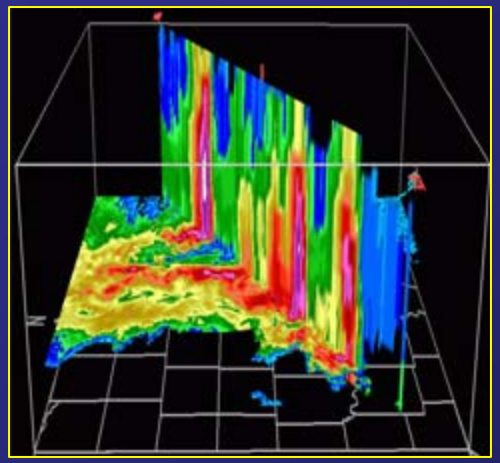
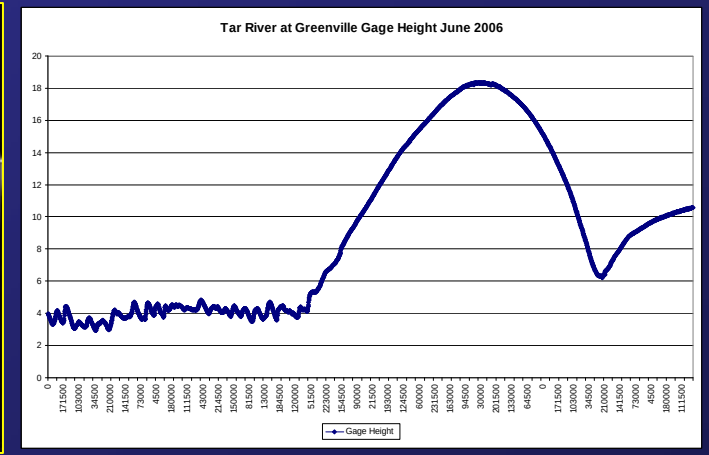
Coastal and Inland Flooding Observation and Warning

(CI-FLOW) Project





Program Update for NOAA in the Carolinas

February 6-7, 2008 at Beaufort, NC

Topics of Interest

- Personnel and Program Focal Points
- FY07 Program Component Updates and Research Support
- Project Task Priorities for FY08
- Quantitative Precipitation Estimates (QPE) Research Collaborations
- NSSL Q2 System and Access
- Future Opportunities including NOAA Regional Team Activities

Personnel and Program Focal Points

- New National Sea Grant Weather/Climate Extension Specialist

  Suzanne Van Cooten, Ph.D.

  OU CIMMS IPA (2 year assignment from NOAA NSSL)

- Regional Sea Grant climate extension specialist and NSSL Deputy Director will continue to lead CI-FLOW activities within NSSL

- Selection of Graduate Student to support OU Sea Grant Climate Extension Specialist

  Heather Moser

  OU School of Meteorology M.S. Candidate

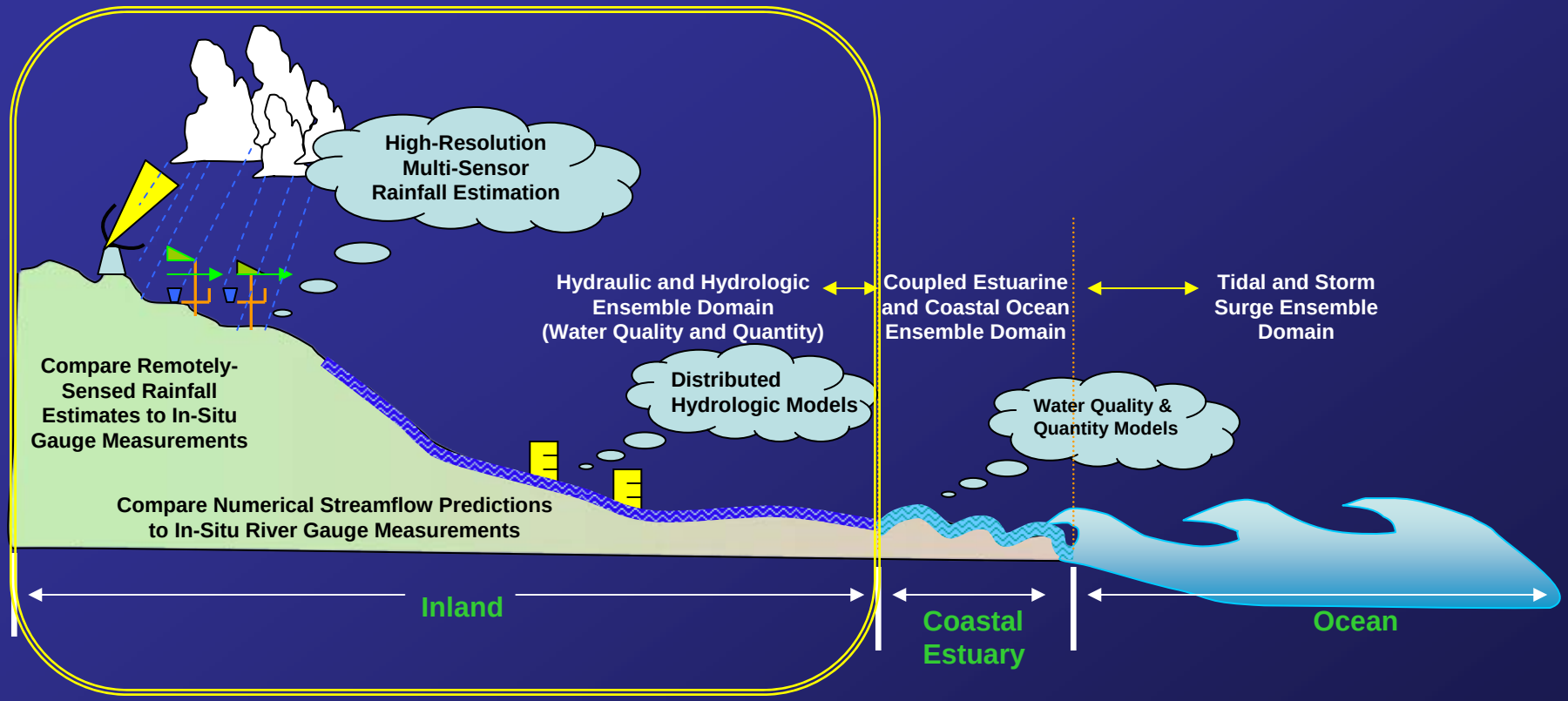
  B.S. in Meteorology from Iowa State (Area of emphasis in GIS and Hydrogeology)

FY07 CI-FLOW Project Component Updates

Summit to Sea…Atmosphere to Atlantic

CI-FLOW

Outreach, Education, and Customer-Driven Product Improvement from the Summit to the Sea



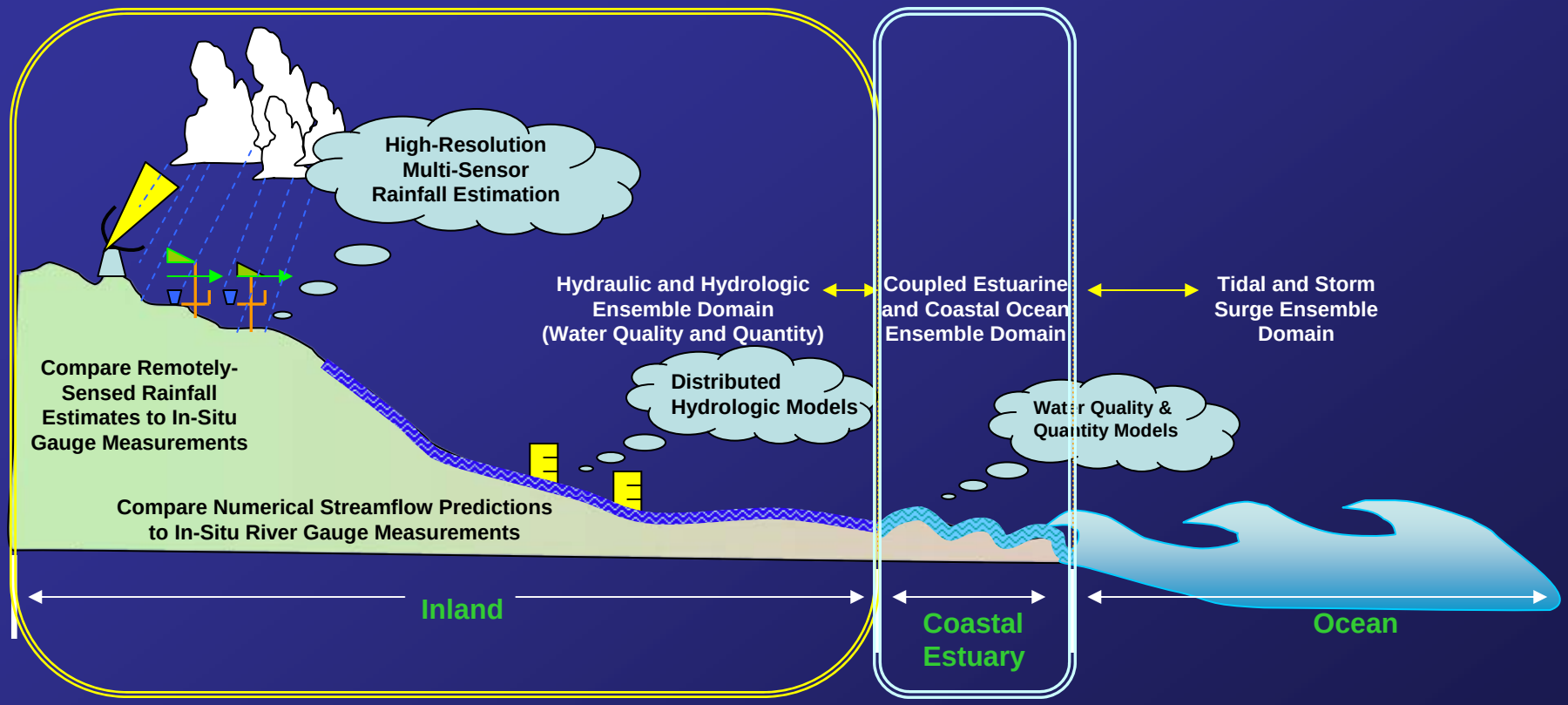
Ensemble Efforts Accomplished in FY07

Precipitation : QPE Collaboration (NSSL Q2 and OHD EMPE) incorporating VPR research

Inland Streamflow: HL-RDHM in headwater basins; Initial T-REX (CASC 2-D) Distributed Model Evaluation for entire Tar River basin

CI-FLOW

Outreach, Education, and Customer-Driven Product Improvement from the Summit to the Sea



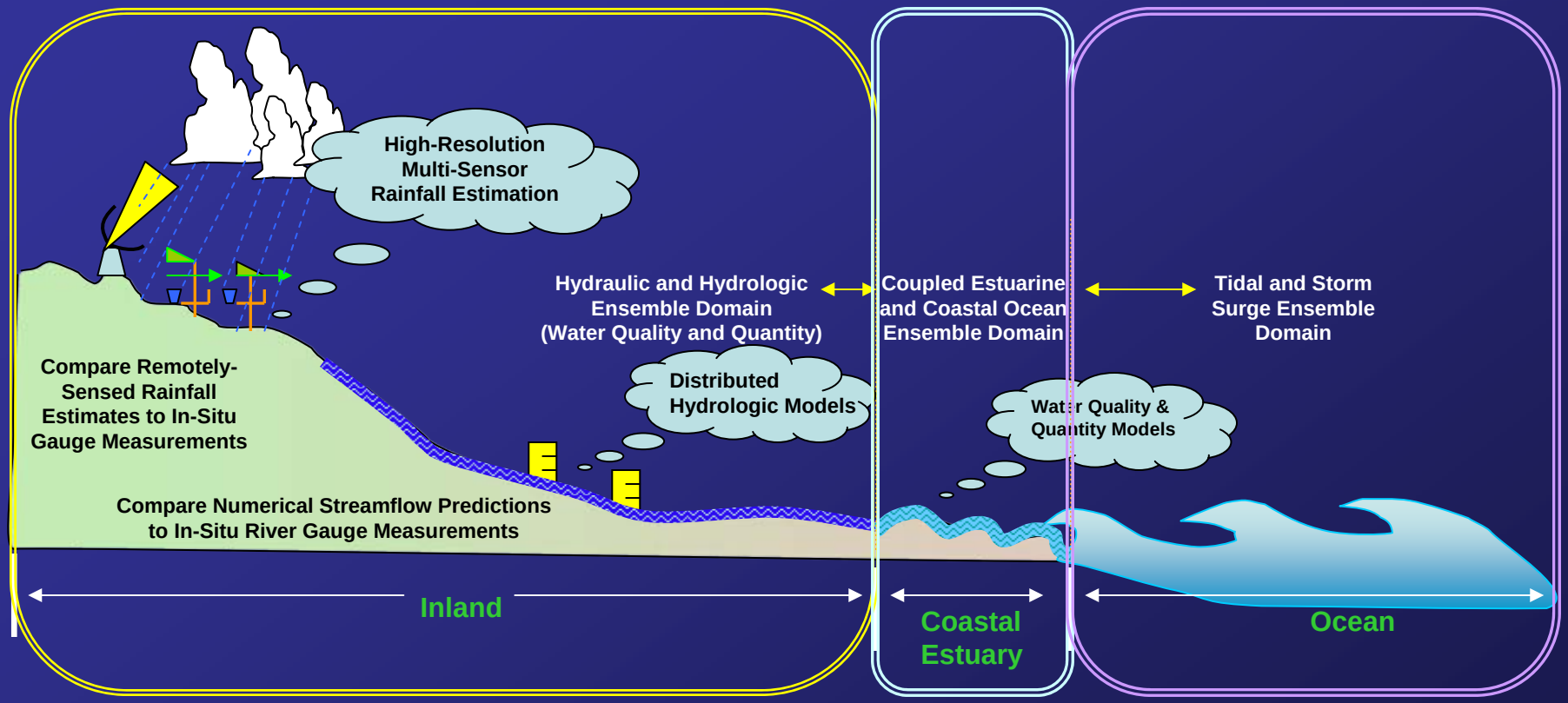
Ensemble Efforts Accomplished in FY07

T-REX and NCSU hydrodynamic model coupling efforts below Washington, NC

OU College of Civil Engineering (R. Kolar) and NSSL IOOS proposal submitted and funded for FY08 for grad student support for research on coupling inland streamflow output from CI-FLOW ensemble to output of hydrodynamic ocean ensemble

CI-FLOW

Outreach, Education, and Customer-Driven Product Improvement from the Summit to the Sea



Efforts Accomplished in FY07

OU College of Civil Engineering (R. Kolar) and NSSL IOOS funded proposal

Identification of IPA with support of Coastal Services Center to facilitate collaboration to build coastal ocean modeling ensemble and testing framework

Momentum for CI-FLOW Project

IOOS and NWS partners are funding portions of CI-FLOW in FY08

Coastal Services Center IPA identified to facilitate interaction of Carolina ocean modeling community with CI-FLOW

NWS Integrated Water Resources Services and Coastal Services Center funding to support aspects of QPE and storm surge modeling ensemble development

IOOS FY08 funding for fundamental science to be conducted on coupling inland streamflow ensemble to hydrodynamic ocean models producing storm surge output

Southeast and Central NOAA Regional Teams have invited briefings from CI-FLOW projects for their meetings and are including CI-FLOW in their strategic planning activities

Development of Outreach, Education, and Customer-Driven Products

Tar River Basin Information Portal

Primary point to showcase CI-FLOW project elements

Promote inspeak and outspeak for CI-FLOW Partners and constituents

Visualization of NSSL, OHD, and NESDIS precipitation, streamflow, and numerical weather prediction products to stimulate discussion and stakeholder advocacy

Primary point to leverage and increase visibility of Tar/Pamlico research projects

Coastal Services Center, NWS OCCWS, and State of North Carolina flood inundation and streamflow mapping efforts

NOWCOAST capabilities to sync in-situ and remotely-sensed observations with derived NWS and NOAA operational and research forecast and warning products (incl. NSSL Q2)

Primary point to showcase and leverage SeaGrant activities for Tar and Pamlico Basins

The portal is fundamental to developing interactive and sustainable stakeholder assessment activities to develop and improve NOAA products for coastal communities

Infusing Research Results Into CI-FLOW Project Elements : Demonstrating the Importance of Integrating New Technologies and Techniques to Improve NOAA Hydrologic Services

Quantitative Precipitation Estimates (QPE) Research Collaborations

A comparison of evolving multisensor precipitation estimation methods based on impacts on flow prediction using a distributed hydrologic model

David H. Kitzmiller, F. Ding D. Riley and Y. Zhang, NOAA/NWS/OHD
S. Van Cooten, K. Howard, C. Langston, J. Zhang, H. Moser, NOAA NSSL
R. J. Kuligowski, NESDIS
D. Kim, NESDIS/NCDC

http://ams.confex.com/ams/88Annual/techprogram/paper_134451.htm

Assessing Vertical Profiles of Reflectivity (VPR's) To Detect Extreme Rainfall: Implications for Flash Flood Monitoring and Prediction

Amos Dodson, North Carolina State University
S. Van Cooten, K. Howard, J. Zhang, and X. Xu, NOAA NSSL

http://ams.confex.com/ams/88Annual/techprogram/paper_135143.htm

OHD/ NSSL/ NESDIS Research Collaboration:

A comparison of evolving multisensor precipitation estimation methods based on impacts on flow prediction using a distributed hydrologic model

This project is a joint scientific research effort that was conducted by:

Office of Oceanic and Atmospheric Research National Severe Storms Laboratory (NSSL)

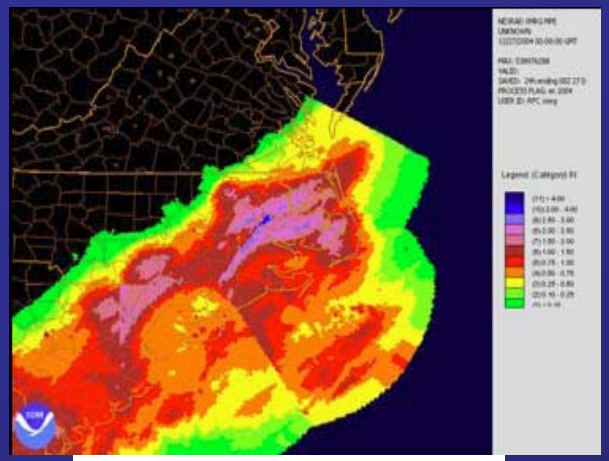
National Weather Service Office (NWS) of Hydrologic Development (OHD)

National Environmental Satellite, Data, and Information Service (NESDIS) Center for Satellite Applications and Research (STAR)

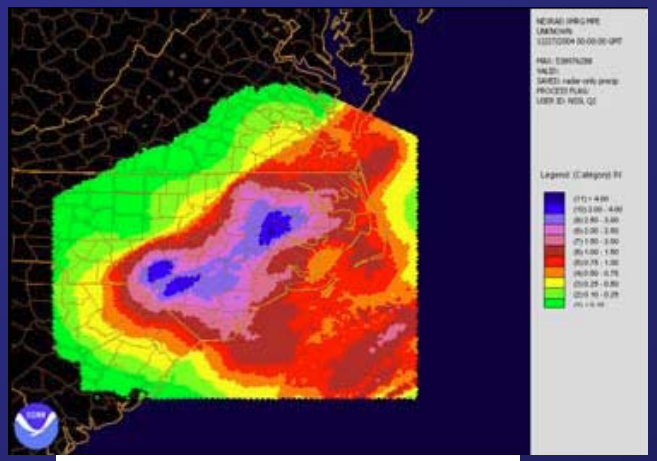
This initial research effort is in the NWS H-OSIP process and has been approved through Gate 3

QPE products were generated for four cases from December 2004 through January 2005 to evaluate the performance of NSSL Q2 and OHD MPE at 1 km grid resolution. Stage IV mosaic composites used in this study are those created by the National Centers for Environmental Prediction for use by the National Precipitation Verification Unit

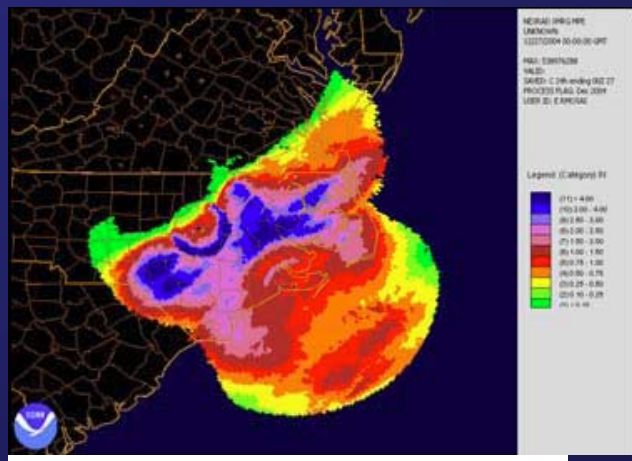
Radar-Only QPE (no gauge adjustment algorithms used)



SERFC 27 Dec 2004



NMQ Radar 27 Dec 2004



MPE/HPE Radar 27 Dec 2004

Total 24-h precipitation ending 0000 UTC 27 December

QPE Research Findings

Our experiment was initiated with the cool-season event, which represented some special challenges to the QPE systems. Portions of this period featured snow or rainfall with low freezing level heights, which lead to large uncertainties in the reflectivity/surface-rainfall relationship.

Over four precipitation events in the December 2004-January 2005 period, the NMQ radar–only QPE was generally closer to rain gauge reports and the operational SERFC analysis than was the HPE.

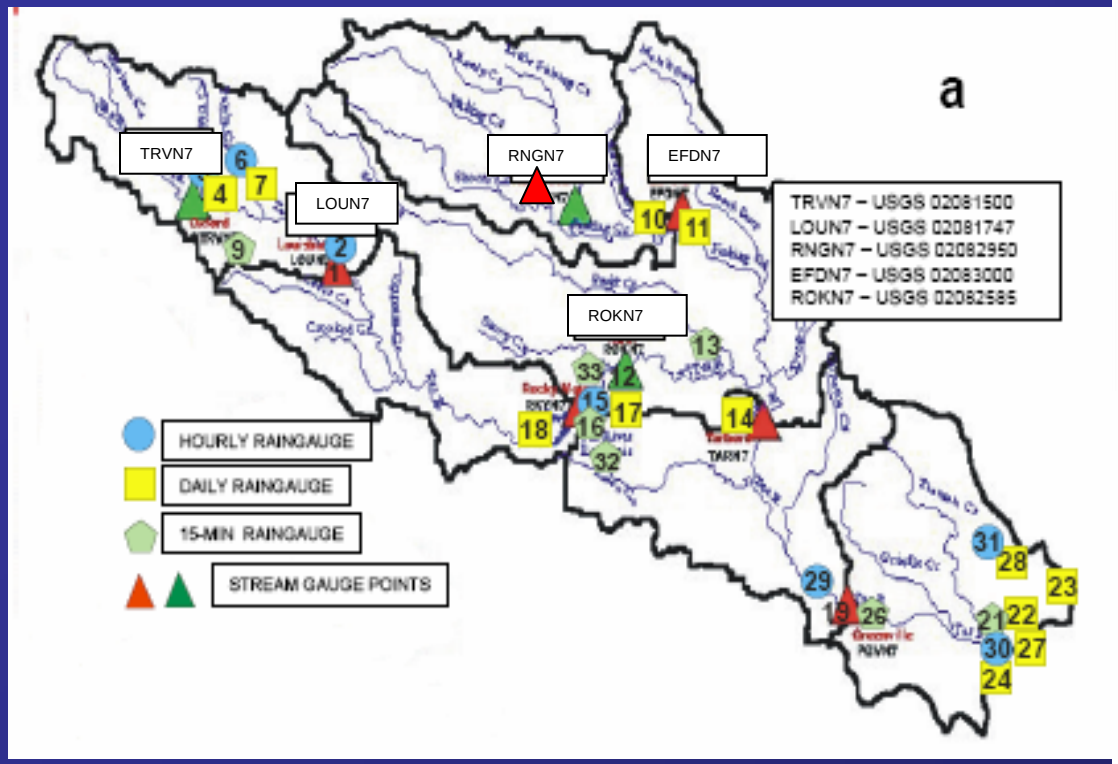
In particular, the NMQ logic produced much less overestimation during the challenging event of 26 December, which affected the remainder of the hydrologic simulation period. This could be due to its adaptive adjustment of Z-R relationships, which is not a feature of the NEXRAD precipitation processing system or HPE.

Impact of QPE accuracy on HL-RDHM streamflow simulations

Hydrologic Laboratory-Research Distributed Hydrologic Model (HL-RDHM) using a-priori variables (not calibrated) was implemented by NWS OHD personnel for the headwaters of the Tar River Basin

Due to the HL-RDHM not being calibrated, our analysis of the NMQ and HPE precipitation products was focused on their ability to duplicate the manually quality-controlled SERFC precipitation analysis, and the impact of the differences in precipitation on differences in modeled discharge.

Among the four basins, total discharge volume and precipitation were correlated fairly strongly, with percentage differences among the three QPE sources produced similar percentage differences in total modeled discharge. Thus the RDHM appears to be sensitive to rather subtle differences in precipitation


a
TRVN7
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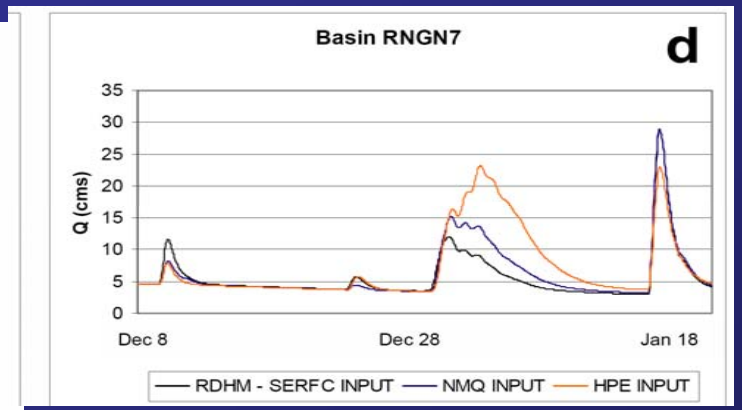
RNGN7
EFDN7
ROKN7
TRVN7 – USGS 02081500
LOUN7 – USGS 02081747
RNGN7 – USGS 02082950
EFDN7 – USGS 02083000
ROKN7 – USGS 02082585
HOURLY RAINGAUGE
DAILY RAINGAUGE
15-MIN RAINGAUGE
STREAM GAUGE POINTS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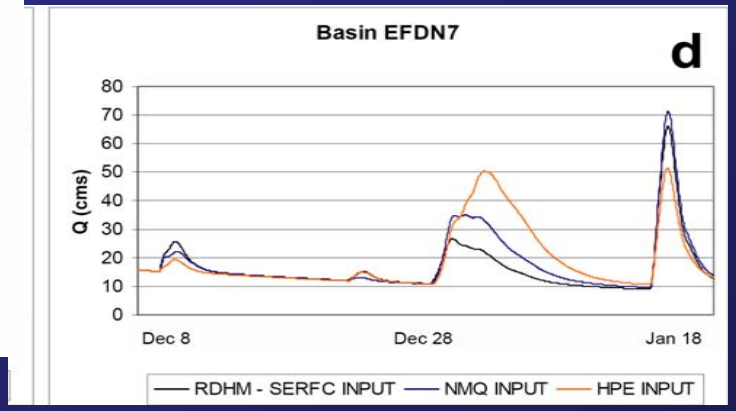
Jan 18
RDHM - SERFC INPUT
NMQ INPUT
HPE INPUT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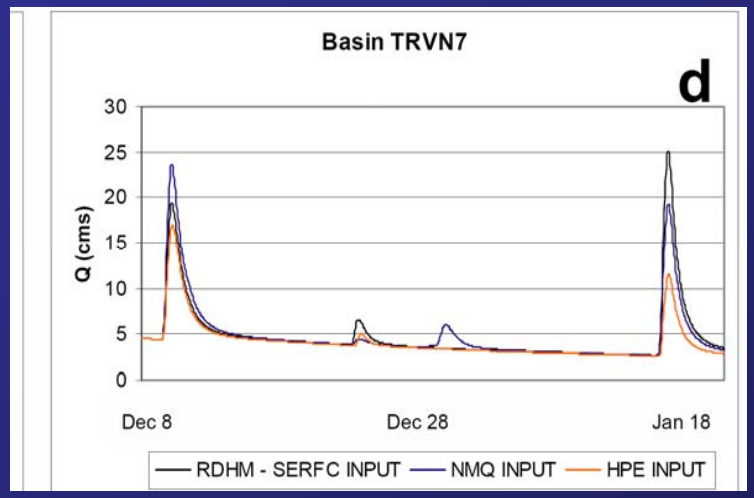
RDHM - SERFC INPUT
NMQ INPUT
HPE INPUT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RDHM - SERFC INPUT
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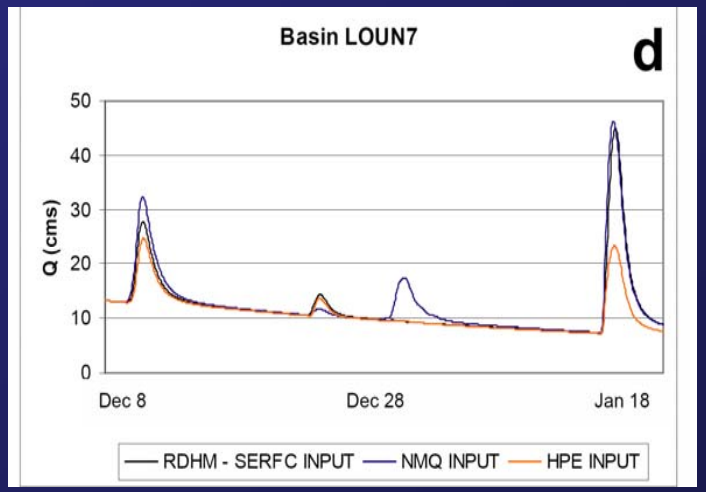
HPE INPUT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RDHM - SERFC INPUT
NMQ INPUT
HPE INPUT

CI-FLOW Project Impacts

HL-RDHM has been implemented for the headwaters of the basin

15 minute and hourly precipitation observations have been archived for November 2004-February 2005 for the gauges residing under the radar umbrellas of Raleigh, Morehead City, and Wakefield

1 km gridded QPE has been generated and archived for December 2004 and January 2005 for an area encompassing the radar umbrellas of Raleigh, Morehead City, and Wakefield

Future Research

Additional efforts will be required to implement HL-RDHM in the lower portions of the basin which contain reservoirs (i.e. Rocky Mount)

Future analyses will concentrate on gauge-radar multisensor precipitation, testing of the impact of other features of NMQ and HPE such as gauge-radar-satellite products, and examination of SCaMPR products

Evaluation of QPE algorithms' performance during warm season events

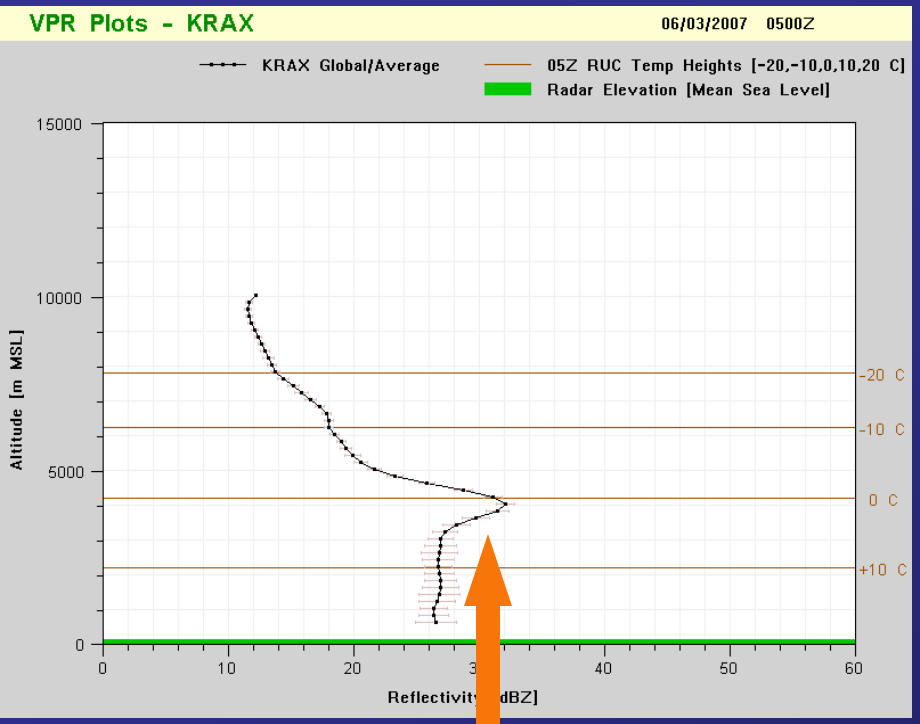
Assessing Vertical Profiles of Reflectivity (VPR's) To Detect Extreme Rainfall: Implications for Flash Flood Monitoring and Prediction

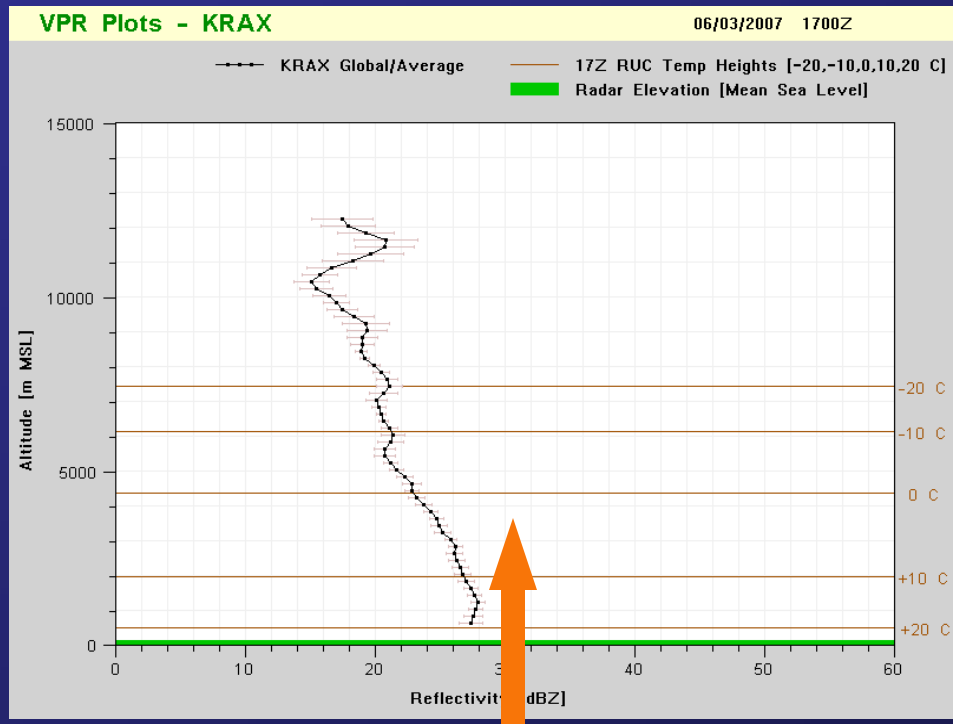
Amos Dodson, North Carolina State University
S. Van Cooten, K. Howard, J. Zhang, and X. Xu, NOAA NSSL

http://ams.confex.com/ams/88Annual/techprogram/paper_135143.htm

- **VPR's are proving to be an excellent diagnostic tool to identify air mass characteristics**
- **Intense storms produced in a continental air environment typically have an area of high radar reflectivity centered along the freezing level**
- **Intense storms produced in a tropical air environment lack this area of high radar reflectivity**

Example

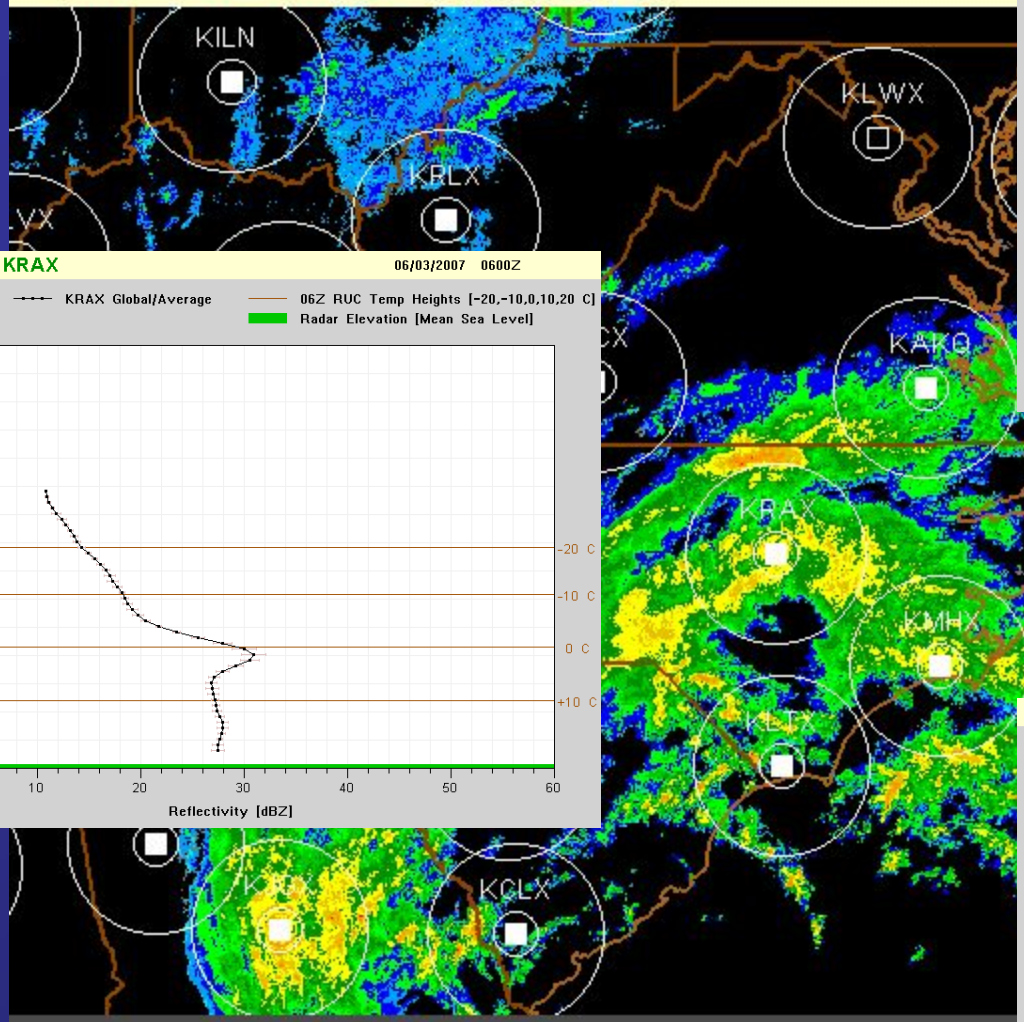




Region of High Reflectivity (Continental)

No Region of High Reflectivity Present (Tropical)

VPR Plots Index



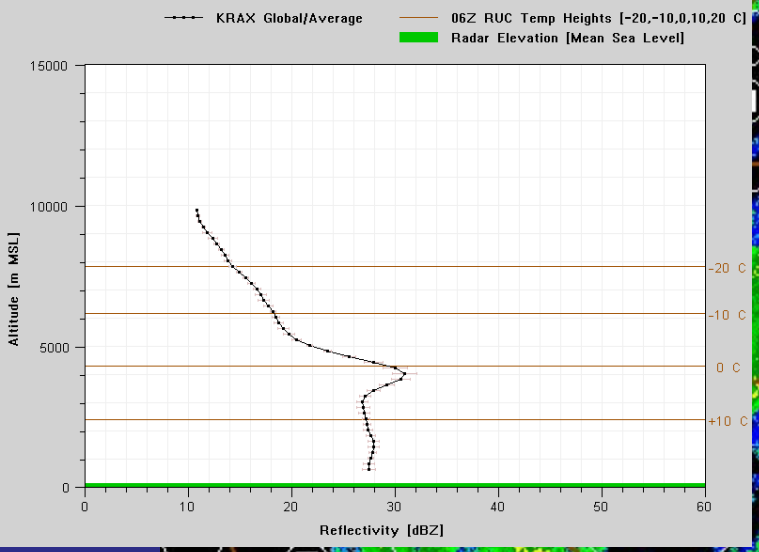
Radars with VPR data

Radars with no VPR data

Range rings show 20km/80km annulus used for VPR data.

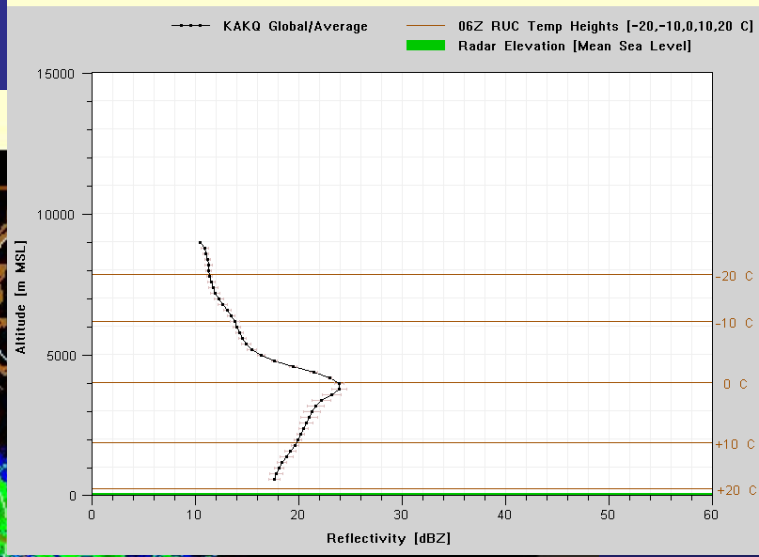
VPR Plots - KRAX

06/03/2007 0600Z



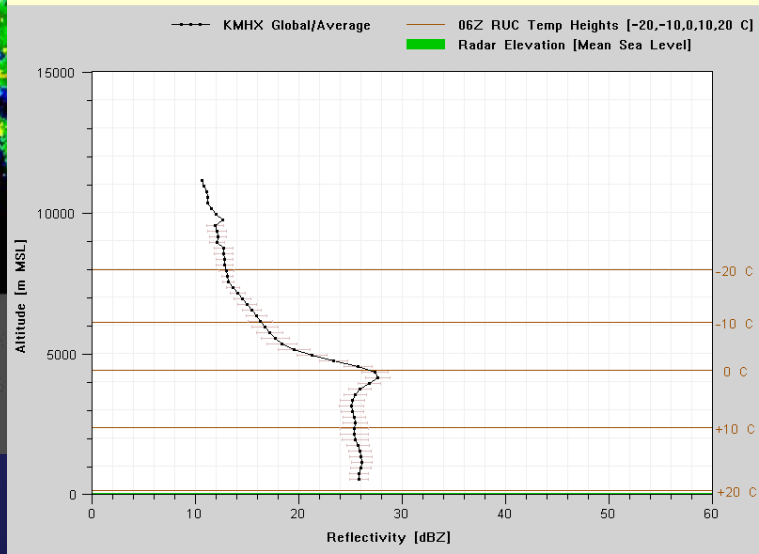
VPR Plots - KAKQ

06/03/2007 0600Z

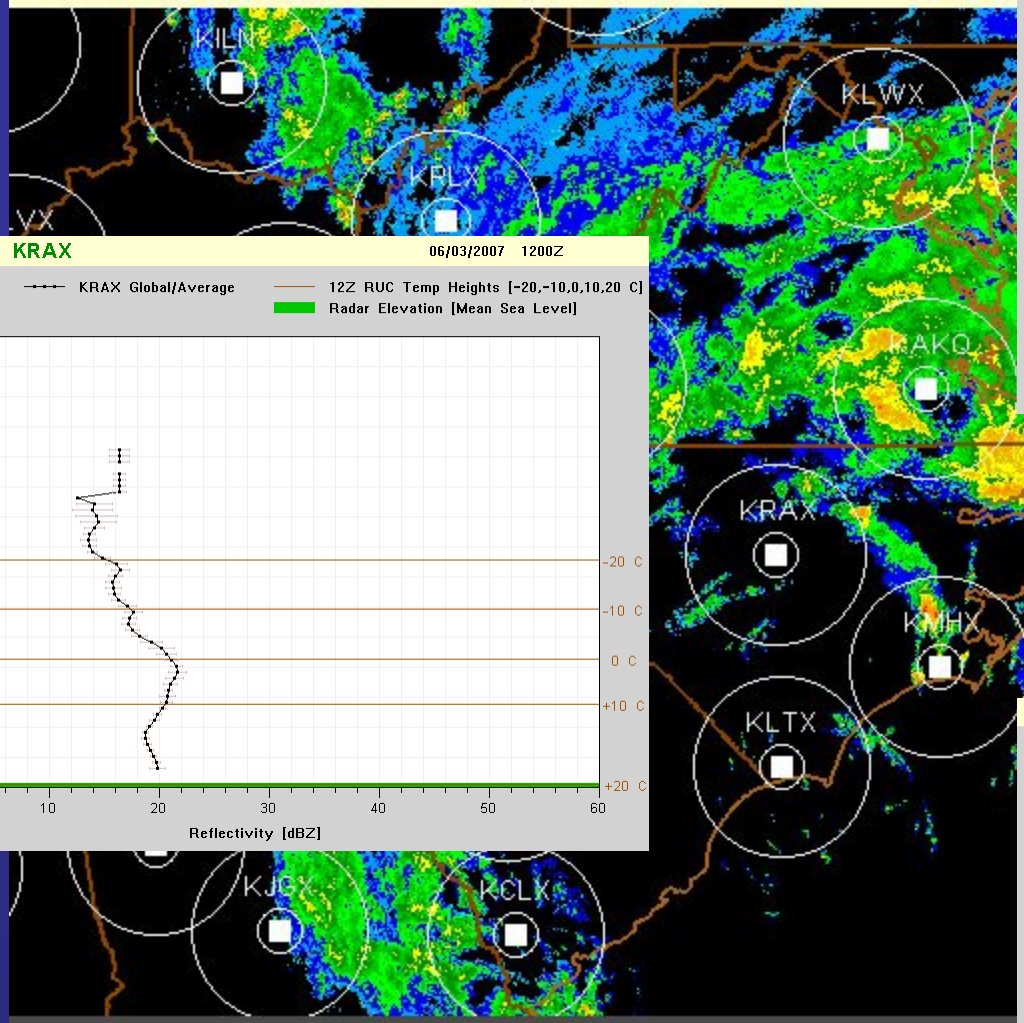


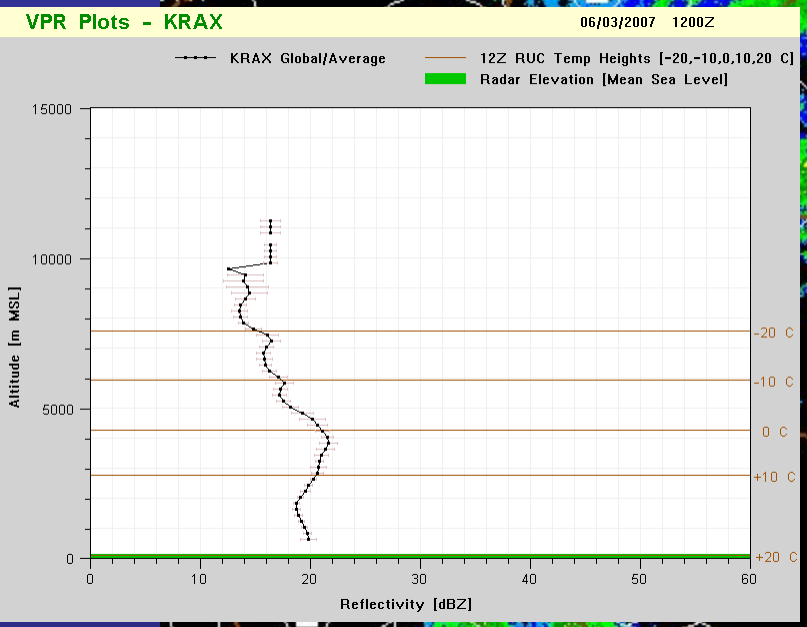
VPR Plots - KMHX

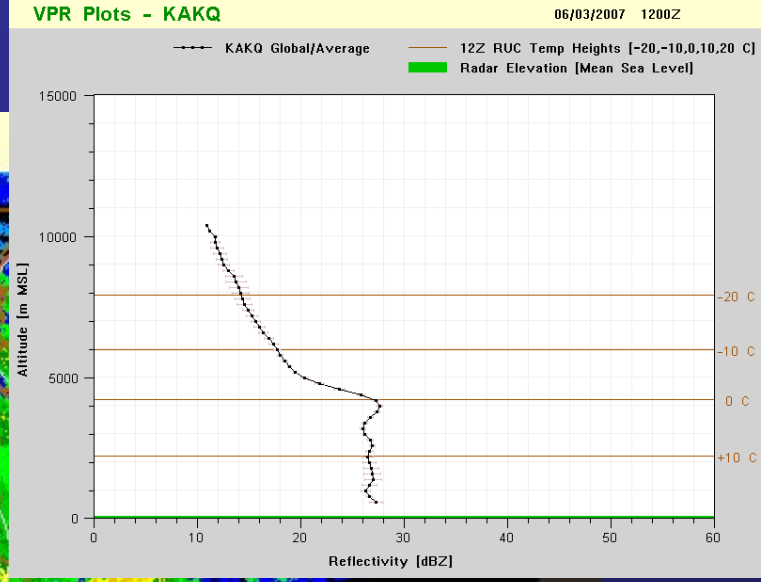
06/03/2007 0600Z

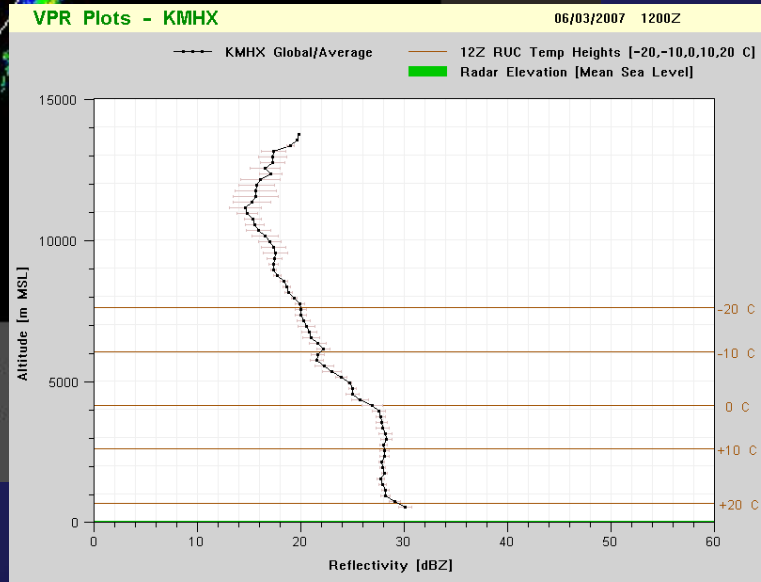


VPR Plots Index







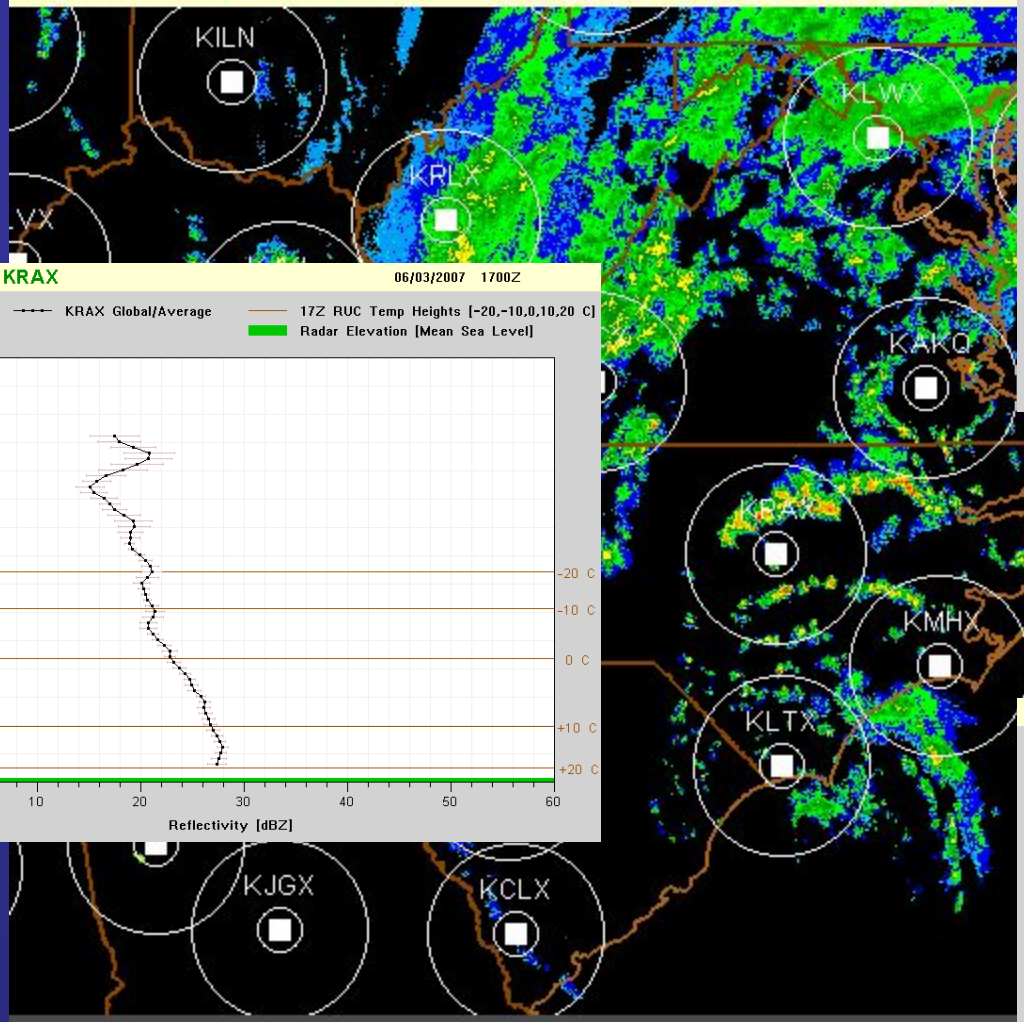


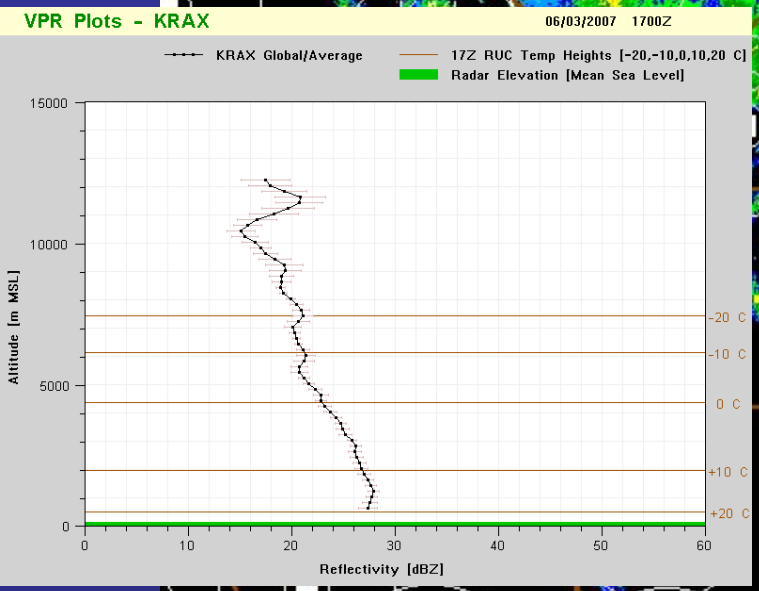
■ Radars with VPR data

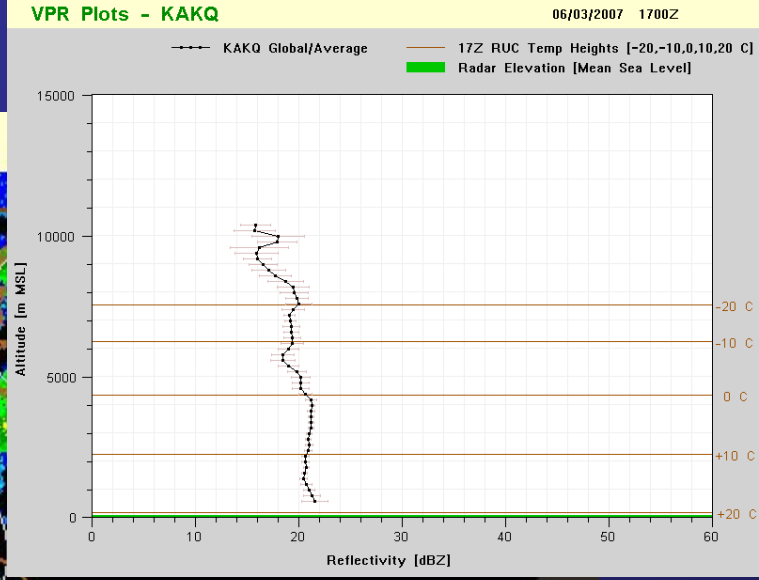
□ Radars with no VPR data

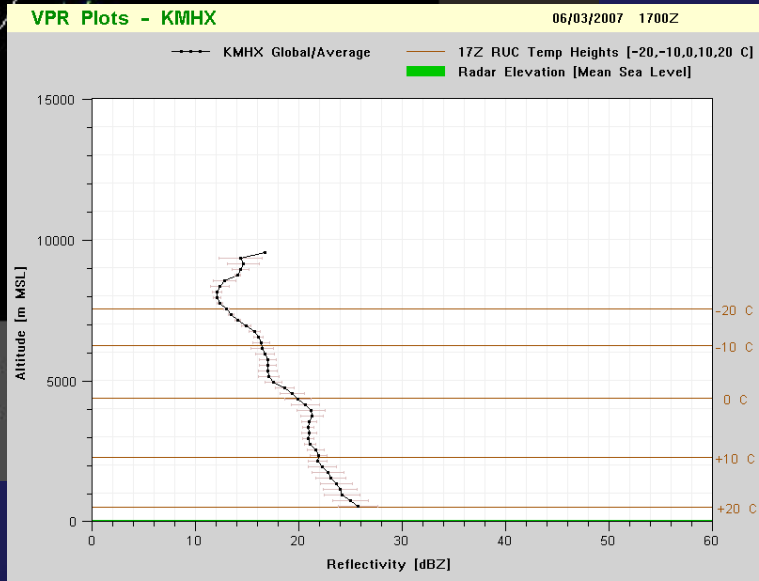
Range rings show 20km/80km annulus used for VPR data.

VPR Plots Index





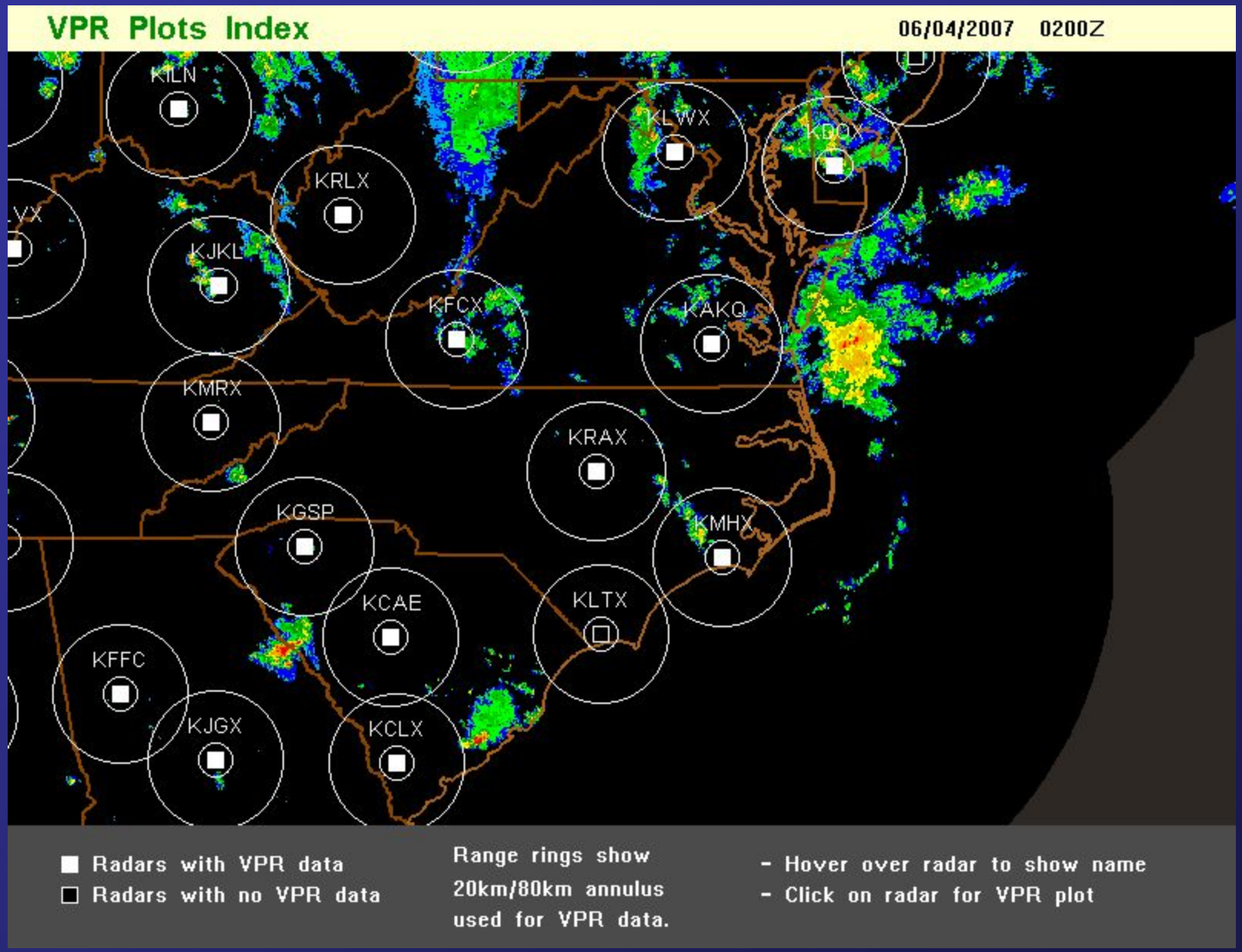




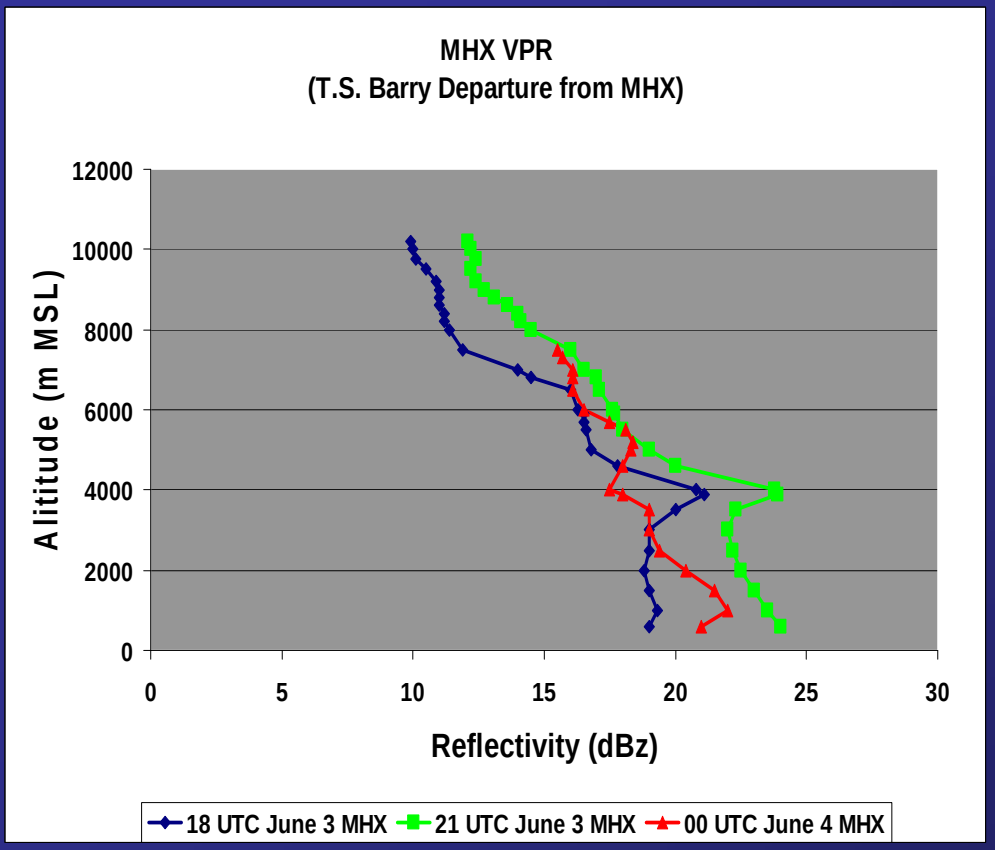
■ Radars with VPR data

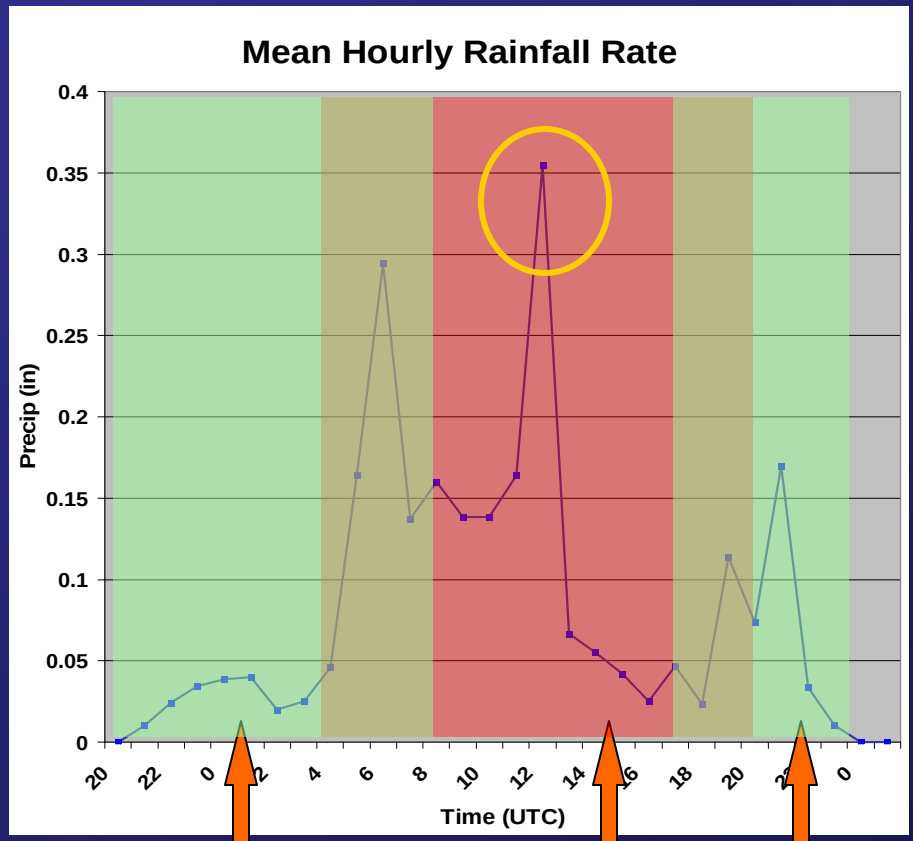
□ Radars with no VPR data

Range rings show 20km/80km annulus used for VPR data.


VPR Plots Index
06/04/2007 0200Z
KILN
KLWX
KDOX
KRLX
KJKL
KFCX
KAKQ
KMRX
KRAX
KGSP
KMHX
KCAE
KLTX
KFFC
KJGX
KCLX
Radars with VPR data
Radars with no VPR data
Range rings show 20km/80km annulus used for VPR data.
- Hover over radar to show name
- Click on radar for VPR plot

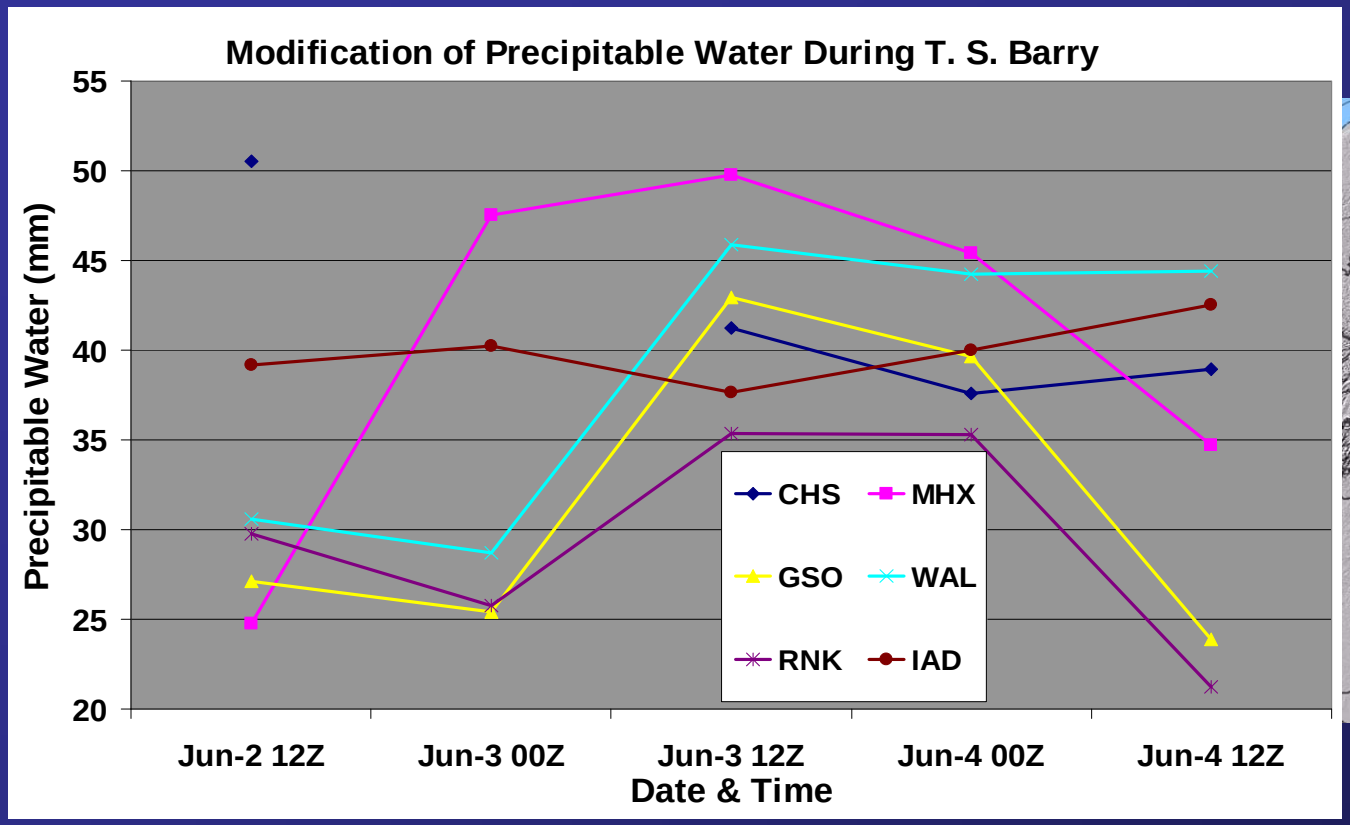
Morehead City VPR's & Rainfall Data

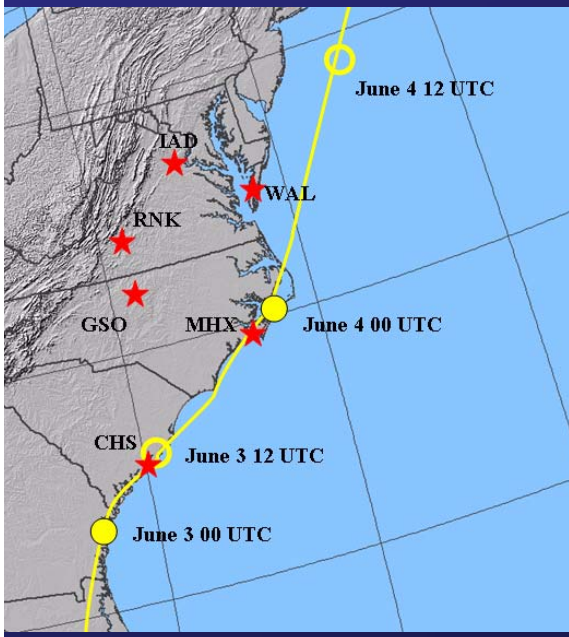




Continental Tropical Continental

Upper Air Sounding Data





Precipitable Water values increase twofold or more in 24 hours at Upper Air sites near the coast as T.S. Barry moves north

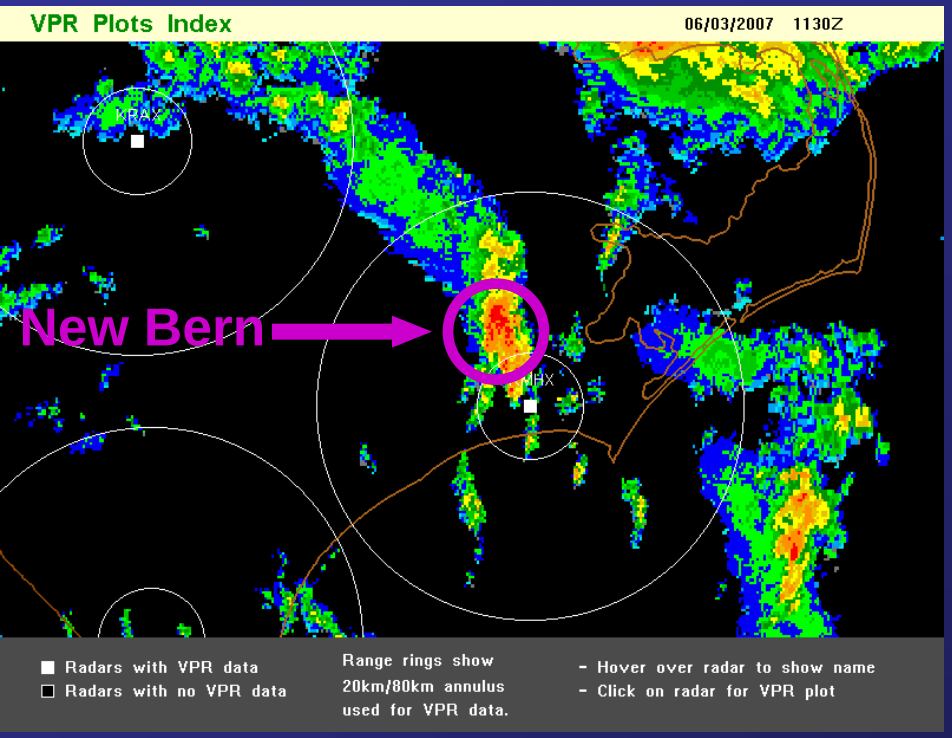
(MHX 12Z June 2 = 24.75 mm (.98 in) and 12 Z June 3= 49.77 mm (1.96 in))

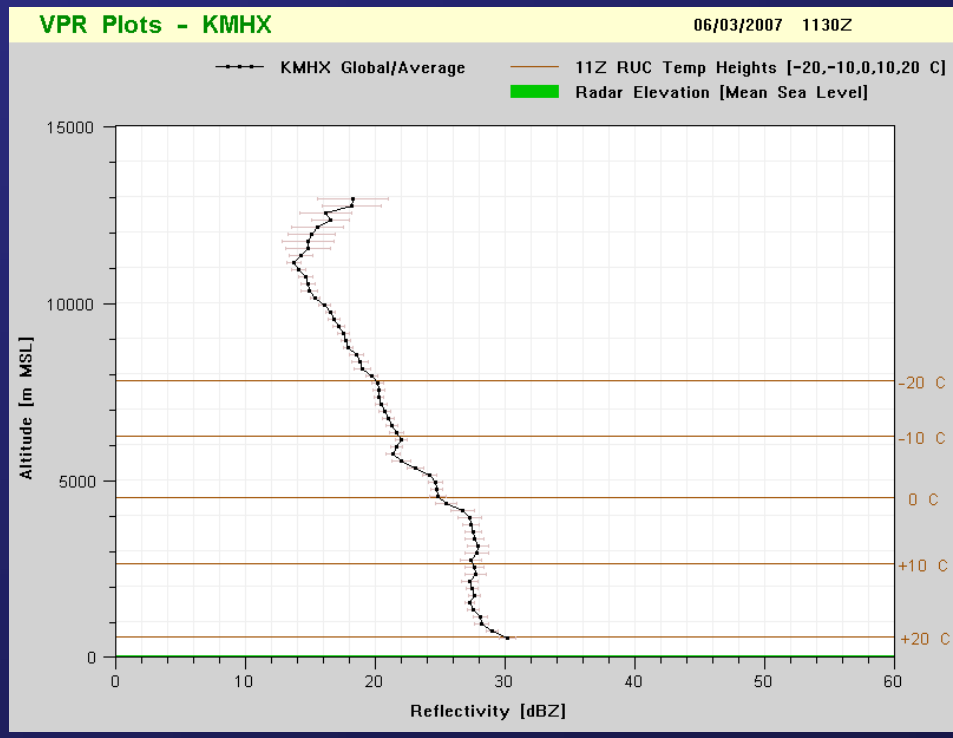
What Can Happen in 1 Hour

New Bern Craven Co Airport
New Bern, NC

COOP A ASOS-FAA ASOS

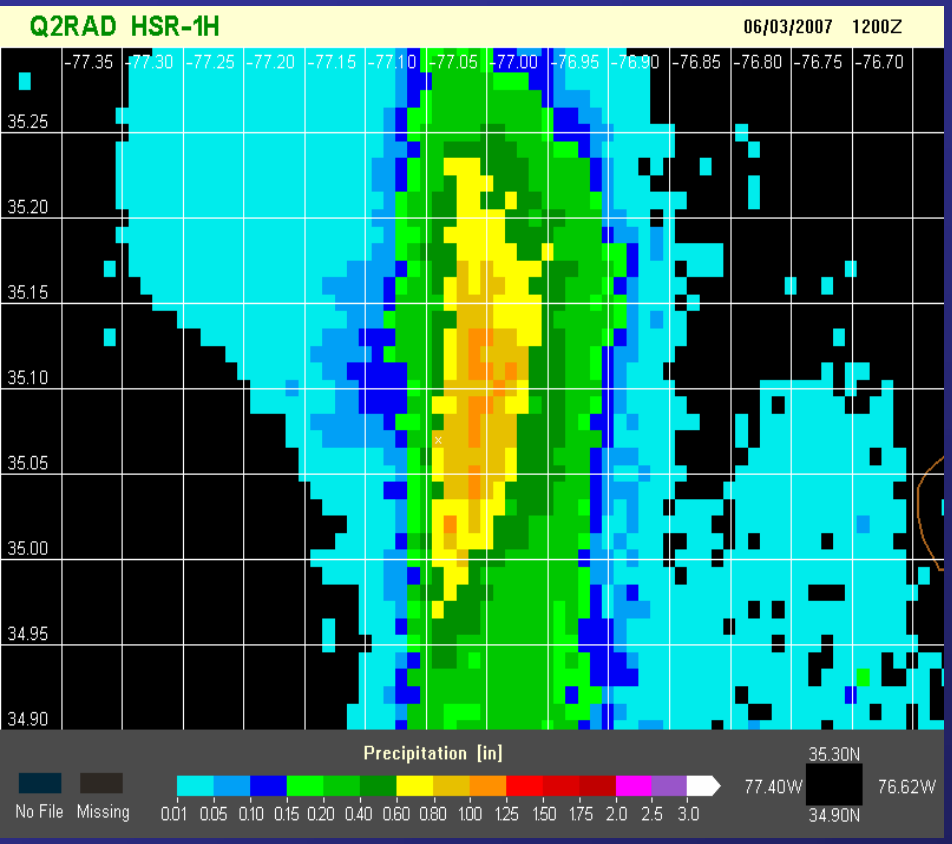
11-12Z: 1.2”



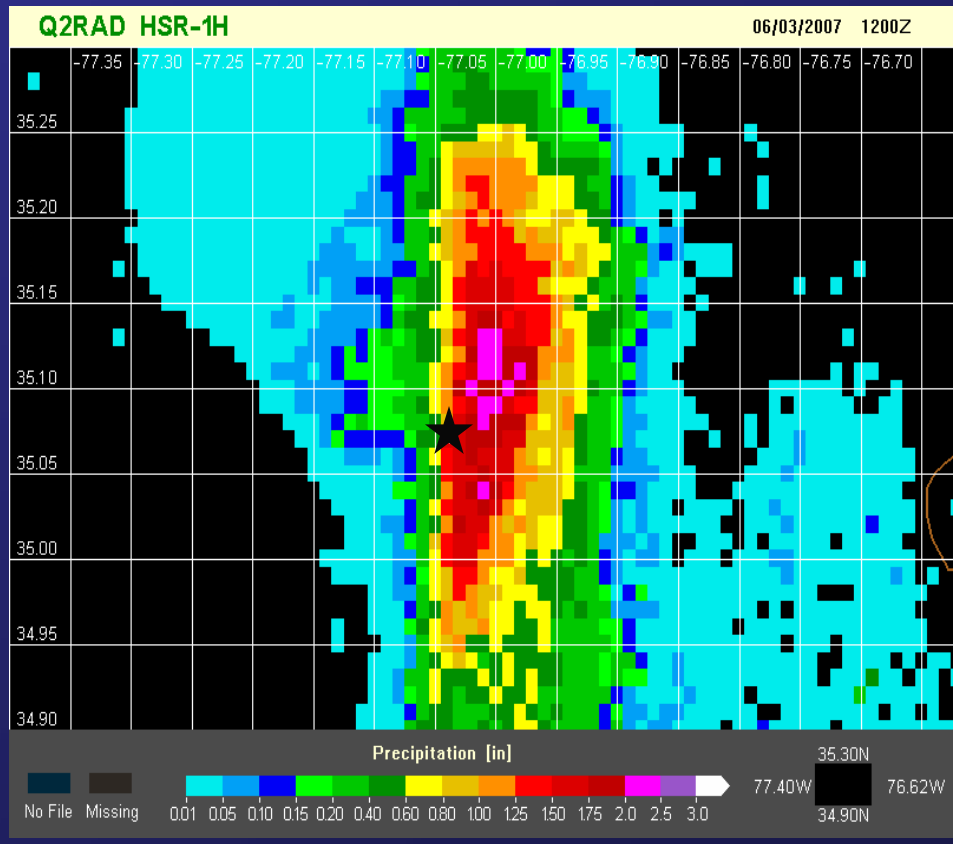


A Comparison of Radar Rainfall Estimates

Non-Tropical *Z-R*
Estimating .8”
(Actual: 1.2”)



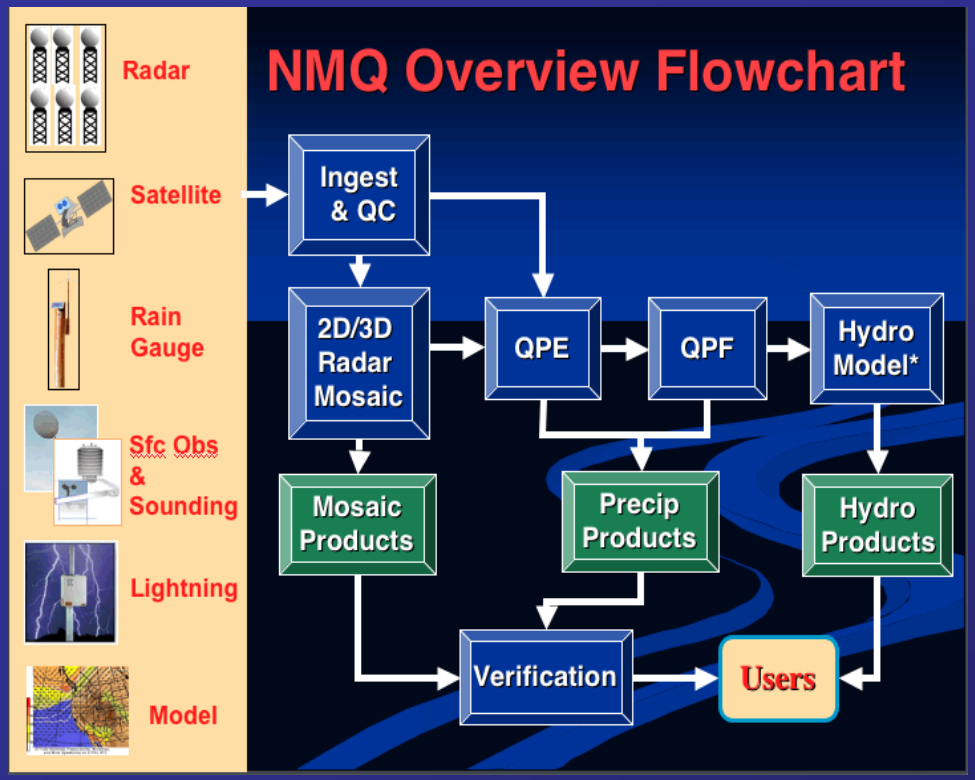
Tropical *Z-R*
Estimating 1.25”
(Actual: 1.2”)

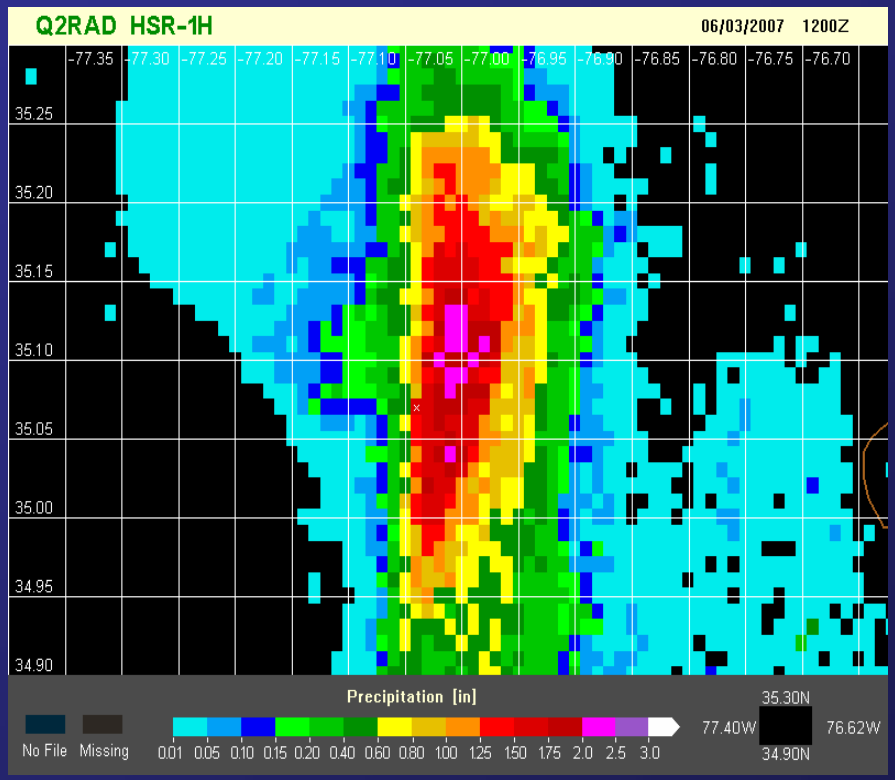


VPR Research Results

- VPR's show two different precipitation regimes during the T.S. Barry event
- T.S. Barry illustrates the need to dynamically adjust Z-R relationships on a pixel by pixel (1 km X 1 km) basis
  - NSSL is producing VPRs for each NEXRAD radar every five minutes through its Q2 system
  - These VPRs can detect the arrival of different air mass regimes (i.e. tropical or continental) allowing rain rates to be automatically adjusted
  - The NSSL NMQ tropical Z-R algorithm based on VPR characteristics performed well in T.S. Barry
  - This research indicates Q2 rainfall estimates will allow forecasters to quickly detect tropical environments and consequently storms producing very high rainfall rates

NSSL NMQ System Access





1km spatial resolution for CONUS every 5 minutes

NOAA NOWCOAST Partnership to push Q2 products for visualization in GEOTIFF format

NSSL System Access: Kenneth.Howard@noaa.gov

Future Opportunities for CI-FLOW Project

NOAA Hydrometeorological Testbed http://hmt.noaa.gov/

In third year of operation in American River Basin (Sacramento, CA, area)

Plans call to spin up east coast activity (HMT-East) in FY09-10 timeframe (dependent on funding) with location yet to be decided

NWS Deployment of Dual-Polarization technology to upgrade NEXRAD

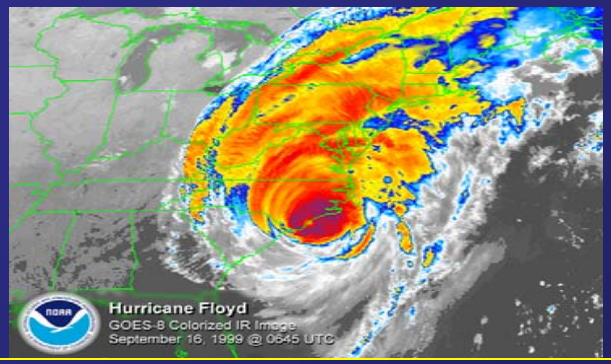
Dual-Pol technology will be deployed on NEXRAD platforms

Initial sites are being selected. CI-FLOW hydrologic programs are prime candidates to benefit from this information. NOAA in the Carolinas partners need to decide priority (i.e. coastal location or inland; maritime airmass effects)

Regional Team (NOAA and Non-NOAA) and NOAA Integrated Water Resources (IWRS) Activities

Future stakeholder advocacy and research transfer opportunities available from NOAA Regional Teams, NOAA CERIS, State of North Carolina (RENCI), Western States Governors Council (NIDIS), and IOOS activities

CI-FLOW Partners are demonstrating the importance of integrating new technologies and techniques to improve NOAA hydrologic services especially in highly vulnerable coastal watersheds



The CI-FLOW program is establishing a sound science foundation for the development and implementation of a Coastal Estuary River Information System (CERIS):

A NOAA South Atlantic Region Team/ Integrated Water Resource Services Priority Area Task Team Collaboration

Contact Information:

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