Assignment 1: Introduction

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OVERVIEW

This exercise accompanies the lessons in Water Data Analytics on introductory material.

Directions

1. Change "Student Name" on line 3 (above) with your name.
2. Work through the steps, **creating code and output** that fulfill each instruction.
3. Be sure to **answer the questions** in this assignment document (marked with >).
4. When you have completed the assignment, **Knit** the text and code into a single PDF file.
5. After completing your assignment, fill out the assignment completion survey in Sakai.

Having trouble? See the assignment's answer key if you need a hint. Please try to complete the assignment without the key as much as possible - this is where the learning happens!

Target due date: 2022-01-18

Course Setup

1. Post the link to your forked GitHub repository below. Your repo should include one or more commits and an edited README file.

   Link: https://github.com/lydiecos/Water_Data_Analytics_2022

Data Visualization Exercises

2. Set up your work session. Check your working directory, load packages `tidyverse`, `dataRetrieval`, and `zoo`. Set your ggplot theme as theme_classic (you may need to look up how to set your theme).

```
# Check working directory
getwd()
```

```
## [1] "/Users/lydiecostes/Documents/Duke/WaterDataAnalytics/Water_Data_Analytics_2022/Assignments"
```

```
# Load packages
library(tidyverse)
library(dataRetrieval)
library(zoo)

# Set ggplot theme
theme_set(theme_classic())
```

3. Upload discharge data for the Eno River at site 02096500 for the same dates as we studied in class (2012-01-01 through 2021-12-31). Obtain data for discharge. Rename the columns with informative titles, as we did in class.

```
# Import data
EnoDischarge <- readNWISdv(siteNumbers = "02096500",
                     parameterCd = "00060", # discharge (ft3/s)
                     startDate = "2012-01-01",
                     endDate = "2021-12-31")

# Rename columns
names(EnoDischarge)[4:5] <- c("Discharge_cfs", "Approval_Code")
```

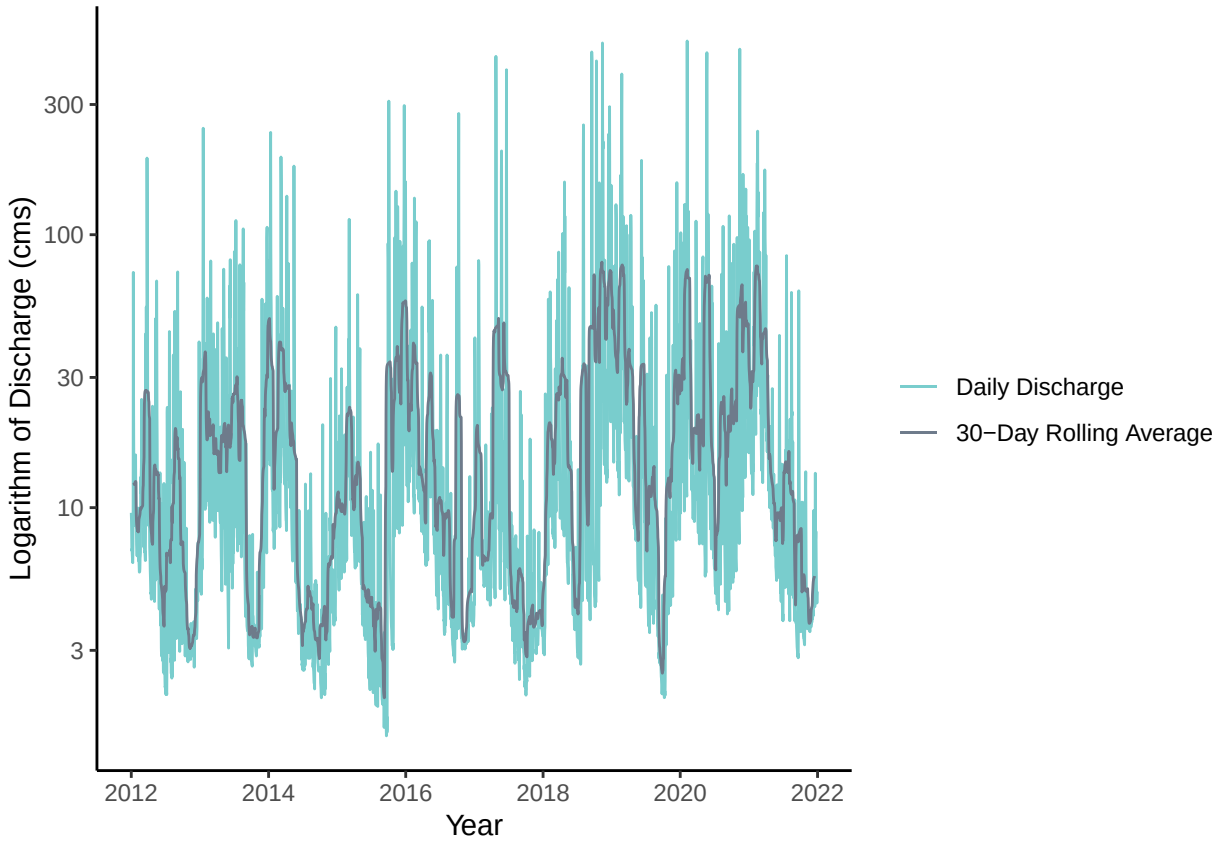
4. Build a plot called EnoPlot2. Use the base plot we made in class and make the following changes:

- Add a column to your data frame for discharge in meters cubed per second. hint: package dplyr in tidyverse includes a `mutate` function
- Add a column in your data frame for a 30-day rolling mean of the metric discharge. (hint: package dplyr in tidyverse includes a `mutate` function. hint: package zoo includes a `rollmean` function)
- Create two geom_line aesthetics, one for daily discharge (meters cubed per second) and one for rolling mean of discharge. Color these differently.
- Update your ggplot theme. I suggest "classic." (hint: https://ggplot2.tidyverse.org/reference/ggtheme.html)
- Update axis names
- Change the y axis from a linear to a log10 axis (hint: google "ggplot logged axis")
- Add a legend. (hint: Google "add legend two geom layers ggplot")

```
EnoDischarge <- EnoDischarge %>%
  mutate(Discharge_cms = Discharge_cfs*0.028316847) %>%
  mutate(Dis_30d_cms = rollmean(Discharge_cms, 30, fill = NA))

EnoPlot2 <-
  ggplot(EnoDischarge, aes(x = Date)) +
         geom_line(aes(y = Discharge_cms, color = 'Daily Discharge')) +
         geom_line(aes(y = Dis_30d_cms, color = '30-Day Rolling Average')) +
         xlab("Year") +
         theme_classic() +
         scale_y_continuous(trans='log10') +
         labs(y = "Logarithm of Discharge (cms)") +
         scale_color_manual(name = "", values = c('Daily Discharge' = 'darkslategray3', '30-Day Rolling
EnoPlot2
```

```
## Warning: Removed 29 row(s) containing missing values (geom_path).
```



5. In what ways was the second plot a more effective visualization than the first?

   ANSWER: It shows lows as well as highs, and the rolling average allows for more easily visualizing broad patterns over time.

6. What portions of the coding were challenging for you?

   ANSWER: I always get confused by the aesthetic of the plot, what should go in that parentheses versus not, and I find the legend building process unnecessarily complicated! I've done these steps before but appreciate the practice.

7. Interpret the graph you made. What are the things you notice about within- and across-year variability, as well as the differences between daily values and 30-day rolling mean?

   ANSWER: Discharge varies greatly within years, perhaps more so than across years. Looking at how the 30-day average tracks compared with daily numbers, it appears that there are more sustained droughts, whereas extreme high discharges tend to be more short-lived. This makes sense, as droughts are more likely to last than extreme precipitation events. There may be a slight pattern of increasing discharge over time, but further analyses (and more data) would be needed to draw any definitive conclusions.