Meteorology: Earth Systems

Stage 1 Desired Results

ESTABLISHED GOALS:
Competencies:

- Cause & Effect Students will demonstrate the ability to investigate, explain, and evaluate potential causal relationships by using evidence to support claims and predictions about the mechanisms that drive those relationships.
- Scale, Proportion, & Quantity Students will demonstrate the ability to describe and represent the significance of changes in observable and non-observable phenomena in terms of relative scale, proportion, and quantity.
- Stability & Change in Systems Students will demonstrate the ability to investigate and analyze static and dynamic conditions of natural and human designed systems in order to explain and predict changes over time.
- Nature of Science Student will demonstrate the ability to work collaboratively and individually to generate testable questions or define problems, plan and conduct investigations using a variety of research methods in a various settings, analyze and interpret data, reason with evidence to construct explanations in light of existing theory and previous research, and effectively communicate the research processes and conclusions.
- Students will demonstrate the ability to analyze and summarize text and integrate knowledge to make meaning of discipline-specific materials.
- Students will demonstrate the ability to produce coherent and supported writing in order to communicate effectively for a range of discipline-specific tasks, purposes, and audiences.
- Students will demonstrate the ability to speak purposefully and effectively by strategically making decisions about content, language use, and discourse style.

Content 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.
• 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.
• HS-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system (and predict weather and climatic patterns here on earth)

Transfer

Students will be able to independently use their learning to make informed decisions and act responsibly based upon their knowledge of interrelated weather systems.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…
• empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
• change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.
• algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).

ESSENTIAL QUESTIONS
• Who should care about the weather?

	Acquisition	
	Students will know… •that the physical characteristics and motion of the sun and earth interplay to drive weather changes. • that the earths titled axis combined with its yearly journey around the sun creates the seasons. • that the different solar insolation created at different latitudes, drives weather changes. • that the Coriolis force affects the direction which the wind appears to blow. • that 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. • that 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. • that 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. • that Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system. • that 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. And moderates climate, provides moisture and heat for storms and precipitation. • that 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. Heat radiating from the surface leads	Students will be skilled at… • using models to describe variations. • analyzing data and its results. • using mathematical or computational representations for predicting. • observing and measuring real phenomena.

	to differences in temperature with height with warm air lying near the surface and cold air above, produces cloud development. • that there are different layers of the Earth's atmosphere composed of different amounts of different gasses. • that the Seasons are due to many factors • that the different air masses have specific causes and effects. • that the different cloud types have specific causes and effects • that the different storm types have specific causes and effects. *vocabulary:* cloud types (cumulo-, strato-, cirro-), precipitation, insolation, latitude, longitude, Coriolis force, radiation, convections,conduction, tornadoes, hurricanes, thunderstorms, winter storm, layers of the atmosphere (specific names), gasses found in the atmosphere (specific names), basic Earth geography, solar wind, Aurora Borealis, solar angle, adiabatic temperature lapse rate, pressure, humidity, air masses (all types), front (types, cause, and effect), condensation nuclei	

Content Area Literacy Standards	***21st Century Skills***
• RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. • RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*. • RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. • RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. • WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. • WHST.11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. • WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. • WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.	• *use systems thinking* • *solve problems* • *work creatively with others* • *communicate clearly*

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	PERFORMANCE TASK(S):
	OTHER EVIDENCE:

Stage 3 – Learning Plan	
Summary of Key Learning Events and Instruction	
Language Arts Integration	***Mathematics Integration***
	HSN-Q.A.1 - Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS2-4), (HS-ESS3- 5) **HSN-Q.A.2** - Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-4), (HS-ESS3-5) **HSN-Q.A.3** - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-4), (HS-ESS3-5) **MP.2** - Reason abstractly and quantitatively. (HS-ESS2-4), (HS-ESS3-5) **MP.4** - Model with mathematics. (HS-ESS2-4)

Technology Integration	***District Materials***
Science and Engineering Practices	

S&EP 2. Developing and using models S&EP 4. Analyzing and interpreting data S&EP 6. Constructing explanations (for science) and designing solutions (for engineering) S&EP 7. Engaging in argument from evidence S&EP 8. Obtaining, evaluating, and communicating information	