A Spectrum for Convective Self-Aggregation and Tropical Cyclogenesis Based on Background Rotation

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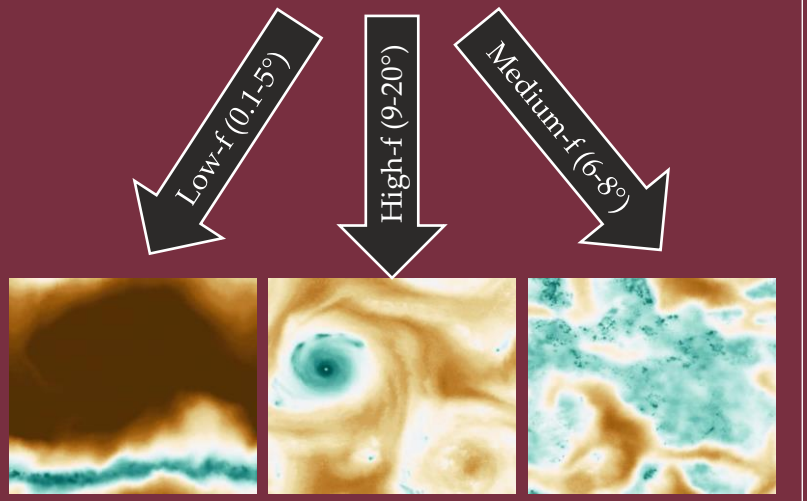
Convection is key in TC formation/intensification. If we allow convection to organize spontaneously "on its own" in a CRM, what feedbacks are most important, and how does a TC form?

Does this change as the background rotation changes? Use simulations across 14 f-planes to study this, split into 3 groups.

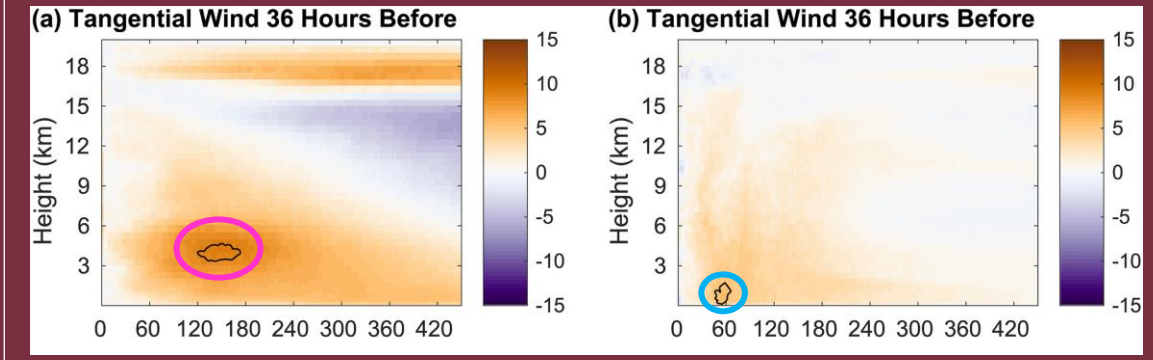
Self-Aggregation (SA)

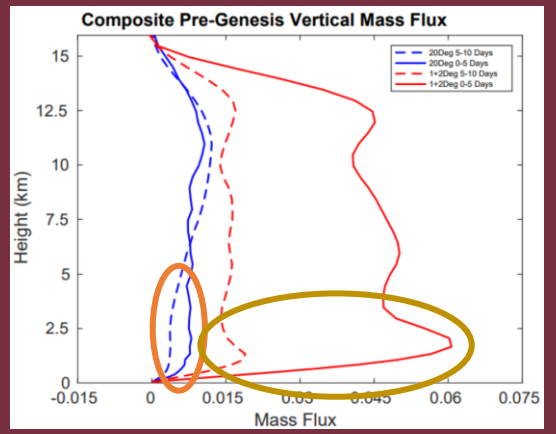
Initialize convection randomly from an otherwise uniform field in radiative-convective equilibrium.



Medium-f: Transition zone between 2 well-defined regimes of SA. Negative advective feedbacks on SA suggest a dynamical influence by rotation as it increases.

Tropical Cyclogenesis (TCG)





- High-f: Mid-level vorticity maximum first emerges, w/ cold core beneath and warm core above.
- Increased static stability enhances low-level convective mass flux and vorticity generation.
- Low-f: Vortex generation starts from low levels after SA completes and takes circular geometry.
- Overturning circulation associated w/ SA drives persistent near-surface inflow into moist region. Preceding mid-level vortex is not needed in low-f!

Model used in this study/ongoing work: System for Atmospheric Modeling 6.8.2 (Khairoutdinov and Randall 2003)

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