipitation via the process of infiltration. Soil moisture is a very heterogeneous variable and varies on small scales with soil properties and drainage patterns.

	Satellite measurements integrate over relative large-scale areas, with the presence of vegetation adding complexity to the interpretation. The soil moisture, up to 5cm soil depth, is recognized as an Essential Climate Variable (ECV) by the Global Climate Observing System (GCOS). More info at: Copernicus SWI documentation on line
Screenshot	
Available variables	Soil water index at 1, 5, 10, 15, 20, 40, 60 and 100cm
Available accumulations	1 value every 24 hours
Spatial aggregations	World regions HydroShed basins level 4 and 5

2.8. Cloud Cover

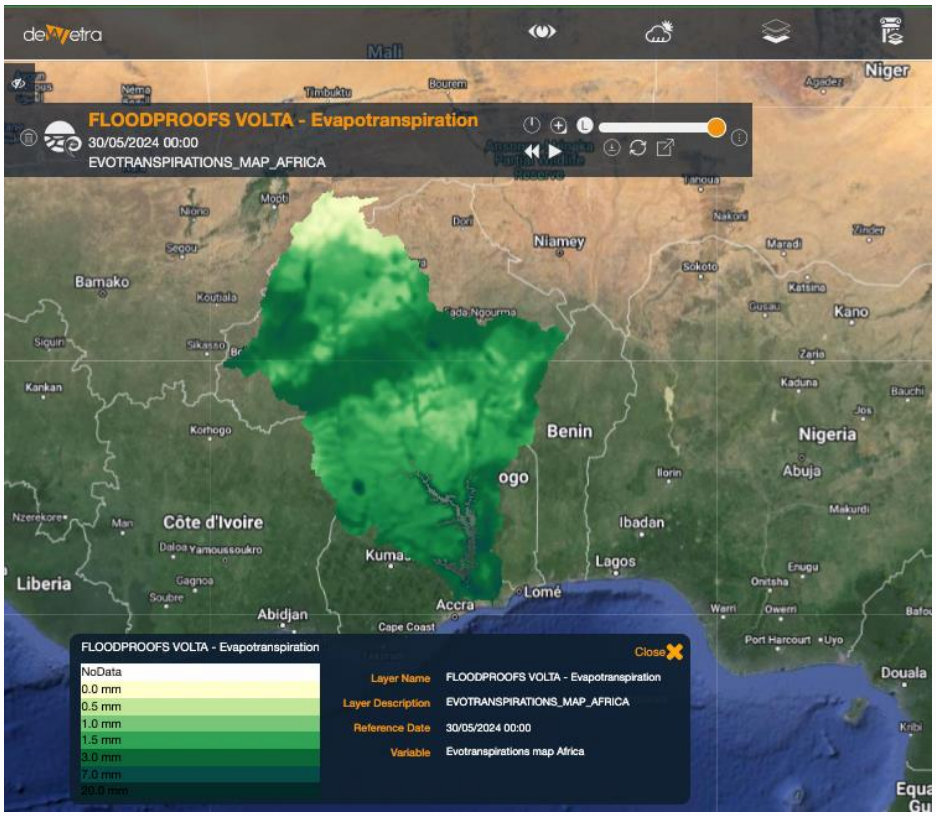
Layer name	MSG IR 10.8
Tag	Cloud Cover
Source	EUMETSAT
Description	MSG (Meteosat Second Generation) is a joint effort of ESA (European Space Agency) and EUMETSAT and follows the success of the first generation Meteosat satellites. ESA is responsible for the design and development of the first satellite (now in orbit) and the assembling of the other three in collaboration with EUMETSAT. The first satellite, MSG-1 was launched in August 2002. MSG-2 was launched in December 2005. The others were launched later (2011-2013). Each satellite has a nominal lifetime of seven years. The third and fourth MSG satellite of the same design are provided to ensure service continuity until the end of the next decade. With the launch of MSG-2, two MSG satellites are operational in

	geostationary orbit, the first one operating at 0 degrees longitude on the west equatorial Africa while the other is the back up. The second generation MeteoSat is designed to meet the different needs of users interested in nowcasting applications and the development of numerical models for weather forecasts and will also provide important data for climate monitoring which will help to quickly-identify the weather events that could trigger devastating aftermaths. The second generation of Meteosat images resumes at longer wavelengths and narrower intervals than its predecessors, making it particularly suitable for short-term forecasts of unexpected and troublesome weather phenomena such as snow, thunderstorms and fog. By default, the system displays the last available image in the infrared channel (10.8μHz). the refresh time is 15 minutes with a spatial resolution of about 3km. More info at: MSG documentation on line
Screenshot	
Available variables	Infrared brightness temperature

2.9. FloodProofs Volta

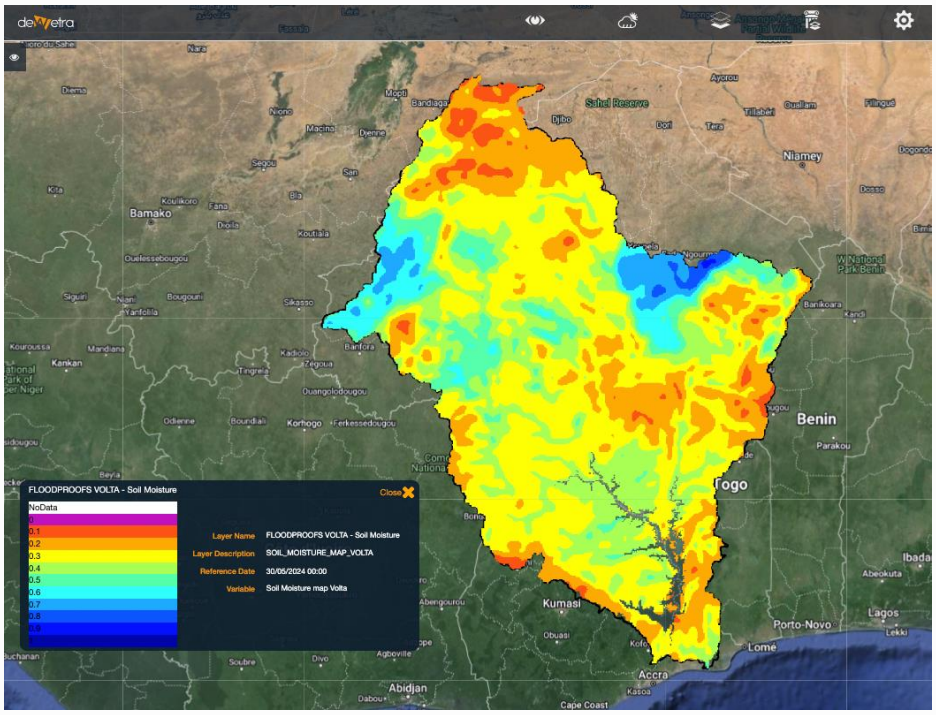
FloodProofs Volta – Evapotranspiration

Layer name	FloodProofs Volta – Evapotranspiration
Tag	FloodProofs Volta
Source	VFDM Project
Description	Simulated actual evapotranspiration at the start of each forecast run.

Screenshot	
Available variables	Daily evapotranspiration (mm)
Interpretation and use	The evapotranspiration map shows the spatial distribution of evapotranspiration rates across the Volta basin, according to daily CONTINUUM and FloodPROOFS Volta run. Evapotranspiration (ET) is the combined process of evaporation from the soil and other surfaces and transpiration from plants. These maps are crucial for understanding water loss in an ecosystem, which is vital for agriculture, water resource management, and environmental monitoring. For instance high ET migh indicates dense vegetation, a high demand for water by crops, and more susceptible are to drought because of higher warer losses by the vegetation to the atmosphere.

FloodProofs Volta – Soil Moisture

Layer name	FloodProofs Volta – Soil Moisture
Tag	FloodProofs Volta
Source	VFDM Project
Description	Simulated root-zone soil moisture at the start of each forecast run.

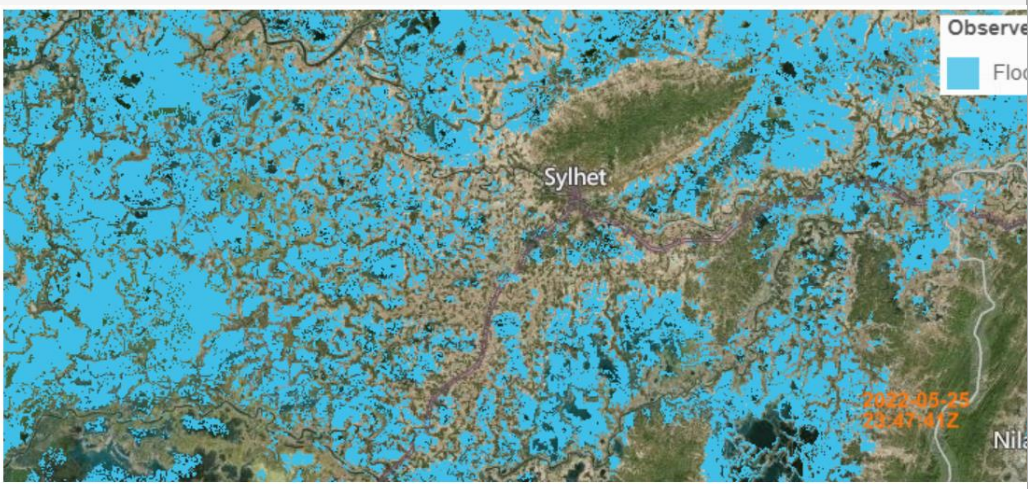
Screenshot	
Available variables	Daily soil moisture
Interpretation and use	The soil moisture map shows the spatial distribution of soil moisture content across the Volta basin, , according to daily CONTINUUM and FloodPROOFS Volta run. These maps are interesting for various applications in agriculture, hydrology, meteorology, and environmental monitoring. Tracking soil moisture can help in managing natural resources, predicting wildfire risks, floods and assessing the health of ecosystems.

2.10. Floods

The following global products are available in MyDewetra, as tools to observe floods extents from satellite data in the case of a flood event:

GFM products

Layer name	Observed Flood Extent (GFM)
Tag	Flood
Source	GFM
Description	The GFM product output layer S-1 Observed Flood Extent identifies the pixels covered by flood-water, mapped using Sentinel-1 (S-1) SAR backscatter intensity. Pixels that are normally under water (identified based on the monthly Sentinel-1 Reference Water Mask) are not part of the Sentinel-1 Observed Flood Extent. Sentinel-1 Observed Flood Extent is derived using the GFM ensemble flood mapping algorithm, as described in the dedicated section of this PUM.

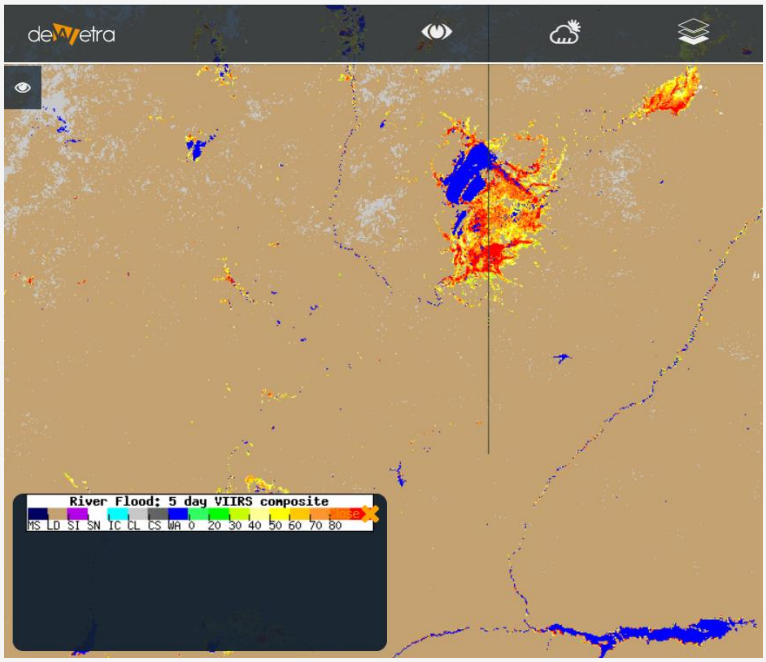
	To map flood extent pixels for a certain date, the algorithm uses as input the S-1 data overpass plus offline-generated S-1 SAR parameters and auxiliary thematic datasets such as Exclusion Mask and topography (e.g. digital elevation models and HAND index). The relative orbit path information, to select the corresponding offline-generated S-1 SAR parameters, is extracted from the S-1 Metadata. During the near real-time operation of the GFM product, the acquisition month of the S-1 scene is retrieved from the S-1 Metadata and the corresponding monthly Sentinel-1 Reference Water Mask is cropped to the extent of the processed S-1 scene.
Screenshot	
Available variables	Observed Flood Extent

Other products are (please click on the name of each layer to see detailed description):

- Advisory Flags (GFM)
- Affected Landcover (GFM)
- Affected Population (GFM)
- Exclusion Mask (GFM)
- Reference Water Mask (GFM)
- Uncertainty Values (GFM)

VIIRS products

Layer name	VIIRS 1-day composite/ 5-day composite/floodwater depth
Tag	Flood
Source	Space Science and Engineering CenterUniversity of Wisconsin-Madison
Description	The VIIRS Composited Flood Products are used to filter out cloud cover through a maximal waterfraction composition process and thus derive the maximal flood extent during a flood event from the VIIRS NRT flood maps of Suomi-NPP and NOAA20. The routinely global VIIRS Composited Flood Products include daily composited flood product and 5-day composited

	flood product. The composition process is done by dividing the global land into 136 AOIs. More info here See descriptions also here: • VIIRS 1-day • VIIRS 5-day • VIIRS floodwater depth
Screenshot	 Example of VIIRS 5-days composite
Available variables	5-day persistency of flooding

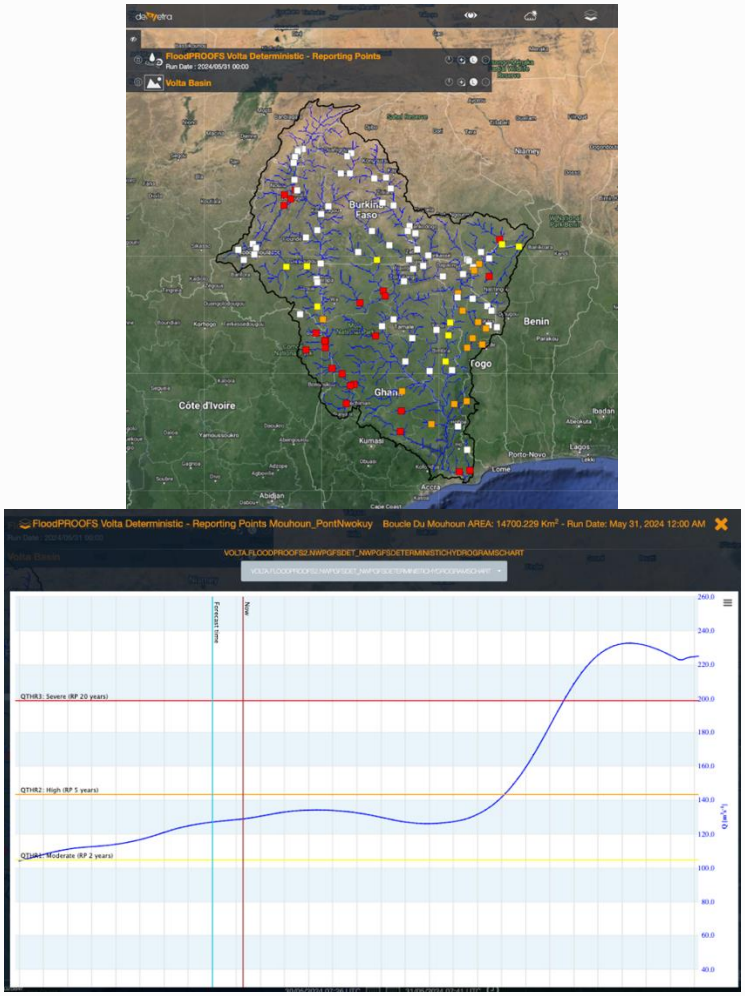
3. Forecast data and products

The second action button of the **Toolbar** is the **Forecasts** menu, which provides access to all weather and hydrological forecast models to the user. Once the user clicks on the menu, two different views are offered: the **Tag** and **Folder** mode. The **Tag** mode shows the forecast data as organized by thematic criteria, as shown in the following table.

Tag	Layer
Hydrological models	Floodproofs Volta Deterministic – Reporting points Glofas Initial soil moisture anomaly Glofas reporting points Glofas seasonal outlook – basin overview Glofas T=20 Glofas T=5 West Africa Hype V1.2 West Africa Hype V1.2+Updating local stations
Meteorological models	GFS 0.25° (VOLTA) ECMWF OpenData Africa ECMWF-ENS GSMAP Nowcasting ICON Africa
Hazard	FloodPROOFS Volta – Flood Hazard Level FloodPROOFS Volta – Flood Hazard map Rain Hazard Level Volta
Impacts	FloodPROOFS Volta –Affected Crop FloodPROOFS Volta –Affected Grazing FloodPROOFS Volta –Affected Population FloodPROOFS Volta –Affected protected ares FloodPROOFS Volta –Affected Roads Glofas - Flood –Affected Population Multihazard Impact-based Classification Volta

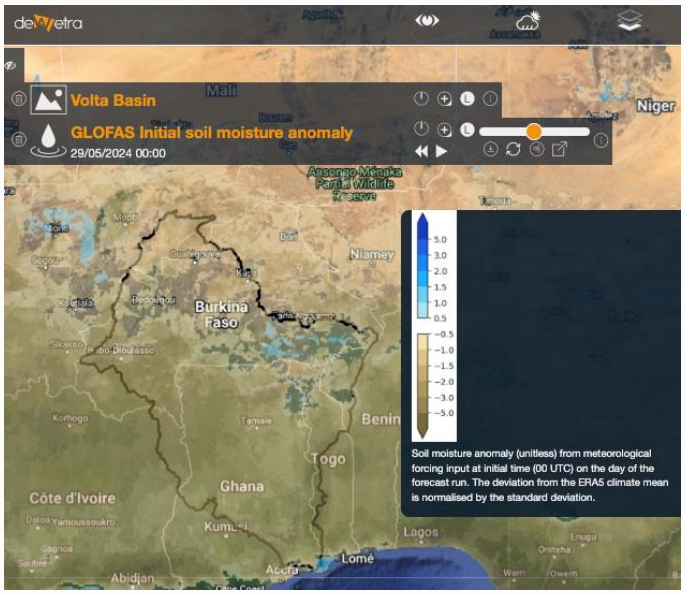
3.1. Hydrological models

Floodproofs Volta Deterministic – Reporting points

Layer name	Floodproofs Volta Deterministic – Reporting points
Tag	FloodProofs Volta
Source	VFDM Project
Description	Reporting points where forecast discharge time series can be visualized and compared to the warning thresholds. Based on deterministic forecasts.
Screenshot	
Available variables	Forecasted river discharge Forecasted flood peak severity (threshold exceedance)
Interpretation and use	The different reporting points are coloured according to the severity of the forecasted flood peak, based on the exceedance of return period thresholds defined from long-term run of the FloodPROOFS model.

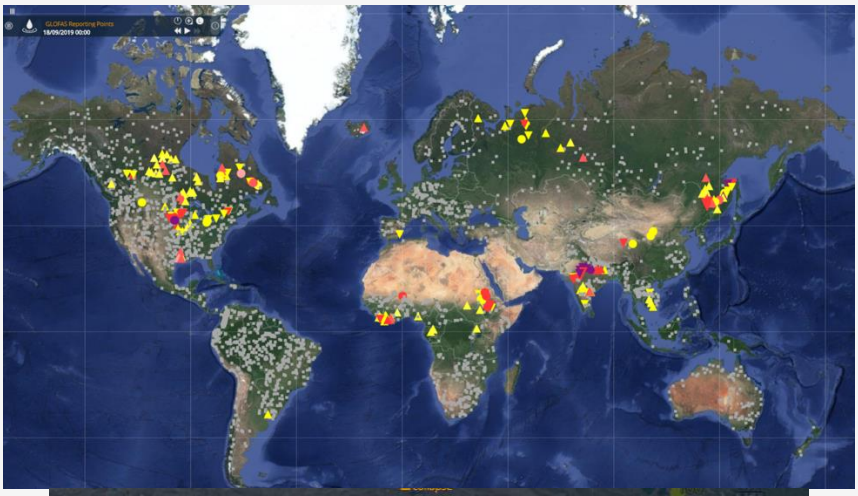
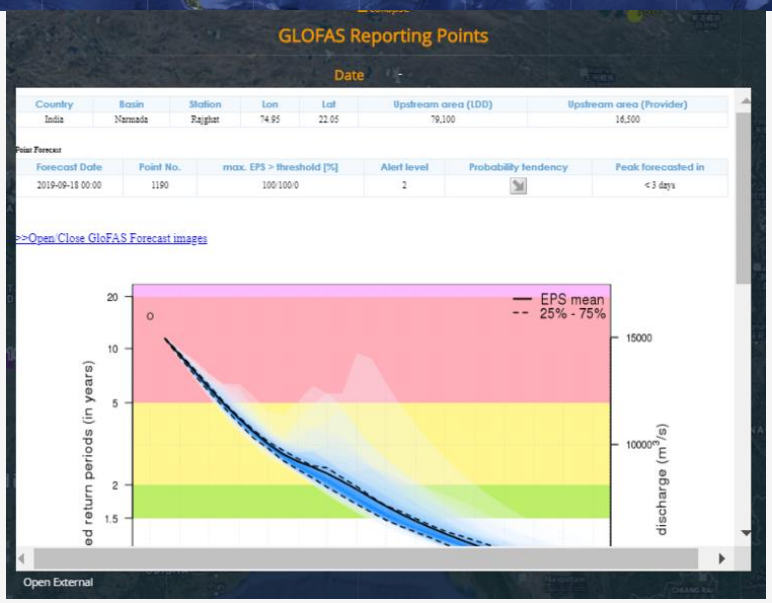
	No significant flood (T<2 years) Ordinary flood (T=2 years) Extraordinary flood (T=5 years) Exceptional flood (T=20 years) The reporting points can be consulted using the information icon, allowing the flood peak and river flow to be tracked along the river network in time.

Glofas Initial soil moisture anomaly

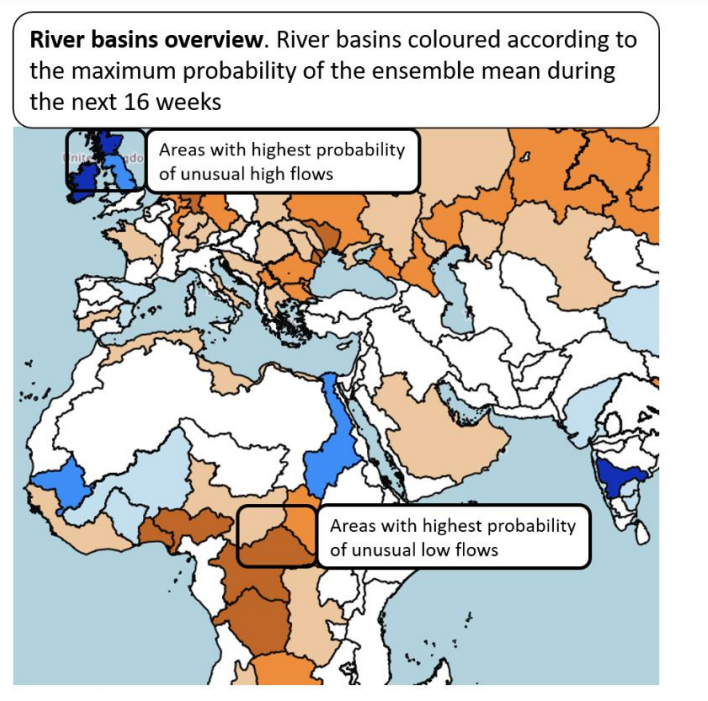
Layer name	Glofas Initial soil moisture anomaly
Tag	Hydrological model
Source	GLOFAS
Description	Initial condition of Soil moisture (%) from Glofas. It represents the ratio between the soil water content in the top layer (currently with 7 cm depth) compared with the maximum water content that this soil layer can hold from meteorological forcing input at initial time (00 UTC) on the day of the forecast run. The soil moisture anomaly is expressed as a ratio between the soil water content in the top layer (currently with 7 cm depth) compared with the maximum water content that this soil layer can hold.
Screenshot	
Available variables	Soil moisture anomaly

Glofas reporting points

Layer name	GLOFAS Reporting Points
Tag	Hydrological Models
Source	Global Flood Awareness System

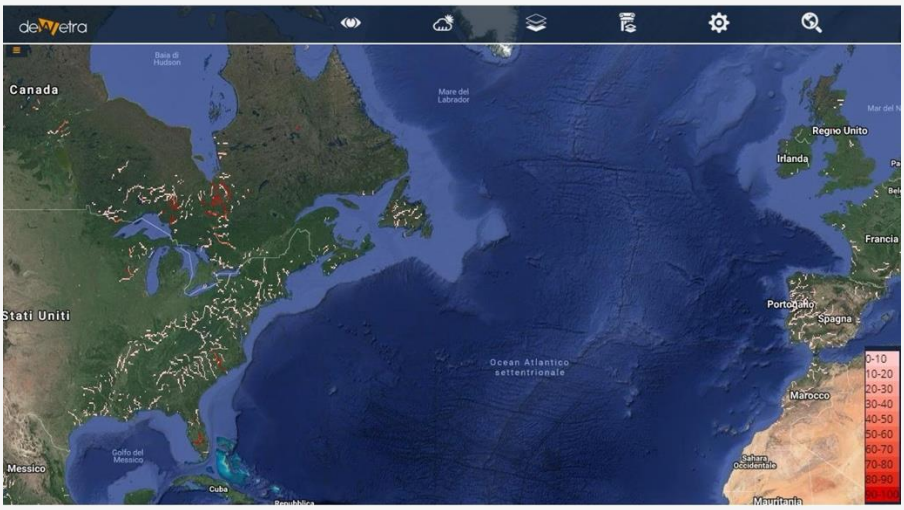
Description	This data set contains key locations at which the GloFAS flood forecast shows a high probability of exceeding the 2-, 5- and 20-year return period (three separate layers). Additionally, information for a large number of fixed stations all over the world is provided. For all stations, a wide-range of additional hydrological information is provided, such as: - hydrograph showing the probabilistic forecast for the next 30 days based on ECMWF-ENS - calendar matrices showing the evolution of forecasts in relation to the exceedance of critical hydrological thresholds. The update frequency of this data set is daily, and the spatial coverage is global; while the horizontal resolution is 0.1 degree. This information is produced by the operational suite of GloFAS (www.globalfloods.eu) in order to provide the user with in-depth information at relevant key locations. This information also provides a good indication of the reliability of the hydrological forecast. More info at:GLOFAS Reporting Points
Screenshot	 
Available variables	Probabilistic daily flow forecast for the next 30 days for each reporting point

Glofas seasonal outlook – basin overview

Layer name	Glofas seasonal outlook – basin overview
Tag	Hydrological model
Source	GLOFAS
Description	This shows the maximum area-averaged probability of unusually high (>80 percentile) or unusually low (<20 percent) weekly river flow for the four-month forecast period in 305 major world basins. For a detailed interpretation of the legend, refer to GloFAS Seasonal basin overview.
Screenshot	
Available variables	Maximum area-averaged probability of unusually high (> 80th percentile, blue) or low (<20th percentile, orange) weekly river flow occurring during the four 4-month forecast horizon for 305 major world river basins

GloFAS RP = 5 or 20 years

Layer name	GLOFAS T=5 years or T=20 years (Alert Probability)
Tag	Hydrological Models
Source	Global Flood Awareness System
Description	GloFAS 30-day v2.0 uses the Lisflood river routing model (van der Knijff et al., 2010) to propagate along the river channel the surface and sub-surface runoff forecasts of the HTESSEL land surface model (Balsamo et al., 2009) of the ECMWF ENS medium- and extended-range forecasting

	system to produce daily discharge forecasts. In GloFAS 30-day v2.0, Lisflood was calibrated for better accounting for the variability in the hydrological processes (Hirpa et. al., 2018). More details can be found in the Lisflood calibration page. ECMWF-ENS is the ensemble forecast of ECMWF and consists of 51 members at ~ 18 km resolution up to 15 days, increasing to ~36 km from day 16 to 30. ECMWF ENS runoff forecasts are resampled to 0.1 spatial resolution (~10 km) before being used as daily input to Lisflood to produce discharge up to day 15; from day 16 the latest available extended range forecast is used as forcing to produce seamless discharge forecasts for 30 days. GloFAS 30-day v2.0 initial conditions (atmosphere and land surface states from which to start the ensemble discharge forecast) are based on a 5-day monitoring analysis of the latest proxy-observations, the ERA5 ECMWF reanalysis. Because of ERA5's has a ~2 days latency (compared with real time), ERA5 is used only as long as it is available; for the remaining 2 to 3 days, prior to the GloFAS 30-day forecast, the day-1 of ECMWF-ENS-CNTL forecast is taken as input. More info at: GLOFAS documentation on line
Screenshot	
Available variables	Probability of exceedance of flood thresholds along the global river network (5, 20 years return period)

West Africa Hype V1.2 and **West Africa Hype V1.2+Updating local stations**

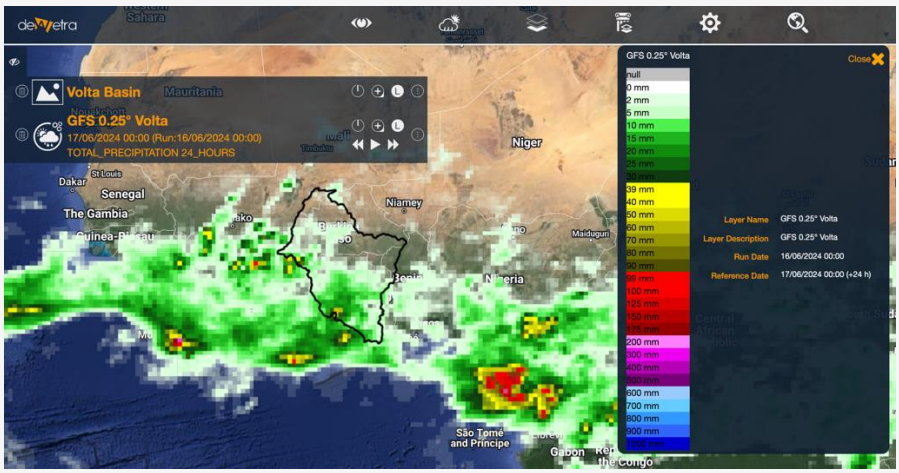
Layers name	West Africa Hype V1.2 West Africa Hype V1.2+Updating local stations
Tag	Hydrological model
Source	SMHI FANFAR
Description	Outcomes from the project FANFAR by the Swedish Institute SMHI, performing hydrological modelling and focussing on providing forecasts and alerts for fluvial flood in West Africa. These layers show the simulated streamflow at each reporting points in West Africa, including forecasted hydrographs of the next 8 days. Two versions are available in myDewetra, the standard West Africa Hype V1.2 as well as a version calibrated to local stations.
Screenshot	*Same visualisation as Floodproofs Volta Deterministic – Reporting points*
Available variables	Forecasted river discharge for the next 10 days

3.2. Meteorological models

GFS 0.25° or GFS 0.25° Volta

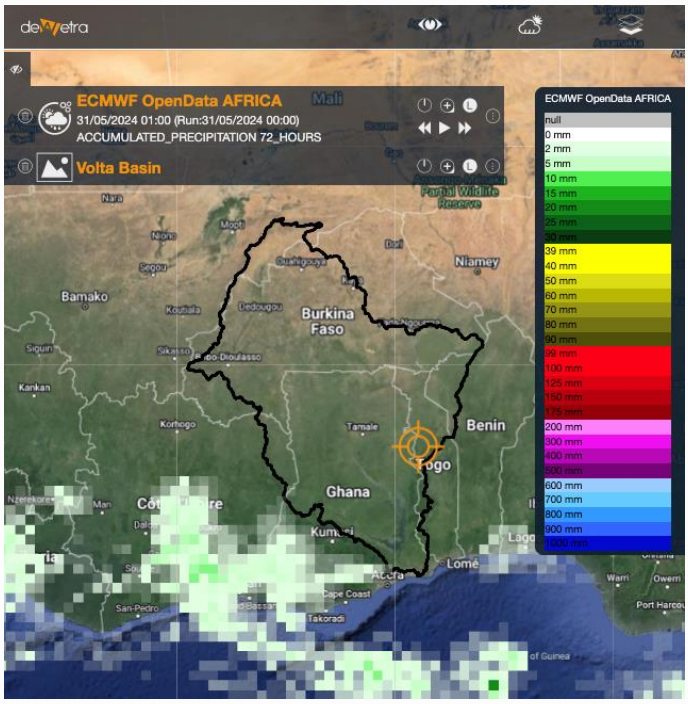
The Global Forecast System (GFS) is a weather forecast model produced by the National Centers for Environmental Prediction (NCEP). More information on the product is described at GFS 0.25°. Same visualisation of variables of other weather model in myDewetra-VOLTALARM.

Layer name	GFS 0.25° or GFS 0.25° Volta
Tag	Meteorological Models
Source	NOAA-NCDC
Description	The Global Forecast System (GFS) is a weather forecast model produced by the National Centers for Environmental Prediction (NCEP). Dozens of atmospheric and land-soil variables are available through this dataset, from temperatures, winds, and precipitation to soil moisture and atmospheric ozone concentration. The entire globe is covered by the GFS at a base horizontal resolution of 18 miles (28 kilometers) between grid points, which is used by the operational forecasters who predict weather out to 16 days in the future. Horizontal resolution drops to 44 miles (70 kilometers) between grid point for forecasts between one week and two weeks. The GFS model is a coupled model, composed of four separate models (an atmosphere model, an ocean model, a land/soil model, and a sea ice model), which work together to provide an accurate picture of weather conditions. Changes are regularly made to the GFS model to improve its performance and forecast accuracy. It is a constantly evolving and improving weather model. Gridded data are available for download through the NOAA National Operational Model Archive and

	Distribution System (NOMADS). Forecast products and more information on GFS are available at the GFS home page. Prior to January 2003, the GFS was known as the GFS Aviation (AVN) model and the GFS Medium Range Forecast (MRF) model. GFS-AVN and MRF products are a collection from NCEP's NOAAPort. Grids, domains, run frequencies, and output frequencies have changed over the years. More info at: GFS documentation on line GFS 0.25° Volta the same product as GFS 0.25°, with possible spatial aggregation at the level of the volta basin and administrative levels withing the basin.
Screenshot	
Properties	
Available variables	Rainfall, 2-metre Temperature, 10-metre wind, 2-metre relative humidity
Available accumulations	3, 6, 12, 24, 48 and 72 hours (rainfall)
Spatial aggregations	Admin boundaries level 1 (also only within Volta) Basins HydroShed level 4 and 5 (also only within Volta)

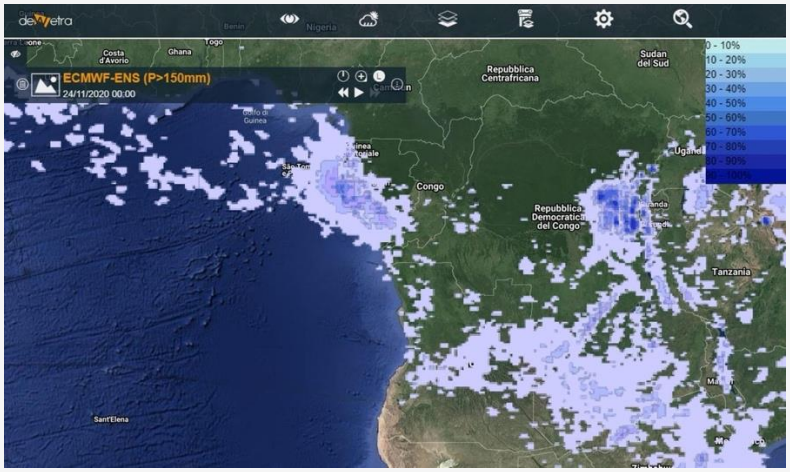
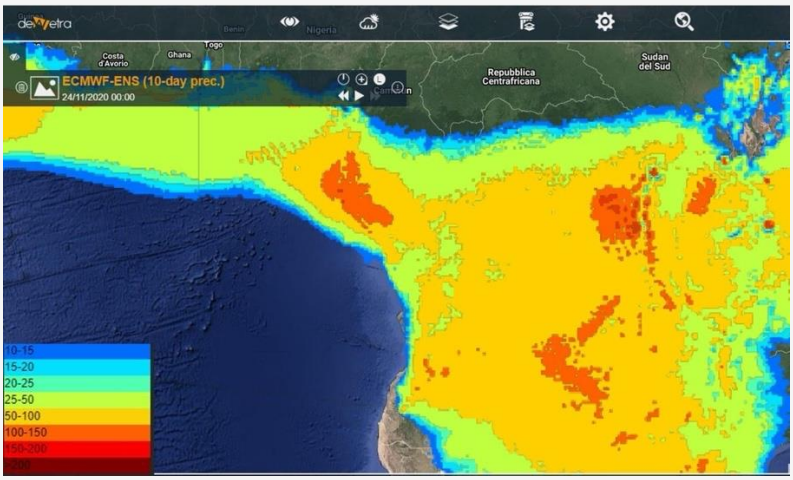
ECMWF OpenData Africa

Layers name	ECMWF OpenData Africa
Tag	Hydrological model
Source	ECMWF
Description	ECMWF OpenData Africa hourly wind speed and direction (at 10m) and hourly total precipitation up to 5 days ahead. https://www.ecmwf.int/en/forecasts/datasets/open-data

Screenshot	
Available variables	Wind at 10m Accumulated precipitation
Available accumulations	1,3,6,9,12,24,48 and 72hours
Spatial aggregations	1-st level administrative subdivisions Hydroshed basins level 4 and 5

ECMWF-ENS

Layer name	ECMWF-ENS
Tag	Meteorological Models
Source	ECMWF
Description	For the medium-range forecasts an ensemble of 52 individual ensemble members are created twice a day. One member is at a higher spatial resolution than the other members (called the HRES at ECMWF), its initial state is the most accurate estimate of the current conditions and it uses the currently best description of the model physics. The HRES provides a highly detailed description of future weather and averaged over many forecasts it is the most accurate forecast for a certain period, which is currently estimated as 10 days for large scale properties of the atmosphere. However for any particular forecast it may not be the most skilful member of the ensemble. Also when viewed in isolation it cannot provide an estimate of forecast uncertainty or confidence. Another member of the ensemble (CNTL: Control forecast) is at a lower spatial resolution than the HRES but at that lower resolution it utilises the most accurate estimate of the current conditions and the currently best description of the model physics. Its significance for the ensemble is that it provides the unperturbed member to which the perturbations for the remainder of the ensemble members are applied.

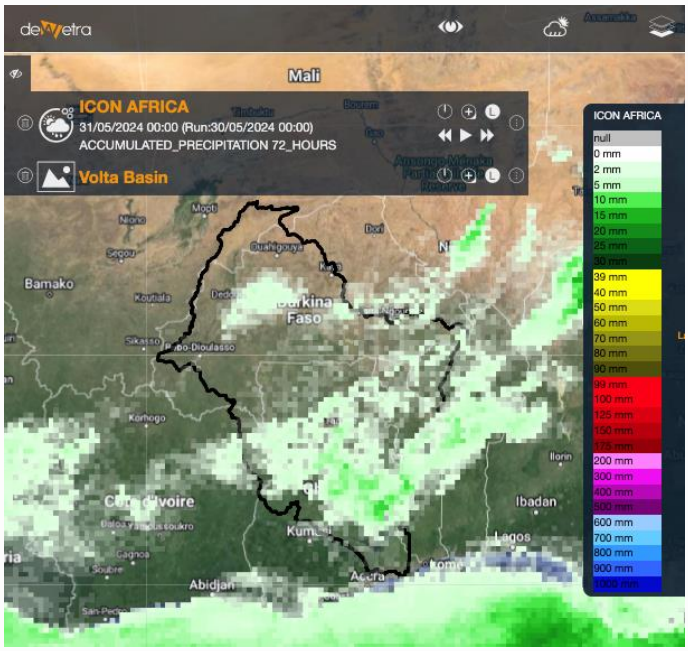
	The perturbed members (50 members) are similar to the CNTL but their initial states and model physics have been perturbed to explore the currently understood range of uncertainty in the observations and the model. They provide a range of possible future weather states. When averaged over many forecasts (although not necessarily for any particular forecast) these have lower skill than either the HRES or the CNTL. However they do provide an estimate of the forecast uncertainty or confidence. The CNTL and perturbed members are continued beyond fifteen days at a reduced horizontal resolution. The sections below highlight the variety of ECMWF medium-range forecast products. More info at: ECMWF-ENS documentation on line Products available are: • ECMWF- ENS (10 DAYS PREC) • ECMWF- ENS (P>50MM) • ECMWF- ENS (P>150MM) • ECMWF- ENS (P>300MM)
Screenshot	 
Available variables	Amount of accumulated rainfall over the forecast range of 10 days for the median of the ensemble ECMWF forecast; Probability [%] of exceeding 50-150-300 mm of accumulated rainfall over the forecast range of 10 days for the ensemble ECMWF forecast.

GSMAP Nowcasting

Layers name	GSMAP Nowcasting
Tag	Meteorological model
Source	JAXA and NASA
Description	The global precipitation GSMap RIKEN nowcast (GSMAP_RNC) forecasts precipitation 12 hours in advance using hourly-updated global precipitation data based on Near-Real-Time satellite products provided by JAXA (GSMaP_NRC). GSMAP NRC nowcasting products are also consultable in the platform https://sharaku.eorc.jaxa.jp/GSMaP_CLM/index.htm with option for spatial aggregation and time accumulation. GSMAP Nowcast provides precipitation forecasts 6 hours in advance using hourly-updated global precipitation data based on satellite observation.
Screenshot	
Available variables	Hourly precipitation rates up to 12 hours ahead

ICON Africa

Layers name	ICON Africa
Tag	Hydrological model
Source	ICON
Description	Precipitation forecast from the global ICON (Icosahedral Nonhydrostatic) Model developed by the Deutscher Wetterdienst (DWD). The outputs in MyDewetra are Wind at 10m And accumulated precipitation for the next 5 days.

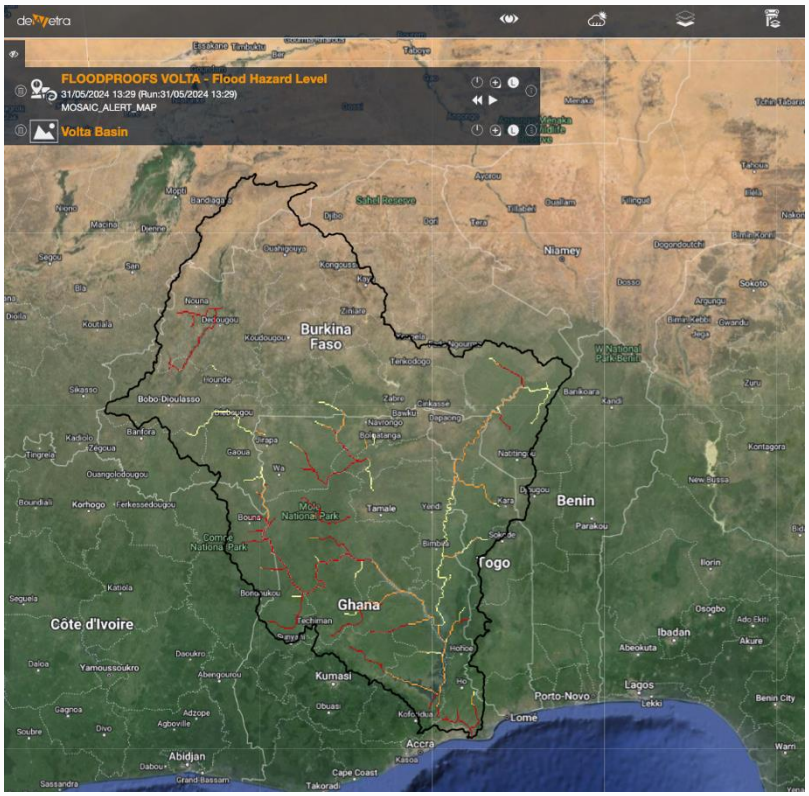
Screenshot	
Available variables	Wind at 10m Accumulated precipitation
Available accumulations	1,3,6,9,12,24,48 and 72hours (rainfall)
Spatial aggregations	1-st level administrative subdivisions Hydroshed basins level 4 and 5

3.3. Hazard

As part of the VFDM Project, and the development of the impact-based FloodPROOFS flood forecasting chain within the Voltalarm platform, the following layers forecasting the flood hazard characteristics are of particular interest.

FloodPROOFS Volta – Flood Hazard Level

Layers name	FloodPROOFS Volta – Flood Hazard Level
Tag	Hazard
Source	VFDM – FloodPROOFS outcomes
Description	Map of the forecast exceedance of the 3 flood warning thresholds (based on return periods of river discharge) in the next 5 days, for pixels in the hydrological network modeled for the Volta Basin.

Screenshot	
Available variables	Daily Mosaic alert map with threshold exceedance by pixel
Interpretation and use	Consulting the flood hazard level layer in the hazard menu one can see the streams of the river network (even where there are no reporting points available) and the associated colour when the forecasted river discharge is expected to exceed the following return period thresholds No significant flood (T<2 years) Ordinary flood (T=2 years) Extraordinary flood (T=5 years) Exceptional flood (T=20 years)

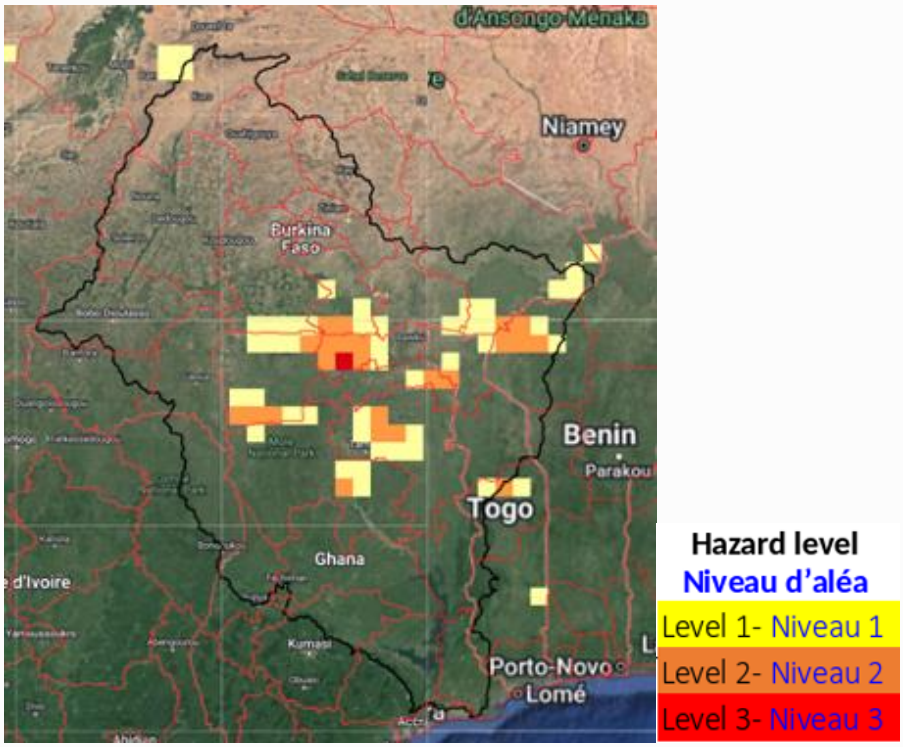
FloodPROOFS Volta – Flood Hazard map

Layers name	FloodPROOFS Volta – Flood Hazard map
Tag	Hazard
Source	VFDM – FloodPROOFS outcomes
Description	Map showing the Maximum flood extension forecasted for the next 5 days in each river section, computed from a set of pre calculated flood extent maps for fixed return periods (2-5-10-20-25- 50-100-200-500-1000 years) using 90 m HDMA digital elevation model and the REFLEX geomorphological model for the whole basin.

Screenshot	
Available variables	Flood Hazard map highlighting potentially flooded areas
Interpretation and use	Blue pixels indicate areas likely to be flooded in the Volta basin within the next 5 days, based on the FloodPROOFS outomes.

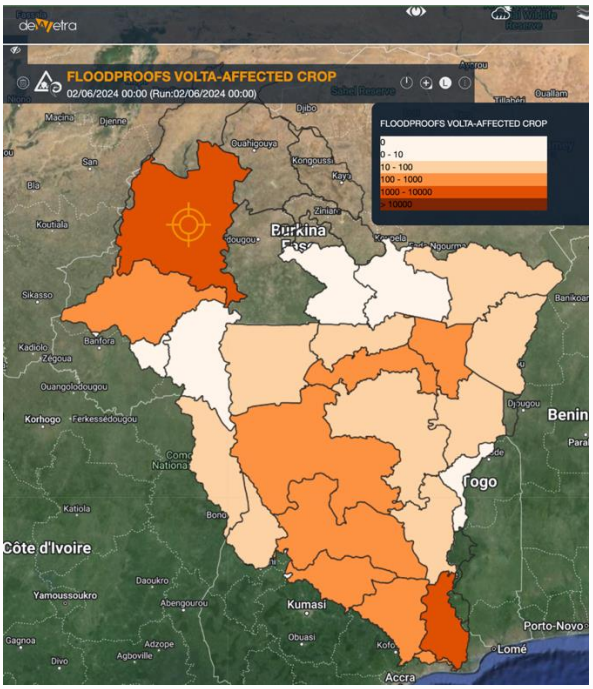
Rain Hazard Level Volta

Layers name	Rain Hazard Level Volta
Tag	Hazard
Source	VFDM
Description	Map of forecasted rainfall hazard level based on the threshold exceedance (2, 5 and 20 years) of the maximum of 24 hours forecasted precipitation in the next 5 days, using GFS precipitation forecast model.

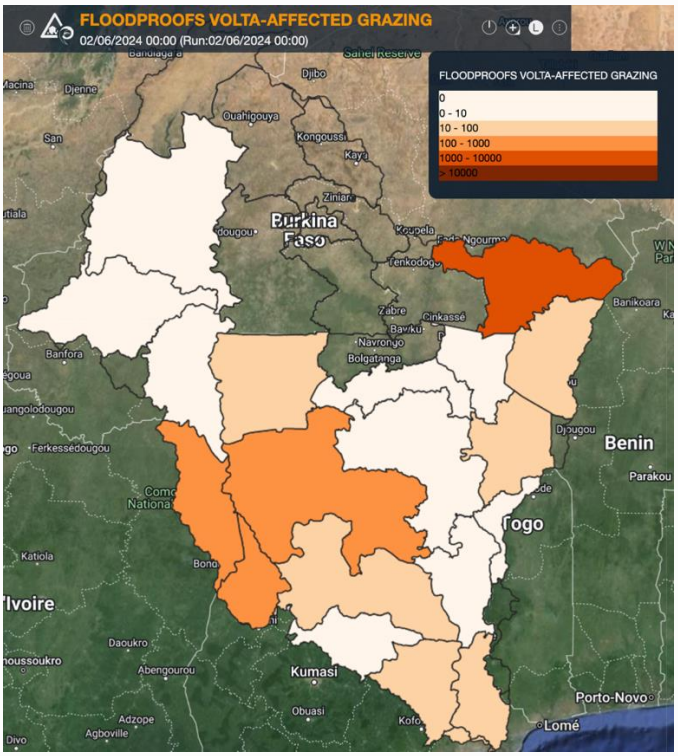
Screenshot	
Available variables	Hazard level class (1, 2, 3)
Interpretation and use	Outcomes are classified in 3 categories of rainfall hazard level: - Level 1 (yellow) is attributed when the 2 years Return Period of maximum 24h rainfall is exceeded at the pixel level over the next 5 days - Level 2 (Orange) is attributed when the 5 years Return Period of maximum 24h rainfall is exceeded at the pixel level over the next 5 days. - Level 3 (Red) is attributed when the 20 years Return Period of maximum 24h rainfall is exceeded at the pixel level over the next 5 days.

3.4. Impacts

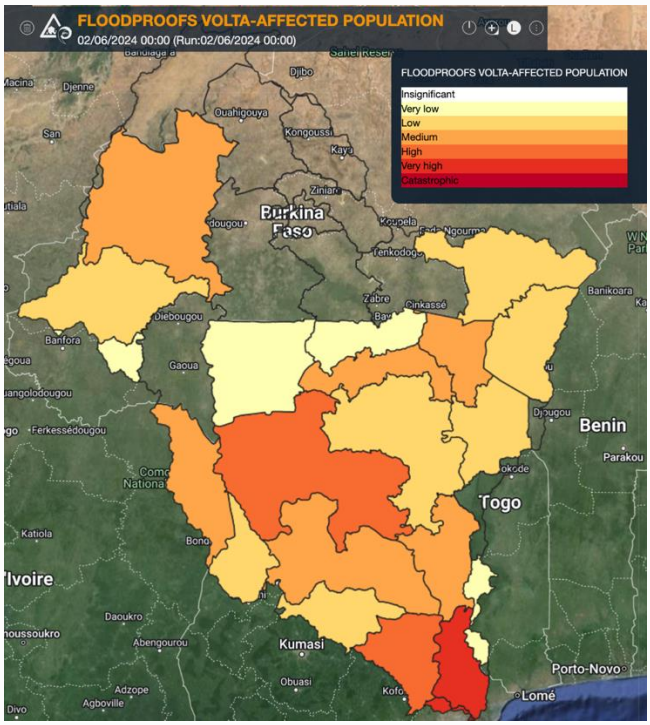
FloodPROOFS Volta –Affected Crop

Layers name	FloodPROOFS Volta – Affected Crop
Tag	Impacts
Source	VFDM
Description	Hectares of crops at risk of flooding forecast for the next 5 days at administrative level 1 (sub-national level) in the Volta basin. The calculation is extracted for the overlay of the forecasted flood hazard map and the distribution of cultivated land (hectares per pixel) in the Volta Basin (based on land cover data and data from the JRC's ASAP 2019 Version 03, 90m resolution, Anomaly Hotspots of Agricultural Production initiative, used as a mask). The calculation includes some simplified factors of vulnerability and lack of coping capacity to estimate impacts.
Screenshot	
Available variables	Absolute (ha) and relative (%) estimates of the number of potential affected cropland
Interpretation and use	The map represents the potential impact on crops by flood within the next 5 days for each administrative level 1 of the Volta basin. The outcomes can either be consulted - As an absolute value (total number of hectares of crops likely to be affected by the upcoming flood in the administrative level) or; - As a relative value (percentage of the cultivated land in the admin level likely to be affected by the upcoming flood). The color scale highlights in darker orange administrative levels with higher expected damage to crops.

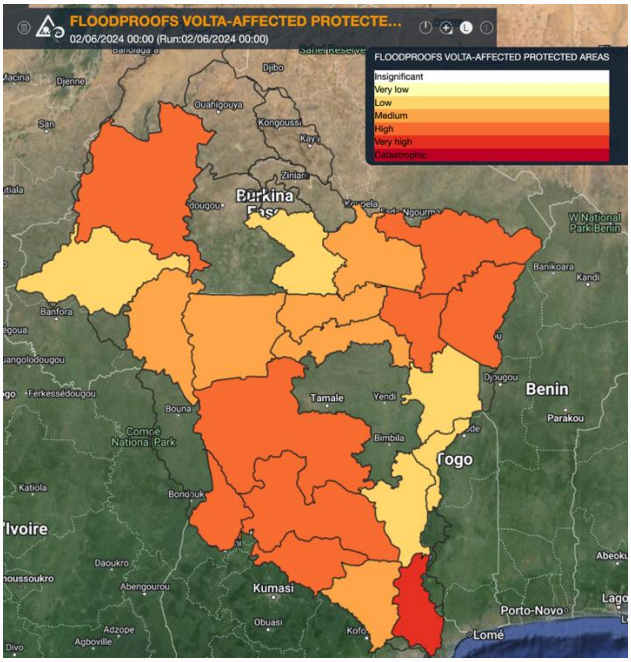
FloodPROOFS Volta –Affected Grazing

Layers name	FloodPROOFS Volta – Affected Grazing
Tag	Impacts
Source	VFDM
Description	Hectares of grazing land at risk of flooding forecast for the next 5 days at administrative level 1 (sub-national level) in the Volta basin. The calculation is extracted for the overlay of the forecasted flood hazard map and the grazing land distribution (hectares per pixel) in the Volta Basin (based on land cover data and data from the JRC's ASAP 2019 Version 03, 90m resolution, Anomaly Hotspots of Agricultural Production initiative, used as a mask). The calculation includes some simplified factors of vulnerability and lack of coping capacity to estimate impacts.
Screenshot	
Available variables	Absolute (ha) and relative (%) estimates of the number of potentially affected grazing land.
Interpretation and use	The map represents the potential impact on grazing land by flood within the next 5 days for each administrative level 1 of the Volta basin. The outcomes can either be consulted as: - As an absolute value (total number of hectares of grazing land likely to be affected by the upcoming flood in the administrative level) or; - As a relative value (percentage of the grazing land land in the admin level likely to be affected by the upcoming flood). The color scale highlights darker orange administrative levels with higher expected damage to grazing land.

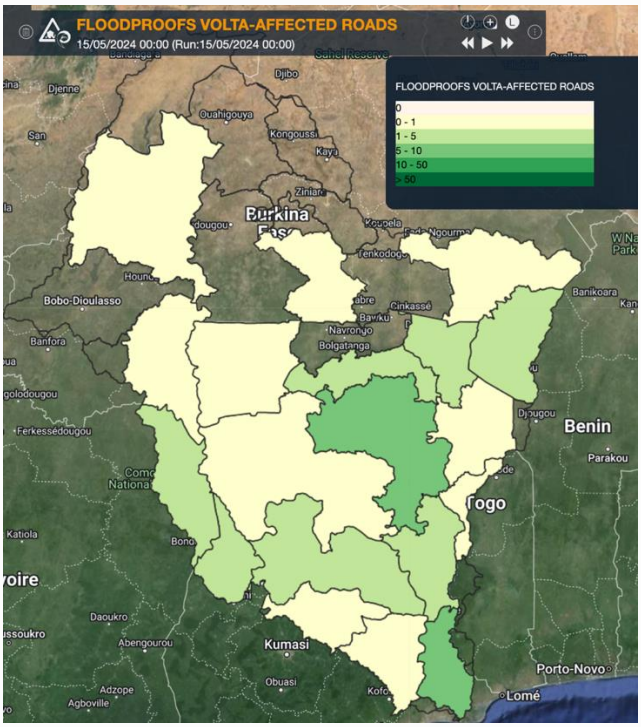
FloodPROOFS Volta –Affected Population

Layers name	FloodPROOFS Volta –Affected Population
Tag	Impacts
Source	VFDM
Description	Population at risk of being affected by the flooding forecast for the next 5 days at administrative level 1 (sub-national level) in the Volta basin. The calculation is extracted for the overlay of the forecasted flood hazard map and the population distribution (number of persons per pixel) in the Volta Basin (based on WorldPop Unadj 2020 constrained and local information from national statistic and demographic institutes). The calculation includes some simplified factors of vulnerability and lack of coping capacity to estimate impacts.
Screenshot	
Available variables	Absolute (ha) and relative (%) estimates of the number of people likely to be affected.
Interpretation and use	The map represents the potential impact of flood on population within the next 5 days for each administrative level 1 of the Volta basin. The outcomes can either be consulted: - As an absolute value (total number of people likely to be affected by the upcoming flood in the administrative level) or; - As a relative value (percentage of the people in the admin level likely to be affected by the upcoming flood). The color scale highlights in darker orange administrative levels with higher impacts on population to be expected. In addition, outcomes are classified in 7 impact severity classes from insignificant to catastrophic.

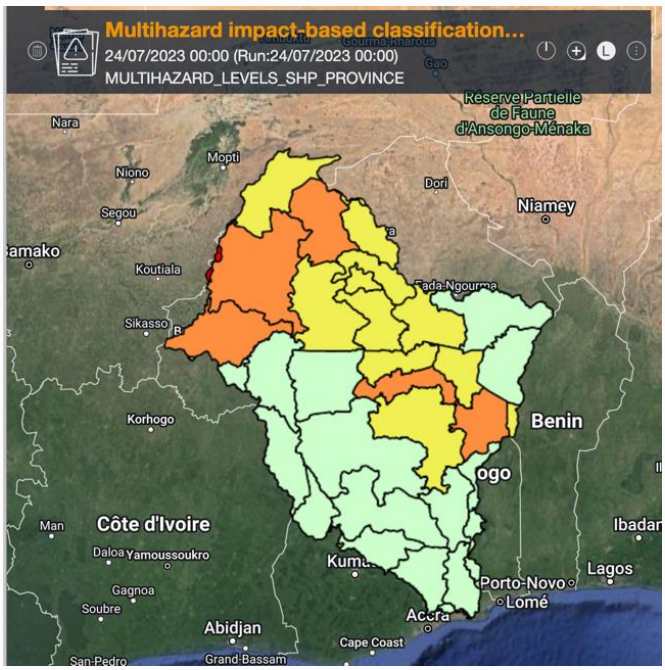
FloodPROOFS Volta –Affected protected areas

Layers name	FloodPROOFS Volta –Affected protected areas
Tag	Impacts
Source	VFDM
Description	Protected areas at risk of being affected by the flooding forecast for the next 5 days administrative level 1 (sub-national level) in the Volta basin. The calculation is extracted for the overlay of the forecasted flood hazard map and the protected area distribution in the Volta Basin (based on IUCN database). The calculation includes some simplified factors of vulnerability and lack of coping capacity to estimate impacts.
Screenshot	
Available variables	Absolute (ha) and relative (%) estimates of the number of hectares of protected area likely to be affected.
Interpretation and use	The map represents the potential impact of flood on protected areas within the next 5 days for each administrative level 1 of the Volta basin. The outcomes can either be consulted: - As an absolute value (total number of hectare of protected areas likely to be affected by the upcoming flood in the administrative level) or; - As a relative value (percentage of the total protected area in the admin level likely to be affected by the upcoming flood). The color scale highlights in darker orange administrative levels with higher impacts on protected areas to be expected.

FloodPROOFS Volta –Affected Roads

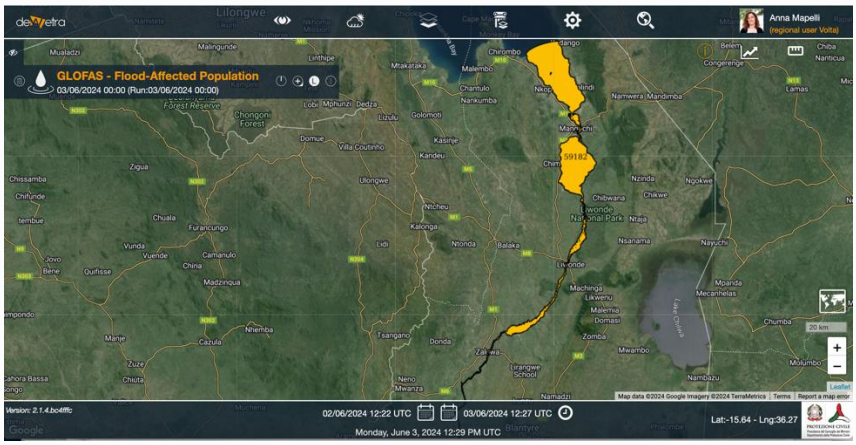
Layers name	FloodPROOFS Volta –Affected Roads
Tag	Impacts
Source	VFDM
Description	Kilometers of roads at risk of being flooded forecast for the next 5 days at administrative level 1 (sub-national level) in the Volta basin. The calculation is extracted for the overlay of the forecasted flood hazard map and the road infrastructure network in the Volta Basin (based on data provided by national geographic institutes, combined with roads shapefiles from OpenStreetMap). The calculation includes some simplified factors of vulnerability and lack of coping capacity to estimate impacts.
Screenshot	
Available variables	Absolute (km) and relative (%) estimates of the kilometers of roads likely to be affected.
Interpretation and use	The map represents the potential impact of flood on the road network within the next 5 days for each administrative level 1 of the Volta basin. The outcomes can either be consulted: - As an absolute value (total number of kilometers likely to be affected by the upcoming flood in the administrative level) or; - As a relative value (percentage of the road network in the admin level likely to be affected by the upcoming flood). The color scale highlights in darker greens administrative levels with higher impacts on roads to be expected.

Multihazard Impact-based Classification Volta

Layers name	Multihazard Impact-based Classification Volta
Tag	Impacts
Source	VFDM
Description	Impact-based classification of the risk level at administrative level 1 (region) of the Volta basin, based on GFS and FloodPROOFS outcomes relative to the number of people potentially affected by heavy rainfall and flood in the next 5 days. Results are available for two type of hazards: Pluvial (Rain variable) and Fluvial (Flood variable)
Screenshot	
Available variables	Risk level class (0 to 4) for pluvial (RAIN variable) and fluvial (FLOOD variable) hazards.
Interpretation and use	The maps represent the heavy rainfall and flood risk forecast for the next 5 days for each administrative level 1 of the Volta basin. The color code and scale presented below are used to illustrate the risk severity based on classes of impacts. The classification is based on threshold of affected population (absolute and relative) estimated from empirical thresholds based on 5062 disasters occurred in 1990-2021.

Index threshold Seuil	Lev Niv	Warning class Niveau d'alerte
<10 people (personnes)	0	None - Nul
<500 people (personnes)	1	Local / Sub-National
<0.5% of Admin pop	2	National
<5% of Admin pop or >10k people (personnes)	3	Regional
>5% of Admin1 pop or >50k people (personnes)	4	Continental

Glofas - Flood –Affected Population

Layers name	Glofas - Flood –Affected Population
Tag	Impacts
Source	CIMA
Description	Potential affected population in polygons calculated using the forecast flood extent provided by Glofas, superimposed with the Gridded Population of the World layer (GPWv4)
Screenshot	
Available variables	Number of people potentially affected at admin 1 level
Interpretation and use	The layers show the potential extension of the flood from Glofas, and associated number of people likely to be affected in each polygon.

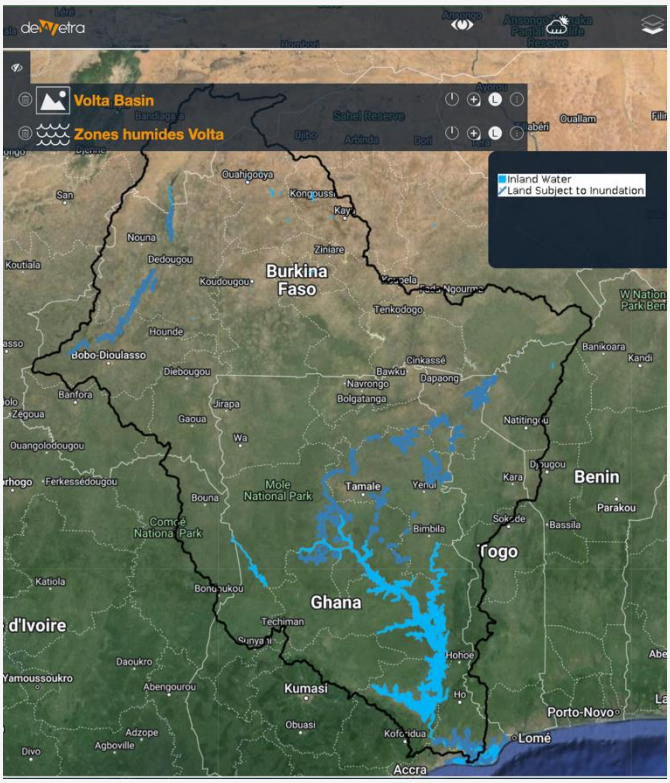
4. Static data and products

The third action button of the **Toolbar** is the **Static Layers** menu, which provides access to all the time-independent data to the user. Once the user clicks on the menu, two different views are offered: the **Tag** and **Folder** mode. The **Tag** mode shows the static data as organized by thematic criteria: in the table below the layers of this category are shown according to the assigned tags.

Tag	Layer
Exposure	Zones humides Volta
	Volta Flood- Exposure of population and Education facilities for RP 25 and 1000 years
	Volta Flood- Combined exposure index RP 25 and 1000 years
	Critical infrastructures OSM (health, education, finance, airports) – Volta
	GHS-Population (2015)
	Global Roads Network (ESRI)
	Health facilities
	Dams
	World Population (GPV v4 - 2015)
	Airports
	Power Plants
	Global Railroads Network
Basic	Volta basin
	CORINE Land Cover (2018)
	Admin Boundaries lev. 1 and 2 – Volta basin
	Global Administrative Boundaries
	Global Lakes and Wetlands Database
	Catchments Boundaries
	River Network (Africa and Europe)
	River Network (Global)
Hazard	GAR Flood Hazard
	JRC Flood Hazard
Risk	Maps of the Flood and Drought Risk Profile for the Volta basin
	Maps national risk profiles 2018-2019 (Ghana and Côte d'Ivoire)
	Economical exposition to flood
	GAR Flood risk
	Physical exposition to flood
Impacts	Affected areas and elements of 60 local communities

4.1. Exposure

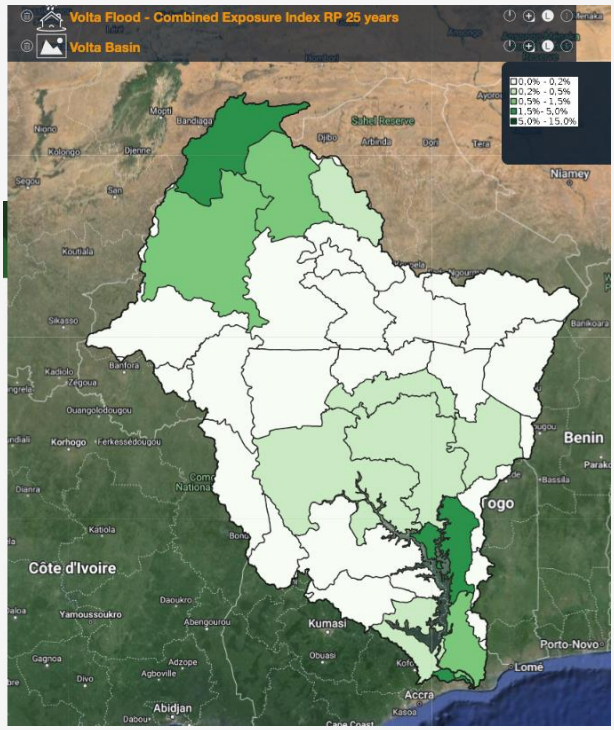
Zones humides Volta (wetlands)

Layer	Zones humides Volta (wetlands)
Tag	Exposures
Source	GLOWA Project
Description	The layer indicates the location of wetlands in the Volta basin, differentiating the inland water to the area with high flood susceptibility. https://waterandchange.org/wp-content/uploads/2017/04/Heft7_fr.pdf
Screenshot	

Volta Flood- Exposure of population and Education facilities for RP 25 and 1000 years

Layer	Volta Flood- Exposure population RP 25 and 1000 years Volta Flood- Exposure Education facilities RP 25 and 1000 years
Tag	Exposures
Source	VFDM Project
Description	Exposure indices as an outcome from the risk mapping training activities withing the VFDM project. The maps represent the percentage of population and education facilities exposed to a flood scenario of 25 years or 1000 years return periods. Darker greens indicate higher exposure.

Volta Flood- Combined exposure index RP 25 and 1000 years

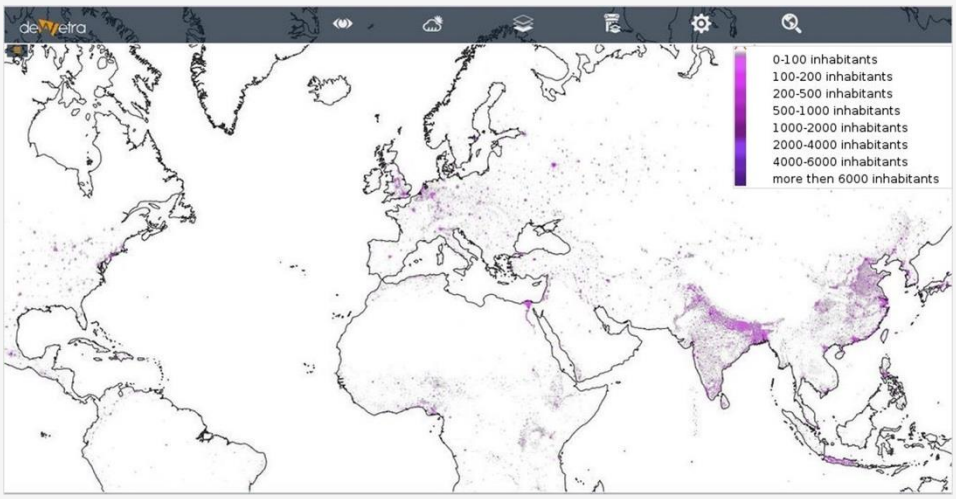
Layer	Volta Flood- Combined exposure index RP 25 and 1000 years
Tag	Exposures
Source	VFDM Project
Description	Combined exposure indices, as an outcome from the risk mapping training activities withing the VFDM project. The maps represent a weighted average exposure value considering the percentage of education facilities exposed, the percentage of health facilities exposed, and the percentage of population exposed to a flood scenario with 25 years or 1000 years of return period. Darker greens indicate higher exposure.
Screenshot	

Critical infrastructures OSM (health, education, finance, airports) – Volta

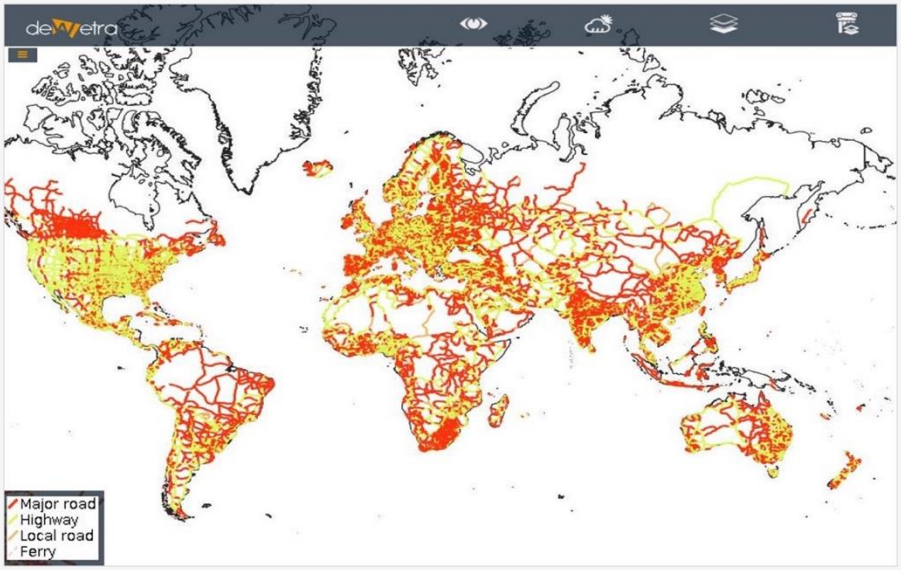
Layers	Different critical infrastructure layers of the Volta basins
Tag	Exposures
Source	HOTOSM (OpenStreetMap)
Description	Different critical infrastructure layers of the Volta basins built from the Humanitarian OpenStreetMap Team (https://www.hotosm.org/), as well as additional data from national institutes, as part of the outcomes of the risk mapping activities of the VFDM project. - Volta - Airports lines and points HOTOSM - Volta - Education facilities points and polygons HOTOSM - Volta - Financial services points and polygons HOTOSM

	- Volta - Health facilities points and polygons HOTOSM - Volta - Point of interest points and polygons HOTOSM

GHS-Population (2015)

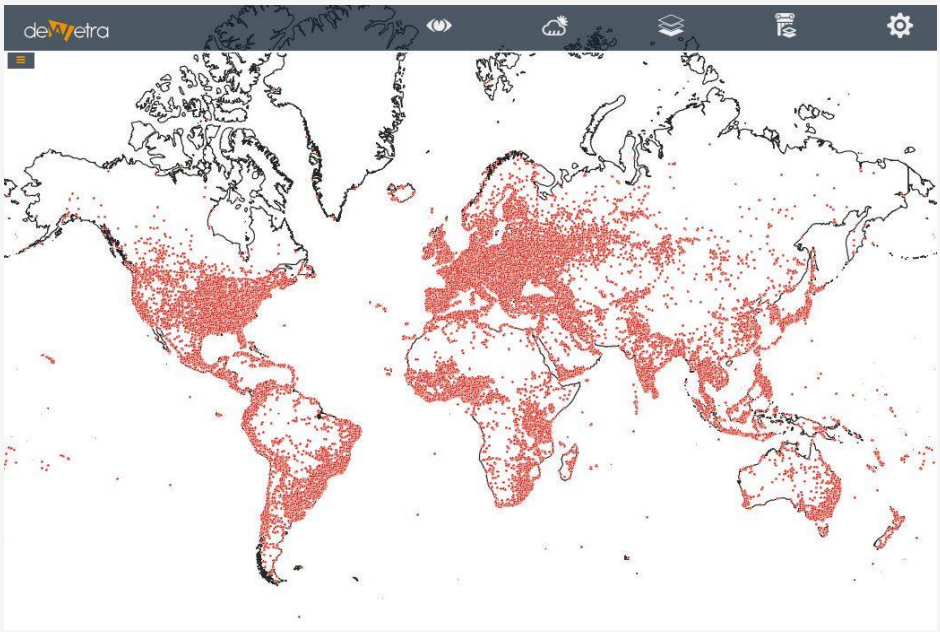
Layer	Global Human Settlements - Density (2015)
Tag	Exposures
Source	JRC
Description	The Global Human Settlement Layer (GHSL) project is supported by European Commission, Joint Research Center and Directorate-General for Regional and Urban Policy. The GHSL produces new global spatial information, evidence-based analytics, and knowledge describing the human presence in the planet. The GHSL relies on the design and implementation of new spatial data mining technologies allowing to process automatically and extract analytics and knowledge from large amount of heterogeneous data including: global, fine-scale satellite image data streams, census data, and crowd sources or volunteering geographic information sources. Spatial data reporting objectively and systematically about the presence of population and built-up infrastructures are necessary for any evidence-based modelling or assessing of i) human and physical exposure to threats as environmental contamination and degradation, natural disasters and conflicts, ii) impact of human activities on ecosystems, and iii) access to resources. This spatial raster dataset depicts the distribution and density of population, expressed as the number of people per cell. Residential population estimates for target years 1975, 1990, 2000 and 2015 provided by CIESIN GPWv4 were disaggregated from census or administrative units to grid cells, informed by the distribution and density of built-up as mapped in the Global Human Settlement Layer (GHSL) global layer per corresponding epoch. More info at: GHS_density webpage
Screenshot	

Global Roads Network (ESRI)

Layer	Global Roads Network
Tag	Exposures
Source	ESRI
Description	World Roads represents the major roads of the world. Derived from the Garmin (formerly DeLorme) 1:2 million scale World Database captured primarily from small scale imagery. More info at: ESRI-GlobalRoads webpage
Screenshot	

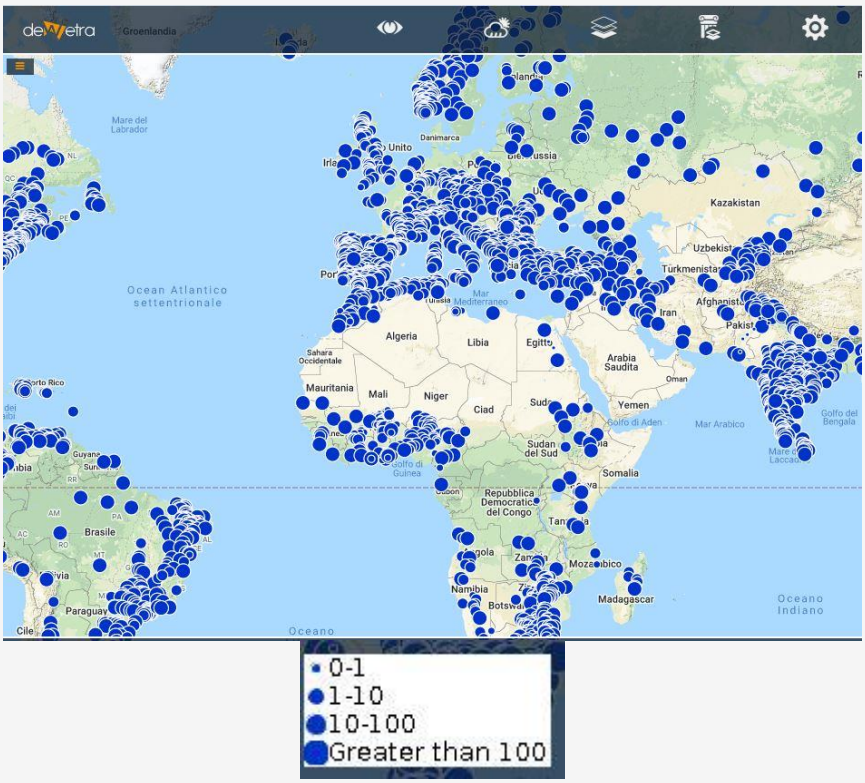
Health facilities

Layer	Health facilities
Tag	Exposures
Source	Healthsites.io
Description	The Global Healthsites Mapping Project is an initiative to create an online map of every health facility in the world and make the details of each location easily accessible. Open data collaboration Through collaborations with users, trusted partners and OpenStreepMap we will capture and validate the location and contact details of every facility and make this data freely available under an Open Data License (ODBL)' Accessible We will make the data accessible over the Internet through an API and other formats such as GeoJSON, Shape files, KML, CSV Focus on health care location data Our design philosophy is the long term curation and validation of health care location data. The healthsites.io map will enable users to discover what healthcare facilities exist at any global location and the associated services and resources. More info at: Health facilities webpage

Screenshot	

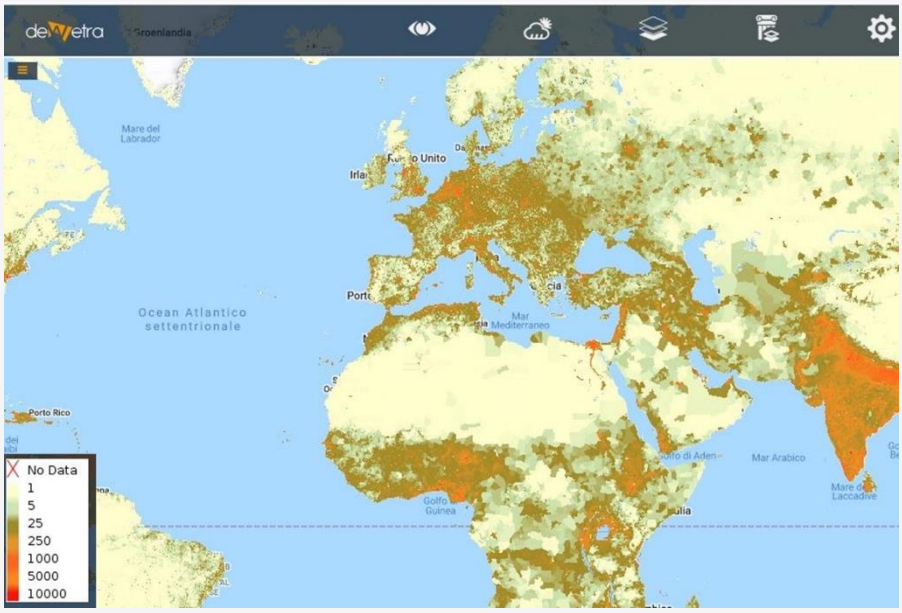
Dams

Layer	Global Reservoirs and Dams
Tag	Exposures
Source	NASA-CIESIN
Description	The Global Reservoir and Dam Database, Version 1, Revision 01 (v1.01) contains 6,862 records of reservoirs and their associated dams with a cumulative storage capacity of 6,197 cubic km. The dams were geospatially referenced and assigned to polygons depicting reservoir outlines at high spatial resolution. Dams have multiple attributes, such as name of the dam and impounded river, primary use, nearest city, height, area and volume of reservoir, and year of construction (or commissioning). While the main focus was to include all dams associated with reservoirs that have a storage capacity of more than 0.1 cubic kilometers, many smaller dams and reservoirs were added where data were available. The data were compiled by Lehner et al. (2011) and are distributed by the Global Water System Project (GWSP) and by the Columbia University Center for International Earth Science Information Network (CIESIN). For details please refer to the Technical Documentation which is provided with the data. More info at: GRanD webpage

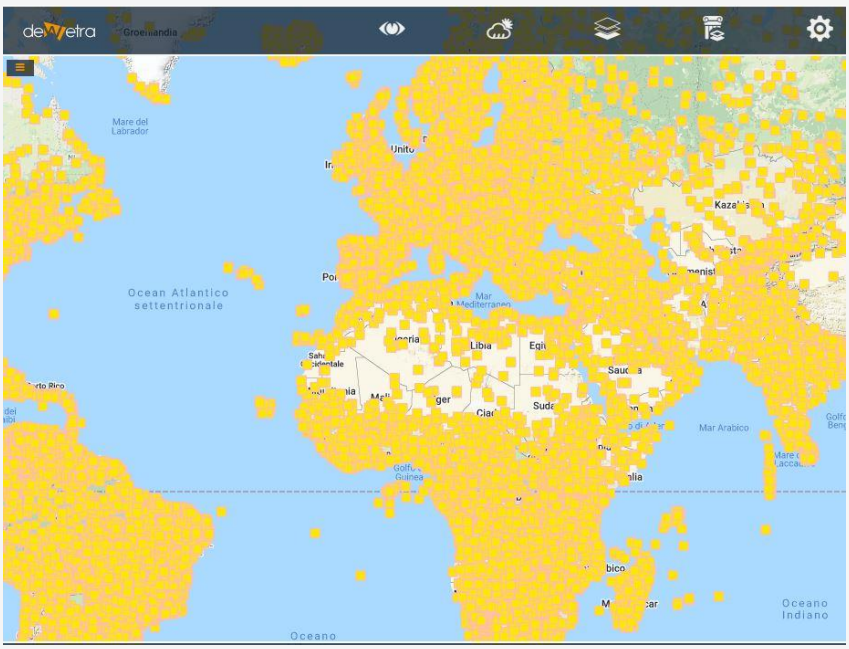
Screenshot	

World Population (GPV v4 - 2015)

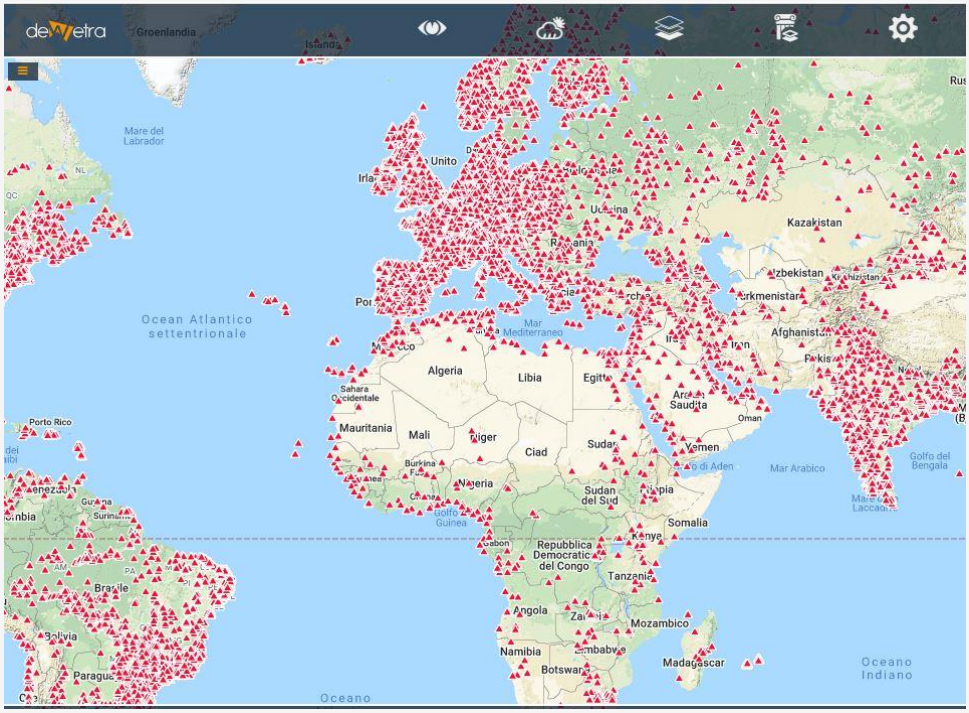
Layer	Gridded Population of the World (2015)
Tag	Exposures
Source	NASA-CIESIN
Description	The Gridded Population of the World (GPW) collection, now in its fourth version (GPWv4), models the distribution of human population (counts and densities) on a continuous global raster surface. Since the release of the first version of this global population surface in 1995, the essential inputs to GPW have been population census tables and corresponding geographic boundaries. The purpose of GPW is to provide a spatially disaggregated population layer that is compatible with data sets from social, economic, and Earth science disciplines, and remote sensing. It provides globally consistent and spatially explicit data for use in research, policy-making, and communications. For GPWv4, population input data are collected at the most detailed spatial resolution available from the results of the 2010 round of Population and Housing Censuses, which occurred between 2005 and 2014. The input data are extrapolated to produce population estimates for the years 2000, 2005, 2010, 2015, and 2020. A set of estimates adjusted to national level, historic and future, population predictions from the United Nation's World Population Prospects report are also produced for the same set of years. The raster data sets are constructed from national or subnational input administrative units to which the estimates have been matched. GPWv4 is gridded with an output resolution of 30 arc-seconds (approximately 1 km at the equator). More info at: GPW (2015) webpage

Screenshot	

Airports

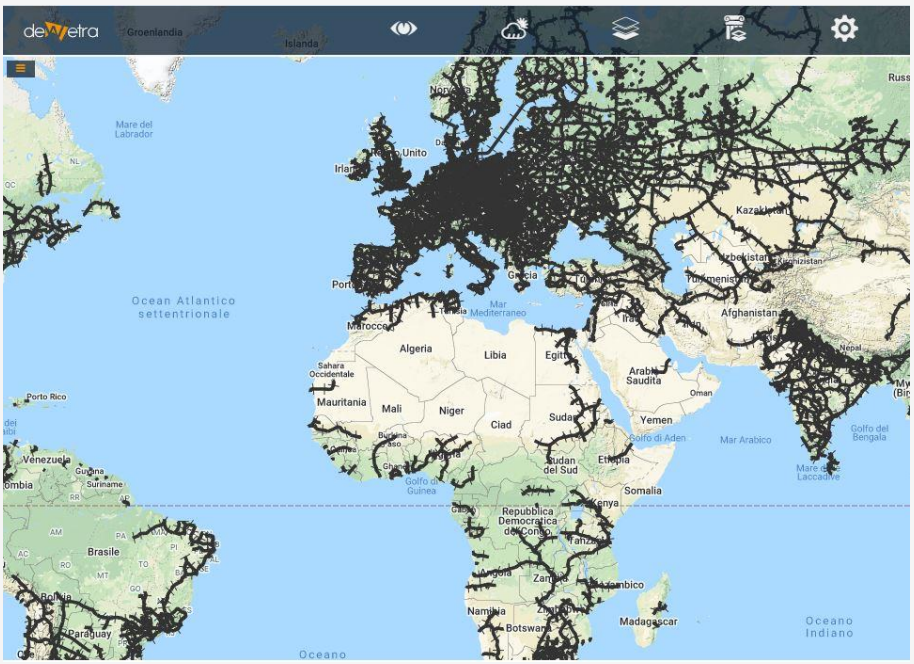
Layer	Airports
Tag	Exposures
Source	OurAirports
Description	OurAirports database is a CSV-formatted open-access database of all the airports, countries, and regions, updated every night. More info at: OurAirports webpage
Screenshot	

Power Plants

Layer	Global database of power plants
Tag	Exposures
Source	WRI
Description	The Global Power Plant Database is a comprehensive, open source database of power plants around the world. It centralizes power plant data to make it easier to navigate, compare and draw insights for one's own analysis. The database covers approximately 30,000 power plants from 164 countries and includes thermal plants (e.g. coal, gas, oil, nuclear, biomass, waste, geothermal) and renewables (e.g. hydro, wind, solar). Each power plant is geolocated and entries contain information on plant capacity, generation, ownership, and fuel type. It will be continuously updated as data becomes available. The methodology for the dataset creation is given in the World Resources Institute publication, A Global Database of Power Plants. More info at: WRI power plants webpage
Screenshot	

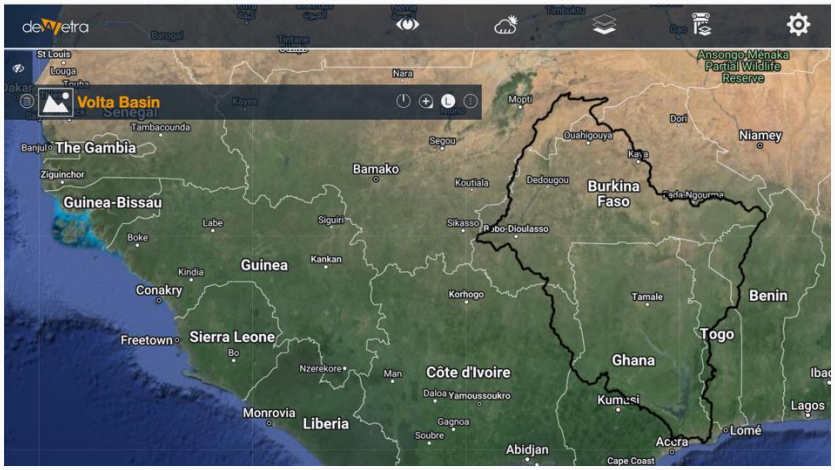
Global Railroads Network

Layer	Global railway network
Tag	Exposures
Source	Natural Earth
Description	The "basic" railroads at 10m scale are from CEC North America Environmental Atlas with no attributes and only 1 scale rank class. The "basic" is only available in North America due to the source. More info at: NE railway network webpage

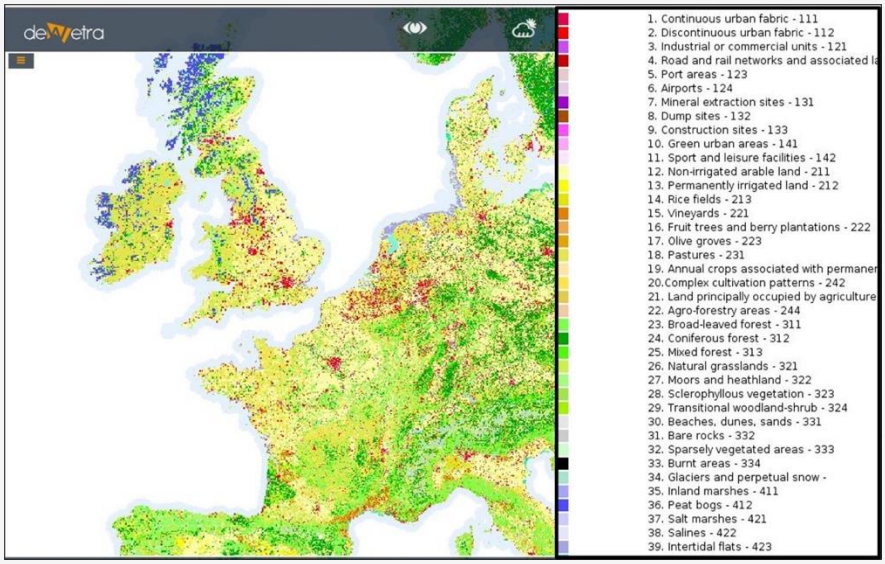
Screenshot	

4.2. Basic

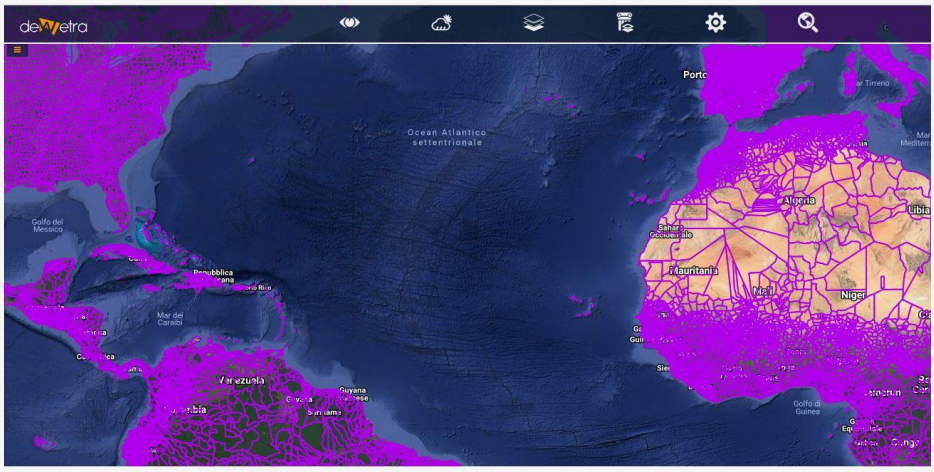
Volta basin :

Layer	Volta basin
Tag	Basic
Source	VDFM
Description	Delineation of the Volta watershed.
Screenshot	

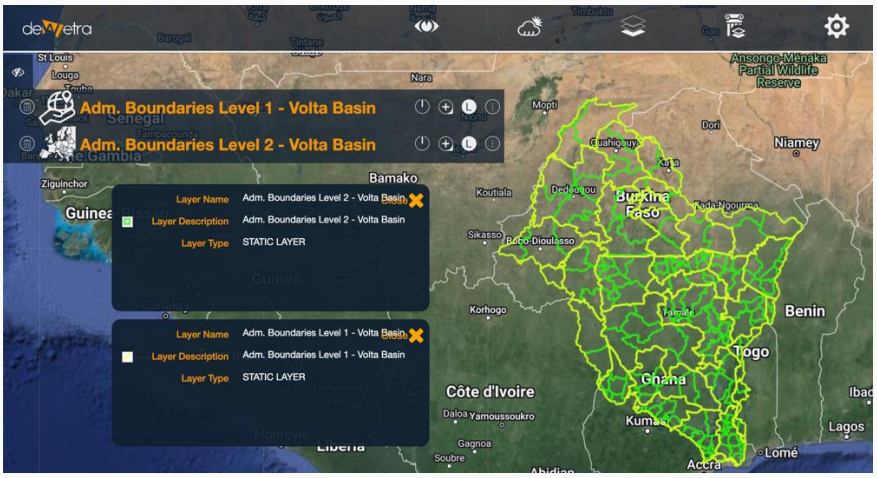
CORINE Land Cover (2018)

Layer	CORINE Land Cover (2018)
Tag	Basic
Source	Copernicus Global Land Service
Description	The CORINE Land Cover (CLC) inventory was initiated in 1985 (reference year 1990). Updates have been produced in 2000, 2006, 2012, and 2018. It consists of an inventory of land cover in 44 classes. CLC uses a Minimum Mapping Unit (MMU) of 25 hectares (ha) for areal phenomena and a minimum width of 100 m for linear phenomena. The time series are complemented by change layers, which highlight changes in land cover with an MMU of 5 ha. Different MMUs mean that the change layer has higher resolution than the status layer. Due to differences in MMUs the difference between two status layers will not equal to the corresponding CLC-Changes layer. If you are interested in CLC-Changes between two neighbour surveys always use the CLC-Change layer. The Eionet network National Reference Centres Land Cover (NRC/LC) is producing the national CLC databases, which are coordinated and integrated by EEA. CLC is produced by the majority of countries by visual interpretation of high resolution satellite imagery. In a few countries semi-automatic solutions are applied, using national in-situ data, satellite image processing, GIS integration and generalisation. CLC has a wide variety of applications, underpinning various Community policies in the domains of environment, but also agriculture, transport, spatial planning et c. More info at: CORINE webpage
Screenshot	

Global Administrative Boundaries

Layer	Global Admnistrative Boundaries
Tag	Basic
Source	GADM
Description	The current version is 3.6 (released on 6 May 2018). It delimits 386,735 administrative areas. You can download the spatial data by country. Downloading by country is the recommended approach. New releases are released approximately every three to six months. GADM has always had multiple unique IDs associated with a record. In the future there will be only the GID and associated tables that link the GID to other ID systems such as ISO, FIPS, and HASC. The GID starts with the three letter ISO 3166-1 alpha-3 country code. If there are subdivisions these are identified by a number from 1 to n, where n is the number of subdivisions at level 1. This value is concatenated with the country code, using a dot to delimit the two. For example, AFG.1, AFG.2, ..., AFG.n. If there are second level subdivisions, numeric codes are assigned within each first level subdivision and these are concatenated with the first level identifier, using a dot as delimiter. For example, AFG.1.1, AFG.1.2, AFG.1.3, ..., and AFG.2.1, AFG.2.2, ... And so forth for the third, fourth and fifth levels. Finally, there is an underscore followed by a version number appended to the code. For example, AFG.3_1 and AFG.3.2_1. The GID codes are persistent after version 3.6 (there were errors in the codes in version 3.4). If an area changes, for example if it splits into two new areas, two new codes will be assigned, and the old code will not be used any more. The version only changes when there is a major overhaul of the divisions in a country, for example when a whole new set of subdivisions is introduced. More info at: Global Administrative Boundaries webpage
Screenshot	

Admin Boundaries lev. 1 and 2 – Volta basin

Layers	Adm. Boundaries Level 1 – Volta basin Adm. Boundaries Level 1 – Volta basin
Tag	Basic
Source	VDFM
Description	Administrative level 1 and 2 cropped to the Volta basin area based on local shapefiles gathered during the training activities for risk mapping within the VFDM project.
Scrrenshot	

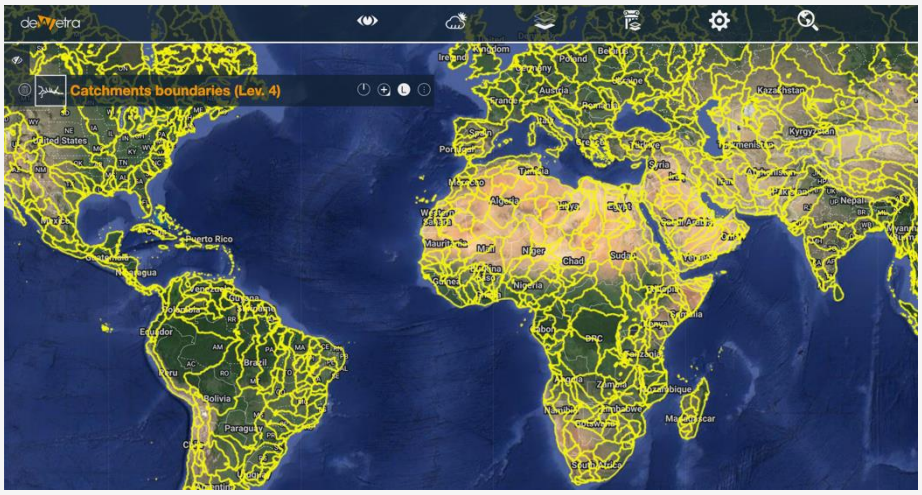
Global Lakes and Wetlands Database

Layer	Global Lakes and Wetlands Database
Tag	Basic
Source	WWF/USGS
Description	Drawing upon a variety of existing maps, data and information, WWF and the Center for Environmental Systems Research, University of Kassel, Germany created the Global Lakes and Wetlands Database (GLWD). The combination of best available sources for lakes and wetlands on a global scale (1:1 to 1:3 million resolution), and the application of GIS functionality enabled the generation of a database which focuses in three coordinated levels on (1) large lakes and reservoirs, (2) smaller water bodies, and (3) wetlands. Level 1 (GLWD-1) comprises the 3067 largest lakes (area ≥ 50 km2) and 654 largest reservoirs (storage capacity ≥ 0.5 km3) worldwide and includes extensive attribute data. Level 2 (GLWD-2) comprises permanent open water bodies with a surface area ≥ 0.1 km2 excluding the water bodies contained in GLWD-1. The approximately 250,000 polygons of GLWD-2 are attributed as lakes, reservoirs and rivers. Level 3 (GLWD-3) comprises lakes, reservoirs, rivers and different wetland types in the form of a global raster map at 30-second resolution. For GLWD-3, the polygons of GLWD-1 and GLWD-2 were combined with additional information on the maximum extents and types of wetlands. Class 'lake' in both GLWD-2 and GLWD-3 also includes man-made

	reservoirs, as only the largest reservoirs have been distinguished from natural lakes. More info at: HydroSHEDS
Screenshot	

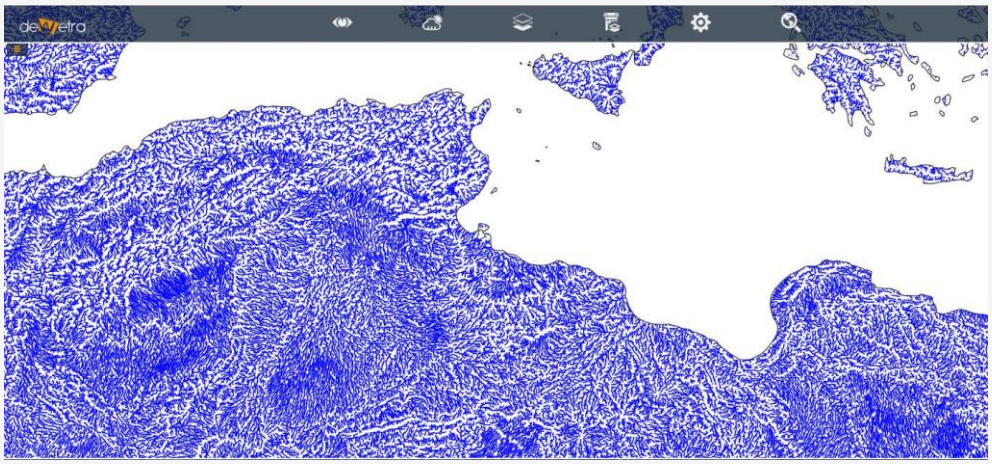
Catchments Boundaries

Layer name	Catchments Boundaries (Lev. 0, Lev. 4, Lev. 5, Lev. 6)
Tag	Basic
Source	WWF/USGS and FAO AQUASTAT
Description	Catchments boundarieas are partly published by HydroSHEDS (a joint WWF and USGS initiative) and partly by FAO. HydroSHEDS provides hydrographic information in a consistent and comprehensive format for regional and global-scale applications. These data layers are available to support watershed analyses, hydrological modeling, and freshwater conservation planning at a quality, resolution, and extent that had previously been unachievable in many parts of the world. It offers a suite of datasets, including stream networks, watershed boundaries, drainage directions, and other data layers such as flow accumulations, distances, and river topology information. Recently available data derived from HydroSHEDS include comprehensive layers of major basins and smaller sub-basins (~100-2,500 km2) across the globe. Access the data A set of three extensions for use with ESRI ArcView software (version 3.x) called HydroSHEDS tools are also available. Find out more and download the tools HydroSHEDS has been developed by the WWF Conservation Science Program in partnership with the U.S. Geological Survey, the International Centre for Tropical Agriculture, The Nature Conservancy, and the Center for Environmental Systems Research of the University of Kassel, Germany. More info at: HydroSHEDS webpage and FAO AQUASTAT

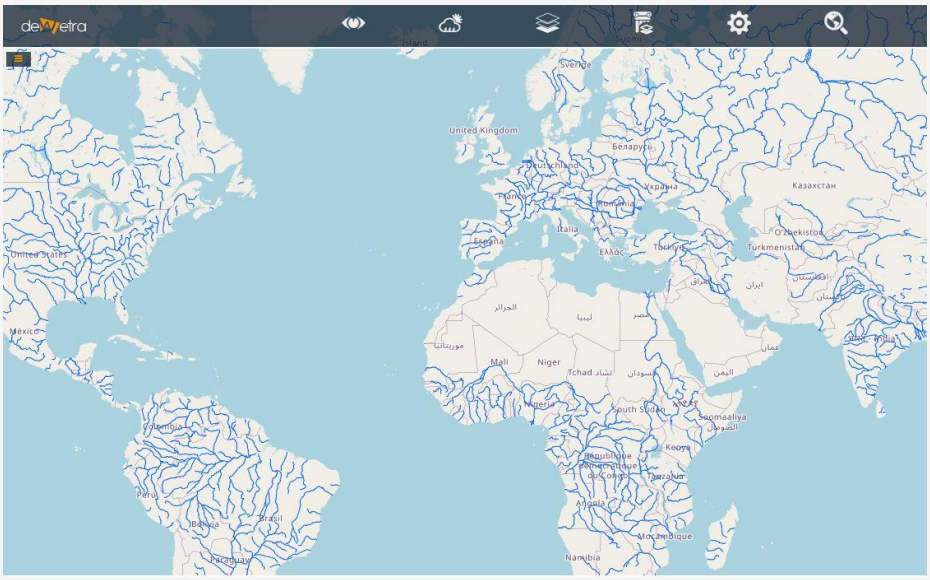
Screenshot	

River Network (Africa and Europe)

Layer name	River Network (Africa and Europe)
Tag	Basic
Source	WWF/USGS
Description	HydroSHEDS provides hydrographic information in a consistent and comprehensive format for regional and global-scale applications. These data layers are available to support watershed analyses, hydrological modeling, and freshwater conservation planning at a quality, resolution, and extent that had previously been unachievable in many parts of the world. It offers a suite of datasets, including stream networks, watershed boundaries, drainage directions, and other data layers such as flow accumulations, distances, and river topology information. Recently available data derived from HydroSHEDS include comprehensive layers of major basins and smaller sub-basins (~100-2,500 km2) across the globe. Access the data A set of three extensions for use with ESRI ArcView software (version 3.x) called HydroSHEDS tools are also available. Find out more and download the tools HydroSHEDS has been developed by the WWF Conservation Science Program in partnership with the U.S. Geological Survey, the International Centre for Tropical Agriculture, The Nature Conservancy, and the Center for Environmental Systems Research of the University of Kassel, Germany. More info at: HydroSHEDS webpage

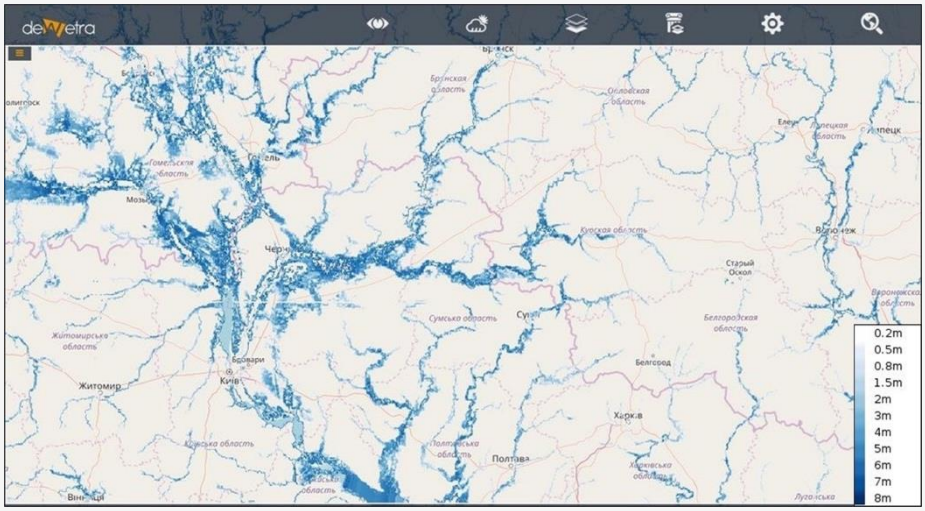
Screenshot	

River Network (Global): River Network (Global)

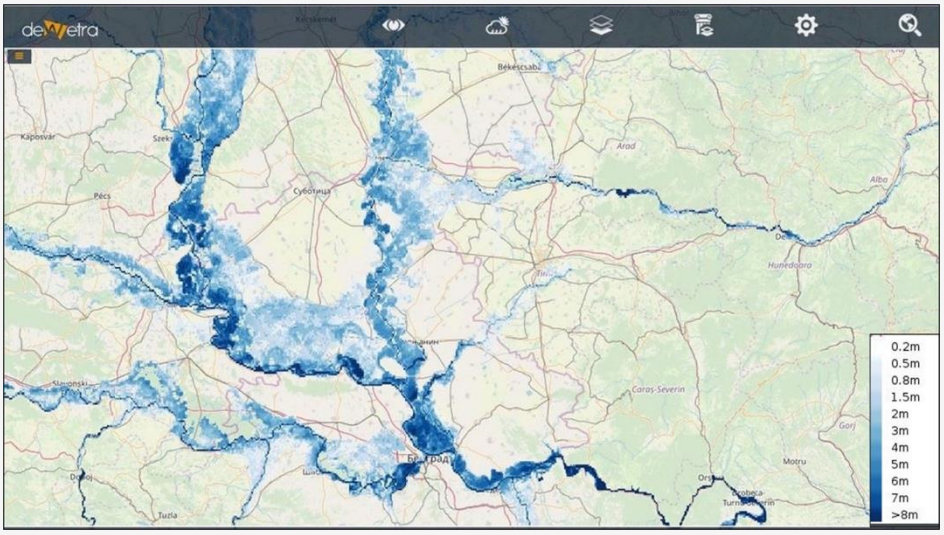
Layer name	River Network (Global)
Tag	Basic
Source	Natural Earth
Description	Natural Earth is a public domain map dataset available at 1:10m, 1:50m, and 1:110 million scales. Featuring tightly integrated vector and raster data, with Natural Earth you can make a variety of visually pleasing, well-crafted maps with cartography or GIS software. Natural Earth was built through a collaboration of many volunteers and is supported by NACIS (North American Cartographic Information Society), and is free for use in any type of project (see our Terms of Use page for more information). More info at: NE download website
Screenshot	

4.3. Hazard

GAR Flood Hazard

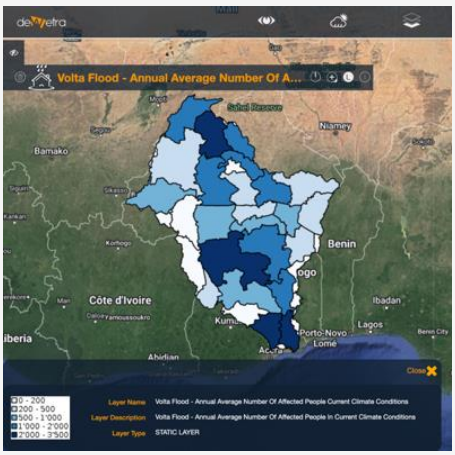
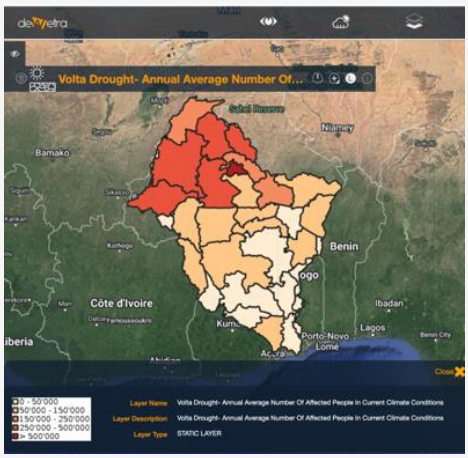
Layer	GAR Flood Hazard Maps
Tag	Hazards
Source	UNISDR
Description	The Global Assessment Report on Disaster Risk Reduction (GAR) is a biennial global assessment of disaster risk reduction and comprehensive review and analysis of the natural hazards that are affecting humanity. The GAR contributed to achieving the aims of the Hyogo Framework for Action through monitoring risk patterns and trends and progress in disaster risk reduction while providing strategic policy guidance to countries and the international community. It will also be a powerful tool as the world works to implement the Sendai Framework for Disaster Risk Reduction through to 2030. The GAR aims to focus international attention on the issue of disaster risk and encourage political and economic support for disaster risk reduction. The preparation of the GAR is coordinated and supervised by UNISDR. The GAR is produced in collaboration and consultation with a wide range of stakeholders, including various UN agencies, governments, academic and research institutions, donors and technical organizations and specialists. Available maps: flood hazard maps for 25, 50, 100, 200, 500, and 1000-year return period. More info at: GAR webpage
Screenshot	

JRC Flood Hazard

Layer	JRC Flood Hazard Maps
Tag	Hazards
Source	JRC
Description	This collection contains a set of flood hazard maps, based on streamflow data from the European and Global Flood Awareness System (EFAS and GloFAS) and computed using two-dimensional hydrodynamic models. The European and global maps are documented in the following publications, respectively: 1. Alfieri, L., Salamon, P., Bianchi, A., Neal, J., Bates, P.D., Feyen, L., 2014. Advances in pan-European flood hazard mapping, Hydrol. Process., 28 (18), 4928-4937, doi:10.1002/hyp.9947. 2. Dottori, F., Salamon, P., Bianchi, A., Alfieri, L., Hirpa, F.A., Feyen, L., 2016a. Development and evaluation of a framework for global flood hazard mapping. Advances in Water Resources 94, 87-102. IMPORTANT NOTE: the maps in this dataset are based on JRC modelling tools and have several limitations which should be considered during usage (see mentioned references for a detailed description). Note that the maps might differ from official national flood hazard maps. Available maps: flood hazard maps for 10, 20, 50, 100, 200, 500-year return period. More info at: JRC flood hazard maps webpage
Screenshot	

4.4. Risk

Maps of the Flood and Drought Risk Profile for the Volta basin

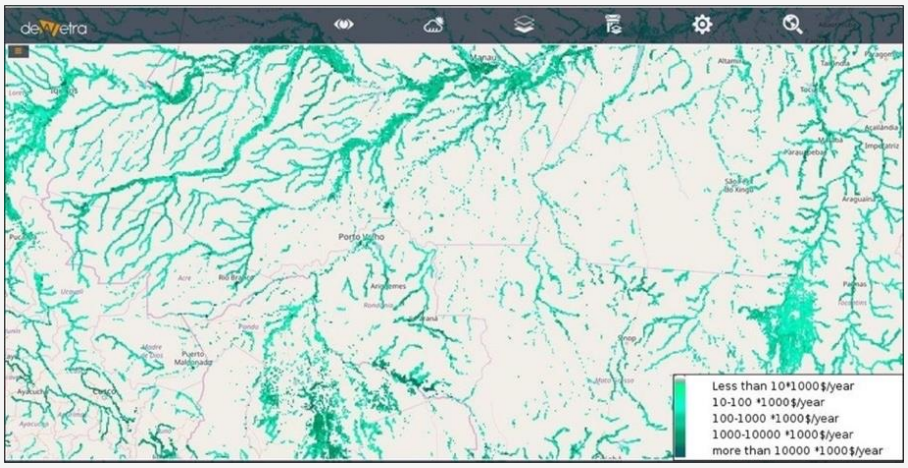
Layer name	Maps of AAL in present and projected conditions + anomaly for population, built-up sector, cropland, grazing land, road network and protected areas (floods) Maps of population, livestock, crop production/yields and protected areas potentially affected by drought in present and projected conditions + anomaly
Tag	Risk
Source	VFDM project
Description	This dataset includes the results in terms of annual average loss (AAL) for present and projected conditions for several sectors issued by the probabilistic risk assessment carried out to produce the Flood and Drought Risk Profile for the Volta basin within the framework of VFDM projects. Maps are available classifying the admin level 1 within the Volta basin in terms of AAL for population, built-up sector, cropland, grazing land, road network and protected areas for flood risk. Maps of anomalies (%) resulting from the comparison of results in present and projected climate conditions are also available, highlighting if with projected climate conditions the losses might increase or decrease. Maps are available classifying the admin level 1 within the Volta basin in terms of population, crop production, livestock and protected areas potentially affected by drought risk in present and projected climate conditions. Maps of anomalies (%) resulting from the comparison of results in present and projected climate conditions are also available, highlighting if with projected climate conditions the losses might increase or decrease.
Screenshot	 Example for flood risk(pop)  Example for drought risk (pop)

Maps national risk profiles 2018-2019 (Ghana and Côte d'Ivoire)

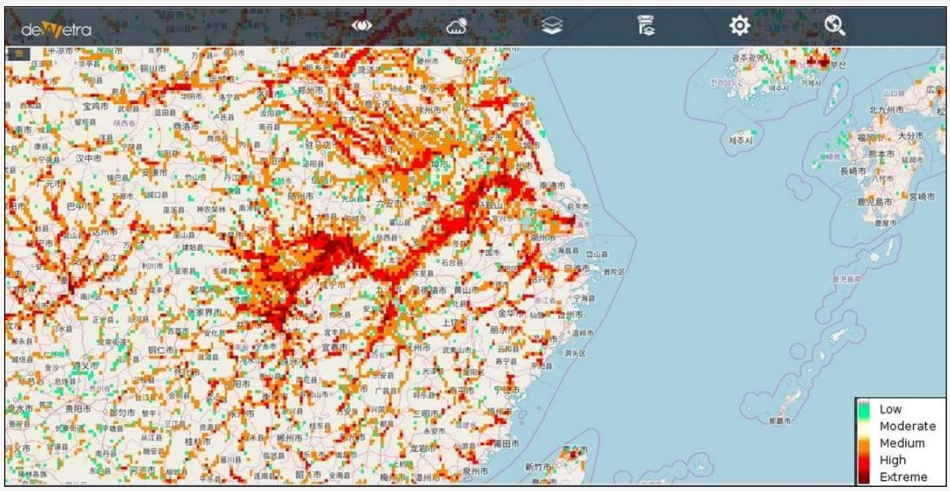
Layer name	Maps of AAL in present and projected conditions + anomaly for population and other sectors for floods and drought risk
Tag	Risk
Source	CIMA-UNDRR
Description	This dataset includes the results in terms of annual average loss (AAL) for present and projected conditions for several sectors issued by the probabilistic risk assessment carried out to produce the National Flood and Drought Risk Profile for Ghana and Côte d'Ivoire within the initiative Risk Profiles of UNDRR (*http://riskprofilesundrr.org*)

Economical exposition to flood

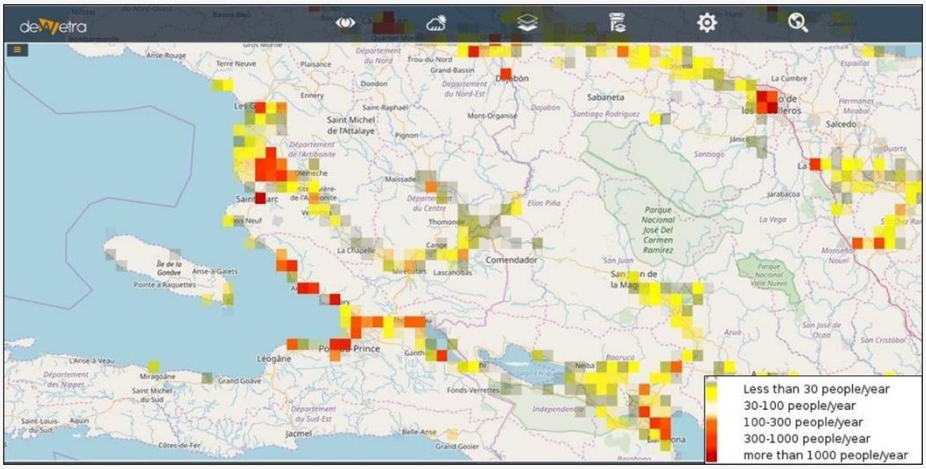
Layer name	Economical exposition to flood
Tag	Risk
Source	UNEP
Description	This dataset includes an estimate of the annual economical exposition to flood. It is based on four sources: 1) A GIS modeling using a statistical estimation of peak-flow magnitude and a hydrological model using HydroSHEDS dataset and the Manning equation to estimate river stage for the calculated discharge value. 2) Observed flood from 1999 to 2007, obtained from the Dartmouth Flood Observatory (DFO). 3) The frequency was set using the frequency from UNEP/GRID-Europe PREVIEW flood dataset. In area where no information was available, it was set to 50 years returning period. 4) A population grid for the year 2010, provided by LandScanTM Global Population Database (Oak Ridge, TN: Oak Ridge National Laboratory). 4) A Global Domestic Product grid for the year 2010, provided by the World Bank. Unit is expected average annual GDP (2010 as the year of reference) exposed in (US $, year 2000 equivalent). This product was designed by UNEP/GRID-Europe for the Global Assessment Report on Risk Reduction (GAR). It was modeled using global data. Credit: GIS processing UNEP/GRID-Europe, with key support from USGS EROS Data Center, Dartmouth Flood Observatory 2008. This layer presents an estimation of the annual economical exposition to flood. Unit is expected average annual GDP (2010 as the year of reference) exposed (in US $, year 2000 equivalent). More info at: Global Risk Data Platform webpage

Screenshot	

GAR Flood risk

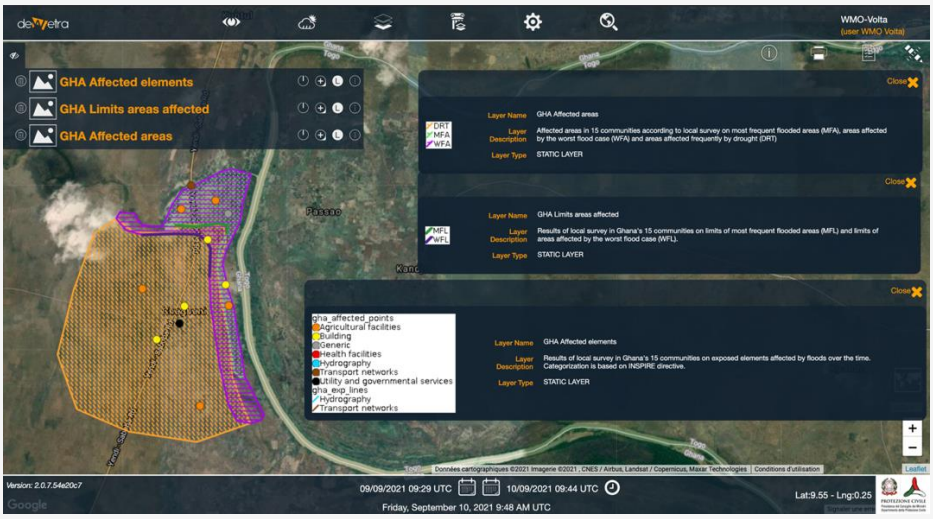
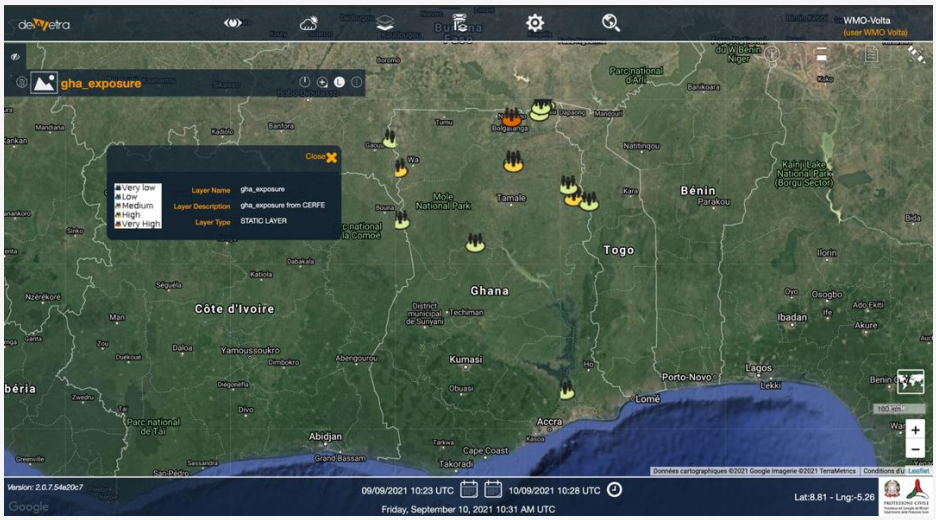
Layer	Flood risk (GAR)
Tag	Risk
Source	UNEP
Description	This dataset includes an estimate of the global risk induced by flood hazard. Unit is estimated risk index from 1 (low) to 5 (extreme). This product was designed by UNEP/GRID-Europe for the Global Assessment Report on Risk Reduction (GAR). It was modeled using global data. More info at: Global Risk Data Platform webpage
Screenshot	

Physical exposition to flood

Layer name	Physical exposition to flood
Tag	Risk
Source	UNEP
Description	This dataset includes an estimate of the annual physical exposition to flood. It is based on three sources: 1) A GIS modeling using a statistical estimation of peak-flow magnitude and a hydrological model using HydroSHEDS dataset and the Manning equation to estimate river stage for the calculated discharge value. 2) Observed flood from 1999 to 2007, obtained from the Dartmouth Flood Observatory (DFO). 3) The frequency was set using the frequency from UNEP/GRID-Europe PREVIEW flood dataset. In area where no information was available, it was set to 50 years returning period. 4) A population grid for the year 2010, provided by LandScanTM Global Population Database (Oak Ridge, TN: Oak Ridge National Laboratory). Unit is expected average annual population (2007 as the year of reference) exposed (inhabitants) . This product was designed by UNEP/GRID-Europe for the Global Assessment Report on Risk Reduction (GAR). It was modeled using global data. Credit: GIS processing UNEP/GRID-Europe, with key support from USGS EROS Data Center, Dartmouth Flood Observatory 2008. More info at: Global Risk Data Platform webpage
Screenshot	

4.5. Impacts

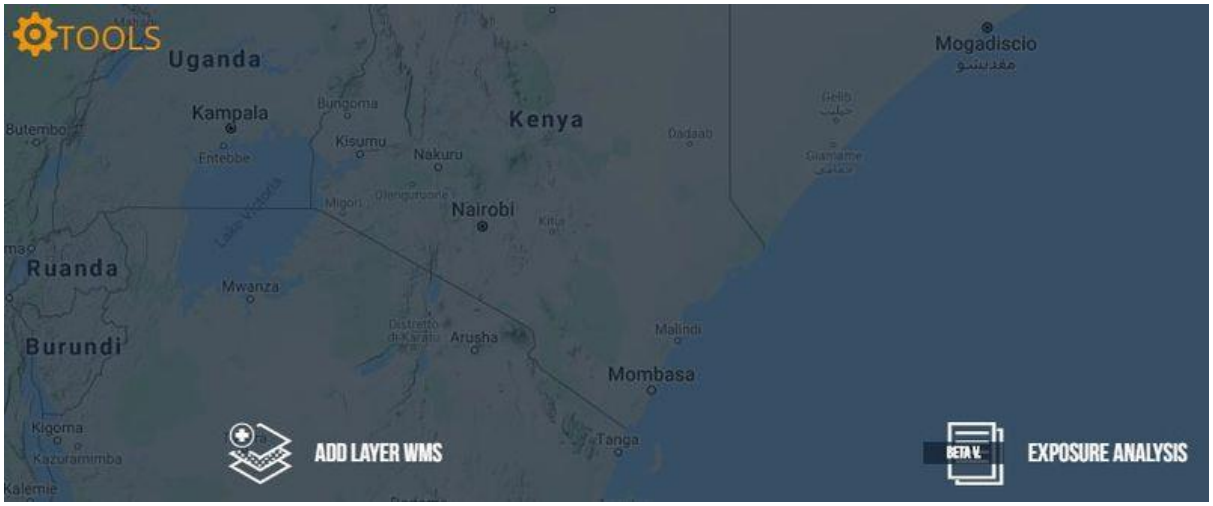
Layer name	Affected areas, limit of affected areas and affected elements in local communities (by country) Indexes for exposure, vulnerability and coping capacity
Tag	Impacts
Source	VFDM project
Description	This dataset includes the results of a survey at community level conducted by local technicians under the guidance of CIMA Research Foundation, DPC and Knowledge&Innovation (K&I) within the framework of the VFDM project.

	60 local communities have been identified in the Volta basin and then, after being trained, local technicians visited those communities with the objective of interviewing inhabitants and mapping: • Areas affected by floods and drought (worst and most frequent situations) • Limits of those areas • Buildings, facilities, infrastructures usually affected by floods This information has been mapped with myGoogleMaps in a shared environment with CIMA and K&I and it has been categorized with agreed legends for their visualization on myDewetra-VOLTALARM as risk knowledge information coming from local communities. K&I (at the time called CERFE) proposed to the communities also a survey composed by several questions. Starting from answers collected through local surveys K&I elaborated some specific indexes to represent vulnerability, exposure and coping capacity for each community. These indexes are also available for visualization on myDewetra-VOLTALARM.
Screenshot	 Example of local communities data in Ghana  Example of exposure index for communities in Ghana

5. Tools

The fifth action button of the **Toolbar** is the **Tools** menu, which provides the users with some useful functions that are available within the platform. Once the user clicks on the menu, the available tools shown as listed below:

- **Add a WMS**
- **Exposure Analysis**



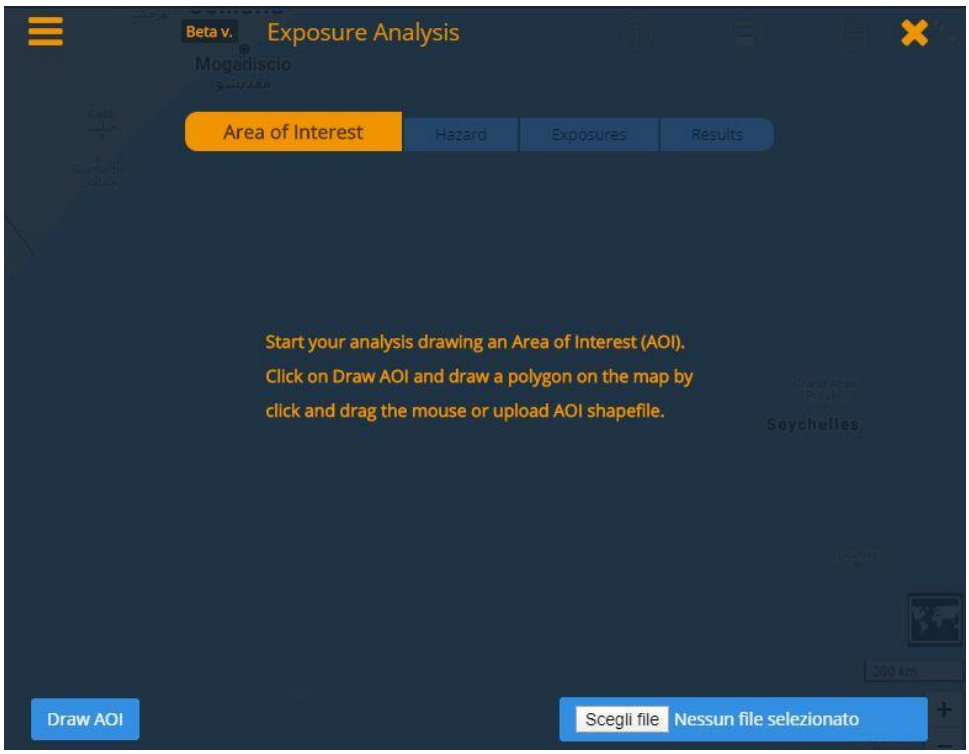
5.1 Add a WMS

This function allows the users to add to the list of the available layers any data (raster, vector, geotiff) that can be provided through a WMS.
Once the user has selected the function, the following form is displayed:

The user has to copy the url of WMS server they would like to visualize in the text box and then press **Load Data ID**.
If the service is freely available (no usr/pwd needed to enter), the system will prompt a list of all the layers available on that server.
Then, to visualize the chosen WMS layer, the user has to click on it and then press **Add WMS layer**: the data will automatically appear on the control map.

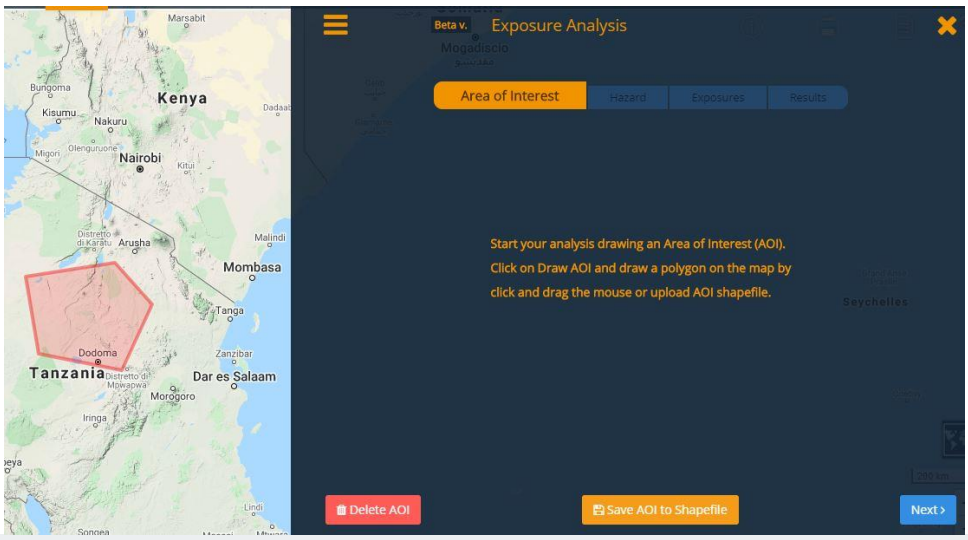
5.2. Exposure Analysis

A comprehensive risk scenario can be designed by the user through the **Exposure Analysis** dashboard (see the figure below).



- First Step – Defining the Area of Interest (AOI)

The first step consists in drawing an Area of Interest (AOI) to carry out the exposure analysis. To do that, after pressing the *Draw an AOI* button the user has to left click on the map to set the initial point of the polygon: to complete the AOI, the last point and the initial one must coincide (i.e., the user has to click again on the initial point). Alternatively, an AOI might be uploaded directly to the platform by the user, provided it is a shapefile: in this case, the full set of file in *.zip* format has to be uploaded after clicking on **Select a file**.
In order to compose a risk scenario, exposure layers have to be selected. To do that, click on the **Select layers** button.



Please note that the maximum extent of the AOI is set to 10,000km²

➢ Second Step - Exposures

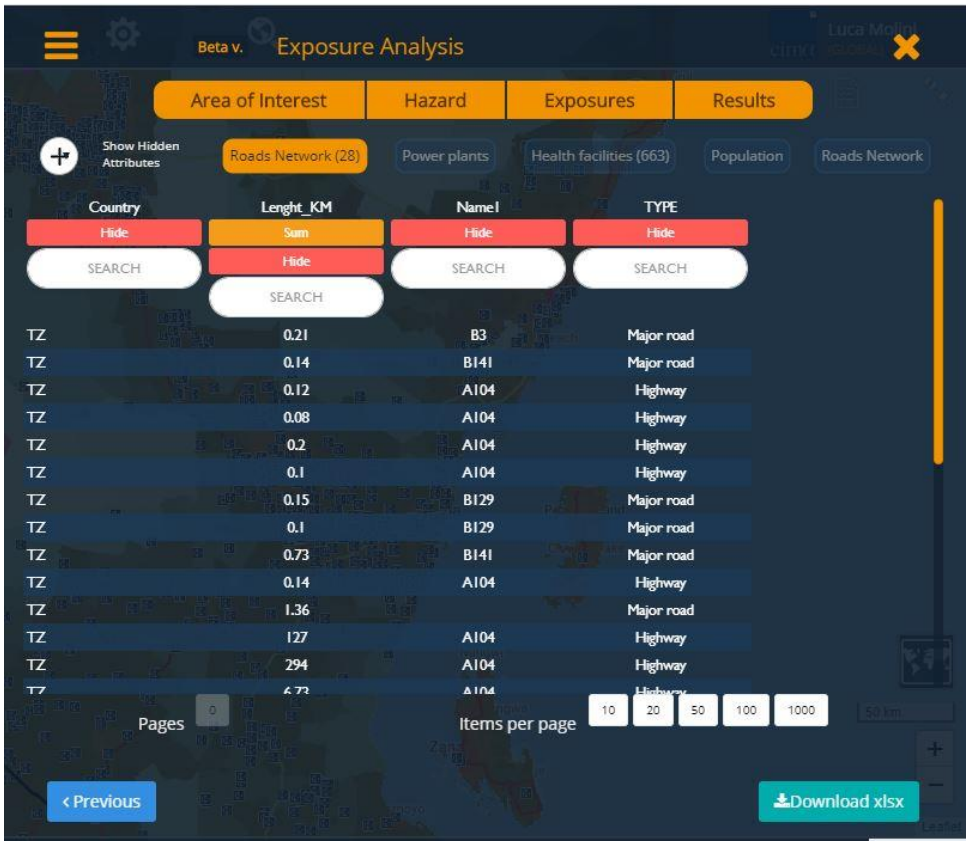
At present, these exposures layers are available:

- GHS-Population (2015)
- World Population (GPV v4 - 2015)
- Health facilities
- Dams
- Power Plants
- Airports

The user is allowed to pick without restrictions as many layers as desired by means of the **Add other layers** button.

➢ Third Step - Risk scenario

Once the selections have been made, the user can visualize the results of the exposures laying within the AOI by clicking on the **GO** button: a list of the available features for each exposure will be prompted as in the figure below.



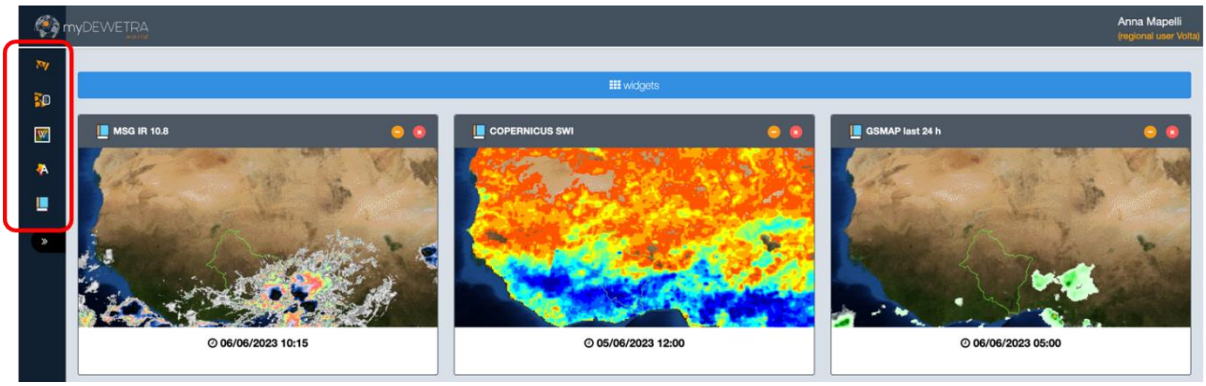
The results might be downloaded in *.xlsx* format by clicking on the button **Download .xlsx**.

If the user is not satisfied with the results, the scenario can be modified by clicking on **Add other layers** and

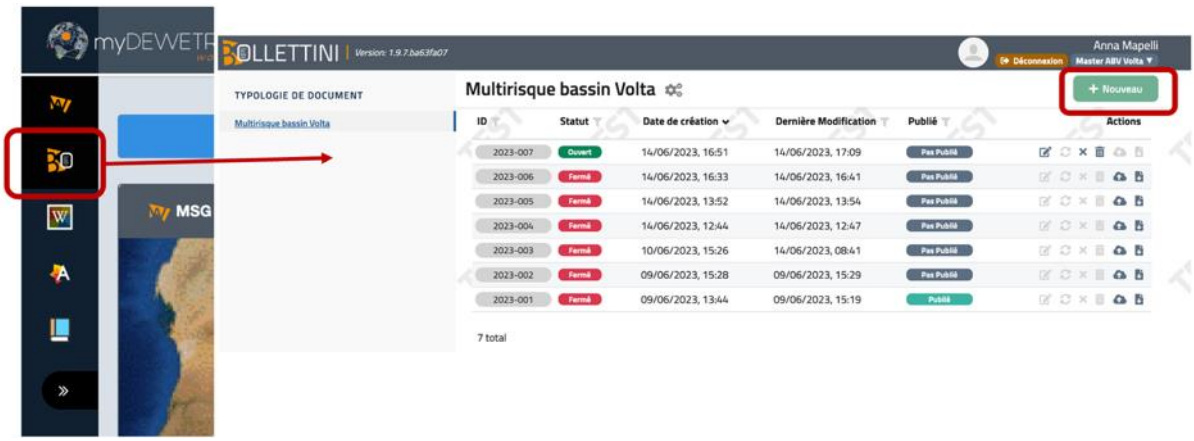
- selecting more/different data or by clicking on **Draw a new AOI**
- or starting over with a new polygon (in this case, remember to click on **Clear the AOI** before drawing a new one).

6. Bulletin application

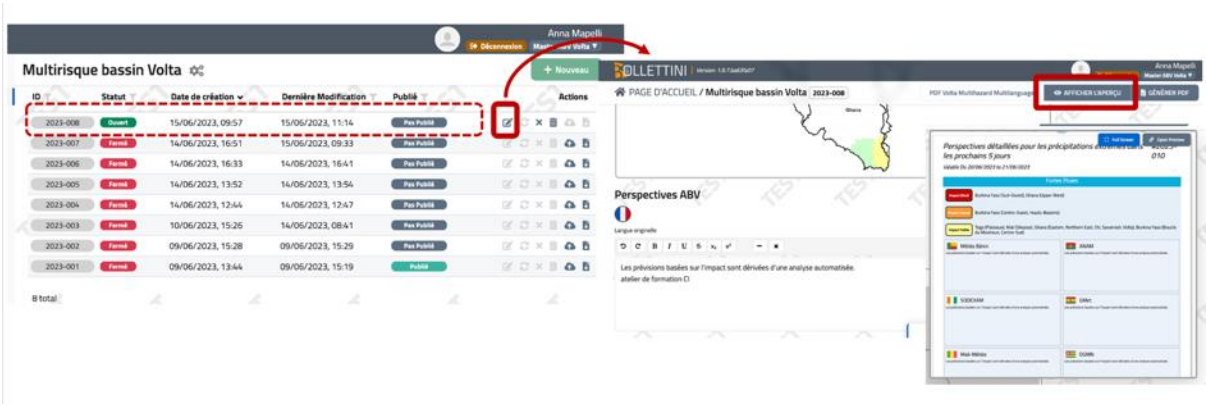
To enter the Bulletin application, users must click on the second upper left icon (a black **B** on orange background) in the sidebar highlighted in red in the below image.



The Bulletin application present itself as a user interface providing list of possible documents to be produced (left side of the webpage) and the full list of bulletins already produced or ongoing for the specific type of document selected from the left-side list.



For the Volta basin, the Bulletin tool has been adapted and customized according to the stakeholders needs and the procedures for the issuance of the bulletin defined with a participatory approach with the same stakeholders. All the stakeholders can access simultaneously to the Bulletin tool and contribute to the open document for its own mandate and competence, being able to visualize in real-time the contributions of the other stakeholders.



The Volta Basin Authority in its mandate of coordinator of the bulletin issuance can open, modify, close and disseminate the bulletin. The dissemination is realized via email throughout the dedicated functionality of the Bulletin tool, allowing the management of the beneficiaries' mailing list (it's possible to add, delete or modify recipients' email address) and semi-automatic dissemination.

An example from a bulletin issued in September 2023 is presented hereafter.