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High resolution climatology
- towards climate change services

Convection in tropical cyclones associated with vapor volume reduction - a new concept

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Low pressure zone formation due to convection in a tropical cyclone is associated by a newly discovered phenomenon.

The explanation is based on Avogadro's law. According to the law 18 grams (molecular weight expressed in grams) of water when evaporated occupies 22.414 litres of vapor at standard temperature and pressure (STP). Therefore, 1.0 gram of water in the vapor form will occupy 1.245 litres. That is, 1245 ml volume of vapor at STP when condensed will form 1.0 ml volume of water. Due to the phase change that is from water vapor to liquid water, huge reduction in volume occurs. The process of condensation of vapor into liquid water from the vapor component of the vapor-rich air is continuously taking place in a tropical cyclone particularly in the eye wall on a very large scale. The condensed water precipitates as rain or forms clouds. Each ml of the rain leaves behind a vacant space equal to 1245 ml forming a low-pressure zone and consequently a pressure gradient force is formed. Therefore, when there are continuous heavy rains in the eye wall, the magnitude of the low pressure zone and the pressure gradient force forming continuously in the condensation regions of the eye wall is gigantic. At the same time the latent heat released in the condensation process is absorbed by the remaining air component, it becomes warmer and buoyant, therefore ascends and ultimately escapes from the top of the cyclone as the outflow, again forming a low pressure zone. Thus, continuous condensation and continuous ascent and escape of warm air from the top together form a continuous pressure gradient and the vapour-rich air is continuously sucked up from below, that is from above the sea surface in the region of the eye wall due to the continuously forming pressure gradient force maintaining the near sea surface convergence of the vapour rich air. The value 1245 changes with change in temperature and pressure, but it does not affect the presented concept. The formation of the low pressure zone due to the condensation is instantaneous. The moment the condensation takes place, the low pressure zone and the consequent pressure gradient force is formed at that instant, hence this phenomenon enhances the fuel input process. Thus, the combination of the convection and the low pressure zone formation due to condensation and vapor volume reduction plays a combined role in the dynamics of a tropical cyclone.

In case of tornadoes in the tornado alley, tornadoes are formed where warm vapor-rich air from the Gulf of Mexico meets the cold dry air from Canada. Here the same phenomena of vapor volume reduction and consequent formation of the low pressure zone as explained above is dominantly contributing in initiating and maintaining the flow of air forming a tornado. Since this phenomenon is taking place on land and vapour supply is limited, the tornadoes have a short life span.