Science Department
Global Climate Studies Curriculum

Revised by: Kevin Tempsick, Jessica Penberthy
Effective Date: Fall 2026, Revised Spring 2025

COURSE OUTLINE:

This course introduces students to the scientific principles of Earth's climate system and the evidence for global climate change. Students analyze real-world data, explore human and natural factors that influence climate, ecological connections, and examine the environmental and societal impacts of a warming planet. The course emphasizes problem-solving, sustainability, and local-to-global climate solutions through hands-on activities and project-based learning.

Scope and Sequence

Number of Weeks - approximate (based upon 56 minute periods in rotating blocks)	Unit
6 weeks	Principles of Earth's Heat and Energy Transfer
8 weeks	Introduction to Weather and Climate Systems
8 weeks	Ecological and Anthropogenic Climate Connections
8 weeks	Societal Mitigation, Adaptation, and Solutions

Unit 1	
Principles of Earth’s Heat and Energy Transfer	
Summary and Rationale	
The unit is an introduction to the concepts of energy and heat circulation through the variety of mediums that make up the Earth. Convection, heat absorption, radiation, and transfer of heat through currents will set the stage for further understanding of climate and weather as systems driven by energy input. Students will investigate physical processes that rely on these foundational principles such as fluid density, the water cycle, ocean currents, geological convection, and the differential heating of the Earth.	
Recommended Pacing	
6 weeks	
Standards	
HS-ESS2-1	Develop a model to illustrate how Earth’s internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedback that causes changes to other Earth systems.
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-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
Interdisciplinary Connections	
RST-11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS2-2),(HS-ESS2-3)
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. (HS-ESS2-2)
WHST9-12.7	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. (HS-ESS2-5)
Technology Integration	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Instructional Focus	
Enduring Understandings:	**Essential Questions:**
Students will understand that energy from the Sun is the primary force that drives Earth's weather, climate, and natural systems. Heat energy moves through the planet by radiation, conduction, and convection, transferring energy between the atmosphere, oceans, land, and Earth's interior. Differences in temperature create differences in density, which cause air, water, and molten rock to move and form convection currents. These movements power large-scale processes such as winds, ocean currents, the water cycle, and geological activity. Because all Earth systems are connected through the flow of energy, even small changes in heat transfer can lead to significant environmental and climate impacts.	● How does energy from the Sun drive weather, climate, and Earth's systems? ● How is heat transferred through radiation, conduction, and convection? ● Why do differences in temperature and density cause air and water to move? ● How do convection currents shape the movement of the atmosphere, oceans, and Earth's interior? ● How does differential heating of Earth's surface affect winds, ocean currents, and climate patterns? ● In what ways does water cycle through Earth's systems, and how is energy involved in each step? ● How are ocean currents and air currents connected, and why are they important to life on Earth? ● How do small energy changes lead to large-scale environmental effects? ● How can understanding heat and energy flow help us predict weather and climate? ● Why is the movement of energy considered the foundation of many Earth processes?

Evidence of Learning (Assessments)
Virtual and Real Life Lab Modeling - phenomena observation, data collection, and analysis Informal and Formal Assessment - intermittent short quizzes End of unit Project

Objectives (SLO)

Students will know:

- The Sun is the primary source of energy that drives Earth's weather, climate, and natural systems.
- Heat is transferred through radiation, conduction, and convection.
- Differences in temperature affect density and cause matter to move.
- Convection currents occur in the atmosphere, oceans, and Earth's interior.
- Energy flow connects and powers systems such as the water cycle, ocean currents, atmospheric circulation, and geological processes.

Students will be able to:

- Explain how solar energy drives weather, climate, and Earth system processes.
- Describe and compare radiation, conduction, and convection as methods of heat transfer.
- Investigate and model how temperature and density differences create convection currents.
- Analyze how energy transfer influences the water cycle, ocean currents, atmospheric circulation, and geological activity.
- Use observations, data, and scientific reasoning to explain and predict weather and climate patterns

Suggested Resources/Technology Tools

- General Lab manuals and materials kits, hot plates, access to water, lab packets, etc.
- Online Resources throughout climate data and organization websites such as NOAA, EPA, etc.
- Teacher made slideshows and note packets - #1, #2, #3
- Virtual lab websites such as Explore Learning
- Google Earth and other full scale earth modeling software resources

Modifications

Special Education-

Modifications and accommodations must be aligned to students' IEPs and uphold expectations of the plan lawfully.

● Allow additional time for skill mastery.
● Provide small group/ individualized instruction.
● Allow use of assistive technology.
● Anticipate needs; pre-teach if needed.
● Have student repeat directions to check for understanding.
● Highlight text/ visual presentation.
● Modify assessment/assignment content, format, length (benchmarks, tests and quizzes) .

ML-

● Provide additional wait time for student responses to questions
● Provide simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase.
● Speak clearly, using a normal tone and rate of speed, or slightly slower.
● Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading

Gifted and Talented-

● Advance, accelerate, or compact content
● Support abstract and advanced higher-level thinking through differentiated questioning
● Allowance for adapting of content for individual student interests

● Provide assignments geared to development in areas of affect, creativity, cognition, and research skills

504-

Modifications and accommodations must be aligned to the 504 plan and uphold expectations of the plan lawfully.

● Provide additional time for in-class assignments and assessments
● Allow for computer with voice output, spelling and grammar checker
● Offer individual help throughout the lesson
● Modify readings and primary source documents

At Risk-

● Provide small group instruction for identified areas for growth
● Allow for alternate pathways for completion of assignments.
● Provide additional wait time for student responses to questions
● Pair oral instruction with visuals
● Utilize manipulatives

For a full list of Accommodations and Modifications, please click here.

21st Century Learning Standard Connections

Please select all standards that apply to this unit of study:

- ☑ Act as a responsible and contributing citizen and employee.
- ☑ Apply appropriate academic and technical skills.
- ☐ Attend to personal health and financial well being.
- ☑ Communicate clearly and effectively and with reason.
- ☑ Consider the environmental, social and economic impacts of decisions.
- ☑ Demonstrate creativity and innovation.
- ☑ Employ valid and reliable research strategies.
- ☑ Utilize critical thinking to make sense of problems and persevere in solving them.
- ☑ Model integrity, ethical leadership, and effective management.
- ☑ Plan education and career paths aligned to personal goals.
- ☑ Use technology to enhance productivity.
- ☑ Work productively in teams while using cultural global competence.

Unit 2

Introduction to Weather and Climate Systems

Summary and Rationale

Students will apply the concepts from Unit 1 by exploring the different climate zones of Earth, weather and precipitation patterns, as well as other factors influencing local and regional climate. Experimentation with air pressure, wind, storms, waves, and forecasting impacts in the modern world will set the stage for data collection and research activities that allow students to understand prehistoric climate change events in comparison with the changing planet today.

Recommended Pacing	
8 weeks	
Standards	
HS-ESS2-1	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedback loops that cause changes to other Earth systems.
Interdisciplinary Connections	
RST-11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS2-2),(HS-ESS2-3)
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Instructional Focus	
Enduring Understandings:	**Essential Questions:**
Students will understand that Earth's climate zones and local weather patterns are shaped by differences in solar energy, air pressure, temperature, and the movement of air and water. Interactions among wind, precipitation, storms, and waves create both predictable patterns and sudden weather events that affect daily life and ecosystems. Scientific tools, models, and data collection allow meteorologists to	• How do differences in solar energy and Earth's features create distinct climate zones around the world? • What factors influence local and regional weather and precipitation patterns? • How do air pressure, wind, and temperature interact to form storms and other weather events?

<table>
<tr><td>analyze conditions and forecast weather to reduce risks and plan for impacts. Evidence from rocks, ice cores, fossils, and other records shows that Earth's climate has changed many times in the past. By comparing past climate events with modern observations, students recognize that understanding weather and climate processes helps explain changes occurring on the planet today and prepares communities for the future</td><td>● How does the movement of air and water shape waves, storms, and changing weather conditions?
● How do scientists collect and use data to forecast weather and predict impacts on communities?
● In what ways does modern weather technology improve our ability to prepare for severe weather?
● How can evidence from the past help us understand prehistoric climate change events?
● How are past climate patterns similar to or different from climate changes happening today?
● Why is understanding climate and weather important for human safety, planning, and decision-making?
How do small changes in atmospheric conditions lead to large-scale weather and climate effects?</td></tr>
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<tr><td colspan="2">Virtual and Real Life Lab Modeling - phenomena observation, data collection, and analysis
Informal and Formal Assessment - strategic do-nows, questioning, intermittent short quizzes
Project Based Assessments</td></tr>
<tr><td colspan="2">Objectives (SLO)</td></tr>
<tr><td>Students will know:
● Earth's climate zones are influenced by differences in solar energy, air pressure, temperature, and the movement of air and water.
● Weather patterns result from interactions among wind, precipitation, storms, and waves.
● Weather events can be both predictable and sudden, impacting ecosystems and human activities.
● Meteorologists use scientific tools, models, and data to analyze weather conditions and make forecasts.
● Evidence from rocks, ice cores, fossils, and other records shows that Earth's climate has changed over time.</td><td>Students will be able to:
● Explain how solar energy, air pressure, and temperature differences shape climate zones and local weather.
Describe and model how wind, precipitation, storms, and waves develop and interact.
● Collect and interpret weather data using charts, maps, or models.
● Use forecasting tools and evidence to predict weather patterns and potential impacts on communities.
● Compare prehistoric climate evidence with modern observations to analyze how Earth's climate has changed over time.</td></tr>
</table>

Suggested Resources/Technology Tools
● General Lab manuals and materials kits, hot plates, access to water, lab packets, etc. ● Online Resources throughout climate data and organization websites such as NOAA, EPA, etc. ● Teacher made slideshows and note packets - #1, #2, #3 ● Virtual lab websites such as Explore Learning ● Google Earth and other full scale earth modeling resources
Modifications
Special Education- *Modifications and accommodations must be aligned to students' IEPs and uphold expectations of the plan lawfully.* ● Allow additional time for skill mastery. ● Provide small group/ individualized instruction. ● Allow use of assistive technology. ● Anticipate needs; pre-teach if needed. ● Have student repeat directions to check for understanding. ● Highlight text/ visual presentation. ● Modify assessment/assignment content, format, length (benchmarks, tests and quizzes) . **ML-** ● Provide additional wait time for student responses to questions ● Provide simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase. ● Speak clearly, using a normal tone and rate of speed, or slightly slower. ● Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading **Gifted and Talented-** ● Advance, accelerate, or compact content ● Support abstract and advanced higher-level thinking through differentiated questioning ● Allowance for adapting of content for individual student interests ● Provide assignments geared to development in areas of affect, creativity, cognition, and research skills **504-** *Modifications and accommodations must be aligned to the 504 plan and uphold expectations of the plan lawfully.* ● Provide additional time for in-class assignments and assessments ● Allow for computer with voice output, spelling and grammar checker ● Offer individual help throughout the lesson ● Modify readings and primary source documents **At Risk-** ● Provide small group instruction for identified areas for growth ● Allow for alternate pathways for completion of assignments. ● Provide additional wait time for student responses to questions ● Pair oral instruction with visuals ● Utilize manipulatives **For a full list of Accommodations and Modifications, please click here.**
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- ☑ Plan education and career paths aligned to personal goals.
- ☑ Use technology to enhance productivity.
- ☑ Work productively in teams while using cultural global competence.

Unit 3	
Ecological and Anthropogenic Climate Connections	
Summary and Rationale	
This unit will focus on the human and ecological connections to climate. Students will investigate human activities that can impact the systems discussed in the previous two units as well as the role diverse ecosystems play in climate regulation. Greenhouse gas production, carbon sequestration, deforestation, habitat loss, ecological feedback loops, and the carbon cycle will provide students with a strong focus lens for a variety of data collection and research modalities which highlight key processes.	
Recommended Pacing	
8 weeks	
Standards	
HS-ESS2-1	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
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.

HS-ESS3-3	Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*
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's systems.
HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem
Interdisciplinary Connections	
RST-11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS2-2),(HS-ESS2-3)
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. (HS-ESS2-2)
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. (HS-ESS3-5)
RST-11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2),(HS-ESS3-4)
Technology Integration	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment
Instructional Focus	
Enduring Understandings:	**Essential Questions:**

<table>
<tr><td>Earth’s climate system is interconnected with biological, atmospheric, hydrologic, and geologic systems through processes such as the carbon cycle. Diverse ecosystems play a critical role in climate regulation by storing and cycling carbon, and changes to these ecosystems can influence both local and global climate patterns. Human activities—including fossil fuel combustion, deforestation, land use changes, and habitat loss—alter natural systems and increase greenhouse gas concentrations in the atmosphere. These changes can disrupt ecological balance and trigger feedback loops that either amplify or reduce the effects of climate change. Scientific data collection, modeling, and research provide evidence of human influence on climate systems and support informed decision-making related to environmental management, conservation, and mitigation strategies.</td><td>How are human activities connected to changes in Earth’s climate systems?
How do ecosystems (forests, oceans, wetlands, etc.) regulate climate through processes like carbon sequestration?
How does the carbon cycle link the biosphere, atmosphere, hydrosphere, and geosphere?
What human activities contribute to greenhouse gas production, deforestation, and habitat loss?
How do ecological feedback loops influence the rate and severity of climate change?
What evidence from data and scientific research demonstrates the impact of human activity on climate?
How can understanding climate–ecosystem interactions guide responsible environmental decision-making?</td></tr>
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<tr><td>Students will know:
How Earth’s climate is regulated through interactions among the biosphere, atmosphere, hydrosphere, and geosphere.
The role of the carbon cycle in transferring and storing carbon within Earth’s systems.
How diverse ecosystems contribute to climate regulation through processes such as carbon sequestration.
The sources and impacts of greenhouse gas production on climate systems.
How human activities, including deforestation, land use change, and habitat loss, affect ecosystems and climate.
How ecological feedback loops influence climate stability and long-term environmental change.</td><td>Students will be able to:
Model and explain the movement of carbon through Earth’s systems.
Analyze data related to greenhouse gas concentrations, carbon storage, and climate trends.
Evaluate the impact of specific human activities on climate systems and ecosystem health.
Interpret evidence to identify relationships between ecosystem change and climate regulation.
Explain positive and negative ecological feedback loops using scientific examples.
Construct evidence-based arguments about strategies to reduce greenhouse gas emissions or enhance carbon sequestration.</td></tr>
</table>

● How scientific evidence and data are used to understand relationships between human actions, ecosystems, and climate.	● Use multiple research modalities (data analysis, modeling, scientific texts, case studies) to investigate climate–ecosystem connections.

Suggested Resources/Technology Tools

- General Lab manuals and materials kits, hot plates, access to water, lab packets, etc.
- Online Resources throughout climate data and organization websites such as NOAA, EPA, etc.
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Modifications

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Unit 4	
Societal Mitigation, Adaptation, and Solutions	
Summary and Rationale	
In this unit, students will utilize their new knowledge of climate systems to explore mitigation strategies that address climate impacts on human life. Evaluation of major problems happening now as well as predicting possible future issues will set the stage for planning and engineering solutions that will allow societies around the globe to adapt and avoid potential collapse. Students will be responsible for utilizing data and experimentation to provide evidence for the best possible plans and policies to follow as we move towards a more sustainable planet.	
Recommended Pacing	
8 weeks	
Standards	
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*
HS-ESS3-6	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
Interdisciplinary Connections	
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. (HS-ETS1-1),(HS-ETS1-3)
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ETS1-1),(HS-ETS1-3) (HS-ESS3-4)
RS.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. (HS-ETS1-1),(HS-ETS1-3)
Technology Integration	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment
Instructional Focus	
Enduring Understandings:	**Essential Questions:**
Human societies are deeply affected by changes in Earth's climate systems, which influence resources, infrastructure, health, and economic stability. Mitigation and adaptation strategies can reduce the severity of climate impacts and improve societal resilience when informed by scientific evidence and data analysis. Evaluating current climate challenges and predicting future risks allow communities to plan and implement engineering and policy-based solutions that address both immediate and long-term	● How do climate impacts affect human societies and quality of life? ● What strategies can be used to mitigate and adapt to climate change at local and global scales? ● How can data and scientific evidence be used to evaluate current climate challenges and future risks? ● How do engineering and planning solutions help societies respond to climate-related threats? ● What factors determine the effectiveness and sustainability of

needs. Effective climate responses require interdisciplinary approaches that combine science, technology, and responsible decision-making to promote sustainability and prevent societal collapse.	climate policies and mitigation strategies? ● How can proactive decision-making help societies avoid or reduce future climate-related collapse? ● What role do humans play in shaping a sustainable future in response to climate change?
Evidence of Learning (Assessments)	
Informal and Formal Assessment - Real and Hypothetical Scenario Discussions Project Based Assessments and Evidence-Backed Solutions Proposals	
Objectives (SLO)	
Students will know: ● How climate change impacts human systems, including health, resources, infrastructure, and economies. ● The difference between climate mitigation and climate adaptation strategies. ● Examples of current climate-related challenges facing societies around the world. ● How future climate risks can be predicted using scientific models and data. ● The role of engineering, planning, and policy in responding to climate impacts. ● How evidence-based decision-making supports sustainable solutions to climate challenges. ● The characteristics of effective and sustainable climate strategies.	Students will be able to: ● Analyze data related to climate impacts on human populations and systems. ● Evaluate the effectiveness of different mitigation and adaptation strategies using scientific evidence. ● Predict potential future climate challenges based on trends and models. ● Design or propose engineering and planning solutions to address climate-related problems. ● Use experimentation and data analysis to support climate-related claims and recommendations. ● Construct evidence-based arguments for policies or plans that promote sustainability. ● Assess trade-offs and limitations associated with different climate solutions.
Suggested Resources/Technology Tools	
● General Lab manuals and materials kits, hot plates, access to water, lab packets, etc. ● Online Resources throughout climate data and organization websites such as NOAA, EPA, etc. ● Teacher made slideshows and note packets ● Virtual lab websites such as Explore Learning ● Google Earth and other full scale earth modeling resources	
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- ☑ Model integrity, ethical leadership, and effective management.

- ☑ Plan education and career paths aligned to personal goals.
- ☑ Use technology to enhance productivity.
- ☑ Work productively in teams while using cultural global competence.