TROPICAL CYCLONES

- A tropical cyclone is a large, low-pressure system that forms over the tropical oceans.
- Tropical cyclones are classified by sustained wind speed as:
  - Tropical disturbance – wind less than 25 knots
  - Tropical Depression (TD) – wind 25 to 34 knots
  - Tropical storm (TS) – wind 35 to 64 knots
  - Hurricane (or Typhoon) – wind 65 knots or greater
- Sustained winds means winds averaged over a 3-minute period (in U.S.).
  - It is the sustained wind that is used to classify tropical cyclones, not the gusts.
- A typhoon and a hurricane are the exact same thing. They just have different names in different parts of the world.
- Global numbers:
  - About 80 tropical cyclones per year world-wide reach tropical storm strength
  - About 50 – 55 each year world-wide reach hurricane/typhoon strength
- Safir-Simpson Intensity Scale (used in U.S.)

<table>
<thead>
<tr>
<th>Category</th>
<th>Max Sustained Wind</th>
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<tbody>
<tr>
<td></td>
<td>knots</td>
</tr>
<tr>
<td>1</td>
<td>64 - 82</td>
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<tr>
<td>2</td>
<td>83 - 95</td>
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<td>3</td>
<td>96 - 113</td>
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<td>4</td>
<td>114 - 134</td>
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<td>5</td>
<td>135 +</td>
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- A major hurricane is a Category III or higher.
FORMATION

- The energy that drives hurricanes is the latent heat of condensation from the thunderstorms that comprise the hurricane.
  - Therefore, hurricanes can only form over very warm water, where there is plenty of moisture to feed the thunderstorms.
  - Hurricanes weaken rapidly when moving over colder water, or over land.
- Hurricanes can only form in regions of low vertical wind shear.
  - Hurricanes weaken when encountering strong vertical wind shear.
- Hurricane formation
  - The hurricane will begin its life as a tropical disturbance. The tropical disturbance is a large group of thunderstorms. The updrafts from these thunderstorms will result in surface convergence, pressure trough developing at the surface.
    - In the North Atlantic these disturbances are often associated with easterly waves, which originate in the atmosphere over Saharan Africa and move eastward.
  - If conditions are right, the disturbance will grow to a tropical depression. A surface circulation will form, or become better defined, and the convection becomes more organized.
  - The depression can continue to grow into a tropical storm. The tropical storm may begin to have well-developed feeder bands (also called rain bands).
  - As the tropical storm approaches hurricane intensity, an eye begins to form in the middle of the storm.
    - The eye is a region of clear or mostly clear skies. This is because the motion in the eye is downward, which causes adiabatic heating.
    - The eye is surrounded by the eye wall, an intense band of thunderstorms.

NORTH ATLANTIC HURRICANES

- Season is June 1 to November 30, but can occur in any month.
- Peak of season is September.
• Per year there are on average
  ◦ 10.1 named cyclones
  ◦ 5.9 hurricanes
  ◦ 2.5 category III or greater

• Seasons highly variable
  ◦ Have been as few as 1, to over 20 cyclones in a year.
  ◦ 1940’s and 1950’s had high activity
  ◦ 1970’s and 1980’ had low activity
  ◦ mid-1990’s and on are back to high activity
  ◦ 2005
    ◦ 27 named cyclones
    ◦ 15 hurricanes

• Since record keeping began there have been three Category V land-falling hurricanes in U.S.
  ◦ Labor Day Hurricane (1935) – Florida Keys
  ◦ Camille (1969) – Gulf Coast
  ◦ Andrew (1992) – South Florida

EASTERN NORTH PACIFIC HURRICANES
• Season similar to Atlantic.
  ◦ Peak in late-August

• Per year there are on average
  ◦ 16.4 named cyclones
  ◦ 9.2 hurricanes
  ◦ 4.0 category III or greater

MOVEMENT
• Most hurricanes initially travel toward the west, or west-northwest, in the trade winds below the subtropical high.
• If there is a break, or trough, in the subtropical high the hurricane may move northward, or *recurve* around the western edge of the high.
• The most difficult part of forecasting hurricane tracks is forecasting if and when they will recurve.

HURRICANE DAMAGE AND INTENSITY
• Most damage and destruction from hurricanes is not caused by the wind directly, but by the flooding caused by the torrential rains and *storm surge*.
• The storm surge from a typhoon in Bangladesh in 1970 killed at least 200,000 and may have killed up to 500,000 people!
• The right hand side of the storm (relative to its direction of motion) is where the highest winds (and greatest storm surge) are found. This is because the storms speed of advance is added to the wind circulating around the storm.

SAFETY AND AWARENESS
• The National Weather Service issues watches and warning for hurricanes and tropical storms. These are as follows
  o Hurricane watch – hurricane force winds are possible within 36 hours
  o Hurricane warning – hurricane force winds are expected within 24 hours.
  o Tropical storm watch – tropical storm force winds are possible within 36 hours
  o Tropical storm warning – tropical storm force winds are possible within 24 hours.
• The key to hurricane preparedness is not to be caught near the coast or in low-lying areas. **HEED ALL EVACUATION ORDERS BY THE AUTHORITIES!**
  o Many people are reluctant to leave their homes during a hurricane. They often will use the excuse that “we’ve ridden them out before”. What they fail to consider is that they may have been through a weak hurricane, or they may have only experienced the tropical storm force winds farther from the eye. They are not prepared to be hit by a category 4 or 5 hurricane dead on!