Workshop on Probabilistic Flood Hazard Assessment

Panel 3: Extreme Precipitation Events

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Panel 3 Observations, Insights and Opportunities

1. Opportunities in Extreme Rainfall Observations/Databases
   - Point rainfall data
   - Radar data – significant use; better spatial and temporal correlations
   - need extreme storm catalog

2. Advances in statistics and data processing methods
   - regionalization techniques
   - storm spatial and temporal patterns
   - mapping larger regions, accounting for seasonal variability
   - uncertainty estimates

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Panel 3 Observations, Insights and Opportunities

3. Physical and Numerical Modeling
   - radar and better resolution models provide better results
   - use models for hypothesis testing
   - evaluate past events (September 1970; May 2010 Nashville)
   - lack of funding restricts research

4. Technical and Other Barriers
   - technical complexities (watershed size, different storm mechanisms…)
   - computing resources
   - skilled personnel
   - funding

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Panel 3 Opportunities and Next Steps

1. Opportunities in Extreme Rainfall Observations/Databases
   - Point rainfall data
   - Radar data – significant use; better spatial and temporal correlations
   - need extreme storm catalog

2. Advances in statistics and data processing methods
   - regionalization techniques

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Panel 3 Questions for Discussion

1. **Describe the advancements and improvements in extreme storm rainfall and precipitation observations and data bases over the past 30 years. Are there opportunities with radar, point observations, reanalysis data sets, and other data that can readily be utilized for extreme precipitation analyses, understanding, and applications for critical infrastructure?**

2. **Outline the advances in statistical and data processing methods that can be used for extreme precipitation frequency estimation. These might include regional precipitation frequency, regionalization of parameters, Geographic Information Systems, climatological estimation (such as PRISM), and other areas. How might these tools be applied in practice, and include uncertainty estimates?**

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Panel 3 Questions for Discussion

3. **Describe the advances in physical and numerical modeling of extreme precipitation (such as the Weather Research and Forecasting Model, WRF) that can give insights into the processes and magnitudes of extreme precipitation, including spatial and temporal distributions. How can these tools be applied to provide practical limits to extreme precipitation magnitudes, spatial and temporal storm patterns, transposition, and other extreme storm scaling?**

4. **The National Research Council (1994) report on extreme precipitation suggested research in several areas, including: radar hydrometeorology and storm catalog, numerical modeling of extreme storms in mountainous regions, and estimating probabilities of extreme storm rainfalls. Are there existing technical barriers to fully probabilistic extreme storm estimation for assessing critical infrastructure, as opposed to Probable Maximum Precipitation?**

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Summary of

Panel Discussions

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Question 1

- **Are there opportunities with advances and improvements in extreme rainfall and precipitation observations and data bases over the past 30 years that can be used for extreme precipitation analyses and their applications for critical infrastructure?**
  - Point rainfall data
    - 30 additional years of data are useful
  - Radar data: capabilities and limitations
    - Better spatial and temporal correlations
    - Are intense events underestimated?
    - Is the useful range of data overestimated?

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Question 2

- **How might advances in statistical and data processing methods be used for extreme precipitation frequency estimates, including evaluating uncertainty?**
  - Fitting generalized extreme value (GEV) distribution to bound shape parameters
  - Changes in regional analyses
    - Mapping a large heterogeneous region into multiple homogeneous regions
    - Account for seasonal variability
  - Confidence intervals (CI) indicate statistical level of confidence
    - Can CI be used to address uncertainties?

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Question 3

- **How can advances in physical and numerical modeling be applied to provide practical limits to extreme storm scaling?**
  - Radar and better resolution models provide better results
    - Storm transposition
    - Test hypotheses
    - Evaluate historic events (May 2010 Nashville flood)
  - Shortage of funding
    - restricts research, improvement to models, and advances in techniques

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Question 4

- **Are there technical barriers to fully implementing probabilistic extreme storm estimation?**
  - Technical complexities
    - Watershed size and heterogeneity
    - Combining the effect of different type of storms
    - Combining storm rainfall with snow melt
  - Access to computing resources
  - Availability of skilled personnel
  - Funding

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Public Questions

- Numerical models (e.g., WRF) were not intended to analyze extreme rainfall events
  - Results of several case studies have been encouraging
- Radar data can be used successfully for evaluating extreme events with proper quality control and supplemental rain data
- How to ensure data independence when using rainfall data (collected in a homogeneous watershed) to define equivalent record lengths
  - Understand the watershed
  - Avoid oversampling by using a subset of the collected data
  - Sort extreme readings above a certain threshold by event date