

NSSL Hydro-Meteorology Research

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Hydrometeorology





Outline

- Brief History – How we got here
- Overviews – National QPE Mosaic Project, Collaborations in HMT, Debris Flow Projects, Use of Hydro Models
- Relevance* – NOAA 20-Year Vision, OAR 5-Year Research Plan documents
- Quality* – Presentations, Papers (>20), Awards
- Performance* – Tech Transfer to NWS, Continued Grant Awards (2008: \$949k) ~64% of group budget

Who We Are



NSSL HydroMet Research Group (left to right)

- ✦ Youcun Qi, Dr. Ming Fang, Dr. J. J. Gourley (Fed), Dr. Jian Zhang (Fed), Mr. Kyle Pickens, Ms. Carrie Langston (CIMMS), Mr. Ken Howard (Fed), Ms. Ami Arthur (CIMMS), Mr. Steve Vasiloff (Fed), Dr. David Jorgensen (Fed), Dr. Suzanne VanCooten (Sea Grant).

5 Ph.D, 4 Federal Employees

Guidance Documents

NOAA 5-Year Research Plan

in the future, NOAA can not only reduce the costs associated with weather disasters, but also increase economic and human benefits, particularly through increasing the forecast accuracy of precipitation and water availability.

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information that is effectively delivered in the future, NOAA can not only reduce the costs associated with weather disasters, but also increase economic and human benefits, particularly through increasing the forecast accuracy of precipitation and water availability.





Definitions

We'll try to avoid jargon and acronym use . . . But

- **QPE** – Quantitative Precipitation Estimation
- **Z-R** – Radar Reflectivity to Rainfall Relation . .
Usually an empirical relation of the form $Z=AR^b$

History

na MD 5 10 20 30 50 75 100 200 300 400 500 600 800 1000 mm

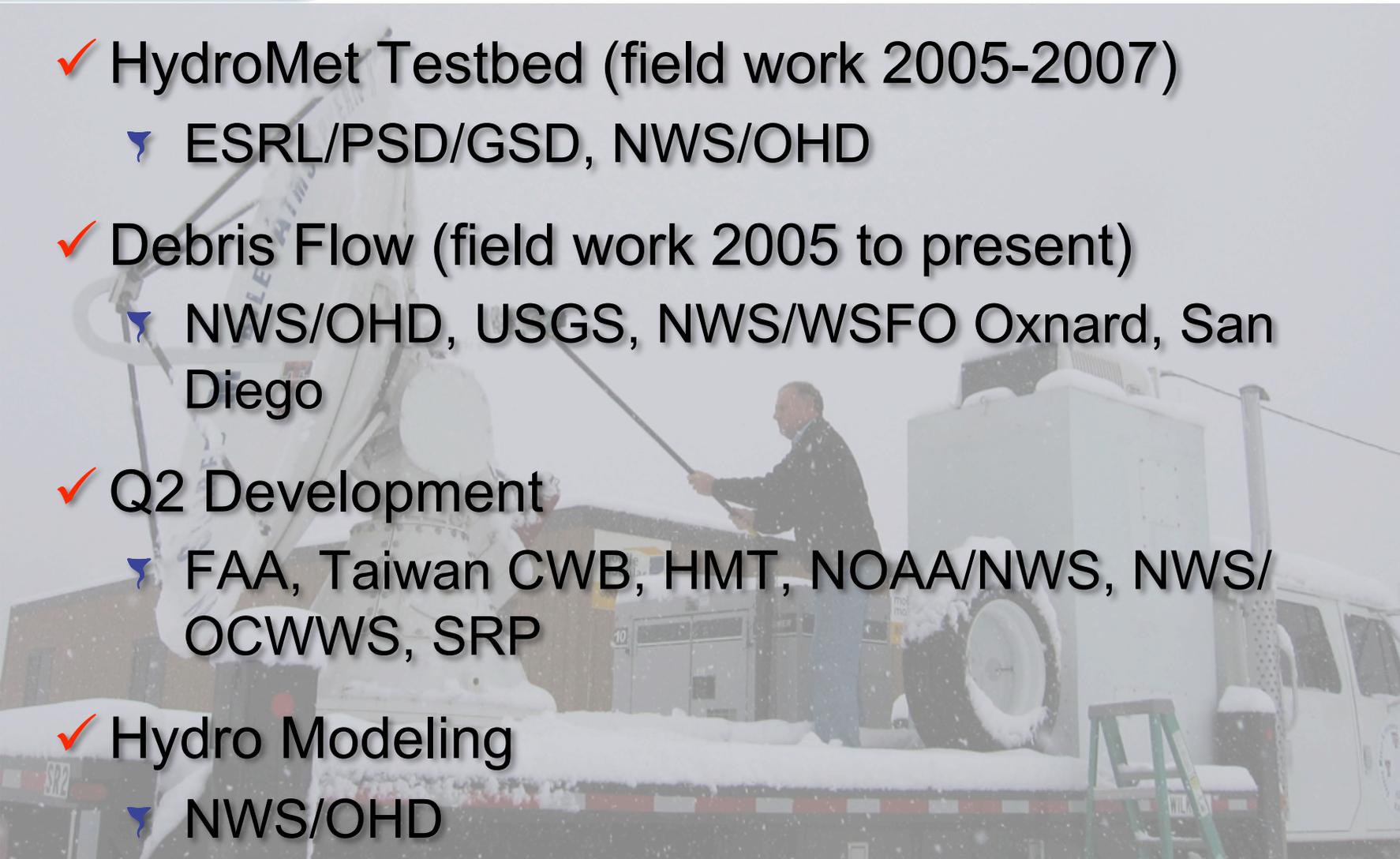
Outgrowth of NSSL's Historical Radar Expertise . .

- Salt River Project (1990s through present)
- Quantitative Precipitation Estimation through Segmentation Using Multiple Sensors (QPE-SUMS)
- Taiwan Support (2002 through present)
- National Radar Network over the Internet (CRAFT)
- National Radar Mosaic (FAA Support)
- National QPE (Q2) – Conus QPE every 5 minutes

q2rad_hsr 24h_rad_hsr 0000.0 [2007 09/01 12:00:00 UTC]

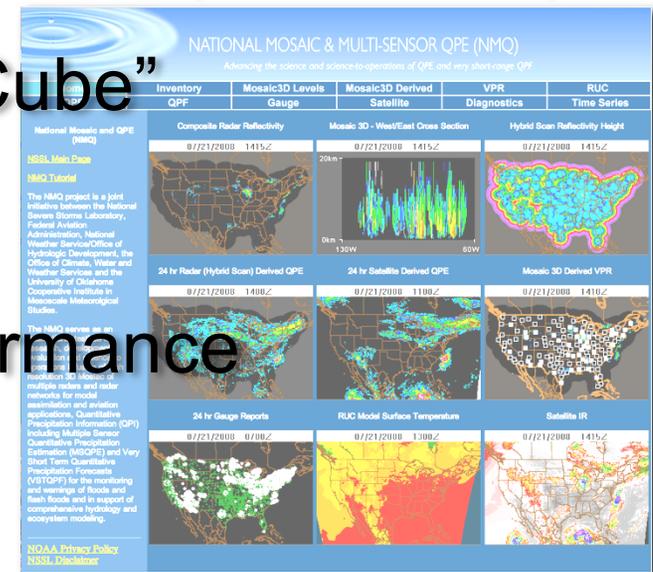


Recent Collaborations

- ✓ HydroMet Testbed (field work 2005-2007)
 - ✦ ESRL/PSD/GSD, NWS/OHD
 - ✓ Debris Flow (field work 2005 to present)
 - ✦ NWS/OHD, USGS, NWS/WSFO Oxnard, San Diego
 - ✓ Q2 Development
 - ✦ FAA, Taiwan CWB, HMT, NOAA/NWS, NWS/OCWWS, SRP
 - ✓ Hydro Modeling
 - ✦ NWS/OHD
- 

National Radar Mosaic & QPE (Q2)

- ✓ QPE Development & Evaluation Tool (<http://nmq.ou.edu/>)
- ✓ FAA development of “Weather Cube”
- ✓ RUC data assimilation
- ✓ Monitoring of 88D network performance



<http://nmq.ou.edu>

Zhang, J., K. Howard, and J.J. Gourley, 2005: Constructing Three-Dimensional Multiple-Radar Reflectivity Mosaics: Examples of Convective Storms and Stratiform Rain Echoes. *J. Atmos. Oceanic Technol.*, **22**, 30–42.

Langston, C., J. Zhang, and K. Howard, 2007: Four-Dimensional Dynamic Radar Mosaic. *J. Atmos. Oceanic Technol.*, **24**, 776–790.



HMT Collaboration

- ✦ QPE Improvements: Calibration with Disdrometer & Z-R Optimization
- ✦ Significant improvements with VPR correction and stitching with ESRL/PSD's polarized radar (Matrosov 2006)
- ✦ However, “best” QPE was from NWS Radar (150 km away!) with optimized Z-R equation and simple VPR adjustment

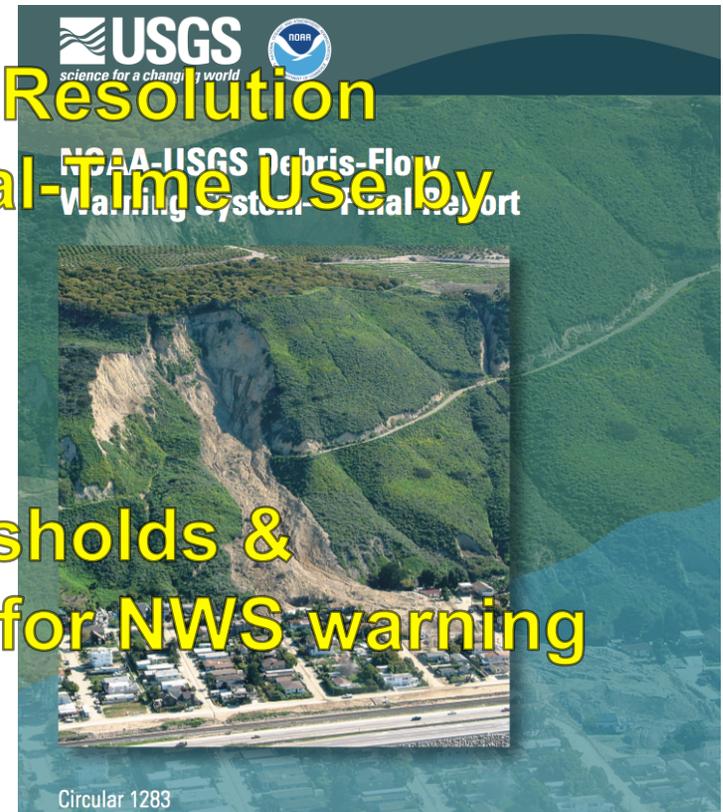
Gourley, J. J., D. P. Jorgensen, S. Y. Matrosov, and Z. L. Flamig, 2009: Evaluation of incremental improvements to quantitative precipitation estimates. Part I: Rain gauge evaluation. *J. Hydromet.*, (submitted)

Debris Flow Collaboration

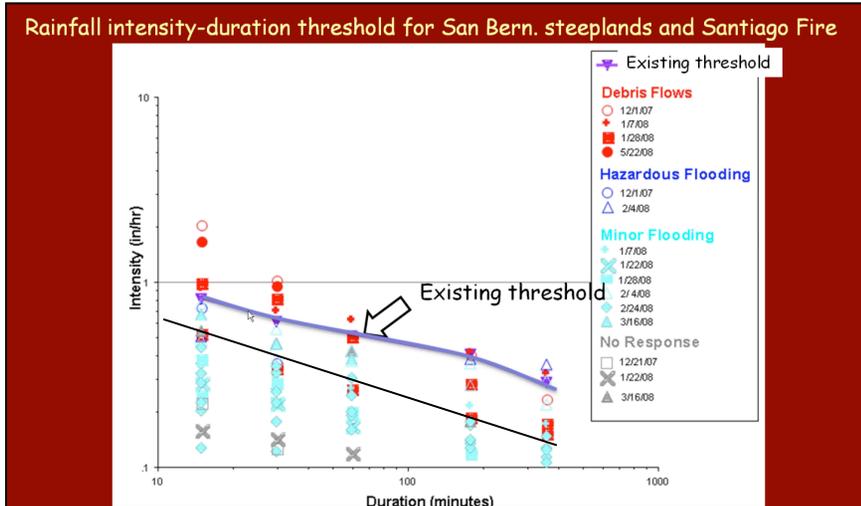
- ✓ Collaboration between NSSL, NWS/OHD, & USGS to implement prototype debris flow warning system in Southern California

- ✓ SMART-R Contribution: High Resolution Rainfall – For Research & Real-Time Use by NWS in Warning Decisions
- ✓ 4th field season
- ✓ Improvements to rainfall thresholds & construction of hazard maps for NWS warning operations

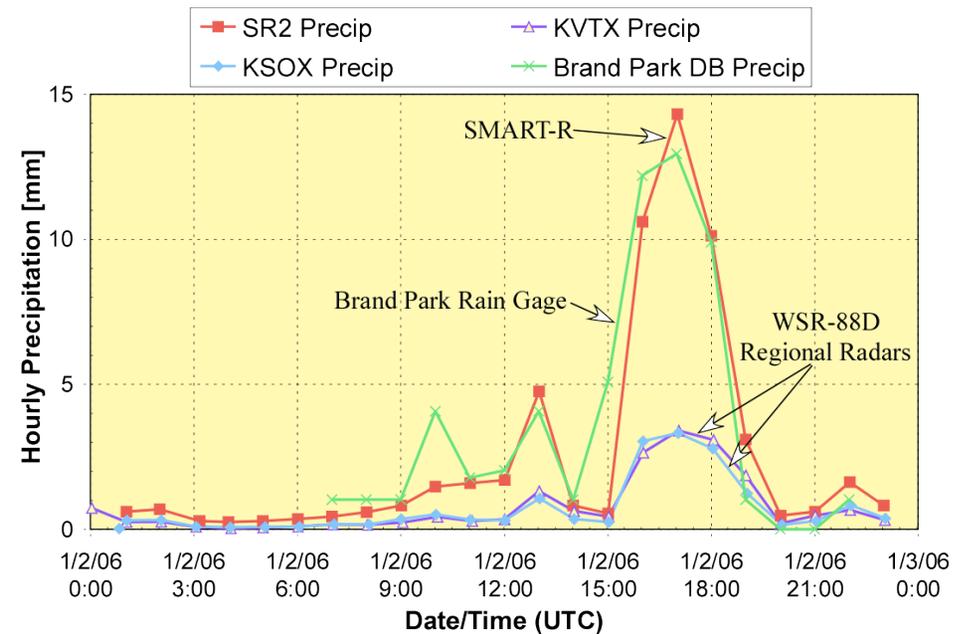
Devore, CA – Dec 2008 – Greenwood Ave



Debris Flow Collaboration



Intensity/Duration Thresholds



Restrepo, P., D. P. Jorgensen, S. H. Cannon, J. Costa, J. Laber, J. Major, B. Martner, J. Purpura, K. Werner, 2008: Joint NOAA/NWS/USGS Prototype Debris Flow Warning System for Recently Burned Areas in Southern California. *Bulletin of the American Meteorological Society*, **89**, 1845-1851, doi:10.1175/2008BAMS241.

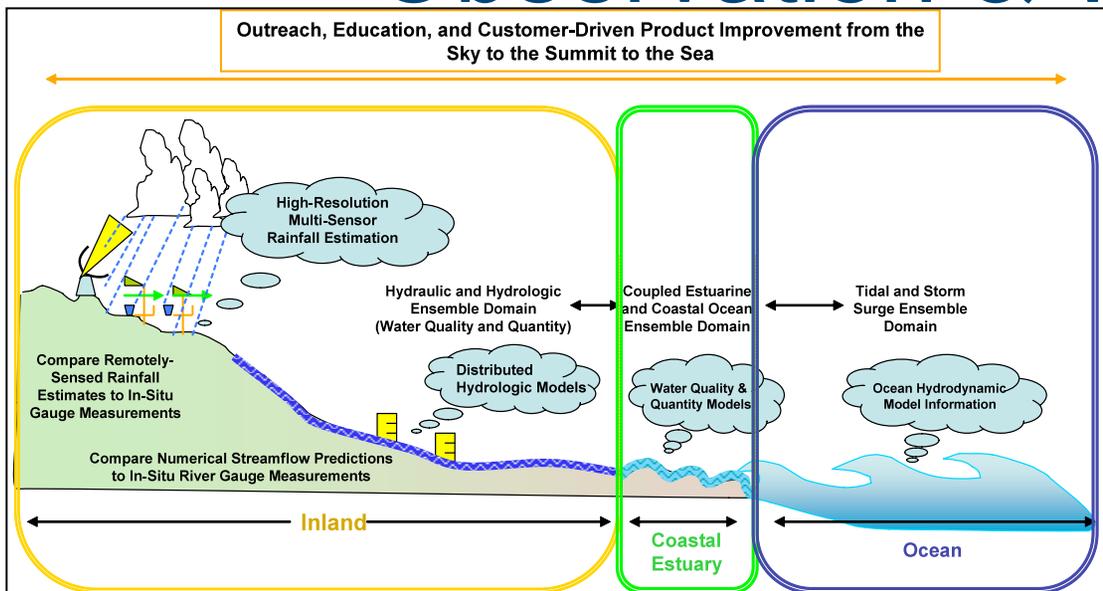


Exploring Hydro Modeling

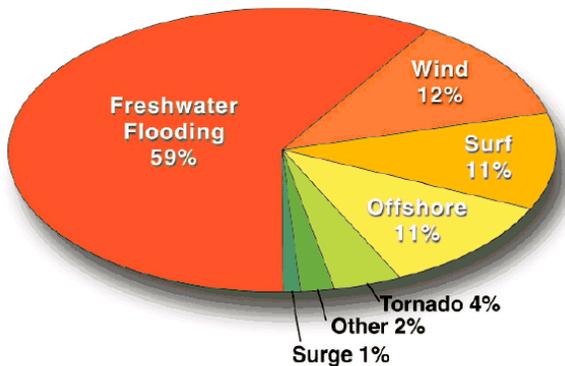
- ✓ Evaluate hydrologic sensitivity to improving accuracy of model inputs
 - ✦ TREX (open source distributed model from Colorado State Univ.) used for event-based simulation
 - ✦ Continuous simulation now possible with HL-RDHM (NWS/OHD new distributed model)



CI-FLOW – Coastal & Inland Flooding Observation & Warning



Leading Causes of Tropical Cyclone Deaths in the U.S 1970-1999



Source: Edward Rappaport—Chief, Technical Support Branch, Tropical Prediction Center



Today's Presentations



Howard – Challenges in Improving QPE for Improved Flash Flood Warning Guidance



Zhang – Q2 Description, Results & Plans



Gourley – Local Testbeds and Field Results



VanCooten – Project CI-FLOW (*Coastal, Inland FLOOD Observation and Warning*)



Jorgensen – Summary and Discussion