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# **Water Data Explorer**

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**Oct 05, 2022**





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## **WATER DATA EXPLORER (WDE)**

### **1.1 Introduction**

In recent years, there has been a growing recognition of the need for standardized ways of sharing water data on the web. In response to this need, the Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI) Hydrologic Information System (HIS) has been developed along with the standardized WaterOneFlow web services and WaterML data exchange format. To access data that are shared using the WaterOneFlow services and WaterML format, tools already exist such as the [Microsoft Windows HydroDesktop software](#) , [WaterML R package](#), and the web-based [CUAHSI HydroClient](#) which serves as an access point to the [CUAHSI HIS](#) database.

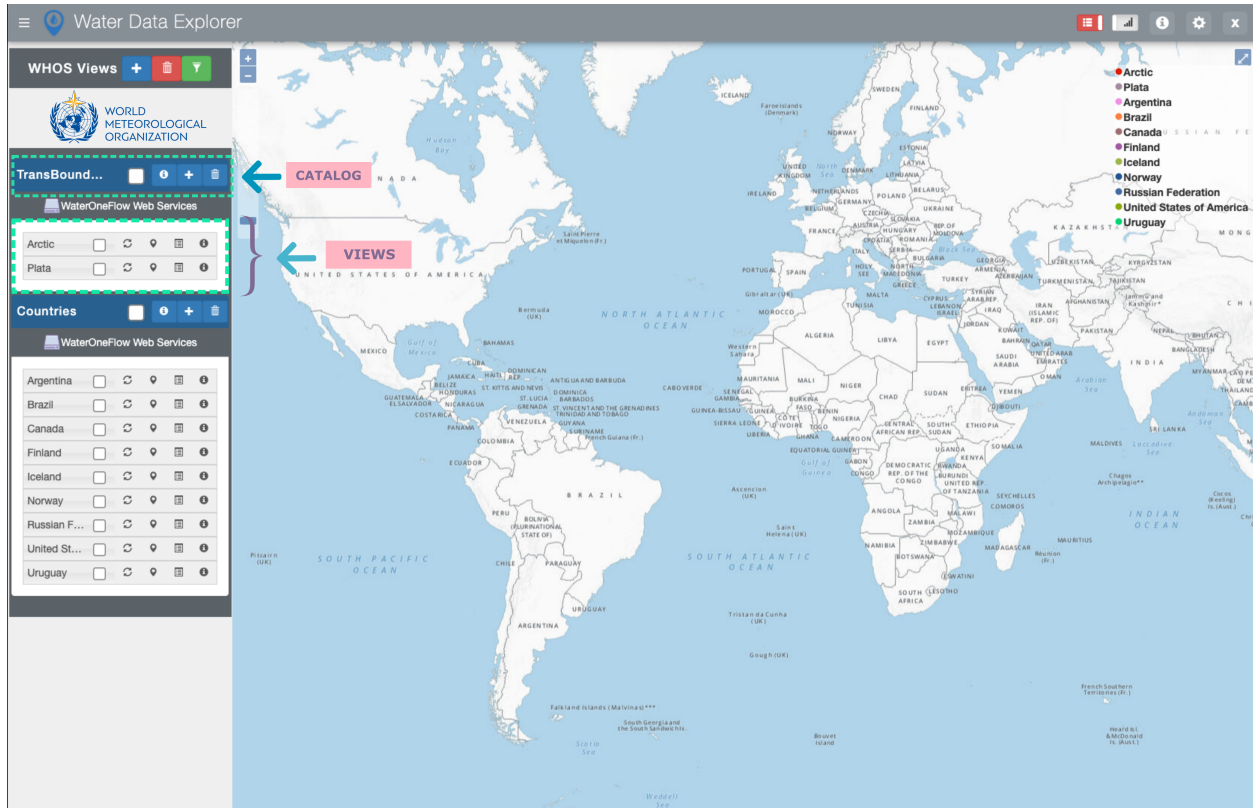
Water Data Explorer (WDE) is a newly developed web-based tool allowing a broad range of users to discover, access, visualize, and download data from any Information System that makes available water data in WaterML format through WaterOneFlow services. WDE is designed in a way that allows users to customize it for local or regional web portals.

### **1.2 WDE Overview**

WDE is an open-source web application providing users with the functionalities of data discovery, data access, data visualization, and data downloading from any Information System that makes available water data in WaterML format through WaterOneFlow web services. WDE can be installed by any organization and requires minimal server space.

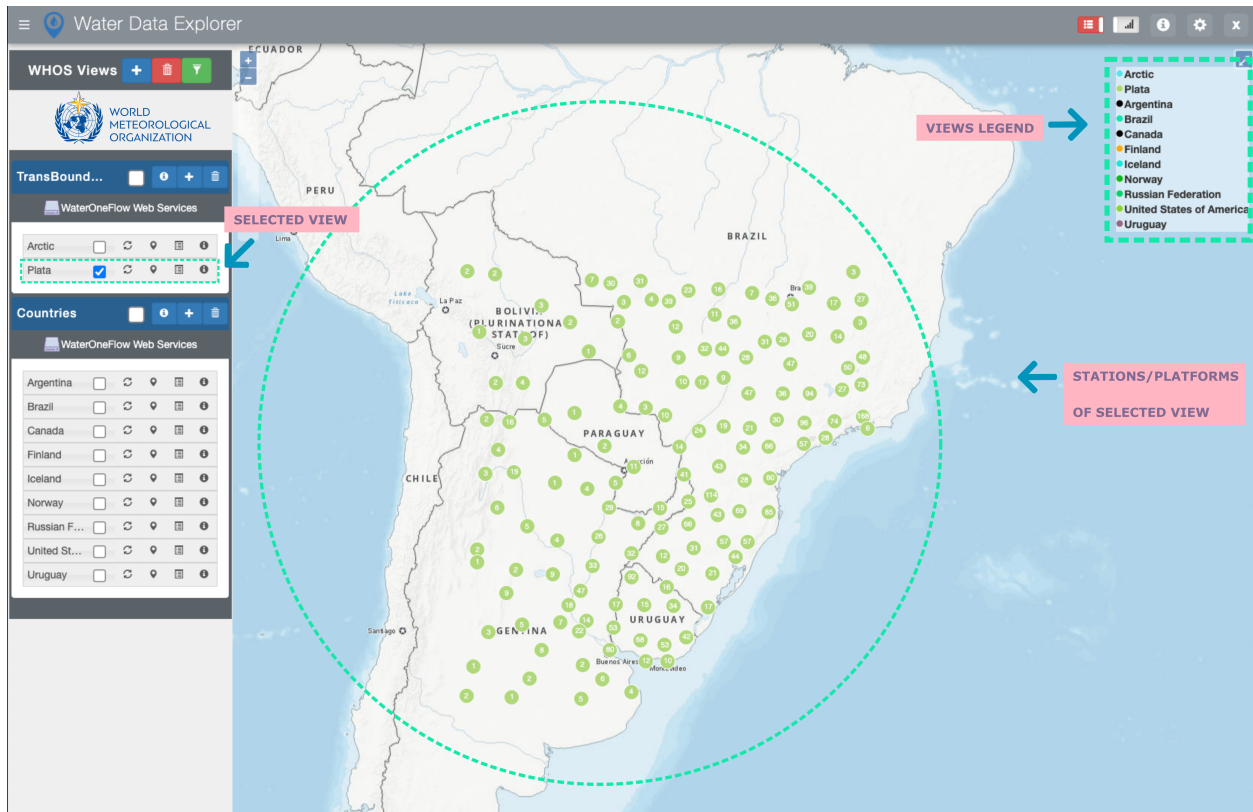
## 1.2.1 User Interface

To organize and manage various WaterOneFlow web services, WDE uses Data Views that are organized in Catalogs.

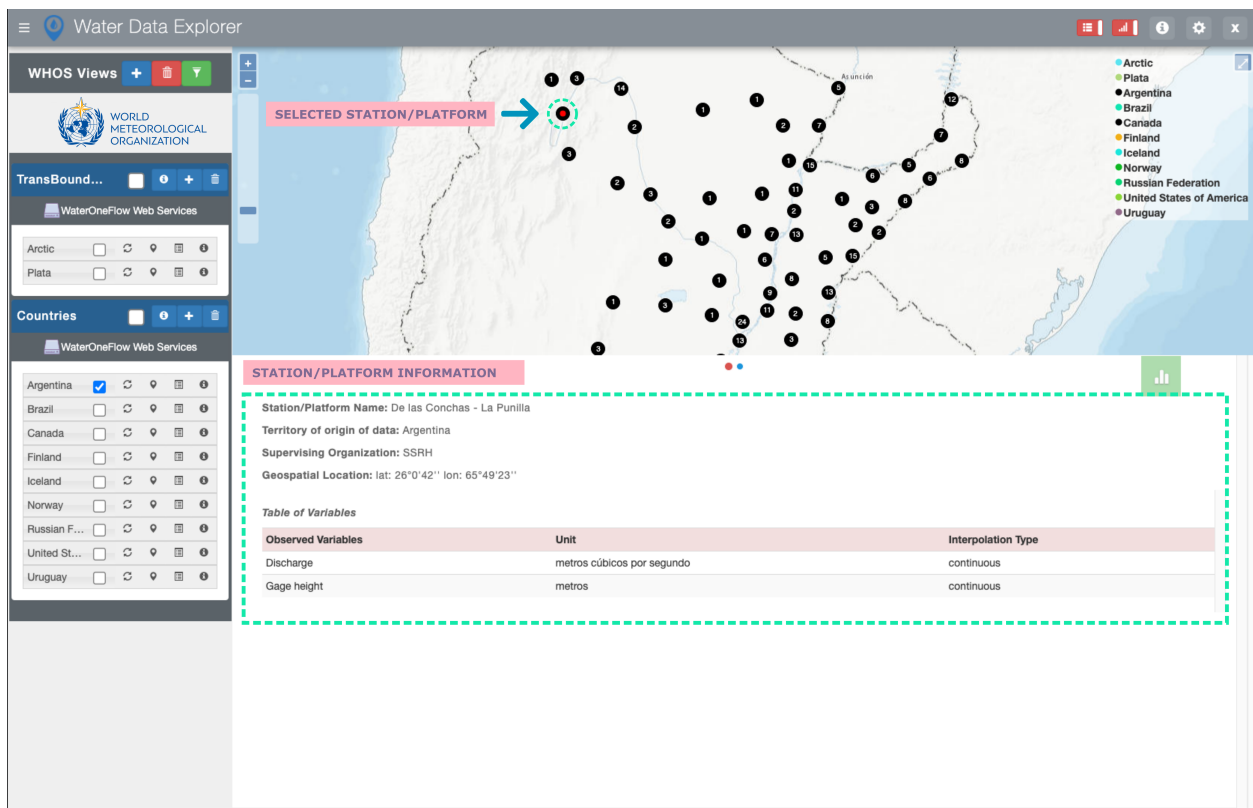


Each Data View contains a set of data that is accessible through a specific WaterOneFlow web service.

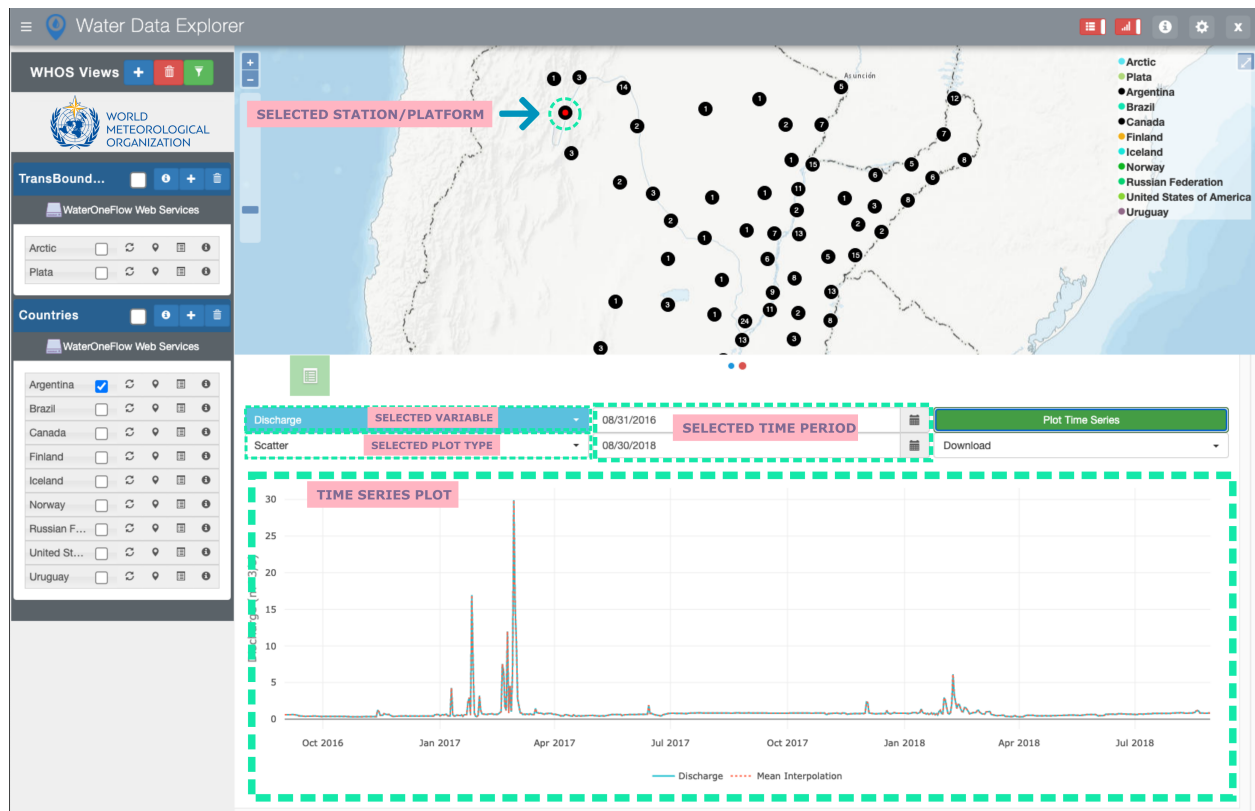
The stations for which data are accessible through a specific Data View are displayed on the WDE map interface along with a legend of the respective Data Views.



For each Station/Platform, a set of metadata is available in the Graphs Panel of the WDE User Interface. Also, for each Station/Platform, a table of observed variables is available and includes variable names, units, and interpolation types.



Station/Platform time series data can be plotted as “Scatter” or “Whisker and Box” plots, and be downloaded in CSV, OGC NetCDF , OGC WaterML 2.0 , and CUAHSI WaterML 1.0 formats for any available time period of interest in the Time Series Plots section.



### 1.2.2 Developers

WDE has been developed by Elkin Giovanni Romero Bustamante at Brigham Young University’s (BYU) Hydroinformatics laboratory with the support of the World Meteorological Organization. The BYU’s Hydroinformatics laboratory focuses on delivering different software products and services for water modelling. Some of the most important works include: Global Streamflow Forecast Services API , creation of the Tethys Platform , and Hydroserver Lite . The most recent publications and works can be found on the BYU Hydroinformatics website.


### 1.2.3 Source Code

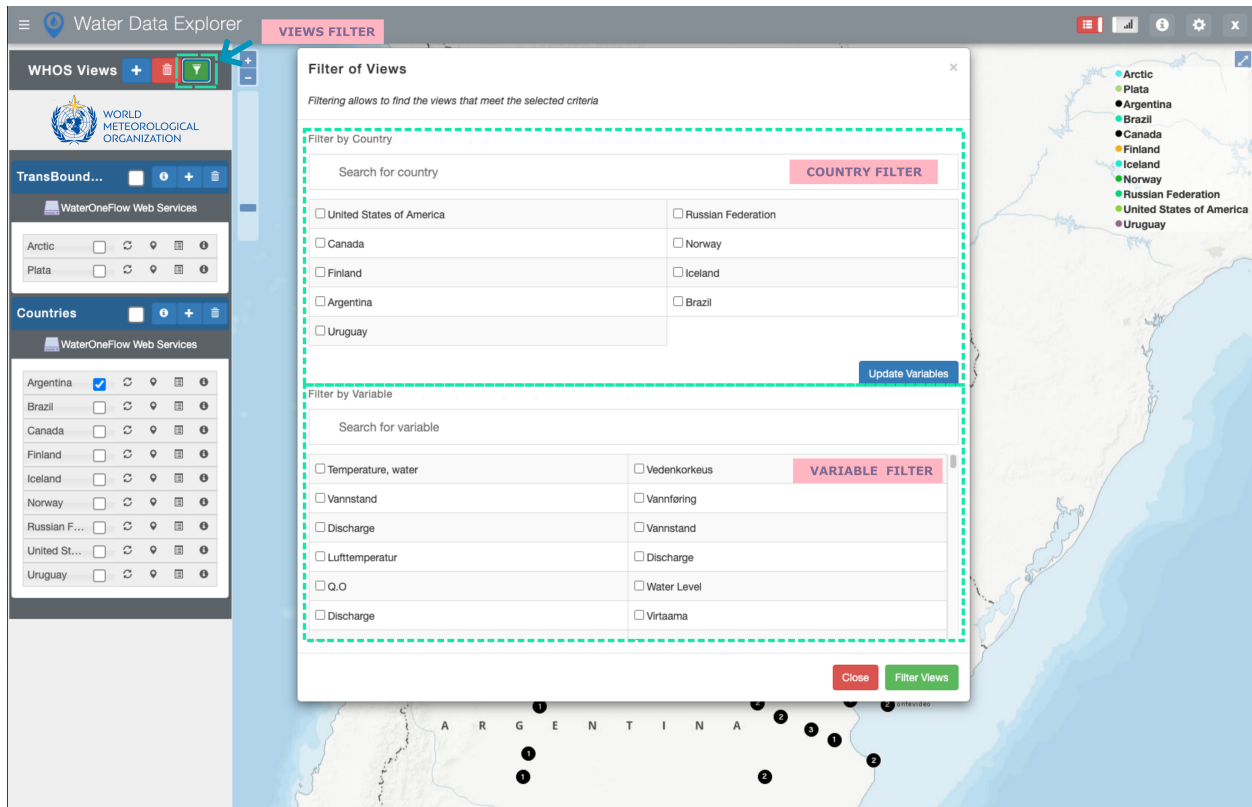
The WDE source code is available on Github:


- <https://github.com/BYU-Hydroinformatics/Water-Data-Explorer>




## WDE USER FUNCTIONALITIES


### 2.1 Data Discovery

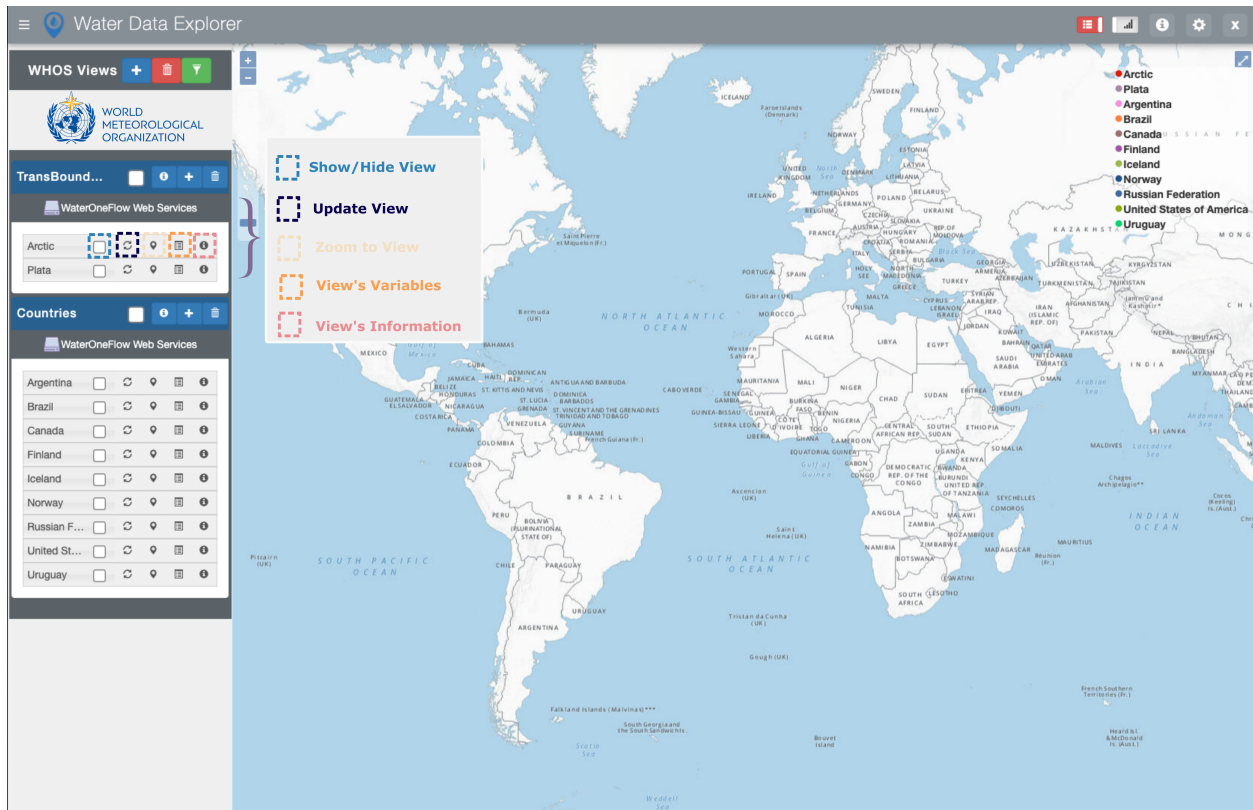
The user can filter the available Views by countries and variables of interest by using the  icon.



**Note:** The user can update the variables to only display the variables of the selected countries in the country filter portion by using the  button.



To display the available stations/platforms of a specific View on the map, the user should use the “Show/Hide View” icon. To see the available variables of a specific View, the user should use the  icon. To display the information about a specific View including description, endpoint, and list of stations as well as the available analysis tools, the user should use the  icon. To zoom to a specific View on the map, the user should use the  icon.

**Note:** To have the data and information of a specific View up to date, the user should update the View by using the  icon.



## 2.2 Data Analysis

WDE application uses a python package called “Pywaterml”. The Pywaterml allows access to WaterOneFlow (WOF) web services and retrieves information in different formats. The Pywaterml can be used in Python Notebook.

Users can open a Python notebook tutorial and the Pywaterml documentation by using the  and  icons.


For a selected View, users can open a Python notebook template in Google Colab. The Python notebook can also be downloaded for a specific station/platform and a specific variable.

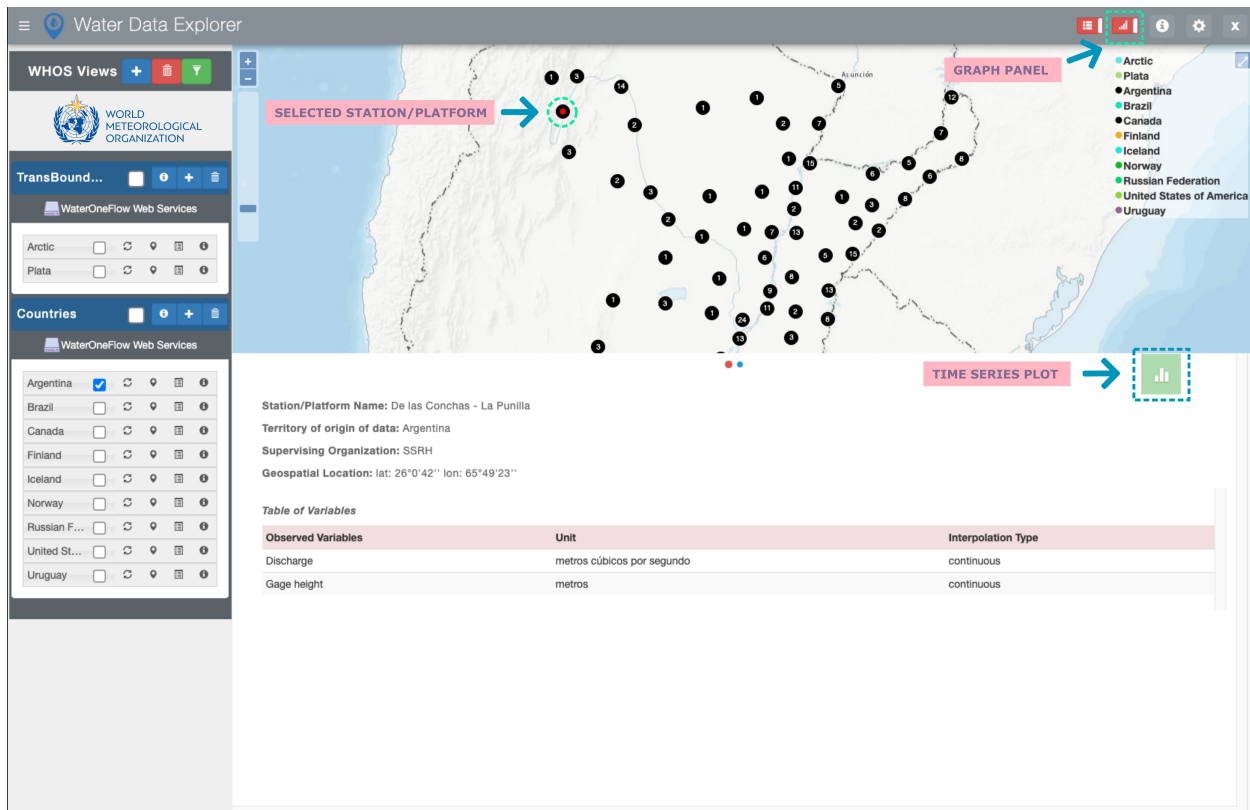



The screenshot displays the Water Data Explorer application interface. On the left, a sidebar contains 'WHOS Views' with the World Meteorological Organization logo, 'TransBound...' options, 'WaterOneFlow Web Services' for Arctic and Plata regions, and a 'Countries' list. The 'Countries' list includes Argentina (checked), Brazil, Canada, Finland, Iceland, Norway, Russian F..., United St..., and Uruguay. A 'VIEW'S INFORMATION' label points to the Argentina entry. The main panel is titled 'Argentina View' and contains the following sections:

- Description:** This service provides a virtual view on datasets from a specific country: Argentina.
- Endpoint/URL:** [http://whos.geodab.eu/gs-service/services/essl/view/gs-view-and\(whos-country:gs-view-country\(ARG\)\)/cuahsi\\_1\\_1.asmx?WSDL](http://whos.geodab.eu/gs-service/services/essl/view/gs-view-and(whos-country:gs-view-country(ARG))/cuahsi_1_1.asmx?WSDL)
- Analysis Tools:** The Water Data Explorer application uses a python package called "Pywaterml". The Pywaterml allows to access WaterOneFlow (WOF) web services and retrieve information in different formats.
- Documentation:** Includes links for Google Colab, Pywaterml Tutorial, Pywaterml Documentation, Open in Google Colab, and Download NoteBook.
- Explore Stations/Platforms:** A map of Argentina showing numbered station locations (1-25) and labels for neighboring countries: CHILE, BOLIVIA (PLURINATIONAL STATE OF), PARAGUAY, and URUGUAY. A legend on the right lists countries: Arctic, Plata, Argentina, Brazil, Canada, Finland, Iceland, Norway, Russian Federation, United States of America, and Uruguay.

## 2.3 Time Series Visualization and Downloading

To visualize and download time series available for a specific station, the user should select the station of interest on the WDE map interface, that triggers the opening of the WDE Graphs Panel at the bottom of the application. To select the time series of interest to be visualized or downloaded, the user should select the  icon on the top right of the Graphs Panel.



**Note:** User can hide or show the Graphs Panel by means of the  icon on the right of the application header. In the opened window, the user can select a variable of interest, plot type, and time period of interest.

**Note:**



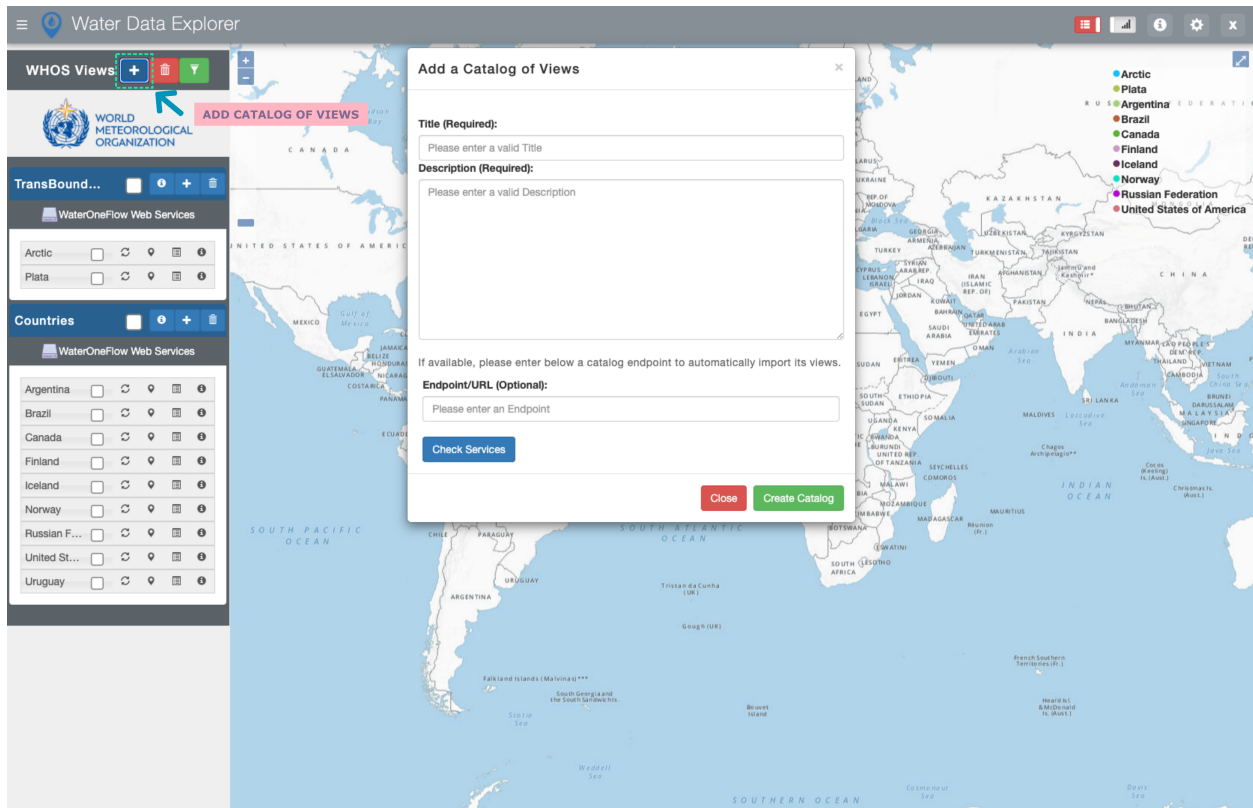
WDE uses the Plotly library which provides the menu above, to allow users to download plots in PNG format, pan to, zoom in/out, and autoscale plots.

## WDE ADMIN FUNCTIONALITIES

The WDE admin functionalities are only available for the WDE administrators.

### 3.1 Adding and Deleting Data Catalogs and Views

To add Catalogs, administrators should use the  icon to access the “Add a Catalog of Views” menu.



The screenshot shows the Water Data Explorer (WDE) interface. On the left, there's a sidebar with 'WHOS Views' and 'Countries' sections. The 'WHOS Views' section has a '+', '-', and 'x' icon. The 'Countries' section lists various countries with checkboxes and icons. The main area shows a world map. Overlaid on the map is a modal form titled 'Add a Catalog of Views'. The form has the following fields and buttons:

- Title (Required):** A text input field with a placeholder 'Please enter a valid Title'.
- Description (Required):** A text input field with a placeholder 'Please enter a valid Description'.
- Endpoint/URL (Optional):** A text input field with a placeholder 'Please enter an Endpoint'.
- Check Services:** A blue button.
- Close:** A red button.
- Create Catalog:** A green button.

Below the 'Endpoint/URL' field, there is a note: 'If available, please enter below a catalog endpoint to automatically import its views.'


In this menu, to add a new Catalog of Views, administrators should enter its title, description, and endpoint if available.

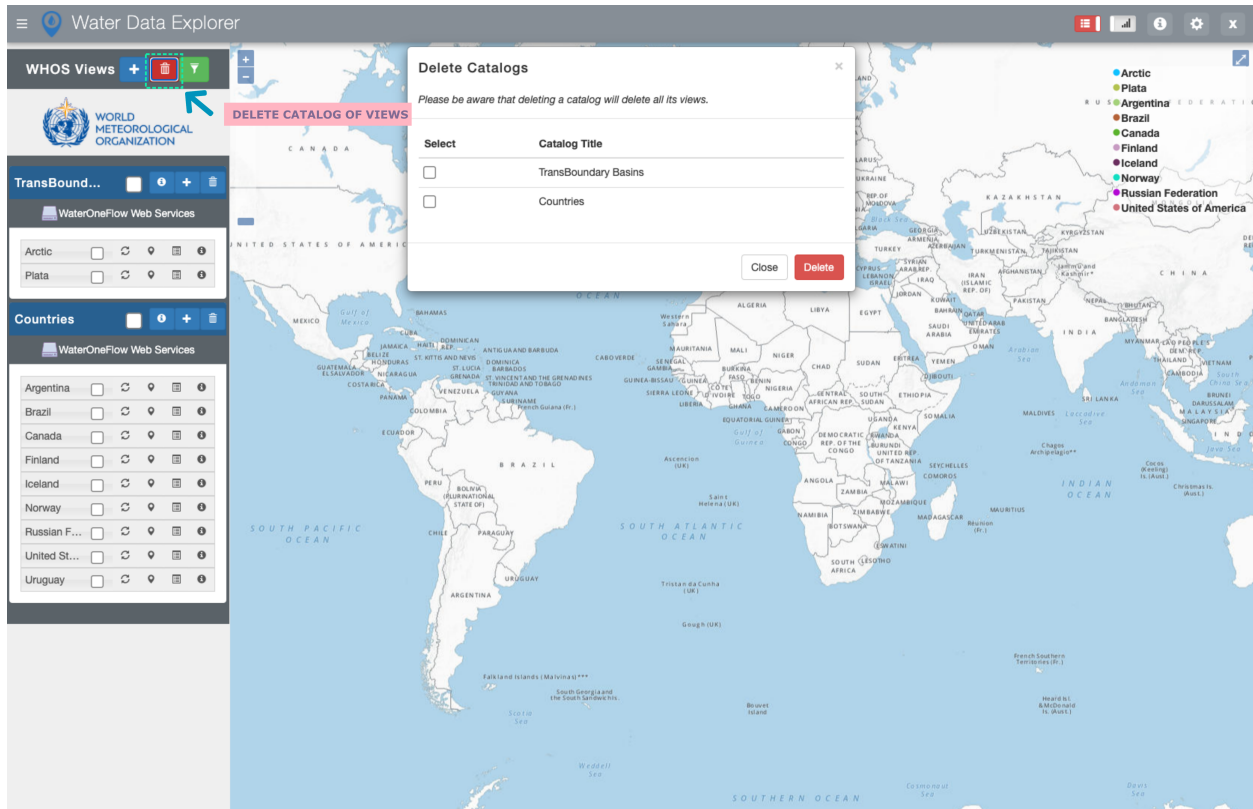
**Endpoint/URL (Optional):**


Please enter an Endpoint

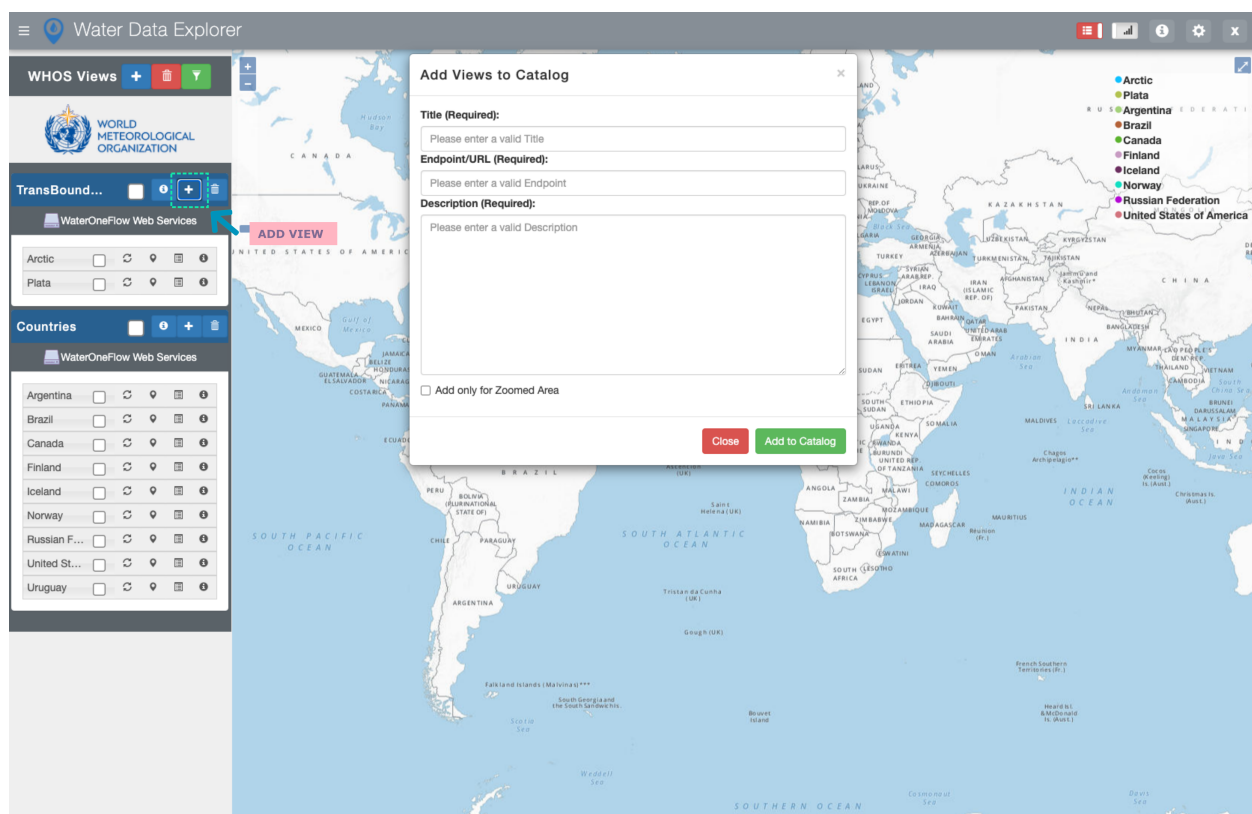
**Note:**


To add a Catalog that is already published and accessible through WaterOneFlow web services, administrators should enter the Catalog endpoint to automatically import its Views. Administrators can check the available Views by using the [Check Service](#) button.

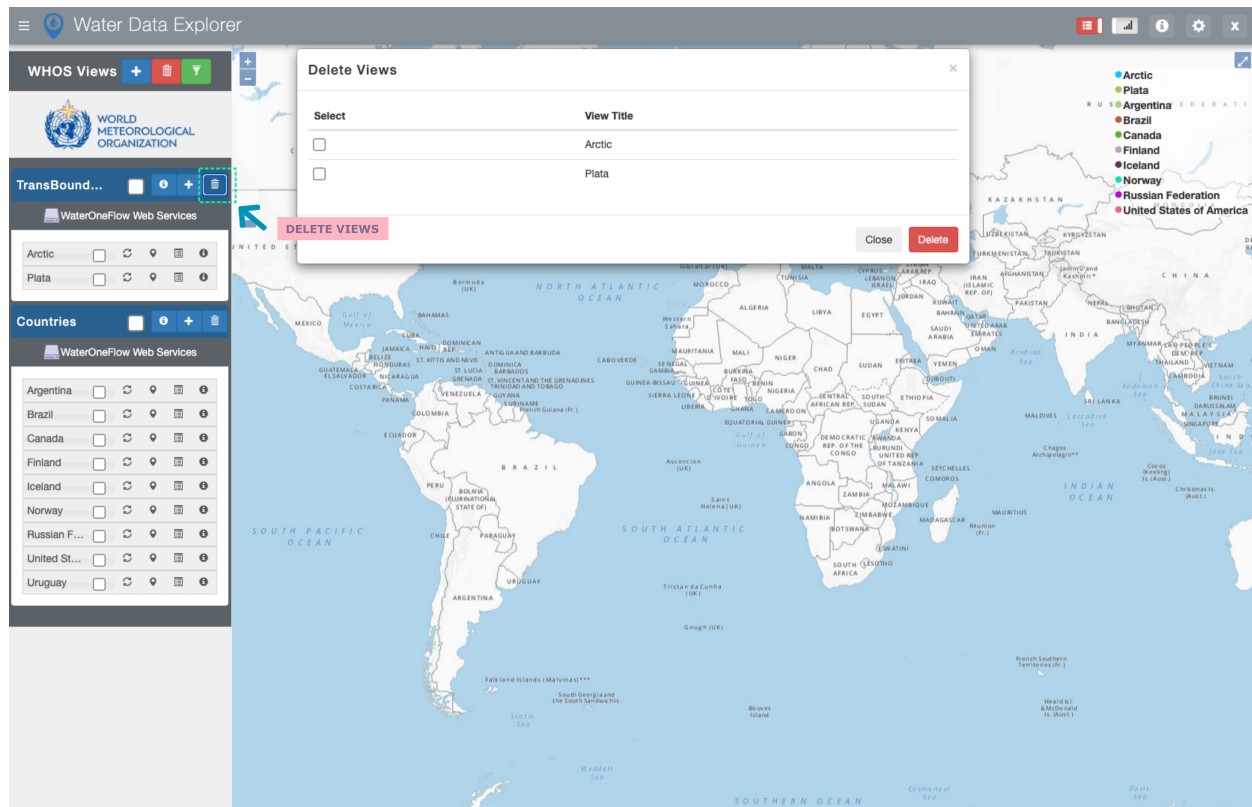
To delete Catalogs, administrators should use the  icon to access the “Delete Catalogs” menu and select the Catalog to be deleted.



To add Views to a specific Catalog, administrators should use the  icon to the right of the Catalog’s title to access the “Add Views to Catalog” menu.

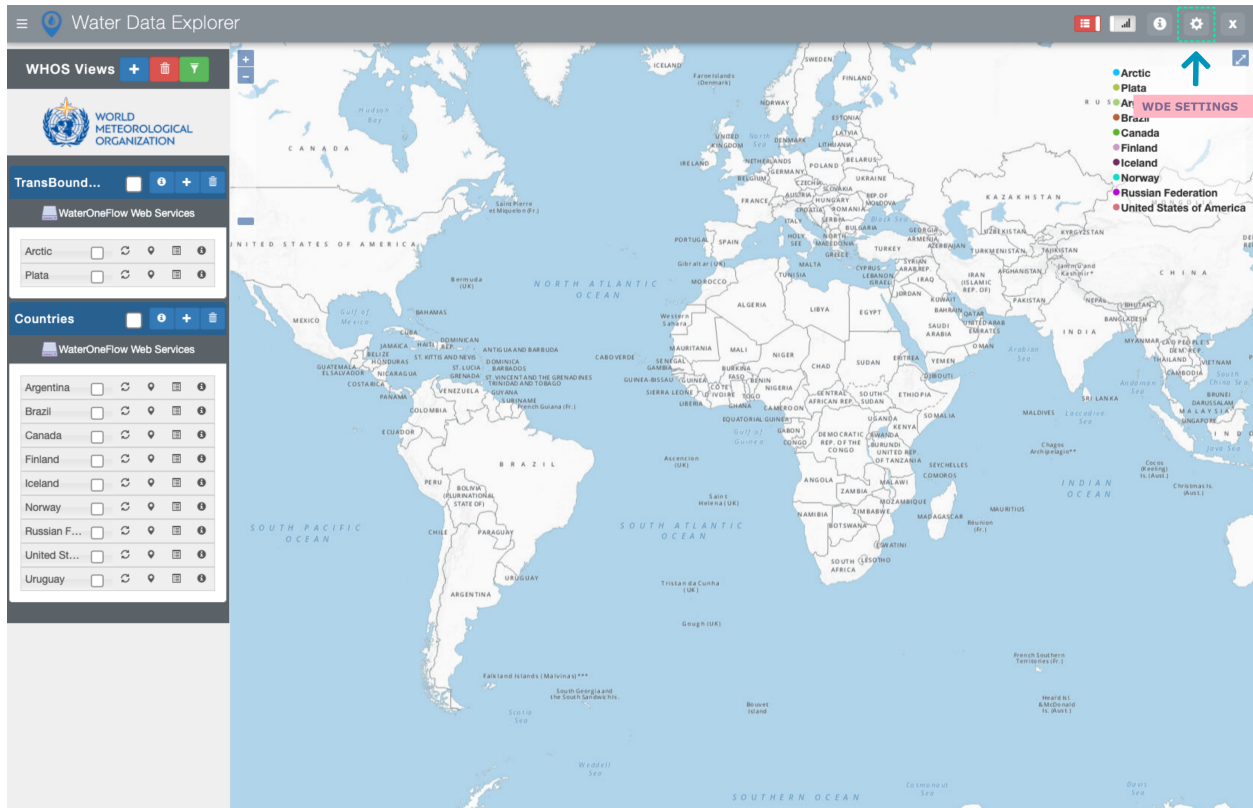


To delete Views, administrators should use the  icon to access the “Delete Views” menu and select the View to be deleted.



## 3.2 Customizing the WDE User Interface

Administrators can customize the WDE user interface by selecting the  icon.



In the settings window, administrators can customize the name of the institution/system that provides Catalogs/Views to the WDE. Administrators can also customize the institution/system logo, as well as the boundaries of the WDE map interface. These customizations are available in the Custom Settings table.