

# Evaluation of Numerical Model surface wind field structure during rapid intensification TC cases using H\*Wind

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# Motivation

- \* Rapid intensification (RI) challenging forecast problem
  - \* Can cause significant property loss and damage at landfall
  - \* The damage caused by TCs is related to the surface wind structure of the storm
- \* Much research on understanding and predicting intensity during RI, less attention on wind structure, especially surface wind structure
- \* Ability to predict RI, and the structure and evolution of surface wind field during RI.

# Methods

- \* Evaluate surface wind field evolution from HWRF model and H\*Wind
  - Symmetric wind field
  - Structure parameters eg RMW and IKE
- \* HWRF model 2012 operational implementation
  - \* DOMAIN: 27KM:77.76X77.76
    - 9KM:10.56X10.2
    - 3 KM:6.12X5.42
  - \* Cycling: 3 km vortex only
  - \* Ocean coupling: 27-9km

# Data

- \* H\*Wind

- HRD's surface wind analyses, variable native resolution
- uses all available obs.
- Obs are standardized to a common exposure and averaging time

- \* Test cases

- Bill (8/22-8/29 2009)
- Earl (8/25-9/05 2010)
- Irene (8/20-8/29 2011)

# Intensity

Bill  
8/22-8/29

Earl  
8/25-9/05

Irene  
8/20-8/29

--- Best track

--- Best track

--- Best track

RI

RI

RI

Peak winds (kts)



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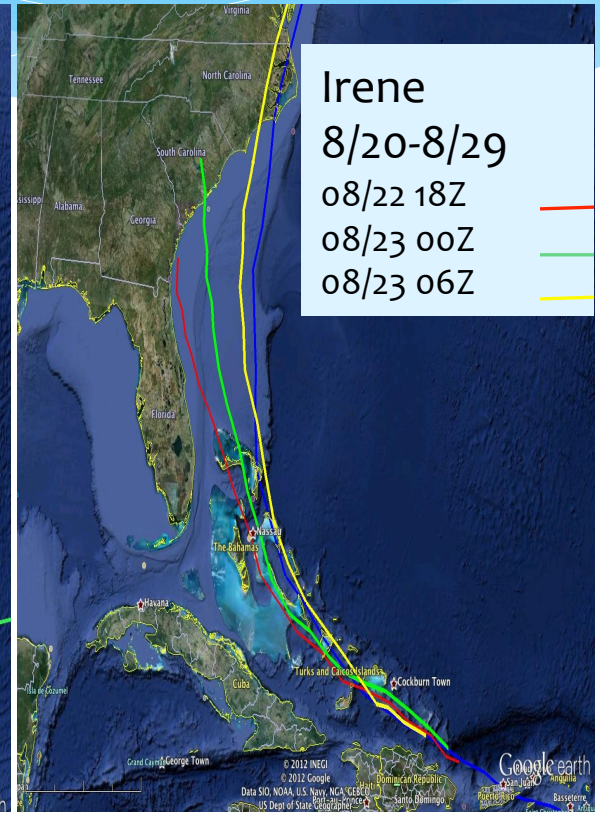
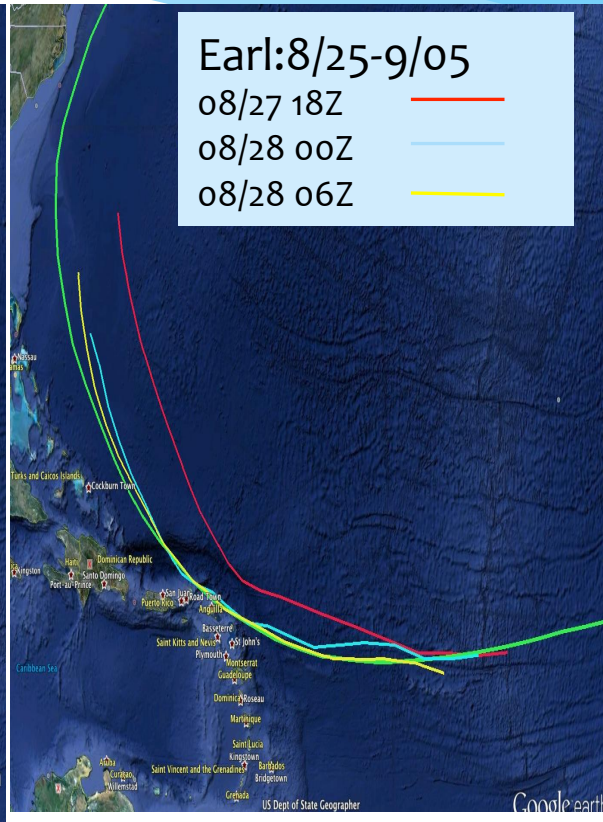
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# Storm tracks

## HWRF Compared To Best Track

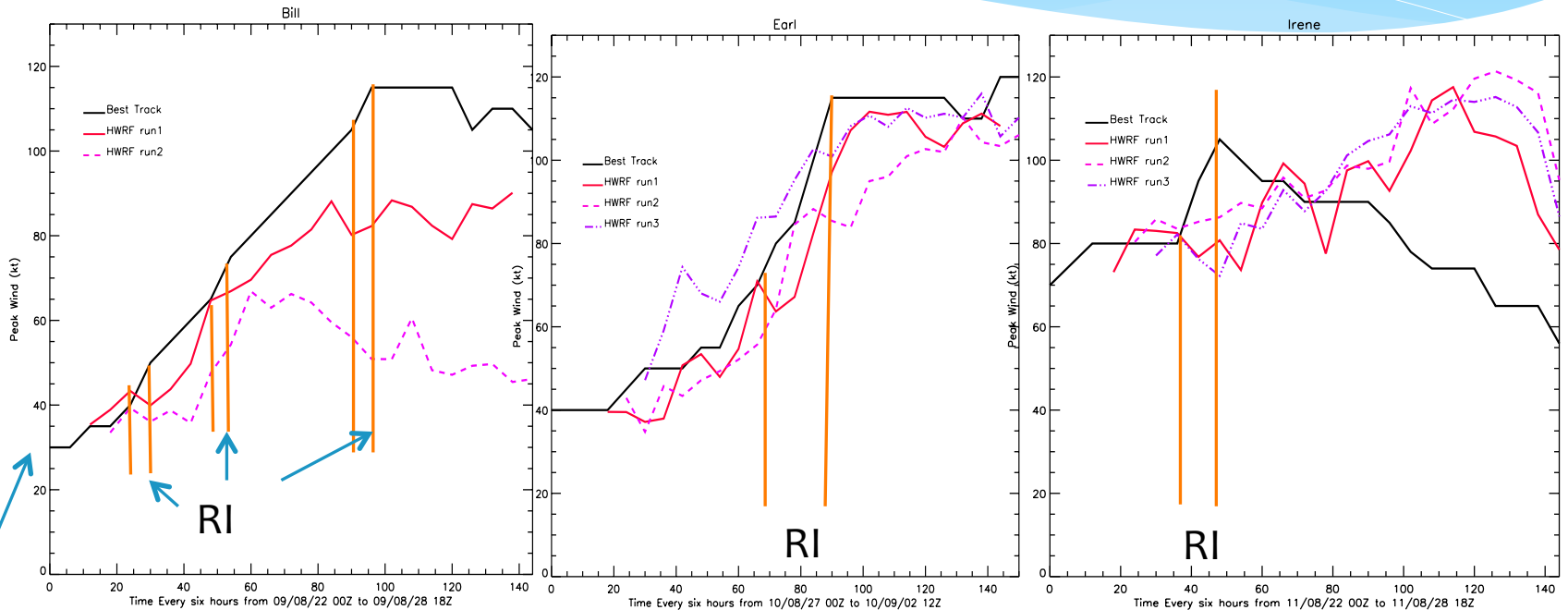


# Best Track and model intensities

Bill  
8/22-8/29

Earl  
8/25-9/05

Irene  
8/20-8/29



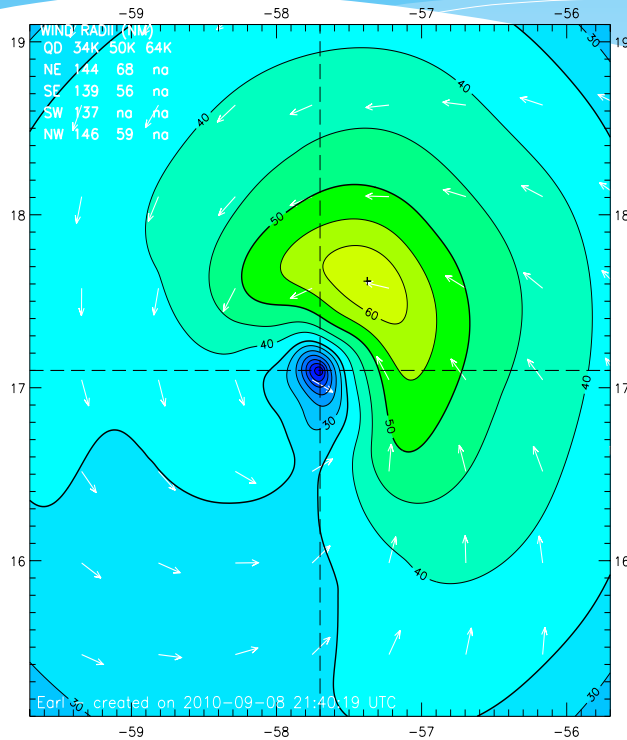
Peak winds (kts)

# H\*Wind and HWRF

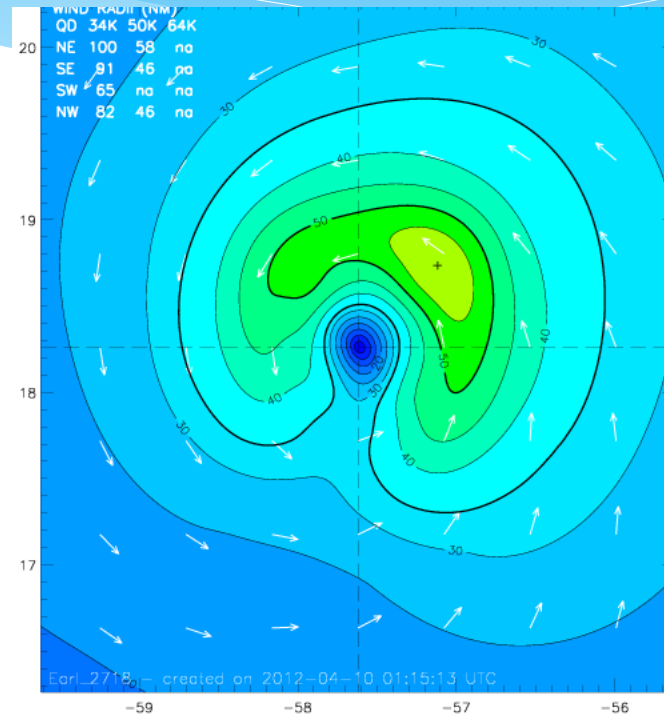
EARL 082912Z (42 hr forecast)

H\*Wind

HWRF



Max Wind=64kts  
RMW=35nm,IKE=34 TJ  
WDP=1.6 SDP=3.2



Max Wind=59kts  
RMW=41nm,IKE=13TJ  
WDP=1.3,SDP=2.0

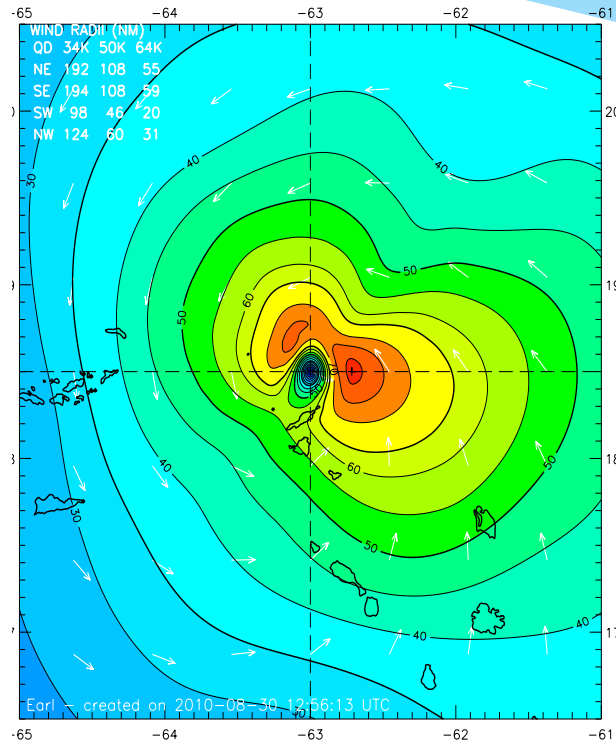


# H\*Wind and HWRF

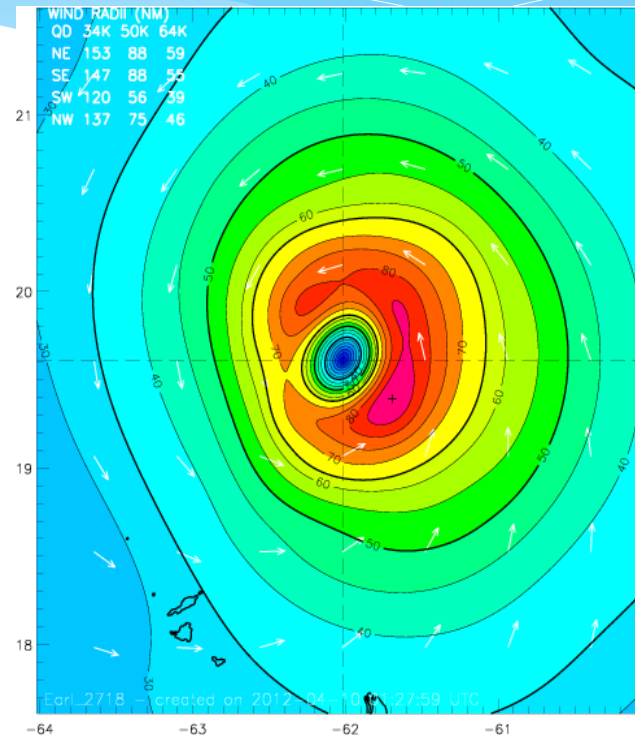
EARL 083012Z

H\*Wind

HWRF



Max Wind=82kts  
RMW=16nm, IKE =52 TJ  
WDP=2.3, SDP=3.8



Max Wind=90kts  
RMW=23nm, IKE=51 TJ  
WDP 2.7, SDP=3.8

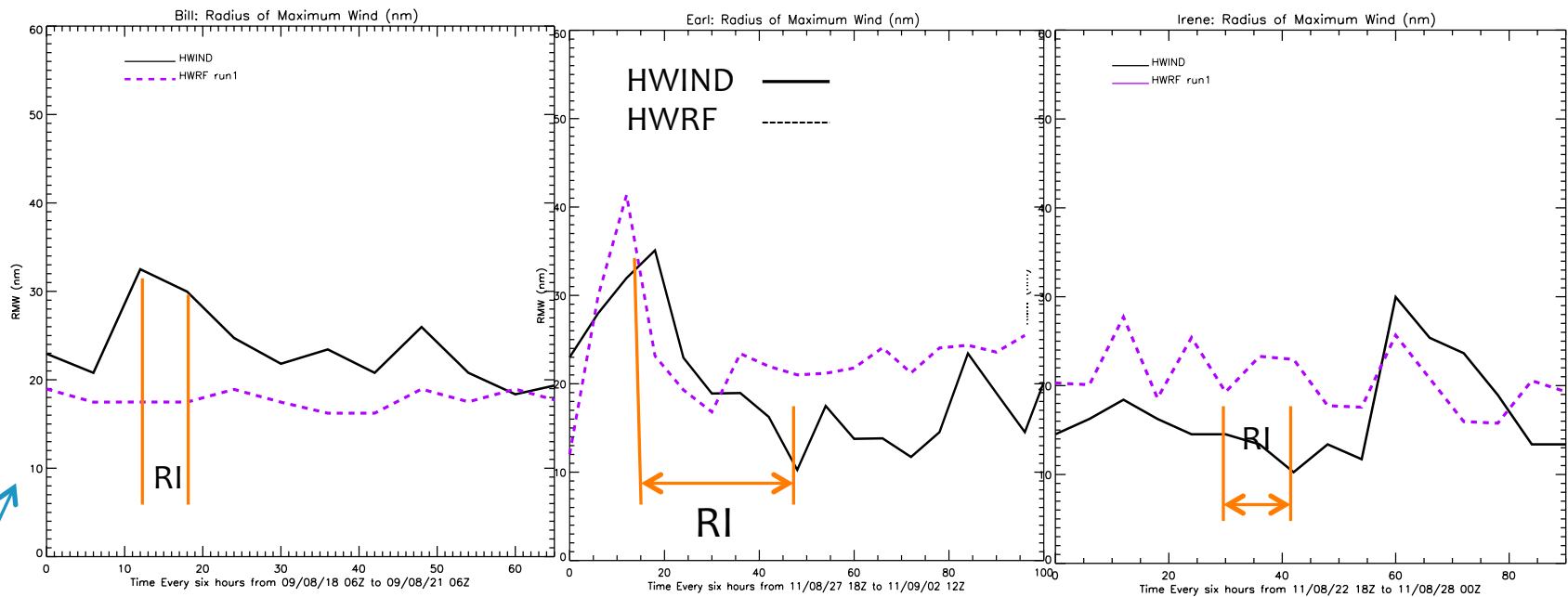
# Radius of Maximum wind (nm)

## H\*Wind compared To HWRF

Bill  
8/22-8/29

Earl  
8/25-9/05

Irene  
8/20-8/29



RMW (nm)

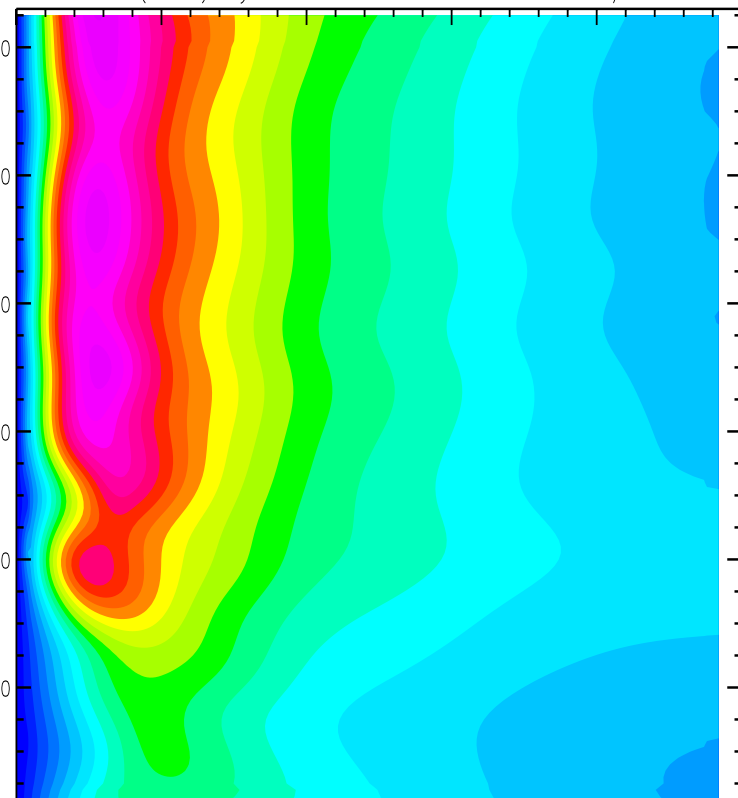
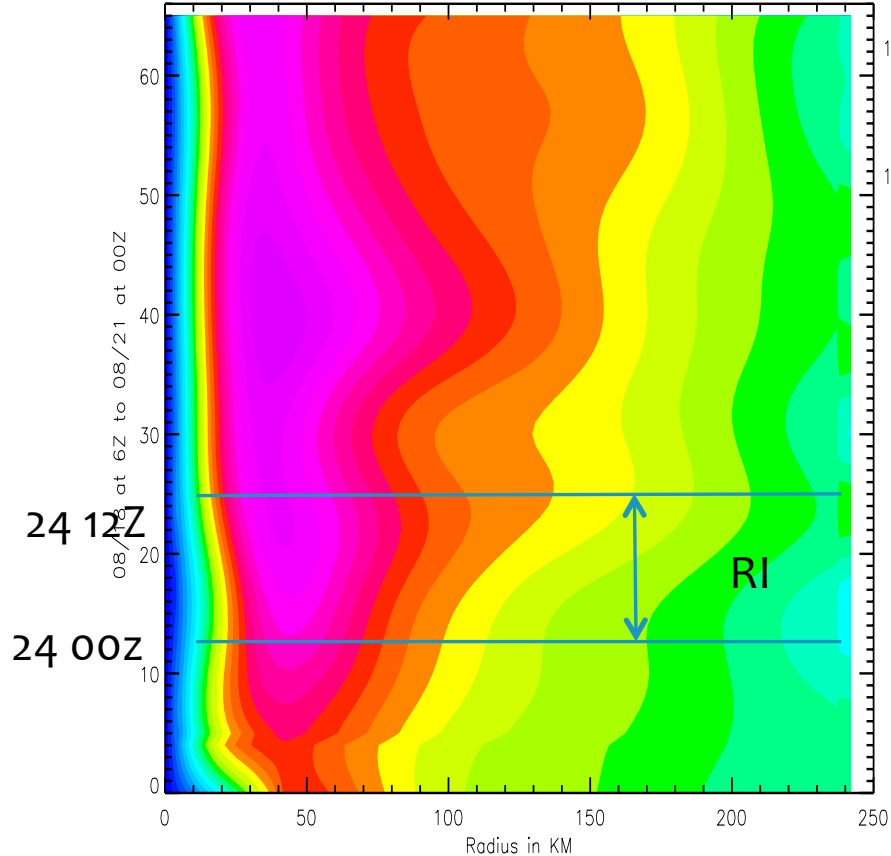
# Symmetric wind field evolution (m/s)

Bill: H\*Wind

Bill: HWRF o8/15 18Z



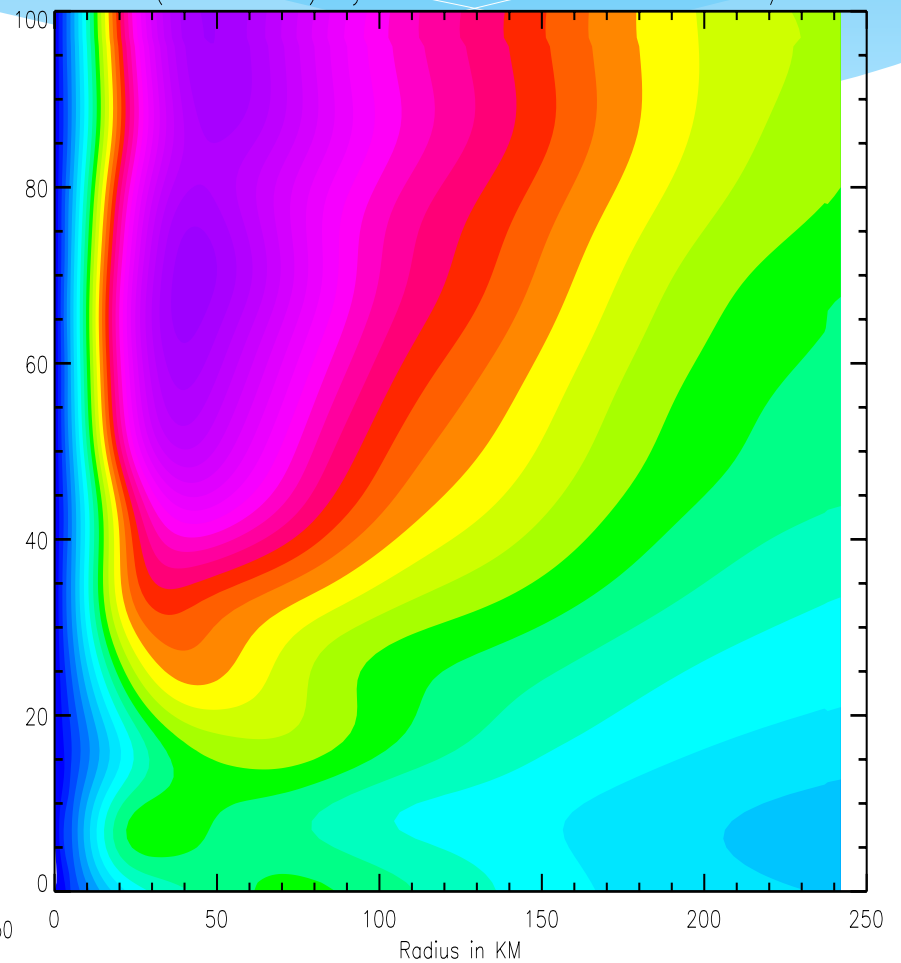
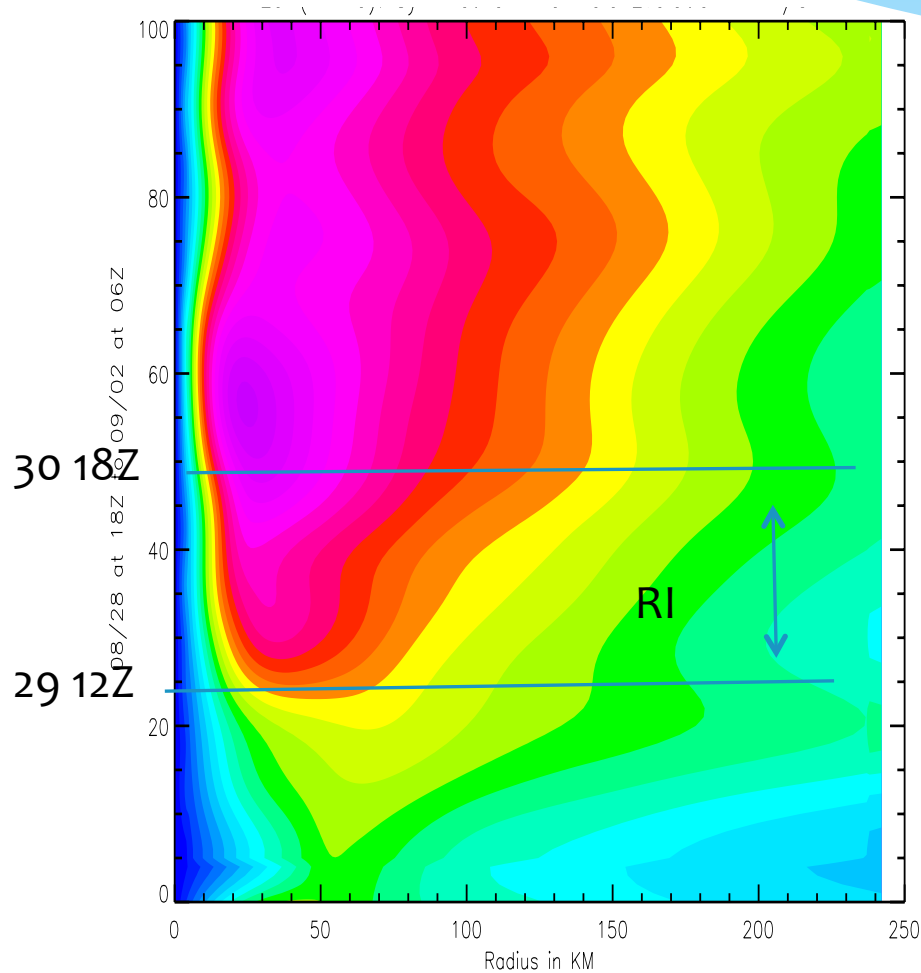
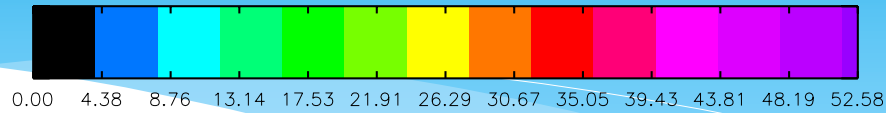
0.00 3.89 7.78 11.67 15.56 19.45 23.34 27.24 31.13 35.02 38.91 42.80 46.69



# Symmetric wind field evolution (m/s)

Earl: H\*Wind

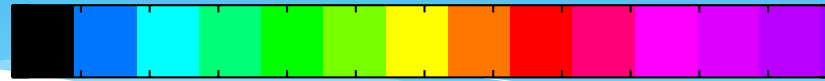
Earl: HWRF 08/27 18Z



# Symmetric wind field evolution (m/s)

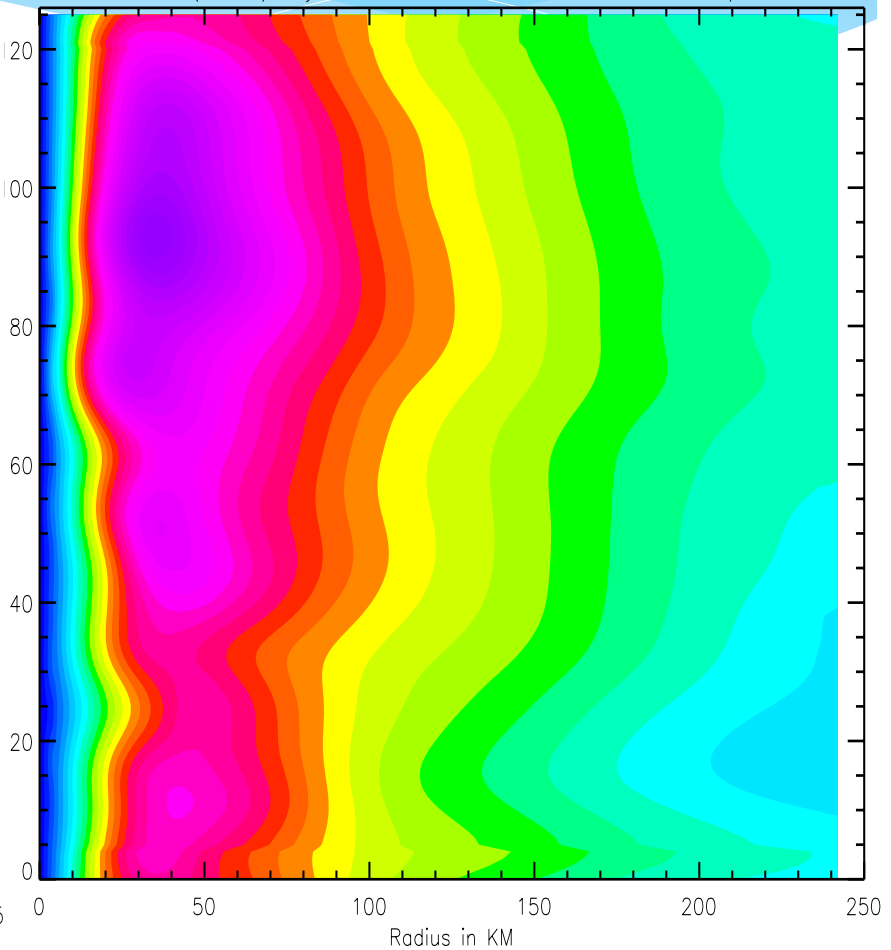
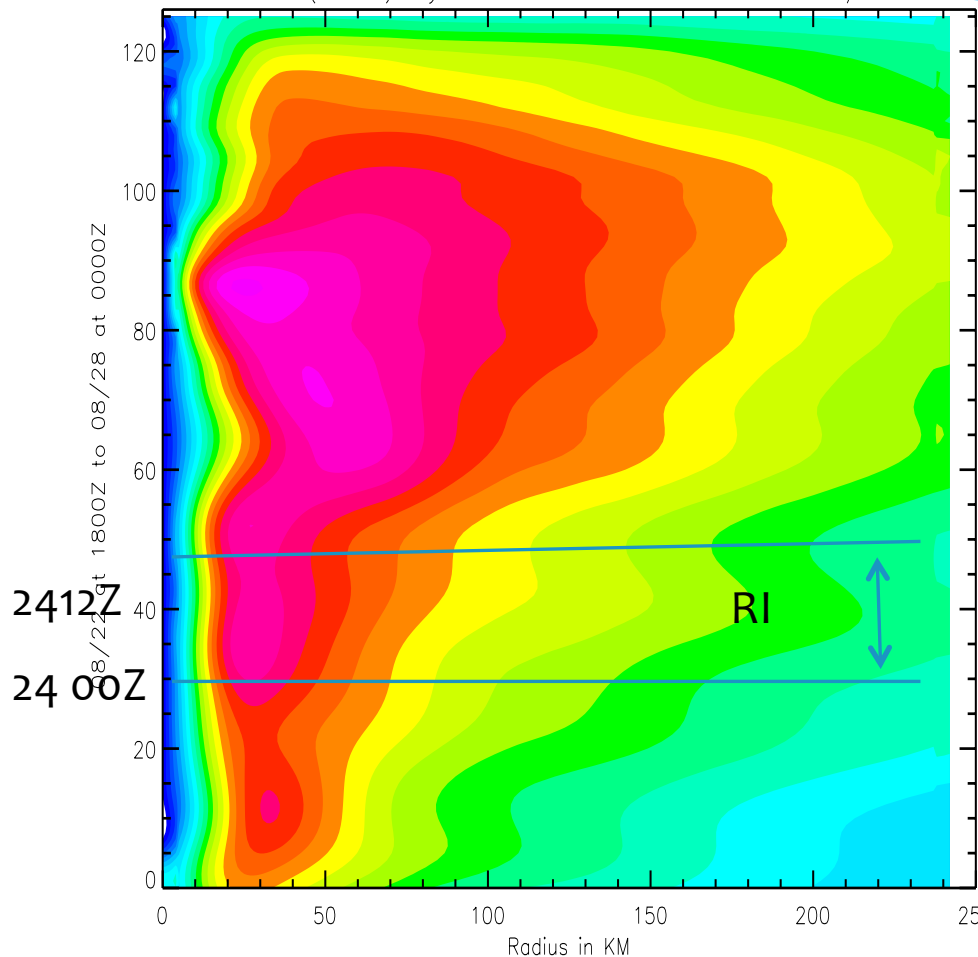
Irene: H\*Wind

Irene: HWRF o8/22 18Z



Irene(Hwind): Symmetric Wind Field Evolution in m/s

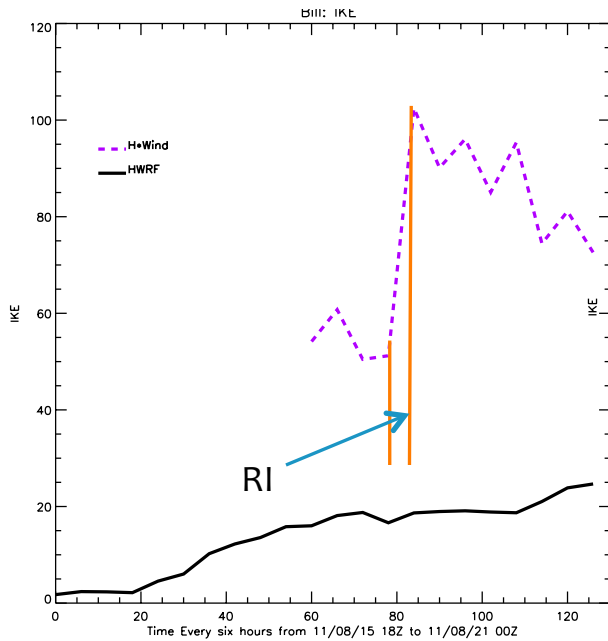
Irene(2218): Symmetric Wind Field Evolution in m/s



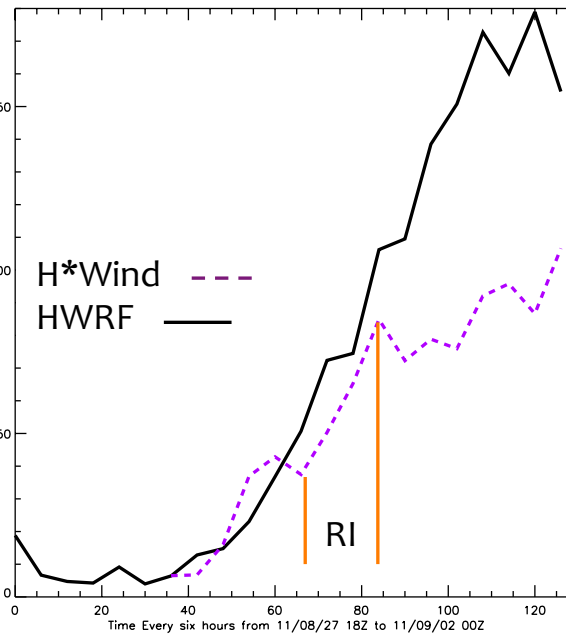
# IKE

## H\*Wind compared To HWRF

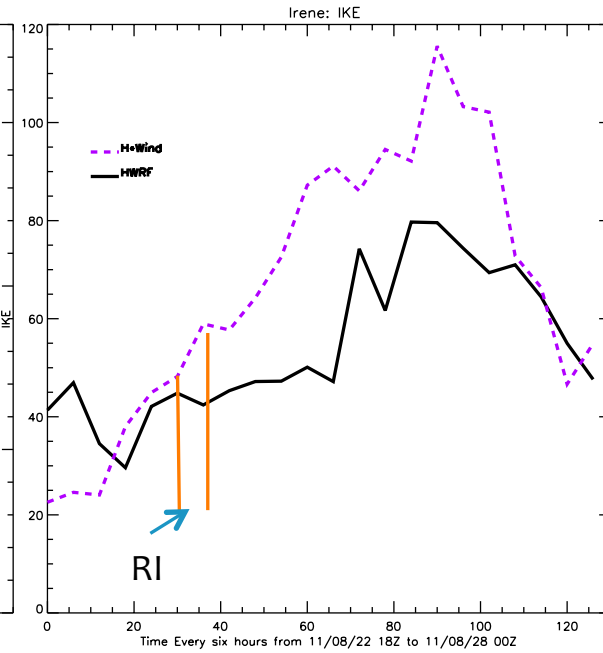
Bill  
8/22-8/29



Earl  
8/25-9/05



Irene  
8/20-8/29



IKE(TJ)

# Summary

- \* 3 storms shown : 2 produced RI, 1 did not
  - \* Bill: 1 out of 2 runs did not produce RI
  - \* Earl: all three runs produced RI
  - \* Irene: all three runs produced RI
- \* RMW in HWRF: similar or larger than obs in 2 cases
  - \* -RMW larger in HWRF for cases where HWRF produced RI
- \* In obs, RMW decreased during RI. In model, RMW sometimes decreased during RI, sometimes remained nearly constant.
- \* Wind field expanded, and IKE increases, in all cases (obs and model) during RI.

# Future Work

- \* Expand data set
  - Include more RI cases
- \* Consider vertical structure of wind field
- \* Include other models
- \* Examine azimuthal asymmetries
  - Radial profiles of winds as a function of quadrant



# Questions?

- \* What determines RMW contraction?
- \* Wind field expansion?
- \* What is role of outer-core wind field in determining likelihood of RI?
- \* How is that tied to surface wind field? How well does the model represent these processes?