Hurricanes Essay, Research Paper

How a Hurricane Begins

The Equatorial trough is the area in the ocean in which the trade winds converge. It moves north and south with the seasons. This phenomena can not be explained by scientists. Hurricanes always form along or be the Equatoral trough but, never in it.

In the Tropics warm air rises, cools, sinks and then returns to the equator with the trade winds. Once this air starts sinking it warms adiabatically. This produces and layer of high level air that is warmer than the air below it. This is called a high level temperature inversion. In this rising warm air is usually trapped. This cause storms to develop closer to the surface of the Earth. If a storm is growing vigorously, and is being pushed up by unusually strong winds, then there is a possibility of it breaking through the low lying air. This causes a Tropical depression, that can be up to 40,000 feet tall.

For a tropical depression to grow further into a hurricane, there must be low pressure at the surface accompanied by high pressure at an altitude of about 56,000 feet. This forms an anticyclone Constant vertical moving air feeds the anticyclone. This causes the air to circulate around the high and low pressure areas. In the northern hemisphere the air turns clockwise around the high pressure, and counterclockwise around the low pressure areas. the directions are reversed in the Southern hemisphere. This event is called cyclone circulation.

The wind continues to strengthen until the pressure between the high and the low pressure areas can accelerate no further. It then rises until it meets the anticyclone. The anticyclone (turning clockwise) pushes the rising air outwards away from the center. By removing the rising air more air is drawn upwards. This forces the surface?s atmospheric pressure fall. This fall in pressure need not be great. The average sea-level pressure is 1,016mb. In the center of a hurricane it is 920mb-980mb. This means that the pressure only falls about 4-10%.

Now there is an area, 400m or more across, in which a storm has developed. The air in the center circulates upward towards the top and then disperses outwards. This draws more air upwards. If the air in the center becomes warmer then the air around it the sky in this area will clear, leaving a sunny area surrounded by what appears to be a wall of cloud. This is the eye, and what once was a tropical depression is now a hurricane.

Where Hurricanes Occur

Hurricanes begin as tropical depressions. These are areas where the atmospheric pressure

is just a little lower than the air around it. Hurricanes only start in the tropics, it is impossible for

them to start in places such as Minnesota. Hurricanes have different names in different places. In

the Western Hemisphere they are called hurricanes. In the Bay of Bengal they are called cyclones. Over most of the Pacific they are called typhoons. Near Indonesia they are called baguios. Also some people in Australia call them willy-nillies. Meteorologists use one common name for all of these things. They call them Tropical cyclones. Tropical cyclones are always more intense in the tropics. The opposite of tropical cyclones are anticyclones. These areas of high atmospheric pressure.

In order for a tropical cyclone to form their must be a fall of atmospheric pressure over a large area. This fall in pressure need not be great, only 20mb over a period of two days. This fall in atmospheric pressure is common in temperate latitudes, but is very unusual in the tropics where the air pressure is fairly constant over very large areas. Under certain circumstances this fall in pressure can be enough to trigger a tropical storm.

There are two main scenarios in which tropical storms turn in to hurricanes. It may be that a pocket of low pressure air becomes detached from the edge of a mid latitude weather system and spills over into the tropics as a tongue of low pressure (called a trough) extending the equator at high altitudes. On the other hand, a low pressure system on land may drift out over the sea, or wave develop along the equatoral trough. This will produce a depression that detaches itself from the equatoral trough, which reforms behind it. No matter what the causes it the depression moves westward in an easterly wave.

Minor depressions can start anywhere but will only turn into a hurricane if it crosses over an expanse of very warm sea. This confines the birth place of hurricanes to the tropics. In latitudes higher than 20 degrees the sea surface temperature is usually to low. In areas close to the equator the sea is often warm enough to start a hurricane but hurricanes never start in latitudes lower than 5 degrees. This is because of the Coriolis Effect. The Coriolis effect is needed to swing the air moving towards the low pressure area into a circular path. The effect is not strong enough to cause the swing within 5 degrees of the equator.

Vorticity will cause the air to move in a curved path and eventually cause it to rotate. After it?s momentum accelerates it forms into an even smaller radius. In order for a hurricane to form within 5 degrees of the equator air would need to converge on the low pressure region from such a vast area that there is simply not enough air available.

Taking into account the need for high sea surface temperature, and a sufficiently strong Coriolis effect, you would come to the conclusion that the area that hurricanes can form a belt over the oceans is confined to between 5 degrees and 20 degrees. This is true for both hemispheres. There is also a restriction for what time of year hurricanes can start. Hurricanes can usually only start in late summer, and fall, because this is the only time of year that the water is warm enough to start a hurricane. Sometimes hurricanes can start during other seasons but this is very rare.

Most hurricanes do not develop until the depression crosses the western side of an ocean, but some form in the North Pacific. Over the tropics air moves vertically in Hadley cell. As it moves away from the equator the Coriolis effect causes the causes the air to swing right in the Northern hemisphere and left in the Southern hemisphere (it always swings to the east). It also causes the high level air moving away from the equator to be deeper to the east of Hadley cell than on the west. The high level air then sinks (still over the tropics) and warms it self. This limits the amount of air rising from the surface. This is because the air meets with a layer of subsiding air, and since the air is warmer and less dense it can rise no further. Sometimes it is possible for this air to break through the layer of subsiding air, but since the air on the west side of Hadley cell is denser it is easier for the air to escape. This is why hurricanes start on the west side of the ocean.

Depressions can only turn into hurricanes if they pass over a warm expanse of sea. This is because the depression must collect enough water vapor to provide a layer of vapor most air deep enough to supply it with sufficient latent heat of condensation. This means if a depression goes over the land it would not collect enough water and will die out. This is another reason why most hurricanes begin on the west side of the ocean.

Hurricanes Damage

There have been many hurricanes that caused tremendous amounts of damage. In late August 1992 hurricane Andrew crossed through Southern Florida and Louisiana. It?s winds reached up to 164 MPH. It demolished 63,00 homes in Florida, and left 44,000 people homeless in Louisiana. Hurricane Andrew is the most costly hurricane in history. In these two states alone it caused damages estimated at twenty-five million dollars.

A few days later, on the other side of the world Tropical Storm Polly was forming in the China Sea. It traveled westward towards the Coast of China. There it killed 165 people and left five million without homes.

When we think of hurricane damage we think of huge buildings being crushed by the power of the wind, but in real life the things that suffer the most damage are the homes and the crops. This is especially true in the third world countries where the food is especially needed. Typhoon Cecil devastated crops in central Vietnam in May, 1989. It also demolished around 36,000 houses, but houses are a lot easier to replace than crops. In September, 1989 hurricane Hugo devested crops in the Caribbean, and the eastern United states. Like most hurricanes Hugo up rooted trees. This resulted in the destruction of orchards and forests. It Damaged the Caribbean nation forest, and the Francis Marion Nation forest in South Carolina lost more than two thirds of it?s trees and three quarters of its endangered cockade woodpeckers.

To measure hurricane damage scientist use the Saffir/Simpson scale. There are other scales that can be used but this one is the most widely used. It takes into account such factors as, the pressure in the eye, the wind speed, and the size of the storm surges.

Historic Hurricanes

Hurricanes are entirely natural event and now a days we know a lot more about them than we ever did. The information that we know now is taken from our past experiences with hurricanes. Most of this information is from recent years. Now this does not mean that there are more hurricanes now then there ever were. In older times these hurricanes were not recorded. The people would repair the damage and move on with there lives as if nothing had happen. Occasionally though some people recorded these events. In 1696 for example a party of Quakers sailing from Jamaica to Philadelphia was caught in a hurricane and shipwrecked over night, onto what is now known as Jupiter Island. this event and all the hardships suffered by the crew were recorded by Jonathan Dickinson. We know of this hurricane only because it turned a normal sea voyage into a catastrophic ship wreck.

Other storms are remembered because of the scale of their damage. In 1099, for example a hurricane moving through the English channel killed 100,000 people along the English and Dutch Coast. Besides the fact that many lives were lost there would be major economical problems. There would be shortage of people, therefore less people to employ, therefore an increase in wage rises.

Sometimes the hurricanes effected things other than economy, and population. In rare occasions hurricanes like to disrupt wars. one of the most famous of these occurred in 1281. The Mongols, who at the time ruled China and Korea, ordered the Japanese to give up all their power to them. When the Japanese refused the Mongols sent a Korean ship to the southern most Japanese island of Kyushu. Their army attacked the island and soon overcame the Japanese?s defenses. Then out of now where a hurricane came and destroyed most of the Mongol army, saving Japan. The Japanese called this hurricane kamikaze. This means ?divine wind?. They ended up turning the day of its arrival into a religious celebration.

The Kamikaze is probably the only time that a hurricane has done any good for anyone, and even in this incident many were killed. Most such storms only bring death and destruction, sometimes on a vast scale. Measured in the terms of human life, the worst hurricane ever recorded in the United States lasted from August 27 to September 15 1900. It formed in the Caribbean and found its way into Galveston, Texas, on September 8. It had winds of 77 MPH gusting up to 120 MPH. This may not sound like much of a hurricane but, like other hurricanes it brought storm surges. It was this that caused most of the damage.

At the time Galveston was a thriving city, with a population of 40,000. It had a rapidly growing industry. A warning was issued to the town but little took notice. At dawn the town was starting to get anxious, the were heavy storms heading inland. As the eye of the storm grew closer the water level rose. By noon the bridges connecting to the main land were submerged making the people?s chance of escaping impossible. The water soon formed huge waves that destroyed buildings near the shore. The city was flooded to a depth of about four feet of water. The houses (made mostly of wood) were torn from their foundations by the winds. At 10 pm the winds finally subsided and the hurricane had passed. In the end more then 2,600 homes were destroyed, and around 10,000 people were homeless. About 5,000 people were injured, and about 6,000 were killed. In my opinion the most interesting hurricane ever occurred in the Bay of Bengal in 1876. 100,000 people were killed in only half an hour.

These are just some of the more devastating hurricanes that have hit mainland throughout history.

Hurricane Seeding

In the 1960s the US Navy Oceanic and Atmospheric Administration (NOAA) tried to weaken hurricanes by seeding them. The basic idea was to seed the clouds just outside the eye with silver iodide. The silver iodide, which is widely used in cloud seeding, encourages super cooled water to freeze. This releases latent heat which would make clouds grow. , stealing some of the humid air that is helping the cloud wall grow. It also creates strong winds.

It worked with Hurricane Beulahin 1963, and Hurricane Debbie in 1969. The only problem is scientists have no way of telling if these hurricanes would have weakened anyway. Hurricanes often weaken and then regain strength naturally. Also in the 1980s scientists figured out that there wasn?t enough super cool water for this to work effectively. Concerns have also been made that this could cause the hurricanes to redirect itself and cause even more damage in other areas. For these reasons hurricane seeding is no longer used. One good thing did come out of hurricane seeding anyway. The NOAA ended up gaining a lot of information for hurricane research.

Latent Heat

Latent heat is the heat given off by water as it changes phases. It is a major source of energy for thunderstorms and hurricanes. It also is a factor in any process involving water, such as the forming of snow crystals. The graphic above shows what happens during evaporation – the phase change from liquid to vapor. Fast-moving air molecules in warm air collide with liquid water molecules. The water could be falling rain drops or in a pond or a bowl. The collision transfers energy from the air molecules to the water molecules. This gives some of the water molecules enough energy to speed up, break away from the liquid and go into the air as water vapor. Since energy can’t be created or lost, the air molecules lose energy and slow down. This lowers their temperatures; the air cools. Perspiration evaporating from our bodies cools us by taking heat energy from our skin in a similar way.

Heat is added to the air when the water condenses from a gas to a liquid. This uses the same process as air being cooled by evaporating water, except the energy is transferred from the water molecule into the air. Energy added to the air, heats the air and makes it lighter. The lighter air rises. This is what feeds hurricanes and thunderstorms.

Latent heat uses the same principles as thermodynamics. None of energy is wasted.

How to Prepare For a Hurricane

1. Check to see if your area is at risk of being hit by a hurricane. Consult, newspapers, ask your neighbors and go to the local library. If you live near a coast on the west side of the Atlantic, North Pacific, or South Pacific then your area is at risk of being hit by a hurricane.

2. Research:

How high the area is above sea level

If you are near a river

The height of the ground between your house and the Coast

The History of hurricanes in your area

3. Make Arrangements to stay somewhere if a hurricane does occur.

Find the fastest route to this place where you will be staying

Make sure most of the road is high above sea level in case of flooding

If there are Emergency shelters in your area then make note where they are

4. Keep:

Lumber, and materials to board up windows

A cooler to keep fresh foods in

First aid kit clearly marked

Camping stove to cook on

Bottled water 14 gallons for each person

Canned food, 2 week supply per person, don?t forget your pets

5. Make sure:

The roof is in good condition

The gutter is clear

There are no weak branches on the trees around your home

There are no weak or dead trees around your home

What to do if there is a hurricane warning

1. Check weather broadcasts frequently

2. Fill car with gas and keep extra gas in a container

3. Take out materials to board your windows

4. If you have a mobile home tie it down

5. make sure you have enough food

6. Freeze gel packs for the coolers

7. Take out extra money.

8. If told to evacuate do so

9. Leave the pets at home with food

10. Make reservations if none have been made

11. Alert your relatives as to where you are going

What to do if you are caught in a hurricane

1. Unplug the appliances

2. Move to the safest part of the building

3. Keeping far away from the windows lie on the floor, possibly under a table, to avoid the wind.

Warning! If it becomes sunny and clear outside do not go out. This is most likely the eye of the hurricane. The wind will resume in a few minutes. Wait for a radio announcement before leaving the house.

How Hurricanes are Named.

There were two alternatives for labeling hurricanes. The first was to label the hurricanes by year and sequence. For example the first hurricane of 1996 would be labeled 1:96. The only problem with this method developed in the 1940?s when meteorologists started exploring hurricanes by plane. Back then the form of communication was mainly in Morse code. ?—– —.. —-. …..? means 1:96 in Morse code. This was long and difficult for the pilots to write, so this method was soon disposed of.

Soon ship, and aircraft radios started using voice communication instead of Morse code. In 1951 American meteorologists started using the international phonetic alphabet for radios: Able, Baker, Charlie, Dog, etc. In the beginning of 1953 a new international alphabet was introduced: Alpha, Bravo, Cocoa, Delta, etc. This became confusing because one operator would report ?Hurricane Baker? and another would report ?Hurricane Bravo?. This became a nuisance because it was unclear if these were two different hurricanes, or the same hurricane. Near the end of 1953 meteorologists started using women’s names instead.

Naming hurricanes was not a new concept. For many years people in the West Indies had named hurricanes after the saint on who?s day they struck. One example of this was a storm that swept across Puerto Rico on July 26, 1825, was known as Santa Ana. Personal names were also used in other locations such as Canada. Some meteorologist have been giving hurricanes women?s names since the late nineteenth century.

Women?s names were used until 1978 when lists in the Eastern Pacific used Men?s names. This method still remains. The names alternate between men, and women, for example Andrew, Bonnie, Charley, Danielle, etc. In 1979, these lists also started to include names from non-english-speaking-cultures. Since these names were used instead of the phonetic alphabet they were put in alphabetical order, for example in 1995 the first Atlantic Hurricane was called Allison, then Barry, and so on. Since Hurricanes, and Pacific typhoons use the same method to choose their names six different lists where created. These lists were recycled every six years, So in 1990 one list was used and six years later in 1996.

Some names have been retired because their hurricanes have caused such devastating destruction. They did this so that people would not get confused between hurricanes. For example if Hurricane Bonnie killed many people in 2001 and did again in 2010 then people might be confused between which hurricane it is. the names that have been retired are, Agnes (1972), Andrew (1992), Camille (1969), Gilbert (1988), and Hugo (1989).

Glossary

Equatoral trough- The band of low atmospheric pressure where the trade winds from both hemispheres converge.

Super cooled water- water that is colder than 32 degrees F but is liquid, not ice.

High level temperature inversion- A layer of high level air trapping the air below it.

Anticyclone- an area of high atmospheric pressure.

Cyclone circulation- the event in air circulates around high and low pressure areas

Cyclones- The name for hurricanes in the Bay of Bengal

Typhoons- The name for hurricanes in the Pacific Ocean.

Baguios- The name for hurricanes near Indonesia.

Willy-Nillies- The name for hurricanes in Australia.

Coriolis effect-The effect that causes hurricanes to rotate. Same effect that makes toilets rotate.

Storm Surges- Giant waves sometimes caused by hurricanes.

Kamikaze- The name given to a hurricane by the Japanese. Means divine wind.

Thermodynamics- The study of the conservation of energy.

Meteorologists- People who study hurricanes.

Adiabatically- 1. occurring without loss or gain of heat 2. of or having to do with a change of volume of a gas during which no heat enters or leaves it.

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