GLOSSARY:

Arctic oscillation: An index which varies over time with no particular periodicity of the dominant pattern of non-seasonal sea-level pressure variations north of 20N latitude. It is characterized by pressure anomalies of one sign in the Arctic with the opposite anomalies centered about 37–45N.

Cyclogenesis: The development or strengthening of cyclonic circulation in the atmosphere, a low pressure area.

El Niño: A warm ocean current of variable intensity that develops every few years along the coast of Ecuador and Peru, and sometimes causes catastrophic weather conditions around the globe.

La Niña: The cooling of the surface water of parts of the Pacific Ocean, occurring less frequently than El Niño events but causing similar, generally opposite disruptions to global weather patterns. Often it occurs when the Pacific trade winds blow more strongly than usual, pushing the sun-warmed surface water farther west and increasing the upwelling of cold water in the eastern regions.

Low-pressure system: An area of a relative pressure minimum that has converging winds and rotates in the same direction as the earth. This is counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Malnourishment: The result of an unbalanced diet in which certain nutrients are lacking.

Mercury barometer: A tool in which the weight of a column of mercury in a glass tube with a sealed top is balanced against that of the atmosphere pressing on an exposed cistern of mercury at the base of the mercury column. The height of the column varies with atmospheric pressure.

Meteorologist: The science dealing with the atmosphere and its phenomena, including weather and climate.

Water Cycle: (Also called the hydrologic cycle) The natural sequence through which water passes into the atmosphere as water vapor, precipitates to earth in liquid or solid form, and ultimately returns to the atmosphere through evaporation.

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***Advanced* Teachers Guide**

SYNOPSIS:

Extreme weather events can cause widespread damage resulting in billions of dollars of losses. Recent events, such as blizzards, hurricanes, and droughts have been exceptionally devastating as a result of several environmental factors.

The convergence of several weather systems and the right atmospheric conditions sometimes result in the "perfect storm." This issue examines the factors behind catastrophic weather. It explains El Niño and La Niña, which are instigators of many unusual climactic events around the globe.

These phenomena impact ocean temperatures, wind patterns and other atmospheric conditions. Other intense storms, such as Hurricane Sandy, result from the interaction of low pressure systems, which affect the direction and strength of the storm.

CURRICULUM UNITS:

- Earth science
- Environmental science
- General science
- Meteorology
- Physical science

CAREER OPPORTUNITIES:

- Environmental engineer
- Environmental scientist
- Meteorologist
- Marine biologist
- Researcher

PROGRAM OVERVIEW:

There are many factors that lead to extreme weather events. Some events have resulted from unusual coincidences, while others are influenced by phenomena such as El Niño and La Niña. Warming trends can increase precipitation, river run-off, and melt ice sheets, all of which increase the amount of fresh water flowing into the oceans.

This influx of water impacts the ocean and can affect weather around the globe. The National Climatic Data Center keeps statistics for the worst weather in the United States and in 2012, there were eleven events that made the so-called "billion-dollar list." Although the year saw fewer big disasters than 2011, which had 14, the dollar losses were much larger in 2012.

In the spring of 2012, drought conditions began in the central United States, where low amounts of snow disrupted the normal water cycle. A strong Arctic oscillation and a North Atlantic oscillation prevented the usual storms from developing. In East Africa, El Niño is to blame for the worst drought to affect the area in over 60 years.

Hurricane Sandy was a storm that battered the northeastern United States, particularly New Jersey and New York, in 2012. While it is unusual for hurricanes to occur this far North, Hurricane Sandy became dangerous as a result of the interactions of two other weather systems acting on the hurricane as it traveled along the east coast. These systems steered the hurricane towards land and intensified its effects. The storm, unfortunately, also coincided with extremely high tides, resulting in an excessive storm surge and flooding.

ISSUES & CRITICAL THINKING:

1. Have students research catastrophic weather events in history and the elements that were in place for these events to occur.

2. Discuss with the students how weather is forecasted. Have them research how scientific advancements have improved forecasting in recent years.

3. El Niño and La Niña have cycles. Have students research these cycles and discuss weather events in different parts of the world that might have occurred as a result of El Niño and La Niña.