Throughout the guide, teaching tips are in red.

Activity Description & Estimated Class Time

These activities require three 50-minute sessions. In the first two 50-minute sessions, students work in teams to create maps showing locations of the jet stream, the Bermuda High, and regional air masses during four historical weather events: a snowstorm, a week of temperatures above 100, a hurricane, and a cool dry spell. Students first read about how the jet stream, Bermuda High, and regional air masses can shape weather events, and the teacher demonstrates applying this information to a heavy rain event in North Carolina in 2010. Later, teams place weather factors on a map, with a rationale for the placement. Then, two teams working on the same event combine efforts to agree on a single map. The combined teams present the map and their reasons in a 1-minute report. After each presentation, the teacher projects the actual positions of the jet stream, Bermuda High, and regional air masses on the date of the event. In the third 50-minute session, teams use the map to illustrate ocean temperatures in the Atlantic and Pacific and the longer-term conditions that these temperatures produce. The class is challenged to apply information about these currents to predict longer term conditions.

Objectives

Students will demonstrate knowledge and understanding of the following ideas and content:

- quantifying temperature, wind direction and speed, and precipitation;
- jet stream movement and its influence on local weather;
- Gulf Stream and Pacific currents and their influences on local weather.

Student teams will demonstrate this knowledge and understanding by giving reasoned explanations for probable positions of the above factors during weather events including:

- a snowstorm,
- 5 days of temperatures above 100,
- a hurricane,
- a cool dry spell;

Teams will speculate about the role that ocean currents play in establishing longer-term conditions within which the above weather factors operate.

Correlations to North Carolina Science Standards

5.E.1.3 Explain how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.

Brief Science Background

Global patterns of moving air and water shape local weather. For example, year-round warmth in low latitudes and cold in higher latitudes drive continuous fast air currents that circle the globe to shape weather. These fast air currents are called the jet streams. On a regional scale, hot, cold, moist, or dry conditions on the ground transfer their characteristics to large air masses above them. These air masses interact to drive weather. Tracking air masses is a tool for predicting local weather. One such air mass is the Bermuda High, which moves from place to place over the Atlantic. Its position spells drought or deluge in North Carolina. Ocean currents such as the Gulf Stream or El Niño are great undersea rivers that move heat over great distances and over long periods of time. They influence multi-year weather patterns over whole continents.

Part 1 — Big Picture Weather (two 50-minute sessions)

Materials

Materials for the whole class

- internet access
- equipment to project: BLM 1 The Big Rain, September 27, 2010 and other BLMs listed below
- BLM 2 Blank Map of the Continental US to project and photocopy 2 per team
- 8 photocopied sets of three *Weather Factor Readings*. You will also project them:
  - BLM 3 The Jet stream
  - BLM 4 Regional Air Masses
  - BLM 5 The Bermuda High
- BLM 6 *Weather Data Sheet*, The Big Rain, September 27, 2010
- *Weather Event Sheets,* make two copies each:
  - BLM 7 The Cold Snap, February 2, 2009
  - BLM 8 The Heat Wave, June 30, 2012
  - BLM 9 Hurricane Irene, August 27, 2011
  - BLM 10 The Snow Storm, December 26, 2010
- *Weather Data Sheets* to project only (no photocopies needed):
  - BLM 11 The Cold Snap, February 2, 2009
  - BLM 12 The Heat Wave, June 30, 2012
  - BLM 13 Hurricane Irene, August 27, 2011
  - BLM 14 The Snow Storm, December 26, 2010

Materials for groups of 2 students

- BLM 2 Blank Map of the Continental US.
- one of BLM 7-10 *Weather Event Sheet* (one for a specific weather event)
- one set of three *Weather Factor Readings*
- a *Weather Data Sheet* for the team's weather event to project

Preparation

1. Have a *Weather Event Sheet* for each team (copy as needed).
2. Copy sets of *Weather Factor Readings* (3 sheets each, one set per team).
3. Copy one blank map of the Continental US for each team.
4. Be prepared to project all five *Weather Event Data* sheets, one at a time, via a document camera, OR copy as needed to have the sheet matched to the weather event for each team.

Procedure

1. Introduce the whole class to weather over the US. Ask students how they imagine wind blowing over the whole country: all in the same direction? swirling around? Project the web site http://hint.fm/wind/ and discuss what students notice about it. The moving white lines show ground-level wind over the whole US, updated hourly. Clicking on the map zooms in. Dragging moves the whole map. Call attention to the key at the left of the display that indicates wind speed. It is interesting to project today's weather map and alternate it with the wind patterns site. From this, students can see clear relationships between wind patterns, fronts, and areas of low and high pressure. The discussion sets the stage for understanding that air masses exist, that larger forces are moving the air masses around, and that all of this affects local weather.
2. Ask students what they have heard about things such as the jet stream, cold fronts, low pressure areas, and the Bermuda High. Explain that these are three of the big factors that affect local weather on the East Coast like the Big Rain Event described in BLM 1. Read or project the first paragraph of BLM 1.
3. Form 8 student teams and give each team a set of BLM 3-5 *Weather Factor Readings*. Explain that these short readings are about three factors that influence weather over the Eastern the US. Give teams about 5 minutes to read these. Afterward, project BLMs 3-5. Go over these one at a time to help students understand them and to apply clues. The goal is to prepare students to draw the locations of the jet stream, regional air masses, and Bermuda High on the blank map for the weather event described in BLM 1. Project BLM 1 again to briefly review the weather event; then go over BLMs 3-5 as follows:
   - Project and discuss BLM 3, *The Jet Stream*. Point out that there is warm air on one side of the jet stream and cold air on the other. It seems likely that the jet stream moved south, near NC, and brought cool air. Warm air to the south of it would hold a lot of water vapor. The cold air would cool the warm air to make it rain. Go back to the blank map on BLM 2 and draw in a path of the jet stream dipping south of NC and going up through the center of the state.
   - Project and discuss BLM 4, *Regional Air Masses*. From it, conclude that there must be high pressure to the south causing wind to blow north, and that the area of rain must be low pressure, probably over Eastern NC. On the BLM 2 blank map, draw in a high (H inside a circle) to the south of NC near Florida and a low over Eastern NC (L inside a circle).
   - Project and discuss BLM 5, *The Bermuda High*. Point out that the storm lasted a long time, so a wind blowing steadily in the same direction must have kept bringing it for a long time. Air circulates clockwise around the Bermuda High. If the Bermuda High is in the right place, it can produce a steady wind up the East Coast. On the BLM 2 blank map, draw in the Bermuda High over the Atlantic fairly near NC.

- Project BLM 6, *Weather Data Sheet* The Big Rain, September 27, 2010. Explain that it shows the actual locations of the jet stream, air masses, and Bermuda High on that date. Discuss as needed.

  This is a good break point if you are near the end of a class period.

6. Distribute all four of BLMs 7-10 among the 8 teams so that 2 teams are working with each event. The four events are as follows:

   - BLM 7 The Cold Snap, February 2, 2009
   - BLM 8 The Heat Wave, June 30, 2012
   - BLM 9 Hurricane Irene, August 27, 2011
   - BLM 10 The Snow Storm, December 26, 2010

   Allow about 3 minutes for a team member to read the event aloud and show diagrams to the others. When teams finish reading, explain that they have 10 minutes to discuss where air masses, the jet stream, and the Bermuda High might have been on the date of their historic weather event, then draw these on their blank map (BLM 2). They will use the packet of three Weather Factor Readings (BLMs 3-5) to decide where to put these, and to provide written reasons for drawing each weather factor where they did. These reasons are their "Big Picture Weather Report." Teams are making reasoned guesses here. They do not need a "right answer" but they do need to give *reasons* for locating the factors on the map.

7. Ask each team to find the other team that worked on the same weather event. Give each pair of teams 5 minutes to agree on one map of the weather factors. Each 2-team group will present a 1-minute Big Picture Weather report to the whole class.

Wrap-Up

1. One at a time, project BLMs 11-14 *Weather Data Sheets* matched to the weather events. Explain that each *Weather Data Sheet* shows actual locations of weather factors during the weather events. Discuss student predictions in comparison to actual locations of the weather factors.
2. Remind students that they gave reasons for putting the jet stream, Bermuda High, and air masses at certain places on their maps for their weather events. Ask if actual locations of weather factors seem consistent with the *Weather Factor Readings*. Take questions.

Answer Key

<u>BLM 7 The Cold Snap, February 2, 2009</u>

Because the cold lasted a long time, a high pressure air mass must have moved over NC, and indeed the *Weather Event Sheet* explains that high pressure was moving in from the West. Because it was especially cold, the jet stream had probably moved south of North Carolina and remained in place, bringing Arctic air and keeping it there. Lack of snow indicates that low pressure was probably not nearby. For the cold to last, air currents would have been steady. Either the slow-moving Bermuda High was nearby and promoting a steady air current, or it was far away and producing no northerly air currents along the NC coast.

<u>BLM 8 The Heat Wave, June 30, 2012</u>

Because the air was hot, it is unlikely that any Arctic air was in the region, so the jet stream was probably north of NC. Because the heat wave was long-lasting, the mass of hot air probably sat still over NC for a long time. Because very little rain had fallen, the air mass over NC was probably a high pressure air mass. Because the high pressure air mass remained in place, either the Bermuda High was positioned nearby to keep it in place, or it was unusually far away (as it proved to be). In any case, air currents were not available to move the large mass of hot air.

<u>BLM 9 Hurricane Irene, August 27, 2011</u>

A hurricane is a large, warm, wet, low pressure air mass. For such an air mass to be in North Carolina, the jet stream would have to be to the north. To bring a hurricane across the Atlantic, the Bermuda High would have to be positioned so that winds turning clockwise around it could bring a storm across its southern edge. The Bermuda High would also have to be positioned so that its surrounding circle of wind, with a little help from a high pressure air mass in the Gulf of Mexico, could turn a storm north up the East Coast. For that to happen, the Bermuda High would be somewhere near the middle of the Atlantic.

<u>BLM 10 The Snow Storm, December 26, 2010</u>

For a snowstorm lasting several days to develop in North Carolina, a large low pressure area would have to be over the state to bring moisture for the snow. To be large, a low pressure area might come from the Atlantic or the Gulf of Mexico. The Bermuda High being far away would allow such a low pressure area to develop in the Atlantic. Also, for a long-lasting snowstorm to develop, very cold air (below freezing) would have to collide with warm air. For this to happen, the jet stream would have to be south of North Carolina.

Guided Practice

Guided Practices are similar to typical tests, but require students to reveal their thinking about content. They serve as a practice before a test and should not be graded. They are intended to expose misconceptions *before* an assessment and to provide opportunities for discussion, re-teaching, and for students to justify answers. They are best given as individual assignments without the manipulatives used in the activity. In that context, pose the following "test items" to the class. Ask them to write responses in notebooks.

Choose the response that best completes the following sentences.

1. To be called an "air mass," a body of air must…

   a. …include areas of different pressure, temperature, and humidity.
   b. …be large, possibly covering several states, and be of consistent temperature, pressure, and humidity.
   c. …have low pressure, cool dry air, and winds circulating clockwise.
   d. … have high pressure, contain warm moist air, and have winds circulating counterclockwise.

2. The Bermuda High…

   a. …is a small air mass that moves quickly between Bermuda and the Bahamas, keeping temperatures high and bringing week-long rainstorms.
   b. …is an air mass in the Pacific Ocean that keeps states in the western US dry for most of the year.
   c. …is a dome of dry, high pressure air, thousands of miles across and several miles high in the Atlantic that can cause drought or bring hurricanes to the Eastern US.
   d. …is a region of low pressure over Bermuda that can become a hurricane when cool fall weather approaches.

3. Jet streams…

   a. …are long, thin, clouds made by jet airplanes, traveling several hundred miles per hour and forming white streaks in the sky.
   b. … are jets of air moving from west to east at about 20 miles per hour through the clouds.
   c. …are fast jets of air hundreds miles wide generated by clouds during rain storms that move from east to west. They bring cold weather to the south when they move north.
   d. … are powerful, streams of air a few miles wide moving generally from west to east at about 100 miles per hour 30,000 feet above the earth. When they move south, southern weather can turn cold.

Part 2 — Weather from the Oceans (30-minutes)

Materials

Materials for the whole class

- BLM 1 and 2 to project:
- BLM 15 *Weather Factor Reading* Ocean Currents to project and copy
- *Weather Event Sheets* to Project:
  - BLM 7 The Cold Snap, February 2, 2009
  - BLM 8 The Heat Wave, June 30, 2012
  - BLM 9 Hurricane Irene, August 27, 2011
  - BLM 10 The Snow Storm, December 26, 2010

Materials for each student

- one *Weather Factor Reading* BLM 15 Ocean Currents

Preparation

1. Copy *Weather Factor Reading* BLM 15 Ocean Currents, one per student
2. Be ready to project the BLMs listed above, and if needed, BLM 2 Blank Map of the Continental US.

Procedure

1. Give each student a copy of BLM 15 *Weather Factor Reading* Ocean Currents and allow about 3 minutes for students to read it. When teams finish, project BLM 15, take questions, and clarify as needed. Explain that ocean currents create a general pattern of weather over a few years. If necessary for explanation purposes, project BLM 2 Blank Map of the Continental US.
2. Project BLM 1 and point out some "long term conditions" given for the event:
   - "Much of Eastern North Carolina was in drought, with less than 30 inches for the year."
   - "It had been a hot, dry summer."
3. Draw attention to the date, September 27, 2010 and ask the class: "What evidence can you find that indicates whether this was during an El Niño or a La Niña?" Give the class a chance to find the information that says "The most recent La Niñas were in 1998, 2008, and a strong one in 2010-11."
4. Ask the class to search the reading to find what long term effects La Niñas might have in North Carolina (OPPOSITE to El Niño, so it would be a warmer and drier year in the Southeast). Overall, except for this rain storm, the La Niña had made 2010 warm and dry.

5. Explain that the Gulf Stream does not vary as much as El Niño, so it is not as responsible for long term weather changes. Nevertheless, it does affect weather. Show BLM 1 and ask the class to search the reading again for what the Gulf Stream might have contributed to the storm: a stream of air "brought moisture up from the warm waters of the Gulf Stream near Florida."

Wrap-Up

One at a time, project BLMs 7, 8, 9 and 10. While each one is projected, ask the class to figure out whether it was an El Niño or La Niña year, and to find clues about long term conditions during the year of the event. Ask them for evidence that the El Nino and La Nina patterns do or do not hold up to the evidence.

- BLM 7— The year was 2009, an El Niño year, and "The winter of 2009 had been colder than usual."
- BLM 8—The year was 2012, an El Niño year, and "the early and late summers of 2012 were somewhat cooler and wetter than previous years…"
- BLM 9—The year was 2011, a La Niña year, and "the summer of 2011 had been somewhat warm and dry."
- BLM 10— The year was 2010, a La Niña year, and "The winter was generally warmer and drier than usual."

BLM 1 *Weather Event Sheet* The Big Rain of September 26, 2010

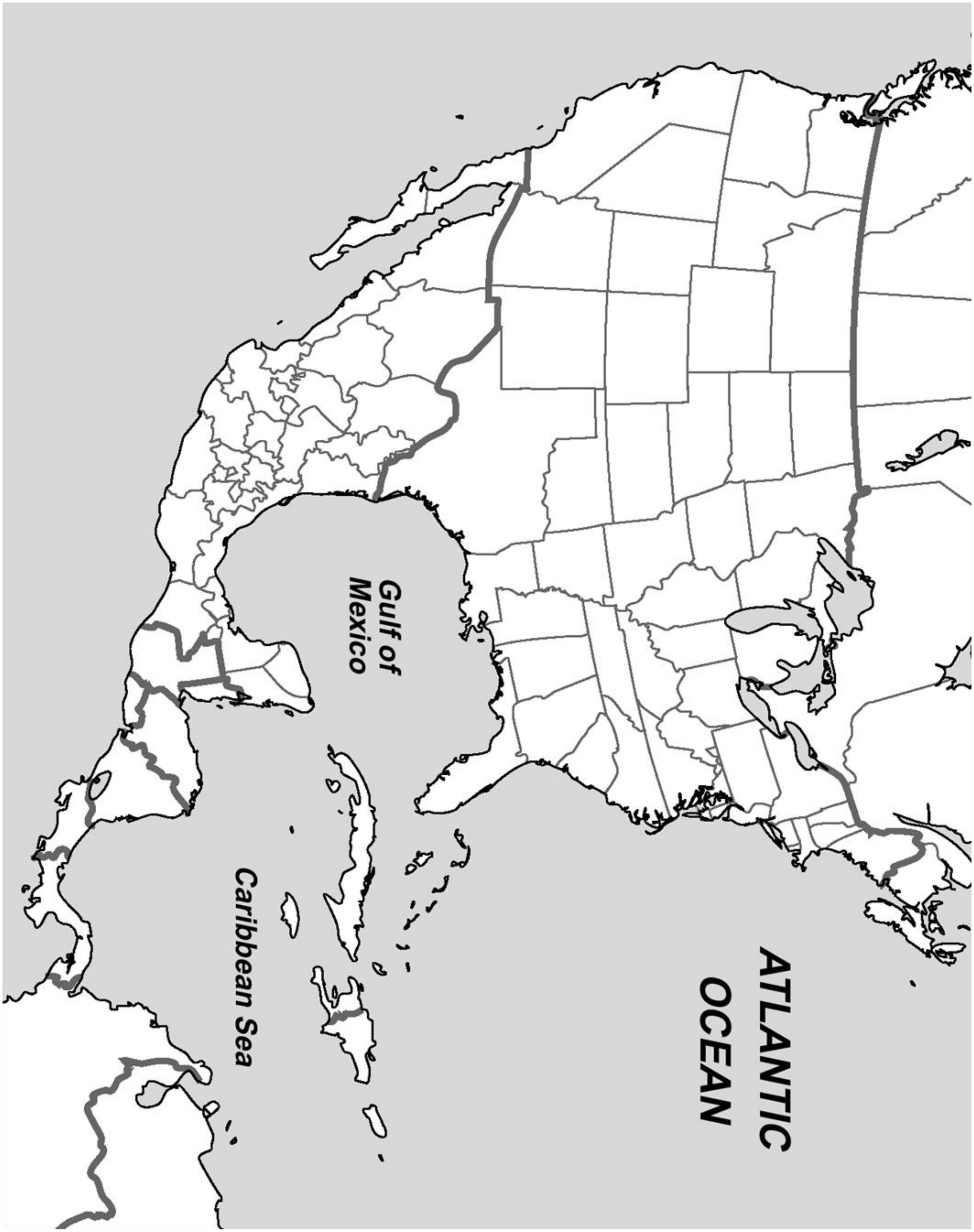
On Sunday, September 26, 2010, the year's rainfall stood at 16 inches below normal. Much of Eastern North Carolina was in drought, with less than 30 inches for the year. It had been a hot, dry summer. However, during the next few days, Eastern North Carolina experienced more rain than had fallen in a single storm since Hurricane Floyd. In 42 hours of non-stop rain, 22 ½ inches fell in Wilmington, with more than 20 inches across New Hanover and Pender Counties.

This rain was not a hurricane or a tropical storm. Instead, high pressure over the western Atlantic (the Bermuda High), high pressure in the Gulf of Mexico, and a low pressure area over Eastern North Carolina produced a constant stream of air that brought moisture up from the warm waters of the Gulf Stream near Florida to collide with unseasonably cool dry air brought by an unusual turn of the jet stream. These conditions lasted for two full days.

To see the NOAA Weather Archive about this event, paste the following URL into your browser.

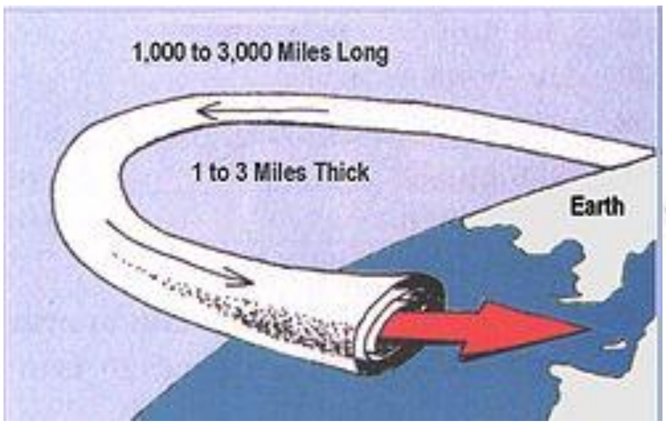
http://www.erh.noaa.gov/ilm/archive/09-30-10/historical_rain.html

BLM 2 Blank Map of the US

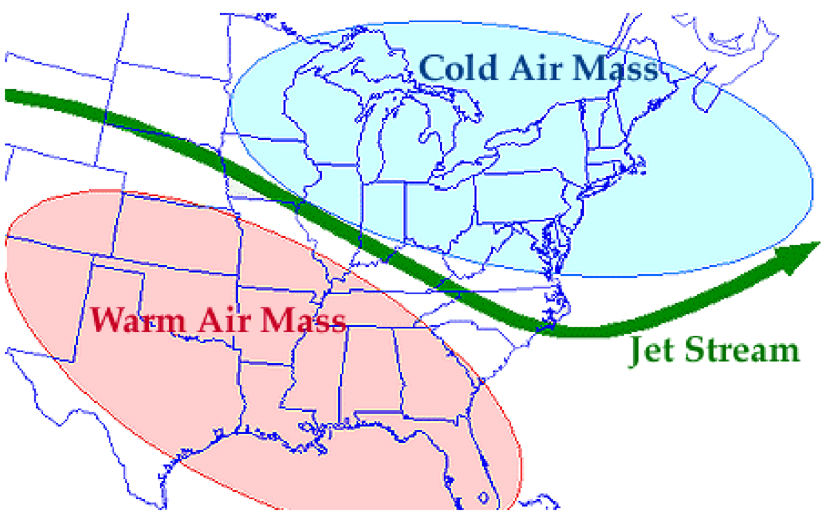


BLM 3 *Weather Factor Reading* The Jet stream

Jet streams are fast, high air currents flowing about as high as jet airliners fly, around 30,000 feet, traveling west to east along a wandering path. Only several miles wide, they usually move at 100 miles per hour, and have been clocked at 247 miles per hour. They may start, stop, split, or combine. The strongest jet streams are those closest to the poles. A northern “polar” jet stream crosses the US. Even though jet streams are above the part of the atmosphere where most weather takes place, their positions can tell us a lot about the weather.



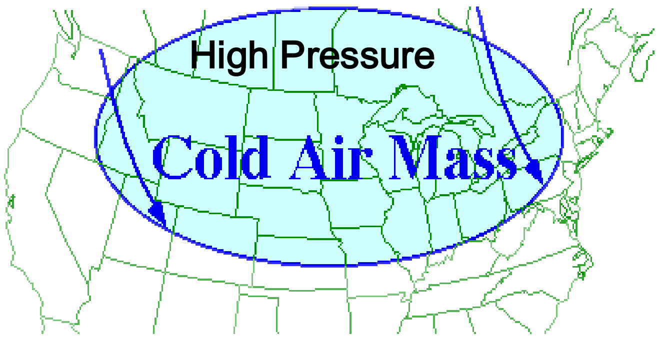
Jet streams are driven by the rotation of the earth and differences in temperature between warm regions nearer the equator and cold regions nearer the poles. As a result, a jet stream traveling over the US always has cold air to its north and warm air to its south. When the jet stream moves south, southern states experience cool, often dry weather. Where it moves north, northern states experience warm weather.

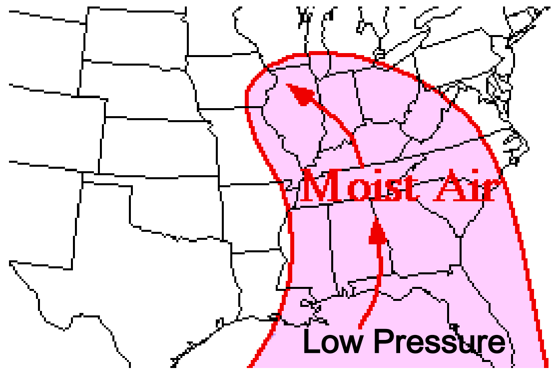


BLM 4 *Weather Factor Reading* Regional Air Masses

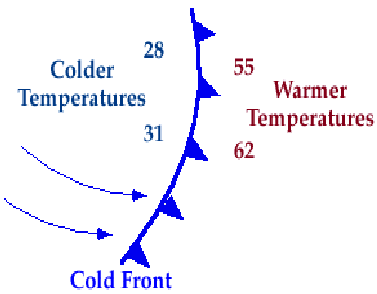
BLM 4 – *Weather Factor Reading* Regional Air Masses

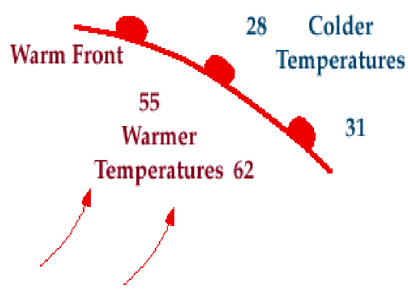
Large bodies of air, called air masses, sometimes cover several states with similar temperature and moisture. They form when air remains over a place long enough to take on characteristics from the surface. Over the Gulf of Mexico, air masses take on heat and moisture from the warm water below. When it moves north, this air carries warm moist air into the US to cause rain, snow, or sleet.

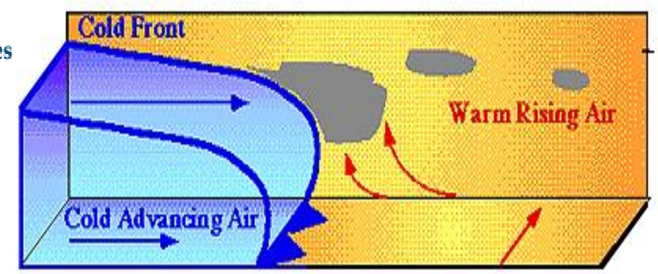




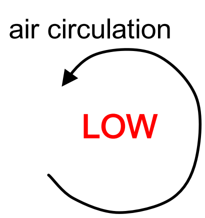
Snow and long cold nights cool the air over northern Canada in the winter. As this air mass moves south, it makes the northern US very cold. Even North Carolina sometimes gets a blast of cold when this air mass moves south. The places where different air masses meet are called “fronts.” Rain or snow often appear near fronts. The leading edge of a cold air mass is called a cold front, and the leading edge of a warm air mass is called a warm front. Fronts are shown as lines with bumps or triangles to show the direction they are moving.

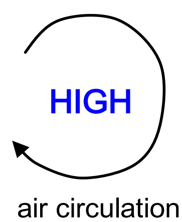






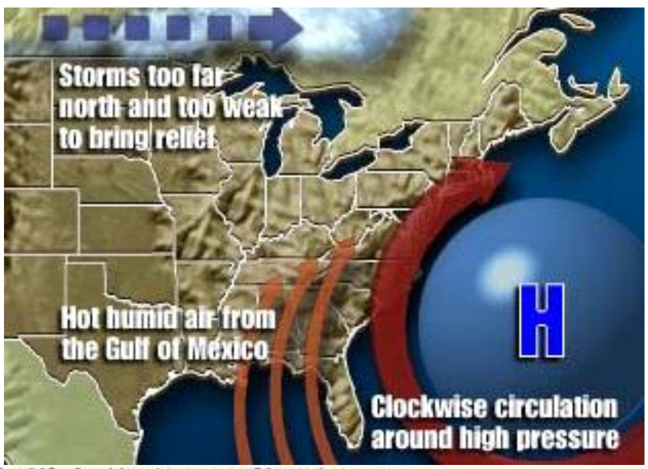
Air circulates clockwise around high pressure areas and counterclockwise around low pressure areas.

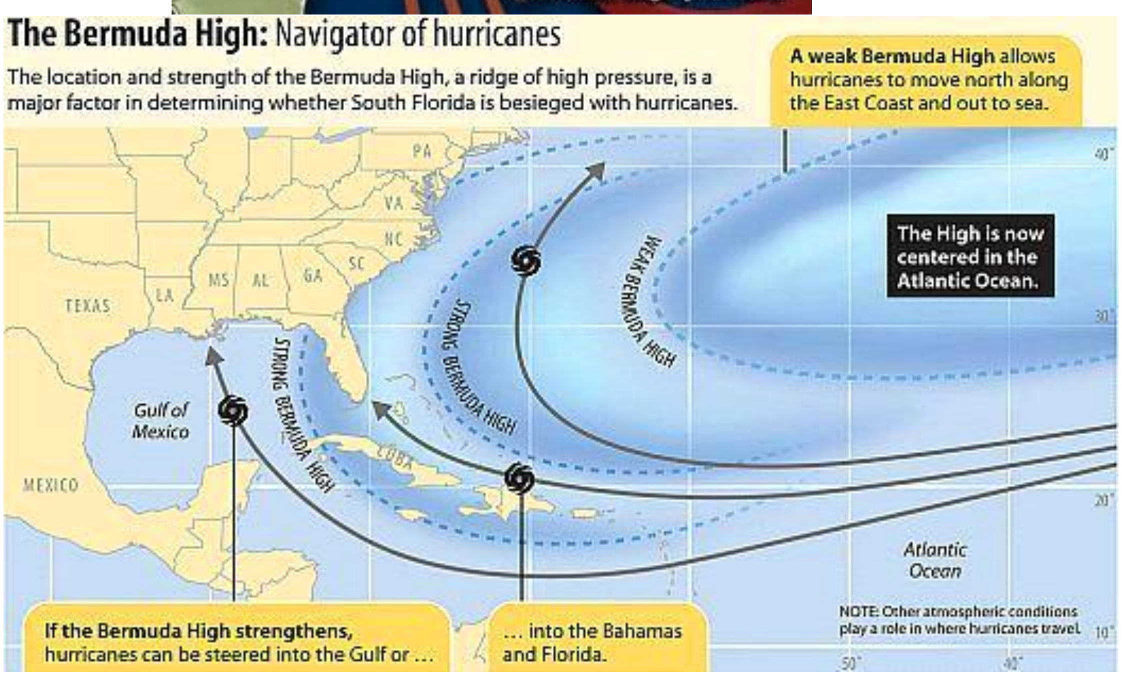




BLM 5 *Weather Factor Reading* The Bermuda High

In the Atlantic between Africa and Bermuda, moisture in the air condenses over cool water and falls as rain, leaving behind a dome of cool, dry, high pressure air. This air, called the Bermuda High, can be two thousand miles wide and several miles high, and is relatively slow-moving. As the Bermuda High moves slowly around the Atlantic, it influences weather in the US. In winter, when it is far from the East Coast, storms can move west to east across the US to shower the Southeast. In the summer, when the Bermuda high is near the US, it pushes storms coming from the west to the north, causing them to miss the South. Without the storms, the Southeast can experience drought. Air circulating clockwise around the Bermuda High brings hot humid air from the Gulf of Mexico. This air makes the Southeastern summer hot and humid, producing occasional afternoon thunderstorms. Air circulating clockwise around the southern edge of the Bermuda High also brings hurricanes across the Atlantic from the tropics. When the Bermuda High is closer to the US, it can bring storms up the East Coast. When it is farther way, it steers storms out to sea.





BLM 6 *Weather Data Sheet* The Big Rain, September 27, 2010

September 27, 2010

BLM 7 *Weather Event Sheet* The Cold Snap, February 2, 2009

Read the weather event below. Use information from the three *Weather Factor Readings*: Jet stream, Regional Air Masses, and the Bermuda High to make an informed guess as to where the jet stream, nearby air masses, and the Bermuda High might have been at this time. Label and draw all three factors on the Blank Map of the US. Write reasons for placing each factor where you did.

Cold Snap
The winter of 2009 had been colder than usual, but on February 2, 2009, the coldest weather in years hit Central North Carolina. Although temperatures did not reach record lows, the National Weather Service pointed out that the cold weather lasted much longer than usual. For a week in areas from Raleigh west, temperatures rarely warmed above freezing, even at the warmest part of the day. Every night, lows were in the teens. January 1977 was the last time a cold snap like this visited central North Carolina. A chill advisory was issued for the mountains. After the temperature dropped below freezing on Friday evening, it did not get above 32 degrees again until the following Tuesday. The US Weather Service warned people to check their pipes and bring their pets inside.

During these few days, high pressure was moving in from the West. The jet stream had wandered much farther south than usual and remained in place. Meanwhile, the Bermuda High was hovering near the East Coast of the US, providing additional, dry, high pressure air.

BLM 8 *Weather Event Sheet* The Heat Wave, June 30, 2012

Read the weather event below. Use information from the three *Weather Factor Readings*: Jet Stream, Regional Air Masses, and The Bermuda High to make an informed guess as to where the jet stream, nearby air masses, and the Bermuda High might have been at this time. Label and draw all three factors on the Blank Map of the US. Write reasons for placing each factor where you did.

The Heat Wave

The early and late summers of 2012 were somewhat cooler and wetter than previous years, but June was very dry, with just a few rare afternoon showers. Then, from June 29 through July 9, 2012, the daily high temperatures in Central North Carolina stayed above 100˚ F. On June 30, Asheville set its record high for that date at 98˚ F and Wilmington set its high for the date at 104 ˚ F. Across Central North Carolina, temperatures reached 102˚ F on June 30, and 100˚ F on June 1 and 2. Heat advisories were issued throughout this time. On June 30, Raleigh and Charlotte matched their hottest temperatures ever at 105˚ F in Raleigh, and 104 in Charlotte. Fayetteville also set a record for the day at 102˚ F.

By June 29, 2012, a high pressure air mass had sat over hot dry conditions in North Carolina without moving for several weeks. The jet stream was traveling across Southern Canada, bringing no cool air southward, and the Bermuda High was far out to sea. Without these strong air currents to move the large mass of dry, high pressure air over North Carolina, the air mass simply heated up day after day, like an oven kept on for days on end.

BLM 9 *Weather Event Sheet* Hurricane Irene, August 27, 2011

Read the weather event below. Use information from the three *Weather Factor Readings*: Jet stream, Regional Air Masses, and the Bermuda High to make an informed guess as to where the jet stream, nearby air masses, and the Bermuda High might have been at this time. Label and draw all three factors on the Blank Map of the US. Write reasons for placing each factor where you did.

Hurricane Irene

The summer of 2011 had been somewhat warm and dry, but at about 7:30 a.m. on August 27, 2011, Hurricane Irene moved up the Eastern Seaboard to strike the Outer Banks of North Carolina with sustained winds of 85 mph and gusts up to 100 mph. Irene was a Category 1 storm. By 2 pm, Irene was about 45 miles northwest of Cape Hatteras, moving northeast at about 15 mph. Two men were killed by falling tree limbs, and a driver died when his car struck a tree. An 11-year-old boy died in Newport News when a tree fell on his home. The storm knocked out power to nearly 800,000 homes in North Carolina and Virginia. New York City shut down its subway system for the first time because of a storm.

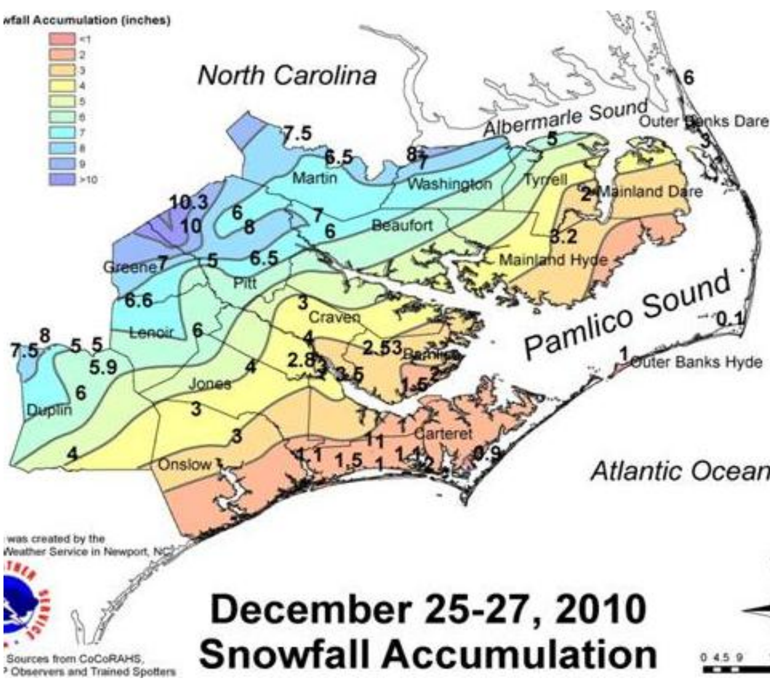
Hurricanes are low-pressure air masses carrying large amounts of moisture, with winds spiraling counter-clockwise inward toward their centers. Earlier in August, the Bermuda High had been in the middle of the Atlantic, well positioned for its clockwise stream of winds to bring Irene westward along its southern edge from the African tropics toward the US. By August 27, it was in place to funnel the weather system up the East Coast, with high pressure in the Gulf of Mexico to help turn the storm north up the coast. The jet stream, then in Canada, did not disturb the progress of the storm.

BLM 10 *Weather Event Sheet* The Snow Storm, December 26, 2010

Read the weather event below. Use information from the three *Weather Factor Readings*: Jet stream, Regional Air Masses, and The Bermuda High to make an informed guess as to where the jet stream, nearby air masses, and the Bermuda High might have been at this time. Label and draw all three factors on the Blank Map of the US. Write reasons for placing each factor where you did.

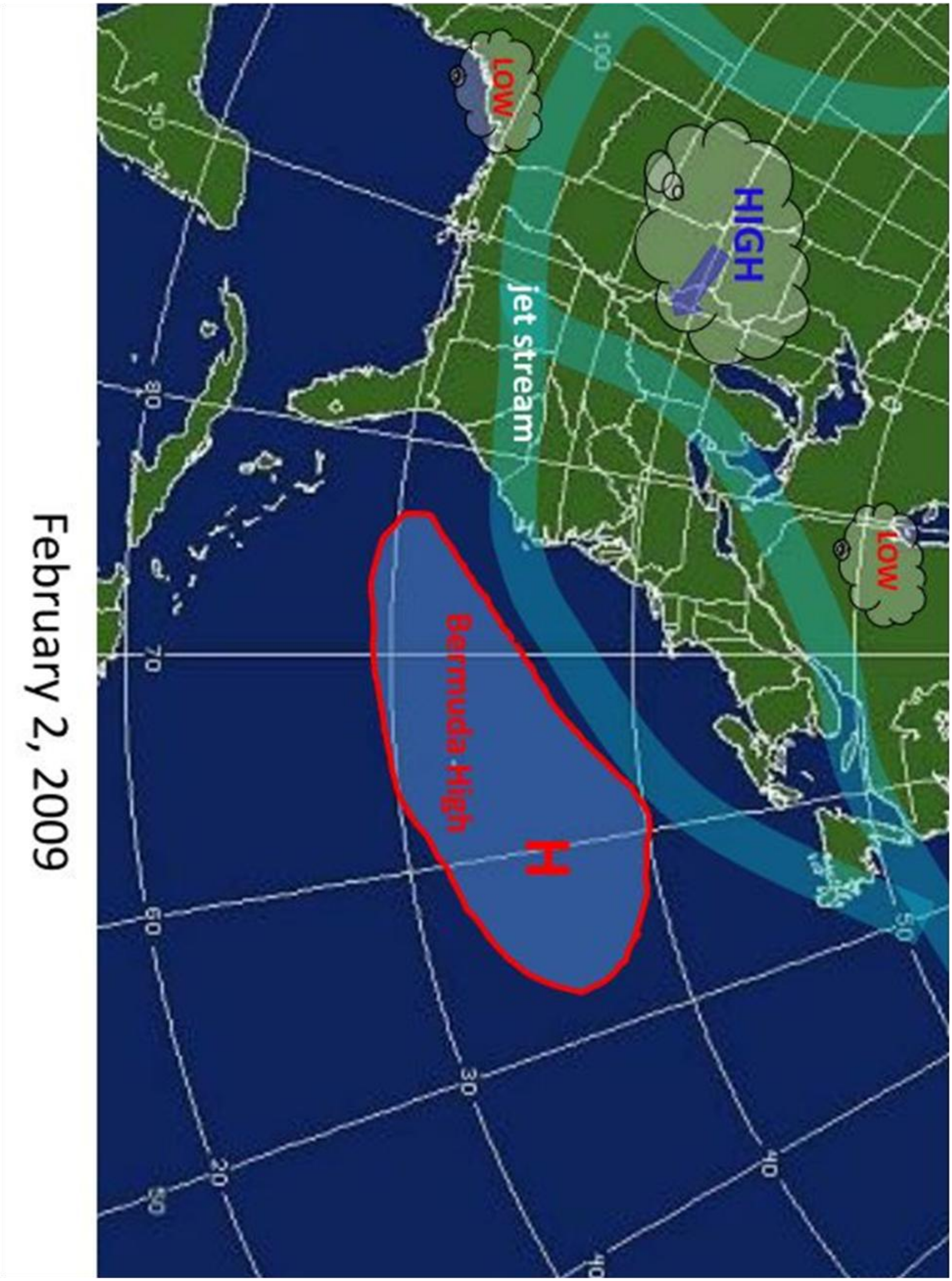
The Snow Storm

The winter of 2010 was generally warmer and dryer than usual, but between December 25 and December 27, 2010, a powerful winter storm dropped up to 10 inches of snow in parts of Central North Carolina. Homes lost power and businesses closed for several days. The area in darker blue on the map at the left below received more than 10 inches of snow. Snow blanketing North Carolina was visible from satellites above the earth.

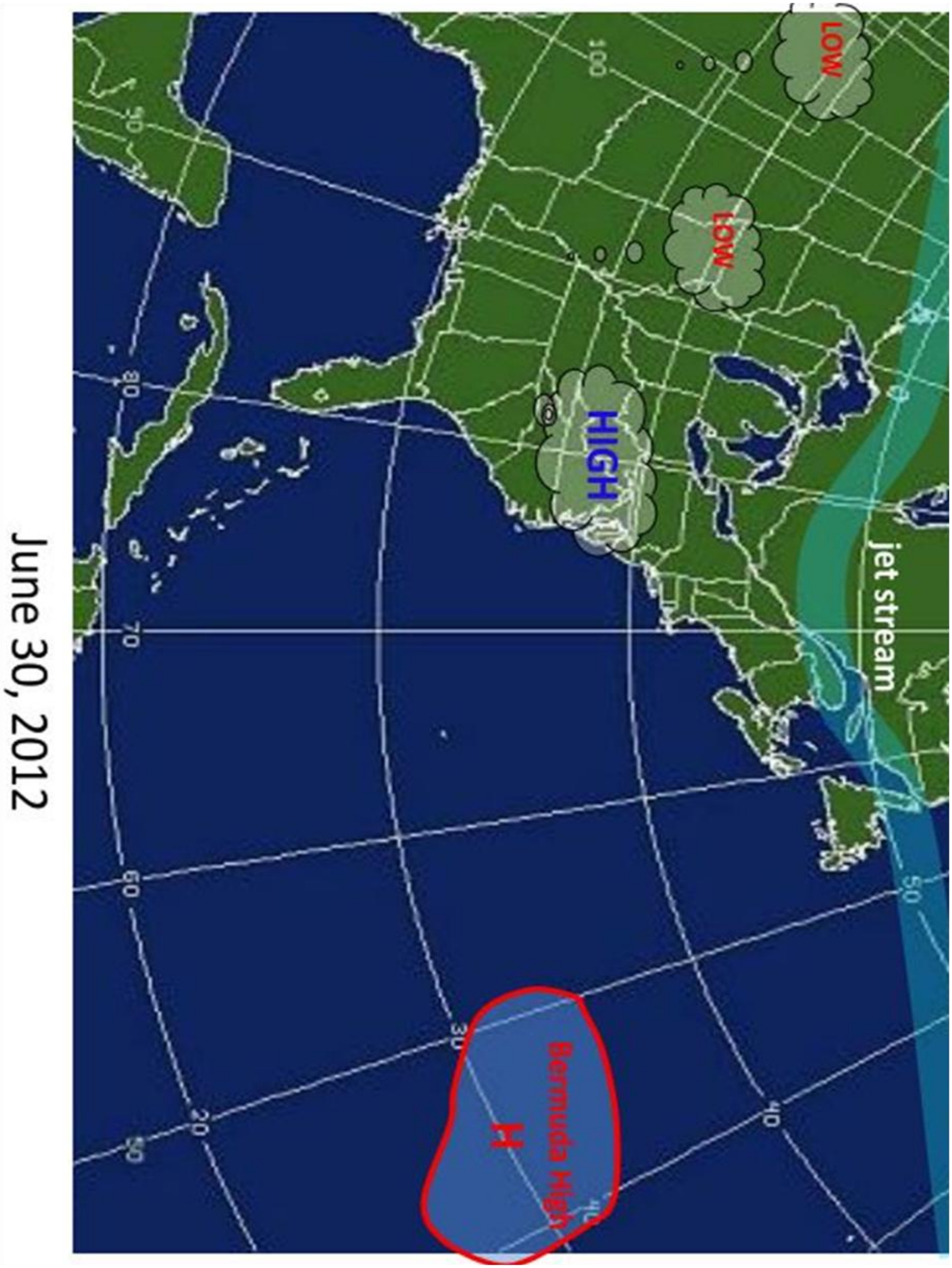


With the Bermuda High far away, a large low pressure area had developed in the mid Atlantic. At the same time, the jet stream had dipped south of central North Carolina to bring in arctic air there, while in the eastern part of the state, a low pressure area from Florida was feeding warm, moist, low pressure air northward up the coast. Where the warm wet air met cold air, it snowed.

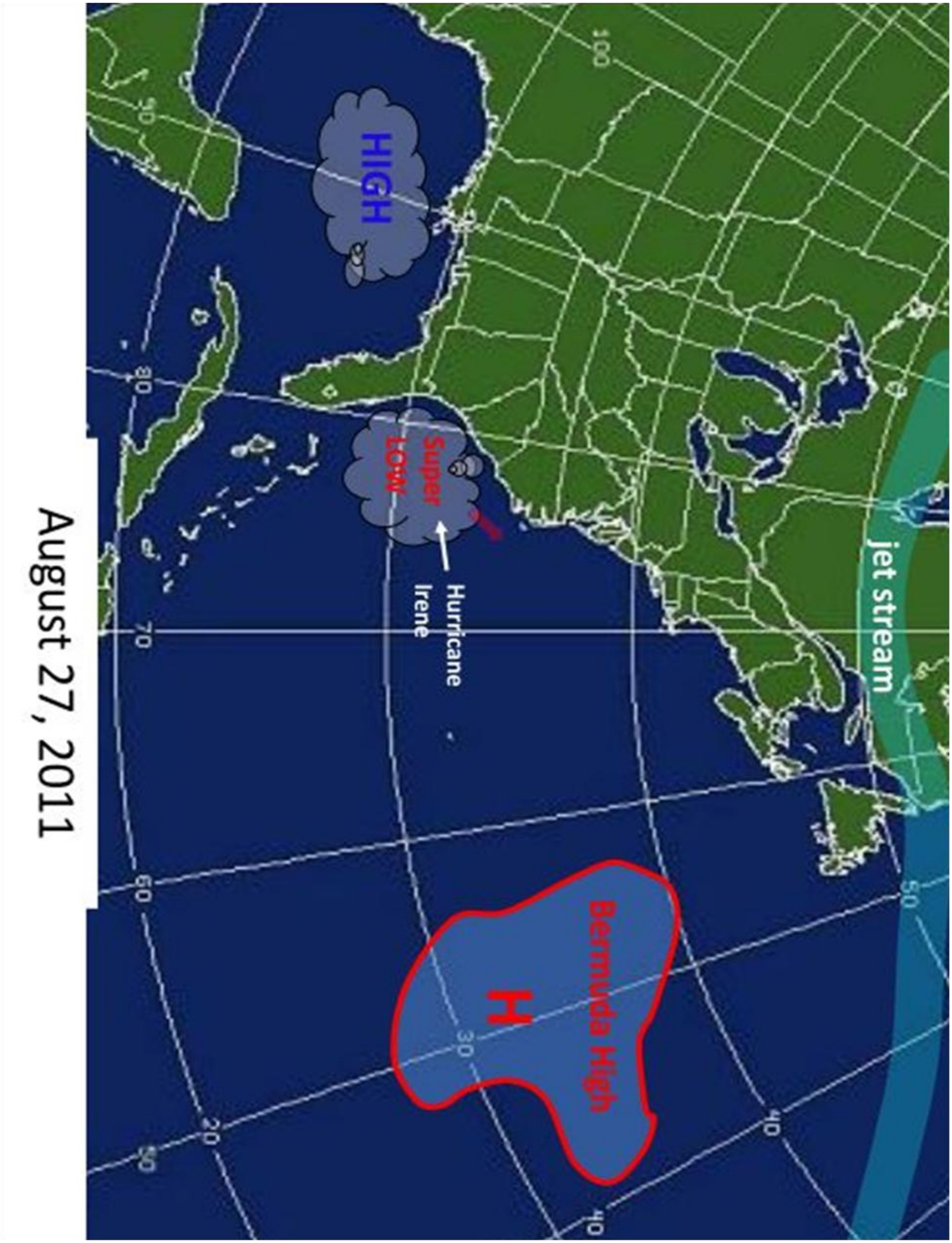
BLM 11 *Weather Data Sheet* The Cold Snap, February 2, 2009



BLM 12 *Weather Data Sheet* The Heat Wave, June 30, 2012

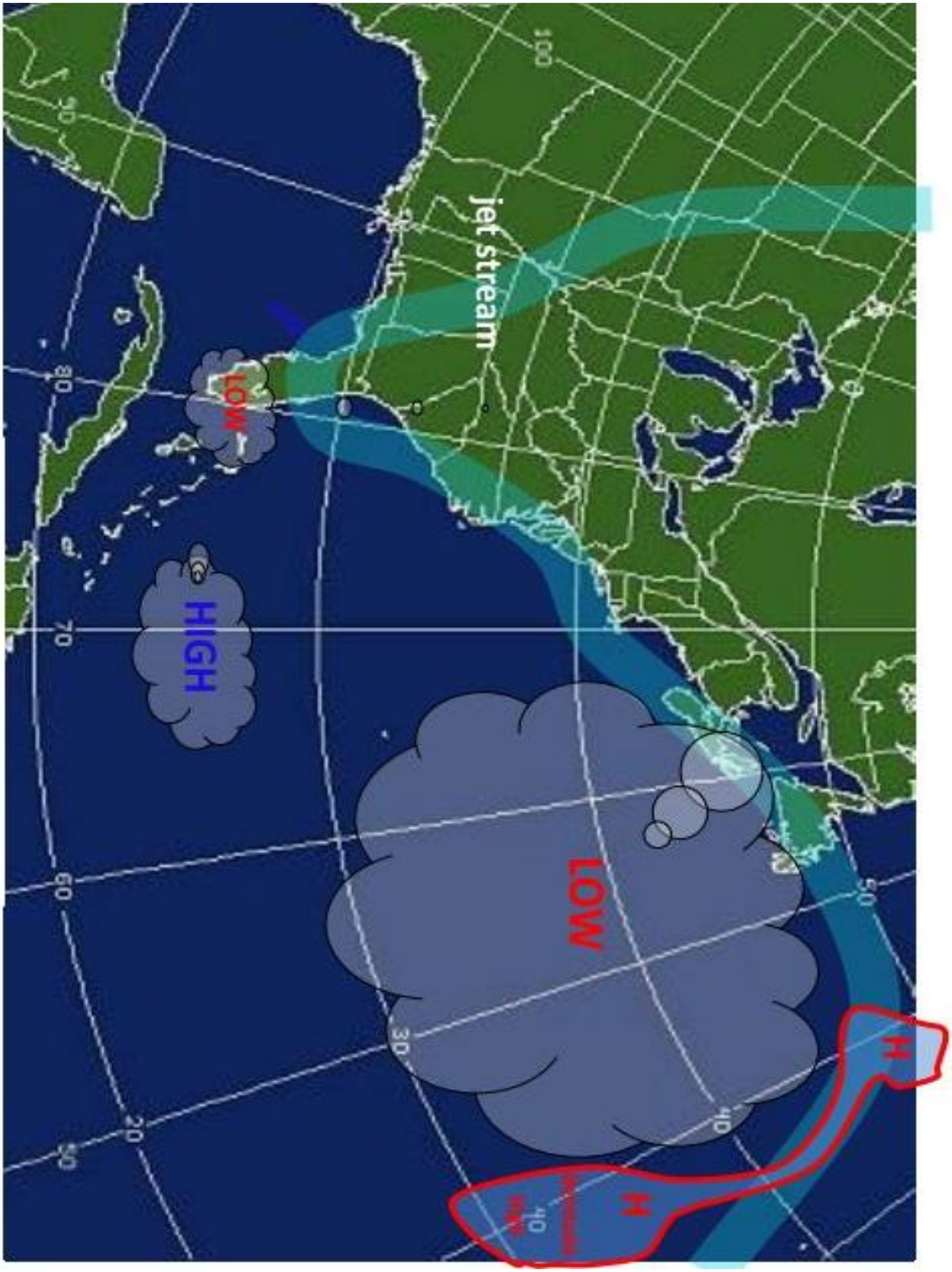


BLM 13 *Weather Data Sheet* Hurricane Irene, August 27, 2011



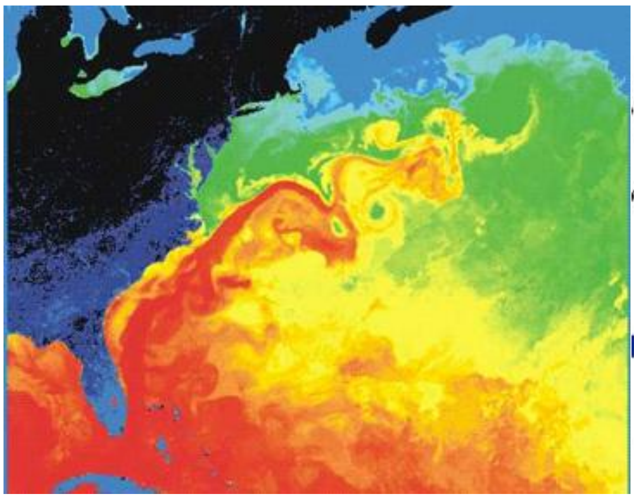
BLM 14 *Weather Data Sheet* The Snow Storm, December 26, 2010

December 26, 2010

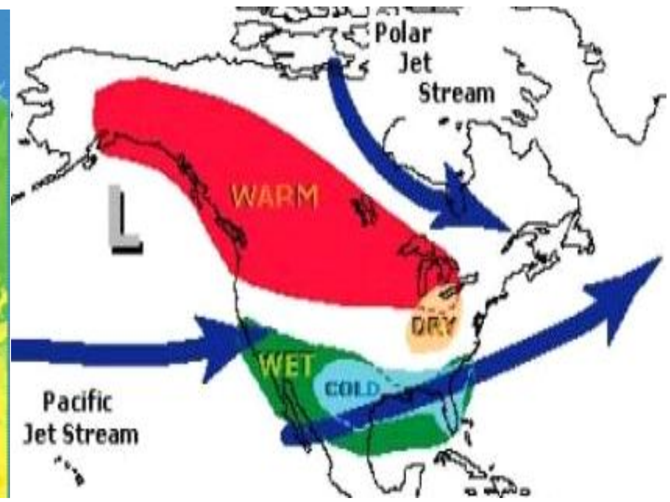


BLM 15 *Weather Factor Sheet* Ocean Currents

Ocean currents move heat through the oceans and affect weather by warming or cooling air masses above them. The Gulf Stream is a warm current originating near Florida and moving up the eastern US, where part of it crosses to Africa and part crosses the North Atlantic. The Gulf Stream creates warm moist low-pressure air masses felt in the eastern US. The contrast between warm and cold along the edges of the Gulf Stream also feeds energy to Atlantic hurricanes. A greater difference between the warm current and cold ocean water strengthens these storms. Hurricanes often begin in the Atlantic near Africa, travel west to the Caribbean, then either move into the Gulf of Mexico or up the US coast.



A Heat Map of the Gulf Stream



Weather Resulting from El Niño

Every three to seven years, an especially warm Pacific Ocean current called El Niño develops near the equator near South America. Between El Niños, a colder current called La Niña prevails. These currents strongly influence US weather patterns. During El Niño, northern US winters are warmer and drier with less snow and winters in northern Mexico and the southwestern US are wetter. During El Niño, the southeastern US, including North Carolina, is cooler and wetter. Extremes of El Niño produce floods and droughts in the US and Mexico. El Niño is also said to reduce the number of hurricanes. La Niña causes effects mostly opposite of El Niño.

The most recent El Niños occurred in 2006-07, 2009, and 2012. The most recent La Niñas were in 1998, 2008, and a strong one in 2010-11.