Daily Plan		Instructor:	
Daily Topic:	Measuring and Analyzing Weather and Climate Data 1: Precipitation		
Unit Title:	Weather and Climate in Our Lives		
Course:	8th Grade Physical Sciences		

Materials, Supplies, Equipment, References, and Other Resources:

Classroom computer/digital projector or Smart TV, PowerPoint slides, a class set of Climate/Weather Paddles (index cards with **Climate** written in marker on one side and **Weather** on the other side, glued to a popsicle stick handle-see photograph of an example), worksheets, student I-Pads or computers, pencils, and rulers. Can add pre-painted artwork depicting weather as a weekly forecast and climate as weather over an extended amount of time, and precipitation data tables for the area if computer access is limited. Precipitation data for the area will be obtained from the NOAA Regional Climate Centers database at http://scacis.rcc-acis.org/

References:

National Center for Atmospheric Research and UCAR Office of Programs. *What's the Difference Between Weather and Climate?* Retrieved from http://eo.ucar.edu/kids/green/what1.htm

National Oceanic and Atmospheric Administration Regional Climate Centers, *SC ACIS*. Retrieved from http://scacis.rcc-acis.org/

National Weather Service. *National Weather Service glossary.* Retrieved from http://w1.weather.gov/glossary/

Intended Outcomes

What do you want students to know (K), understand (U), and be able to do (D)?

AFNR Standards and Benchmarks:

Natural Resources and Environmental Services Systems

Standard III: Apply scientific principles to natural resource management activities.

Benchmark III-A: Apply scientific principles to natural resource management (Performance Standards 2 and 3).

Standard III: Apply scientific principles to natural resource management activities.

Benchmark III-C: Examine natural cycles and related phenomena to describe ecological concepts and principles (Performance Standard 8).

Standard VII: Apply scientific principles to environmental services. Benchmark VII-A: Apply meteorological knowledge to recognize weather systems and weather patterns (Performance Standard 2).

Next Generation Science Standards:

MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. Emphasis on how air masses flow from regions of high pressure to low pressure causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time. Examples of data can be provided to students (precipitation data from local weather stations, tables, graphs, weather maps, diagrams, and visualizations).

MS-ESS2-6: Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Examples of models can be diagrams, maps, and globes, or digital representations.

Essential Question:	How do we measure precipitation and what is the precipitation trend in our area over the last 70 years?

Objective(s):	1. After viewing a PowerPoint slide and receiving weather and climate verbal prompts, students will be able to define climate and weather and correctly distinguish between 4 of 5 weather and climate examples. 2. After viewing two PowerPoint slides, students will be able to correctly give the functions of 6 of 9 common components of a weather station. 3. In pairs, and given instruction and access to an/a I-Pad or computer, students will be able to generate an **Accumulation Graph** that shows the curves for the last, average, wettest, and driest year on record for the area. 4. Given prior instruction about the scientific process and hypothesis writing, students will formulate and test their own hypothesis for the precipitation trend in their geographic area over the last 70 years by finding and graphing seven 10-year annual precipitation means. (hypothesis written in the if/then/because format) 5. Given the weather and climate, weather station, and online precipitation instruction and the learning activities presented in this lesson. Students will score at least a 4 out of 6 on two science knowledge, science skills, and reasoning ability multiple choice questions for this lesson that are on the unit test. **Learning Strategies Used:** Lecture and discussion, Weather/Climate Paddles and individual or paired responses to weather and climate verbal prompts, group work, accessing and analyzing precipitation data for weather and climate from a local active weather station reporting on the NOAA Regional Climate Centers database, writing a climate related precipitation hypothesis and conclusion statements, graphing data, and reading. Learning is differentiated through a variety of activities and exercises. **Literacy:** Understanding components and functions of common components of weather stations, following instructions on the worksheet for three NOAA Regional Climate Centers database searches, and writing a hypothesis and conclusion statements.

Activating Strategy **Preflection/Introduction (Interest Approach)** *How will you prepare students for what you want them to learn today and link today's activities with previous classes?*	**Estimated Time:**	**10-15 Minutes**
Show the PowerPoint slides on weather and climate, and the common components of weather stations and their functions (see attached PowerPoint). Handout the Climate/Weather Paddles. Students will show the weather of climate sides of their paddles when cued with the following prompts. This activity can be done individually or in pairs. Students can be asked to come up with and share more examples of weather or climate prompts. 1. It was sure cloudy and cold on my birthday last year. 2. Droughts are more frequent here than at any other time in our recorded history. 3. In most places in the world, the temperature has increased over the last 100 years. 4. We can expect a sunny day tomorrow with a high temperature of 80 ^{o}F. 5. It doesn't snow as much here now as it did 50 years ago. Students will then complete Activity 1 of their worksheets on weather station components and their functions. (See attached precipitation worksheet)		

Learning Approach 1	Estimated Time:	15-20 minutes

Teaching Strategy / Materials	Brief Content Outline
Activities 2 and 3 on the Precipitation Worksheet for pairs of students Worksheets, student I-Pads or computers, classroom computer/digital projector or Smart TV	*K: What do you want students to know (facts, figures, vocabulary, etc.)?* 1. To access and use the NOAA Regional Climate Centers database. Note: Teachers are recommended to try all of the NOAA Regional Climate Centers database protocols listed in the worksheet in advance of teaching this lesson so they can better assist the students. Exploring other analyses is also recommended so teachers become aware of other features of the database, especially if they plan to have students design an inquiry of their own that goes beyond the three in the worksheet.
	U: What do you want students to understand (what is the big picture)? 1. How to find local precipitation data for a given day using the **Daily Data Listing** function (example of measuring and reporting a day's weather). 2. How to use the **Accumulation Graph** function to develop a graph that compares the last complete year of precipitation for an active local weather station reporting on the NOAA Regional Climate Centers database to the average year, wettest, and driest year on record for that weather station. This result might be an indicator of what is going on with precipitation in the area, but because it is only for one year, it can't yet be called a climate trend (it is more of an example of measuring and reporting a year's weather). Note: for the driest year, the program might select the current incomplete year as the driest. View the 2018 Precipitation Accumulation Graph Example for the Las Vegas, New Mexico Municipal Airport that is included with this lesson to see what this graph looks like and communicates.
	D: What do you want students to be able to do (tasks, skills, etc.)? 1. Pairs of students on their I-Pad or computer will be guided by the teacher and worksheet to enter the URL for the NOAA Regional Climate Centers database (http://scacis.rcc-acis.org/) and follow the teacher who is on the classroom computer/digital projector or Smart TV and demonstrating the Activity 2 and 3 search protocols. The teacher can use the last day in the area that had precipitation as an example for the Activity 2 protocol and then help them make the right choices and interpret the graph generated from the Activity 3 protocol for the last complete year. Students will answer the Activity 2 and 3 questions on the worksheet. 2. This part of the lesson can be enhanced by having the students generate their own precipitation search protocols for other **Single-Station Products** and share their findings with the class. 3. If only a classroom computer/digital projector or Smart TV are available to the class, students can watch as the teacher, or a student with teacher assistance, navigates through the two search protocols and then answer the Activity 2 and 3 questions on the worksheet.

Learning Approach 2	Estimated Time:	20-30 Minutes

Teaching Strategy / Materials	Brief Content Outline
Activities 4, 5, and 6 on the Precipitation Worksheet for pairs of students Worksheets, I-Pads or computers, pencil and ruler, teacher's computer/digital projector or Smart TV	*K: What do you want students to know (facts, figures, vocabulary, etc.)?* 1. To formulate and test a long-term local (climate related) precipitation trend hypothesis using data from a local active weather station reporting on the NOAA Regional Climate Centers database. *U: What do you want students to understand (what is the big picture)?* 1. How to use the **Monthly Summarized Data** function for the NOAA Regional Climate Centers database to determine the local area precipitation trend over the last 70 years (e.g., 1949-2018) (example of measuring and reporting an aspect of climate). *D: What do you want students to be able to do (tasks, skills, etc.)?* 1. Pairs of students will develop their hypothesis on whether it has gotten wetter, drier, precipitation has gone up or down or down and up, or precipitation has not changed at a local active weather station reporting over the last 70 years following the criteria specified on the worksheet (Activity 4 on the worksheet). 2. Pairs of students on their I-Pad or computer will be guided by the teacher to enter the URL for the NOAA Regional Climate Centers database (http://scacis.rcc-acis.org/) and follow the teacher who is on the classroom computer/digital projector or Smart TV and demonstrating the Activity 5 search protocol. The teacher can help them make the right choices for the Activity 5 protocol and enter into the data table the correct average yearly precipitation figures for each of the seven 10-year periods. If the class gets too spread out on this activity, the teacher can give the final answers for the data table if each pair has at least found three of the seven 10-year annual averages. 3. While helping the students to find the average yearly precipitation for each 10-year period, the teacher can also point out other data in the tables. View the 2009-2018 Example of Average Monthly/Yearly Precipitation Table for the Las Vegas, New Mexico Municipal Airport that is included with this lesson to see what data the table reports. The 10-year yearly average precipitation is circled in pen. 4. The students can look at the averages in the data table and answer if their hypothesis is correct or incorrect and why they can tell this. 5. For a more visual representation of the data and practice in graphing, follow the graph template example for this lesson to develop your own template master with a Y axis precipitation scale that allows all of the local 10-year precipitation averages to fit and an X axis for your 10-year periods of interest, and have the students enter their data points and connect the dots between 10-year periods to see the local precipitation trend (Activity 6). You can also have the

	students design their own graph templates before entering their data. Activity 6 can be done before having the students write conclusions about their hypotheses. 6. This part of the lesson (Activities 4, 5, and 6 on the worksheet) can be enhanced by having the students generate their own hypotheses and precipitation search protocols for other **Single-Station Products** and share their findings with the class. 7. If only a classroom computer/digital projector or Smart TV are available to the class, students can watch as the teacher, or a student with teacher assistance, navigates through the search protocol and then complete their data tables together.

Summarizing Strategy (Reflection) *How will you have students reflect on what they have learned today and prepare them for the next class?*	**Estimated Time:**	**5-10 Minutes**
After students complete their data tables, graphs, and conclusion statements based on their original hypothesis, discuss with the class the results from the Hypothesis Testing and Graphing parts of the worksheet (Activities 5 and 6). Has it gotten wetter, drier, precipitation has gone up and down or down and up, or precipitation has not changed at our local active weather station over the last 70 years? Why?		

Assessing Strategy (Evaluation) *How will you determine if students know (K), understand (U), and can do (D) what you intended?*
Students will be able to differentiate between climate and weather and identify and give the functions of common components of weather stations. They will be able to conduct three protocols in the NOAA Regional Climate Centers database. They will be able formulate and test a precipitation trend (climate) hypothesis and develop a graph of their data. Two science knowledge, two science skills, and two science reasoning multiple choice questions are on the unit test for this lesson. (See unit test)