Atmosphere Learning Progression

Grades 3-5: GLOBE Protocols Aligned with NASA Resources and NGSS Standards

NGSS 3D Progression of Learning: This learning guide builds upon concepts developed in grades K-2 that focus on weather patterns, students in grades 3-5 will examine the relationships associated with how patterns of typical weather conditions over different time scales can be used to describe climate. NASA scientists use satellite data to analyze historical weather patterns to answer questions related to climate and typical weather patterns. By incorporating GLOBE and My NASA Data in the classroom educators provide students with the ability to collect data, learn how to visualize and analyze data while connecting with NASA scientists, and access satellite data to answer their own questions related to atmospheric interactions that affect the weather and climate where they live.

NGSS Performance Expectations: (Note: the following Performance Expectations and 3 Dimensional Learning are aligned with GLOBE and NASA Resources and are meant to support the development of the associated content and skill development but may not lead to complete mastery)

- 3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- 3-ESS2-2 Obtain and combine information to describe climates in different regions of the world.
- 3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.
- 4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
- **5-ESS2-1** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere and/or atmosphere interact.
- 5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Disciplinary Core Idea: Science Practices: Crosscutting Concepts: **ESS2.D Weather and Climate:** Analyzing and Interpreting Data: **Patterns:** Patterns of change can be used to make Scientists record patterns of the weather across different Represent data in tables and various graphical displays predictions. (3-ESS2-1, 3-ESS2-2) times and areas so that they can make predictions about (bar graphs and pictographs) to reveal patterns that Systems and System Models: A system can be what kind of weather might happen next. (3-ESS2-1) indicate relationships. (3-ESS2-1) described in terms of its components and their Climate describes a range of an area's typical weather Analyze and interpret data to make sense of phenomena interactions. (5-ESS2-1, 5-ESS3-1) conditions and the extent to which those conditions vary using logical reasoning. (4-ESS2-2) **Cause and Effect**: Cause and effect relationships over years.(3-ESS2-2) **Developing and Using Models:** Develop a model are routinely identified, tested and used to explain ESS2.A Earth Materials and Systems: using an example to describe a scientific principle. change. (3-ESS3-1, 4-ESS3-2) Earth's major systems are the geosphere (solid and (5-ESS2-1) molten rock, soil, and sediments), the hydrosphere Engaging in Argument from Evidence: Make a (water and ice), the atmosphere (air), and the biosphere claim about the merit of a solution to a problem by citing (living things, including humans). Wind and clouds in the relevant evidence about how it meets the criteria and atmosphere interact with the landforms to determine PRACTICES constraints of the problem. (3-ESS3-1) patterns in weather. (5-ESS2-1) Obtaining, Evaluating and Communicating **ESS3.B: Natural Hazards:** A variety of natural hazards **Information**: Obtain and combine information from result from natural processes, Humans cannot eliminate books and other reliable media to explain phenomena or natural hazards but can take steps to reduce their CROSSCUTTIN solutions to a design problem. (3-ESS2-2, 5-ESS3-1) impacts. (3-ESS3-1, 4-ESS3-2) Constructing Explanations and Designing ESS3.C: Human Impacts on Earth Systems - Human Solutions: Generate and compare multiple solutions to activities in agriculture, industry, and everyday life have

a problem based on how well they meet the criteria and constraints of the design solution, (4-ESS3-2)

ESS3.C: Human Impacts on Earth Systems - Human activities in agriculture, industry, and everyday life have had major effects on land, vegetation, streams, oceans, air, and even outer space. But individuals and communities are doing things to help protect Earth's

	resources and environments.(5-ESS3-1)		
GLOBE Application			
Atmosphere Protocols:	GLOBE Learning Activities: (Learning	Guiding Question(s):	
<u>Air Temperature</u>	activities aligned with the NGSS Performance		
• <u>Clouds</u>	Expectations.)	Weather and Seasonal Patterns	
Surface Temperature	1. Observing, Describing and Identifying	• How does the weather change with the seasons?	
Precipitation	Clouds (3-ESS2-1)	in your region?	
	2. Estimating Cloud Cover (3-ESS2-1)	How do your local weather patterns compare to	
Data Investigation Charter	3. <u>Cloud Watch</u> (3-ESS2-1)	other places around the world?	
Data Investigation Sneets:	4. <u>C1: From Weather to Climate-Looking at</u>		
• Atmosphere Investigation Integrated	<u>Air Temperature Data</u> (3-ESS2-1,	Local Weather and Safety	
<u>Almosphere investigation integrated</u>	3-ESS2-2)	• What weather-related hazards are common in your	
	5. <u>C2: What is Your Climate Classification?</u>	• How do weather changes affect small-scale climate	
<u>Atmosphere Investigation Clouds</u>	(3-ESS2-1)	zones in vour community?	
<u>1-Day</u>	6. How to Make a Climograph from Your		
<u>Atmosphere Investigation Surface</u>	Local Weatner Data (3-ESS2-1)	Environmental Systems and Interactions	
Temperature	7. What Can we Learn About Our Seasons?	The atmosphere interacts with Earth's other systems	
	(3-E332-1, 3-E332-2)	In fascinating ways: (MND Tool: Earth System	
Elementary GLOBE Book:	0. <u>Microclimates</u> (3-ESS2-1)	• With the geosphere (land and rock)	
Do You Know That Clouds Have	5-FSS2-1)	With the biosphere (living things)	
Names?	10 What Can We Learn About Our Seasons?	• With the hydrosphere (water)	
<u>What's Up in the Atmosphere?</u>	11 We are All Part of the Solution (4-ESS3-2		
Exploring Colors in the Sky	5-ESS3-1)	Community Response	
What in the World is Happening to Our		How do local leaders use scientific data to protect eitizons from weather related risks?	
Climate?	GLOBE Resources:		
	GLOBE Water Cycle Protocol Bundle	Discussion Guidelines:	
	GLOBE Weather Protocol Bundle	Consider both short-term weather events and	
	Earth System Science Posters	long-term climate patterns in your responses. Use	
		specific examples from your region when possible.	
NASA ASSETS			
NASA Next Gen STEM for Educators: Resource		My NASA Data Learning Activities Grades 3-5:	
for educators	MV NASA	Interactive Weather Observations (3-ESS2-1)	
STEM Careers: Ask a SME: Close Up with a		<u>Cloud Sort Activity</u> (3-ESS2-1)	
NASA Subject Matter Expert		Modeling Cloud Cover (3-ESS2-1)	

NASA Earth Minute Videos: NASA isn't all about		• Exploring Sky Color and Visibility (3-ESS2-1)
interplanetary exploration; in fact, the agency	MY NASA DATA Earth System Data Explorer:	Global Temperatures Graph (3-ESS2-1,
Why Does NASA Study Earth		3-ESS2-2)
My NASA Is Aerosol		Earth System Satellite Images: Analyze One
<u>Cloudy Forecast</u>	GLOBE Atmosphere Protocols and Related	Image (3-ESS2-1, 3-ESS2-2, 5-ESS2-1)
<u>Sea Level Rise</u>	ESDE Datasets:	Analyzing Date for Mail eastion (2 5002-1)
<u>Earth Has a Fever</u>	My NASA Data features resources for GLOBE	Analyzing Data for My Location (3-ESS2-1)
<u>Mission to Earth</u>	protocols that provide connections to NASA	Observing Earth's Seasonal Changes
NASA Learning Activities:	datasets in the Earth System Data Explorer	(3-ESS2-2, 5-ESS2-1)
Building for Hurricanes: Engineering	Atmosphere STEM Career Connections: My	Energy Absorption on the School Yard Lab
Design Challenge (3-ESS3-1, 4-ESS3-2)	NASA Data (MND) offers resources to help	Activity (3-ESS2-1, 3-ESS2-2, 5-ESS3-1)
Rain Gauge Design Challenge (3-ESS3-1,	students explore careers related to Earth Systems	Our Earth: An Energy Absorption on the School
4-ESS3-2)	missions at NASA. Students may review job	Vord (Lab Activity)
Observing Aerosols (3-ESS2-1)	profiles within the four disciplines of STEM aligned	
<u>Color a Temperature (Ch)art (</u> 3-ESS2-1)	with projects in the Atmosphere, Biosphere,	• Our Earth A <u>Web of Systems</u> (3-ESS2-2,
• <u>Seasons Greetings (</u> 3-ESS2-2, 5-ESS2-1)	Cryosphere, Geosphere, and Hydrosphere.	5-ESS2-1)
<u>Climate Kids</u>	My NASA Data Resource Pages	<u>Cloudy vs Clear</u> (3-ESS2-1)
• How do Clouds Form? (3-ESS2-1)	About the Atmosphere	Hurricane Dynamics Data Literacy Cube Activity
• What's the difference between	<u>Air Temperature</u>	(3-ESS2-1, 3-ESS2-2, 5-ESS2-1)
weather and climate? (3-ESS2-1,	NASA Langley GLOBE Resource Page	What Will Happen if Climate Variability and
3-ESS2-2)	Whish Eurigicy GLOBE Resource Fuge	Change Cause Glacier and Polar Ice Can
 <u>NASA Space Place: Weather (</u>3-ESS2-1, 		
3-ESS2-2)		Meiting (3-ESS2-2, 4-ESS2-2, 5-ESS2-1)
 <u>Precipitation Towers (</u>3-ESS2-1) 		<u>What Will Happen if Climate Variability and</u>
How do you build a weather satellite?		Change Cause Glacier and Polar Ice Cap
<u>(</u> 3-ESS3-1, 4-ESS3-2)		Melting
Water in the Atmosphere (3-ESS2-1)		Human Impacts and the Creation of Urban Heat
<u>NASA eClips Interactive Lesson: Clouds</u>		Islands (4-ESS3-2, 5-ESS3-1)
(3-ESS2-1)		Trapical Ovelana Counte Model (4 ESS2 2)
NASA eClips Interactive Lesson: Seasons (2,5000,4)		
(3-ESS2-1)		Iropical Cyclone Counts Bar/Column Chart
<u>The Air We Breathe</u>		(4-ESS3-2)

Prepared by NASA Langley Research Center Science Directorate: Tina R. Harte and Elizabeth Joyner (2017) Revised by NASA Langley Research Center Science Directorate, Science Education Team (2025))