

Functional Flows Calculator (FFC) Tool Demonstration: R Package

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CABW/Cal-SFS Annual Meeting

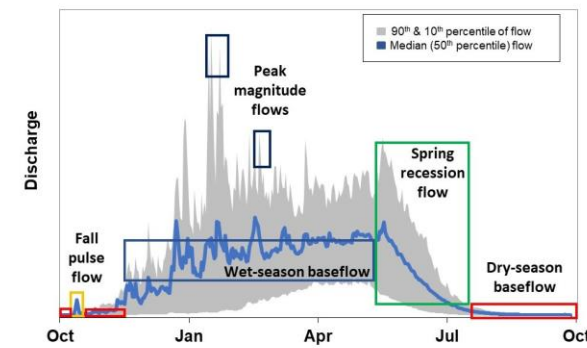
Goal

Demonstrate how to calculate functional flow metrics using daily flow timeseries (observed or modeled)

AGENDA:

- Online resources
- FFC R package demonstration

Functional Flows Calculator



- Tool that quantifies functional flow metrics based on long-term daily streamflow timeseries using signal processing algorithms (Patterson et al., 2020, J. Hydrol.)
- Available on various platforms:
 - Python: <https://github.com/leogoesger/func-flow>
 - R package: <https://github.com/ceff-tech/ffc> api client
 - E-flows website: <https://eflows.ucdavis.edu/>

← Today's demo

Resource Links

- FFC Python code repository:
 - <https://github.com/leogoesger/func-flow>
 - FFC documentation: <https://eflow.gitbook.io/ffc-readme/>
- Eflows website:
 - <https://eflows.ucdavis.edu/>
 - Website documentation: https://eflows.gitbook.io/project/website_summary
- FFC R package repository:
 - https://github.com/ceff-tech/ffc_api_client
 - R package documentation: https://ceff-tech.github.io/ffc_api_client/reference/index.html

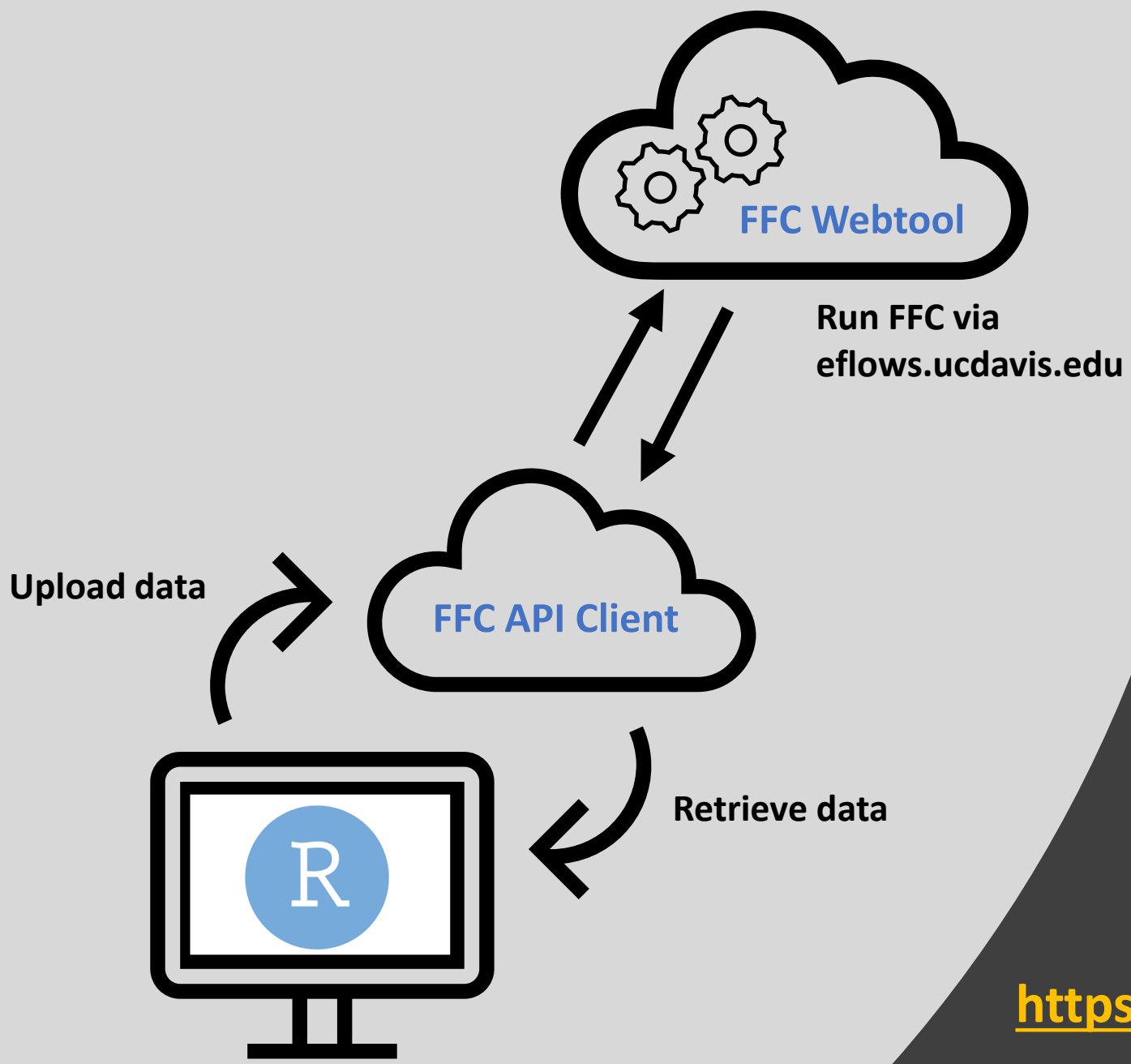
Online Webinars

- Functional flows calculator overview (Belize Lane, Noelle Patterson)
 - <https://www.youtube.com/watch?v=W83xsMyMpKw>
- Functional flows calculator under the hood webinar – Webtool and Python demonstration (Noelle Patterson)
 - <https://www.youtube.com/watch?v=nN08f3nFGe8>
- Additional CEFF presentations
 - <https://ceff.ucdavis.edu/presentations>

Publication for FFC

Patterson, N. K., Lane, B. A., Sandoval-Solis, S., Pasternack, G. B., Yarnell, S. M., and Qiu, Y. (2020). A Hydrologic Feature Detection Algorithm to Quantify Seasonal Components of Flow Regimes. *J. Hydrol.* 585, 124787. doi:10.1016/J.JHYDROL.2020.124787

-  nickrsan Nick Santos
-  ryanpeek Ryan Peek
-  alyssaobester Alyssa Obester



FFC API Client R Package

https://github.com/ceff-tech/ffc_api_client

https://github.com/ceff-tech/ffc_api_client

Simple Functional Flows Calculator API client

This R package is designed to:

- Process flow data through the online functional flows calculator
- Calculate annual functional flow metrics
- Conduct alteration assessments by metric
- Return boxplots showing the observed versus predicted reference ranges for each metric

It is meant to be used with a gage ID, or with a timeseries dataframe of daily flows along with either a stream segment COMID or longitude and latitude (it will look up the COMID for you).

Reference

Use ffcAPIClient to Follow CEFF Steps

Getting Started

Run Multiple Gages



All functions

FFCProcessor

FFCProcessor Class

USGSGage

USGS Gage Retrieval Tools

assess_alteration()

Assess hydrologic alteration by flow metric

attach_water_year_data()

Add calendar_year/calendar_month/calendar_day/water_year fields

clean_account()

Clean account

early_or_late()

Determine if timing metrics are early, late, or in range

evaluate_alteration()

Generate FFC Results and Plots for Timeseries Data

evaluate_gage_alteration()

Generate FFC Results and Plots for Gage Data

ffcAPIClient

ffcAPIClient: Processes time-series flow data using the online functional flows calculator

fill_na_10th_percentile()

Fill 10th Percentile NA values when 25th percentile value is 0

filter_timeseries()

Filter Timeseries data

flow_metrics

Modeled flow metric predictions for all stream segments

Getting Started

https://ceff-tech.github.io/ffc_api_client/articles/getting_started.html#usage-examples

Need: latest version of R (download [here](#)) and {devtools} package installed

- 1. Install {devtools} package:** If you don't already have it, run `install.packages('devtools')` in your R console
- 2. Install the {ffcAPIClient} package:**
 - `devtools::install_github('ceff-tech/ffc_api_client/ffcAPIClient')`
 - If you get an error on this installation step, make sure you are using the latest version of R and of the {devtools} package.

Getting Started

https://ceff-tech.github.io/ffc_api_client/articles/getting_started.html#usage-examples

3. Retrieve your eflows API token:

- In Firefox or Chrome, log into <https://eflows.ucdavis.edu> to retrieve API token
- Step by step instructions on following slides

<https://eflows.ucdavis.edu/signup>



eFlows beta-v2.32

Hydrology ▾

Geomorphology

Ecology

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Papers

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Login



Sign Up



Sign Up

Welcome, please enter your information below to upload your own time series data

First Name

Last Name

Email

kristinetq@sccwrp.org

Password

Repeat Your Password

[Log In](#)

SUBMIT

<https://eflows.ucdavis.edu/login>



Log In

Welcome back, please enter your user email and password.

Email

kristinetq@sccwrp.org

Password

[Sign Up](#)

SUBMIT

*As we are going through changes in our server, we wipe our entire database. If your login stopped working, just create another one with the same email.



<https://eflows.ucdavis.edu/profile>



eFlows beta-v2.32

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Welcome, Kris

The calculator was designed to be flexible and to accept data with missing values or partial years. For best results, the user is encouraged to clean data prior to upload. Suggested data cleaning steps include to:

Subset to complete water years (i.e., October 1 to September 30)

Exclude water years with more than 7 total days of missing data

Exclude water years with more than 1 consecutive day of missing data

The natural stream class of your site should be selected prior to running the functional flows calculator so that the correct parameters are applied. The stream class for your site can be identified on the website landing page.

Upload your time series data here. The application requires a comma separated values (.csv) file with two columns: column 1 contains dates (mm/dd/yyyy) and column 2 contains the corresponding daily flow (cfs). The columns must have the following exact headers: **date** for the dates column and the **flow** for the flow column. Any gaps in the data will be interpolated. Please download [this sample csv file](#) for a data format example. Tool is under development for user uploaded streamflow data, please use results with caution.

Water Year Start Date

10/1

Name your uploaded data

 PICK A FILE

River Name (optional)

Location (optional)

 PARAMS (OPTIONAL)

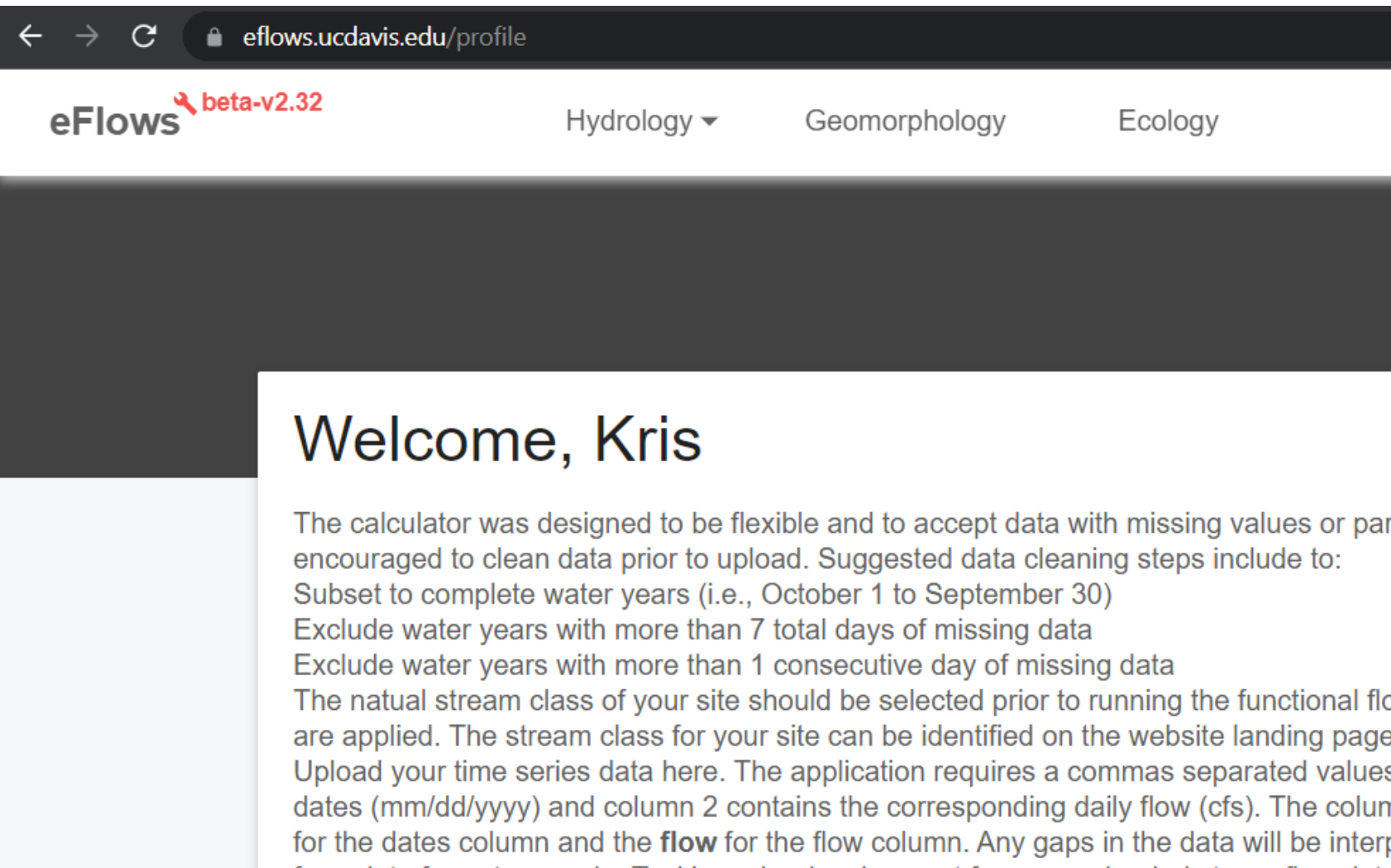
UPLOAD

Uploads

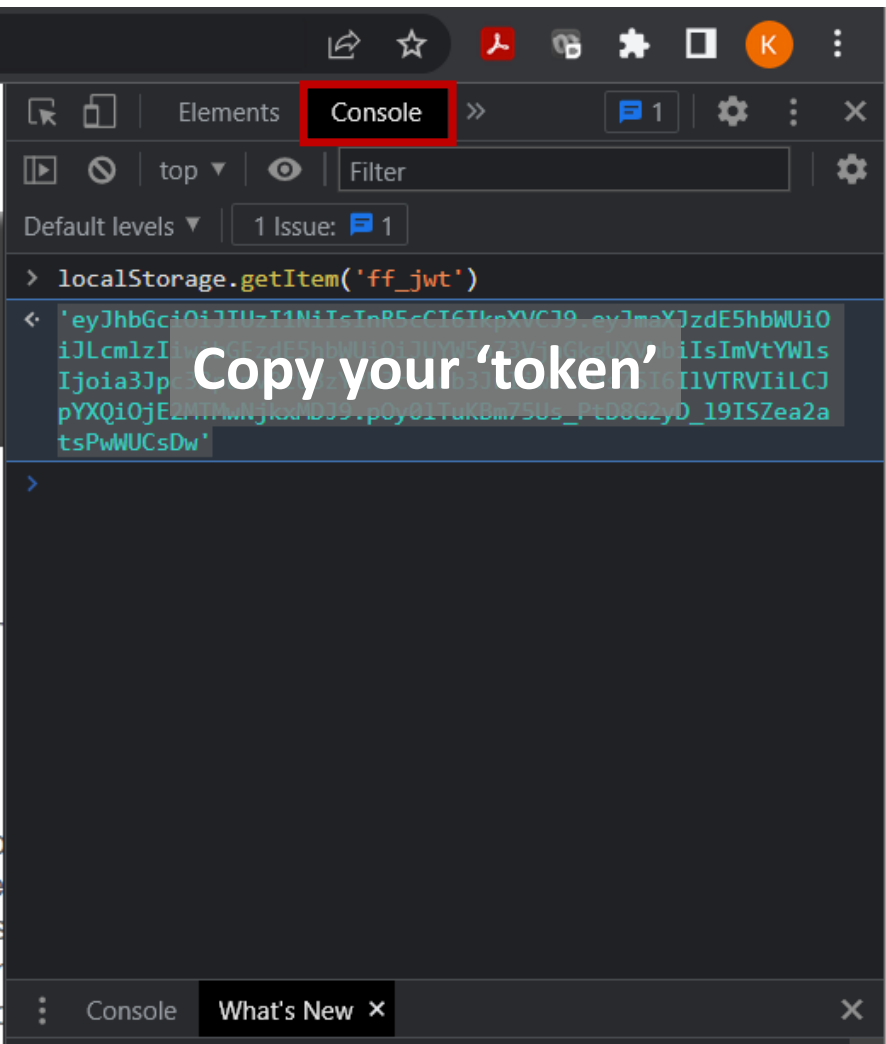
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Aliso STP ref

Press F12



The screenshot shows the top portion of a web browser displaying the eFlows website. The address bar shows the URL `eflows.ucdavis.edu/profile`. The page header includes the eFlows logo with a red tag `beta-v2.32`, and navigation tabs for `Hydrology`, `Geomorphology`, and `Ecology`. The main content area displays a large heading `Welcome, Kris` and a list of instructions for data upload, including steps like 'Subset to complete water years' and 'Upload your time series data here'. The text is partially cut off at the bottom.



The screenshot shows the browser's developer console with the `Console` tab selected. The console log shows the execution of `localStorage.getItem('ff_jwt')`, resulting in a long alphanumeric string representing a JWT token. A white text box with the text `Copy your 'token'` is overlaid on the token string. The console also shows a `1 Issue` notification.

R code demonstration

- R scripts for setup and examples are saved at:
https://github.com/kristaniguchi/FFC_API_Setup_Examples