Earth and Human Activity/Earth Systems ■ MIDDLE SCHOOL Grades 6–8

These resources can be used to build towards the following dimensions of the Next Generation Science Standards.
Find these collections — and more — at the links to NASAWavelength.org lists (at the top of of each table).

middle school

MS-ESS3. EARTH AND HUMAN ACTIVITY

MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. Examples of human impacts can include water usage, land usage, and pollution.

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

NASAWAVELENGTH
Find this collection and more at:
http://nasawavelength.org/list/1772

Science and Engineering Practices

Analyzing and Interpreting Data. Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships.

Apply scientific principles to design an object, tool, process, or system.

Engaging in Argument from Evidence. Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomena or a solution to a problem.

Disciplinary Core Ideas

ESS3.B Natural Hazards. Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2)

ESS3.C Human Impacts on Earth Systems. Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)

Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-3), (MS-ESS3-4)

Cross Cutting Concepts

Patterns. Graphs, charts, and images can be used to identify patterns in data.

Cause and Effect. Cause and effect relationships may be used to predict phenomena in natural or designed systems. Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

SAMPLE INVESTIGATIONS, LESSONS & RELATED RESOURCES

Hurricane Katrina
http://nasawavelength.org/resource/nw-000-000-001-660

This problem-based learning module asks students to consider how future climate change could impact the frequency and intensity of hurricanes. They are tasked with studying the trends and impacts of hurricanes on coastal regions. They proceed by conducting an Earth system analysis, examining connections and causal chains of impact that are set in motion by the hurricane throughout the Earth's atmosphere, biosphere, lithosphere, and hydrosphere.

Hurricanes
http://nasawavelength.org/resource/nw-000-000-004-002

Students learn about hurricanes as a natural hazard as well as some of the technologies used to study tropical storms and hurricanes. The lesson focuses on factors impacting tropical storm and hurricane development, including precipitation and sea surface temperature. Students learn about the Tropical Rainfall Measuring Mission (TRMM), which gathered data during hurricanes and how this data helped scientists forecast how much precipitation could be expected. Students also learn how the Global Precipitation Measurement (GPM) mission enables the collection of new data on hurricanes.

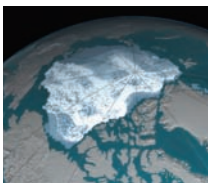
EO Kids: Urban Heat Islands: Hot Times in the City
https://earthobservatory.nasa.gov/eokids

EO Kids brings engaging science stories from NASA's Earth Observatory to children ages 9 to 14. This issue explores how NASA observes and measures urban heat islands from space. Includes hands-on activities, experiments and more. Research the urban heat island in your own backyard with some DIY Science. What do city lights and urban heat islands have in common? Find out when you are the Data Detective.

Worldview: Earth at Night
http://bit.ly/EarthatNight4

Explore nighttime images of Earth and city lights showing where populations are concentrated. Add layers to explore possible correlations with other parameters (e.g., surface temperature, surface water, air quality, etc.).

Images of Change
https://climate.nasa.gov/images-of-change



This gallery features over 100 interactive image pairs that show change over time periods ranging from centuries to days. Some of these effects are related to climate change, some are not. Some document the effects of urbanization, or the ravage of natural hazards such as fires and floods.

MS-ESS2. EARTH SYSTEMS

MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

NASA WAVELENGTH

Find this collection and more at: ***http://nasawavelength.org/list/1774***

middle school

Science and Engineering Practices

Developing and Using Models. Develop and use a model to describe phenomena.

Analyzing and Interpreting Data. Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships.

Analyze and interpret data to provide evidence for phenomena.

Disciplinary Core Ideas

ESS2.D Weather and Climate. Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)

The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)

ESS2.C The Roles of Water in Earth's Surface Processes. Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)

Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)

Cross Cutting Concepts

Patterns. Graphs, charts, and images can be used to identify patterns in data.

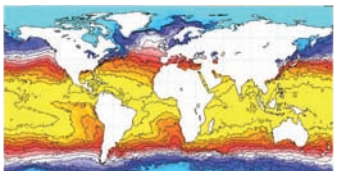
Systems and System Models. Models can be used to represent systems and their interactions—such as inputs, processes and outputs— and energy and matter flows within systems.

Energy and Matter. Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

SAMPLE INVESTIGATIONS, LESSONS & RELATED RESOURCES

MY NASA DATA: Ocean Currents and Sea Surface Temperatures

http://nasawavelength.org/resource/nw-000-000-002-209



Students explore and analyze NASA datasets to investigate how differential heating of Earth results in circulation patterns in the oceans and the atmosphere that globally distribute the heat. Students explore the link between: 1) ocean temperatures and currents, 2) uneven heating and rotation of Earth, 3) resulting climate and weather patterns, and 4) projected impacts of climate change.

GLOBE Data Explorations

http://nasawavelength.org/resource/nw-000-000-004-300

A collection of nine atmospheric science and geography activities that guide students in developing the skills used to analyze GLOBE environmental data. GLOBE (Global Learning and Observation to Benefit the Environment) is a worldwide, hands-on, K–12 school-based science education program.

Students:

- Interpret a frequency distribution of GLOBE temperature data to decide whether statements about the weather are accurate.
- Construct, read, and analyze climographs and understand how climate differs from weather.
- Match data with its location given what they know about the relationship between latitude and seasonal temperature variations.
- Learn how temperature varies with altitude.

Bringing the Universe to America's Classrooms: Earth Science Modules

http://pbslearningmedia.org/universe

PBS LearningMedia

New instructional modules contain digital media that address the content and practices in the K–12 *Framework for Science Education* and feature innovative media formats — including satellite images, data visualizations, and videos drawn from WGBH's signature programs like *NOVA* and *PEEP & the Big Wide World.* Resources have been designed to be accessible for diverse learners and include support materials, such as background essays, teaching tips, and student handouts. Grades 6–8 instructional modules are on the topics of Weather & Climate and the Story of Earth.

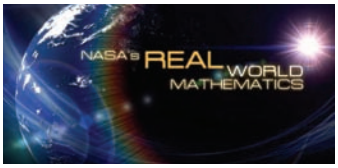
Exploring the Water Cycle

https://pmm.nasa.gov/education/lesson-plans/exploring-water-cycle

Students will observe/investigate the movement of water through the different stages of the water cycle and determine what drives this cycle.

NASA eClips™ Real World: Earth Systems

https://nasaeclips.arc.nasa.gov/playlists/realworld?v=real-world-earth-systems



In this 5 minute video, NASA scientists explain how NASA studies Earth systems and demonstrate how mathematical modeling helps scientists in their predictions of climate, weather, and natural hazards.