

Science Georgia Standards of Excellence

SCIENCE - Meteorology

The Science Georgia Standards of Excellence are designed to provide foundational knowledge and skills for all students to develop proficiency in science. The Project 2061's *Benchmarks for Science Literacy* and the follow up work, *A Framework for K-12 Science Education* were used as the core of the standards to determine appropriate content and process skills for students. The Science Georgia Standards of Excellence focus on a limited number of core disciplinary ideas and crosscutting concepts which build from Kindergarten to high school. The standards are written with the core knowledge to be mastered integrated with the science and engineering practices needed to engage in scientific inquiry and engineering design. Crosscutting concepts are used to make connections across different science disciplines.

The Science Georgia Standards of Excellence drive instruction. Hands-on, student-centered, and inquiry-based approaches should be the emphasis of instruction. The standards are a required minimum set of expectations that show proficiency in science. However, instruction can extend beyond these minimum expectations to meet student needs.

Science consists of a way of thinking and investigating, as well a growing body of knowledge about the natural world. To become literate in science, students need to possess sufficient understanding of fundamental science content knowledge, the ability to engage in the science and engineering practices, and to use scientific and technological information correctly. Technology should be infused into the curriculum and the safety of the student should always be foremost in instruction.

The meteorology course is designed to build on the foundation laid by the Earth systems and Earth science courses. Students will learn that Earth is a dynamic system and Earth's atmosphere is a result of processes that took millions of years. The learner then takes this knowledge of the composition and characteristics of Earth's atmosphere and transfers it to delve into the factors that can cause short term and long term changes in Earth's atmospheric conditions. Students will learn that the Earth is an interacting system of both energy and matter. To understand the interaction, students must build on prior knowledge of matter and the factors the affect its behavior. In addition, throughout this course students will use science inquiry skills, manipulation of appropriate lab equipment and demonstration of appropriate safety practices.

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SM1. Obtain, evaluate, and communicate information about the structure and composition of Earth’s atmosphere and the processes that cause weather.

- a. Construct an explanation for how atmospheric properties (i.e., temperature, density, chemical composition, pressure and moisture) influence its structure.
- b. Develop a model that explains seasonal variations in insolation including length of daylight hours, angle of midday sun, and Earth’s axial tilt.
- c. Plan and carry out an investigation to explain how albedo and specific heat (land versus water surfaces) create differences in surface heating.

SM2. Obtain, evaluate, and communicate information about energy transfer and its role in precipitation, cloud formation, and air mass formation.

- a. Ask questions to compare and contrast the relationships between air masses, source regions, fronts, and the changes associated with frontal passage (e.g., air density, temperature, dew point, wind direction, cloud types, precipitation.)
- b. Ask questions to identify major types of clouds and weather associated with each type.
(*Clarification statement:* Cloud types should go beyond cirrus, stratus, and cumulus and may also include cirrostratus, altocumulus, cumulonimbus, etc.)
- c. Construct an explanation of how clouds and different types of precipitation develop.
(*Clarification statement:* The convective loop processes should be addressed here.)
- d. Develop and use models to construct an explanation of the role that pressure differences have on energy transfer and the development of wind systems (e.g., sea breeze, land breeze, Hadley cells, Ferrel cells, prevailing winds, jet stream, ENSO, global scale winds).
(*Clarification statement:* Inclusion of the Coriolis effect is appropriate at the global scale).

SM3. Obtain, evaluate, and communicate information about the science of weather forecasting.

- a. Analyze and interpret data to create a surface map that includes, but is not limited to, high- and low-pressure systems, isobars, wind barbs, and fronts.
- b. Construct an argument supported by evidence for the type of weather expected for a specific location using weather maps and knowledge of the movement of air masses, fronts, and weather systems.
- c. Ask questions to develop predictions about the formation of meteorological events including severe thunderstorms, hurricanes, tornadoes, floods, droughts, and winter storms.
- d. Ask questions to investigate and communicate the role of technology and public awareness on weather forecasting (e.g., NOAA/NWS observation data network, instrumentation, satellites, radar, weather balloons, models, watch/warning criteria).
- e. Construct an argument supported by observations to verify the forecast contained in a weather briefing for a specific location.

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SM4. Obtain, evaluate, and communicate information about the relationship between weather and society.

- a. Obtain and communicate information to relate the personal, local, national, and global implications of severe weather events.
- b. Ask questions to identify the relationships between weather and society (e.g., urban heat island, smog formation, air quality, stratospheric ozone).
- c. Obtain, evaluate, and communicate information about the potential individual and societal impacts of changing weather and climate conditions.
(Clarification statement: Impacts such as economic, social, health (physical and emotional), political, ecological, etc. should be addressed.)
- d. Design and defend a safety plan based on common weather events for your geographic location.
(Clarification statement: Safety plans should address hazardous weather alerts and include protocols for a variety of weather events.)

SM5. Obtain, evaluate, and communicate information about climate and climate change.

- a. Analyze and interpret data to construct explanations for various global climate types based upon climatic characteristics such as latitudinal variations in insolation, distribution of land and water, prevailing winds, average temperature and precipitation, atmospheric circulation, physical geography, altitude, and ocean currents.
- b. Ask questions and communicate information about factors impacting global climate change (e.g., Milankovitch and ENSO cycles, greenhouse gases, changes in physical geography).
- c. Construct an argument from evidence about the potential implications of global climate change on weather.