Meso-β-scale environment for the formation of a stationary band complex in tropical cyclones

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The stationary band complex (SBC) is a distinct, quasi-stationary convective asymmetry outside of the eyewall of tropical cyclones. As such, the SBC is a major characteristic of storm structure and plays an important role for the overall intensity evolution. The SBC strongly influences rain band activity and thus the occurrence and distribution of severe precipitation.

Consistent with previous work, I will relate the occurrence of the SBC to environmental vertical wind shear. Convective-scale processes within the SBC have received considerable attention following a major field campaign in 2005. In this presentation, we will focus on meso-β-scale (20 – 200 km) processes that lead to favorable conditions for SBC formation. Seminal previous work by Willoughby et al. (1984) has hypothesized on a formation mechanism that is here tested with data from an idealized numerical experiment. My results do not confirm this hypothesized formation mechanism and therefore a new mechanism is proposed.

The proposed, new formation mechanism takes into account the kinematic and dynamic consequences of environmental vertical wind shear, i.e. the deformation of the storms "moist envelope" – high-θe air that encompasses the inner core – and vortex tilt. Using a simple slab boundary layer model, I demonstrate that asymmetric frictional convergence due to the tilted vortex is a viable forcing mechanism for the SBC. Importantly, this frictional convergence occurs in the region of low-level high-θe air associated with the deformed moist envelope, thus favoring the deep convection in the band complex. If time allows, I will conclude the presentation with a discussion of predictability aspects of the SBC formation.