

Hydrosphere Learning Progression

Grades 9-12: GLOBE Protocols Aligned with NASA and NGSS

NGSS Disciplinary Core Ideas Learning Progression: Building on concepts developed in grades K-2, 3-5, and 6-8 that examined the properties of water, how it shapes the land, the distribution of freshwater and saltwater and interactions that occur among land, ocean and the atmosphere, grades 9-12 will explore how the planet's dynamics are greatly influenced by water's unique chemical and physical properties. Resource availability has guided the development of human society and use of natural resources has associated costs, risks, and benefits. Natural hazards and other geological events have shaped the course of human history at local, regional and global scales. Using GLOBE and MY NASA DATA educators and students can access NASA satellite data to examine a variety of Earth system interactions.

Performance Expectations: 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. HS-ESS2.5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.		
Science Practices: Planning and Carrying Out Investigations: plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence. Analyzing and Interpreting Data: analyze data using tools, technologies, and/or models in order to make valid and reliable scientific claims. Constructing Explanations and Designing Solutions: Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	Disciplinary Core Idea: ESS2.C: The Roles of Water in Earth's Surface Processes The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. ESS2.D Weather and Climate The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage and redistribution among the atmosphere, ocean, and land systems and this energy's re-radiation into space. ESS3.A: Natural Resources Resource availability has guided the development of human society. ESS3.B: Natural Hazards Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.	Crosscutting Concepts: Structures and Function The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. Cause and Effect - Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. Influence of Science, Engineering, and Technology on Society and the Natural World - Modern civilization depends on major technological systems.
GLOBE Application		
Hydrosphere Protocols Water Temperature Water Transparency Dissolved Oxygen pH Atmosphere Protocols Clouds Precipitation Surface Temperature Water Vapor Pedosphere (Soil) Soil Moisture	GLOBE Data Sheets: Hydrology Investigation Data Sheet Surface Temperature Data Sheet Soil Moisture Data Sheet GLOBE Learning Activities: GC2: Components of the Earth System Working Together (HS-ESS2.2) Water Walk (HS-ESS2-5, HS-ESS3-1) Modeling Your Water Balance (HS-ESS3-1) The pH Game (HS-ESS2-5) Just Passing Through (HS-ESS2-2, HS-ESS2-5) Environmental Health Connection: Monsoons and Health: A GLOBE Data Exploration	Guiding Question(s): - According to geoscience data, what type of effect is the reduction of sea ice creating for other components of the Earth system? - What are the characteristics of waters various phases and properties that help it shape and impact the landscape and Earth systems? - How have the intensity, occurrence and location of natural hazards influenced human activity? (Examples: droughts, floods, hurricanes, tsunamis, etc)
NASA Resources		
Extension Learning Activities/Resources: NASA Climate Change Educational Modules NASA Earth Observatory World Maps NASA Wavelength Learning Resource List http://nasawavelength.org/list/2037 Worldview	MY NASA DATA Live Access Server Data Visualization Tool: Earth System Data Explore MY NASA DATA Parameter Suggestions: Daily Sea Surface Temperature (GHRST) Monthly Cloud Coverage (CERES) Monthly Precipitation (GPCP) Monthly Surface Skin Temperature (CERES) Daily Soil Moisture (SMAP)	MY NASA DATA Lessons/Activities: How Much Water is Available in the Atmosphere for Precipitation? Evidence of Change Near the Arctic Circle Hurricane Frequency and Intensity Nutrients in Chesapeake Bay Ocean Impacts of an El Nino Event