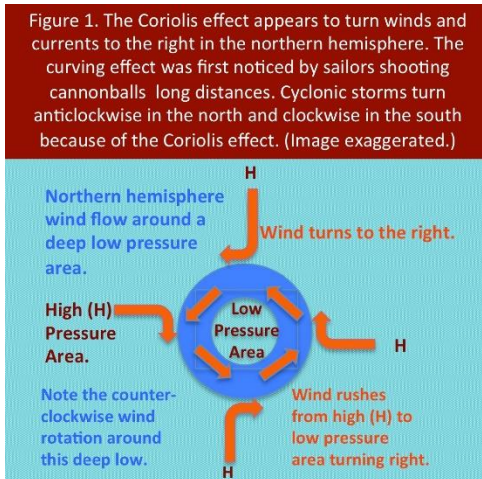




Hurricanes and Cyclones



Hurricanes (also known as cyclones, typhoons, cyclonic storms) are rotating storms driven by an exchange of heat energy from sea surface (evaporation) to high (~12 kilometers up) in the atmosphere (condensation). Even if we don't live on a coast hit by hurricanes, cyclones or typhoons, it's worth knowing more about these storms as their intensity is increasing with global climate change, perhaps linked to warmer sea surface temperatures.

A number of factors must be lined up, to make a hurricane. These tropical cyclones, known by different names, form out at sea close enough to the equator ($>5^\circ$ north or south) to be hot (sea surface temperature must be at least 26.5°C) and far enough away from the equator to have a Coriolis effect. The Coriolis effect (see Figure 1.), from our planet's spin, causes winds and currents to turn to the right in the northern hemisphere and to the left in the southern hemisphere, the effect is weakest at the equator. During a hurricane, rising warm water vapour from sea surface evaporation cools the remaining surface water and by taking its heat energy with it aloft. The rising water vapour must be able to rise up high (~12 kilometers up), where it releases heat energy through condensation into rainclouds and cold rain, producing outflow winds at height. Related to this, please note that water vapour is also a greenhouse gas: the primary one. Lack of knowledge about water vapour is a big contributor to uncertainties in predicting global climate change, so the more we know about it the better.

Starting as a low-pressure area with a spiral of associated thunderstorms lined up, cyclonic storms develop into a tropical depression (a really low, low pressure area where winds rush in). If all conditions continue to be present, these massive storms will continue to gain momentum. Typically, hurricanes weaken rapidly over land where they are cut off from their energy source of evaporation from a hot sea surface. On route, they dump vast amounts of rain and their winds, waves and storm surges wreak havoc on coastal communities in their path. At the surface behind them, they leave cool water, which defuses any other hurricanes that might otherwise track in behind them. If this seems too complicated, check out the short PowerPoint presentation called Hurricanes. It will help if you are a visual learner and need more clarity.



Hurricane Worksheet (Fill in the blanks.)

- 1.) What is the Coriolis effect, on wind and current direction in the northern hemisphere? Coriolis effect makes the wind and currents turn to the _____ in the northern hemisphere.
- 2.) If winds are rushing into a deep low pressure area from all around, the Coriolis effect will spin the winds circling counter-clockwise in the northern hemisphere and _____ in the southern hemisphere.
- 3.) In a hurricane, cyclone or typhoon, heat energy is removed from the sea surface through the process of _____ during which liquid water transforms into its gas form, water vapour. The warm, wet air is carried up high by _____.
- 4.) During a hurricane, heat energy rises held within the water vapour and when the water vapour condenses into cold rain, heat energy is _____, which further drives outflow winds aloft.

Reflection

While it is important to understand how conditions line up to create and power these monster storms, the suffering and loss from their brute force, is another realm that also deserves our serious attention. International aid organizations play important roles in providing temporary relief to victims with potable water, food, shelter and medical treatment. We can help these organizations by donating, by doing a personal or class project or by volunteering our time.

We can also supporting ecosystems that give natural protection to coastal areas. Areas hit hard by Hurricane Katrina where wetlands were removed and shorelines hardened and parts of the Philippines walloped by cyclone Hainan where mangroves had been removed, provide two illustrations of the benefits of natural, coastal resilience. Recovery of natural systems is also important. Coral reefs can be smashed by these massive storms and mangroves, which are very resilient, provide nursery areas for young coral reef fish to keep algae in check during coral reef recovery after a storm. Reef recovery can also mean traditional food sources for people nearby.

Research which International Aid organizations have the best reputations for helping victims of hurricanes, cyclones and typhoons?

Do the same for conservation organizations that work to protect essential ecosystems like wetlands and mangroves?

Thinks about how you and your family, class or community might want help after a devastating storm? Pick something small and achievable and brainstorm how to achieve it. Work with others. Share your story for an inspirational ripple effect.