The Operational HWRF System: Asymmetric Intensification of Hurricane Earl

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To understand the HWRF modeled intensification process (Gopal et al. 2011 MWR) based on the best predication and support that with OBS as much as possible.
Maximum Surface Wind (ms$^{-1}$)

Central Pressure (hPa)

Radius of Maximum Wind

RMAX (KM)

MODEL HOUR

Best Track
HWRF
850-200 hPa shear within 1000 km x 1000 km domain
Radar Observation

Pre-RI

RI

Shading: wind speed at 2km
Thin black lines: streamline at 2km
Grey lines: streamline at 8km
Thick arrows: tilt

Large tilt in Pre-RI stage and small tilt in RI stage!
Tilt precession

RI onset leads vertical alignment 6 hours!
Morphed Integrated Microwave Imagery
06Z29AUG (t = 60 h)

Total condensate water averaged between 0.25 km and 20 km
04Z29AUG (t = 58 h)

Black arrows: shear direction

Shear induced WN-1 asymmetry dictates convection
**Shading:** temperature perturbation in the eye center with respect to mean temperature averaged over 400km x 400km domain

**Contour:** potential temperature in the eye center

**Shading:** mean vertical motion averaged over 50 km x 50 km domain surrounding eye center using RH $\leq$ 70%

**Note:** the magnitude of vertical motion corresponding to the warming rate instead of warming magnitude

Upper level warm core formation coincides with RI onset!
**Horizontal cross section**

Grey shading: RH averaged between 1-10 km
Color dots: convective bursts at 30 min interval

T (39h - 45 h)

T (45h - 51 h)

**Vertical cross section along AB**

Shading: Vertical motion along cross section AB
Contour: RH along cross section AB

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Moisture work up downstream and wrap around the eye center!
Time-Height cross section for inner core and outer region
Time-Height cross section for inner core and outer region
Averaged over r=50 km
Averaged over 100km<r<200km

Zone = 2 km
Zone = 8 km

Outer core spins up earlier than inner core at low level!

Upper level spins up earlier than low level in the outer core region!
Conclusion

- RI onset leads vertical alignment 6 hours;
- RI onset coincides with the formation of upper level warm core;
- RI onset coincides with moisture wrap-around;
- Outer core spins up earlier than inner core at low level;
- Upper level spins up earlier than low level in the outer core region!
- Inner core structure is very much different from outer core structure