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RWater –A Cyber-enabled Data-driven Tool for Enhancing Hydrology Education

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Motivation

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

Bridging the gap in idealized classroom hydrology education

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

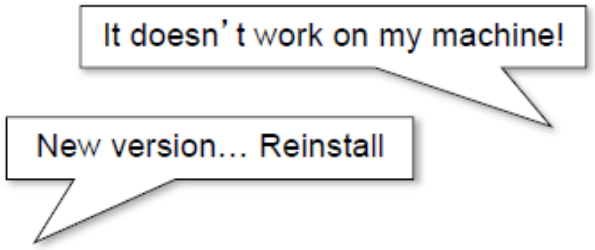
User-friendly tool-kit

Platform independent

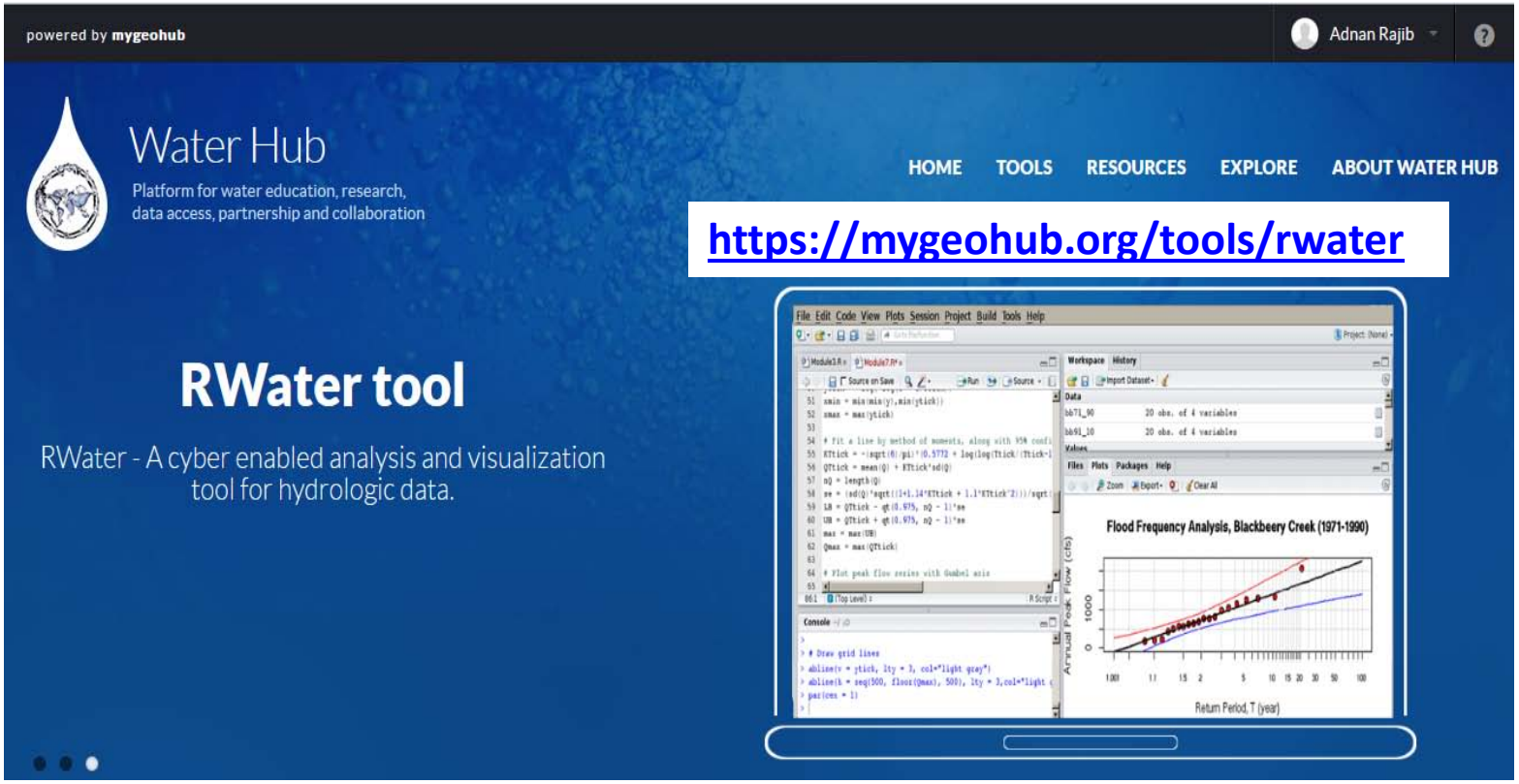
Scalable

32-bit

64-bit



Introducing **RWater**



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

- Does not require any installation of RWater software
- Does not store anything in user's computer
- All you need is a browser

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** in real world rivers
  - Making it interesting and practical
- Total 7 learning modules
  - Contained both hypothetical and real-time examples
  - Each module has a short quiz, that helps testing the lessons learnt

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RWater Interface and Online Modules

https://mygeohub.org/tools/rwater

Science from RWater

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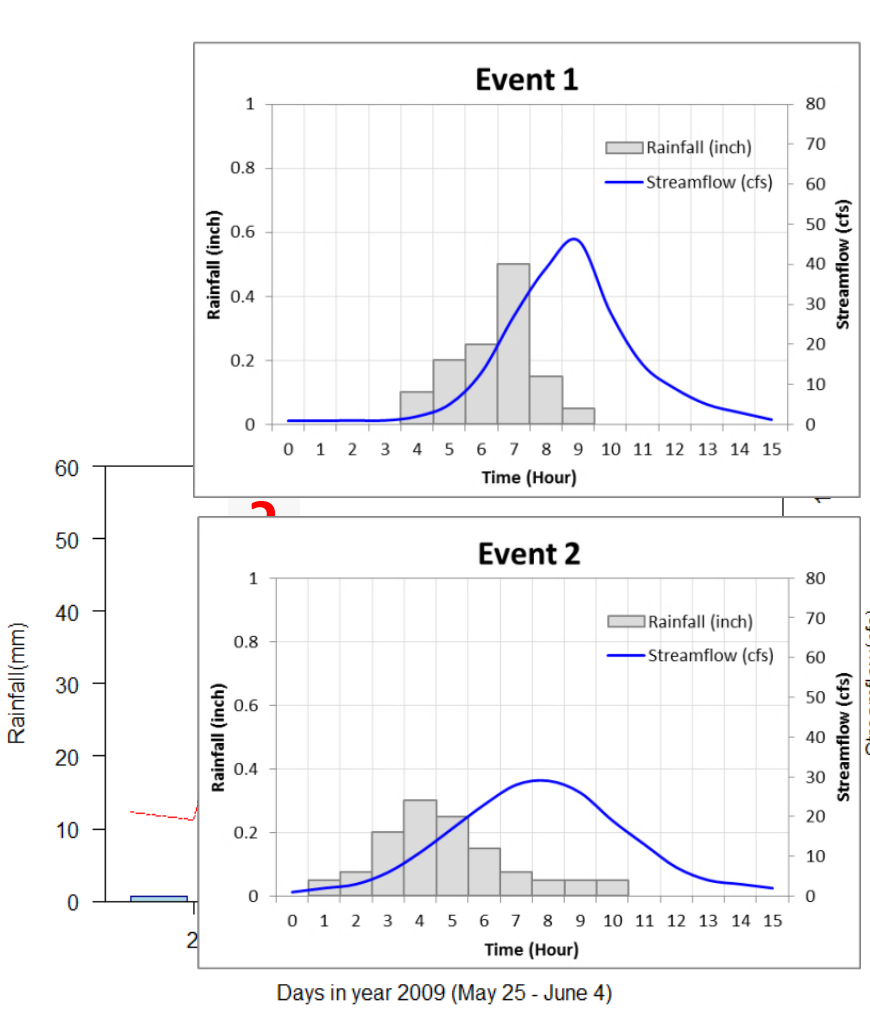
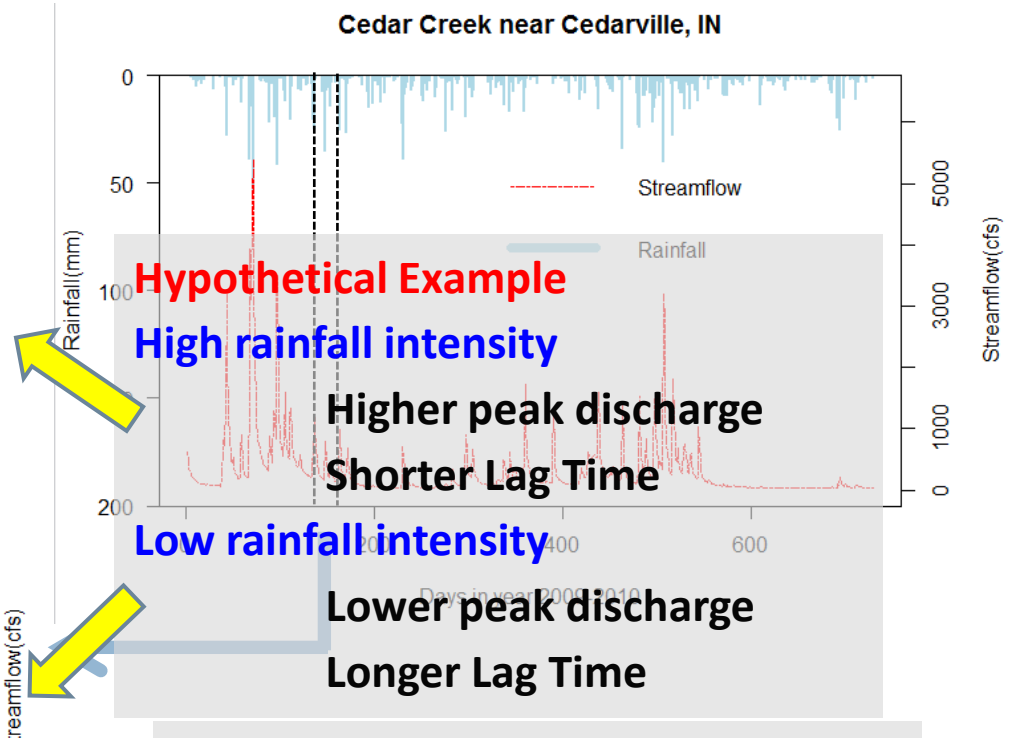
Understanding Rainfall-Streamflow Relationship

Example for Cedar Creek, IN





Hypothetical Example

High rainfall intensity

Higher peak discharge

Shorter Lag Time

Low rainfall intensity

Lower peak discharge

Longer Lag Time

RWater Example

Real-time data for Cedar Creek, IN

Science from RWater

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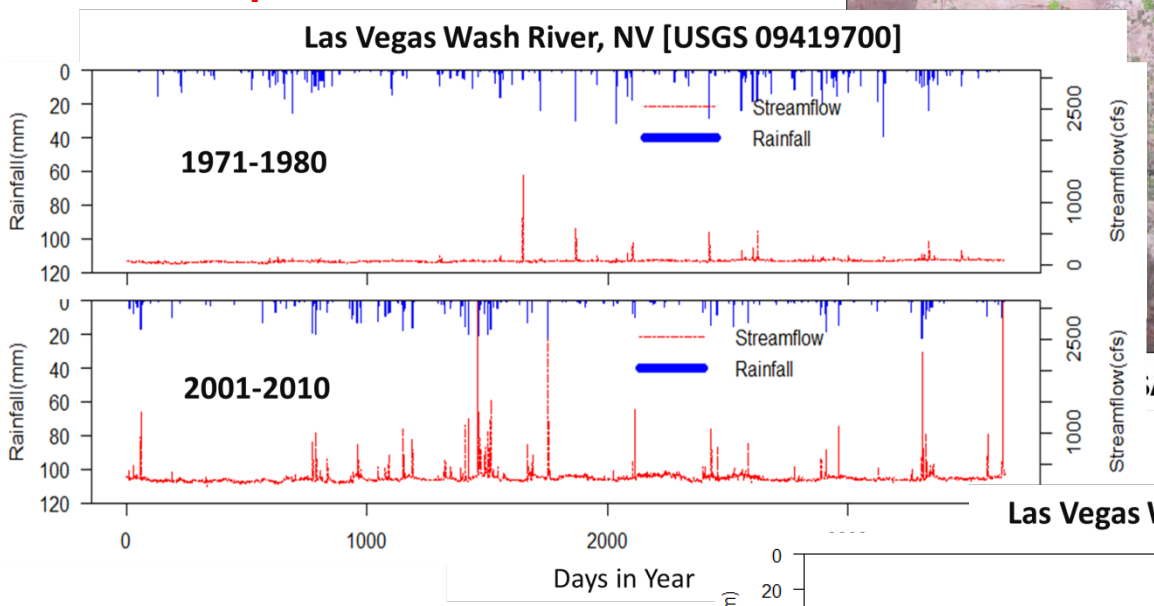
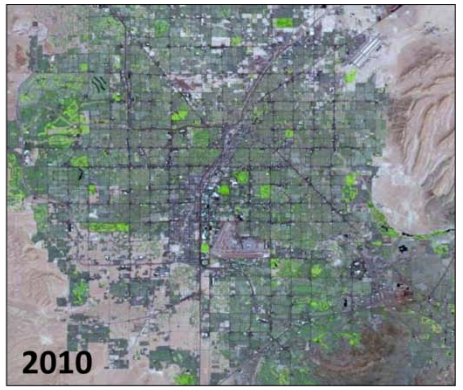
Streamflow Response with Landuse Change

Example for Las Vegas, NV

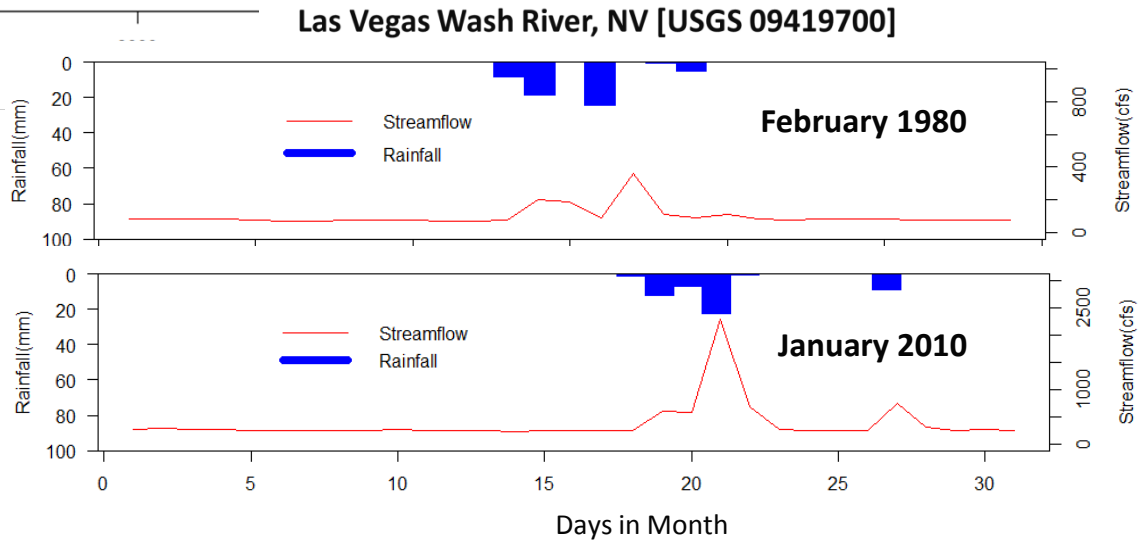
More frequent extreme event in recent times!





SA Landsat Image for Las Vegas

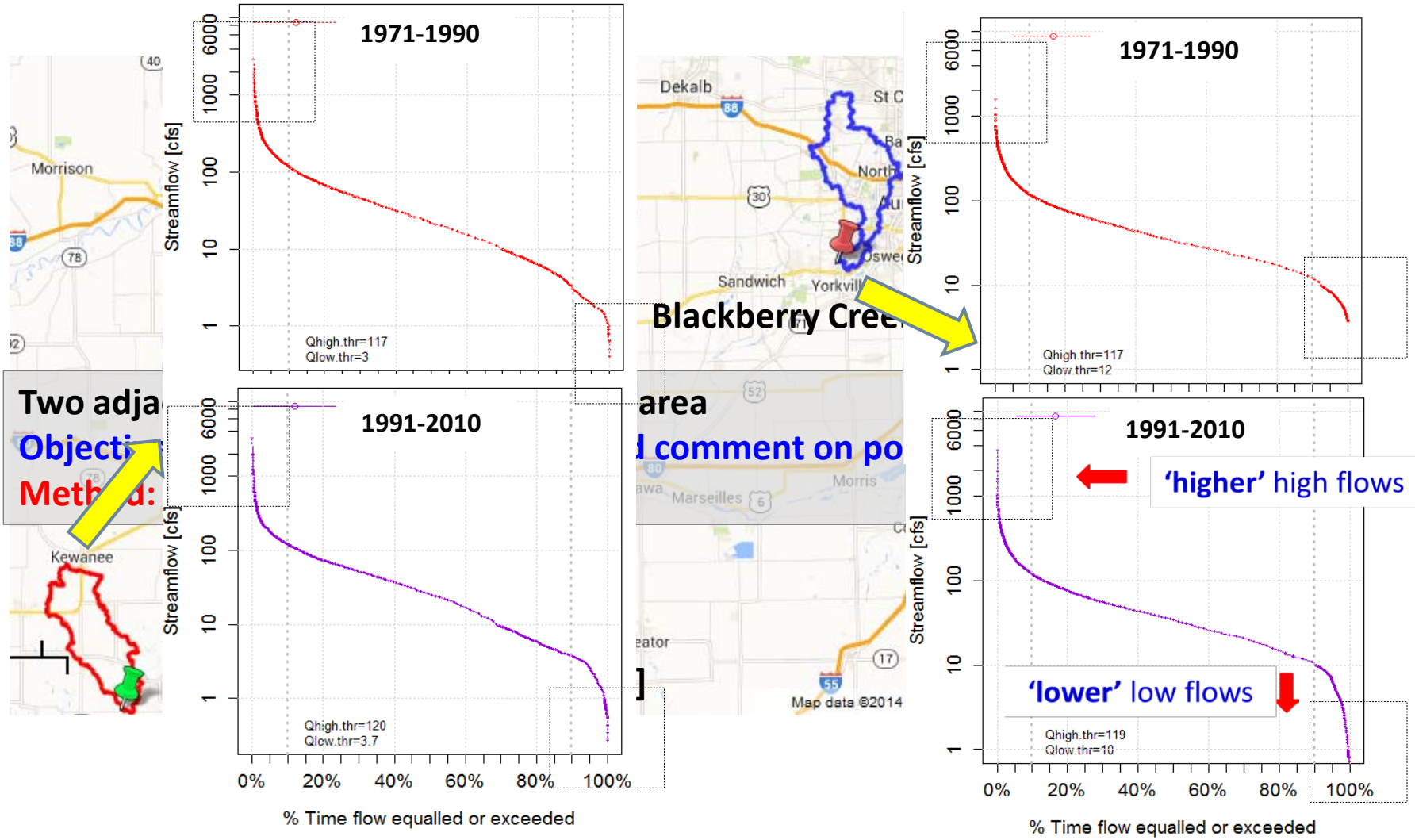
Higher Peak Discharge and shorter Lag Time!



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

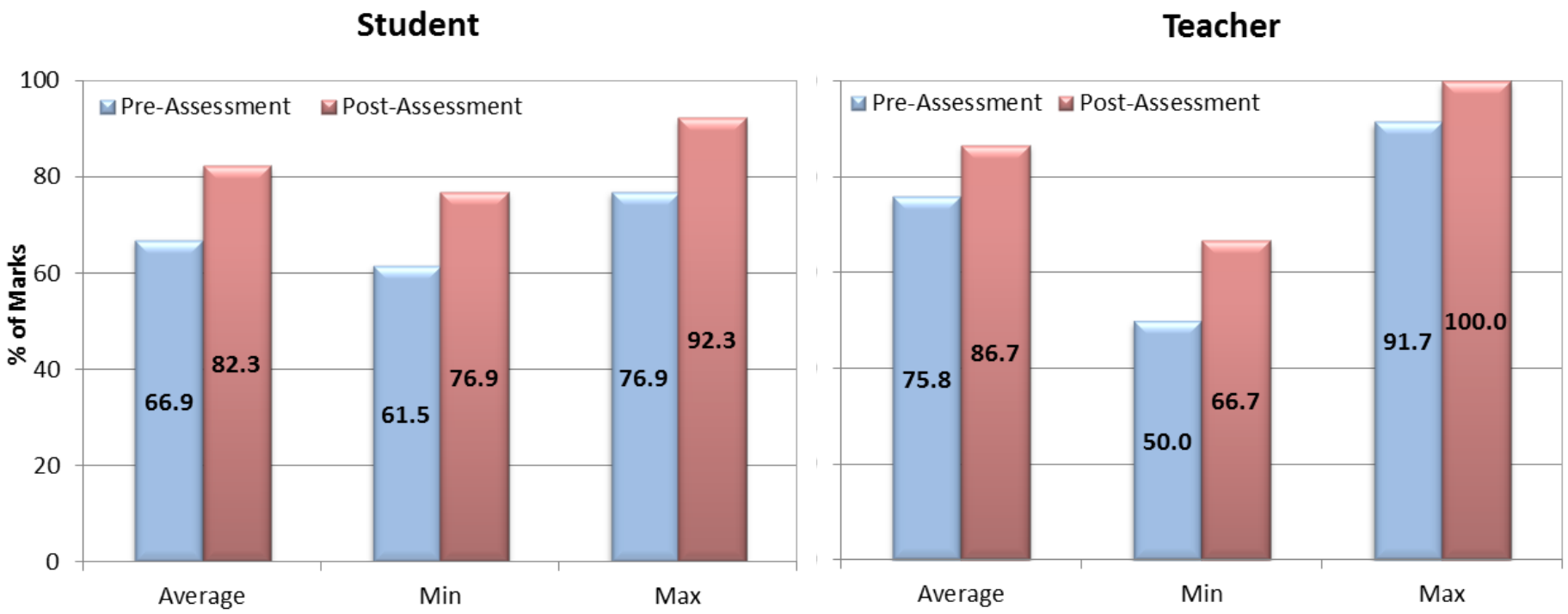
  17 – 18 July, 2014

  Total 20 Middle and High School Teachers

Student-Teacher Evaluation

Survey Results

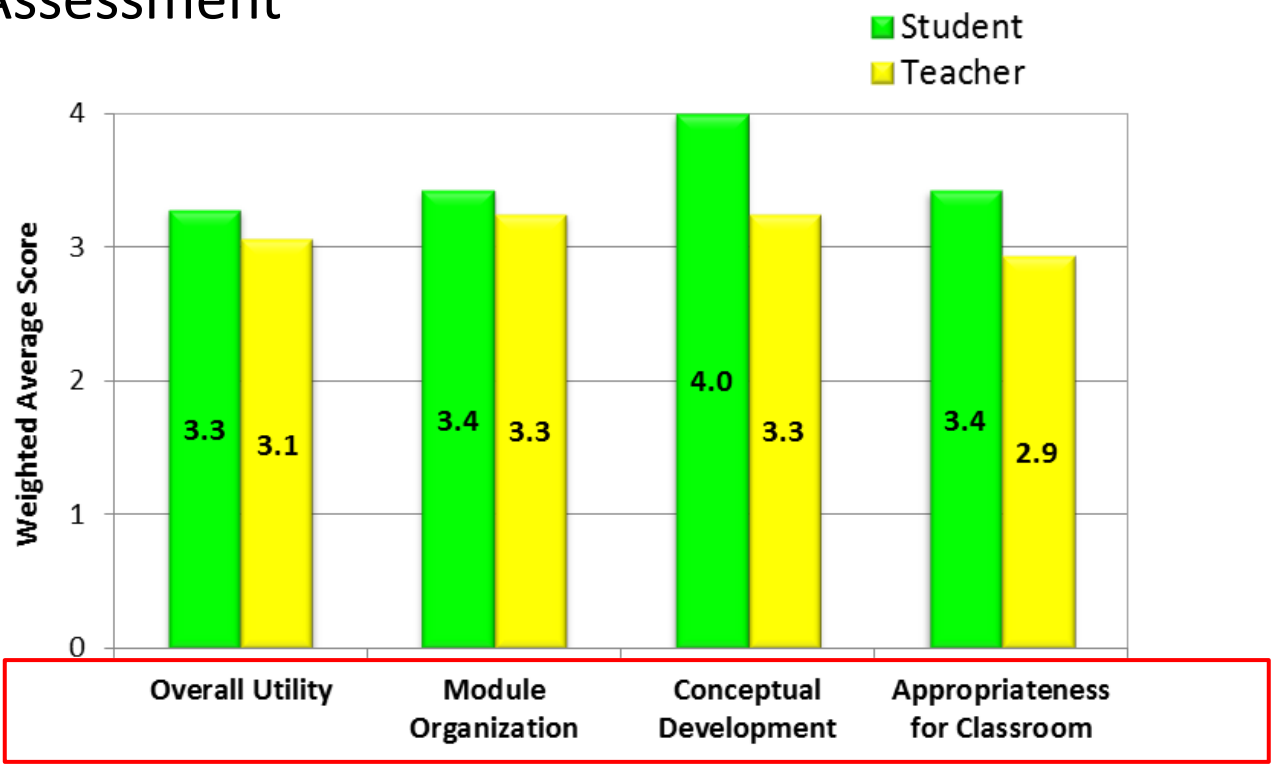
- Testing the improvement in users' hydrologic perception
- Pre/Post Assessment



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.

Thank You!

Questions ?

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