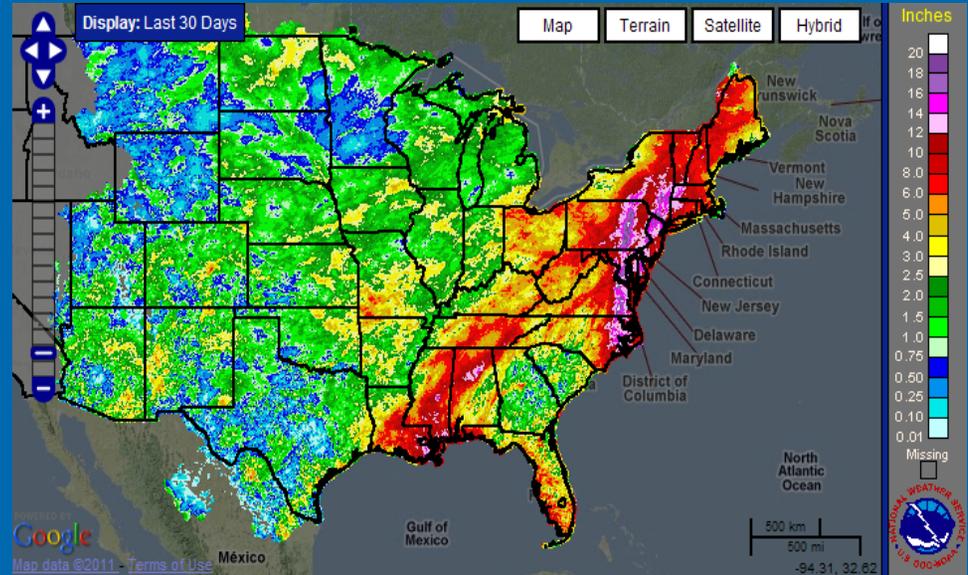
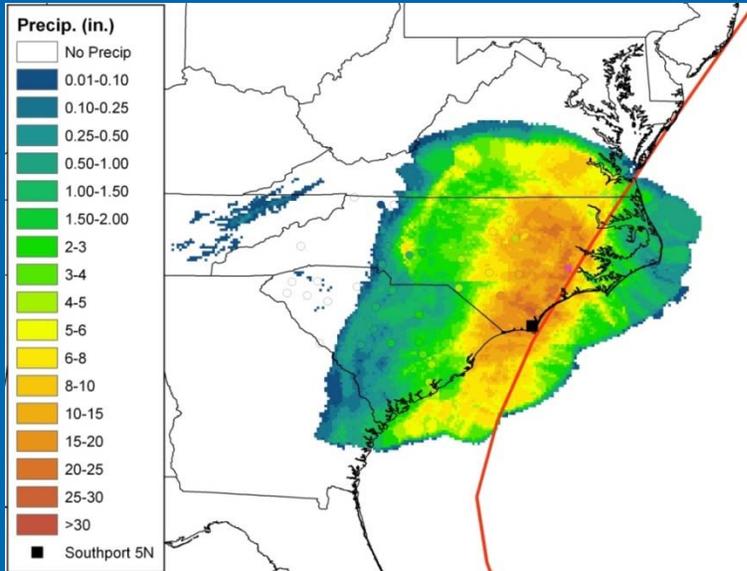


SOH - Extreme Storm Work Group Activities and Recommendations



SOH Meeting
April 19, 2012



Extreme Storm Events Work Group Tasks (2008 Charge Statement)

1. Solicit Work Group membership: Federal, state agencies, universities, professional organizations, consultants: expertise in hydrometeorology.
2. Literature review.
3. Long-term plan to update the extreme storm catalog and HMRs/PMP w/new technologies.
4. List of individual Federal agency needs.
5. Inform SOH/ACWI on Federal funding support.
6. Conference calls, workshops.

SOH - Extreme Storm Work Group

Initial Work Group Activities

- **Commence Pilot Extreme Storm Study in Southeast U.S.** for application to flood assessments of nuclear facilities
- **Discuss ways to update generalized HMRs and PMP estimates**
- **Compare recent storm data** and PMP estimates to published PMP estimates in HMR 51
- **Review and analyze Depth-Area-Duration (DAD) data sets** used to develop generalized PMP estimates
- **Upper Missouri Pilot storm data** by USACE for use in future storm transposition studies and HMR updates

Extreme Storm Events Work Group Task Status

1. Solicit Work Group membership
 - complete
2. Literature review.
 - complete; initial effort in Reclamation report to NRC
3. Long-term plan to update the extreme storm catalog and HMRs/PMP w/new technologies.
 - Incomplete.
4. List of individual Federal agency needs.
 - Incomplete. Individual agencies need to review with new activities and new objectives for flood assessments and risk
5. Inform SOH/ACWI on Federal funding support.
 - Ongoing. Critical need (described further below).
6. Conference calls, workshops.
 - Ongoing through individual members.

Extreme Storm Events Work Group Members

Lead Agency

- ??? (needs to be designated)

Agencies Providing Technical Contributions and Work

- US Army Corps of Engineers
- Bureau of Reclamation

Supporting Agencies

- NRC, FERC, TVA
- NRCS, USGS, FEMA, NWS

Major Efforts and Progress

1. Reclamation pilot study for NRC in NC/SC
 - complete
 - existing and new data catalogs; analysis
2. USACE Storm Data Collection, Data Base.
 - initial pilot database
 - ongoing data collection – ***see presentation from USACE***
 - related projects – PMP in Alaska
3. Reclamation Extreme Storm research and Climate Change
 - Initial efforts funded by Reclamation S&T
 - Collaboration with NOAA and CIRES
 - just beginning work

Reclamation NRC Key Findings

- Pilot project in NC/SC centering on MPR data
- New data analyses suggest ***HMR 51 PMP values too low*** for durations > 12 hrs and area sizes > 5,000 mi² along coastal Carolinas (Floyd and Fran)
- Other durations and area sizes unaffected in this location
- Storm maximized values somewhat sensitive to radar rainfall biases and use of maximized moisture
- Use of median moisture max ratio, Floyd still close to PMP

NRC SE Key Findings (continued)

- No significant trends found in SST and Td grids; suggests stationary series for maximization
- Potential for increased temporal clustering of TC events in August-September (1999, 2004, 2011)
- Longer-duration rainfalls (> 72 hr) and soil moisture for runoff may be changing factors
- PMP ratios to 1/1000 AEP 24hr rainfall range from 2 to 6x
- PMP 24hr, 10mi² return periods range from 10⁻⁵ to > 10⁻⁷
- Additional efforts needed to address orographics and piedmont

Discussion, Implications from Reclamation NRC SE Work

Risk perspective:

- NOAA 14 extrapolations suggests PMP point values may be exceeded at 10^{-5} along coast and less frequent inland
 - problems with use of different distributions in space and extrapolations, especially GLO in W SC
- Point frequency estimate confidence intervals need to be utilized (e.g. observed events)
- PMP amounts are ESTIMATES and can be exceeded
- Uncertainties of PMP estimates can be quantified for point values
- Further work needed for areal estimate uncertainties

Extreme Precipitation Estimates

- Two Categories for Hierarchical Hazard Assessment – NRC; Risk for USBR, USACE
- ***Deterministic, Upper Limit***
 - Probable Maximum Precipitation
 - Used as Design Maximum Precipitation in NuREG 1.59
- ***Probabilistic, Risk-Based Estimates***
 - Precipitation Frequency (NOAA 14)
 - Stochastic Storm Transposition with Depth-Area-Duration (D-A-D) Data: Yankee Atomic Energy, 1985; NRC, 1988
 - Detailed Regional Precipitation Frequency (LMoments)

Ongoing Activities and Challenges

1. Extreme Storm Data Base

- Development of a data base and portal will be the focus over the next year and subsequent years.
- Extreme storm data based on radars (over the past 10 years) will be gathered and analyzed
- We envision a national scale effort to do this.

2. PMP Updates

- HMR 51 might be the first HMR to be revised.
- User needs statements have been gathered.
- There are currently insufficient resources to complete a proposal.

3. Storm Probabilities

- The work group is continuing conversations on probabilistic extreme storm alternatives to PMP.

Major Issues

1. Designation of a Lead Agency for Data and Analysis Repository

- A lead agency is needed to coordinate the data collection and analysis effort, and serve as a repository.
- There are a big user and community needs on extreme storms - data and analyses.

2. Lack of Technical Resources, Organization and Community

- There is a shortage of technical resources performing this type of work, with extensive knowledge and expertise.
- Work is dispersed and highly-varied, depending on agency need

3. Funding and Centralization of Effort

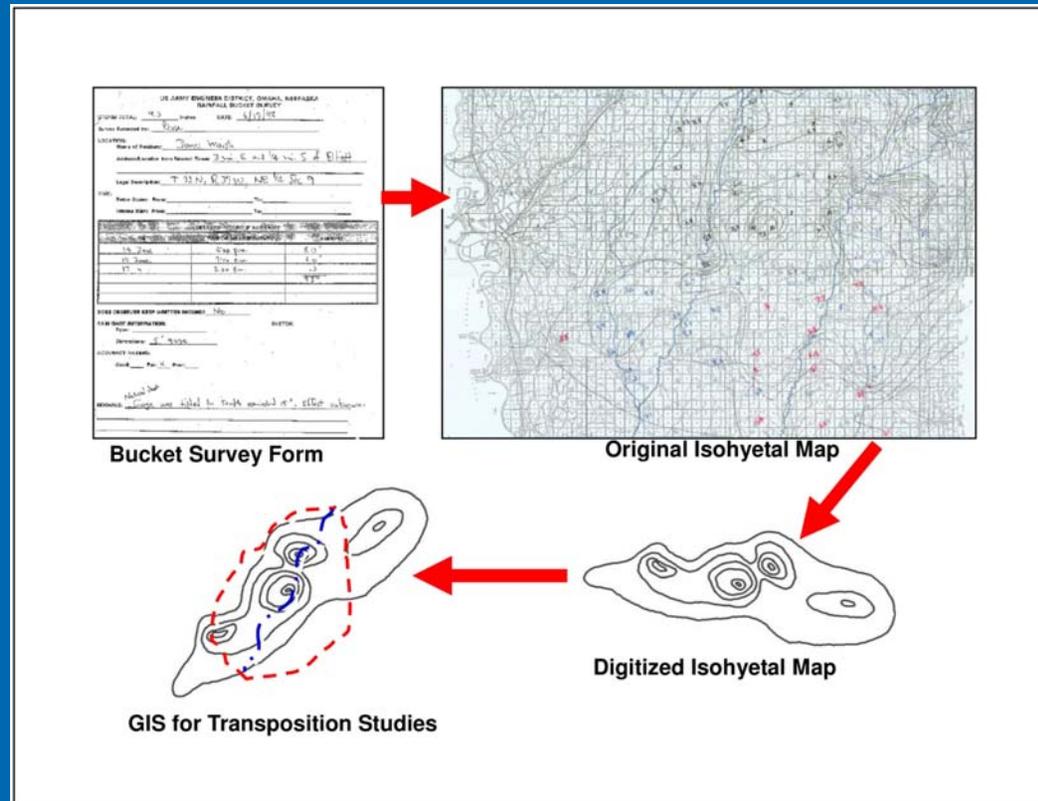
- Coordination of financial and technical resources remains a challenge.

SOH - Extreme Storm Work Group

Recommendations to ACWI

- ACWI Recommend to the Water Information Coordination Program (WICP)
 - **Support of the recommendations** designated
 - **Designation of a Lead Agency** to accomplish this work
 - **Identification / Designation of funding** to support these activities of **environmental and national security relevance & urgency**

USACE Data Archiving and Analysis System



refer to USACE Extreme Storm Team Slides on Current Activities

SE US Extreme Storm Catalog From Existing D-A-D Data for NRC

- Digital (GIS) HMR 51
- Storms analyzed and used in HMR 23, 33 and 51
- Focus on Critical and Controlling Storms in Southeast: ***74 storms***
- PAPER copies of data – scanned for major storms
- Electronic Catalog

HMR 51 PMP: New Digital Layers

All HMR 51
Maps (30):

Electronic

Images

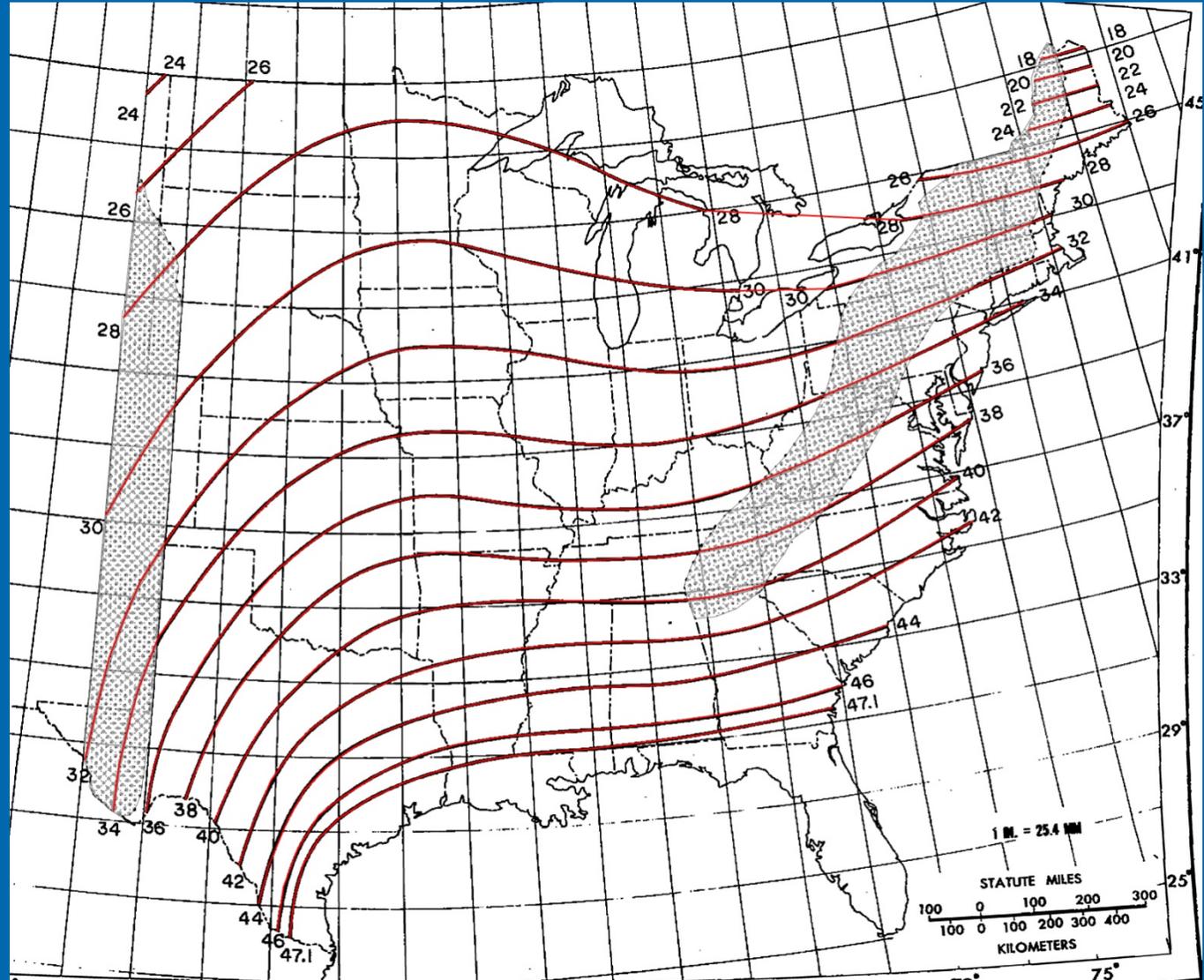
Grids

Shapefiles

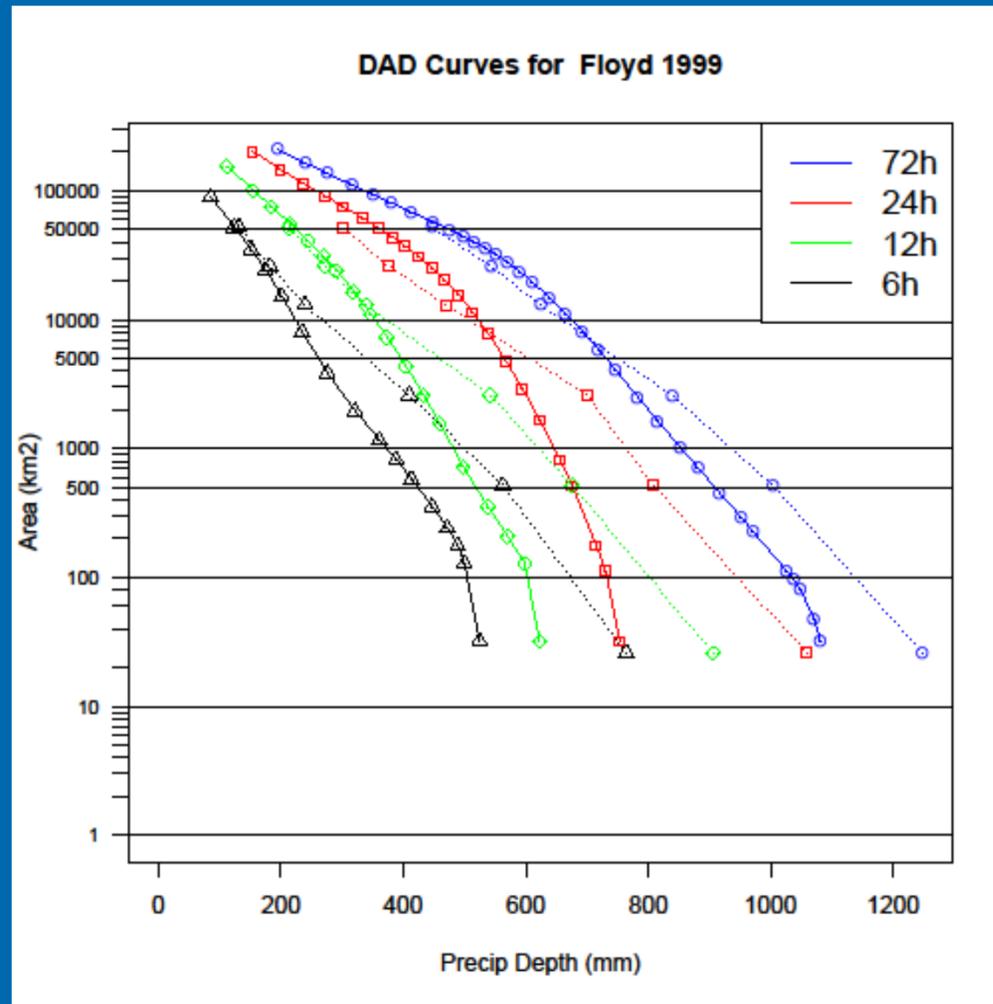
e.g.

24 hr, 10

mi²



Floyd – HMR 51



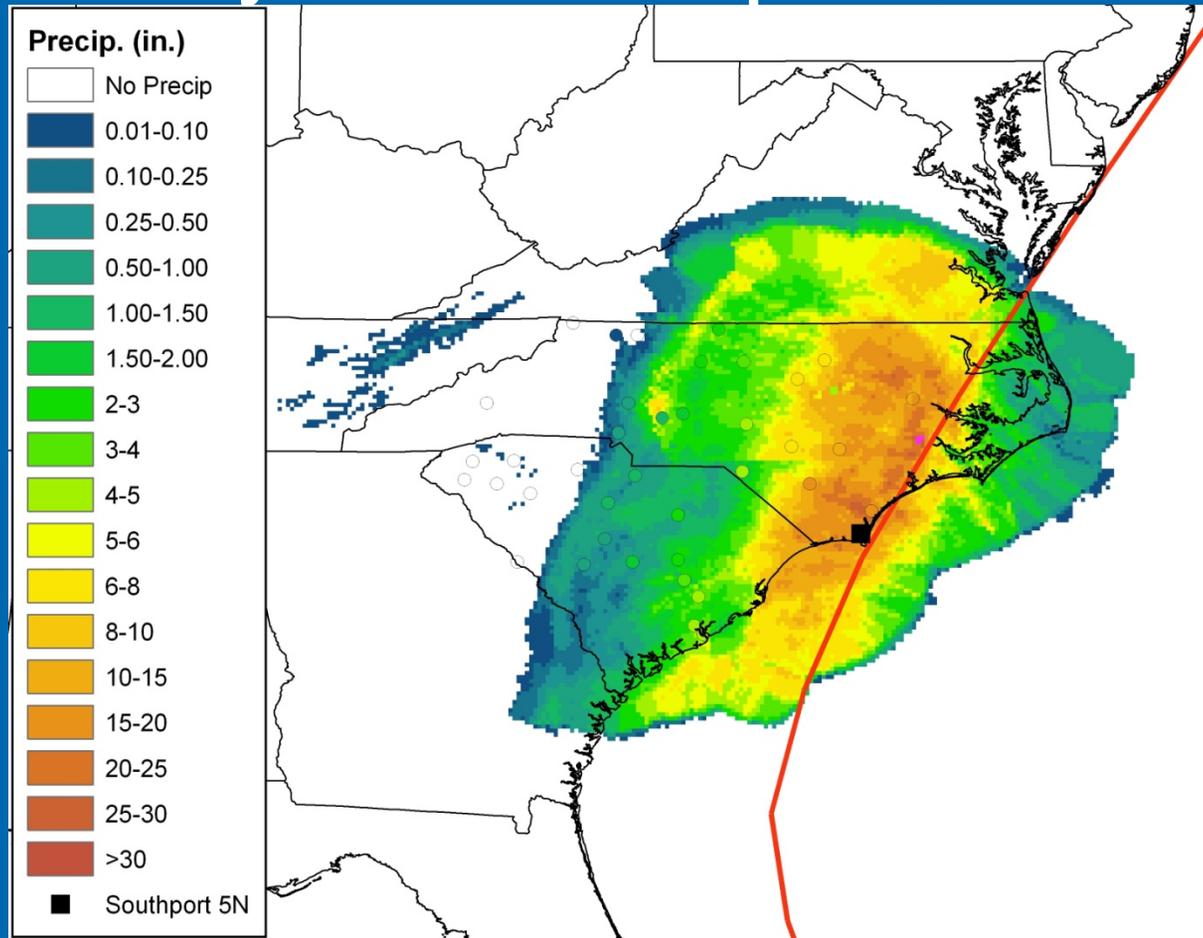
Comparison of DADx curves from MPR (solid) and HMR51 (dashed) for Floyd 1999. Exceedance of HMR51 PMP values are evident where solid lines cross dashed lines of the same color.

Floyd – HMR 51 24 hour and 72 hr

Floyd1999		24h			72h		
Area (km ²)	Area (mi ²)	HMR51	MPR	% diff	HMR51	MPR	% diff
25.9	10	1084.59	755.40	-43.58	1279.64	1085.44	-17.89
51.8	20	840.78	675.41	-24.48	1046.30	906.62	-15.40
2589.99	1000	731.55	601.39	-21.64	873.40	779.99	-11.98
12949.94	5000	485.41	504.01	3.69	651.87	650.61	-0.19
25899.88	10000	388.75	443.13	12.27	567.97	578.20	1.77
51799.76	20000	309.86	357.37	13.29	462.52	467.33	1.03

Comparison of PMP values from HMR51 grids and 24-hour and 72-hour DADx from MPR for Floyd 1999.

Floyd – Southport, NC



Storm total precipitation for Hurricane Floyd with best storm track from NOAA shown in red. Hourly precipitation gauge accumulations are overlaid to indicate differences between gauge and radar estimates. The location of the maximum point rainfall at Southport 5N along the southeast coast of North Carolina is shown as a black square