Cyclones are one of the world’s most devastating natural disasters causing billions of dollars in damages to homes, buildings, and infrastructure annually. The United Nations estimates that cyclones have caused an average of 11,000 deaths per year over the last two decades. In the worst cases, cyclones have caused catastrophic loss of life numbering in the hundreds of thousands.¹

Hurricanes, cyclones, and typhoons are all the same weather phenomenon; we just use different names for these storms in different places. In the Atlantic and Northeast Pacific, the term “hurricane” is used. The same type of disturbance in the Northwest Pacific is called a “typhoon” and in the South Pacific and Indian Ocean, the term cyclone is used. We will use the term cyclone throughout this activity for all these Tropical Storm events.

Interestingly, although science can explain all the ingredients that make a cyclone possible, there is still some mystery as to when an event will actually occur. All the known factors that produce a cyclone can be present and yet a storm event may or may not be born. The components for these storms include a pre-existing weather disturbance, warm tropical oceans, moisture, and relatively light winds. If the right conditions persist long enough, they can combine to produce the violent winds, incredible waves, torrential rains, and floods we associate with this phenomenon. The low-pressure centers and the wind producing waves also generate extremely damaging storm surge events that generate an upwelling of water many times higher than normal high tides that inundates coastal areas.

In the Atlantic, hurricane season officially runs June 1 to November 30. However, while 97 percent of tropical activity occurs during this time period, there is nothing magical in these dates, and hurricanes have occurred outside of these six months.²

**Hurricanes and Climate**

In recent years, the relationship between cyclones and climate change has become a source of public interest, significant scientific debate, and a focus for current research. The potential relationship between cyclones and climate change has great implications for society, especially in coastal regions affected by these extreme storms. The Intergovernmental Panel on Climate Change (IPCC) has reported that cyclone intensity may be increasing due to warmer tropical sea surface temperature (SST); however, the connection to Atlantic cyclones frequency is less conclusive.³

In this activity, we will explore where cyclones occur and where they do not occur and understand some of the global ocean and atmospheric circulation patterns that generate
Global Climate Change and Human Health
Cycloning out of Control: Climate Change Impacts on Natural Disasters; Cyclones

these tropical storms. We will then use the ChangeViewer tool to help students learn how tropical storms impact the United States and nations around the world. Specifically, we will look at measures of storm impact on the economies of these countries as measured by percent of GDP and the health effects of storms by looking at projected mortality rates. We will then investigate the numbers and locations of populations in areas that may experience tropical storm of significantly increased intensity.

For more information on the relationship between tropical storms and global climate change, please review the following links:

**Intensity of Hurricanes on the Rise**

Please review the stories found at the links below for more background on how climate change may be responsible for increased tropical storm intensity over the next century.

http://www.usgcrp.gov/usgcrp/links/hurricanes.htm

![Figure 1. Hurricanes and Climate Change, Union of Concerned Scientist](http://www.ucsusa.org/global_warming/science_and_impacts/science/hurricanes-and-climate-change.html)
Case Studies


Figure 2. NASA satellite image of Cyclone Nargis over Myanmar (Burma) taken on May 1st, 2008
Composite satellite image below is of the intense hurricanes Dennis, Emily, Katrina, Rita and Wilma from different dates in 2005. The storms all made landfall at various locations around the Gulf of Mexico, causing nearly $180 billion in damage.

Figure 3. Image courtesy of Univ. of Wisconsin-CIMSS and UCL.
Global Climate Change and Human Health

Cycloning out of Control: Climate Change Impacts on Natural Disasters; Cyclones


Figure 4. NASA Satellite image of the eye wall of Hurricane Katrina - taken on Aug 28th, 2005
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Cycloning out of Control: Climate Change Impacts on Natural Disasters; Cyclones

References

