

# **Syr Darya Flood and Drought Monitoring and Forecasting System (SYR-FDM)**

## **Practical Guide to using the System**

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**Version: 1.0**

### **Introduction**

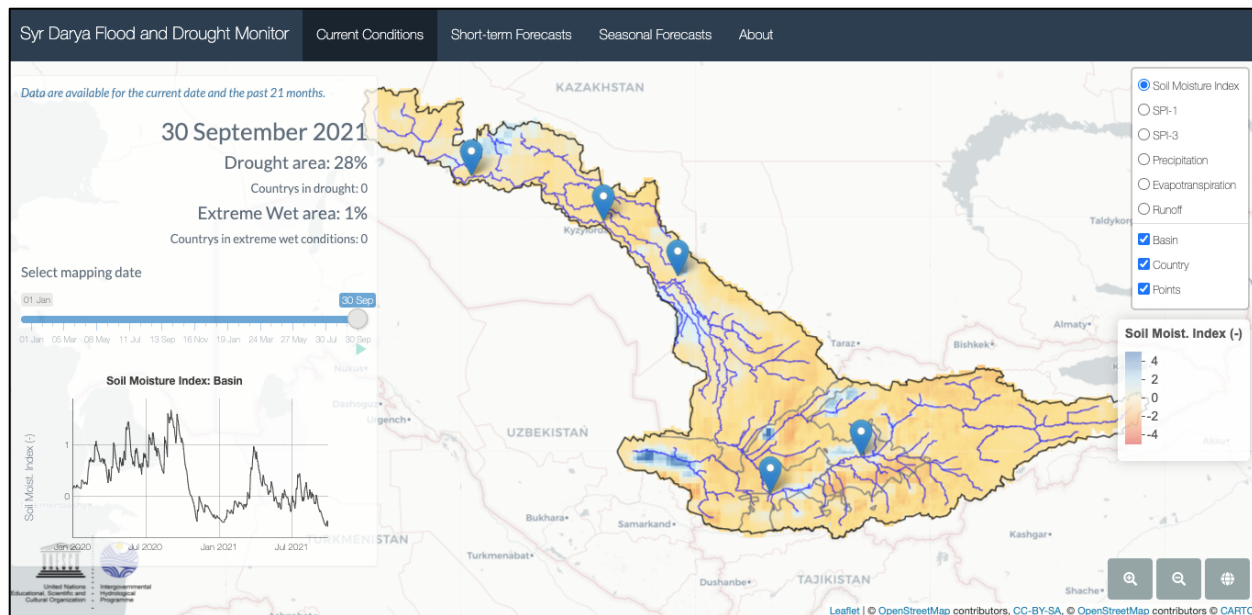
This practical guide provides an overview of the main features of the demonstration version of the Syr Darya Flood and Drought Monitoring and Forecasting System (SYR-FDM) web-interface. The SYR-FDM comprises a database of climate and hydrological information from ground observations, satellite remote sensing and models, which can be accessed via the web interface for use in monitoring and forecasting hydrological variability and in particular for floods and droughts. The interface allows access to the data and derived flood/drought information as maps, time series and summary statistics, including alert information on current and potential future conditions. This is a practical, self-guided exercise on accessing and navigating the system, the menus and help, the map functions, selecting layers, selecting point and area information, the time series functions, data access/download and integration with other software (e.g. Excel). This guide will take about 30-60 minutes to complete.

**NOTE:** this is a demonstration system that is intended to showcase the potential to provide early warning of floods and droughts in the region, focused on the Syr Darya basin as an example. The functionality and data have undergone initial testing, but there may be some lingering bugs and inconsistencies.

### **Accessing the system**

- ⇒ Open your web browser (preferably Google Chrome or Firefox) and to the:  
**<http://stream.princeton.edu/test>**
- ⇒ The system is fully open, so there is no need to register.
- ⇒ When you first access the system, there will be a delay of a few seconds for the system to initialize, and for the interface to be rendered. If you are presented with the interface but no information (e.g. no maps) then continue to wait a few seconds more.

## 1. The Main Interface



You will then see the main interface of the SYR-FDM which provides visualization and access to the data of the monitor. Before moving on to explaining how to access the data, you will first learn about the top bar and the different tabs.

- The top bar shows the name of the system and a menu with a series of tabs. The tabs provide access to the different parts of the SYR-FDM. This includes tabs for current conditions, short-term forecasts, seasonal forecasts, help, etc.



- Current Conditions – This tab shows a summary of current conditions and the latest forecast.
- Short-term Forecasts - This analysis tab shows detailed information on current and short-term (7-day) forecast conditions, with a focus on hydrological variables at national and district scale, and streamflow at a series of points of interest.
- Seasonal Forecasts - This analysis tab shows more detailed information on current and seasonal (6-month) forecast conditions for the districts, with a focus on precipitation (*hydrological forecast variables and indices are in development*).
- About/help – this provides background information about the SYR-FDM, as well as help information on the system and its various functions.

For the remainder of this guide you will learn how to explore the interface, starting with the main tab and then each other tab in turn.

## 2. The “Current Conditions” tab

This tab allows you to view a summary of current conditions and forecasts of the meteorological, hydrological flood and drought variables in an interactive way, as spatial data layers, and area/point time series. The map display provides functionality to pan and zoom in on the map layers to see regional and local detail.

### Summary Panel

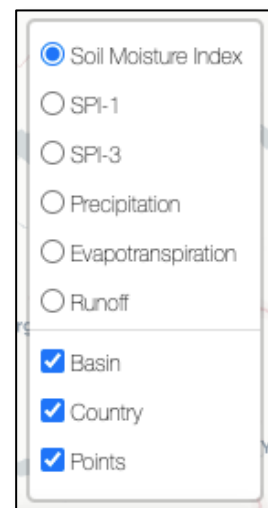
A summary of the current status of the country in terms of flood and drought conditions is provided at the top of the left panel. The date of current conditions is shown first, followed by the total area in drought or flood (extreme wet conditions) and the number of countries within the basin in drought or flood. Drought is defined when the soil moisture index is below -1. The drought area is calculated as the total area in drought across the country as a percentage. A country is said to be in drought when more than 50% of its area is below the drought threshold. Flood area and numbers of countries in flood are defined similarly based on the soil moisture index but the threshold for flood conditions is above 3, which indicates very wet conditions.

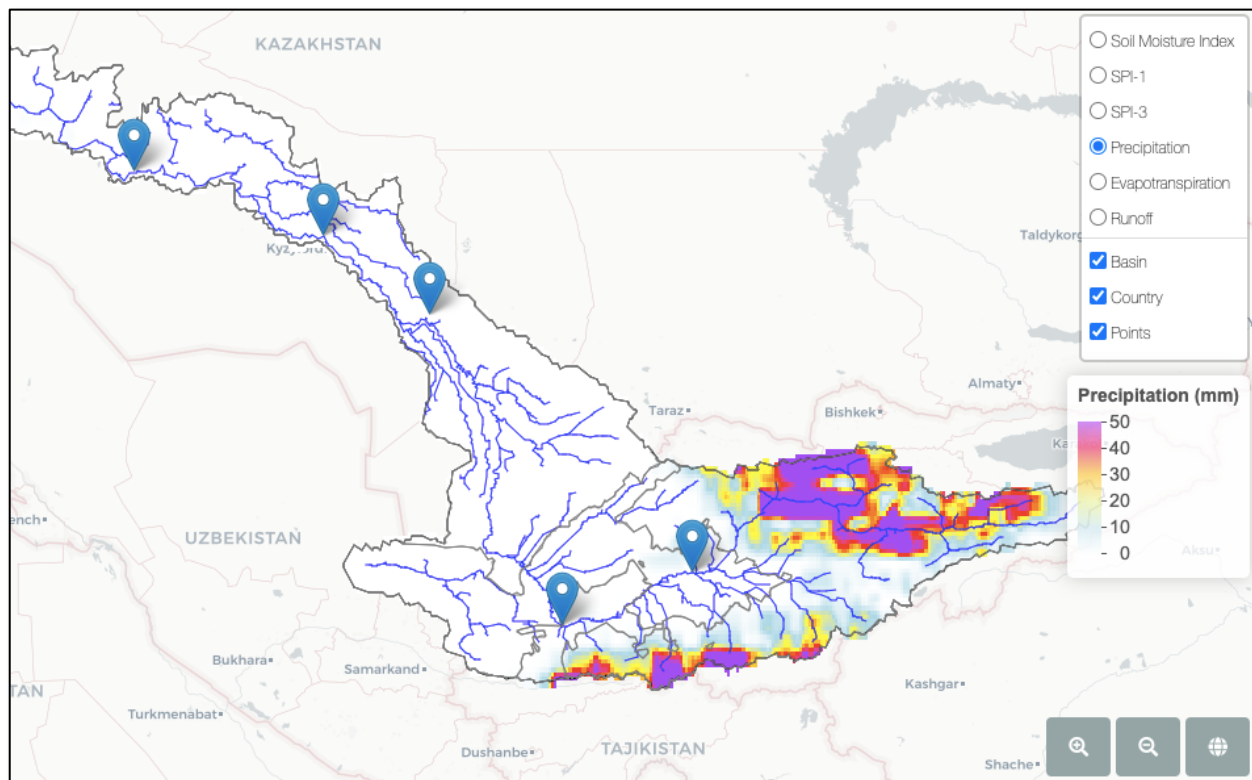


### Main Map

The main map shows current conditions for different hydrological variables and flood/drought indices. The background to the map is provided by Open Street Maps which gives the geographical context of political boundaries and landscape features such as lakes and coastlines. By default, an index of flood/drought based on soil moisture is shown, and other variables can be selected and shown. This is overlain by the river network.

- ⇒ Display different layers on by clicking their check boxes on the variable list on the right. The legend is updated to reflect the top layer that is currently selected.
- ⇒ Click and drag anywhere on the map to move it around. Once you have chosen a region of interest use the zoom bar (+ and – buttons) on the bottom right of the map to zoom in or out.
- ⇒ Click on the globe button to return to the original map view of the whole basin.
- ⇒ Download the maps using the download button in the bottom right of the map, which will save the map layers for the selected date to the user's Desktop or Downloads folder in Tiff format. These Tiff files can be imported into GIS software for further analysis.



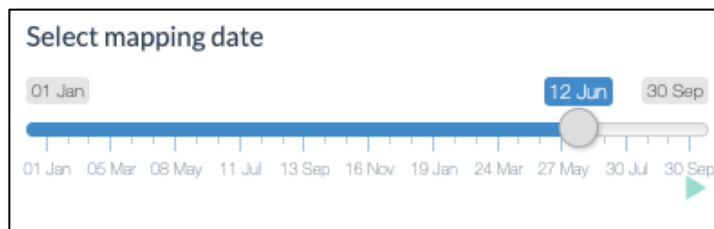


**Table 1.** The various map layers are:

Layer Name	Description	Units
<i>Streamflow</i>	Daily average streamflow	m3/sec
<i>Soil Moisture Index</i>	Daily average soil moisture drought index based on standardized anomalies	-
<i>SPI-1</i>	Standardized precipitation index (1-month time scale)	-
<i>Precipitation</i>	Daily precipitation	mm/day
<i>Runoff</i>	Daily surface runoff and subsurface drainage	mm/day
<i>Evaporation</i>	Daily evapotranspiration	mm/day

**Animating the Map**

By default, the map shows data for current date, but the user can select other dates from the past several months, and animate the maps between selected dates. The date is selected using the “*Select mapping data*” slider on the left panel.

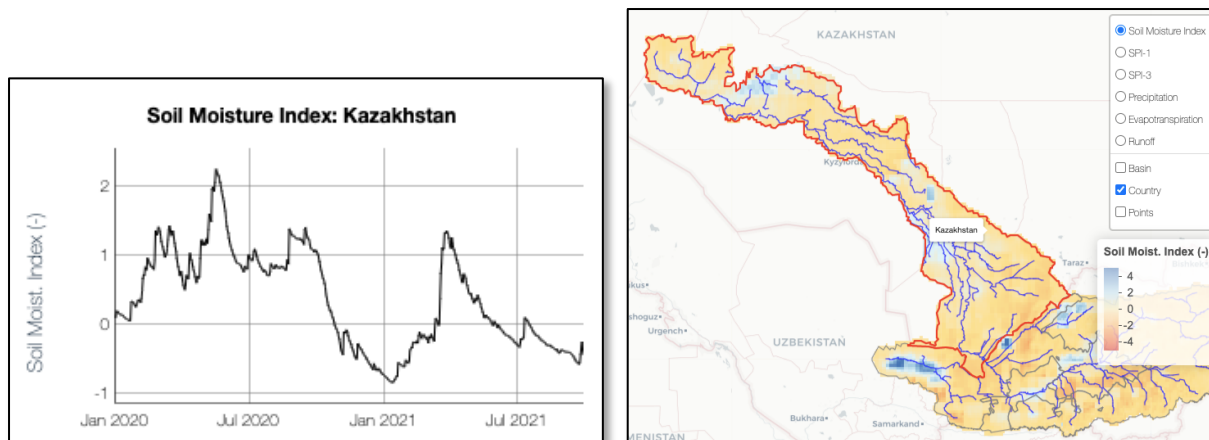


- ⇒ Click and drag on the slider button to select a different date. The map will be updated automatically to show data for the selected date. The date and summary status information will be updated in the panel above.
- ⇒ Press the “play” icon at the bottom left of the slider to animate the maps from the selected date onwards.

### Selecting Vector Overlays

The user can also select different vector layers to display on top of the map layers. These are the Syr Darya basin boundary, the country boundaries, and a set of river points of interest. Clicking on one of the features of a layer will update the time series on the left (see next) to show a time series of the selected variable averaged over the selected feature.

- ⇒ Select one of the layers (e.g. “Country”), and then hover the pointer over the vector features on the map and these will be highlighted in red.
- ⇒ Clicks on the feature, and the time series chart on the left (see next) will be updated with information from the selected feature. For example, if you select the “Country” layer, and click on one of the countries on the map, the time series will be updated with data for the current variable averaged over the selected country.



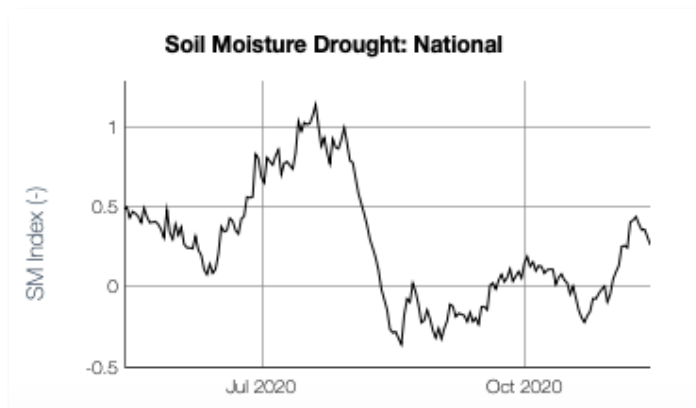
**Table 2:** Description of the possible selection layers

Selection Layer	Description
<i>Basin</i>	Syr Darya basin domain
<i>Country</i>	The countries that share the Syr Darya basin

Points	Selected river location points (see section 2)
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**Time Series Chart**

To the left of the map is a time series of past conditions for the last 6 months and current conditions. The data shown initially in the time series is for the whole basin by default, and can be updated by clicking on different vector overlays for countries and streamflow points on the map.



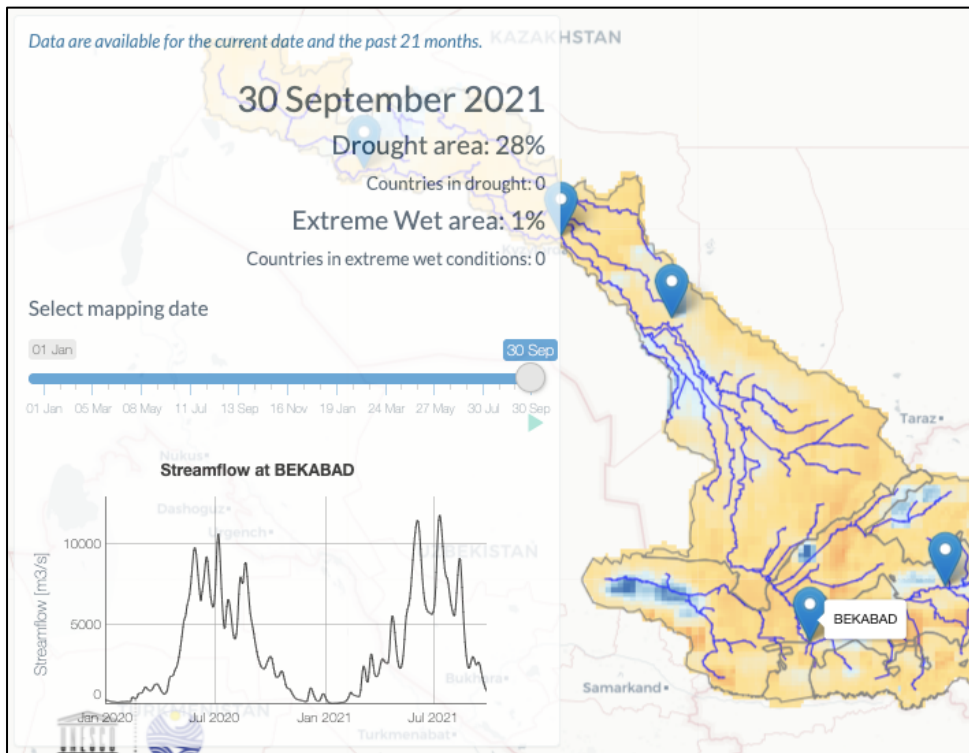
- ⇒ Return to the map and select “Country”; click on one of the countries on the map to update the chart with time series of country average values.
- ⇒ Hover the pointer over the time series to show the values of each variable at each date.

When the “Select By” layer is “Points”, the time series shows past and current conditions for streamflow for the selected river point. These river points are list in the table below.

**Table 2:** Locations of the 5 selected forecast points in the basin, which are also river gauging locations based on the GRDC database.

Location	ID	Longitude	Latitude	Type	River
TYUMEN-ARYK,KZ	2316200	67.05	44.05	Gauging station	Syr Darya
KAZALINSK,KZ	2316201	62.12	45.75	Gauging station	Syr Darya
KARAOZEK,KZ	2316204	65.27	45.00	Gauging station	Syr Darya
KAL,KG	2416202	71.45	40.88	Gauging station	Syr Darya
BEKABAD,UZ	2816203	69.27	40.22	Gauging station	Syr Darya

- ⇒ Return to the map and select “Points”; click on one of the point locations on the map to update the chart with time series of streamflow at the point.
- ⇒ Hover the mouse over the time series chart to see the values at each date.



### 3. Short-term Forecasts

This tab provides access to more detailed data and summary information for the short-term forecasts. These forecasts are provided for the next 7 days and are aimed at early warning of flood conditions and other short-term extremes. The forecasts are available as time-series for basin or country averages, or for the selected river points. The forecasts are summarized in tables for a set of metrics relevant to flood and drought. The time series and tables are accessible from different sub-tabs: *Time Series*, *Country summary*, *River points summary*.

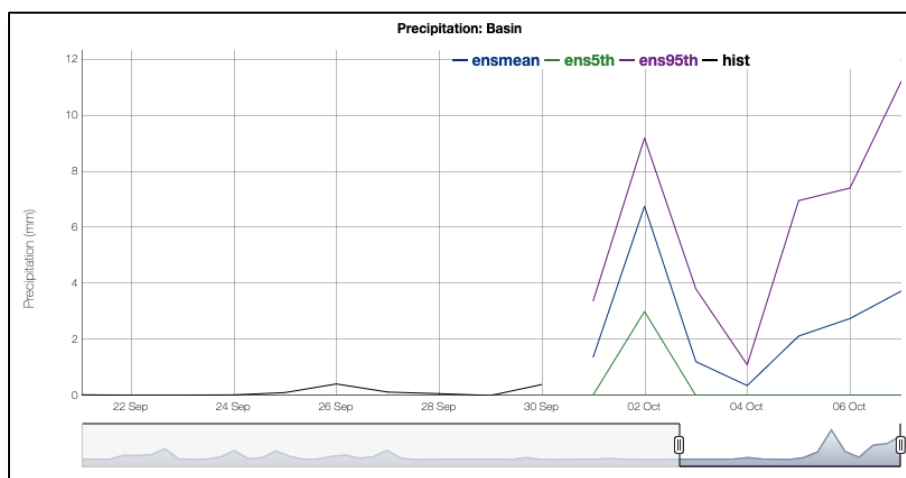
#### *Time series sub-tab.*

On the left of the tab is a menu providing drop down menus for selecting the different variables and averaging areas/river points. By default, a time series of precipitation averaged over the basin is shown. The available variables are shown in the table below. The time series chart shows historic conditions for the last month and the 7-day forecasts from the current date. The forecast is shown as the ensemble mean, 5<sup>th</sup> and 95<sup>th</sup> percentiles. The ensemble mean represents the most likely forecast, and the 5<sup>th</sup> and 95<sup>th</sup> percentiles represent the uncertainty range of the forecast.

**Table 3:** Variables available in the “Short-term Forecasts” tab.

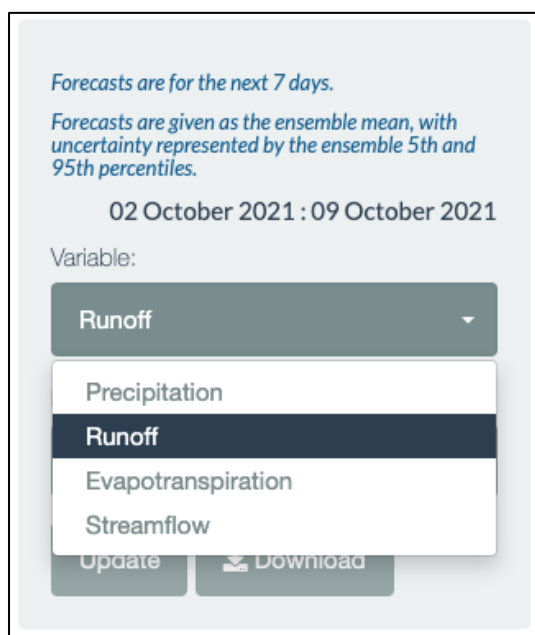
Statistic	Description	Units
<i>Precipitation</i>	Precipitation averaged over the selected area	mm
<i>Runoff</i>	Runoff averaged over the selected area	mm
<i>Evapotranspiration</i>	Evapotranspiration averaged over the selected area	mm
<i>Streamflow</i>	Streamflow for the selected point	m <sup>3</sup> /sec

⇒ Hover the mouse over the time series chart to see the values for the historic and forecast data. Use the slider bar below the time series to zoom into a part of the time series.

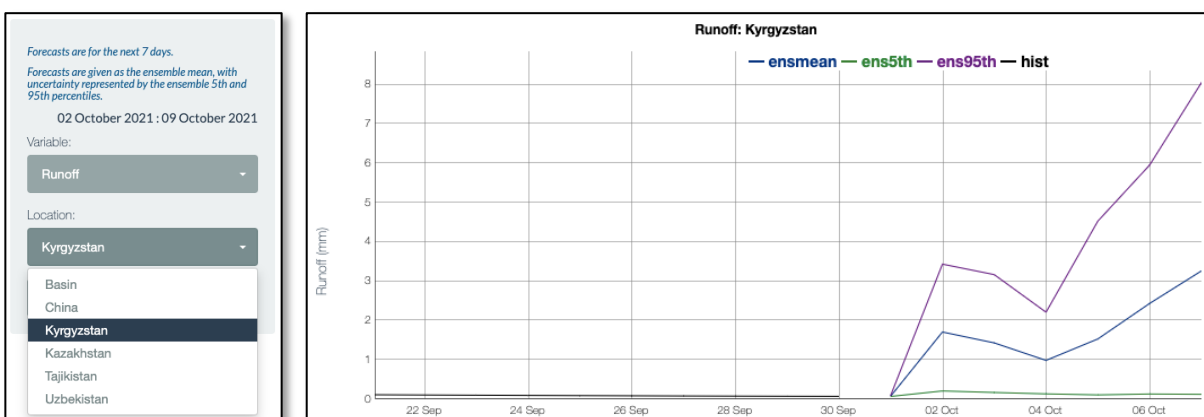




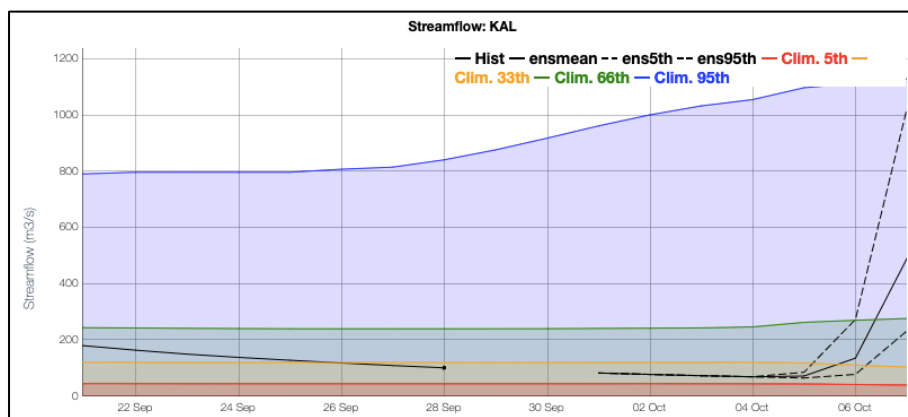
- ⇒ Click on the “*Variable*” drop-down menu on the left panel to see the list of available variables. Select another variable such as *Runoff* and click the “*Update*” button below to update the time series chart.



- ⇒ Click on the “*Location*” drop-down menu on the left panel to see the list of available locations. Select one of these, and “*Update*” to show the selected variable averaged over the location.
- ⇒ You can download the data as a text file in “*csv*” format by clicking on the “*Download*” button. The data will be saved in “*csv*” (comma separated) format to the user's Desktop or Downloads folder. This file can be imported into Microsoft Excel for your own analysis and for plotting.



- ⇒ Now select “*Streamflow*” as the variable and select one of the river points from the “*Location*” list. Click “*Update*” to show the time series of streamflow at the selected point.



The streamflow time series graph also provides the long-term climatology of streamflow in terms of the 5<sup>th</sup>, 30<sup>th</sup>, 70<sup>th</sup> and 95<sup>th</sup> percentiles, which represent the range of values that has been experienced historically. These are shown as red, orange, green and blue shading respectively.

*Country Summary sub-tab.*

This sub-tab summarizes the current and forecast data for the countries that share the basin, with a set of statistics as described below in the table.

**Table:** The statistics provided in the “Country Summary” sub-tab

Statistic	Description	Units
<i>Rain past 90-day</i>	Area average total rainfall over the past 90 days	mm
<i>Rain past 7-day</i>	Area average total rainfall over the past 7 days	mm
<i>Rain fcst 7-day</i>	Area average total rainfall forecast over the next 7 days	mm
<i>SM current drought area</i>	Area in drought for the current day as indicated by <i>SMindex</i> below -1	%
<i>SM fcst drought area</i>	Forecast area in <i>SMindex</i> drought forecast over the next 7 days. This is based on the ensemble mean forecast.	%

The statistics are coded by color bars which give a quick visual indication of countries with higher or lower rainfall or soil moisture indices.

- ⇒ Click on the table column titles to order the data in the table, to show the Country with the highest or lowest values of the selected statistic:

ID	District	Rain past 90day (mm)	Rain past 7day (mm)	Rain fcst 7day (mm)	SM current drought area (%)	SM fcst drought area (%)
4	Uzbekistan	23.67	0.58	4.60	40.80	31.66
1	Kyrgyzstan	196.29	0.80	52.59	38.98	5.28
3	Tajikistan	45.60	0.02	1.77	26.19	22.20
0	China	140.50	0.00	20.52	23.08	19.23
2	Kazakhstan	8.62	0.50	0.54	14.38	17.20

⇒ Use the Table search box to filter the list of Countries, to show a subset:

ID	District	Rain past 90day (mm)	Rain past 7day (mm)	Rain fcst 7day (mm)	SM current drought area (%)	SM fcst drought area (%)
2	Kazakhstan	8.62	0.50	0.54	14.38	17.20

*River Points Summary sub-tab.*

This sub-tab summarizes the current and forecast data for the river locations, with a set of statistics as described below in the table.

**Table:** Streamflow statistics provided in the “River Points Summary” sub-tab

Statistic	Description	Units
<i>Current flow</i>	Current streamflow	m <sup>3</sup> /sec
<i>Current pctl</i>	Percentile of the current streamflow, relative to the long-term climatology	%
<i>Fcst 7-day max flow</i>	Forecast streamflow. This is based on the 7-day maximum of the forecast ensemble mean.	m <sup>3</sup> /sec
<i>Fcst 7-day max pctl</i>	Percentile of the forecast streamflow, relative to the long-term climatology. This is based on the 7-day maximum of the forecast ensemble mean.	%

The statistics are coded by color bars which give a quick visual indication of locations with higher or lower flow magnitudes or streamflow percentiles.

⇒ Click on the table column titles to order the table by each variable:

ID	Locaton	Current flow (m3/s)	Current pctl (%)	Fcst 7-day max flow (m3/s)	Fcst 7-day max pctl (%)
2316200	TYUMEN-ARYK	0.00	100.00	0.00	100.00
2316204	KARAOZEK	6,358.63	100.00	7,240.80	100.00
2816203	BEKABAD	849.66	94.12	865.61	94.70
2416202	KAL	101.71	23.76	877.19	91.83
2316201	KAZALINSK	1,419.84	0.00	1,848.11	0.00

⇒ Use the Table search box to filter the list of locations, to show a subset.

#### 4. Seasonal Forecasts

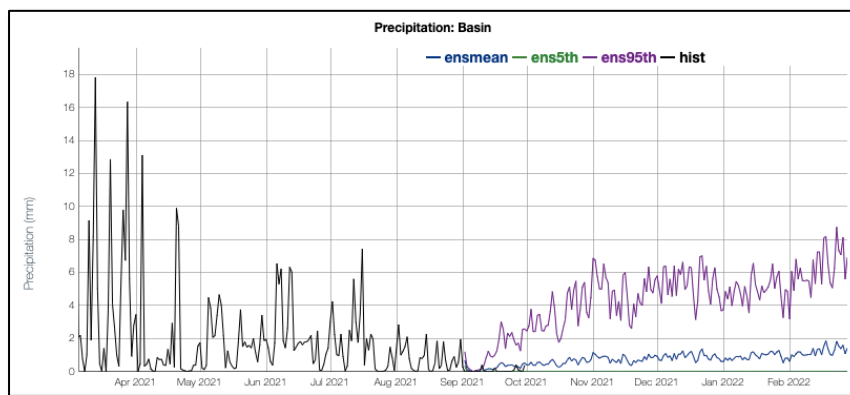
This tab provides access to more detailed data and summary information for the seasonal forecasts. These forecasts are provided for the next 6 months and are aimed at early warning of drought conditions. The forecasts are available as time-series for basin or country averages.

On the left of the tab is a menu providing drop down menus for selecting the different variables and averaging areas. By default, a time series of precipitation averaged over the basin is shown. The available variables are shown in the table below. The time series chart shows historic conditions for the last month and the 6-month forecasts from the latest forecast date. The forecast is shown as the ensemble mean, 5<sup>th</sup> and 95<sup>th</sup> percentiles. The ensemble mean represents the most likely forecast, and the 5<sup>th</sup> and 95<sup>th</sup> percentiles represent the uncertainty range of the forecast.

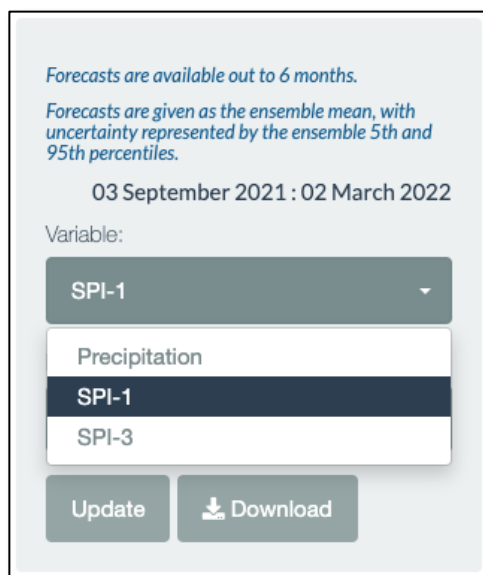
**Table 3:** Variables available in the “Seasonal Forecasts” tab.

Statistic	Description	Units
Precipitation	Precipitation averaged over the selected area	mm
SPI-1	Standardized precipitation index (1-month time scale)	-

⇒ Hover the mouse over the time series chart to see the values for the historic and forecast data.



⇒ Click on the “Variable” drop-down menu on the left panel to see the list of available variables. Select another variable such as *SPI-1* and click the “Update” button below to update the time series chart.



Forecasts are available out to 6 months.  
Forecasts are given as the ensemble mean, with uncertainty represented by the ensemble 5th and 95th percentiles.

03 September 2021 : 02 March 2022

Variable:

SPI-1

Precipitation

SPI-1

SPI-3

Update Download

- ⇒ Click on the “*Location*” drop-down menu on the left panel to see the list of available locations. Select one of these, and “*Update*” to show the selected variable averaged over the location.
- ⇒ You can download the data as a text file in “*csv*” format by clicking on the “*Download*” button. The data will be saved in “*csv*” (comma separated) format to the user's Desktop or Downloads folder. This file can be imported into Microsoft Excel for your own analysis and for plotting.

## 5. About

The “About” tab page gives an overview of the system and its background, including the methods and datasets, and some detail on how it is run operationally. Some details of the operational monitoring and forecasts are also given, including the system model, forecast statistics, and forecast status. The “Help box” provides detailed information on each page of the interface, and covers some of what is in this guide.

**Congratulations!** You have now completed the SYR-FDM self-guided exercise. We hope that this has given you a good overview of the wide range of features for data exploration, visualization, and download that the SYR-FDM has to offer. If you have any questions or comments that you would like to give about the contents of this guide or the SYR-FDM interface and its data, please use the email address on the front page to send a brief comment and we will try to address any questions or concerns that you may have. Thanks!