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Letters to the Editor

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THE TROPICAL CYCLONE WITH THE SMALLEST EYE

The WMO publication "Global guide to Tropical Cyclone Forecasting", (WMO 1993) lists 6 km as the record for the smallest eye radius in a tropical cyclone. This value has been reported in cyclone TRACY on 24 December 1974 off the Australian coast. There is, however, at least one cyclone documented in the south Bay of Bengal which had a still smaller eye and should hold the world record. Raghavan and Veeraraghavan (1979), hereafter referred to as RV have plotted the eye dimensions of the Nagappattinam severe cyclone of 11-12 November 1977 as observed at successive hours by radar. The major and minor axes of the apparently slightly elliptical eye were 22 and 18 km at 0600 UTC of 11 November and gradually decreased to about 3 km each at 2100 UTC about 2 hours before landfall. This happened while the cyclone was intensifying.

RV have discussed the errors in the observation due to radar pulse width and beam width distortion. They attributed the apparent ellipticity of the eye to such distortion and assigned errors in the radial and tangential directions (with respect to the radar) as 600 m and 5 km respectively. Since the apparent major axis was in the radial direction that axis at that hour should be 3 + or - 0.6 km. Allowing for other possible observational errors, the eye radius may be taken to be between 2 and 3 km. The observed eye and eyewall dimensions have been cross-checked by RV with independent data of damage swath on the ground and found to be consistent.

It is not clear at what range and height the eye radius of TRACY was observed by radar. In the case of the Nagappattinam cyclone the radar range was about 270 km and the beam centre was at about 4 km altitude. Since the eye wall of a well-developed cyclone usually slopes outward with height (Willoughby, 1988; Raghavan, 1993) the eye radius near the surface could have been even smaller. Hence the world record for the smallest eye lies in the range 2 to 3 km.

The values of 2, 3 or even 6 km for the eye radius are far smaller than the average values which are of the order of 20 km. It is noteworthy that both the Nagappattinam cyclone and TRACY were at a low latitude (about 11 degrees North and 12 degrees South respectively). From theoretical considerations (Riehl, 1963) eye size should increase with latitude (proportional to the square of the Coriolis parameter). Meighen (1985) in the Australian basin found a weak positive correlation between observed eye size and the square of the sine of the angle of latitude. Shea and Gray (1973) and Schwerdt *et al.*, (1979) show similar observational results in Atlantic hurricanes.

Thus severe cyclones with very small eyes are possible at low latitudes leading to concentration of severe wind damage over very narrow swaths.

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