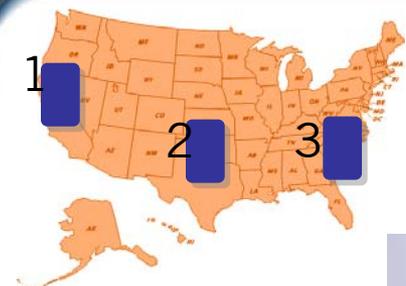


Hydrometeorology: *Local Testbeds and Field Results*

Jonathan J. Gourley
Hydrometeorology



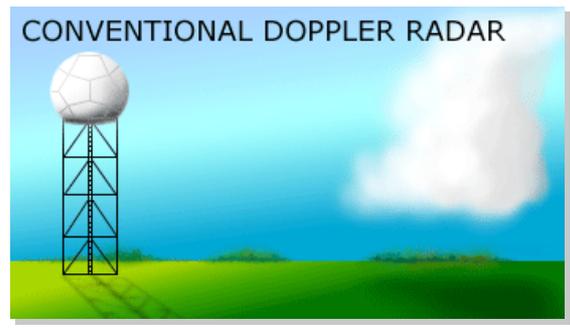


Outline

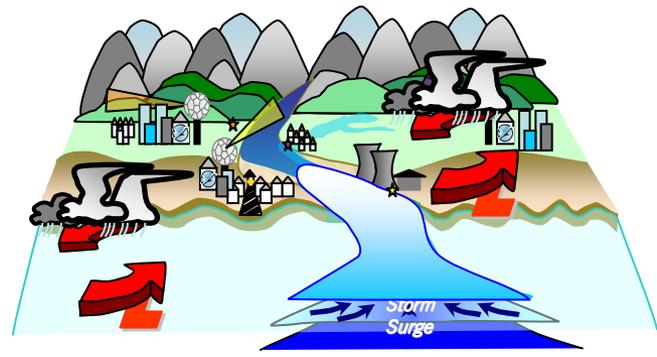
1. QPE and hydrologic sensitivity studies on the American River Basin, CA as part of the Hydromet Testbed (HMT)

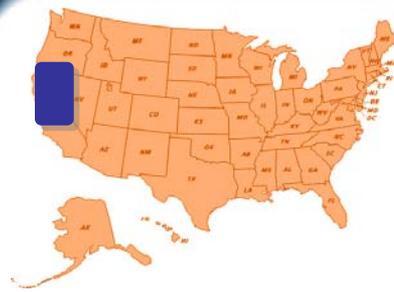


2. Dual-pol QPE evaluation and hydrologic sensitivity studies on Ft. Cobb and field measurements on Blue River Basin, OK



3. Coupled Atmospheric-Hydrologic-Coastal inundation modeling on the Tar/Neuse Rivers, NC as part of CI-FLOW project



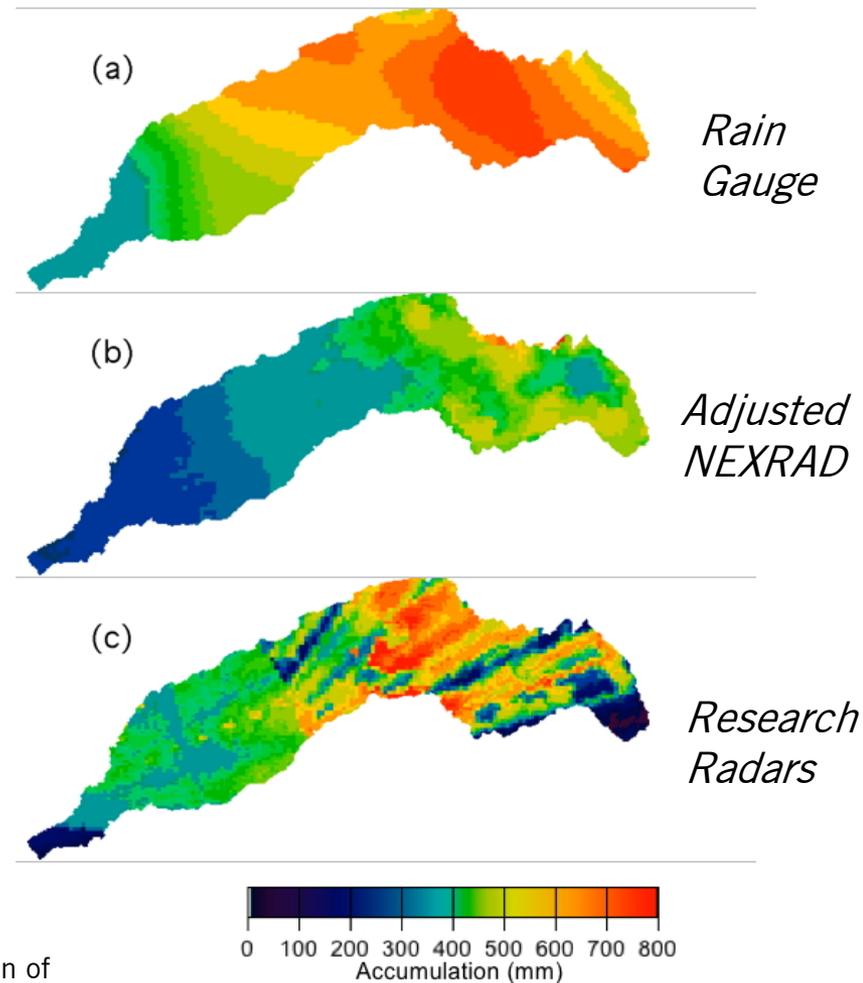


American River Basin - Motivation

- NOAA Hydrometeorological Testbed established to improve QPE, quantitative precipitation forecasts (QPF), snow information, hydrologic applications, and verification and decision support tools
- Exists a need to transition state-of-the-art research and technology into NWS operations
- Customers and partners include ESRL, Office of Hydrologic Development (OHD), NWS river forecast centers and local NWS forecast offices
- Products and services include QPE processing steps for mobile and NEXRAD radars and testing of a “gap-filling” radar in complex terrain

American River Basin – Research

- Disdrometer 11.5 km from radar used for calibration and $Z-R$ optimization
- Significant improvements to NSSL and ESRL research radars *and* NEXRAD with vertical profile of reflectivity (VPR) correction and $Z-R$ optimization*
- Best statistical performance in QPE was from KDAX (150 km away!) with simple adjustments → **simple technology transfer to operations**



* Gourley, J.J., D.P. Jorgensen, S.Y. Matrosov, and Z.L. Flamig, 2009: Evaluation of incremental improvements to quantitative precipitation estimates. Part I: Rain gauge evaluation. Submitted to *J. Hydrometeor.*

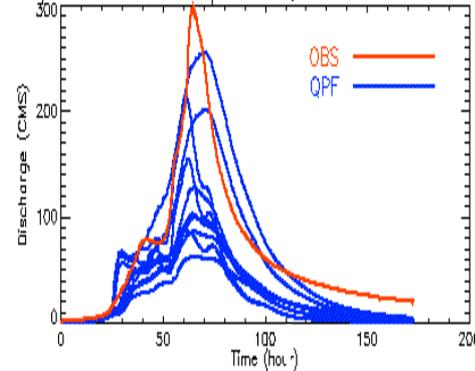
American River Basin – Research

Evaluate hydrologic sensitivity to improving accuracy of model inputs*

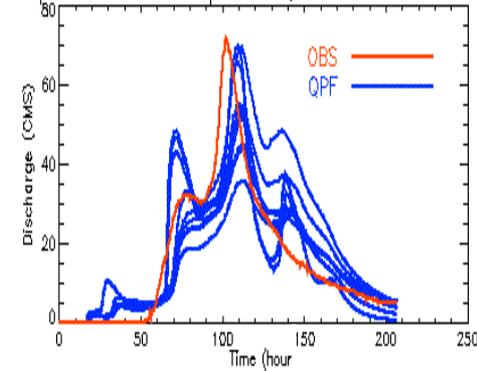
- TREX used for event-based simulation
- Continuous simulation now possible with HL-RDHM

Input high-resolution QPFs into models and evaluate sensitivity/performance (in collaboration with ESRL/GSD)

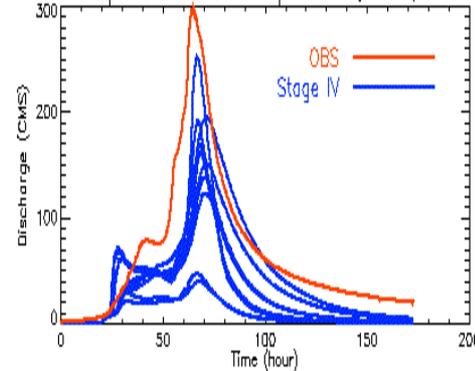
iop5h2007 with different parameters, 0–6 h ensemble mean QPF



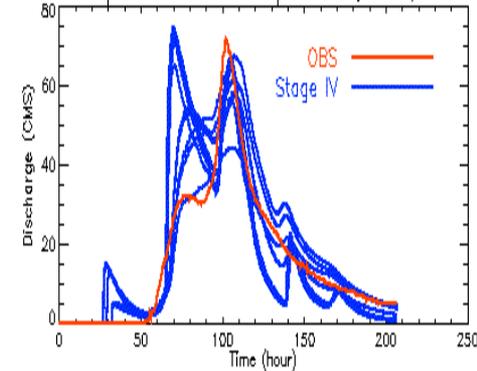
iop7h2007 with different parameters, 0–6 h ensemble mean QPF



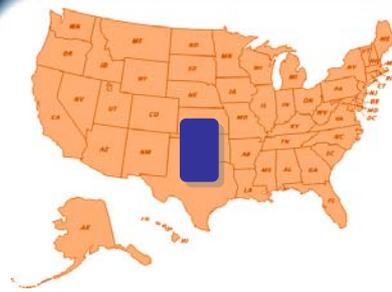
iop5h2007 with different parameters, 6–h QPE



iop7h2007 with different parameters, 6–h QPE



*Gourley, J.J. and B.E. Vieux, 2005: Evaluating the accuracy of quantitative precipitation estimates from a hydrologic modeling perspective. *J. Hydrometeorol.*, 2, 115-133.



Ft. Cobb Basin - Motivation

- ✦ Will radar polarimetry improve QPE? If so, will more accurate hydrologic simulations for flash flood prediction result?
- ✦ Testbed identified due to its close proximity to KOUN (local NWS radar) and collocation of 15 Micronet stations and 3 USGS streamflow stations
 - ✦ KOUN is unique prototype for NEXRAD polarimetric upgrade
- ✦ Products and services will be fundamental QPE research and small-scale hydrologic sensitivity studies
- ✦ Status: 10 hydrologic events archived, including TS Erin; 4 different hydrologic models setup on basin

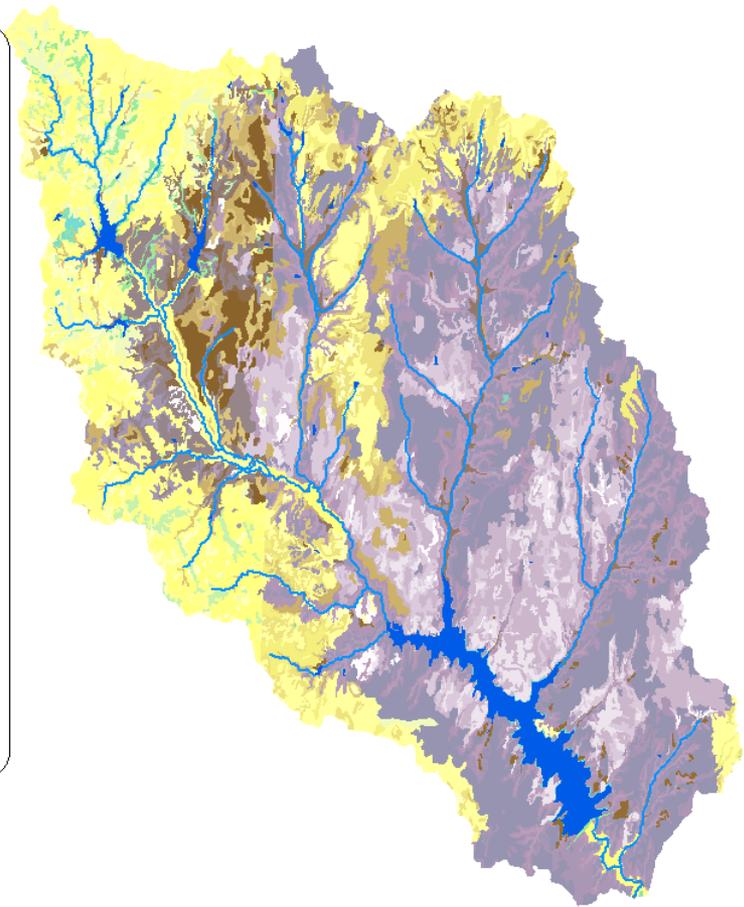
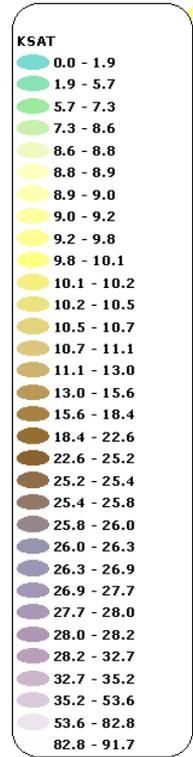
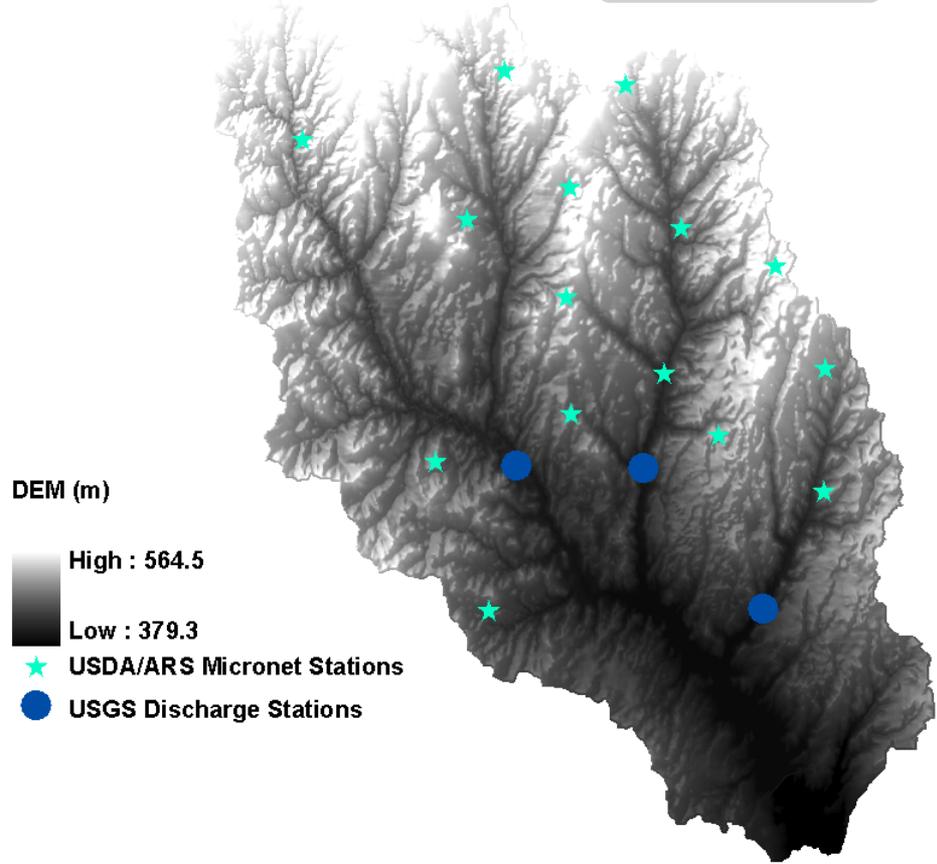
The Basin



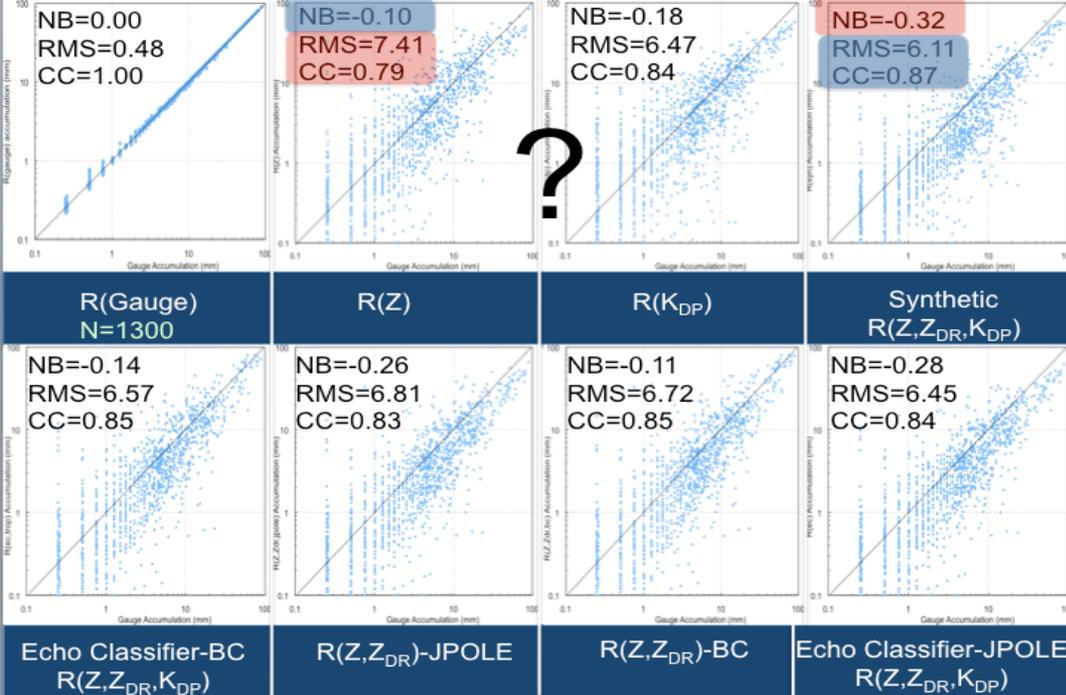
15 Micronet stations
3 USGS discharge stations

Detailed soil survey (SSURGO)

Subbasin areas = 342, 154, 75 km²



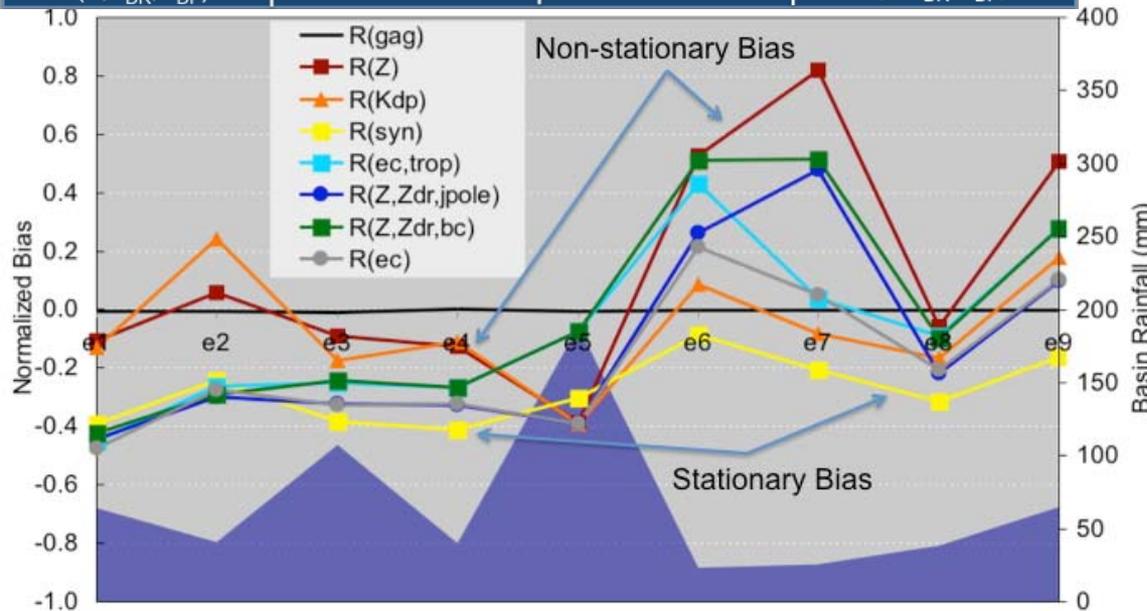
Ft. Cobb Basin – Research

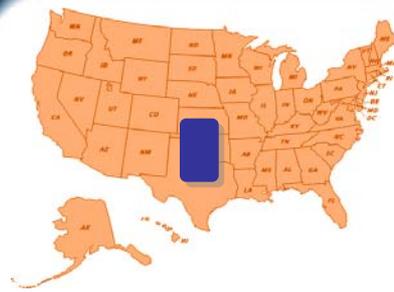


✦ Rain gauge analysis shows synthetic algorithm, $R(Z, Z_{DR}, K_{DP})$, is more precise than $R(Z)$, but slightly less accurate

✦ Bias in synthetic algorithm, however, shown to be consistent from event-to-event (which one is preferable?)

✦ Next step is to evaluate model inputs using a suite of hydrologic models



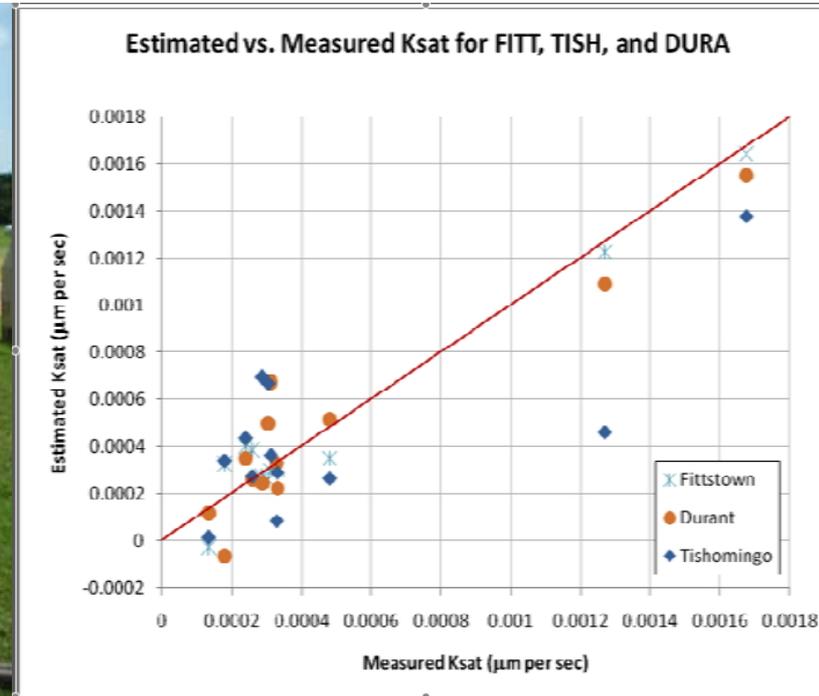


Blue River Basin - Motivation

- ✧ The Blue River Basin is a test site for NWS/OHD's Distributed Model Intercomparison Project
- ✧ Discrepancies between modeled and observed streamflow noted for several models being evaluated*
 - ✧ Bias in precipitation data?
 - ✧ Karst geologic formation (conduits between river and aquifer)?
 - ✧ Variable soil infiltration rates due to clayey soils shrinking/cracking?
- ✧ A double-ring infiltrometer has been purchased and used in field since June 2008 to measure saturated hydraulic conductivity on Blue
- ✧ Collaborators are Y. Hong (OU) and several graduate students

*Gourley, J.J., and B.E. Vieux, 2006: A method for identifying sources of model uncertainty in rainfall-runoff simulations. *J. Hydrology*, **327**, 68-80.

Blue River Basin – Research

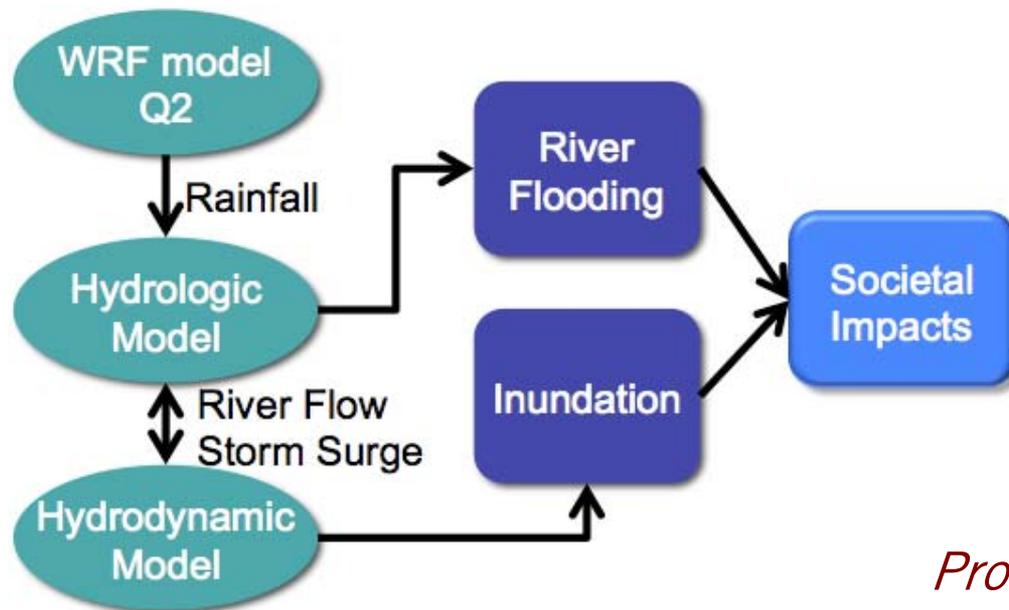


- “Soil macroporosity hypothesis”, causing infiltration rates to increase > order of magnitude, addressed with double-ring infiltrometer measurements

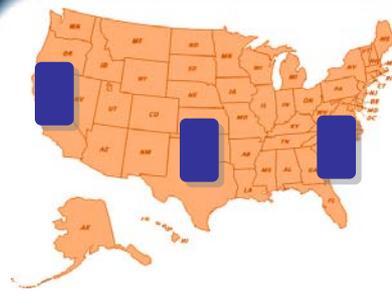


Tar/Neuse River Basin – Research

- Coupled, end-to-end coastal inundation prediction system for emergency management and **community planning**



Prototype of system will be running in real-time for 2009 hurricane season



Summary

- ✦ NOAA Hydrometeorological Testbed - American River Basin, CA
 - ✦ Z-R optimization and vertical profile of reflectivity adjustments most important
 - ✦ Results directly applicable to operational, NEXRAD radar
- ✦ Local Testbeds – Ft. Cobb and Blue River Basin, OK
 - ✦ Test gauge-based, conventional, and polarimetric QPE inputs using a suite of calibrated hydrologic models with different complexity
 - ✦ What will dual-polarization QPE do for hydro community?
 - ✦ Variability of soil infiltration rates being quantified
- ✦ CI-FLOW Project – Tar/Neuse River Basins, NC
 - ✦ Demonstration of inundation prediction system in summer of 2009