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RWater –A HUBZero Tool for K-12 Hydrology Education

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Water Hub
Platform for water education, research, data access, partnership and collaboration

HUBbub 2014, Indianapolis

NSF

Motivation

How can we enhance students' ability to analyze the '**cause-and-effect**' relations in hydrologic processes?

Relating classroom concepts with real observations

Interpreting real-time events from real locations

- Data extraction
  - Not emphasizing on data post-processing
- Visualization
  - Not concentrating on how to create a plot
- Interpretation
  - Focus on the *science* part

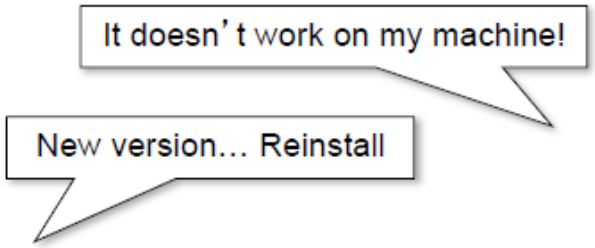
User-friendly tool-kit

Platform independent

Scalable

32-bit

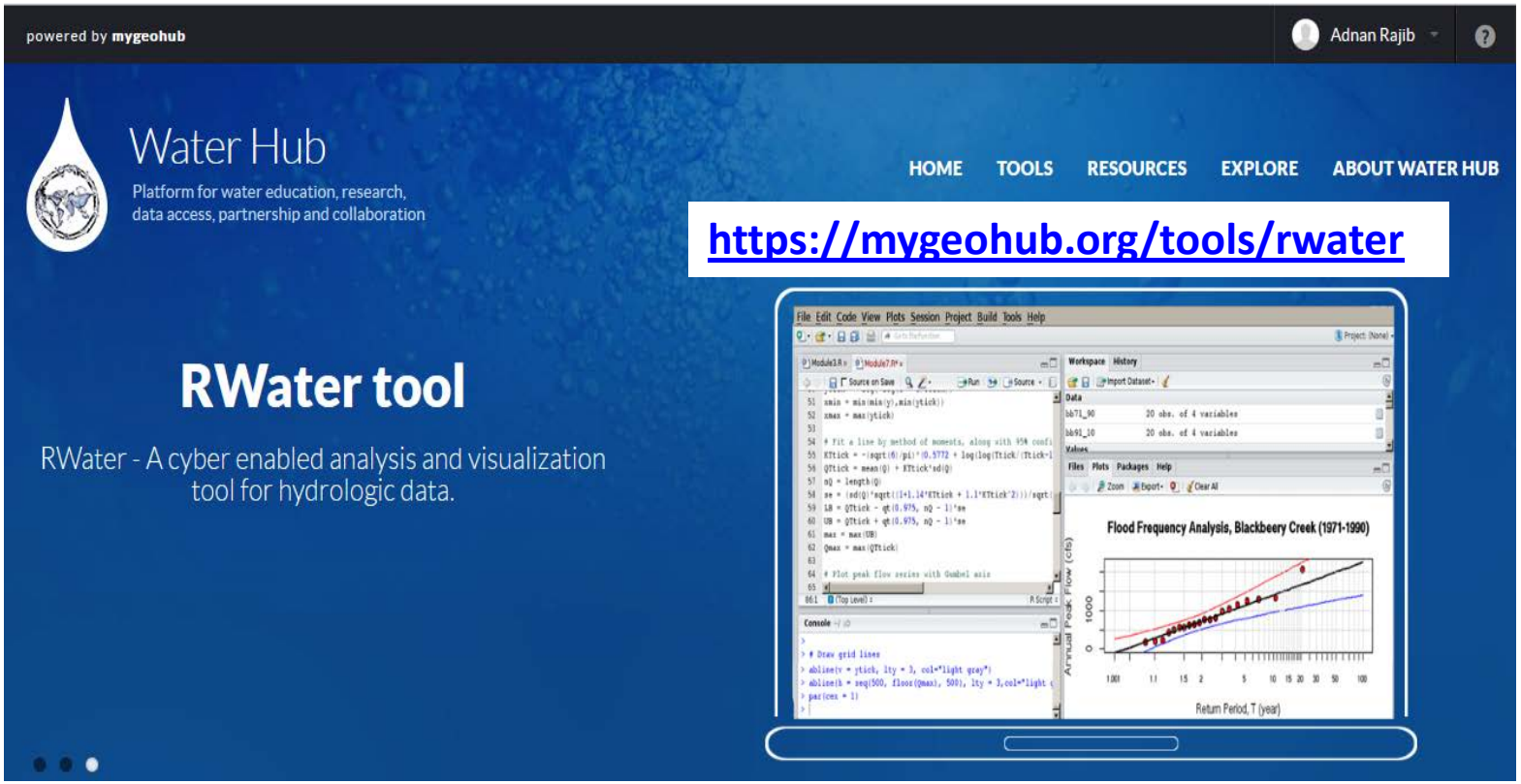
64-bit



RWater:
Design for Classroom Teaching

- It pulls streamflow data directly from the USGS website
  - Only required information: time period and location ID
  - Does not require any data post-processing
- Following the data-driven modules, students can write/modify R scripts to create visualizations
- Those visualizations allow users to understand the **cause and effect relationships** in hydrology
  - Making it interesting and practical
- Total 7 learning modules
  - Contain both hypothetical and real-time examples
  - Each module has a short quiz to evaluate students' learning

Introducing **RWater**



Runs in a self contained environment on Purdue's cyber-infrastructure (WaterHUB)

- Does not require any installation any software
- Does not store anything on user's computer
- All you need is a Java compatible browser

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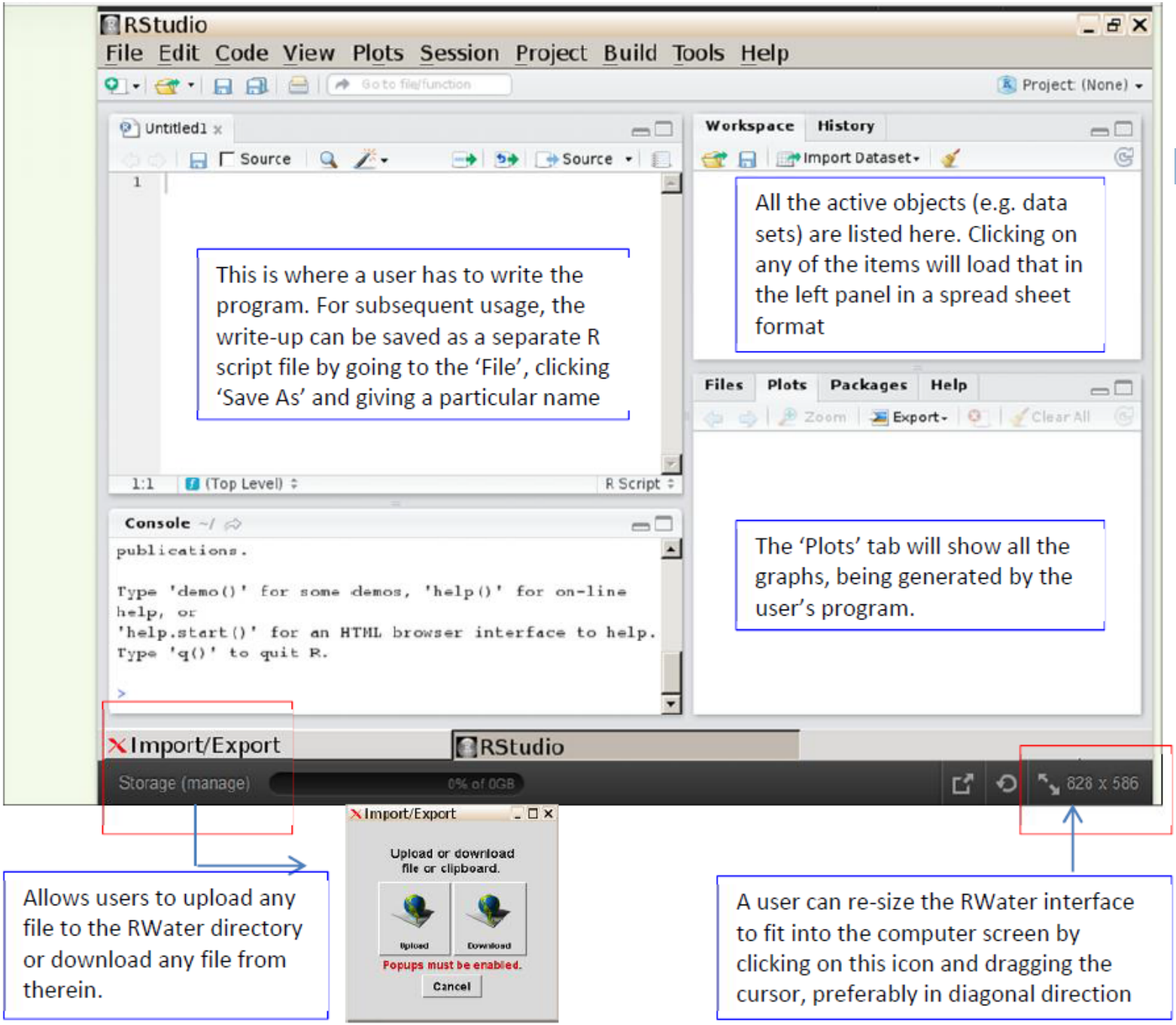
RWater Interface

https://mygeohub.org/tools/rwater



This is where a user has to write the program. For subsequent usage, the write-up can be saved as a separate R script file by going to the 'File', clicking 'Save As' and giving a particular name

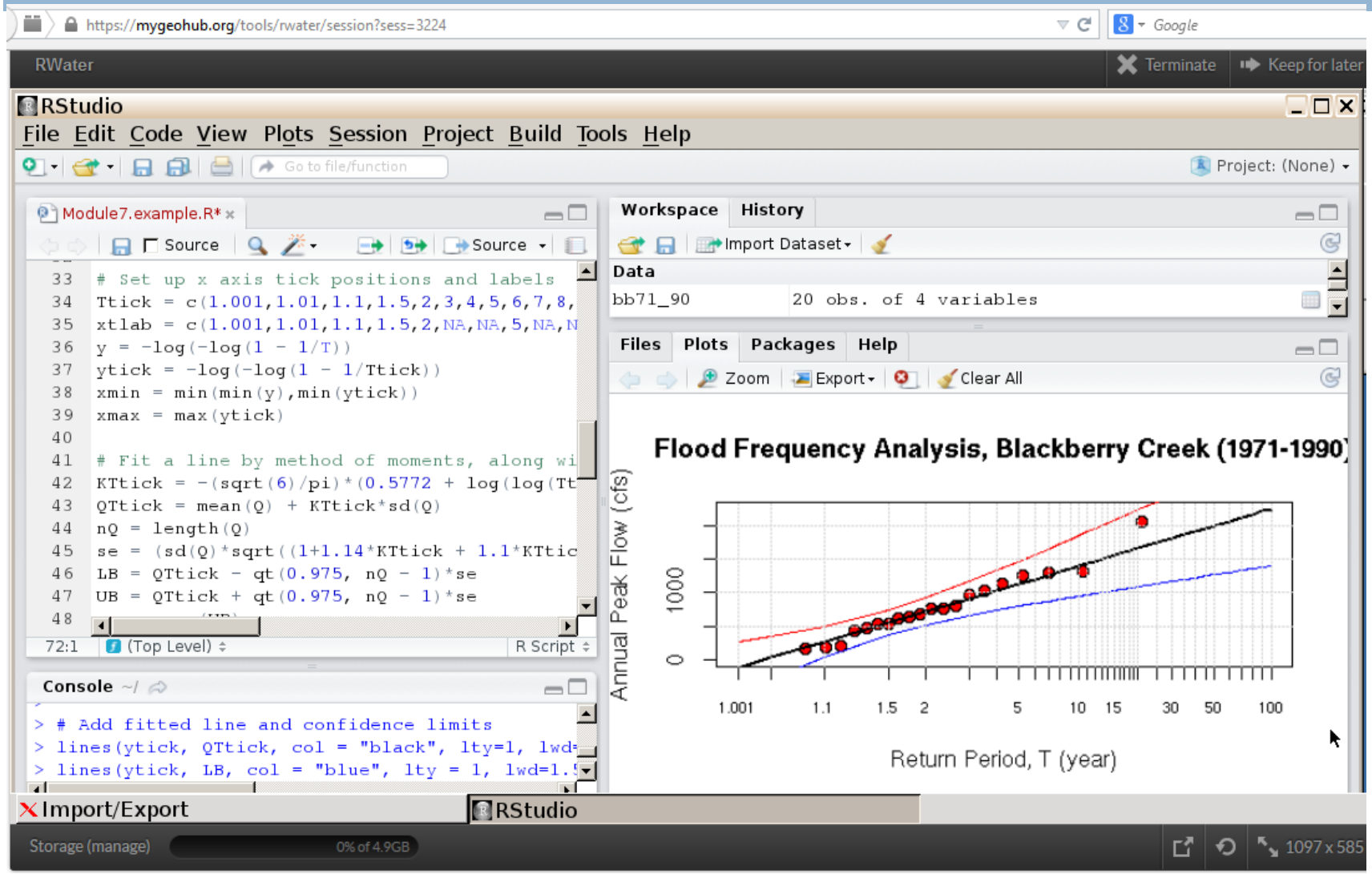
All the active objects (e.g. data sets) are listed here. Clicking on any of the items will load that in the left panel in a spread sheet format

The 'Plots' tab will show all the graphs, being generated by the user's program.

Allows users to upload any file to the RWater directory or download any file from therein.

A user can re-size the RWater interface to fit into the computer screen by clicking on this icon and dragging the cursor, preferably in diagonal direction

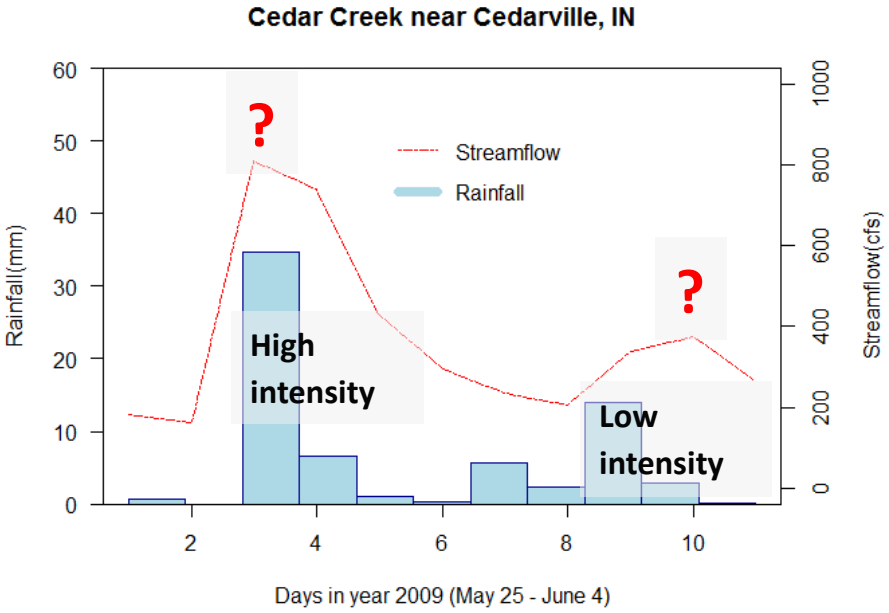
Sample Rwater Project

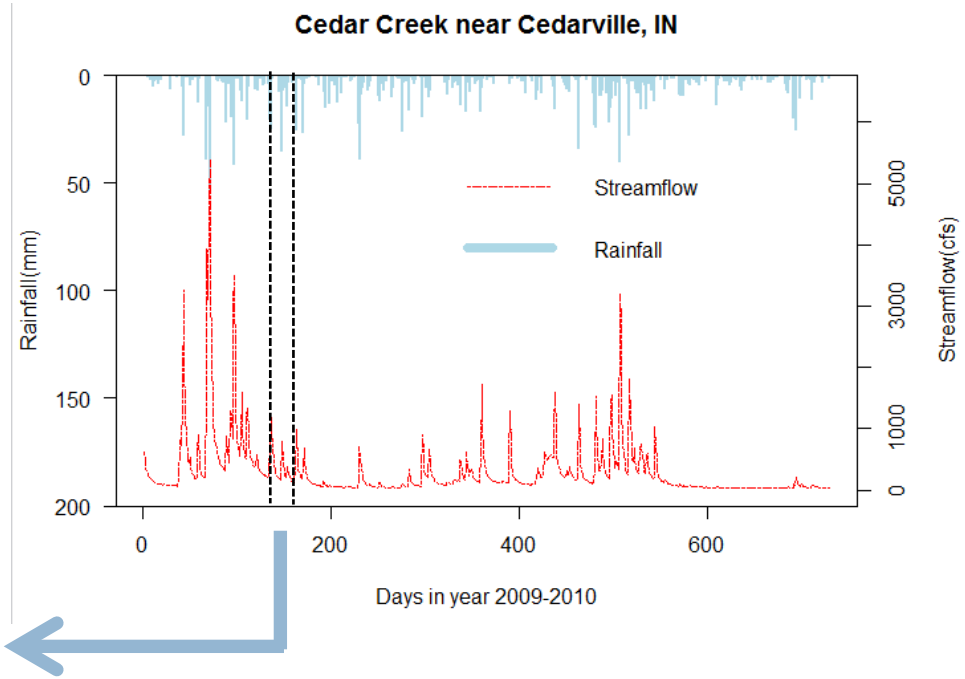


Science from RWater

Understanding Rainfall-Streamflow Relationship

Example for Cedar Creek, IN





RWater Example

Real-time data for Cedar Creek, IN

Science from RWater

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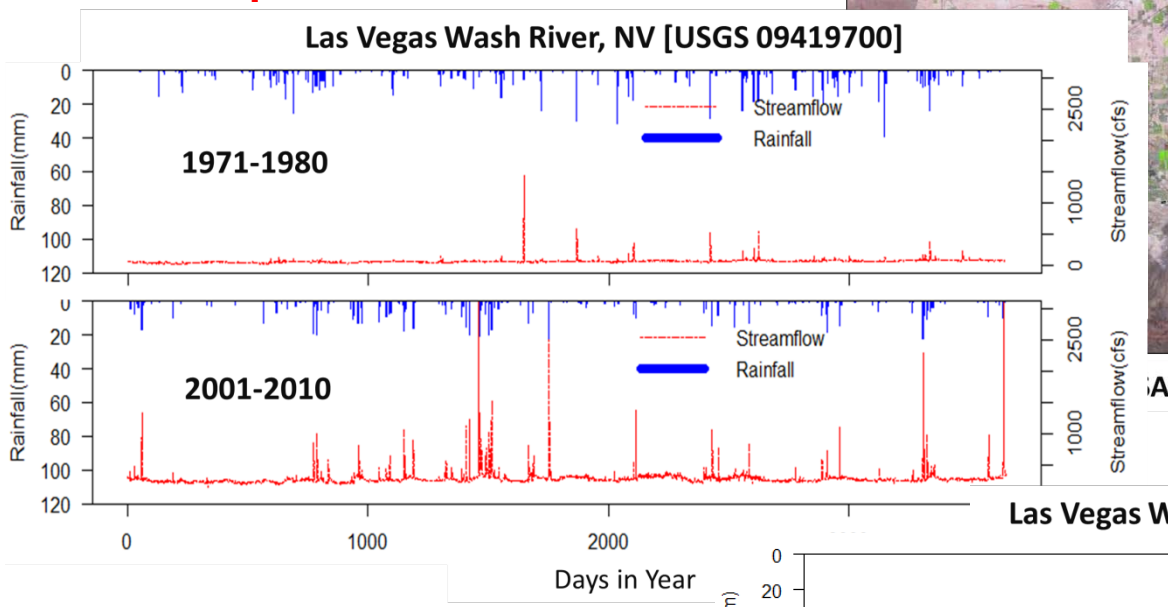
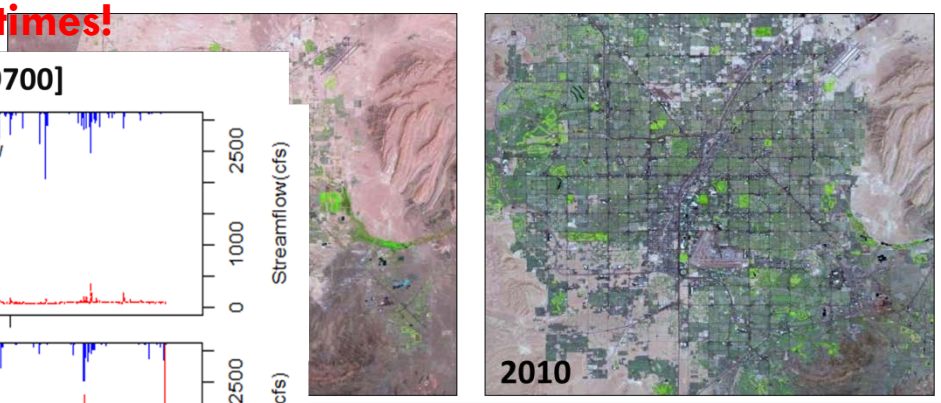
Streamflow Response with Landuse Change

Example for Las Vegas, NV

https://earthengine.google.org/#intro/LasVegas

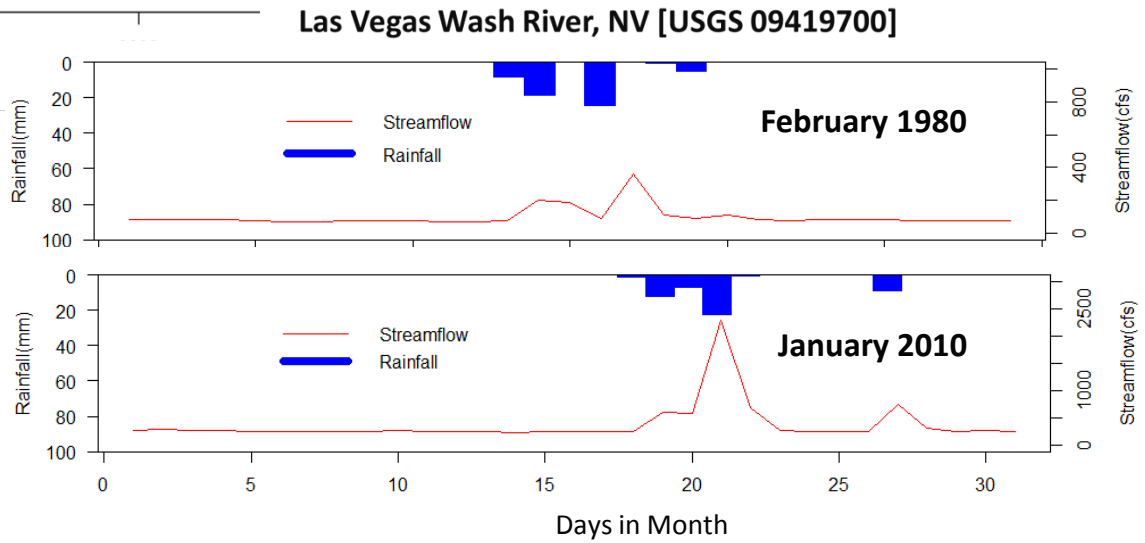
More frequent extreme event in recent times!





A Landsat Image for Las Vegas

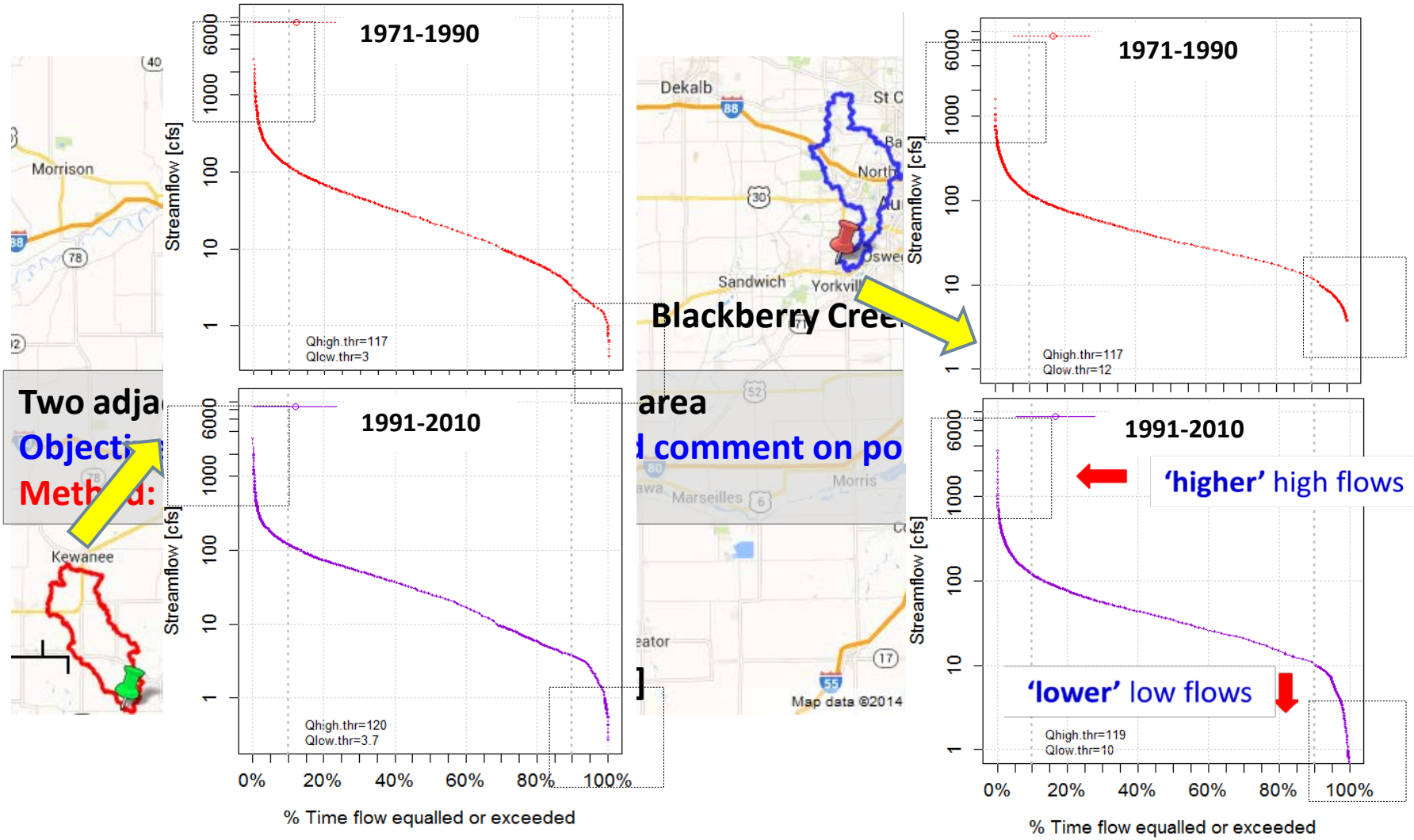
Higher Peak Discharge and shorter Lag Time!



Science from RWater

Trending Urbanization by Flow Duration Curve

Example for Chicago area



Student-Teacher Evaluation

- **Summer Residential Program,**

  College of Education, Purdue University

  29 June – 12 July, 2014

  Total 7 High School Students (9-12 Grade)

- **RWater Teacher's Workshop,**

  Lyles School of Civil Engineering, Purdue University

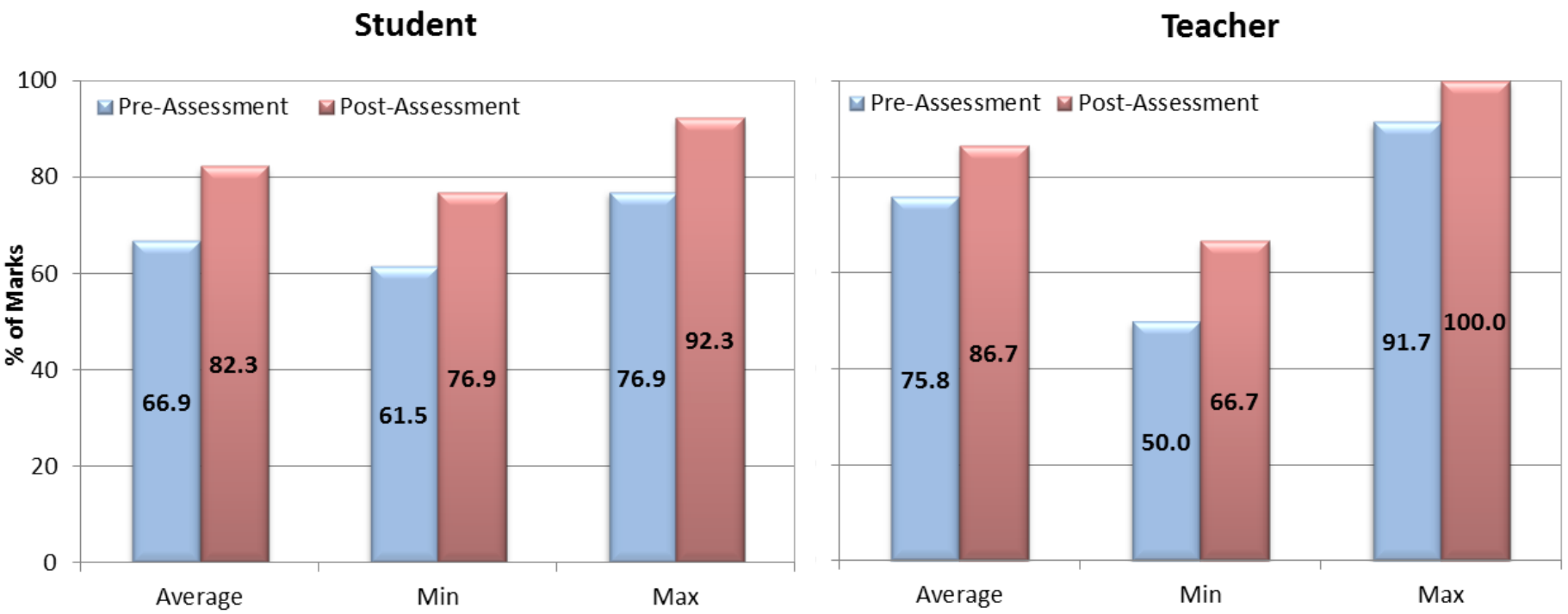
  17 – 18 July, 2014

  Total 20 Middle and High School Teachers

Student-Teacher Evaluation

Survey Results

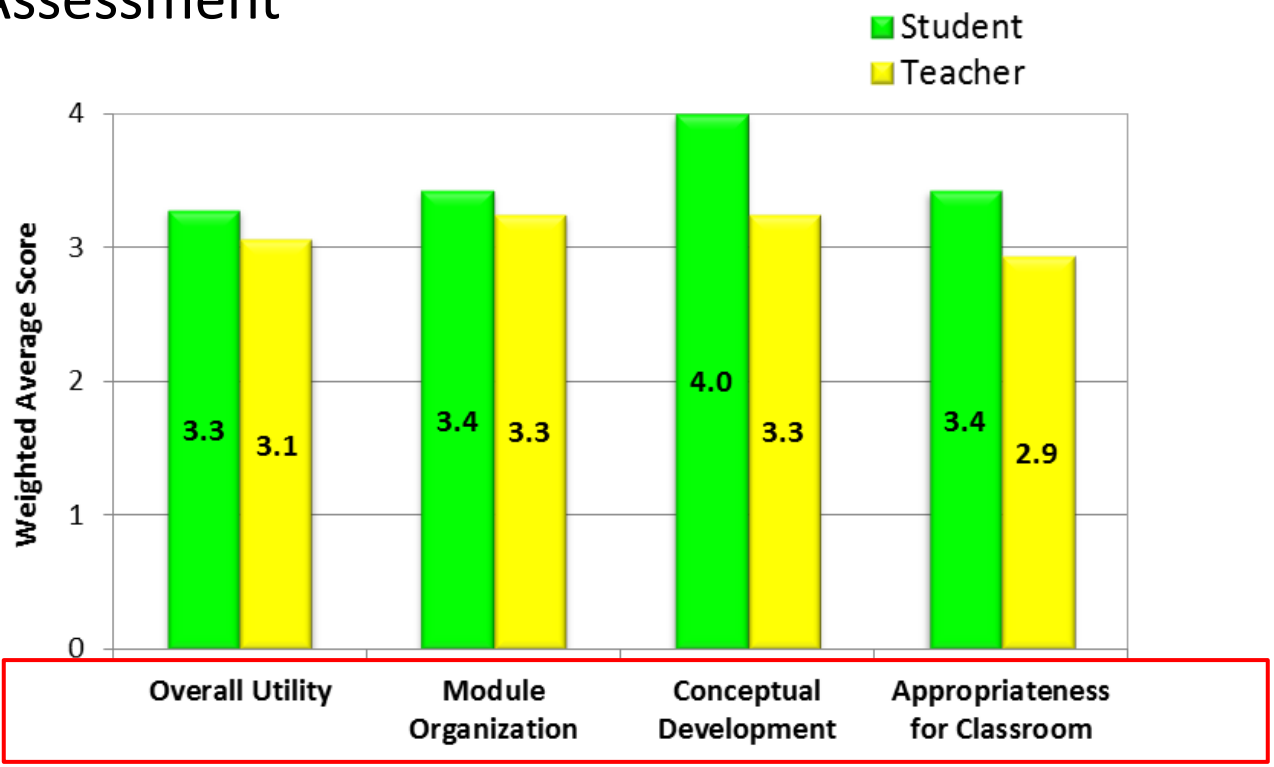
- Testing the improvement in users' hydrologic understanding
- Pre/Post Assessment



Student-Teacher Evaluation

Survey Results

- User opinion on RWater's Utility
- Post Assessment



Evaluation Criteria

Response	Strongly Agree	Agree	Disagree	Strongly Disagree	Undecided
Score	4	3	2	1	0

Future Work

- Addition of a conceptual rainfall-runoff model with opportunities of high performance calibration
    - Making RWater a comprehensive modeling and analysis tool
- Testing RWater for upper undergraduate/graduate class
    - Making RWater applicable from K-12 to the graduate level
- Creating a database with RWater class projects from participating schools/universities all over United States.
    - This will record hydrologic assessments over the real locations across the country, being done by the students.

Tool link: https://mygeohub.org/tools/rwater

Modules: https://web.ics.purdue.edu/~vmerwade/rwater

Thank You!

Questions ?

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