

Seminar (Seminar#186)

Date: November 24 (Tue) 10:30-12:00

Room: The meeting room (#617) of Research Institutes Building.

Speaker: Prof. Hung-Chi Kuo (Department of Atmospheric Sciences, National Taiwan University)

Title: Wavenumber-2 Deep Convection in Tropical Cyclone

Abstract:

Many radar observations, such as in the Second Miyakojima typhoon (1966), Typhoon Herb (1999), Typhoon Haitang (2005) and Typhoon Dujuan (2015), are with cyclonically rotating elliptical eyewall. Interestingly, there were often the deep convection occurred on the tips of the major axis in the elliptical eyewall. This paper investigates the structure of boundary layer pumping and convection in tropical cyclones that have elliptical eyewalls or polygonal eyewalls. We use the simple approach of a nondivergent barotropic model for the inviscid flow above the boundary layer (BL), and then use the associated pressure field (derived from the nonlinear balance condition) to drive a slab boundary layer model. The BL flow driven by this pressure field is divergent so that the spatial distribution of BL pumping (updraft on top of BL) can be calculated. The interaction is one-way in the sense that the overlying flow drives the BL, but the BL pumping does not feed back onto the overlying flow. The model calculations are in the Cartesian geometry with double Fourier pseudospectral method. The model results of maximum BL pumping on the tips of the major axis of the elliptical eyewall is in general agreement with the observations. The model also indicates the existence of jet-like high speed tangential winds upstream the major axis tips in the BL. The formation of BL pumping (and convergence) in the tip of the major axis is caused by local super-gradient winds, in a way similar to the dynamics of super-geostrophic winds in the midlatitude jet exit region. The results highlight the wavenumber-two feature of the BL radial wind in shock-like structures, which lead to large BL pumping. Our experiments also indicate that the similar radial profiles and BL pumping may occur in the tips of the polygonal eyewalls.

(given in English)