EXTREME PRECIPITATION WEBINAR / WORKSHOP

Desired Outcomes

- Summarize the state of the science on extreme precipitation, historical trends, projections, and relationships to flooding.

  Pre-workshop webinars.

- Exchange ideas on using precipitation observations, projections, and associated flood modeling for decisions

  Case studies

- Understanding of what tools and resources are available for estimating extreme precipitation in the future and application in design and planning

  Tools sessions

- Hear from practitioners what is really needed to use and apply.

Preposterous* Precipitation – A Practitioner's Prerspective

Charles Hebson
MaineDOT / ENV

What is Needed for Design?

- Projected IDF, DDF curves & tables
  - Use same R/RO design tools
- Focus of ongoing NCHRP research
- Small urban and flashy watersheds likely most at need
  - Strongest relationship bet Rainfall & Runoff
- Larger watersheds?
  - R/RO relationship much more complicated

Wait a Minute!

Step back – take a deep breath

- Don't just automatically go to design with projections
- Time to look at uncertainty in current IDF / DDF
- Doesn't come naturally
  - *"Give me a number"*
- Need a design protocol to look at projections *and* existing uncertainty

Duration	Average recurrence interval (years)			
	10	25	50	100
5-min	**0.597** (0.451-0.785)	**0.716** (0.525-0.981)	**0.806** (0.581-1.13)	**0.900** (0.631-1.30)
10-min	**0.846** (0.638-1.11)	**1.01** (0.744-1.39)	**1.14** (0.822-1.60)	**1.27** (0.894-1.85)
15-min	**0.995** (0.751-1.31)	**1.19** (0.876-1.64)	**1.34** (0.968-1.88)	**1.50** (1.05-2.17)
30-min	**1.36** (1.02-1.78)	**1.63** (1.19-2.23)	**1.83** (1.32-2.56)	**2.05** (1.44-2.96)
60-min	**1.72** (1.29-2.25)	**2.06** (1.51-2.82)	**2.32** (1.67-3.25)	**2.59** (1.82-3.76)
2-hr	**2.22** (1.69-2.91)	**2.70** (1.99-3.69)	**3.05** (2.21-4.26)	**3.42** (2.43-4.97)
3-hr	**2.58** (1.96-3.37)	**3.14** (2.33-4.29)	**3.55** (2.59-4.96)	**4.00** (2.85-5.81)
6-hr	**3.31** (2.53-4.30)	**4.03** (3.00-5.48)	**4.56** (3.34-6.34)	**5.14** (3.68-7.43)
12-hr	**4.17** (3.21-5.39)	**5.07** (3.79-6.84)	**5.73** (4.21-7.91)	**6.44** (4.63-9.25)
24-hr	**5.02** (3.88-6.46)	**6.11** (4.60-8.22)	**6.92** (5.11-9.50)	**7.79** (5.62-11.1)

- We have time to reflect, ponder & act responsibly
- We are *not* facing a crisis when it comes to sizing structures for changing precipitation

Extreme precipitation webinar series

- Sep 10: regional extreme precip climatology and trends (Laurie Agel and Jonathan Winter)
- Sep 19: Projections of precipitation data

  (Matt Barlow and Art Degaetano)
- Oct 3: Distinguishing extreme precipitation and flooding (Glenn Hodgkins and David Vallee)

Recorded webinars available at: http://www.nrcc.cornell.edu/services/precip/precip.html

Extreme precip climatology and trends

- Peaks in spring and late summer/fall for coastal areas peaks in late summer for inland areas
- Most Northeast extreme precip extratropical storms, but inland to coastal differences
- Amount that falls on 99%-ile wet days has increased by 53% since 1996, relative to 1901-1995.
- Primary trend driver is tropical cyclones, likely attributable to warmer SSTs and enhanced water vapor in hurricane development areas.

Extreme precip projections

- Extreme precip very likely to be more intense and more frequent
- Understanding and projecting extremes is a rapidly-developing area
- Estimating current and future extreme precipitation probabilities requires numerous assumptions
- By 2050 the annual probability of the heaviest rainfall events will nearly double from that expected in 2008, making the old 100-year storm more like a 50-year storm

Distinguishing extreme precip and flooding

- Northeast flood peak increases over last 50 years < heavy precip increases
- Flood peaks are influenced by precip AND antecedent basin moisture, snowpack, urbanization and reservoirs
- Increased flood frequency especially in small watersheds and basins that have experienced substantial land use change

Discussion

- Trends observed by practitioners-- understand causative factors underlying the trends
- If tropical, what does it mean for flooding in NE? Antecedent conditions are ‘good’ in the fall
- A lot of practitioners on this one– usefulness of change in precip for design. Precip change can be very useful esp for small watersheds.

Discussion continued

- Duration and timescale– is there a timescale that could be more useful?

Tools 1: precip.net and Atlas 14

- Mix of groups using precip.net vs. Atlas 14
- Atlas 14 for NW soon based on pooled FHWA funds?
- NOAA has long range plans for incorporating projections no date or funds
- NRCC maintains precipchange.eas.cornell.edu living precip.net (updated each year)

Tools 2: Climate Explorer, Projected IDF curves DOT/FHWA tools

- State decisions as to what can be used
- Designing something for stormwater vs bridge will require different tools
- Guidance on models/how to use them
- Urban vs coastal settings (may reach tipping point where systems don’t work anymore)
- Redundancy, duplication of effort, funding models

Tools 3: National Water Model

- Full spectrum hydrologic model (not solely a drought or flood)
- 2.7 million river segments
- Short range, medium range (10-days), long range (30 days)
- Piloting inundation maps locations that will be covered by water. CONUS-wide inundation maps in the future
- Working on visualization services, key is to unlock information - make it accessible for information

Case Studies G-BRAG, Casco Bay/Portland,

Boston area

- GBRAG, rainfall important for highly urbanized area
- Talked w stakeholders-- community planners' concerns
- Issues-- flooding, stormwater, etc-- concerns, and relation to diff sectors (utilities, property, transport, etc.)

Casco Bay/Portland, ME (Argonne National Lab)

- IDF in the face of a changing climate
- Use GCMs, downscaling (WRF) and deliver to specific areas-- Casco Bay
- IDF curve development
- Incl snowmelt effect on IDF
- Incl future cli projections
- Incl non-stationarity frequency analysis

Case Studies Virginia Beach DPW, NYC

Virginia Beach DPW/Dewberry Project

- Risk-based approach to hazards, and addressing w policy and design to actions
- Looking at rainfall/surge correlation (how frequently the co-occur), trends
- Approach: used medium/high emission scenarios (ensemble approach, bias correction)
- Wanted defendable line of rationale MULTIPLE LINES OF EVIDENCE
- Talked w engineers, stormwater guidance-- 20% incr to existing IDF curves and Atlas-14

NYC Civil Engineering Design Firm

- Work in built environment, architects, engineers Resilience framework
- Projections not included in NYC building codes
- Using Atlas 14 and Precip.net
- Use precip data with site-specific design considerations for resilient design
- Trades offs between what is practical and what is not.
- Uncertainty question comes up frequently in discussions regarding resiliency

Happy Halloween