



# Disaster Loss Normalization: Methods, Applications, Limitations

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## **The Study of Economic Loss from Natural Disasters**

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THE LONDON SCHOOL  
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# Outline – Five Questions

- What is “normalization”?
- What is “bias” in normalization?
- Why is it so difficult to identify signals of climate change in a normalization?
- What should we expect from normalization studies?
- What about future research and applications?

# Defining “normalization”

A normalization of disaster losses seeks to answer a deceptively simple question:

*What would a historical record of disaster losses look like if all disasters in the time series occurred under the societal conditions of a common base year?*

In other words, a normalization seeks to remove the integrated signal(s) of societal change from a time series of disaster losses.

# How might one evaluate a normalization?

Consider two normalizations of US hurricane losses . . .  
First, Nordhaus (2010)

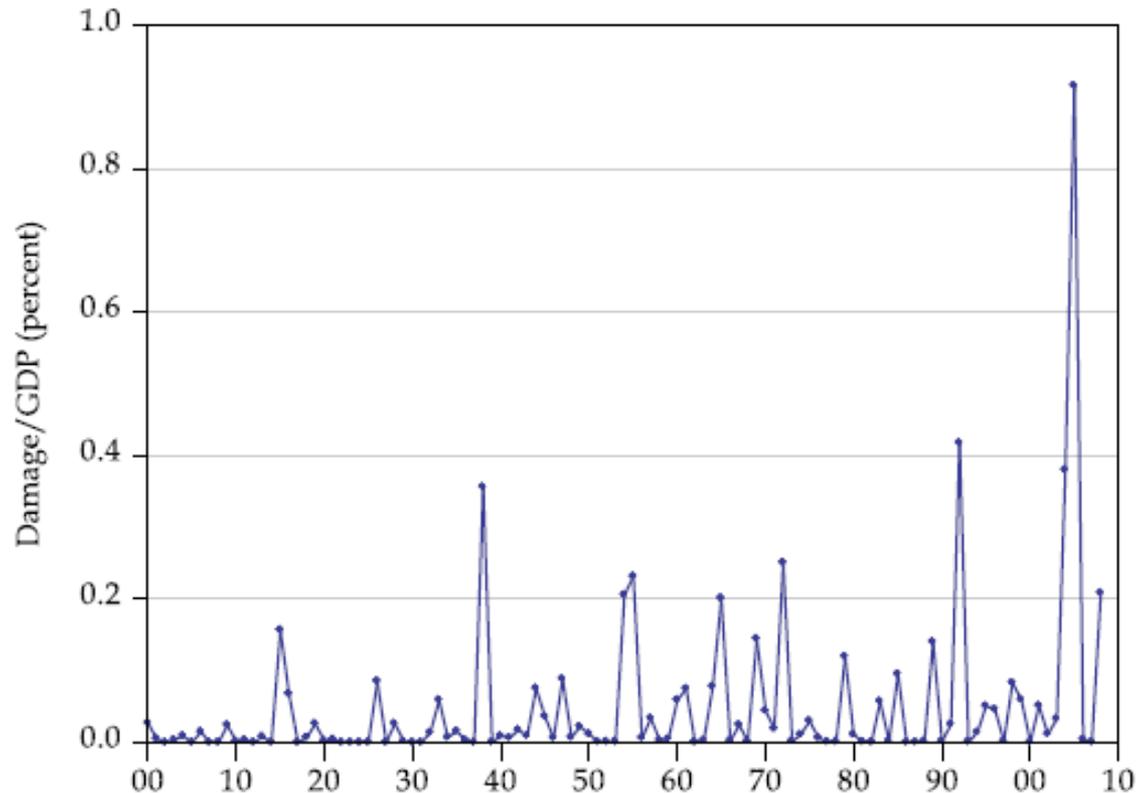


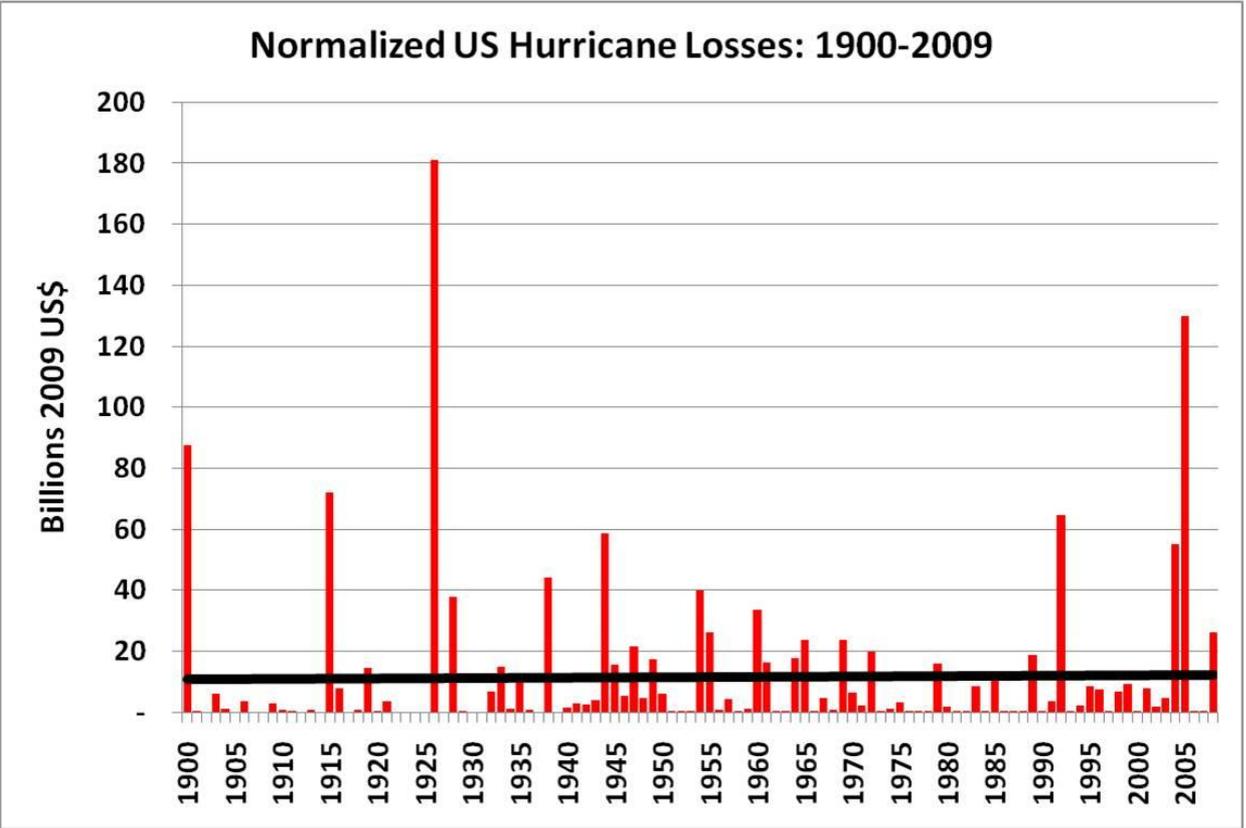
Figure 2. Normalized costs of hurricanes, 1900–2008

This figure shows the ratio of damages to GDP for all hurricanes for the given year.

*Source:* See text for discussion of damages. GDP from US Bureau of Economic Analysis.

# How might one evaluate a normalization?

Consider two normalizations of US hurricane losses . . .  
Second, Pielke et al. (2008)



# What would it mean to say that one normalization is "better" than another?

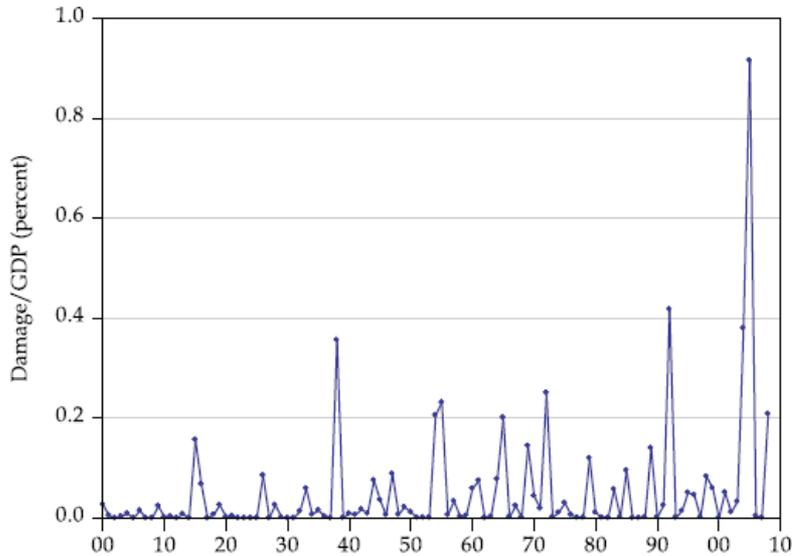
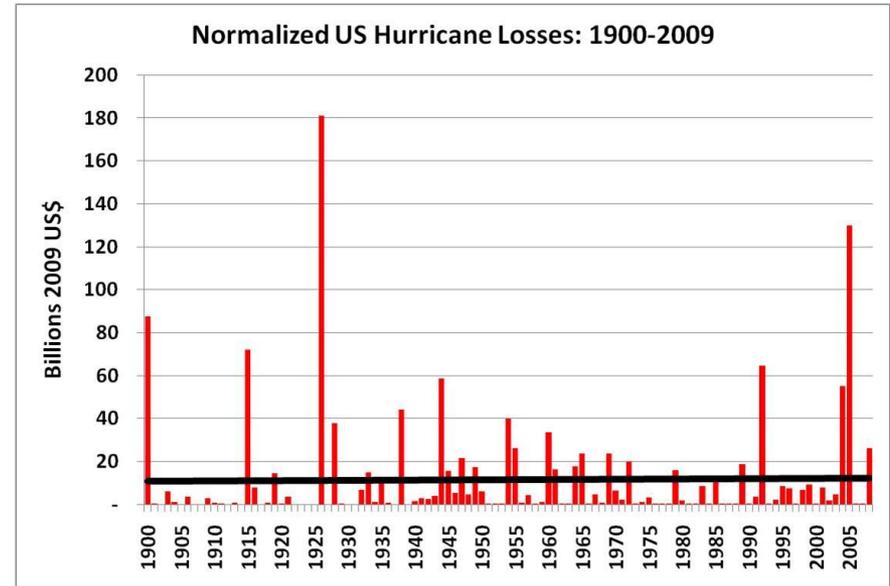
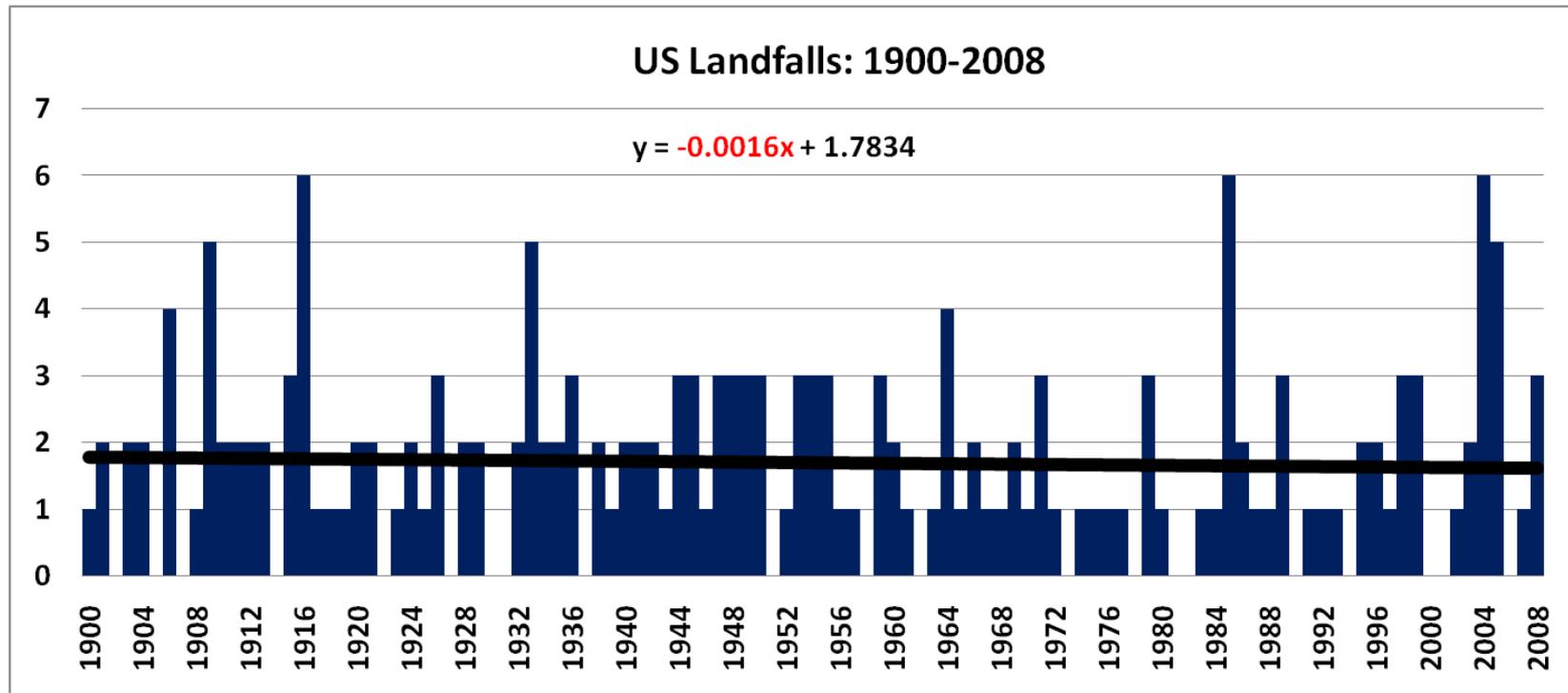


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The answer lies in recalling what a normalization seeks to do: specifically, to remove the integrated signal(s) of societal change, leaving behind a time series that reflects the signal of geophysical phenomena.

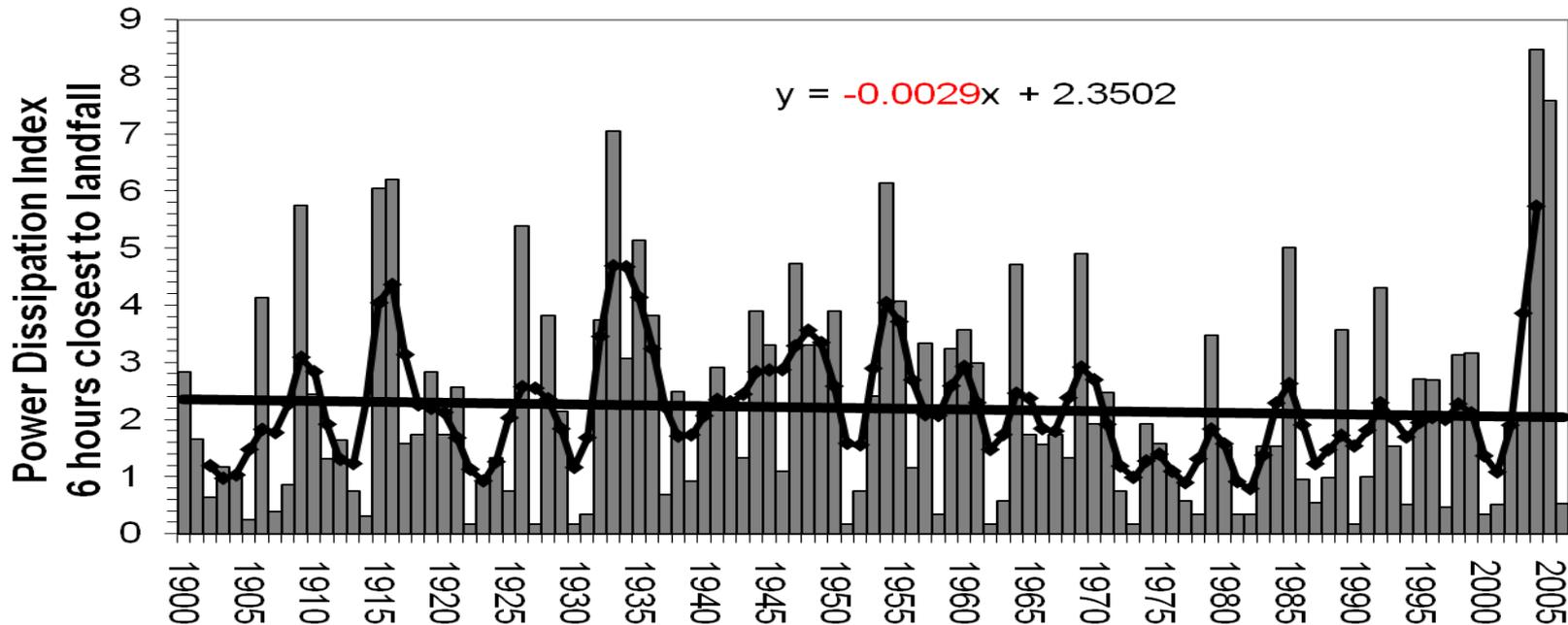
# For NATL tropical cyclones, data on hurricane landfalls can be used to evaluate a normalization of losses



From 1900 to 2008 there was no upwards trend in the number of US hurricane landfalls (but instead a very, very slight decrease)

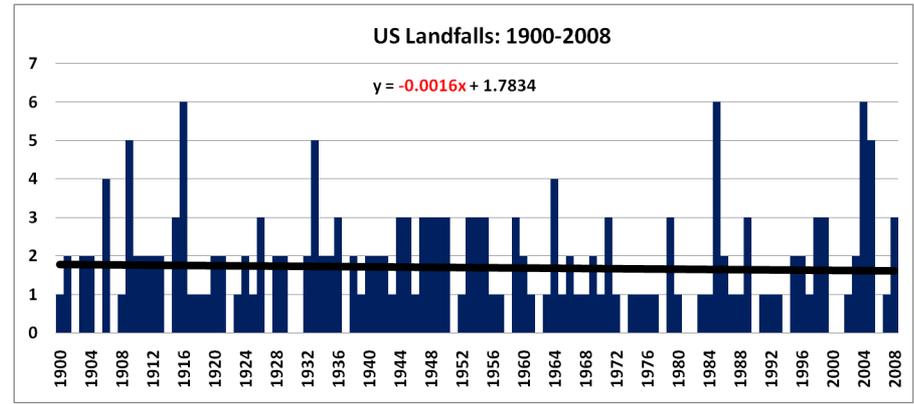
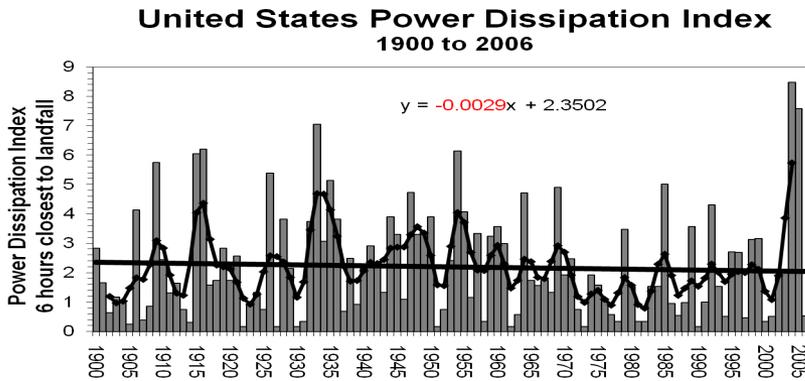
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## United States Power Dissipation Index 1900 to 2006



From 1900 to 2008 there was no upwards trend in the intensity of US hurricane landfalls (but instead a very, very slight decrease)

# For NATL hurricanes data on hurricane landfalls can be used to evaluate a normalization of losses



With no upwards trends in hurricane landfall frequency or intensity, there is simply no reason to expect to see an upwards trend in normalized losses

# What would it mean to say that one normalization is "better" than another?

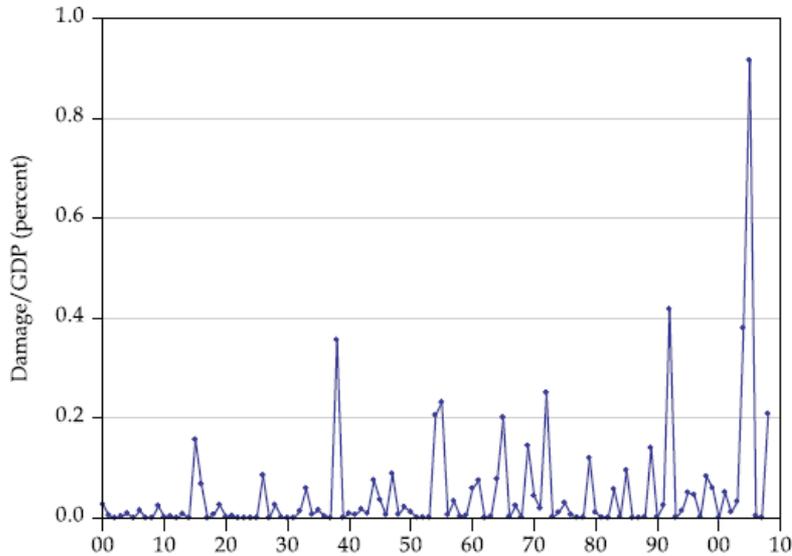
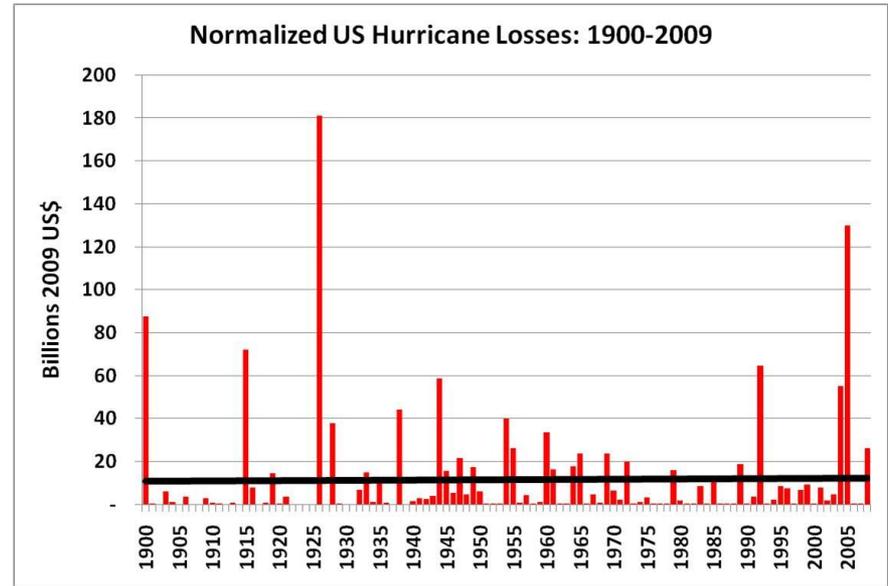


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Source: See text for discussion of damages. GDP from US Bureau of Economic Analysis.



The evidence suggests that Nordhaus (2010) is biased in the sense that, after normalization, a trend is evident that is at odds with the trends observed in the most directly relevant geophysical data.

# What would it mean to say that one normalization is "better" than another?

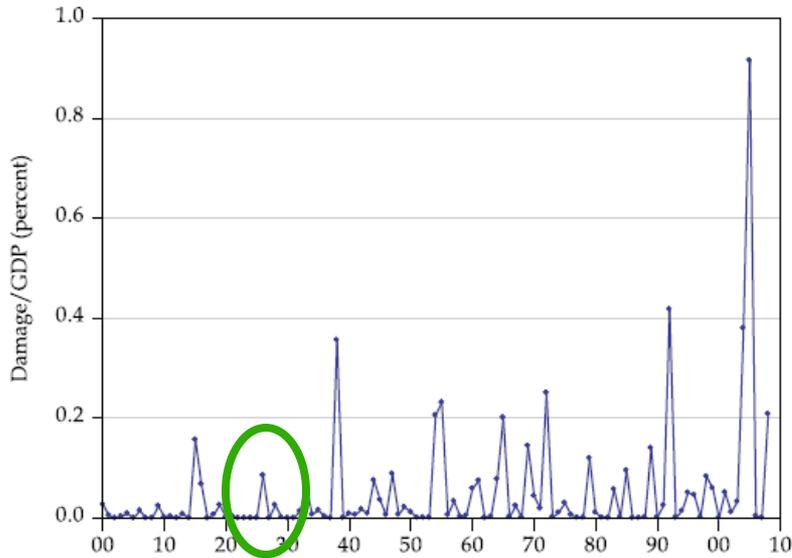
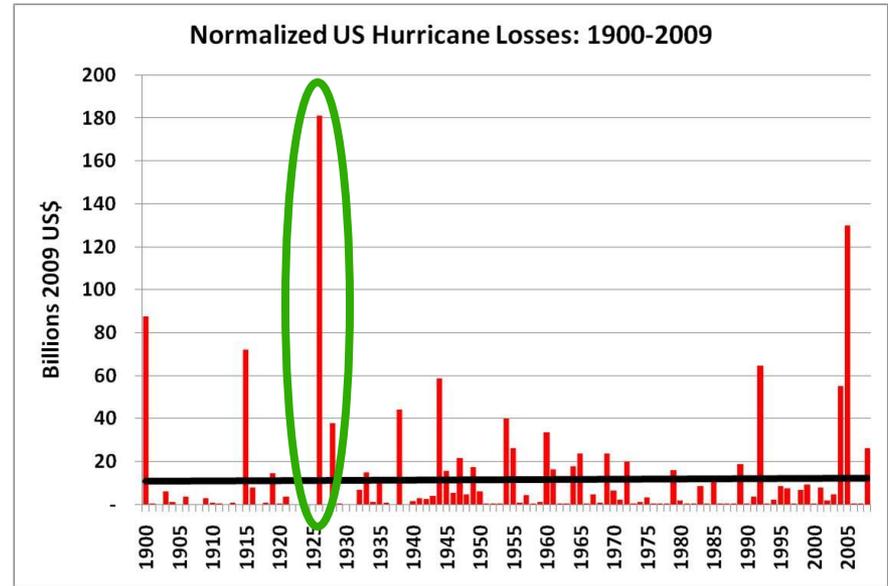


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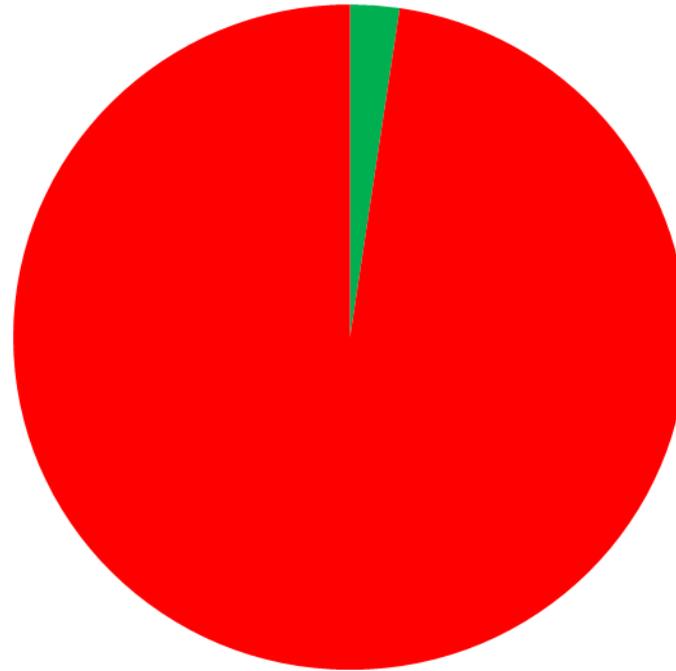


## Consider 1926!

Is it plausible that the Great Miami Hurricane of 1926 (Cat 4 over downtown Miami) would result in 1/5 the damages of Andrew (1992)?

# Why is it difficult to see a climate signal in a loss record?

## Idealized Comparison of the Effects on Damages of Climate and Societal Changes Over 50 Years



- climate change (10% increase in intensity, raised to the 6th power)
- societal change (doubling of losses every 10 years)

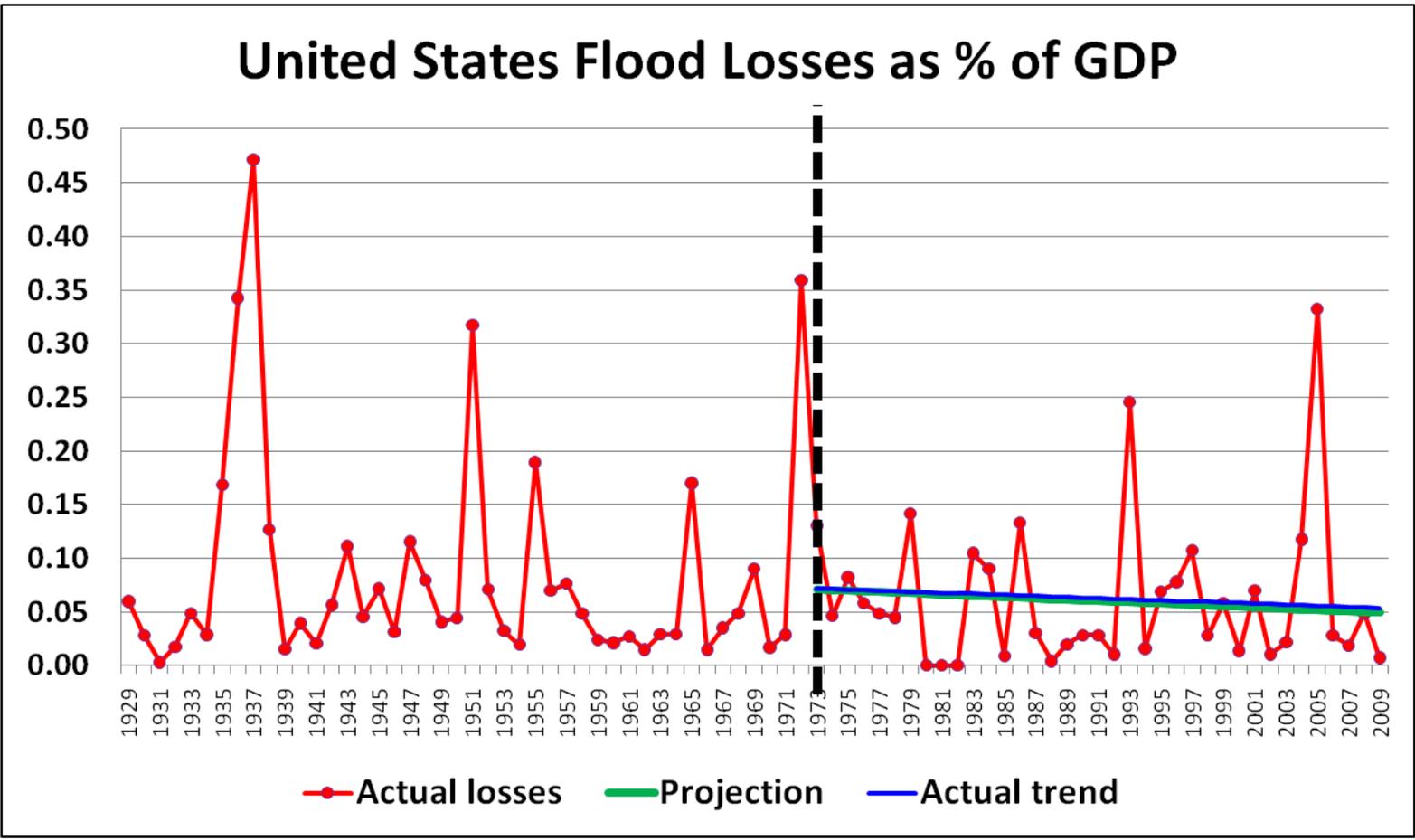
# What normalization can and can't do

- An unbiased normalization can be used to identify strong climate signals (e.g., ENSO)
- A normalization can be used to identify long-term trends in geophysical phenomena that influence losses (detection)
- Detection requires a longer time period for normalized losses than for the geophysical phenomena itself (see Crompton et al.)
- A normalization cannot be used for purposes of attribution of causal factors driving geophysical trends

# Frontiers in normalization research

- Robust findings related to climate change – the Hohenkammer consensus remains current!
- Other applications, e.g., evaluation of catastrophe models, identification of signal of policy interventions (US NFIP)
- Other phenomena and regions, e.g., “developing” world losses
- More rigorous evaluation of bias and methodologies in particular contexts, US hurricanes well studied in this regard, in other cases, not so much ...

# Search for signals of policy implementation



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# Thank you!

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- Papers etc. can be downloaded from:  
<http://sciencepolicy.colorado.edu>