EYE OF THE HURRICANE .

Speranskaya A.A., Anisimova E.P., Moscow, the Moscow State University in the name of M.V. Lomonosov, physical faculty, Lenin mountains, 1/2 2, speransk2004@mail.ru
Pokhil A.E., Russian Hydrometeorological Research Center, 9-11, Big Predtechensky lane, 123242, Moscow, Russia, pokhil@mecom.ru

2004 is marked by a series of powerful tropical cyclones. It may be associated with the global warming. If so, incidence of hurricanes and typhoons will accrue in the future. As a result, there is growing interest to study of TCs.

This article is focused on study of the eye of tropical cyclones (TCs).

Evolution of the eye of tropical cyclones moving on open water areas in the Pacific and the Atlantic was studied at the base of observations from stationary satellites.

Changes of the size of the eye of tropical cyclones were studied depending on pressures in and maximal wind velocities in central cyclone areas. The following trend was identified: a more powerful whirlwind (with lower pressure and greater velocity in the centre) corresponds to a greater radius of the eye. At average, changes of the size of the eye of a whirlwind during TC development are slower, than during TC decline. It was found that at constant (within 60 hour) pressure in TC center, the size of the eye may change in some times.

Causes of fluctuations of diameter of the eye of tropical cyclones can not be identified with use of modern natural observations alone.

The authors sought to fill in this gap, using the results of study of tropical cyclones by laboratory modelling of air intensive convective whirlwinds (ICW) of humid type.

The experimental model - an advanced vortical Fitzjarrald D.E. chamber - provided for the necessary conditions for concentrated whirlwinds such as the background whirlwind and its concentration. In the model a vortex structure emerges, that by the basic criteria of similarity corresponds to the central part of the bottom troposphere of a developed tropical cyclone. The thermal Frud (Fr *) number was found to be the determining criterion of similarity for whirlwinds of such class. The research results obtained with use of ICW physical model at $Fr^* < 0.065$ are presented. Under these conditions, there is a clear black "eye" in the center of a whirlwind and, hence, there is no condensed moisture.

In the central area of vortical structure the temperature maximum is observed - the maximum is located at some height from the water surface. While moving away from the axis of a whirlwind, the maximal temperature decreases and moves upwards along the axis of heights. Inversion of temperature in humid ICWs is observed in a thin vertical layer suggesting existence of a local heat source. Measurements of relative humidity in a whirlwind allow to

suggest, that such local heat source is associated with release of condensation heat in the course of phase transition of water.

Presence of a warm nucleus in the central part of a whirlwind results in intensification of density instability in this area. The density instability grows as a result of heat coming from the heated water surface and - particularly - due to release of latent condensation heat.

When density instability reaches some critical size it results in thermal breakdown of the boundary layer that explains explosive nature of vertical heat-and humidity transfer in humid ICWs. The process repeats with some quasi periodical frequency. It should be noted, that increase of density instability in the center of a whirlwind occurs slower than its discharge. It corresponds to observation data when real TCs were observed.

Research studies have shown, that diameter of the eye of a whirlwind also undergoes quasi periodical fluctuations. The function of spectral density of pulsations of diameter of the eye of a whirlwind has a well marked authentic maximum.

The pulsation of diameter of a whirlwind eye can be explained, if we assume, that the stage of increase of the diameter of the eye corresponds to accumulation of density instability in the whirlwind's core, and that its reduction is a result of a break of warm air under "explosive" mechanism of heat and humidity transfer.

Estimates of Struhal numbers describing dimensionless frequency of fluctuations of the diameter of a whirlwind eye, carried out for physical model of intensive convective whirlwind of humid type and for a real tropical cyclone demonstrated a good conformity.

It is possible to assume, that fluctuations of the diameter of the eye of a real TC are of the same nature, as in the model of convective whirlwind. This means that they are associated with the thermal breakdowns peculiar to the explosive mechanism of warm - and humid transfer in the model of humid ICW.

Thus, it is possible to assume, that the explosive mechanism of heat and humidity transfer in a whirlwind similar to TCs identified by physical modelling should be extended to natural intensive convective whirlwinds such as hurricanes and typhoons.