AMP IT UP

Advanced Manufacturing & Prototyping Integrated to Unlock Potential

EARTH SCIENCE

Data-Driven Decision Making

SNOW DAY

Winter Weather Challenge

Annotated Teacher's Edition

Fall 2018

6DMS

SECTION 1 – THE WINTER WEATHER CHALLENGE

1.1 INTRODUCTION

"Snow Day!!" This is joyful news to many students, hopeful for a day off from school. In areas of the country that get lots of snow, it takes a very large snow storm to cancel schools. In other areas, generally in the south, snow is rare and communities often do not have snow removal equipment, and cars and buses don't have tires made for driving on snow. Schools in these areas might close if there is a likelihood of even a small amount of snow or ice, or if the temperature is very cold. Who decides?

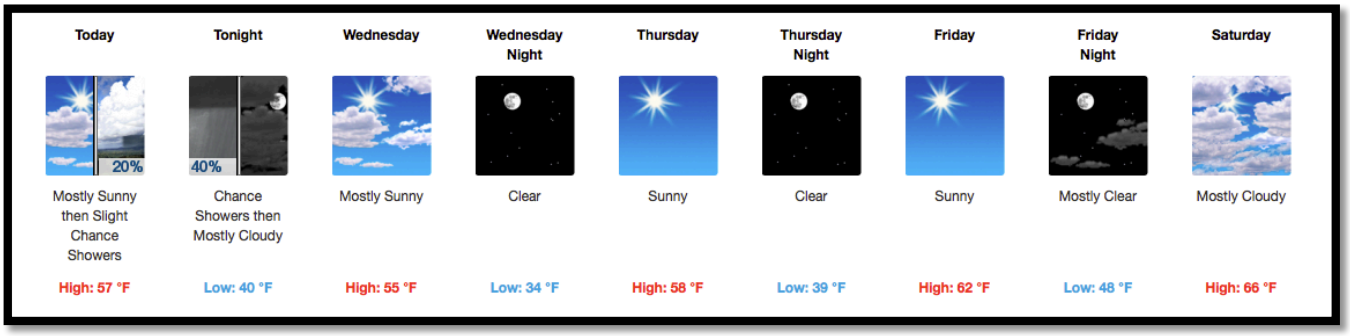
If bad weather is forecasted, the school superintendent must decide whether to close school, release students early, or have a normal school day. This is a decision that cannot be made lightly. A school superintendent must consider many factors, including the type of weather forecasted and the timing of the precipitation. He or she must also consider the **trade-offs** and the safety of everyone traveling to and from school using different types of transportation—on school buses, in cars, on foot, or on bicycle. Trade-offs is a new term introduced here for students to help them understand you can't just call off school every time the weather looks poor. Every decision has trade-offs ("there's no such thing as a free lunch")

A trade-off is a situation where you must choose between two things that you cannot have at the same time. For example, there is a show that you might want to watch late at night but watching it means you will get less sleep on a school night. You cannot both stay up to watch it and get your regular amount of sleep. How do you choose between them? You have to consider the trade-offs. In the case of winter weather, the superintendent also needs to consider a variety of trade-offs.

Discuss these questions as a class:

1. If there is a chance of bad weather, why not play it safe and just close school?Need a min. # of days in school each year, need to learn,etc.
2. What trade-offs do you or others experience when schools are closed due to weather?Child care/work coverage; missed learning opportunity or presentation, etc
3. What are some other decisions that you make in which you need to consider trade-offs? After school clubs, babysitting/other job-interference with school work or other responsibilities at home

1.2 FORECASTING THE WEATHER



Meteorologists are scientists who study the atmosphere and the weather.

Watch ***Kid Meteorologist*** video #1.

This video is relatable to students because of the age of the "kid" and shows her interest in meteorology along with her role in making observations

When meteorologists make weather forecasts, they are weighing different factors and making decisions. These forecasts are based on an understanding of science, knowledge of the geography of the forecast area, information from satellites, and their own experience. They also use computer models to help make sense of the data. Meteorologists include a lot of information in their forecasts to inform the public of upcoming weather. The forecast for a specific date may be provided seven to ten days in advance to allow the public to plan for activities.

PLEASE DO NOT WRITE IN THIS BOOK.

The **National Weather Service (NWS)** is a government organization that provides climate data, forecasts and warnings. The chart below shows National Weather Service forecasts for a specific date: Saturday, January 23rd. Observe how the content of the forecast changed over a 7-day period.

The way to read this forecast is as if you were asking students on Saturday, Jan 16th what the forecast was for next Saturday (23rd); then Sunday the 17th; Monday the 18th; Tuesday the 19th; Wednesday the 20th; etc

Forecast Issued	Forecast for Saturday, January 23rd *This forecast is just used as an example for students to read through. Was actually a blizzard forecast for Long Island*
7 days in advance	Mostly sunny and breezy. Highs in the upper 30s.
6 days in advance	Mostly sunny and breezy. Highs in the upper 30s.
5 days in advance	Snow likely. Windy with highs in the mid 30s. Chance of snow 70%.
4 days in advance	Snow likely. Very windy with highs in the mid 30s. Chance of snow 70%.
3 days in advance	Snow likely in the morning then snow likely with a chance of rain in the afternoon. Additional moderate snow accumulation possible. Very windy with highs in the mid 30s. Chance of precipitation 70%.
2 days in advance	Blizzard watch in effect from Saturday morning through Sunday afternoon. Snow likely in the morning then snow, rain and sleet in the afternoon. Very windy with highs in the mid 30s. Northeast winds 30 to 40 mph with gusts up to 50 mph. Chance of precipitation 90%.
1 day in advance	Blizzard warning in effect from midnight tonight to 7am Sunday. Snow may be heavy at times. Visibility one quarter mile or less at times. Additional snow accumulation of 4 to 8 inches. Very windy with highs in the mid 30s. Northeast winds 30 to 35 mph with gusts up to 50 mph. Chance of snow near 100%.
Day of	Blizzard warning in effect until 7am Sunday. Snow may be heavy at times. Visibility one quarter mile or less at times. Additional snow accumulation of 8 to 12 inches. Very windy with highs in the mid 30s. Northeast winds 30 to 35 mph with gusts up to 50 mph. Chance of snow near 100%. *The day of the event the forecast is much more detailed showing the confidence the meteorologists had in the forecast.*

Discuss these questions as a class:

1. What types of information are included in the forecast? temperature, sky conditions (clouds, sun), whether there would be precipitation and how much, what the chance of precip was, visibility (how far you can see), watches/warnings
2. How does the forecast change as you get closer to the day? The forecast contains more information and is much more detailed. Gone from mostly sunny to a blizzard warning forecasting a lot of snow.

PLEASE DO NOT WRITE IN THIS BOOK.

When you compare forecasts for a specific day like this over time, it allows you to spot patterns or trends in the forecast. What was the actual weather on this day, Saturday, January 23rd? The forecasted area did experience a blizzard and over 15" of snow fell. You could say this was a well-forecasted event.

1.3 ANALYZING WEATHER FORECASTS

Let's take a look at the types of information that a forecast contains and how to identify them. Note that not every forecast contains all of these categories of information. You'll learn more about these categories in the next section. *The purpose of this is to help students learn how to identify the different categories of information in the forecasts- not so much their definitions, just learning how to identify them.*

Forecast Category	Key	What to Look For
Forecasted Conditions		Mentions sun, clouds or a chance of precipitation
Temperature		Listed as highs or lows and a number
Probability of Precipitation		Tells you what the "chance of" precipitation is by percentage
Precipitation Amount		Mentions "accumulation" and might detail a specific amount (example 1-2 inches)
Watch/Warning/Advisories		Would lead off a forecast and include the timing for how long it is in effect for.

Sample forecast showing how it would be highlighted is a separate student page. Display/share it for students to see

PLEASE DO NOT WRITE IN THIS BOOK.

1.4 YOUR CHALLENGE

You and your team of meteorologists have been hired by the superintendent of McCarver City Schools to help decide whether or not to close school when winter weather is predicted. Before a storm hits, the superintendent wants to have a practice session so everyone will be prepared for the real thing. In this practice run, you need to analyze forecasts starting several days before the weather event begins. This way you can analyze the forecasts carefully and look for patterns or trends, just like the example you looked at earlier. You need to make your official decision before the buses get ready to pick up students in the morning, so the last forecast you will have to consider is the 4:00am forecast on the day of the event.

Procedure: (completed as **individuals**)

1. On *Analyzing the Forecast: Student Sheet #1*, use colored pencils to underline the different types of information included in the forecast for January 28th. *This forecast is completely different than the one students have already done- remind them of this if you see them looking back at the example. The example is just a guide ☺. The different categories are highlighted in the book but they should use the colored pencils to underline the categories on their student sheets.*
2. Look for trends and patterns in the information, and answer the questions on *Analyzing the Forecast: Student Sheet #1*.

Discuss these questions as a class:

1. What trends or patterns do you see in the forecast?
2. Would you recommend that the Superintendent close schools in this situation?

SECTION 2 – ADD TO YOUR UNDERSTANDING

2.1 MAKING A FORECAST

Meteorologists use computer **models** to help with their forecasts. These models use computer programs that rely on the data collected from scientific instruments to make predictions. Meteorologists combine their expertise with forecasting certain situations with the computer model predictions to make their official forecasts. *Computer models take the data gathered from weather instruments at the surface and throughout the atmosphere (from weather balloons) and input that data into scientific formulas which generate a computer model of how the weather is expected to change based on that model. There are dozens of models and they all are unique in how they handle the conditions. It takes a skilled meteorologist to recognize the "biases" of the models and to choose the correct model based on the forecast situation (example: some models are great for winter storms but terrible at predicting tropical weather)*

KEY TERMS

Model: A model of a real-life situation can be used to test important aspects of a phenomenon under investigation. It can be used to generate predictions, explanations, and solutions. That said, models are limited in what they can represent about the real-life situation.

Watch ***PBS Weather Forecasting*** video #2.

This is a great video that shows a TV meteorologist and how she generates forecasts using computer models. Also note in the video- the chart she makes and how she enters all the temperature predictions from the models and then makes her forecast. You'll replay this part of the video again later.

PLEASE DO NOT WRITE IN THIS BOOK.

2.2 FORECAST CATEGORIES

Weather forecasts include a lot of information. When you analyzed the practice forecast, you noted five categories of information. *This section provides all the definitions/content about the categories students learned how to identify in section 1. This is provided as a resource, it's not expected that students memorize any of this but they do need to know the significance of 32 degrees and how it will determine if the precipitation is liquid (rain) or frozen (snow/sleet/freezing rain or ice)*

Forecasted Condition

This category includes information about the weather conditions that are expected. Rain, snow, freezing rain and sleet are all examples of precipitation. ***If the temperature is greater than 32 degrees, precipitation will remain as liquid rain. If the temperature is 32 degrees or less that precipitation can freeze into freezing rain (ice), snow or sleet depending on the conditions in the atmosphere.*** *More details about winter precipitation can be found at: https://climate.ncsu.edu/climate/winter_wx/Precipitation_types.php The differences between freezing rain and sleet: https://weather.com/storms/winter/news/sleet-freezing-rain-difference-20121123*

Temperature

The temperature is a measure of the energy the atmosphere contains. It can be measured by thermometers at the surface in weather stations. It can also be measured throughout the atmosphere when instruments are attached to weather balloons. Forecasts will include the predicted maximum daytime ("high") or minimum overnight temperature ("low") in degrees Fahrenheit. The high temperature does not always happen in the afternoon. Sometimes it happens in the morning and then the temperature cools off during the day as bad weather approaches. 32 degrees is an important temperature for precipitation. If the temperature is 32 degrees or colder, precipitation can freeze and turn into snow, freezing rain or sleet.

Probability of Precipitation

You have probably heard in local weather forecasts that there was a "40% chance of showers". In the forecast you analyzed, three days ahead of time the National Weather Service predicted a 70% chance of precipitation. That is the ***Probability of Precipitation***. The value tells you the likelihood (as a percent) that there will be measureable precipitation in the forecast area during the time period for the forecast. The closer the value is to 100%, the more likely that there will be measurable precipitation. However, sometimes it remains dry even when the weather forecast calls for a 100% probability of precipitation. Why? The conditions that influence the weather are very complex. The uneven heating of the Earth, local and regional geography, the presence of large bodies of water, and many other factors influence the weather. Plus, the weather forecast is for a region, not a very specific spot. So it might rain in one area of town, but not another.

Precipitation Amount

When there is a high probability of precipitation (rain, sleet, snow), the forecast will also include a predicted amount.

Watch/Warning/Advisories

When meteorologists notice that the weather conditions will be severe, they will issue an advisory, watch or warning with their forecast to alert the public. These announcements are made about tornadoes, hurricanes, severe thunderstorms, flash floods, winter storms, and more. By communicating these announcements, meteorologists alert the public that they should prepare for dangerous weather. The criteria for the advisories, watches, and warnings may vary by geographic area. Listed below are the criteria for severe winter weather for regions that historically don't get much snow. *Specifically, this is the criteria for advisory/watch/warnings for Georgia. The criteria are different for areas all over the country- in Buffalo, NY part of the criteria includes "7 inches or more in 12 hours or less." This table is included for reference but the information is also included in the video.*

Winter Weather Advisory	Issued when, within the next 36 hours, there is a high probability of enough snow, sleet, or ice to cause inconvenience, but not enough to warrant a warning.
Winter Storm Watch	Issued 12-48 hours in advance of an event for a 50% or greater chance of conditions favorable for a significant winter storm (including heavy sleet, heavy snow, or ice storm). Winter storm conditions include 2 or more inches of snow, ½ inch or more of sleet, or ¼ inch or more of freezing rain.
Winter Storm Warning	Issued up to 36 hours before an event for an 80% or greater chance of a winter weather event that meets at least one of these criteria: • 2 or more inches of snow • ½ inch or more of sleet • ¼ inch or more of freezing rain.

Watch ***Winter Weather Alerts*** video #3.

This video covers winter weather in Georgia and was filmed at the National Weather Service in Peachtree City.

PLEASE DO NOT WRITE IN THIS BOOK.

SECTION 3 – WINTER WEATHER STRIKES

3.1 MAKING A DECISION

PART 1 of 2 – DECISION MATRICES

Making a decision is much easier when you have already learned the outcome. Unfortunately, you usually do not have this advantage and you have to make the best decision that you can with the available information. Sometimes, you can have too much information available and it can be overwhelming. How do you know which information is most useful to the decision that you are making? How do you know which information is not as critical?

Did you feel confused when you made a decision about the sample forecast? Sometimes there is so much information to consider that it can feel overwhelming. Meteorologists often organize the information to make it easier to evaluate and easier to make a decision.

Watch ***PBS Weather Forecasting*** video #2.

Replay video 2 but this time start around the 2-minute mark. This is to remind students about how this meteorologist uses a grid to help organize data for making her forecast (like they will)

In this challenge, your decision is whether or not to close school based on the weather forecasts that are available. To make the decision you need to consider what weather criteria is necessary to close school. Realizing that safety is a primary concern to the superintendent, **what kind of weather would cause the most dangerous road conditions? Snow, sleet, and freezing rain**. Predictions of winter precipitation are not enough to close school. **Superintendents also have to consider the time that the precipitation begins to fall, how long it is predicted to fall, and how much is expected to accumulate. The answers to those questions will influence the decision to close school because of transportation issues.** Do you remember the students that were stranded at school? You definitely want to avoid a situation like that.

To make it easier for you to make a decision, the superintendent's office has provided your team with a Decision Matrix *(the matrix is essentially just a grid or graphic organizer)*. The Decision Matrix separates the different categories found in a forecast (Forecasted Weather Conditions, Temperature, Probability of Precipitation, Frozen Precipitation Amount and Watch/Warning/Advisories) into a chart so that you can study them separately.

There is a lot of information that needs to be considered for each forecast. The conditions in one category won't be enough to influence the decision to close school or not. You will need to consider the conditions in all 5 categories. The Decision Matrix will also help you to compare them to each other. The criteria in each category are based on whether dangerous winter conditions would be present. If the conditions do not pose a threat to canceling school, you should shade that box green. If the conditions do pose a threat then you should shade that box red. In situations where the conditions are in between, you should shade that box yellow.

Forecast Issued	**Forecasted Weather Conditions** Green—Dry Yellow—Rain Red—Frozen Precipitation	**Temperature** Green—40° or higher Yellow—Mid-to-upper 30's (33-39°) Red—32° or less	**Probability of Precipitation** Green- Less than 40% Yellow- 40% to 70% Red-Greater than 70%	**Frozen Precipitation Amount** Green—None, or no accumulation Red-Measurable accumulation	**Watch/ warning/ advisories** Green—none Yellow—Advisory Red—Watch or Warning
Sunday, 4 a.m.					

The first forecast that you considered for the January 28th event was: **Mostly cloudy. Highs in the upper 30s. Northwest winds 10-15 mph.** How does this forecast fit into the Decision Matrix? Look at the example on the next page.

PLEASE DO NOT WRITE IN THIS BOOK.

Forecast Issued	Forecasted Weather Conditions Green—Dry Yellow—Rain Red—Frozen Precipitation	Temperature Green—40° or higher Yellow—Mid-to-upper 30's (33-39°) Red—32° or less	Probability of Precipitation Green- Less than 40% Yellow- 40% to 70% Red-Greater than 70%	Frozen Precipitation Amount Green—None, or no accumulation Red-Measurable accumulation	Watch/ warning/ advisories Green—none Yellow—Advisory Red—Watch or Warning
Sunday, 4 a.m.	Mostly cloudy	Highs in the upper 30s.			

After analyzing the conditions and color coding them, you see mostly green. This indicates non-severe conditions and school would have been kept open. Continue filling out the Decision Matrix for this example forecast and decide whether to close school or keep it open. *If the forecast doesn't include information for some categories, then students should just shade those boxes green.*

Procedure: **(as individuals)**

1. On *Sample Decision Matrix: Student Sheet #2*, use colored pencils to shade the boxes based on the forecast conditions and answer the questions. The forecast for the January 28th event can be found on the next page. *Students need the forecast found on Student Sheet #1 to complete Student Sheet #2 but if they don't have it the forecast has been included on the next page of this SE. At the end of this activity they will have analyzed the same forecast in 2 ways- by underlining & reading the forecast and by shading in the matrix based on criteria.*

Discuss these questions as a class:

1. Did you decide that school should remain open or be closed? Why?
2. How did the Decision Matrix influence your decision?

Forecast Issued	Forecast for Tuesday, January 28th
48 hours	Mostly cloudy. Highs in the upper 30s. Northwest winds 10-15 mph.
40 hours	Mostly cloudy. Highs in the upper 30s. Northwest winds 10-15 mph.
32 hours	Mostly cloudy with a slight chance of snow or chance of freezing rain in the afternoon. Highs in the mid 30s. Northwest winds 10-15mph. Chance of precipitation 30%.
24 hours	Winter storm watch in effect from Tuesday morning through Wednesday afternoon. Chance of snow in the morning then snow likely in the afternoon. Snow accumulation up to 1 inch. Highs in the mid 30s. North winds up to 10mph. Chance of snow 60%.
16 hours	Winter storm watch in effect from Tuesday morning through Wednesday afternoon. Slight chance of freezing rain. Snow and sleet in the morning then snow likely in the afternoon. Snow and sleet accumulation up to 1 inch. Highs in the upper 20s. North winds 10-15 mph. Chance of precipitation 70%.
8 hours	Winter weather advisory in effect from 10am Tuesday to 7am Wednesday. Slight chance of snow in the morning. Then snow likely in the afternoon. Snow accumulation up to 1 inch. Highs around 30. North winds 10-15 mph. Chance of snow 70%.
Decision must be made	Winter storm warning in effect from 9am this morning to 7am Wednesday. Snow and sleet likely in the morning. Then snow and freezing rain in the afternoon. Snow and sleet accumulation of 1-2 inches. Highs in the lower 30s. North winds 5-15mph. Chance of precipitation 80%.

Watch ***Forecast and What Really Happened*** video #4.

This video has 2 parts- the first part reminds students of the forecast for Jan. 28th, the second part describes what actually happened that day. After the video students might want to share their memories of the event.

PLEASE DO NOT WRITE IN THIS BOOK.

PART 2 of 2 – YOUR TURN

Watch ***Blizzard Freak Out*** video #5.

This video shows a forecaster freaking out over a blizzard forecast in Baltimore. It just adds some interest as students transition to the final part of this challenge but can be skipped if you're running short on time (although the "hopefully you can maintain your composure" sentence won't make much sense to students)

The time has come to put your skills to the test. There is a special event coming soon and you need to monitor the forecast. Hopefully you can maintain your composure! The first forecast that you will receive is 48 hours ahead of the date of the event. So if you needed to make a decision to open or close school at 4am on Wednesday, the first forecast you have to analyze is from 4am on Monday.

You will analyze each forecast and fill out the Decision Matrix. You will then create a Tweet that summarizes the forecast for all people who are concerned about school closing that day. When you have completed this, your teacher will give you the next forecast from 8 hours later and you will repeat the steps. You will receive additional information with the last forecast. This is an hourly forecast of the temperature and probability of precipitation. The combination of precipitation and temperature could play an important role in your decision. Remember, the freezing temperature of water is 32 degrees so if it's warmer than 32 the precipitation would be rain. *This paragraph contains critical information about how to complete this activity. Go over it several times with students. Remember there are 3 events to analyze and each pair of students will receive 1 event to work on. You might have to cut the forecast into individual strips to pass out.* ***Do not*** *pass out all 7 forecasts at the same time. Pass them out individually or at the very least 3 at a time and* ***save the final forecast & student page for the end****.*

Procedure: **(working in pairs)**

1. Read the background information and initial forecast for your event.
2. Complete the Decision Matrix for that forecast and create a Tweet that summarizes it on *Making the Decision: Student Sheet #3*.
3. Show your teacher your completed work and then receive the next forecast.
4. Repeat steps 2 and 3.
5. When you receive the last forecast your teacher will give you the *Hourly Temperature and Precipitation Forecast: Student Sheet #4* to complete and consider for your final decision.

3.2 ANALYZING YOUR DECISION

Now that your group has decided whether to close school or keep it open, you will meet with other groups to share your work and analyze the decisions that were made. Would you have made the same decision they did based on those forecasts? *Combine 3 groups together so they can all share their forecasts/decision matrices and final decisions. As students share information, the other students should offer feedback and see if they agree with the decisions that were made. You will have to give each larger group a copy of the forecasts for each event (easier if they are on a complete sheet of paper so if you cut up all the forecasts, print uncut ones from the Google Drive)*

Discuss these questions as a group:

1. For each of the events, should school remain open or be closed? Why?
2. How did the Decision Matrix influence your decisions?

3.3 SUMMARY

After each event meteorologists look back at previous forecasts to determine how their forecast compared to what actually happened. These reflections help them improve their forecasts for the next time the atmosphere presents similar conditions. Similarly, after major weather events, school officials will also reflect on their decisions to determine if they made the right choice on whether to close school or to keep it open. You will also evaluate your decision on whether to close school or to keep it open. Now that you have made your decision, let's find out what actually happened.

Watch ***Event Recaps*** video #6.

Play as much of these videos that you would like based on the amount of time available in class

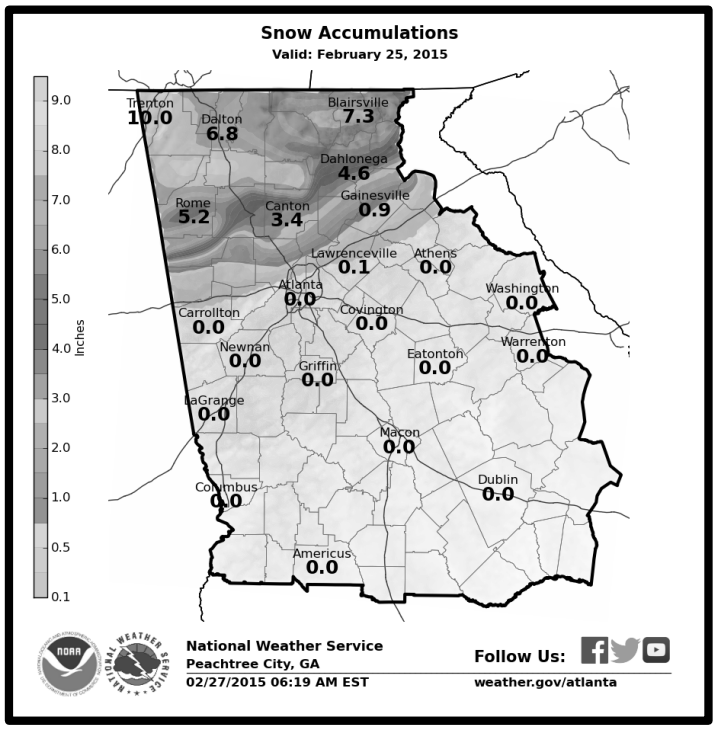
PLEASE DO NOT WRITE IN THIS BOOK.

Discuss these questions as a class:

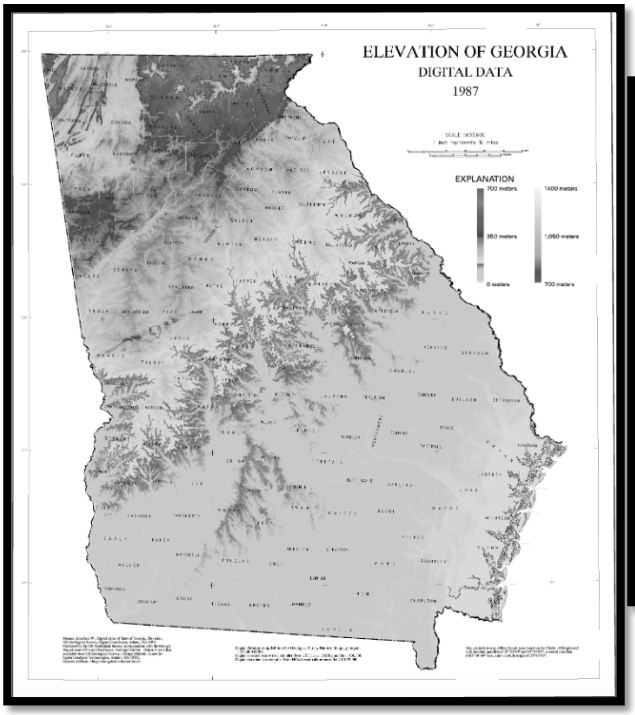
1. For each of the events, should schools have remained open or be closed? Why?

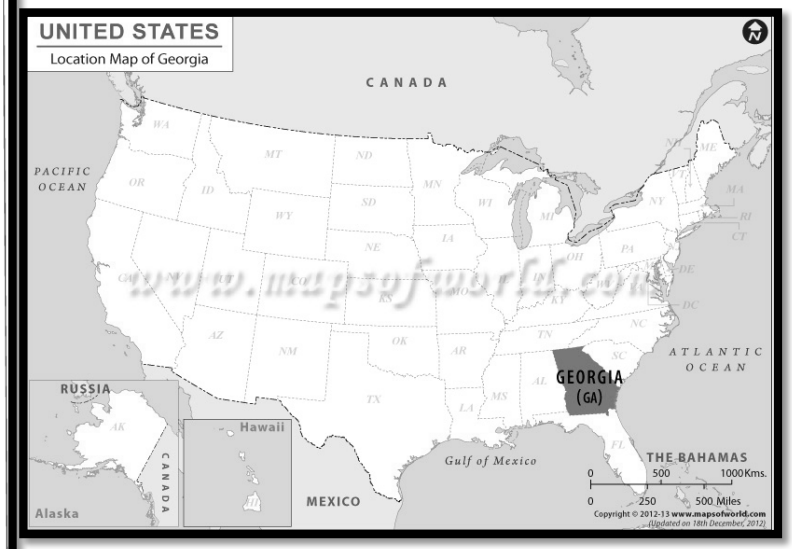
Event 1 is the focus of some additional add to your understanding text on the following pages.

Forecasting winter weather in Georgia is challenging. This is due to the large elevation changes across the state and nearby warm air from the Gulf of Mexico. In Event 1, the National Weather Service issued a Winter Storm Warning for the forecast area. The mountainous areas in north Georgia received between 7 and 10 inches of snow. However, the metro-Atlanta area did not experience snow because ~~of~~ warmer air from the Gulf of Mexico moved into the region, changing the precipitation to rain. The rain/snow division line is the border between the green and blue shaded areas. If that line had shifted farther south Atlanta could have received a few inches of snow. Accurately predicting where that rain/snow line will be is a goal for all meteorologists forecasting winter weather.



PLEASE DO NOT WRITE IN THIS BOOK.





In this elevation map of Georgia on the left, the purple and red colors have the highest elevation and the pale green has the lowest elevation. The map on the right shows you the location of Georgia in the United States and you can see how close it is to the Gulf of Mexico. For Event 1, the storm warning areas occurred for the central light blue area and a few areas of the dark blue area. As you can see, this area is at the foothills of the mountainous area of the state of Georgia.

In Event #1, some schools in the metro area remained open while others decided to close. Some schools originally announced they were open, then announced a delayed start or closure even though some students were already dropped off at school. This meant those students needed to be picked up by their parents. This caused a lot of anger and confusion among many school stakeholders (families, bus drivers, school employees, etc.). The districts north of the metro area received snow so many families felt closing school was necessary, but they were not happy that the decision was made so late. In districts that closed where only rain was reported, there was much frustration voiced to school district officials. In many cases, those families had to take off work or make alternate arrangements for their children when they found out that school was cancelled. *This section reminds students of the school decisions that are made based on the weather and the trade-offs*

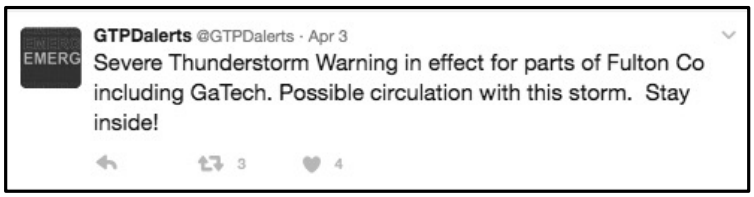
PLEASE DO NOT WRITE IN THIS BOOK.

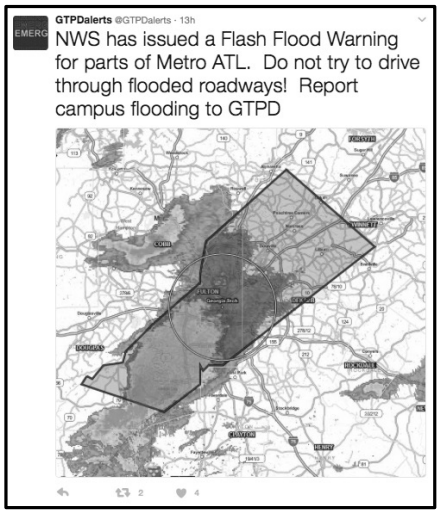
SECTION 4 – THE IMPACT OF WEATHER AT GEORGIA TECH

In this module, you learned more about winter weather and what information is most helpful making a local decision regarding school closures. The weather can also have a huge impact on colleges and universities. William Smith is the Director of Georgia Tech's Office of Emergency Preparedness and part of his job is to keep an eye on dangerous weather conditions.

He uses his specialized training in disaster management and meteorology to analyze the weather conditions and keep the Georgia Tech community informed about impending threats. He relies on weather data from the National Weather Service, the three WeatherSTEM weather stations located on the Georgia Tech campus and other sources.

Prior to working at Georgia Tech, he worked as the Operations Officer for the Atlanta-Fulton County Emergency Management Agency. He worked through natural disasters such as the Downtown Atlanta Tornado of 2008! He understands how important it is to analyze weather conditions and alert the community in a timely manner. How does he communicate threatening weather conditions to the Georgia Tech community of thousands of people? One way is through Twitter.





Weather conditions can affect campus life in many ways. A snow or ice storm may result in classes being cancelled. The threat of heavy rain showers may cause an outdoor graduation ceremony to be held indoors instead. Fast moving severe thunderstorms can affect students that are outside walking to class. Lightning may result in sporting events to be delayed. For Will, and others with similar jobs at other colleges and universities, paying careful attention to the weather and communicating dangers with school officials keeps the community safe. As you will learn in the video, lightning is a major threat for college football games and rules exist for spectator safety.

Watch ***Lightning and College Football*** video #7.

PLEASE DO NOT WRITE IN THIS BOOK.

Georgia Tech

Center for Education Integrating Science, Mathematics & Computing

This curriculum is produced by Advanced Manufacturing & Prototyping Integrated to Unlock Potential (AMP-IT-UP) supported by National Science Foundation Award #1238089 through Georgia Institute of Technology's Center for Education Integrating Science, Mathematics, and Computing (CEISMC).

For more information about AMP-IT-UP
and to download our curriculum,
please visit our website at www.ampitup.gatech.edu.