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An observational study of asymmetric precipitation structure associated with typhoon Nari (2001) during its landfall period

BEN JONG-DAO JOU[1] and ZHAO KUN[1]
[1]*Department of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan*

In this study, the asymmetric precipitation structure of Typhoon Nari during its landfall is investigated using the reflectivity data collected by Wu-Feng-Shan radar (a S-band NEXRAD). The reflectivity is decomposed into axisymmetric and asymmetric components by using the Fourier decomposition in a coordinate system relative to the storm motion.

It is found that, before landfall, the storm has a pronounced axisymmetric component in the inner core and the outer core is dominated by a wave-one feature. This outer core asymmetry is mostly caused by an outward propagating spiral rain band. During the landfall, the wave-one asymmetry signature arises in the inner core and propagates outside in a speed of 3m/s. This propagation speed is much slower than the gravity waves and the vortex Rossby wave theory may help to partially explain its origin.

The possible influences of storm motion, vertical wind shear and local topography on the observed asymmetric precipitation structure are also examined. It is found the vertical wind shear of 850-200 hPa is very weak and smaller than 1 m/s for the whole period, its effect should be minimal. Meanwhile, the moving speed of the storm is less than 3 m/s in average during the landfall period, thus, should not alter the precipitation structure significantly. It is suggested that the effect of Taiwan topography may play the most important role in change of the precipitation asymmetry of the storm during landfall.