Two Topics:

I. Paradigms for Rainband-Inner-Core Interactions

II. RAINEX Modeling Plans

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I. Paradigms for Rainband-Inner-Core Interactions

• Perhaps we can divide these ideas into two classes:

  A. Quasi-symmetric processes

  B. Essentially asymmetric processes
A. Quasi-symmetric processes:
   Secondary eyewall formation and replacement

1. Secondary eyewall replacement as symmetric, nonlinear instability
   But - where does the *initial* secondary wind max come from?

2. Radiating Vortex-Rossby waves accumulate in the *stagnation* region:
   Radial group velocity goes to zero as waves are sheared and get thinner.

Issues: Inner-core bands/VRWs don’t seem to propagate outward
   Accumulation point determined by initial structure
   Radial inflow changes accumulation point?
B. Asymmetric Interactions

1. Eddy momentum transport by asymmetric wind fields:
   Positive PV/Vorticity associated with rainband convection
   generates asymmetric wind field
   Wind asymmetries result in net transport of momentum *inward*

\[ u'v' < 0 \text{ (inward)} \]

Doesn’t seem outer bands could affect inner core this way.
Positive effects of axisymmetrization have been brought into question.
2. Spiral Band “Penetration”

*Inward* moving spiral band disrupts eyewall, then recovery cycle

Seen in at least two papers:

3. Large, “stationary” bands.

Negative influences:

Disruption of inflow

Stationary wavenumber one forcing (longer range influence)

Large bands often seen in less-than-favorable environments:

Vertical shear

Dry air

Cooler air

Are large stationary bands the mechanism by which shear and other “negatives” first affect the inner core? (Shuyi’s Hypothesis)
II. RAINEX Modeling Plans

• Again, two classes:

  A. Pre-Season

  B. In-Season
A. Pre-Season

1. Goal: To simulate, identify, and evaluate the interaction mechanisms

2. Models:
   High resolution MM5 (Chen et al.)
   Medium resolution WRF (Nolan et al.)

3. Analysis:
   Full decomposition of most fields into symmetric and asymmetric parts:
   \[
   \frac{\partial \ddot{v}}{\partial t} + \ddot{u} \frac{\partial \ddot{v}}{\partial r} + \ddot{w} \frac{\partial \ddot{v}}{\partial z} + \frac{\ddot{u} \ddot{v}}{r} + f \ddot{u} = -\frac{1}{r^2 \partial r} \left( r^2 u'v' \right) \quad ....
   \]

   and into various wavenumbers:
   \[
   \frac{u'v'}{N} = \sum_{n=1}^{N} \frac{u_n v_n}{u_n v_n} \quad \text{(small amplitude limit)}
   \]
B. In Season

1. Near real-time MM5.

2. Near real time HWRF.

3. Motivation: Guidance for morphology changes and interaction events

4. Obstacles:
   a) CPU Time
   b) Global model/analysis data stream
   c) Runtime complications, RSMAS infrastructure, disks, etc.
   d) Initialization of mature storms

   Global model storms are too weak, too broad

   Run from GFDL initial conditions?