

## Unit 2: Local Climate and Climate Change

### Introduction

Students will explore Weather Underground ([www.wunderground.com](http://www.wunderground.com)), a data base with over 70 years of daily weather readings as they develop their ability to create data tables and graphs using Excel. Students will explain how our local climate has changed over the past 70 years and predict what it may be 25 years from now. Finally, they will present their findings to their peers in a poster session in class. This unit is designed as a part of the NASA Climate Module, but can be used as a separate unit; simply replace “Day 5” with “Day 1” and proceed.

### Expectations –

- C1.1B** Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions.
- C1.1D** Identify patterns in data and relate them to theoretical models.
- C1.1E** Describe a reason for a given conclusion using evidence from an investigation.
- C1.1f** Predict what would happen if the variables, methods, or timing of an investigation were changed.
- C1.2A** Critique whether or not specific questions can be answered through scientific investigations.
- C1.2B** Identify and critique arguments about personal or societal issues based on scientific evidence.
- C1.2C** Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.
- C1.2D** Evaluate scientific explanations in a peer review process or discussion format.
- C1.2E** Evaluate the future career and occupational prospects of science fields.
- C1.2j** Apply science principles or scientific data to anticipate effects of technological design decisions.
- C1.2k** Analyze how science and society interact from a historical, political, economic, or social perspective.
- B3.4C** Examine the negative impact of human activities.
- B3.4x** Humans can have tremendous impact on the environment. Sometimes their impact is beneficial, and sometimes it is detrimental.

### Resources

- Weather Underground, [www.wunderground.com](http://www.wunderground.com)
- Computer Labs
- Excel
- Large white boards and dry erase markers

### Safety

- Students will use the internet both in school and at home. Take a moment to review acceptable use policies.

### Engage

Day 5: Students will use large white boards and dry erase markers to complete a ten minute competition. In groups of 4 to 5 students based on rows in the seating chart, students will move to lab tables with a white board and markers present. Their challenge is to guess (based on experience living in the area) what the average temperature (°F), precipitation (in), and wind speed (mph) was for the previous calendar year and to predict what those three values may be in the year 2030. They have 10 minutes to represent their knowledge and predictions pictorially on the board. Finally, students will briefly explain their board to the class while I record their board with a digital photo.

### Exploration

Day 6: Students will explore History Data at Weather Underground, [www.wunderground.com](http://www.wunderground.com).

- Reserve the computer lab well in advance
- Students will require several pieces lined paper, a ruler, and a pen or pencil
- Students will log into the computers and navigate to <http://www.wunderground.com/history/>
- Students will construct a data table on their lined paper in order to record all of the historical climate data available for zip code 48185 by month. (*ACT ID*)
  - This data table will not be completed today. Students are exploring the vast amounts of data available by manipulating wunderground.com.
  - Students will eventually be required to record ALL of this data in groups. They will be allowed to divide and conquer after they have agreed upon a data table format.
- Walk around as students begin to construct their data tables. Guide them with the following questions as necessary. (*ACT ID*)
  - What year does the historical data on wunderground.com begin?
    - 1943
    - The data base goes back to 1942, but there was no data for 48185 in 1942
  - What year are we currently in?
    - 2012
  - How many years of data are we able to search?
    - 69
  - How many months are in a year?
    - 12

- How many total months will you eventually record data for?
  - 828
- What type of data is available?
- Should you record temperature, precipitation, dew point, degree days, conditions, wind, sea level pressure, barometric pressure?
  - Climate is defined as temperature, precipitation, and wind for a particular region
  - Temperature is available from 1943 onward
  - Precipitation is available in the daily calendar, but not listed as means or averages by month
  - Monthly Calendar Overview has the Average Month Total listed. Students should record this number for their precipitation for each month.
  - Students should also record the average wind mph for each month.
- When recording for the month, should you record maximum and minimum numbers or averages (means) and what units should you use?
  - Averages and means
  - Temperature
  - Precipitation
  - Wind
- Students may design their data tables in their own accord, so long as it ends up having these minimum fields:

Year	Month	Temperature (average mean temperature, °F)	Precipitation (average month total, in)	Wind (average wind, mph)
1943	April	43	2.78	14
1943	May	47	3.03	11
1943	June	73	3.56	9
1943	July	74	3.22	8
1943	August	72	2.93	8
1943	September	61	2.92	9
1943	October	50	2.1	11

Classwork: “Welcome to Your Group!”, pages 6 and 7 - I use this as an organizational tool in my classroom. I form groups based on whatever my classroom needs most at the time and list each group member's name on the lines provided. If there are four members to a group, I write all four of their names on four sheets of the assignment paper and also make a copy for myself. This way each student has a record of who they are supposed to be working with. By using page 7, ("Graphing Plans") they assign responsibility among the group members. This assignment is not essential to the unit, but I find it very important and helpful.

### **Explanation**

Day 7:

- Students will bring their data to class and develop explanations of what our local climate has been for the past 70 years. (*ACT ID*)

- Students will share their observations with one another and make decisions regarding presenting data to a group of their peers. *(CI.2D)*
- They will be asked to graph temperature means, precipitation totals, and wind speeds on three separate graphs.
  - They may desire to have less than 828 plot points. If that is the case, they may choose to reduce their number to quarterly data sets (four per year). Encourage them to verify the use of the same four months from year to year.
- Students will begin to connect vocabulary to their observations
  - What is climate? What is weather? How are they related? How are they different?
- Students will assess their current understanding of local climate *(CI.2C)*
  - Why do you think it is important to understand local climate and its change?
    - This particular prompt will serve as the WWCS D Secondary Non-Fiction Writing Requirement for the 5<sup>th</sup> Marking Period.
    - HOMEWORK: “Shallow and Deep Thoughts”, pages 8 and 9  
Encourage students to connect changes in weather data to possible human impact (see Expectations B3.4C and B3.4x)

### **Elaboration**

Day 8: (Note: This day can be combined with Day 2 for computer-lab-reservation purposes)

- Reserve the computer lab well in advance
- This day will allow students to graph their data and prepare it for discussion
- Homework: *(ACT ID)*
  - Complete their data tables (each group member should be responsible for one graph for experience and practice of using data and analysis).
  - Prompts each student must answer in order to be admitted to class on Monday:
    - Describe how our local temperature changed over the past 70 years.
    - Predict what it might be 25 years from now.
    - Describe how our local precipitation changed over the past 70 years.
    - Predict what it might be 25 years from now.
    - Describe how our local wind speed has changed over the past 70 years.
    - Predict what it might be 25 years from now.

HOMEWORK: “Shallow and Deep Thoughts; Part Two”, pages 10 and 11

Day 9:

- Students return to their data collection groups to discuss answers to the prompts and compare graphs. *(ACT ID, CI.2D)*
- About half way through the hour draw their attention to the SmartBoard for a teacher lead discussion using his/her own graphs from the data collection.
  - Prepare your own graphs previous to class discussion!
    - It is important to experience what the students have been grappling with as they may be very frustrated by the process.
  - Show them how to extrapolate data
- Students return to their groups to extrapolate their data if they had not come to this point previously *(ACT ID, CI.1f)*

- Encourage student discussion to check for understanding among their peers (*CI.2D*)

### **Evaluation**

Day 10:

Poster Board Presentations

Rubric – See “Poster Presentations”, pages 12 and 13

- Students will critique other groups interpretations of historical climate and their prediction of our future local climate (*CI.2D*)
- Students will be graded on their data tables, graphs, analysis of historical climate, and prediction of future climate (see “Poster Presentations”)
- Students will discuss why it is important to understand local climate and its changes
- Student groups will be given one or more of the original index cards and will be asked to discuss the topic based on new knowledge
- Students will be asked to describe how their thinking and behaviors may change because of this project and after reading “Climate Literacy: The Essential Principles of Climate Science” (<http://www.climatescience.gov>)
  - Why do you think it is important to understand local climate and its change? (*CI.2E, CI.2k*)
  - How would you explain our local climate to a member of your family?
  - What questions would you like to investigate in the future?

HOMEWORK: “Climate and Change”, pages 14 and 15

Student Name:  
Date:  
Hour

## Welcome to your group!

You have been assigned to work with

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Decide on a final format for your data table.  
Divide the 69 years of data equally amongst yourselves.  
Exchange contact information.  
Bring your data to class on Thursday.

Student Name:  
Date:  
Hour:

## Graphing Plans

Who will graph temperature data?

Who will graph precipitation data?

Who will graph wind speed data?

Will you graph all 828 months?

If you are not graphing all 828 months, will you graph every other month or once a quarter?

Decide which months of every year you are graphing so that each person uses the same months!!

You will have the entire hour in the computer lab on Friday. Bring something to save your work on in case you do not finish. Check the local library hours if you will not have access to a computer at home or at your partner's home.

Student Name:  
Date:  
Hour:

## Shallow and Deep Thoughts

Directions: Answer each question thoughtfully with one or more complete sentences. Use the amount of space provided for your answer as a guide to the importance of your answer. More space, more answer, more points.

What is climate?

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What is weather?

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How are they related?

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How are they different?





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Student Name:  
Date:  
Hour:

## Shallow and Deep Thoughts (Part Two)

Directions: Answer each question thoughtfully with one or more complete sentences. Use the amount of space provided for your answer as a guide to the importance of your answer. More space, more answer, more points.

Describe how our local temperature changed over the past 70 years.

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Predict what it might be 25 years from now.

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Describe how our local precipitation changed over the past 70 years.

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Predict what it might be 25 years from now.

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Describe how our local wind speed has changed over the past 70 years.

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Predict what it might be 25 years from now.

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## Poster Presentations

### Parameters:

- You must use a white or pastel poster board (no black, bright, or neon colors), sized 28" x 22"
- Your combined data table for monthly figures must be clearly visible on the poster board
- Your graphs for monthly temperature, precipitation, and wind speed must be clearly visible on the poster board
- An extrapolation line must be clearly visible on all graphs
- A well written analysis of local historical climate must be clearly visible on the poster board
- A well written prediction of future local climate must be clearly visible on the poster board
- A title must be present on the poster board
- Each group members name must be presented on the front of the poster board

### **An Overly Detailed Rubric for the Poster Presentations**

A circled 5 means you have gone above and beyond basic requirements. Good job!

A circled 4 means you have satisfied the basic requirements.

A circled 3 means you have barely met the basic requirements.

A circled 2 means you were below expectations.

A circled 1 means you may have put in some effort, but it was fairly misplaced.

No circled numbers means you did not meet this requirement at all.

1. Did the students use a white or pastel poster board, appropriately sized?  
1                    2                    3                    4                    5
2. Is a combined data table with monthly figures posted neatly on the board? Is it easy to read? Does it make sense?  
1                    2                    3                    4                    5
3. Does the graph for monthly temperature data have x and y-axis labels? Are they correct? Does the graph have a title? Does the graph make sense? Is it easy to read? Is it in color? Is the extrapolation line present?  
1                    2                    3                    4                    5
4. Does the graph for monthly precipitation data have x and y-axis labels? Are they correct? Does the graph have a title? Does the graph make sense? Is it easy to read? Is it in color? Is the extrapolation line present?  
1                    2                    3                    4                    5
5. Does the graph for monthly wind speed data have x and y-axis labels? Are they correct? Does the graph have a title? Does the graph make sense? Is it easy to read? Is it in color? Is the extrapolation line present?  
1                    2                    3                    4                    5
6. Did the group maintain the same months throughout all of the graphs (e.g. January, April,

July, and October are used for every year)?

1                    2                    3                    4                    5

7. Is the analysis of local historical climate well written? Does it have spelling and grammar problems? Is it easy to read? Is it neat? Does it make sense?

1                    2                    3                    4                    5

8. Is the prediction of future local climate well written? Does it have spelling and grammar problems? Is it easy to read? Is it neat? Does it make sense?

1                    2                    3                    4                    5

9. Is there a title on the poster? Is it neat and easy to read? Does it make sense?

1                    2                    3                    4                    5

10. Is each group member's name clearly visible and neatly written on the front of the poster?

1                    2                    3                    4                    5

Student Name:

Date:

Hour:

## Climate and Change

Why do you think it is important to understand local climate and its change?

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How would you describe our local climate to a member of your family?

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Write at least two questions about climate that you would like to investigate in the future.

1.

2.

