*Unless otherwise specified, "descriptions" referenced in the evidence statements could include but are not limited to written, oral, pictorial, and kinesthetic descriptions.

MS-ESS2-2 Earth's Systems

Students who demonstrate understanding can:

MS-ESS2-2. **Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.** [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future.

Disciplinary Core Ideas

ESS2.A: Earth's Materials and Systems

- The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.

ESS2.C: The Roles of Water in Earth's Surface Processes

- Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.

Crosscutting Concepts

Scale Proportion and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

Observable features of the student performance by the end of the course:		
1	Articulating the explanation of phenomena	
	a	Students articulate a statement that relates a given phenomenon to a scientific idea, including that geoscience processes have changed the Earth's surface at varying time and spatial scales.
	b	Students use evidence and reasoning to construct an explanation for the given phenomenon, which involves changes at Earth's surface.
2	Evidence	
	a	Students identify and describe* the evidence necessary for constructing an explanation, including:
		i. The slow and large-scale motion of the Earth's plates and the results of that motion.
		ii. Surface weathering, erosion, movement, and the deposition of sediment ranging from large to microscopic scales (e.g., sediment consisting of boulders and microscopic grains of sand, raindrops dissolving microscopic amounts of minerals).
		iii. Rapid catastrophic events (e.g., earthquakes, volcanoes, meteor impacts).
	b	Students identify the corresponding timescales for each identified geoscience process.
	c	Students use multiple valid and reliable sources, which may include students' own investigations, evidence from data, and observations from conceptual models used to represent changes that occur on very large or small spatial and/or temporal scales (e.g., stream tables to illustrate erosion and deposition, maps and models to show the motion of tectonic plates).
	Reasoning	

3	a	Students use reasoning, along with the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future, to connect the evidence and support an explanation for how geoscience processes have changed the Earth's surface at a variety of temporal and spatial scales. Students describe* the following chain of reasoning for their explanation:	
		i.	The motion of the Earth's plates produces changes on a planetary scale over a range of time periods from millions to billions of years. Evidence for the motion of plates can explain large-scale features of the Earth's surface (e.g., mountains, distribution of continents) and how they change.
		ii.	Surface processes such as erosion, movement, weathering, and the deposition of sediment can modify surface features, such as mountains, or create new features, such as canyons. These processes can occur at spatial scales ranging from large to microscopic over time periods ranging from years to hundreds of millions of years.
		iii.	Catastrophic changes can modify or create surface features over a very short period of time compared to other geoscience processes, and the results of those catastrophic changes are subject to further changes over time by processes that act on longer time scales (e.g., erosion of a meteor crater).
		iv.	A given surface feature is the result of a broad range of geoscience processes occurring at different temporal and spatial scales.
		v.	Surface features will continue to change in the future as geoscience processes continue to occur.