# Meteorology Curriculum Maps



NOTE: Meteorology is a one semester course designed for students interested in understanding the complex systems that control our weather.

| **Grade: 11-12**<br>**Subject: Meteorology** | **Unit 1: Basic Concepts of Meteorology** |
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| **Big Idea/Rationale** | The composition and structure of our atmosphere is crucial to life on Earth. The atmosphere has evolved over time, and we can track both the current condition of the atmosphere (weather) and long term patterns that exist in different regions (climate). Sunlight plays a crucial role in driving changes in our atmosphere, through day/night cycles and the water cycle and setting up convection currents that drive weather. |
| **Enduring Understanding** | 1. Weather is the instantaneous or current state of the atmosphere and is measurable in terms of temperature, atmospheric pressure, humidity, wind speed and direction, cloudiness and precipitation.<br>2. Climate is the state of the atmosphere over long time periods, such as over years, decades, centuries or greater.<br>3. Weather parameters are measured with different instruments, such as a barometer, thermometer, anemometer, and wind vane.<br>4. The knowledge of weather phenomena has been obtained over hundreds of years by many different people and it continues to evolve today through the work of modern meteorologists and climate scientists.<br>5. Meteorologists study the atmosphere with both modern and traditional technologies.<br>6. The atmosphere is the gaseous envelope surrounding Earth.<br>7. The mixing of gases insulates and protects Earth.<br>8. Without the atmosphere the surface of Earth would be sterile.<br>9. The atmospheric concentrations are changing.<br>10. The sun heats Earth unevenly.<br>11. There is an interrelationship between the angle of light rays and the area over which the light rays are distributed and the potential to affect changes in the temperature of materials.<br>12. The temperature of water and air masses affect density and movement.<br>13. The water cycle involves movement of water around the Earth through evaporation, condensation, precipitation, and runoff/collection.<br>14. Percent humidity is used to calculate dew point.<br>15. Clouds indicate lapse rates and air movement.<br>16. Air temperature in the clouds determines the precipitation types.<br>17. Air always travels from an area of high to low pressure.<br>18. A location's proximity to water, elevation, and latitude all affect the location's climate.<br>19. Seasons are caused by the axis tilt, not distance. |

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| **Essential Questions** | 1. How do meteorologists study the atmosphere?<br>2. Who is NOAA?<br>3. What is NWS?<br>4. What is the atmosphere? What is it made of?<br>5. How does the atmosphere change with increasing altitude?<br>6. What role does the sun play in our weather?<br>7. What does the atmosphere do for me?<br>8. What technologies do we use to study and forecast the weather?<br>9. Why do we have seasons?<br>10. What factors determine seasonal temperature variations?<br>11. How do various types of precipitation form?<br>12. Why do clouds change shape? How do they form?<br>13. What can cloud observations tell us about weather? |
| **Content (Subject Matter)** | 1. Differentiating between weather and climate<br>2. Atmospheric Hazards - why it's important to understand meteorology<br>3. Warming the Earth and the atmosphere (heat transfer)<br>4. The water cycle<br>5. Relative humidity and dew point<br>6. Cloud types and formation<br>7. Types of precipitation<br>8. Air pressure and wind<br>9. Climate factors (effects of latitude, geographical location, elevation, oceans).<br>10. Seasons (effect of the tilt of the Earth's axis). |
| **Skills/Benchmarks (NGSS) Standards** | HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.<br><br>HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.<br><br>ESS3.D: Global Climate Change. Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.<br><br>HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.<br><br>HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and |

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| | biosphere.<br><br>ESS2.D: Weather and Climate. Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. |
| **Materials and Resources** | NOAA, NSF websites<br>"The Weather Book" by Jack Williams USA Today<br>"Wild About Weather" National Wildlife Federation/ NatureScope<br>"An Ocean of Air" by Gabrielle Walker<br>NSTA (National Science Teachers Association) *Meteorology Activity Guide* |

| **Grade: 11-12**<br>**Subject: Meteorology** | **Unit 2: The Atmosphere in Motion** |
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| **Big Idea/Rationale** | Understanding the atmosphere's role in energy transfer is crucial to understanding both weather and climate, and predicting both short term weather changes and long term patterns. The patterns of energy transfer are complex, and are affected by sunlight, physical geography, ocean currents and long term climate patterns. Understanding these patterns is crucial to understanding weather and climate. |
| **Enduring Understanding** | 1. Air masses mixing in the mid-latitudes cause weather changes.<br>2. Fronts are where different air masses collide to create a change in weather.<br>3. Many factors synch together to influence a weather forecast.<br>4. Technologies used to determine weather forecasts continually evolve.<br>5. Atmospheric pressure, wind speed and wind direction, and other parameters are recorded to determine a storm's direction.<br>6. Thunderstorms require heat and moisture.<br>7. Tornadoes are formed by a combination of low pressure and high winds along with smooth topography.<br>8. Lightning is a discharge of energy; thunder is the sound of air being rapidly warmed.<br>9. Hurricanes use warm water as fuel.<br>10. El Nino is characterized by warming water in the tropical Pacific.<br>11. La Nina is characterized by cooler than normal waters in the tropical Pacific.<br>12. Changes in Pacific Ocean temperature and its overlying atmosphere occur in a cycle known as the El Nino Southern Oscillation (ENSO).<br>13. Water currents are affected by El Nino and La Nina, which contributes to variations in the fishing industry and economy of several areas in the tropical Pacific region.<br>14. Changing to atmospheric events can occur in the form of extreme weather, such as extreme heat, torrential rains, and dry spells.<br>15. Climate change happens naturally over time, and has also been enhanced (accelerated) by human activities. |

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| **Essential Questions** | 1. What air masses cause weather in the U.S.?<br>2. What conditions are needed to set up a thunderstorm, hurricane, and blizzard?<br>3. How do meteorologists predict where it will rain vs. snow?<br>4. Why do so many thunderstorms occur in the late afternoon? Why do so many tornadoes happen in the mid-west?<br>5. How does hail form?<br>6. Why don't we get many hurricanes in New Jersey?<br>7. What is the difference between a hurricane and a tropical storm? |
| **Content (Subject Matter)** | 1. Air Masses<br>2. Fronts<br>3. Weather Forecasting<br>4. Storms<br>5. Severe weather (thunderstorms, tornadoes, hurricanes)<br>6. El Nino, La Nina Cycles<br>7. Climate Change<br>8. Effects of natural phenomena (volcanic eruptions, solar radiation variations) |
| **Skills/Benchmarks (NGSS) Standards** | HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.<br><br>HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.<br><br>ESS3.D: Global Climate Change. Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.<br><br>HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.<br><br>HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.<br><br>ESS2.D: Weather and Climate. Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. |

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