

# Improved Automation and Performance of VORTRAC Intensity Guidance

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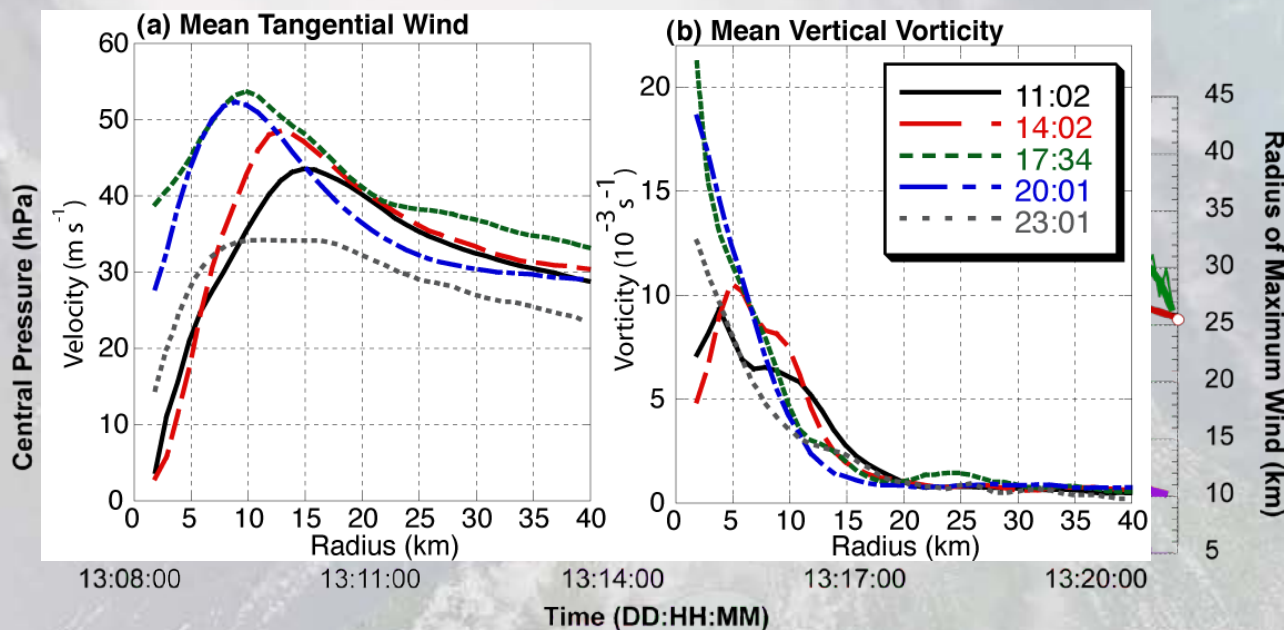
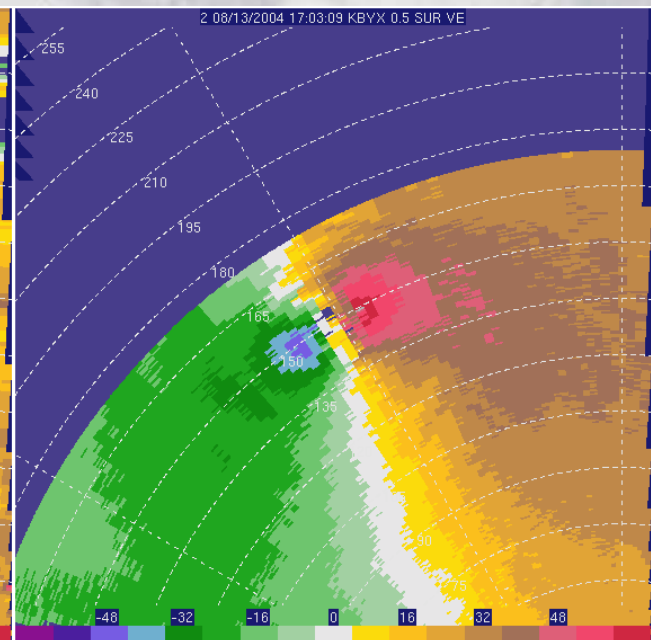
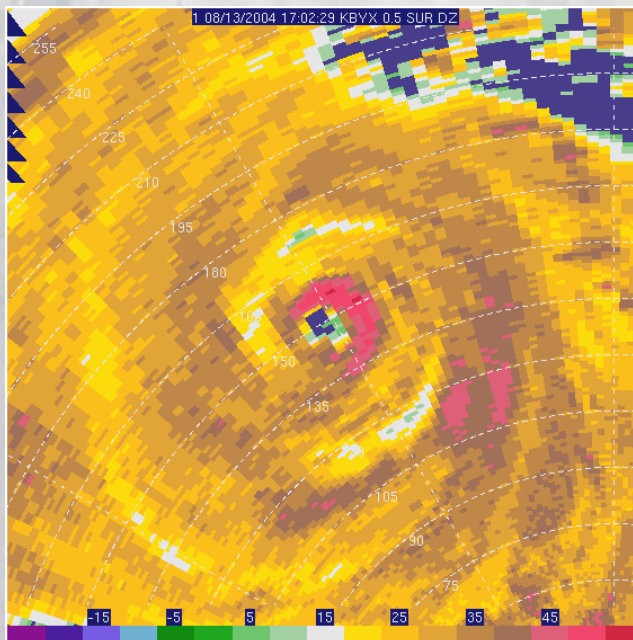
Wallace Hogsett

TPC Contact



# From Single Doppler Velocities to TC Central Pressure

- Basic Assumptions:
  - A single circulation center can be identified accurately
  - Primary circulation is deduced from GBVTD
  - Radial pressure gradient is deduced from the gradient wind balance
  - Central pressure is deduced from one anchor surface pressure measurement
  - TC surface central pressure and RMW are displayed in every 6 min

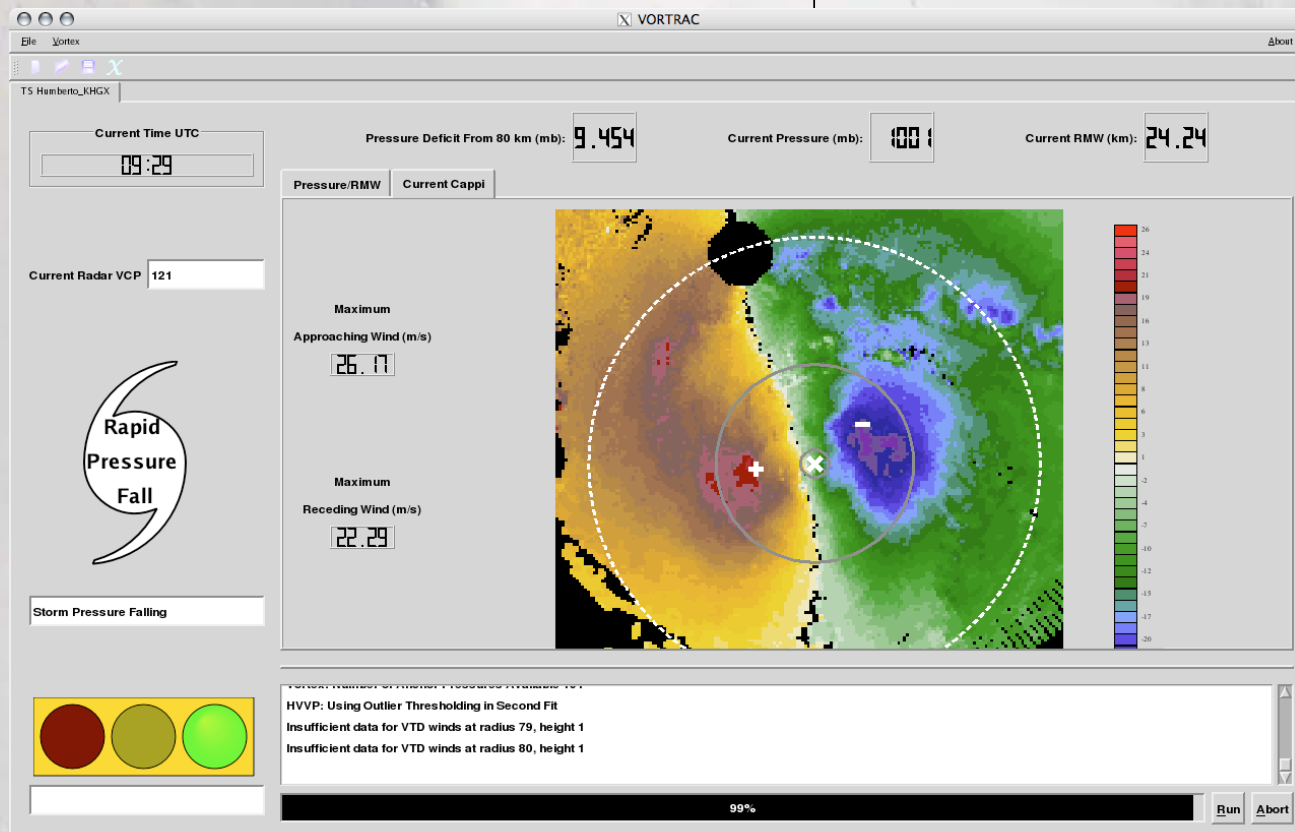


# VORTRAC

## Vortex Objective Radar Tracking and Circulation

- Combines single Doppler radar algorithms to find TC circulation center, compute primary circulation, derive central pressure and radius of maximum wind from real-time coastal WSR-88D data
- Automated procedures driven by graphical user interface
- Accepted for operational implementation in 2008

User supplied initial RMW position, and motion



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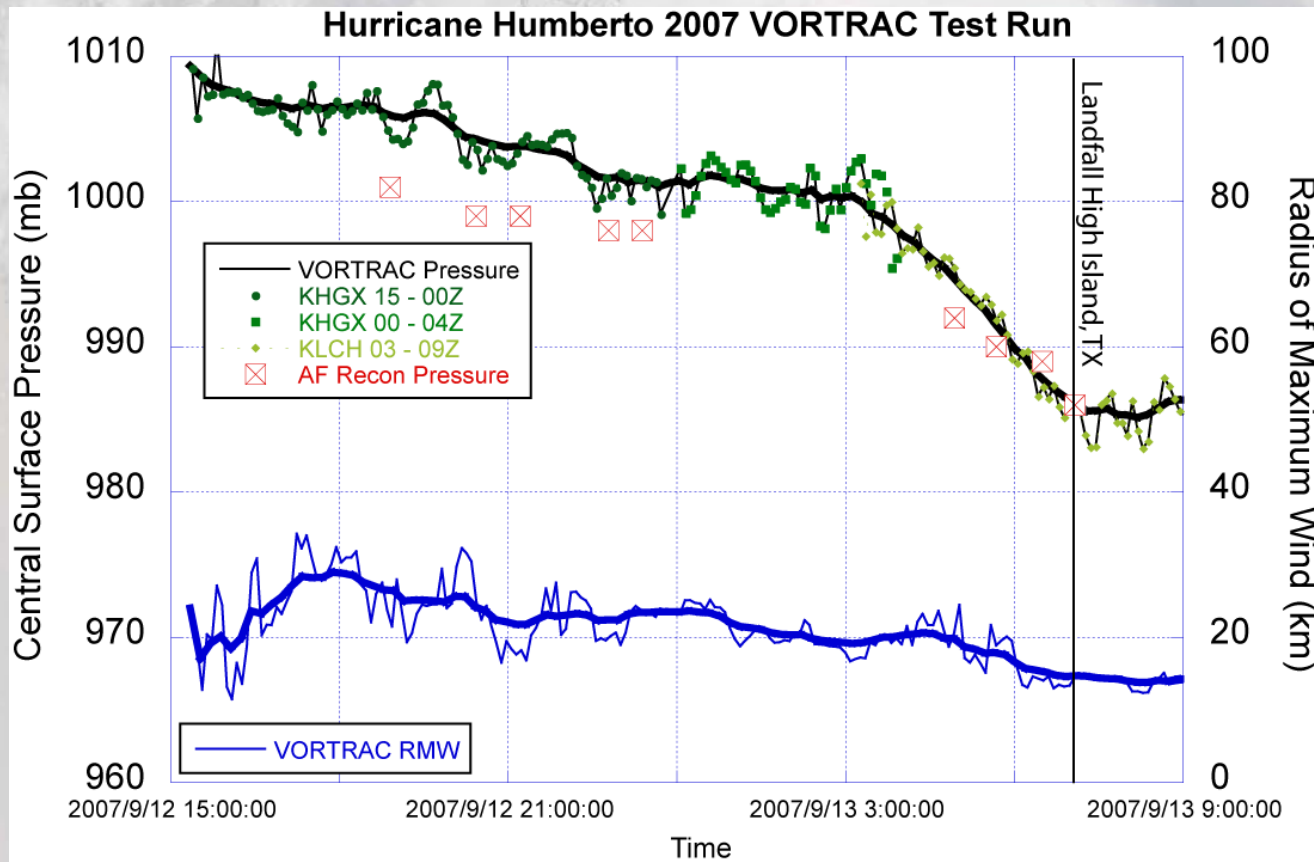


# VORTRAC Challenges for Operations

- Algorithm and technical challenges
  - *TC center tracking near the edge of Doppler range*
  - *Inconsistency between “user-supplied” vs. “VORTRAC-derived” TC characteristics (e.g., TC center and RMW)*
  - *Difficulties in handling “ill-behaved” TCs*
- Operational challenges
  - *Program code maintenance and update (e.g., NEXRAD level II data format changed in 2008 after operational implementation)*
  - *Documentation and training for new users - Colin McAdie retired in 2010*
  - *Real-time error handling and recovery*
  - *Infrequent landfalling hurricanes in US since 2008*



# Hurricane Humberto (2007)



- Rapidly Intensified from TD to Hurricane in 16 hours before landfall, accompanied by a contraction of the eyewall
- VORTRAC captured this rapid intensification, agreeing well with USAF recon dropsonde measurements



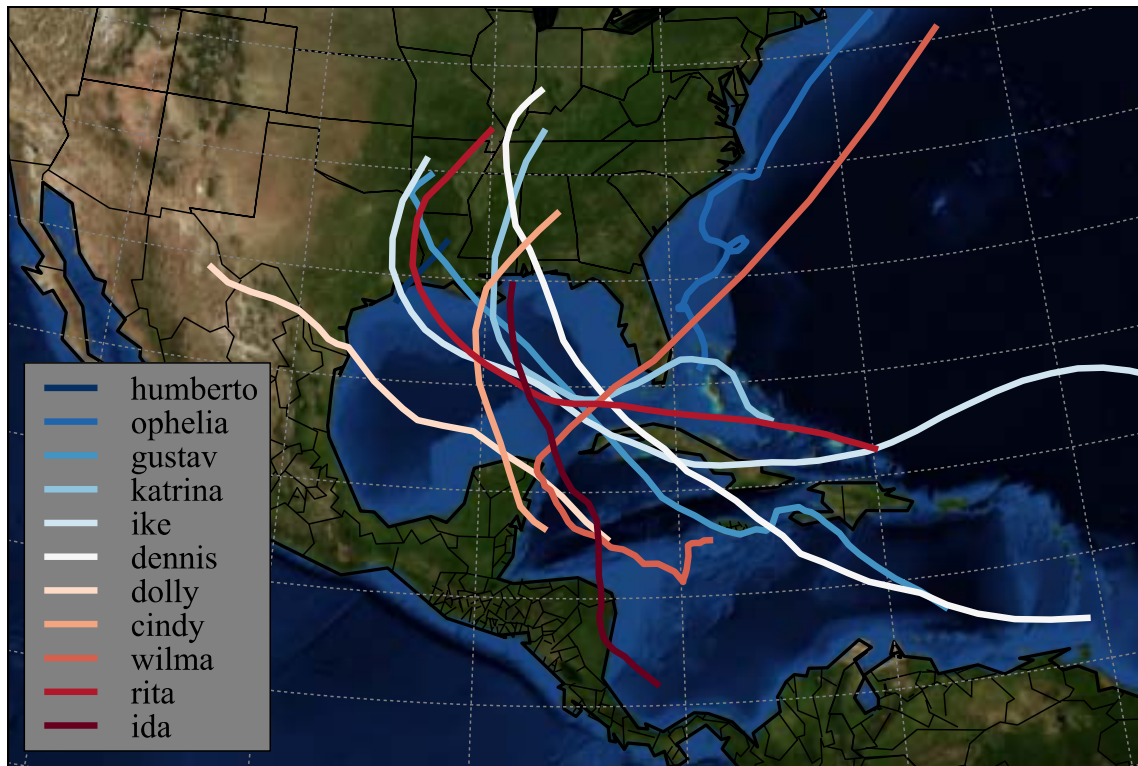
# Key Tasks for Year 1

- Analyze previous landfall cases, and perform necessary modifications and testing of the software improvements
- Update improved VORTRAC code
- Participate VORTRAC operations remotely, working closely with hurricane specialists and the designated NHC contact during US TC landfalling events



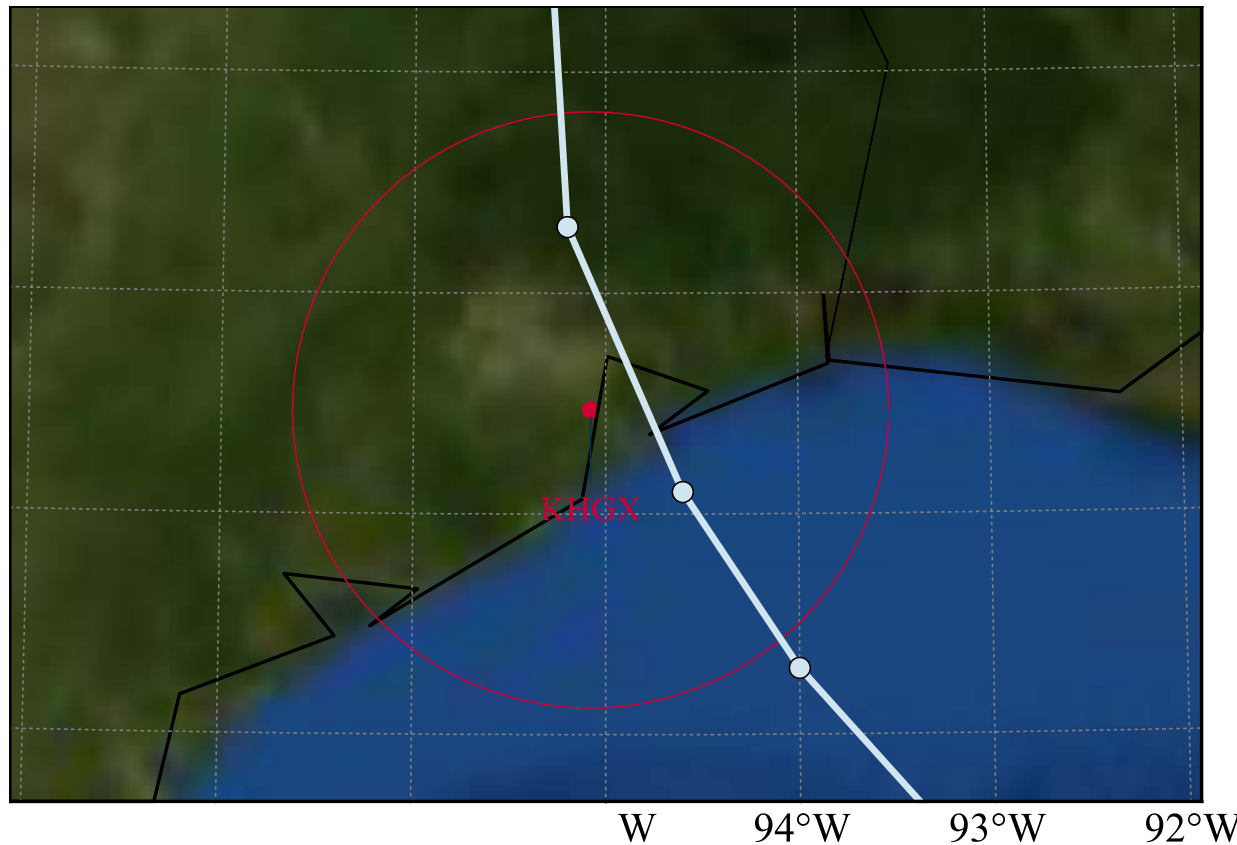


# 12 Historical Hurricanes Will Be Examined in This Project

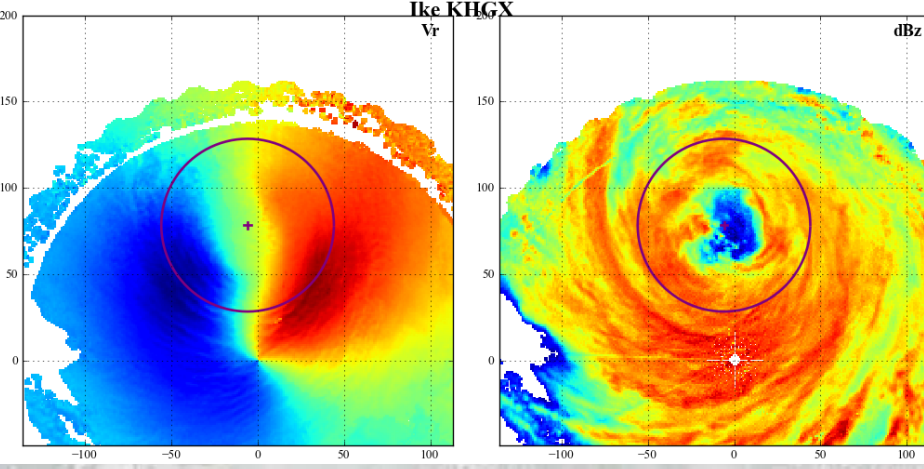
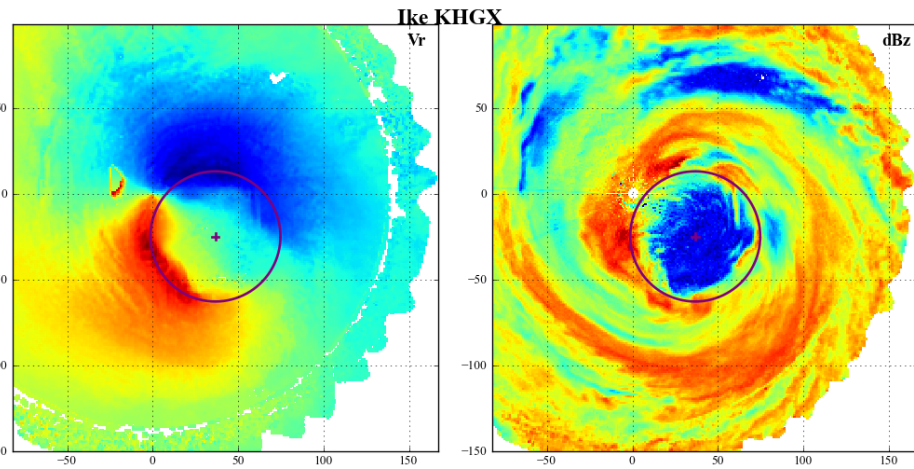
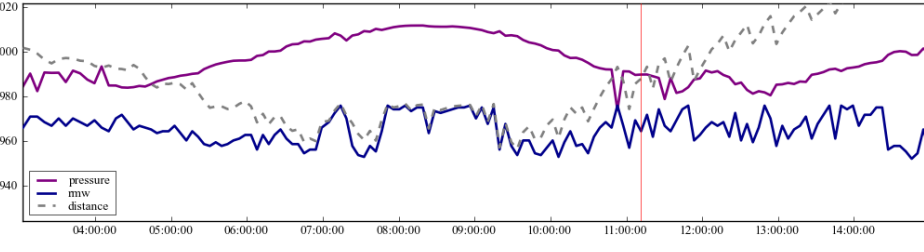
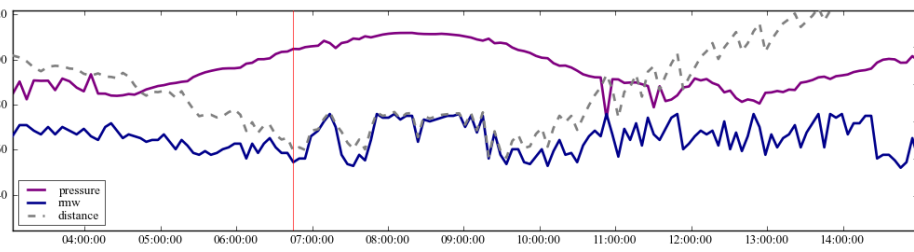
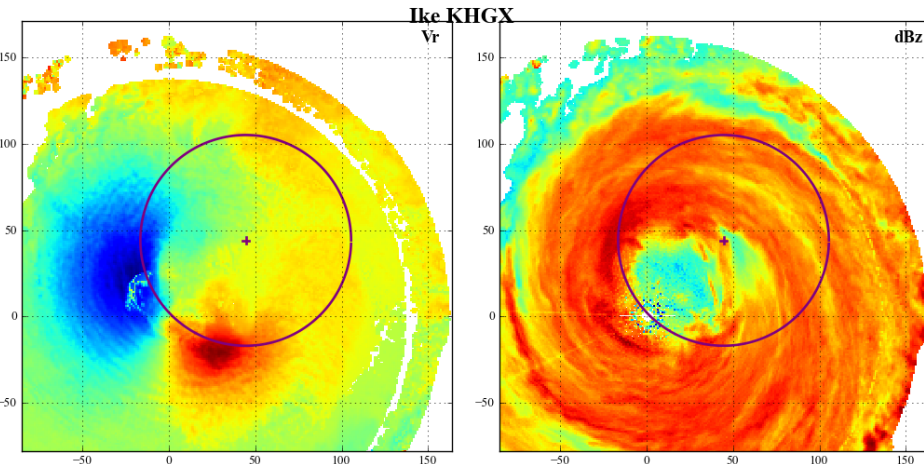
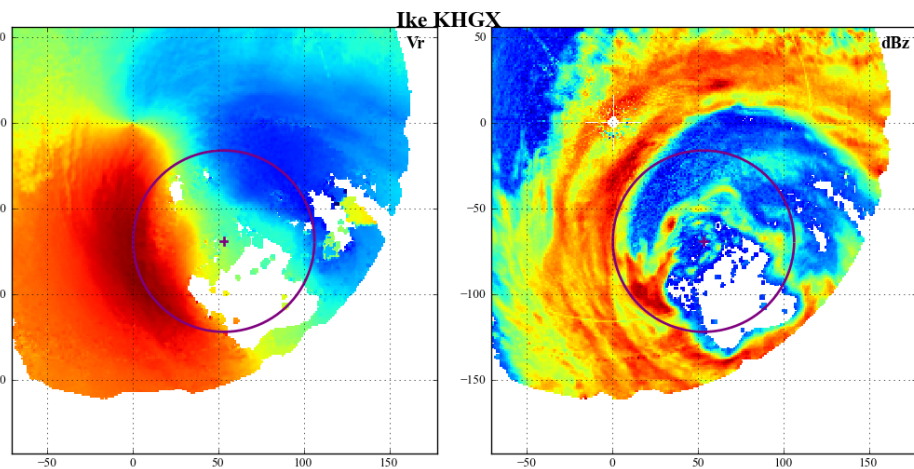
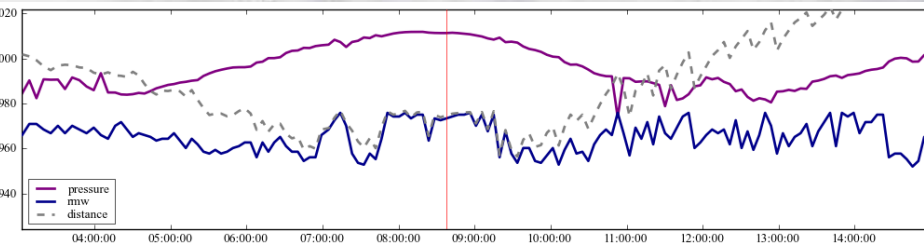
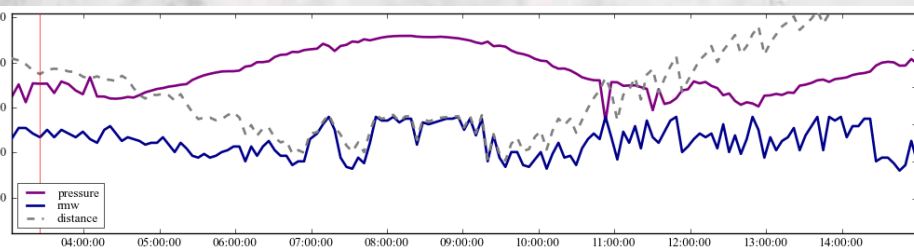


Year	Max. Intensity (Kts)	Hurricane
2005	110	Katrina
2005	105	Dennis
2005	105	Wilma
2005	100	Rita
2005	65	Cindy
2005	65	Ophelia
2007	80	Humberto
2008	75	Dolly
2008	90	Gustav
2008	95	Ike
2009	60	Ida
2011	75	Irene

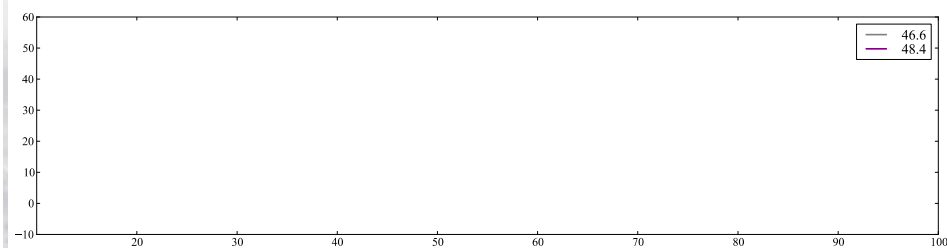
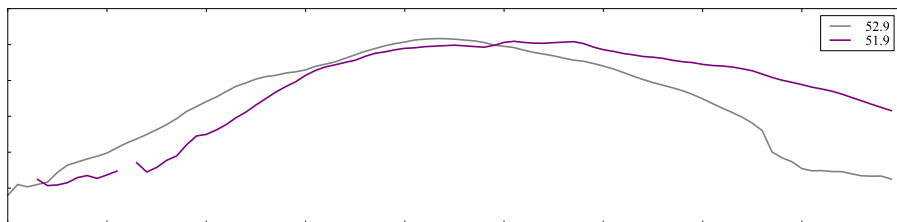
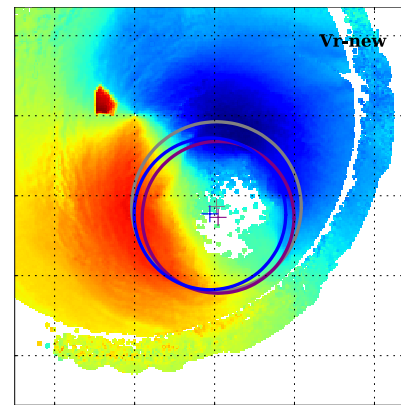
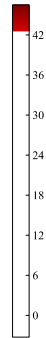
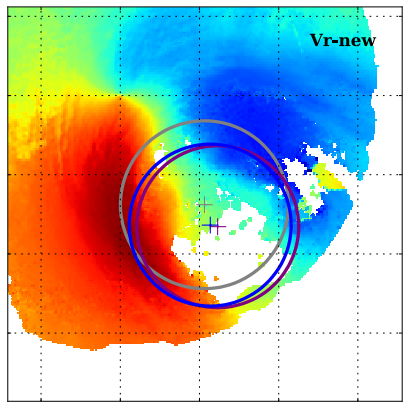
# The Problem Storm - Hurricane Ike (2008)







# Axisymmetric Tangential Wind and Pressure Retrieval in Ike



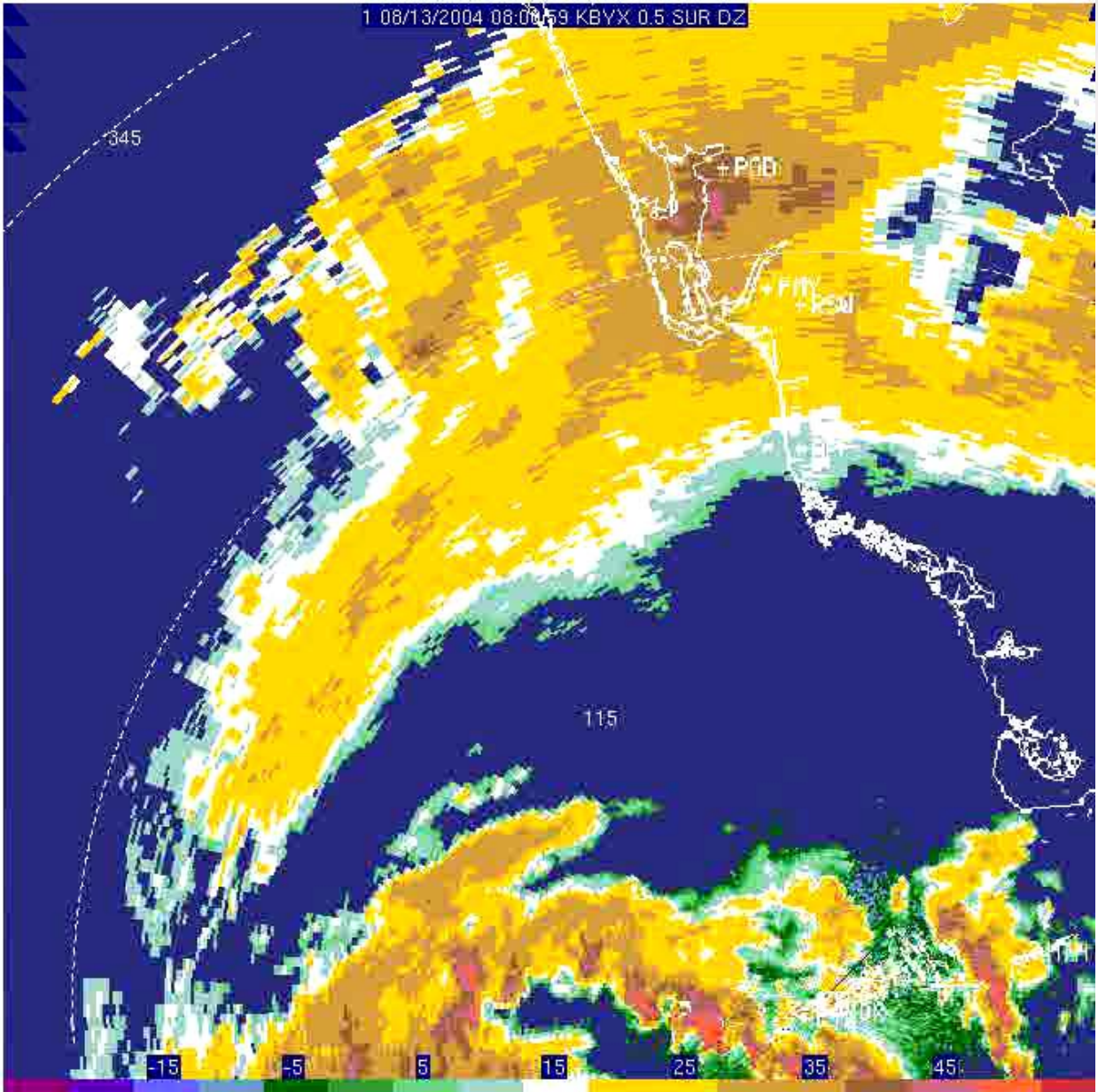




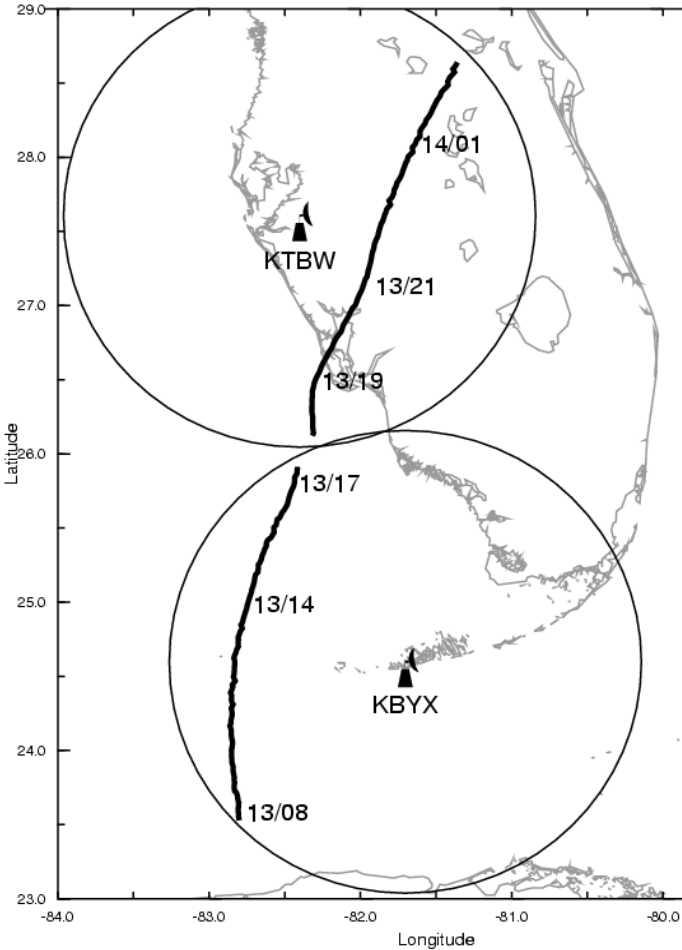
# Summary

- 12 US landfalling hurricanes between 2005 - 2011 have been identified and run through VORTRAC V1
- Preliminary analysis revealed areas for improvements
- Identifying the "correct" hurricane circulation center remains the most challenging component in VORTRAC, especially for ill-behaved hurricanes like Ike (2008)
- PIs intend to test and implement several hurricane center finding algorithms (reflectivity and Doppler velocity based) in addition to the GBVTD-simplex algorithm to improve the confidence of hurricane center estimates



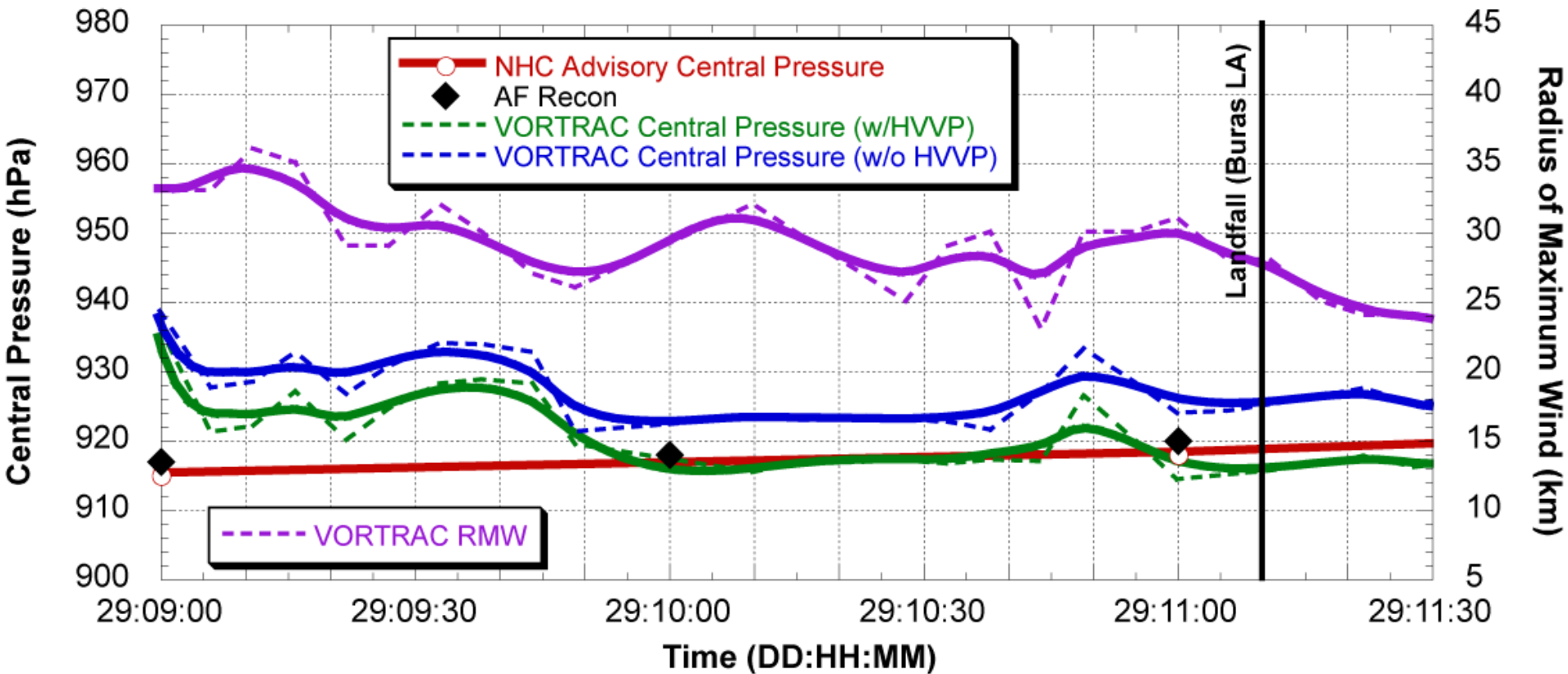


Hurricane Charley (2004) GBVTD-derived track 13/0



# Hurricane Katrina (2005)

Hurricane Katrina (2005)  
Central Pressure and Radius of Maximum Wind Estimates





Current Time UTC

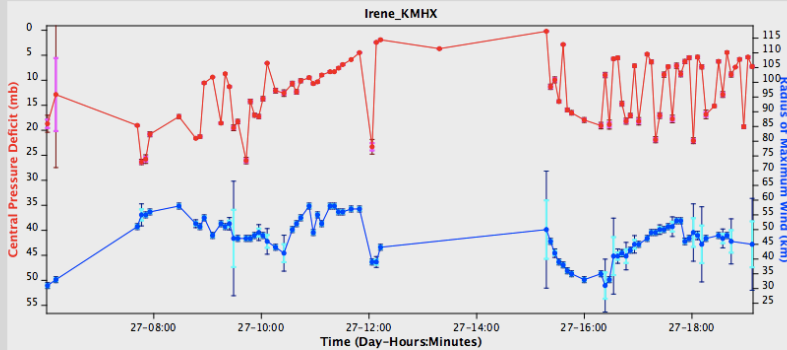
19:21

Pressure Deficit From 100 km (mb): 7.266

Current Pressure (mb): 1005

Current RMW (km): 45

Pressure/RMW Current Capli



See Legend

Save Graph

1.50253 minutes elapsed  
 Analysis: VORTRAC ATCF 2011-08-27T19:07:08,35.8307,-76.1819,1005.73,5,45,7.7982  
 Analysis: Analysis complete!  
 Poller: Completed Analysis On Volume /Users/mbell/Science/current/irene/levelii/KMHX  
 Poller: Storm Central Pressure Stabilized  
 Poller: Data found, starting analysis...  
 Poller: Found file /Users/mbell/Science/current/irene/levelii/KMHX\_20110827\_1911



# KMHX

VORTRAC

Irene\_KAKQ

Pressure Deficit From 100 km (mb): 18.32

Current Pressure (mb): 994

Current RMW (km): 46

Pressure/RMW Current Capli

Irene\_KAKQ

Time (Day-Hours:Minutes)	Central Pressure Deficit (mb)	Radius of Maximum Wind (km)
27-19:30	15	45
27-20:00	15	45
27-20:30	15	45
27-21:00	15	45
27-21:30	15	45
27-22:00	15	45
27-22:30	15	45
27-23:00	15	45

See Legend

Save Graph

0.0202667 minutes elapsed  
 Analysis: Simplex center (-995, -999) > 50 km (999 km) from user estimate, assuming Simplex is lost and attempting user center  
 Analysis: Simplex center 999 km away rejected  
 Analysis: Insufficient Convergence of Simplex Centers  
 Analysis: No Center Convergence  
 Poller: Completed Analysis On Volume /Users/mbell/Science/current/irene/levelii/KAKQ\_20110827\_2357  
 Poller: Storm Central Pressure Stabilized

Last Simplex & Estimate 10 km apart

Run

Abort

Current Time UTC

00:09

Current Radar VCP 212



Last Simplex & Estimate 10 km apart

# Irene 2011

# KAKQ



Current Radar VCP 212

