

# 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

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## 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>

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## 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](http://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 defensible 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



ANY QUESTIONS?

Happy Halloween