





Selected Slides

Geoff Bonnin
301-713-0640 x103 Geoffrey.Bonnin@noaa.gov
Office of Hydrologic Development
NOAA National Weather Service



Climatology Semantics

- “It is likely that the frequency of **heavy** precipitation events ... has increased over most areas.”
 - IPCC AR4, *Climate Change 2007: Synthesis Report*
- “Groisman et al. (2005) found significant increases in the frequency of **heavy** and **very heavy** (between the 95th and 99.7th percentile of daily precipitation events)”
 - IPCC AR4 Working Group I
- These and similar statements in the literature define terms such as
 - “**heavy**”, “**very heavy**”, or “**extreme**” precipitation
 - Sometimes differently!



For Example

- Groisman et al 2005
 - “... we define a daily precipitation event as **heavy** when it falls into the upper 10% and/or 5% of all precipitation events;
as **very heavy** when it falls into the upper 1% and/or 0.3% of precipitation events;
and **extreme** when it falls into the upper 0.1% of all precipitation events.”
 - “The return period for such events ... varies, for example, from 3 to 5 yr for ... **very heavy** precipitation events.”
- Generally consider just daily durations

Civil Engineering Semantics

- Use precipitation frequency estimates
 - average annual exceedance probabilities (AEP)
 - or
 - average recurrence intervals (ARI)
- Heavy, very heavy, and extreme rainfall:
 - generally subjective terms
 - but their meaning can be construed
- Use many durations; not just daily
 - NOAA Atlas 14 provides 5 min through 60 days

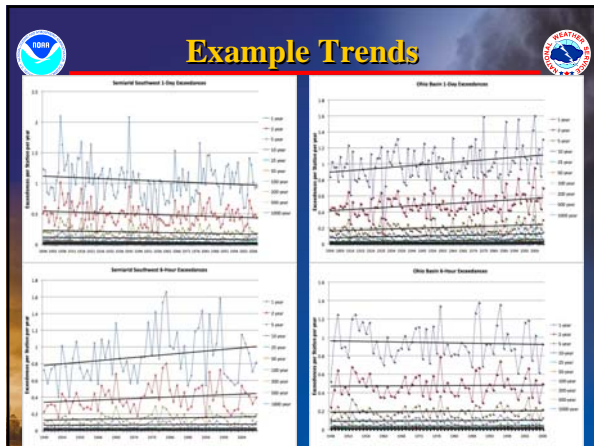
Example Civil Eng Design Criteria

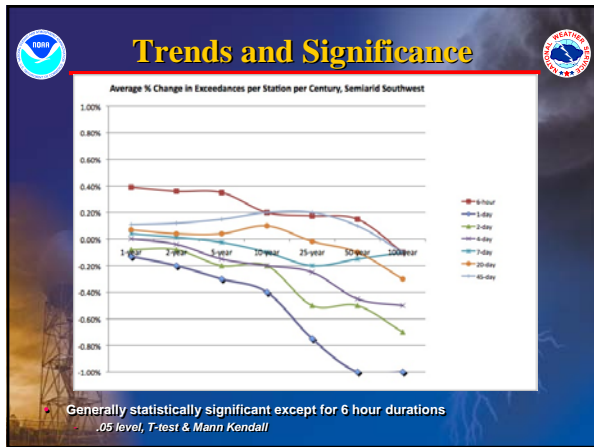
Type of structure	Return period (years)	ELV
Highway culverts	5-10	—
Low traffic	10-25	—
Intermediate traffic	50-100	—
High traffic	—	—
Highway bridges	—	—
Secondary system	10-50	—
Primary system	50-100	—
Pavement drainage	—	—
Culverts	5-50	—
Ditches	5-50	—
Urban drainage	—	—
Storm sewers in small cities	2-25	—
Storm sewers in large cities	25-50	—
Artifacts	—	—
Low traffic	5-10	—
Intermediate traffic	10-25	—
High traffic	50-100	—
Levees	—	—
On-levee	2-50	—
Off-levee	50-200	—
Dams with no likelihood of loss of life (low hazard)	—	—
Small dams	50-100	—
Intermediate dams	100+	—
Large dams	—	50-100%
Dams with probable loss of life (significant hazard)	—	—
Small dams	100+	50%
Intermediate dams	—	50-100%
Large dams	—	100%
Dams with high likelihood of considerable loss of life (high hazard)	—	—
Small dams	—	50-100%
Intermediate dams	—	100%
Large dams	—	100%

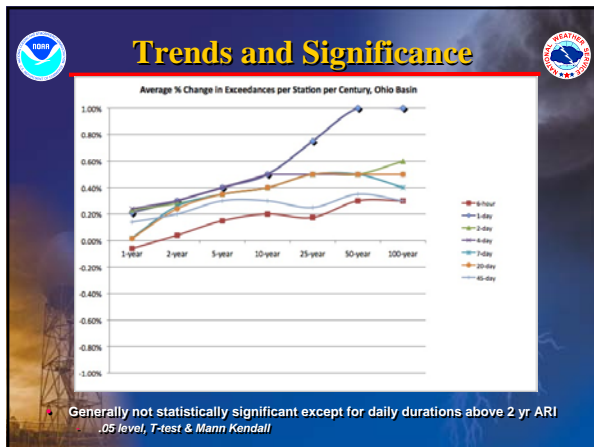
Source: Mays, Water Resources Handbook, McGraw-Hill, 1996.

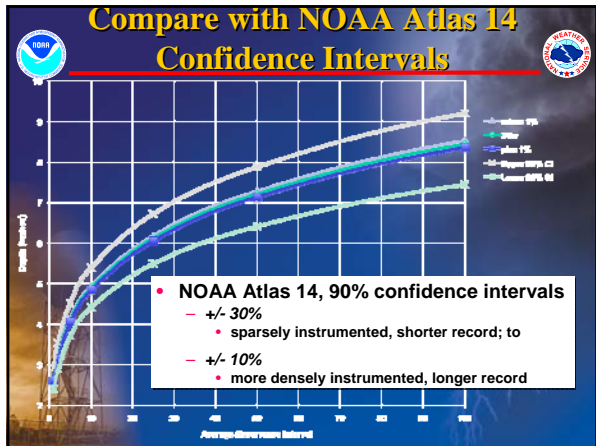
Let's Count Exceedances

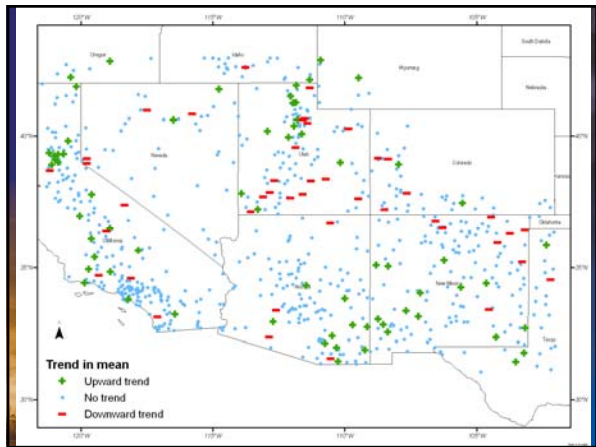
- **Thresholds**
 - Use actual NOAA Atlas 14 thresholds
 - Not a fixed value or a percentile of a time series
 - For:
 - 1 year – 1,000 year ARI
 - Durations: 6 hours – 45 days
- Use Partial Duration Series
 - Complies with ARI definition
- Count Number of Exceedances
 - For each station
 - Sum for each year over the all stations in the domain
 - Normalize for varying number of stations each year
- Linear regression for all ARI/durations
- Show slopes as % of expected mean

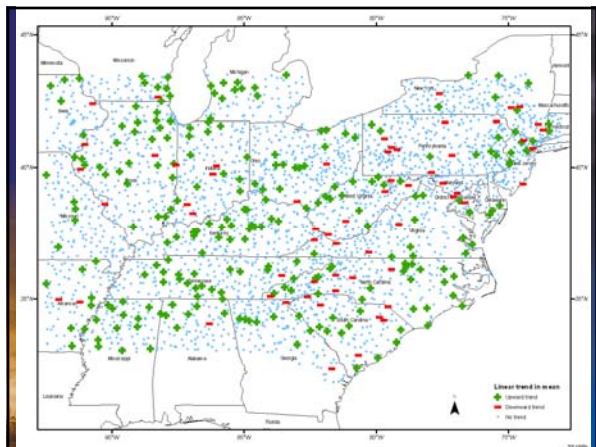
















Conclusions

- Climate community statements on trends in rainfall intensity
 - Do not address frequencies and durations required for civil infrastructure
- Climate community statements are being misinterpreted
- Historical trends in number of events
 - Are small compared to uncertainty of IFD values
- Need better guidance on potential impact of climate change on IFD curves
 - In range relevant to civil infrastructure

Questions

