HS. Weather and Climate

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A Performance Expectations HS.ESS2.WC

1. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. HS.ESS2.4
2. 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. HS.ESS3.5
3. Evaluate data and communicate information to explain how the movement and interactions of air masses result in changes in weather conditions. HS.ESS2.8

B Science and Engineering Practices HS.WC.SEP

1. Developing and Using Models HS.WC.SEP.1
   - a. Use a model to provide mechanistic accounts of phenomena. (HS-ESS2-4) HS.WC.SEP.1A
2. Analyzing and Interpreting Data HS.WC.SEP.2
   - a. Analyze data using tools, technologies and/or models (e.g., computational or mathematical) in order to make valid and reliable scientific claims or determine optimal design solution. (HS-ESS3-5) HS.WC.SEP.2A
3. Obtaining, Evaluating, and Communicating Information HS.WC.SEP.3
   - a. Communicate scientific ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-ESS2-8) HS.WC.SEP.3A
4. Scientific Investigations Use a Variety of Methods HS.WC.SEP.4
   - a. Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HSESS3-5) HS.WC.SEP.4A
   - b. New technologies advance scientific knowledge. (HS-ESS3- 5) HS.WC.SEP.4B
5. Scientific Knowledge is Based on Empirical Evidence HS.WC.SEP.5
   - a. Science knowledge is based on empirical evidence. (HSESS3-5) HS.WC.SEP.5A
   - b. Science arguments are strengthened by multiple lines of evidence supporting a single explanation. (HS-ESS2-4), (HSESS3-5) HS.WC.SEP.5B

C Disciplinary Core Ideas HS.WC.DCI

1. ESS1.B: Earth and the Solar System HS.WC.DCI.ESS1.B
   a. Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. (secondary to HS-ESS2-4) HS.WC.DCI.ESS1.B.1
2. ESS2.A: Earth Materials and Systems HS.WC.DCI.ESS2.A
   a. The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4) HS.WC.DCI.ESS2.A.1
3. ESS2.D: Weather and Climate HS.WC.DCI.ESS2.D
   a. 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. (HS-ESS2-4),(secondary to HS-ESS2-2) HS.WC.DCI.ESS2.D.1
   b. Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2-4) HS.WC.DCI.ESS2.D.2
   c. (NYSED) Concepts of density and heat energy can be used to explain observations of weather patterns (HSESS2-8). HS.WC.DCI.ESS2.D.3
4. ESS3.D: Global Climate Change HS.WC.DCI.ESS3.D
   a. 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. (HS-ESS3-5) HS.WC.DCI.ESS3.D.1

D Crosscutting Concepts HS.WC.CC

1. Patterns HS.WC.CC.1
   a. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-ESS2-8) HS.WC.CC.1A
   b. Empirical evidence is needed to identify patterns. (HS-ESS2-8) HS.WC.CC.1B
2. Cause and Effect HS.WC.CC.2
   a. Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS2- 4) HS.WC.CC.2A
3. Stability and Change HS.WC.CC.3
   a. Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HSESS3-5) HS.WC.CC.3A