CoCoRaHS Lesson Plan

When Rain Reigns

Data Activity

Lesson Objectives

At the end of this activity, students will be able to:

Content:

- Show the timing of precipitation over a one-month period of time.
- Explain how the timing of precipitation can affect land use and personal activities.
- Interpret data to 'tell a story' about the rainfall for the month.
- Extension: Interpret and analyze long-term averages compared to current data.
- Extension 2: Download data and write a simple formula using a spreadsheet.

Process:

- Choose a State (or County within a state) and download one month of precipitation data using the 'Rainy Days Report'.
- Create graphs using a pre-programmed excel spreadsheet.
- Interpret the data and 'tell a story'.
- Extension: Research 'monthly climate precipitation normals' (Data containing the amount of precipitation a city can expect to receive in a given month).
- Extension 2: Download a new data set and write your own formula to calculate the sum.

Step-by-Step Activity

How much rain fell in one month?

Overview
In this activity, each student will select a location of interest (either an entire state or a county within a state) and download 30 days of precipitation averages. The class can choose one location and compare findings with each other, or each student can select their own area of interest. Students will then copy/paste the data into an excel spreadsheet (included) that will calculate the total amount of precipitation and produce a graph of accumulated precipitation for the month.

Materials Needed
To complete this activity, you will need

- Internet access – http://www.cocorahs.org/ for accessing data.
- Desktop computer (iPad will not work well for this exercise).
- A spreadsheet software program such as Microsoft Excel, Google Sheets, Open Office or other spreadsheet program to work with the data.

1. The Research Questions and Background:
Have you ever looked out the window and noticed that it is raining in the distance, but not on you?

Whether it rained on you or not, how much rainfall fell over the county? Or what about the entire state?

When you learn how much rain fell over a certain location, it is usually from one rain gauge at one pinpoint location. But how can you determine how much rain fell over a larger area such as your county or even your entire state? One way would be to calculate an average from all of the rain gauges that are located within those boundaries. (Discuss how to calculate an average by adding up the individual amounts and divide by the number of gauges.)

The CoCoRaHS 'Rainy Days Report' calculates the average amount of rainfall for a location over any period of time. Choose your area of interest and select your start and end dates, and let's see how much rain reigned over the area!

*Extension: Are average rainfall amounts the same from one location to the next, i.e. Florida vs. Colorado? Assign students to explore some annual or seasonal amounts from different locations or seasons.

2. Get the Data.
First we need to choose an area of interest. It might be your own location, or it might be an area that the student is interested in – perhaps the county where they were born.

NOTE: Since "Counties" are less known, students might need to use the internet to determine which county their city is located in.
Go to http://www.cocorahs.org/ and click on 'View Data' at the top of the page. Next, scroll down and select 'Rainy Days Report (Direct link to Rainy Days Report): http://www.cocorahs.org/ViewData/RainyDaysReport.aspx. Choose the State (and/or county) and change the 'start date' and 'end date' to encompass an entire month, i.e. 3/1/2014-4/1/2014 and select 'submit'.
You will now need to open the spreadsheet and demonstrate how to toggle back and forth between the website and the spreadsheet.

If your computer does not have Microsoft Excel, a free software option called OpenOffice has a spreadsheet program that is compatible with Excel. http://www.openoffice.org/

Once the data appears, "copy and paste":

1. Use your mouse to highlight the data. (ONLY HIGHLIGHT the DATA – do not include the headings – see image below)
2. Holding the "control" button (ctrl) + c will copy the data (or right click on the highlighted data and select 'copy').
3. Go to the Excel document and click on the first cell under 'date' (cell A3)
4. Holding the "control" button (ctrl) + v (or right click and select 'paste') will paste the selected data into the spreadsheet.

Search Location and Date Range

Location: USA | Colorado | ALL COUNTIES

Date Range:

Start Date: 3/1/2015 **End Date:** 4/1/2015

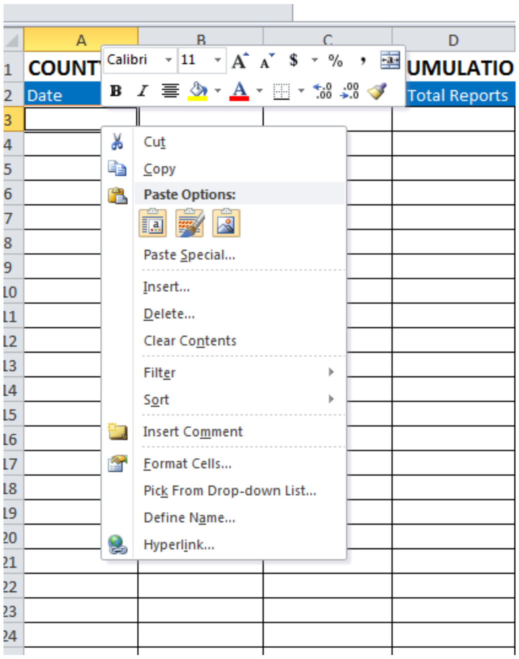
Search

Date	Avg Precip in.	Max Precip in.	# Total Reports	# Reports > Trace	# Trace Reports	# Snow > 0
2015-03-01	0.04	0.85	764	284	139	247
2015-03-02	0.04	0.79	783	325	156	218
2015-03-03	0.05	0.66	780	238	87	134
2015-03-04	0.10	0.55	845	749	36	634
2015-03-05	0.01	0.21	779	218	215	174
2015-03-06	0.00	0.00	744	0	3	0
2015-03-07	0.00	0.33	713	2	1	0
2015-03-08	0.00	0.00	724	0	3	0
2015-03-09	0.00	0.03	735	2	2	1
2015-03-10	0.00	0.05	756	2	2	0
2015-03-11	0.00	0.00	765	0	0	0
2015-03-12	0.00	0.15	761	1	1	1
2015-03-13	0.02	0.53	783	113	102	61
2015-03-14	0.00	0.31	742	64	149	17
2015-03-15	0.00	0.03	728	1	1	0
2015-03-16	0.00	0.01	755	1	0	0
2015-03-17	0.00	0.55	767	5	27	0
2015-03-18	0.00	0.24	762	11	59	2
2015-03-19	0.20	1.07	890	657	111	83
2015-03-20	0.08	1.15	821	446	109	77
2015-03-21	0.00	0.08	743	6	9	1
2015-03-22	0.00	0.00	731	0	2	0
2015-03-23	0.00	0.37	734	4	14	1
2015-03-24	0.03	0.51	804	254	74	118
2015-03-25	0.03	0.42	812	311	180	104
2015-03-26	0.11	0.53	835	609	77	231
2015-03-27	0.00	0.45	755	7	11	1
2015-03-28	0.00	0.04	721	5	23	1
2015-03-29	0.00	0.08	719	7	19	3
2015-03-30	0.00	0.00	745	0	0	0
2015-03-31	0.00	0.00	755	0	0	0
2015-04-01	0.00	0.06	786	3	7	0

Notice that ONLY the data are highlighted…NOT the headings, nor anything else on the page. Make sure to ONLY highlight the data.

Press “ctrl” + C to ‘Copy’ the data.

You can also right-click on your mouse and select ‘Copy’



Next, on the Excel (or Google) spreadsheet, click on the first cell (A3) and press “ctrl” + V to ‘Paste’ the data.

You can also right-click on your mouse from cell A3 and select ‘Paste’

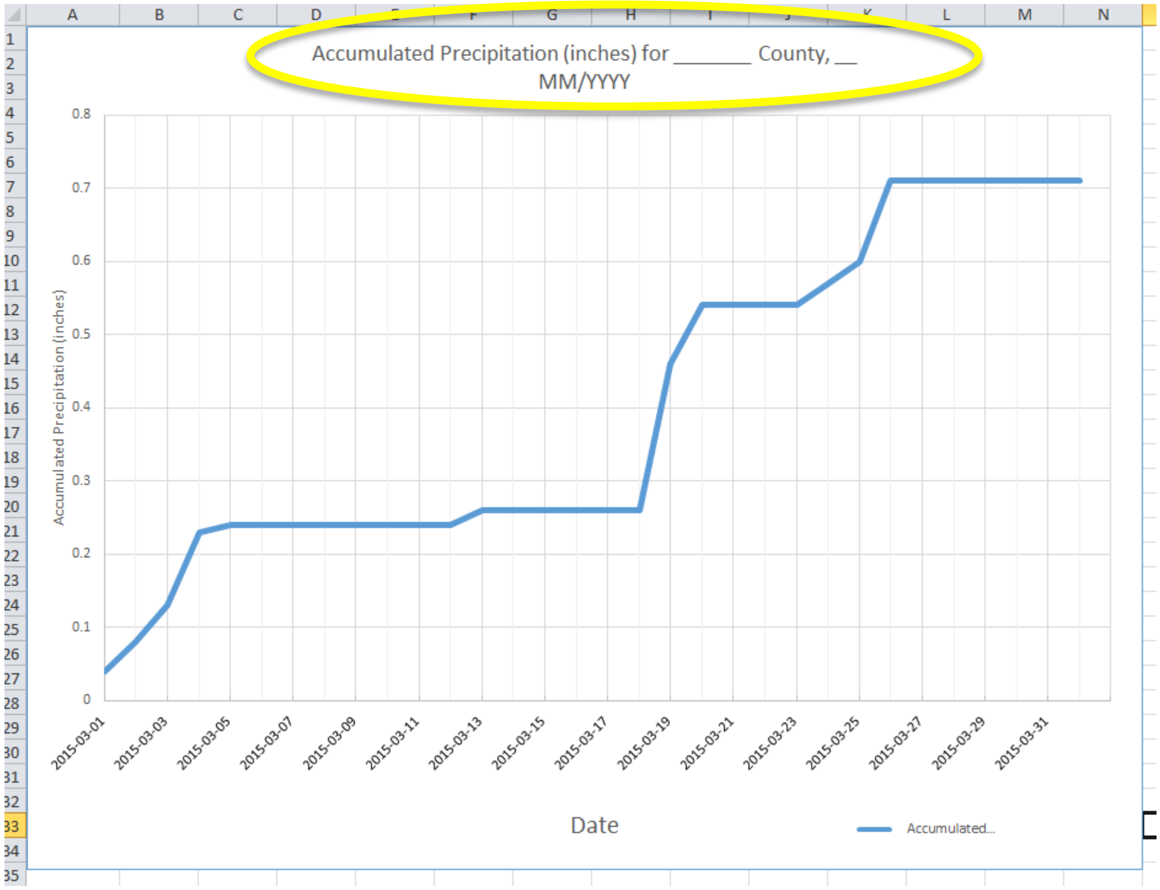
3. Get to Know the Data.
Once you have pasted the data into the spreadsheet, let’s look at what we see.

Looking across the top row, we can see several column headings including ‘Date’, ‘Avg Precip (in.)’, ‘Max Precip (in.)’, ‘#Total Reports’, etc…
We will be paying closer attention to columns A and B (‘Date’ and ‘Avg. Precip. In.’) as well as column H, ‘Accumulated Precipitation’. ‘Avg. Precip. In.’ is referring to the average amount of precipitation (in inches) that fell over your selected location for each day. Whether it is for the entire state or a county within the state, it is calculating the average amount of precipitation from all the reporting rain gauges in that area (column D ‘Reports’ tells us how many rain gauges went into this calculation). Column H, ‘Accumulated Precipitation’, is a running-total of the accumulated precipitation from each previous days’ report. The last entry in column H will be the total for the month. Ask the students to report how much rain fell over their selected location for the month? Was it rain that fell, or could it have been snow? (The ‘Rainy Days Report’ has a column indicating how many reports contained snowfall. All precipitation amounts for this exercise are liquid, i.e. any snow collected was melted prior to measuring the liquid content.)

	A	B	C	D	E	F	G	H
1	COUNTY AVERAGE PRECIPITATION ACCUMULATION							
2	Date	Avg Precip (in.)	Max Precip (in.)	# Total Reports	# Reports	Trace	# Snow	Accumulated Precipitation (inches)
3	2015-03-01	0.04	0.85	764	284	139	247	0.04
4	2015-03-02	0.04	0.79	783	325	156	218	0.08
5	2015-03-03	0.05	0.66	780	238	87	134	0.13
6	2015-03-04	0.1	0.55	845	749	36	634	0.23
7	2015-03-05	0.01	0.21	779	218	215	174	0.24
8	2015-03-06	0	0	744	0	3	0	0.24
9	2015-03-07	0	0.33	713	2	1	0	0.24
10	2015-03-08	0	0	724	0	3	0	0.24
11	2015-03-09	0	0.03	735	2	2	1	0.24
12	2015-03-10	0	0.05	756	2	2	0	0.24
13	2015-03-11	0	0	765	0	0	0	0.24
14	2015-03-12	0	0.15	761	1	1	1	0.24
15	2015-03-13	0.02	0.53	783	113	102	61	0.26
16	2015-03-14	0	0.31	742	64	149	17	0.26
17	2015-03-15	0	0.03	728	1	1	0	0.26
18	2015-03-16	0	0.01	755	1	0	0	0.26
19	2015-03-17	0	0.55	767	5	27	0	0.26
20	2015-03-18	0	0.24	762	11	59	2	0.26
21	2015-03-19	0.2	1.07	890	657	111	83	0.46
22	2015-03-20	0.08	1.15	821	446	109	77	0.54
23	2015-03-21	0	0.08	743	6	9	1	0.54
24	2015-03-22	0	0	731	0	2	0	0.54
25	2015-03-23	0	0.37	734	4	14	1	0.54
26	2015-03-24	0.03	0.51	804	254	74	118	0.57
27	2015-03-25	0.03	0.42	812	311	180	104	0.6
28	2015-03-26	0.11	0.53	835	609	77	231	0.71
29	2015-03-27	0	0.45	755	7	11	1	0.71
30	2015-03-28	0	0.04	721	5	23	1	0.71
31	2015-03-29	0	0.08	719	7	19	3	0.71
32	2015-03-30	0	0	745	0	0	0	0.71
33	2015-03-31	0	0	755	0	0	0	0.71
34	2015-04-01	0	0.06	786	3	7	0	0.71

Data | Graph

4. View your graph. Your spreadsheet has additional pages (see image above) where you can click on 'graph' to view the next page where the graph has been built. The graph title, "Accumulated Precipitation (inches) in ___County, ___" can be updated – instruct each student to click on the title and add the location information such as 'Colorado' or 'Sonoma County, California'. The letters "MM/YYYY" can be replaced with the month and year of the data, i.e. "03/2015" or "March, 2015".



5. Analyze the data

Every month from any location has a story to tell. Did it rain continuously from beginning to end? Can you spot any days where it didn't rain at all? Encourage the students to look at both the graph and data to see how the graph took the shape that was created, i.e. a steep rise indicates heavy rain and a flat line indicates zero precipitation. Looking at the graph, can they count the individual storms throughout the month?

6. Repeat for another location and/or another time frame. (Optional)

Ask the students to start over and try selecting a different month, or perhaps a different location altogether.

7. Tell the story

Each student can select the location and month of their choice and write a short paragraph about what the data tells us. Details such as location, dates, as well as the total precipitation at the end of the month are important, but encourage them to include some additional findings that they can glean from the data (see "Analyze the data" section above).

(**Extension #1:** Research precipitation "normals" (long term monthly averages between 1981-2010.)

8. Was the selected month of precipitation 'normal' compared to the long-term averages? We might be able to learn more about our selected month of data if we were able to compare it to the long-term averages for the same location. There are several stations around the United States that have records going back 30, 50, 75 or even 125 years, depending on the location. These records are extremely valuable, because they can help us determine if the current month is wetter or dryer than 'normal'.
Go to the following URL and look up your nearest city (the list is alphabetical by state, i.e. all Alaska stations (AK), then Alabama (AL), etc…):
http://ggweather.com/normals/precip.html

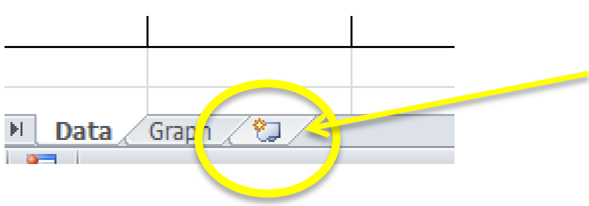
Once you have identified the nearest city, look across the row to see the monthly normals. The first number is January, then February, etc…until the second to the last December, and finally the annual total.

Ask the students to determine if their selected location and month was particularly wet or dry, or perhaps it was 'normal'. Discuss some of the implications and impacts on people if we have a 'wetter than normal' month or what about several months in a row or one extreme or another. Could that affect farmers? Industries? Tourism?

(**Extension #2:** Challenge the students to download a month of data and write their own formula to calculate the total)

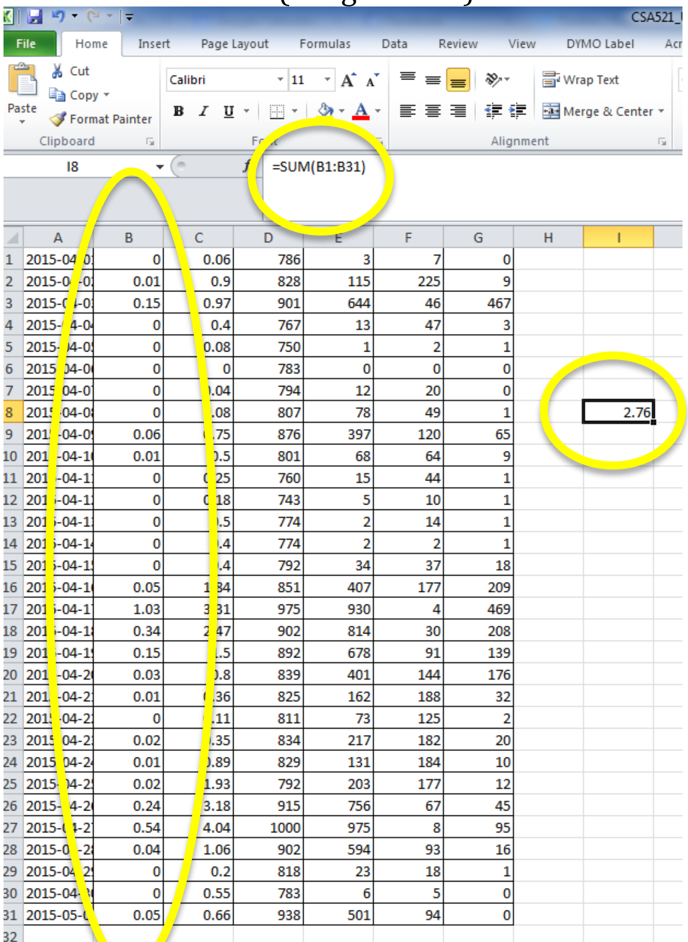
9. Copy and Paste another month of data onto a new spreadsheet page and create a formula to add up the daily averages.

Ask the students to find the button at the bottom of the spreadsheet to begin a new page (next to 'Data' , 'Graph' there is a small button to add a new sheet).



Click here to add a new sheet

Have them select a location and date range, copy/paste the data and select a blank cell next to the data (image below).



Type: =Sum(*highlight the cells range you want to include here*, i.e. B1:B31) – see highlighted area in image above, as well as the formula.
Select 'enter' and the total should appear in the field.
**If 'error' appears, check the formula and try the 'help' function that appears.

Alternate Implementation Ideas:

Working with younger students? Don't want to introduce spreadsheets just yet? Have the students create the graphs by hand. Several teachers have created large 'poster-size' graphs that the students can graph their own precipitation data that they are collecting using a CoCoRaHS rain gauge at their school.

Evaluation materials

Rubric for Plots (separate download)