Citizen Meteorologist
A Real World Science Lesson Plan

BACKGROUND:
Knowing tomorrow's weather totally depends upon knowing what the weather was like in the past. It's only by monitoring the weather that we can understand its patterns, and be able to predict what things will be like in the future. People have been collecting weather data for hundreds of years, and many of the tools they used in the past are similar to the ones we used today. They have of course been supplemented by modern technologies, and we know use computers to analyze weather data.

The timing of the D-Day invasion was carefully planned to account for weather, moonlight, and tides. The tides and moon phases can be known well in advance, but the weather is harder to predict weeks in advance.

The Allies had an advantage over the Germans in predicting the weather in Northern Europe. In the Northern Hemisphere most weather systems move from west to east. Since the Allies had weather stations in North America, across the Atlantic Ocean, and in Greenland and Iceland, they had better data and could better predict the weather and make plans accordingly. In order to improve their capabilities, the Germans attempted to place weather stations across the North Atlantic.

OBJECTIVES:
Students will learn how to make and use common weather tools. They will use weather thermometers to record daily weather and compare it to historical values. Students will also practice graphing in order to display weather data. They will learn how to read weather maps and use them to predict the near-term weather.

GRADE LEVEL:
5-8 with enrichment activities for advanced students

STANDARDS:
3rd-5th grades:
- Climate describes patterns of typical weather conditions over different scales and variations. Historical weather patterns can be analyzed. **NGSS ESS2.D**

6th-8th grades:
- Complex interactions determine local weather patterns and influence climate, including the role of the ocean. **NGSS ESS2.D**

TIME REQUIREMENT:
Making the tools and beginning the discussion about weather patterns will take one period. Regular collection of weather data will take a little time every week, and so will graphing and looking at data.

 ©The National WWII Museum

MATERIALS:

Student Handout, Weather Station Kurt

For Thermometer (for each group, or 1 each if doing as a demonstration)

- 1 clear plastic bottle
- 1 clear plastic straw
- 1 ruler
- rubbing alcohol, colored with food coloring
- clay
- dropper

For Barometer (for each group, or 1 each if doing as a demonstration)

- 1 Empty plastic bottle
- 1 length of Plastic tubing
- water, colored with food coloring
- clay
- 1 ruler

For Hygrometer (for each group, or 1 each if doing as a demonstration)

- 1 metal can
- water
- thermometer
- ice

PRIOR KNOWLEDGE:

If they don't know what temperature represents and about air pressure, you can use this opportunity to give them an introduction.

INFORMATION FOR TEACHERS:

The thermometer works because of thermal expansion in the alcohol. The alcohol will stay in the tube above the level in the jar because the air in the sealed jar prevents the level of alcohol in the jar from rising. Alcohol expands more than water with increased temperature and so it is used here. The barometer works for a different reason—as air pressure changes it will press more or less on the surface of the liquid in the bottle and push the level in the tube up.

OUTLINE OF ACTIVITIES:

1. Students make a thermometer, the most common weather tool. It is a great opportunity to take about kinetic theory and how temperature is actually a measure of the kinetic energy of the molecules in a sample.
2. Students make a barometer, and this is a great opportunity to remind them of, or introduce them to, the idea that our atmosphere has pressure.
3. Students make a hygrometer. You can use this opportunity to remind them about phase change.
4. Students collect and graph weather high and low temperatures, and precipitation amount.
5. Students read Weather Station Kurt and answer questions about the importance of weather monitoring and the advantage the Allies had in WWII.

 ©The National WWII Museum

ASSESSMENT:

Student answers on handouts and student discussions can serve as formative assessments of these standards. Over time their continued practice of the skills can show a more summative view of their growth in these skills.

EXTENSION/ENRICHMENT:

You can have students compare their weather today to weather at times in the past, or to weather in other places. This brings up the idea of climate.

If you want to read together a book about weather, try *Weather Forecasting* by Gail Gibbons

Links for extension and enrichment activities:

- Historical data local climate: **http://1.usa.gov/1GAFVs7**
- Historical data on local weather: **http://1.usa.gov/1FMxcgS**
- National Climate Data Center: **http://1.usa.gov/1IKN0a2**

©The National WWII Museum

STUDENT HANDOUT

MAKE A THERMOMETER:

For Thermometer

You will need from your teacher:

- 1 clear plastic bottle
- 1 clear plastic straw
- 1 ruler
- rubbing alcohol, colored with food coloring
- clay
- dropper

1. Using a pen your teacher gives you, mark every half-centimeter on your straw.
2. Fill the bottle about 1/4 of the way up with alcohol.
3. Put the straw in the bottle and seal the top of the bottle with clay tightly. Make sure the straw is straight and goes through the middle of the clay lid.
4. With the dropper, add alcohol to the straw until the level is just a couple of inches above the level of the alcohol in the bottle.

Now you are ready to test your thermometer. Hold the bottle tightly in your hands to warm it up. It may take a minute for it to absorb the heat from you, but watch the level of the alcohol in the straw.

To test more extreme changes in temperature, try putting your thermometer in hot water or ice water.

MAKE A BAROMETER:

For Barometer

You will need from your teacher:

- 1 Empty plastic bottle
- 1 length of Plastic tubing
- water, colored with food coloring
- clay
- 1 ruler

1. Using a pen your teacher gives you, mark every half-centimeter on your tubing.
2. Fill the bottle about 1/2 of the way up with alcohol.
3. Put the tubing in the bottle and secure it with tape so that the tubing doesn't touch the bottom of the bottle.
4. Suck water up the tubing a ways, and then seal the end of the tubing with the clay

You won't see this change for a while, so note where the level is today and check it tomorrow. Air pressure changes in a place due to weather, but only by about 0.75%. It changes a lot by altitude—at the top of Mt Everest the air pressure is only 1/3 of what it is at sea level.

MAKE A Hygrometer (measuring dew point):

For Hygrometer

You will need from your teacher:

- 1 metal can
- water
- thermometer
- ice

1. Put the water in the can, filling it about halfway up.
2. Add a cube of ice to the water, and stir it as the temperature goes down and then stays constant.
3. Check to see if there is condensation on the outside of the can.
4. If there is condensation, record the temperature of the water in the can as the dew point.
5. If not, repeat until there is condensation on the outside of the can.

©The National WWII Museum

STUDENT HANDOUT

Weather Station Kurt

Imagine you are a Canadian geomorphologist in 1977. A geomorphologist makes maps of Earth features like rocks and hills and valleys, and figures out how they formed. You are mapping the coast of Labrador (the breed of dogs is named after this spot), and you find something strange. You are on the northeast coast of Canada, very far north, in a remote location. You find a large cement structure with radio and scientific equipment inside it. You make the natural assumption that it belongs to the Canadian military and you mark it on your map with the label 'Martin Bay 7.'

Imagine you are a retired electrical engineer from Germany. As a hobby you study the history of the company you worked for, Siemens. In the archives you find papers describing weather stations that Siemens made for the military in WWII. In 1981 you find in those papers a list of places where the weather stations were installed. One of the locations is on the northeast coast of Canada. You contact the Canadian Department of National Defence, and they send a team out to scout the area. They find that some of the parts were removed and damaged, but that the weather station named Kurt in the documents from Siemens is still there. The station was transferred to the Canadian War Museum in Ottawa.

Coast Guardsmen, armed for a fight, use lines to cross a puddle of melted ice on a bay in Greenland as they search for Nazi radio-weather installations. The National WWII Museum, 2011.102.499.

These two curious people uncovered an important part of history. German historical documents show that Weather Station Kurt was installed in 1943. On October 27th of that year a U-boat carrying a meteorologist working for Siemens anchored off Labrador, and a crew of 10 went on shore to install the station. To camouflage it they spread American litter around the site, and labeled the station 'Canadian Meteor Service.' They made sure that the weather tools were working and that the radio was broadcasting before leaving. Working all night, they were there for only 28 hours. This was the only time in WWII that armed German military went ashore in North America.

Why would the Germans risk so much and travel all the way across the Atlantic just to install a weather station?

Weather is really important for military planning. Without knowing weather conditions it's hard to know how to plan maneuvers and to predict what your opponent will be doing.

©The National WWII Museum

STUDENT HANDOUT

Weather Station Kurt

In order to predict future weather you need to be monitoring today's weather. Because weather in the Northern Hemisphere usually moves from west to east, you need to be monitoring weather to the west of where you are.

The Allies had an advantage over the Germans, because the Allies had weather stations all over North America, Greenland, Iceland, and across the North Atlantic. The Germans got weather reports from their ships in the Atlantic, but they didn't have all the data they needed to make really great predictions.

That's why the German military got Siemens to make weather stations, and why they tried to install them in places across the North Atlantic region. The stations sent data on conditions every few hours by radio waves. They used batteries that allowed them to run for 6 months. They made 26 stations, with 14 installed in the Arctic, and 5 installed in the Berents Sea. They planned to install two in North America. Weather Station Kurt was successfully installed, but the other one sent to North America was on a U-Boat sunk in September of 1944 off the coast of Norway.

US soldiers working on weather reports in Italy, January 1944. The National WWII Museum, 2002.337.042.

©The National WWII Museum

Halsey's Typhoons
A Real World Science Lesson Plan

BACKGROUND:
In the winter of 1944 American forces were focusing on wresting control of the Philippines from the Japanese. Task Force 38 was a large group of Navy vessels under the command of Admiral Halsey. They were in the Philippine Sea, launching air attacks on Japanese targets there. In the midst of refueling ships, the weather got very rough. Under orders, ships maintained their positions in formation. Using the forecast, Halsey underestimated the power of the storm and its effects on his ships. As the ships moved into the heart of Typhoon Cobra, it developed into a Category 4 storm.

In high seas with torrential rain and huge swells, 3 destroyers were lost, 790 sailors perished; about 100 aircraft were lost or destroyed. Another 9 ships were seriously damaged.

Several months later, in June 1945, Halsey made the same mistake again, sailing another large group of ships into Typhoon Connie while off Okinawa. Damage was not as serious, since this storm was smaller. However approximately 150 aircraft were lost or damaged, and five sailors and one officer killed.

OBJECTIVES:
Students will learn about tropical storms (typhoons, hurricanes and cyclones), how they form and how they move. They will also learn about the impact of some typhoons in WWII, and how improvements in radar technology led to better predictions about the weather.

GRADE LEVEL:
5-8 with enrichment activities for advanced students

STANDARDS:
3rd-5th grades:
- A variety of hazards result from natural processes; humans cannot eliminate hazards but can reduce their impacts. **NGSS ESS3.B**
- Climate describes patterns of typical weather conditions over different scales and variations.
- Historical weather patterns can be analyzed. **NGSS ESS2.D**

6th-8th grades:
- Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. **NGSS ESS2.A**
- Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. **NGSS ESS2.C**
- Complex interactions determine local weather patterns and influence climate, including the role of the ocean. **NGSS ESS2.D**
- Mapping the history of natural hazards in a region and understanding related geological forces. **NGSS3.B**

 ©The National WWII Museum

TIME REQUIREMENT:

About one class period, but extension activities may take longer.

MATERIALS:

Student Handouts (Halsey's Typhoons, Clouds in a Bottle, Lava Lamp, and Convection Cells)

For Clouds in a Bottle (for each group, or 1 each if doing as a demonstration)

- Large glass or stiff plastic bottle
- Rubber housecleaning glove
- Matches
- Tap water

For Convection Cells (for each group, or 1 each if doing as a demonstration)

- clear plastic shoe-box
- Tap water
- Red food coloring
- Blue colored ice cubes

For Lava Lamp (for each group, or 1 each if doing as a demonstration)

- Tall plastic bottle
- cheap vegetable oil
- tap water
- food coloring
- saucer of hot water

PRIOR KNOWLEDGE:

They apply knowledge of convection and expansion due to heating in this lesson. It would also help if they know about the water cycle.

INFORMATION FOR TEACHERS:

What are cyclones, and how do they form?

Typhoons, cyclones, and hurricanes are all really the same thing. In the Atlantic and North Pacific Oceans, these big rotating storms are called hurricanes, and in the Northwestern Pacific, they are called typhoons. In the Southwestern Pacific and the Indian Ocean they are called cyclones, which is a name that can be used for all of these storms. Whatever they are called, they are tropical storm systems that have a circular flow around a low pressure center. They develop from large disturbances in the atmosphere. These disturbances are caused by rising moist air over warm ocean waters. They develop in the tropics, where the waters of the oceans are warmest. If the conditions are right and a disturbance is large and persistent enough, it can develop a circular flow from prevailing winds caused by the Earth's rotation (the Coriolis Effect). In many ways the pattern is similar to that which causes summer thunder storms, which can create tornados. They can grown very large, with diameters of hundreds of miles.

Today we can predict, with satellite imaging of water vapor in the atmosphere, doppler radar, movement of air masses, and ocean surface temperatures, the development and movement of these tropical systems. In the last century and further back, the location and behavior of these storms was mysterious. If storms passed ports or ships they were observed, but as they developed in the open ocean and began to move towards shore their presence could remain unknown until a ship was in

 ©The National WWII Museum

their midst. Older technologies, like weather balloons and measurements from aircraft are still critical. They provide information on wind speeds and barometric pressure that can't be obtained in any other way. All this information can be entered into computer models, which have processed historical data and so understand how storms have behaved in the past, and are used to make predictions about how the tropical system will develop and where it will go.

Cooler water, atmospheric winds that shear off the top of the convection clouds, and dry air, are all conditions that can prevent the formation of these large tropical systems.

High winds and torrential rainfall can produce their own risks, but one of the most dangerous aspects of cyclones, hurricanes and typhoons is storm surge. The winds cause high waves in front of a storm. In addition the low pressure in the storm's eye can raise the sea level. As a tropical system moves close to shore it pushes this ocean water ahead of it. Behind the storm the water flows away, but as it moves ashore the water in front of the storm has nowhere to go but onshore. The storm surge can cause flooding far inland, especially in areas where coastal terrain has little geographic elevation.

Factors affecting storm development and impact

El Niño is a long term weather phenomenon involving the warming of the Pacific Ocean off the coast of South America. A typical El Niño lasts 3 months and leads to a 0.5ºC warming of the ocean surface. El Niño events seem to be occurring more frequently in recent decades. In El Niño years the typical effects in North America are wetter summers for the Southwestern US, and cooler and drier summers for the Southeastern US. The cooler and drier conditions in the Southeaster US and the stronger southern jet stream lead to the formation of fewer hurricanes in El Niño years.

Models of global climate change seem to indicate two contradictory things. One, that there will be more El Niño events, and two, that as the atmosphere and oceans warm that there will be more and larger tropical storms.

Because storm surge is such an important impact of tropical systems, low-lying coastal areas are most vulnerable to them. Global climate change is bringing rising sea levels which would make coastal areas even more vulnerable.

OUTLINE OF ACTIVITIES:

Halsey's Typhoons—Have the students read about the typhoons that Halsey's fleet ran into in 1944 and 1945. Have them discuss around these questions—"How do hurricanes form?", "What causes hurricanes?", "What is the difference between a hurricane, a cyclone, and a typhoon?", "What are the effects of these tropical storms?"

You can then explain how these storms form, and their definitions. You might use Hurricanes! by Gail Gibbons, Hurricanes by Seymour Simon or Inside Hurricanes by Mary Kay Carson to read together and review the information. This is also a good opportunity to use Freyer Cards to develop scientific vocabulary.

Clouds in a Bottle, Convection Cells, and Lava Lamp could be used in multiple ways. You could use them as group activities, or as demonstrations. Additionally you might set up centers with them and one of the books.

In Clouds in a Bottle, put tap water in the bottle, and then drop a lit match into it. Stretch the the top of the glove to cover the mouth of the bottle with the glove hanging in the bottle. With your hand

in the glove quickly expand the volume of the glove, and then contract your hand into a fist and pull upwards. This will decrease the pressure in the bottle rapidly. A small amount of fog should appear in the bottle as you do this. The particulates in the smoke help nucleate the droplets of water that form the fog. The smoke will settle after about 10 minutes and will need to be replenished.

In Convection Cells, fill the shoe-box nearly full with water. Let the water sit for a few minutes to reduce currents within it. Add a blue ice cube at one end, and a few drops of red food coloring at the other. Observe the flow of the colors in a convection cell.

In Lava Lamp, fill the bottle about 2/3 up with the oil. Add water to the top, and then a few drops of coloring. Place the bottle in the hot water. If convection does not occur, or does not occur quickly enough, you can add small pieces of alka-seltzer tablets. If you do this remember to explain that the model you are making is a little more off from reality.

ASSESSMENT:

Student answers on handouts and student discussions can serve as formative assessments of these standards.

EXTENSION/ENRICHMENT:

Halsey's Typhoon: The True Story of a Fighting Admiral, an Epic Storm, and an Untold Rescue Bob Drury and Tom Calvin, Grove Press 2007.

Sea Cobra: Admiral Halsey's Task Force And The Great Pacific Typhoon Buckner Melton, Lyons Press 2007.

Links for extension and enrichment activities:

- Historical data on hurricanes: **http://bit.ly/1AO6JCA**
- Current data on atmospheric water vapor and sea surface temperatures: **http://bit.ly/1ldpsrm**
- Current data on land and sea conditions from NASA: **http://1.usa.gov/1ePPKpV**
- Storms archive for the National Hurricane Center: **http://1.usa.gov/1FTLuyp**
- National Hurricane Center's Hurricane Creator game: **http://1.usa.gov/1FuQes3**
- National Hurricane Center's Aim a Hurricane game: **http://1.usa.gov/1cy7oN8**

©The National WWII Museum

STUDENT HANDOUT

REAL WORLD SCIENCE: HALSEY'S TYPHOONS

The US entered WWII after the Japanese bombed Pearl Harbor in Hawaii on December 7 1941. In 1941, Hawaii was not a state, but a territory of the US. The same day the Japanese began an attack on the Philippines, which was also a territory of the US. In the middle of 1942, the Japanese pushed the US out the Philippines, and controlled the islands for most of WWII.

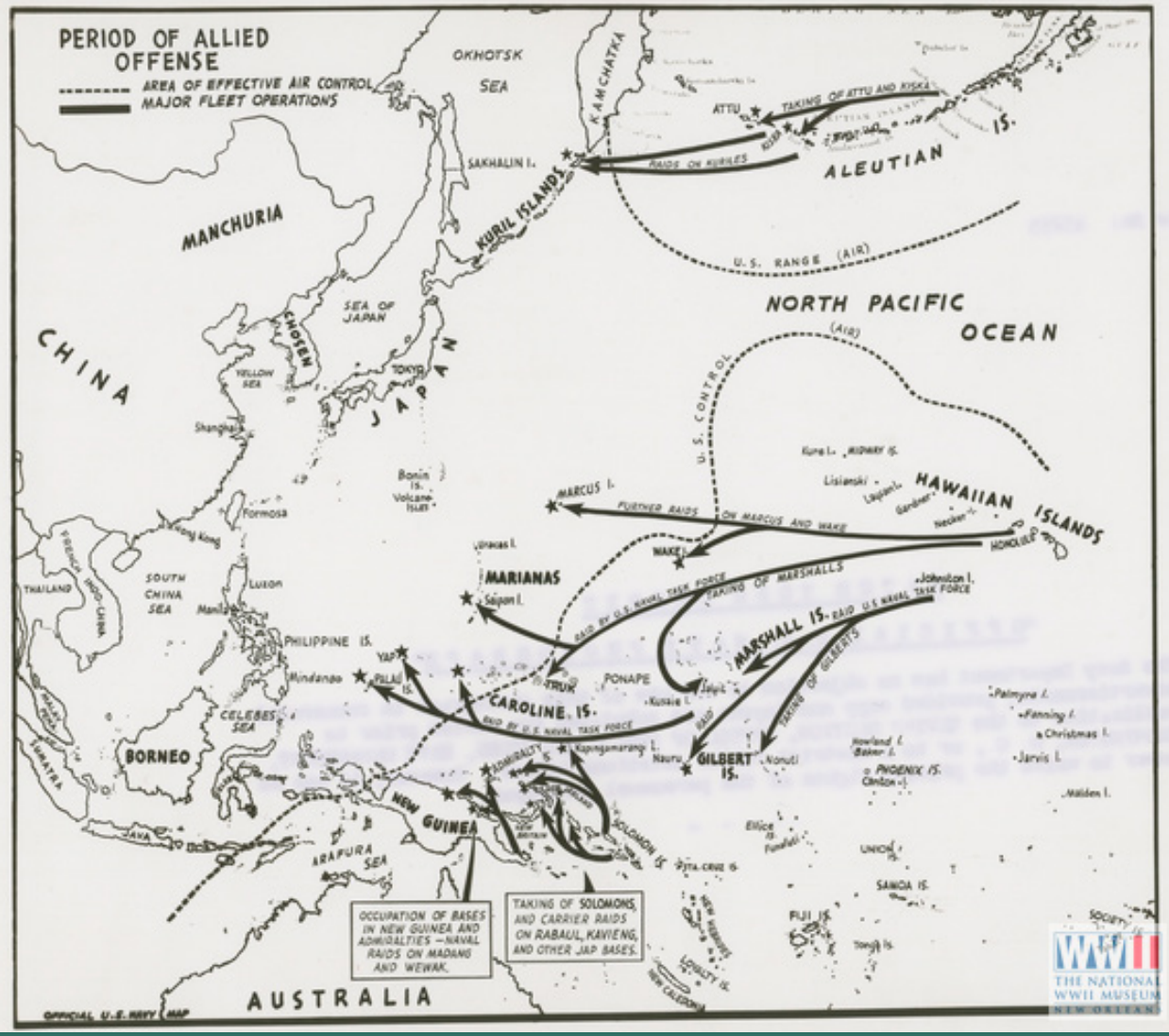
In December of 1944, three years into the war, the US was trying hard to take the Philippines from Japan. Admiral Halsey was in charge of a fleet of ships about 300 miles east of the islands. He commanded 13 aircraft carriers and about 65 other ships. From off the coast they were launching air raids against Japanese bases in the Philippines. On December 17 many of the ships were set to refill their fuel tanks. But as they began to get their fuel they encountered high winds and large waves. Since they were light with nearly empty fuel tanks, many of the smaller ships were pushed around by this bad weather. Halsey received a forecast telling him that Typhoon Cobra was approaching. He ordered that his ships maintain their positions in formation. This was a mistake, as the storm winds reached 140 mph, and ships were tossed about on the ocean. By the end of the next day, when the typhoon passed Admiral Halsey's ships, three ships were completely sunk and one aircraft carrier was on fire. In total, 790 died in the storm, and 100 aircraft were lost or destroyed. Another 9 ships were damaged. Eventually the fleet recovered, and the US regained control of the Philippines, but the effects of Typhoon Cobra slowed US Navy efforts.

Amazingly, Admiral Halsey was in command of many of the same ships when another typhoon, Connie, struck off the coast of Okinawa in June of 1945. This storm was stronger, but much smaller in size. This time another 100 aircraft were lost or damaged, and five sailors and one officer were killed, but no ships were lost.

Today with satellites around the Earth, and with weather radar covering its surface, we can spot and track storms much better than we did 70 years ago. We also have computers that can predict were storms will develop and how they will move, and we know much more about the effects of cyclones, typhoons, and hurricanes. Weather can still affect battles, and international relations, but we are much better prepared for weather events than we were in the past.

©The National WWII Museum

STUDENT HANDOUT



An official US Unvy map of the Waster Pacific. The National WWII Museum, 2011.102.437.

©The National WWII Museum

STUDENT HANDOUT

REAL WORLD SCIENCE: HALSEY'S TYPHOONS

Use the map your teacher gives you to indicate where Halsey's ships were hit by Typhoon Cobra.

Use the map your teacher gives you to indicate where Halsey's ships were hit by Typhoon Connie.

What conditions caused these storms to form?

Why are they called typhoons instead of hurricanes?

What technologies do we have today that reduce the risk of such big storms?

©The National WWII Museum

Why Weather?
A Real World Science Lesson Plan

BACKGROUND:
Weather is always changing. This is the result of the transfer of heat from the sun to the Earth. Since the land surfaces of the Earth are so variable, and since the Earth is spinning, weather has patterns that are always changing.

The timing of the D-Day invasion was carefully planned to account for weather, moon-light, and tides. The tides and moon phases can be known well in advance, but the weather is harder to predict weeks in advance.

Weather forecasting in the 1940s was based on observations from weather stations, data from weather balloons, and occasional observations at sea. Today we have technologies from WWII—radar—and satellites—powered by rockets, another WWII innovation—to improve our forecasting abilities.

OBJECTIVES:
Students will learn how to read and make weather maps. They will use text to learn some weather terms and to understand the importance of weather in planning big events.

GRADE LEVEL:
5-8 with enrichment activities for advanced students

STANDARDS:
3rd-5th grades:
- Climate describes patterns of typical weather conditions over different scales and variations. Historical weather patterns can be analyzed. **NGSS ESS2.D**

6th-8th grades:
- Complex interactions determine local weather patterns and influence climate, including the role of the ocean. **NGSS ESS2.D**

TIME REQUIREMENT:
This material should take about an hour to cover, but with enrichments it might take a bit more.

MATERIALS:
- Student Handout, Why weather?
- Weather maps (use your own or the ones we've provided)
- Weather map key

©TheNationalWWIIMuseum

PRIOR KNOWLEDGE:

You will probably need to review geography of Europe, but this could be done simply by showing the map and talking through it. If students have already learned weather symbols, this could be an application and review. Otherwise the text could be used as an introduction.

INFORMATION FOR TEACHERS:

Storms are generally low pressure systems, and clear weather usually is associated with high pressure systems. Weather maps show areas of high and low pressure, and also indicate the boundaries of large cool or warm air masses.

D-Day was very complex to plan, in part because of the number of troops and groups from which they came. There were power struggles for control of decision-making and information.

OUTLINE OF ACTIVITIES:

Students read the article, make Freyer charts of terms in the article, make a map of the weather before, on and after D-Day using the information in the article.

ASSESSMENT:

Student answers on handouts and student discussions can serve as formative assess-ments of these standards. Over time their continued practice of the skills can show a more summative view of their growth in these skills.

EXTENSION/ENRICHMENT:

You can have students examine weather maps of the continental US during WWII and interpret what the weather would have been like from the maps. There are some maps for this purpose attached.

Links for extension and enrichment activities:

- Historical data local climate **http://1.usa.gov/1GAFVs7**
- Historical data on local weather **http://1.usa.gov/1FMxcgS**
- National Climate Data Center **http://1.usa.gov/1IKN0a2**
- US daily weather maps from the past **http://1.usa.gov/1GhB4Jh**

©The National WWII Museum

STUDENT HANDOUT

REAL WORLD SCIENCE:
Why Weather?

Why are people always talking about the weather? Does it really matter?

The weather forecast for a day in 1944 made a big difference, and may have saved thousands of lives.

When the Allies were making plans to invade France and take it back from Germany in spring of 1944, they had to consider many variables. The tide had to be low so that they could see and avoid mines. The moon had to be full so that airplanes could navigate at night. The weather had to be clear and calm.

The window of opportunity was for early June. If the invasion came much later, the Germans would notice the large numbers of ships and troops assembled in southern England. But in early June the weather on the English Channel (the narrow strip of water that separates England from France and the rest of Europe) is often very stormy.

Captain Stagg was a British officer in the Royal Air Force. He was in charge of assembling forecasts from all the different groups involved in the planning, and he had to tell General Eisenhower, the US officer in charge of the operation, when the weather would work. Eisenhower and his team had initially set the date for June 5th.

The troops were to be carried in landing craft from ships offshore to the beach. These landing craft were small, and rough seas and bad weather would have made it very hard for them to reach the shore. Many of them would have sunk if it were stormy.

The Allies had weather stations in Canada, Greenland, and Iceland to collect data to support forecasts of weather. Since weather generally moves from West to East in the Northern Hemisphere, the open Atlantic is a challenge for forecasters. In the US, for example, we can follow weather systems from the western to the eastern states easily.

The Germans had an even harder time predicting weather, since they had many stations across Europe, but very few in the Atlantic. Today satellites give us a huge amount of data that makes weather forecasting more accurate.

©The National WWII Museum

STUDENT HANDOUT

Why Weather? continued

The Allies and their meteorologists knew that a series of low pressure systems and fronts, each bringing stormy weather, were lined up across the Atlantic Ocean. One of these was arriving over England on June 3 and 4. US meteorologists were recommending that the invasion go ahead on June 5th.

British meteorologists insisted that the weather would be too bad on June 5th and that the invasion should be postponed. Some suggested that the earliest possible date would be around the June 16th. That seemed too late.

A few meteorologists from England suggested that there would be a short period of calm weather between the storms, and that June 6th would be a good date for the invasion. In his report to General Eisenhower, this is the recommendation that Captain Stagg gave, and that is the date that we still remember as D-Day. He trusted that his team, which had more experience predicting the weather coming across England from the Atlantic than the American team, had the better prediction.

The Germans saw the storms in the Atlantic, but didn't have enough data on their size or exact location. Because of this they thought it was impossible for the Allies to invade before the middle of June. Based on this forecast they actually moved some troops away from the coast, and they were less prepared for the invasion.

In the end, the weather on June 5th was terrible. The seas were rough and the winds high. Conditions were still a bit tough on June 6th, but the landing craft were able to get through the waves to shore.

The Allies built a temporary floating port starting June 7. This allowed them to put ashore many trucks and tanks and tons of supplies. Two weeks later, on the date that some officers suggested for the invasion, another large storm came through, and the temporary port was destroyed.

©The National WWII Museum

STUDENT HANDOUT

June 4th Weather Map

June 4, 1944 Weather

June 5th Weather Map

June 5, 1944 Weather

June 6th Weather Map

June 6, 1944 Weather

©The National WWII Museum

STUDENT HANDOUT

REAL WORLD SCIENCE:
Why Weather? Questions

Why was a British officer in charge of forecasting and a US officer in charge of the whole operation?

What were some of the variables that went into deciding on what day they should invade?

What was the long-term forecast for early June?

Why did Captain Stagg think June 6th was the best choice?

©The National WWII Museum