Designing and Teaching Courses with Group Projects and Labs:
Accessing and Analyzing Hydrometric Engineering Data Online

October 17, 2021

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Overview

Summary
Context
Learning Goals
The Activity
Conclusion

https://serc.carleton.edu/teaching_computation/workshop_2021/activities/245728.html

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Summary of the Lab Activity
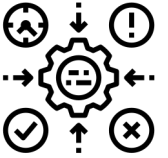

Water Level
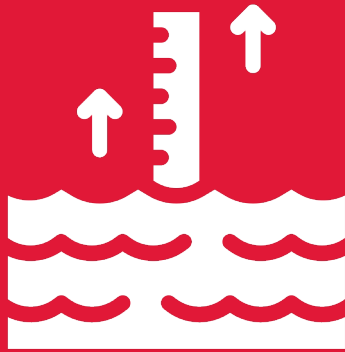
Access Water Monitoring Stations
- By telephone
- By Internet

Important Topics
- Strings
- Reading (CSV) data files
- NaN anomalies
- Figures
- Loops

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Context for Use

GENERAL

> First Year Students in 4 year engineering degree
> Fall: procedural → Winter: OO (Java)
> All Engineering disciplines
> Lab launched pre-COVID
> Course focus on mechatronics (sensors, Arduinos)

COVID19

> Fully online
> Pandemic crisis teaching
> Proficiency-based grading:
>> Do the work, get a B+ (80%)
>> Blog: https://bit.ly/3BvGban / https://tinyurl.com/4d37vf46
>> Paper: https://bit.ly/2WXjM6X / https://tinyurl.com/3fmn9a26

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Learning Goals: Computing Skills & Procedural Constructs

CLO 1: **Use a set of soft computing skills such as reasoning about algorithms, tracing programs, and test-driven development for programming applications** (*GAI: Demonstrate skills in computer programming, data analysis and graphical visualization*)

1. Does not demonstrate skills in computer programming, data analysis and graphical visualization
2. Demonstrates marginal skills in computer programming, data analysis or graphical visualization
3. **Demonstrates competency in computer programming, data analysis and graphical visualization**
4. Demonstrates superior skills in computer programming, data analysis and graphical visualization

CLO 2: **Explain and apply the fundamental constructs in procedural programming, including variables and expressions, control structures (conditionals/loops), and documentation** (GAI: Demonstrate skills in computer programming, data analysis and graphical visualization)

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Open Data: Accessible & Relevant

DIFFICULTIES WITH ONLINE DATA & ACCESSIBILITY

> High threshold for access
>> Complex encoding
>> Passwords, accounts, API keys

PERSONAL RELEVANCE

> Multiple geographic locations (Province & Canada-wide)
> Related to Civil & Mechanical Engineering
> Could be expanded internationally

SOCIAL RELEVANCE

> Inclusion of multiple geographic locations
> Explicit inclusion of northern / rural communities
> Explicit inclusion of indigenous communities
>> Water resource management is a long-standing issue

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The Activity

Part 1: Phone the Sensor

NON-COMPUTER EXPERIENCE
- Automated voice message
- Current water depth conditions
- No computer required

Part 1: Phone the Water Level Sensor

Use your phone to obtain water level at a variety of locations around Canada using the the Canadian Hydrographic service and the waterlevels.gc.ca "Bulletin" site (https://waterlevels.gc.ca/eng/info/bulletin):

1. Section 1: Water level @ St. Lawrence River, <u>above</u> the lock at Iroquois:
   a. (613) 652-4426
2. Section 2: Water level @ St. Lawrence River, <u>below</u> the lock at Iroquois:
   a. (613) 652-4839
3. Section 3: Water level @ Lake Huron at Tobermory
   a. (519) 596-2085
4. Section 4: Water level @ Lake Ontario at Port Weller
   a. (905) 646-9568

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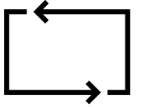
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Part 2: Webread a CSV file

WEBREAD TO OBTAIN DATA FROM THE WEB

> Students use Matlab's webread() function
> No passwords or user names required
> Simple CSV file download
> Four different data sets per lab section
> Six variations based on geography
>> Hundreds of locations possible
>> Water depth -- but flow possible, too.
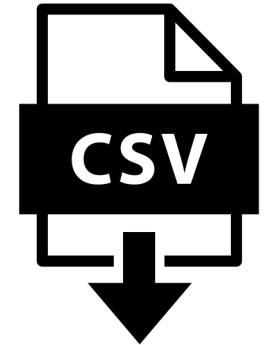
Section	Station 1	Station 2	Station 3	Station 4
1 & 2	"DON RIVER AT TODMORDEN" (02HC024)	"BLACK CREEK NEAR WESTON" (02HC027)	"ATTAWAPISKAT RIVER BELOW ATTAWAPISKAT LAKE" (04FB001)	"ATTAWAPISKAT RIVER BELOW MUKETEI RIVER" (04FC001)
3 & 4	"HUMBER RIVER AT ELDER MILLS" (02HC025)	"DON RIVER AT TODMORDEN" (02HC024)	"ATTAWAPISKAT RIVER BELOW ATTAWAPISKAT LAKE" (04FB001)	"ATTAWAPISKAT RIVER ABOVE LAWASHI CHANNEL" (04FC002)

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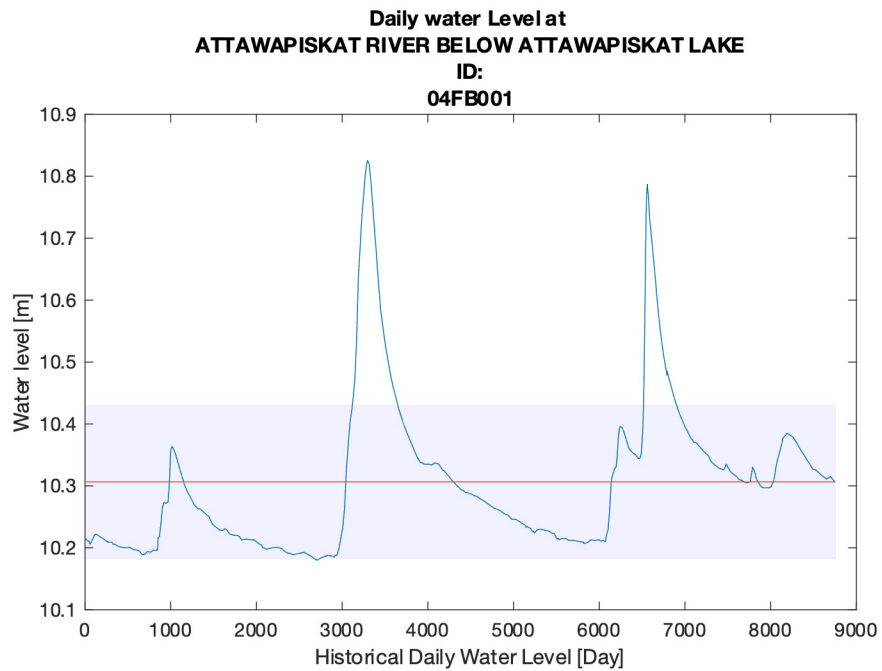
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Part 2: Webread a CSV file

1. Make a list of the stations that you need to look at.
2. Enter the loop

3. Get the data for one station
4. Extract the depth data
5. Process the depth data (remove NaN, find average, find std deviation)
6. Create plot (either new figure or use subplot())
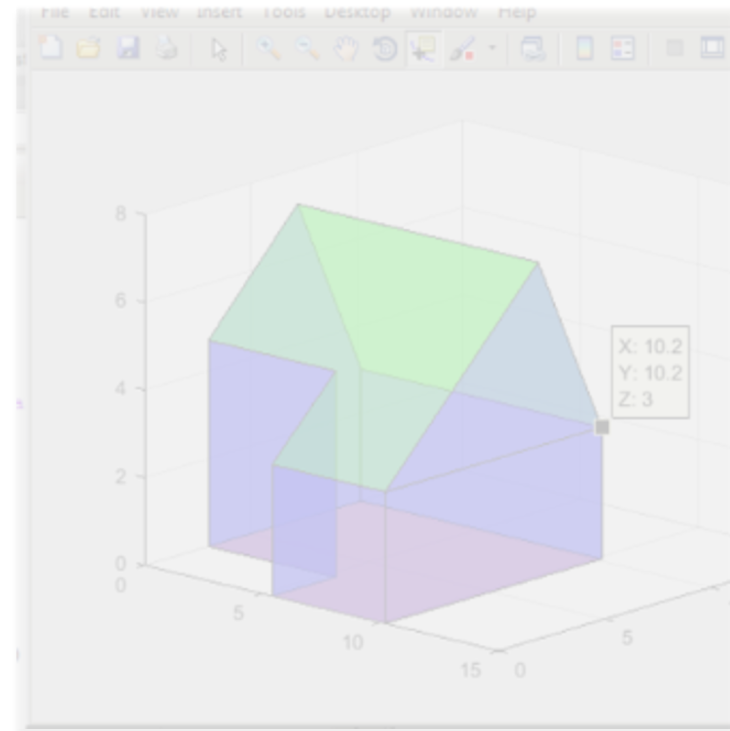7. Unless you've done all four graphs, go to step 3.

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Graphing

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Graphing

AVERAGE & STANDARD DEVIATIONS WITH TRANSPARENCY

Daily water Level at
ATTAWAPISKAT RIVER BELOW ATTAWAPISKAT LAKE
ID:
04FB001
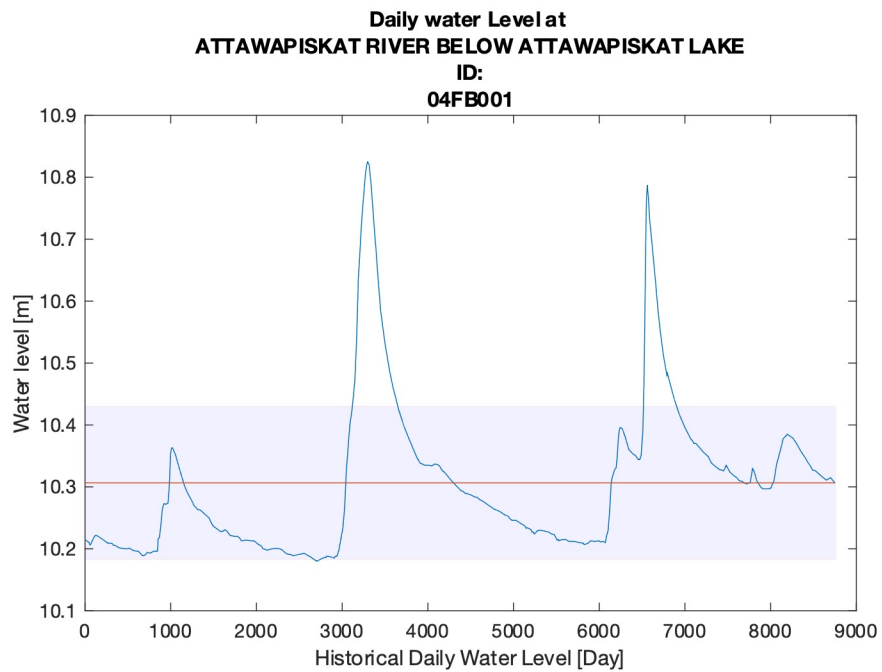
EARLIER LAB: TRANSPARENCY & PATCH

https://youtu.be/BVnnPGoF1Iw

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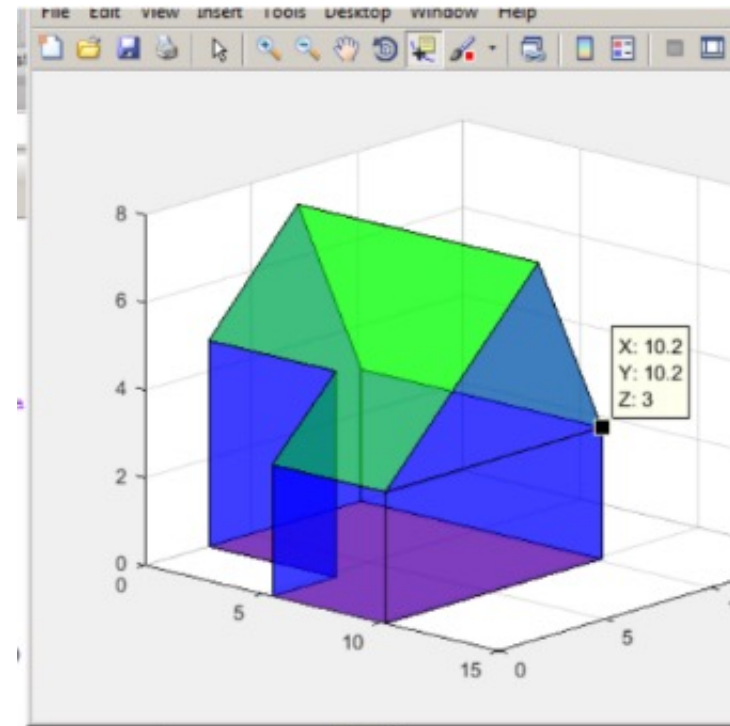
> The fact that the material was ... interesting and **relevant to Mechanical Engineering;** a program that I am working to get in. I could definitely see how the material was useful and important to me.

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Conclusion

- First year procedural programming
  - Little previous experience
  - Working from home
- Open and accessible data sets
  - Social and personal relevance
  - Civil & Mechanical Engineering in mind
- Proficiency grading during COVID

EECS 1011 Grade Distribution

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