EventPicker
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EventPicker is a free open-source tool for identifying storm events in hydrographs. As of 02/2020 it is limited to time series with daily frequencies and works best with continuous records. This document is a step-by-step tutorial in using the tool, if you have questions please contact me.

Introduction and data sources

The basic use of the tool is designed in two sequential tabs: 1) In "Upload hydrograph and pick events" the user uploads a time series and applies a simple yet sensitive peak picking algorithm to identify potential storm events within the hydrograph 2) In "Adjust Events" the user can perform a manual peak-by-peak inspection of each identified event where the events can be adjusted or deleted resulting a custom dataset of storm events based on user preference.

The input hydrograph must have a daily frequency with a column labeled "Date" with format "mm/dd/yy". To complete the following tutorial, download the file "demo_data.csv" from https://github.com/galengorski/EventPicker . Alternatively, the R code query_prepare_data.R can be found in the same github repository and it contains a script that queries discharge data from the USGS NWIS and prepares it for use with the EventPicker app.

Uploading data

1. Using the upload function, navigate to the time series and upload the data. The entire time series should be plotted up.
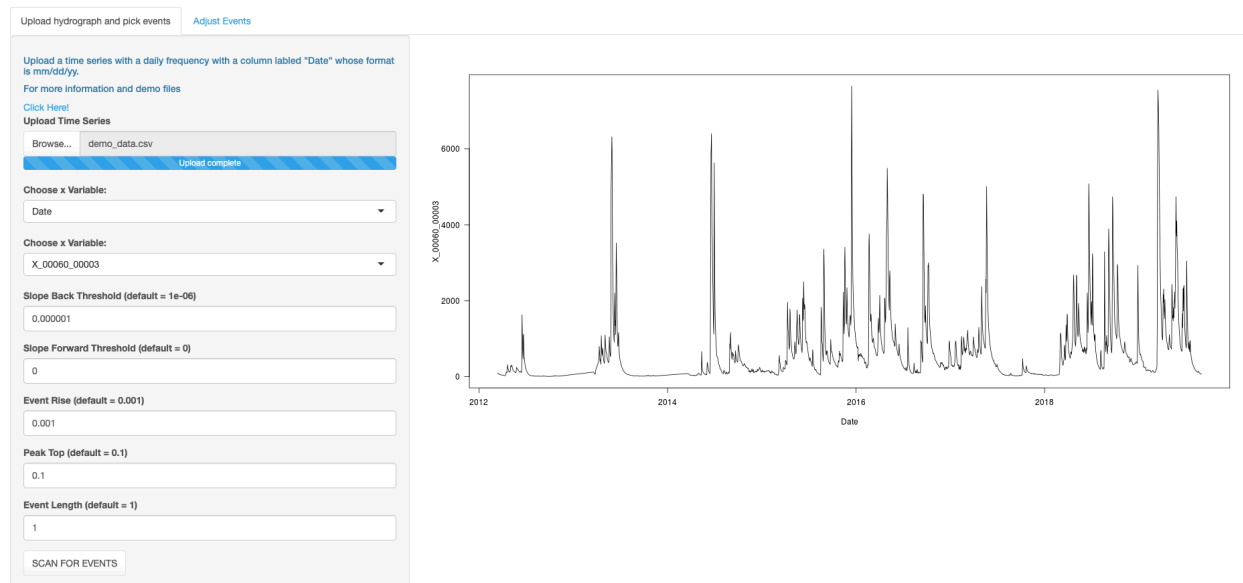
Scanning for events

2. On the left-hand side of the page are options for selecting which columns are plotted as well as some event scanning parameters. Events will only be identified correctly if the x variable is "Date" with the format "mm/dd/yy", the y variable can be any continuous variable.

3. The application works by running a general, sensitive peak picking algorithm through the time series to identify events. The algorithm allows for some user supplied values to make it more or less sensitive although default values are provided. The algorithm has the following steps (with user supplied values indicated by italics):

    i. For each observation in time, calculate the slope forward ($[y_{i+1}-y_i]/[t_{i+1}-t_i]$), and the slope backwards ($[y_i-y_{i-1}]/[t_i-t_{i-1}]$)

    ii. If the slope forward < *Slope Forward Threshold* AND the slope backward > *Slope Backward Threshold* the data point is identified as a peak

    iii. For each peak, the extent of the rising limb and falling limb of the event are extended until the slope backward ≤ 0 and the slope forward is ≥ 0 respectively

    iv. There are then 3 parameters which help to remove small events and can be adjusted to make the algorithm more or less sensitive

        1. *Event Rise* – the slope of the rising limb of the event
        2. *Peak Top* – the maximum observation during the event, normalized to the entire hydrograph
        3. *Event Length* – the number of observations within the event

4. Click the "SCAN FOR EVENTS" button with the default values and the events should be identified with blue circles as shown below
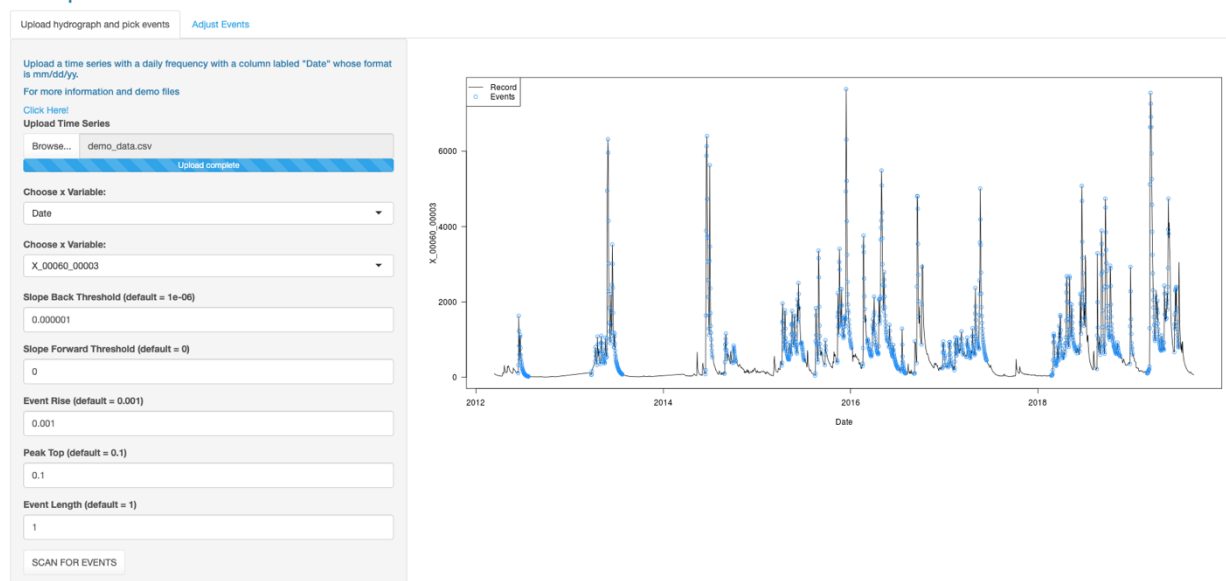
Adjusting events

5. Now in the "Adjust Events" tab, two plots are shown. The first is a complete hydrograph with all the identified peaks in blue and one selected peak shown in red, and the second plot is a zoom in of the selected peak in red.
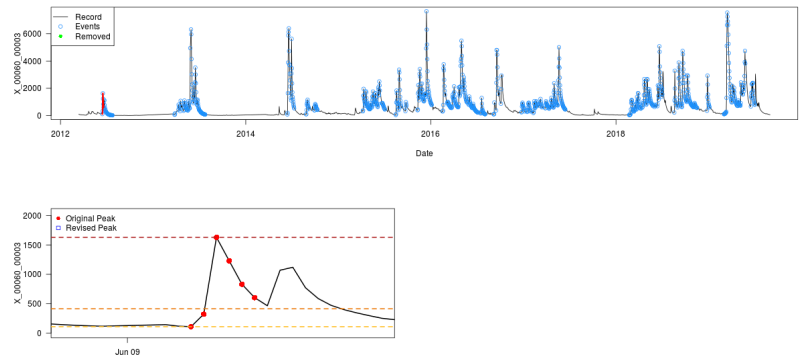
6. Using the "Event Number" ticker, the user can page through the identified events and adjust them with two tickers labeled "Adjust Event Beginning", and "Adjust Event End".

7. Page to event #3
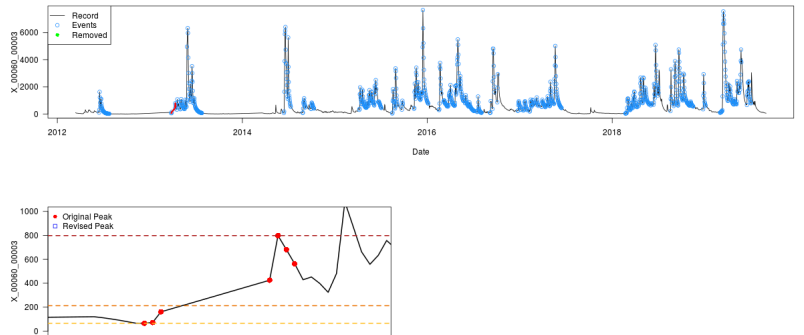
8. Now adjust the event to remove the first three days and include one more day at the end. Once you have made your adjustments, the new event will be shown with blue boxes.
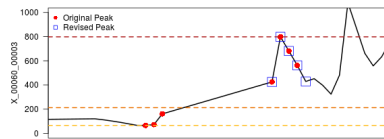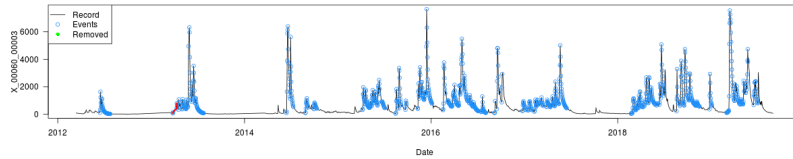
9. Now click "SAVE ADJUSTMENTS" and the event will be adjusted based on your selections. Be sure to reset the "Adjust Event Beginning" and "Adjust Event End" tickers back to zero for adjustment of the next event.
10. The horizontal, colored, dashed lines in the lower plot show the event peak, the lowest point of the event, and 80% of the difference between the peak and lowest point. These lines are meant as guides for user-defined event end points.
11. Any event can be removed by using the "REMOVE" button.
12. To increase the resolution of the hydrograph, choose from the "Select Range" dropdown menu.
13. Lastly, you can download the adjusted events with the download button. The events will be downloaded as an R object, each event is an element of a list. See ?list() in R for more details.