



CAS 2018 Seminar on Reinsurance KatRisk US Flood Modeling

Guy Morrow

KatRisk LLC
2397 Shattuck Ave., Suite 212
Berkeley, CA 94710
510-984-0056
www.KatRisk.com

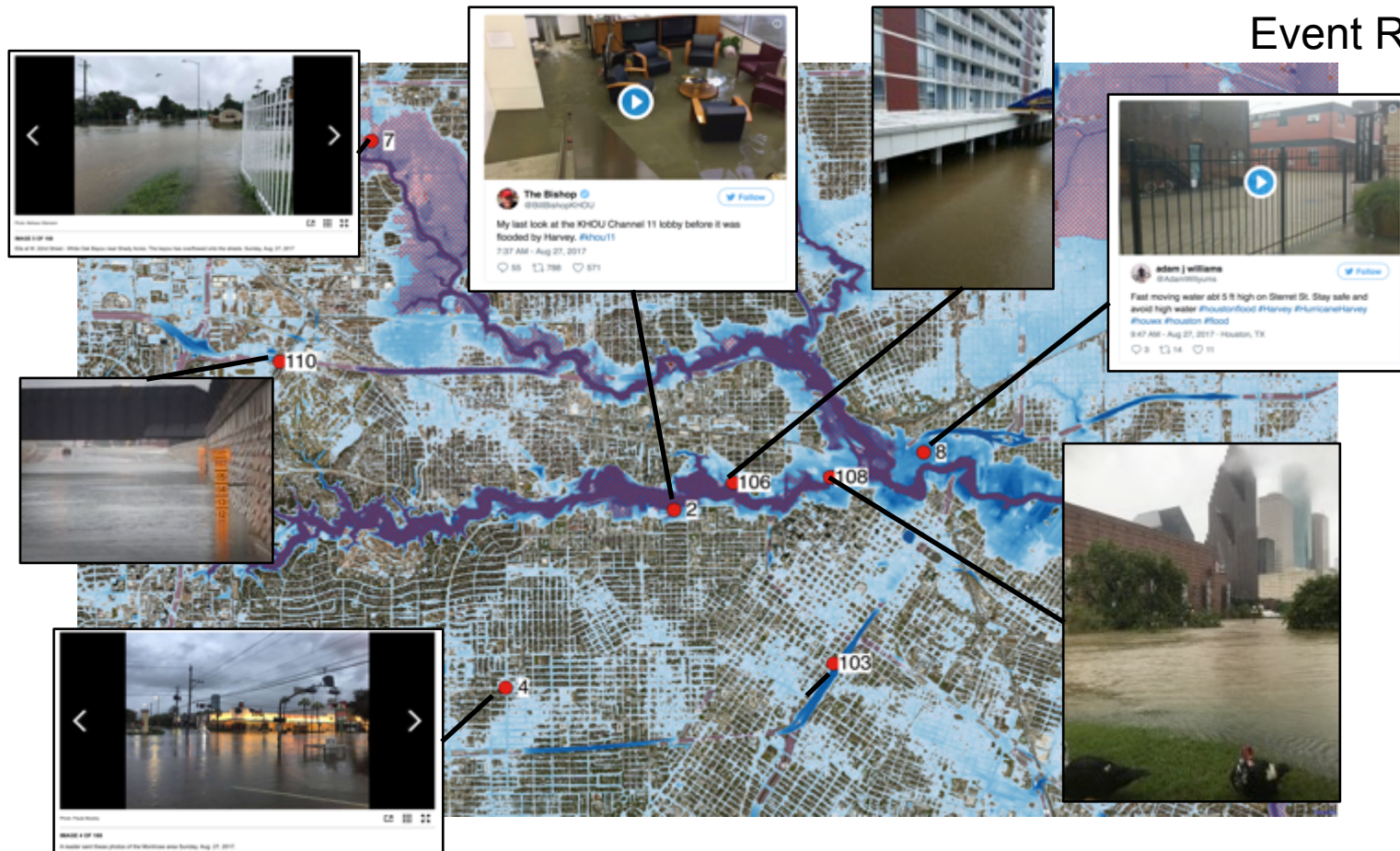
KatRisk Overview

- ❑ Founded in 2012
- ❑ Concentration on Flood and Tropical Cyclone risk data and models
- ❑ Worldwide flood hazard data coverage
- ❑ Clients ranging from large insurers/reinsurers/brokers to start ups entering the US private flood market
- ❑ Products cover underwriting and portfolio management uses:
 - Hazard Data and Location Loss Analytics (SoloKat)
 - Portfolio Management (SpatialKat)

Inland Flood Modeling – Hazard Layers

- ❑ Six return periods: 10, 20, 50, 100, 200, 500 years on a 10 meter grid
- ❑ All areas covered with 2-d hydraulic modeling approaches, no lower limit on the size of catchment modeled
- ❑ Includes both riverine and pluvial (surface water) flooding

Hurricane Harvey
Event Response



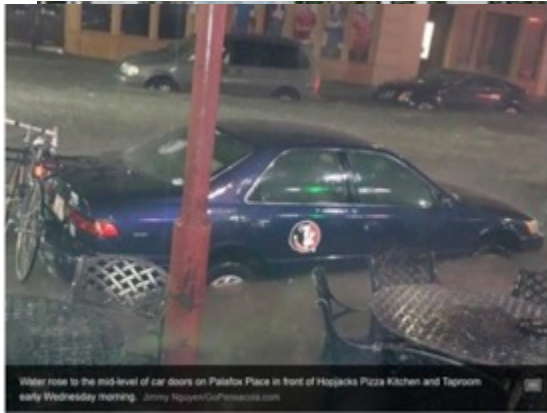
TITAN Supercomputer

Utilized resources of the Oak Ridge Leadership Computing Facility at the Oak Ridge National Laboratory, which is supported by the Office of Science of the U.S. Department of Energy under Contract No. DE-AC05-00OR22725.



Pensacola Flooding April 2014

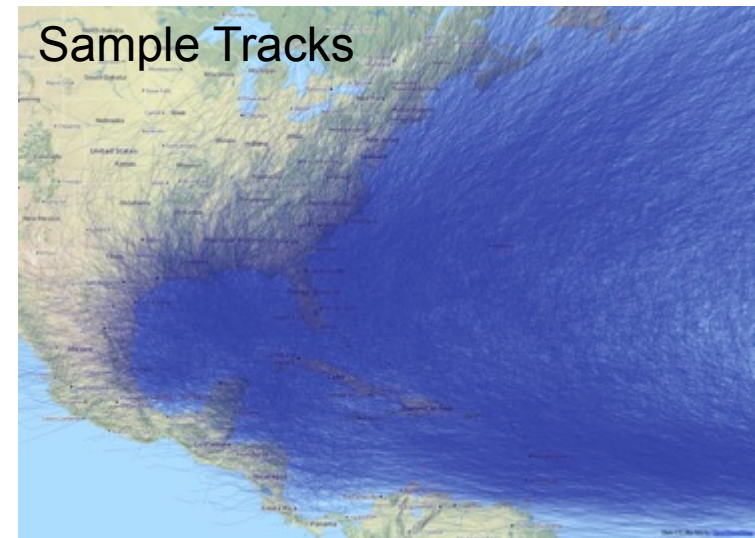
Flooded Downtown Area



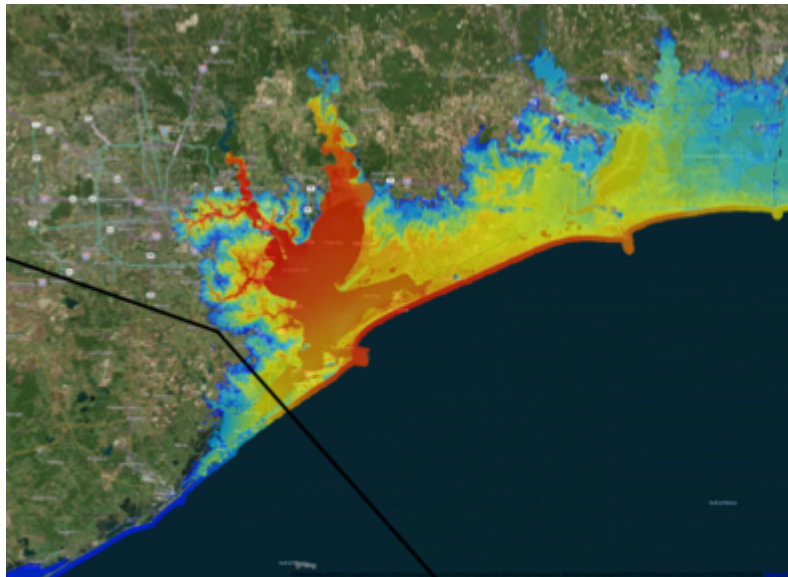
Blue Shading – KatRisk Flood Model
Red Hatched – FEMA Zones A and V

Storm Surge and TC Precipitation Modeling

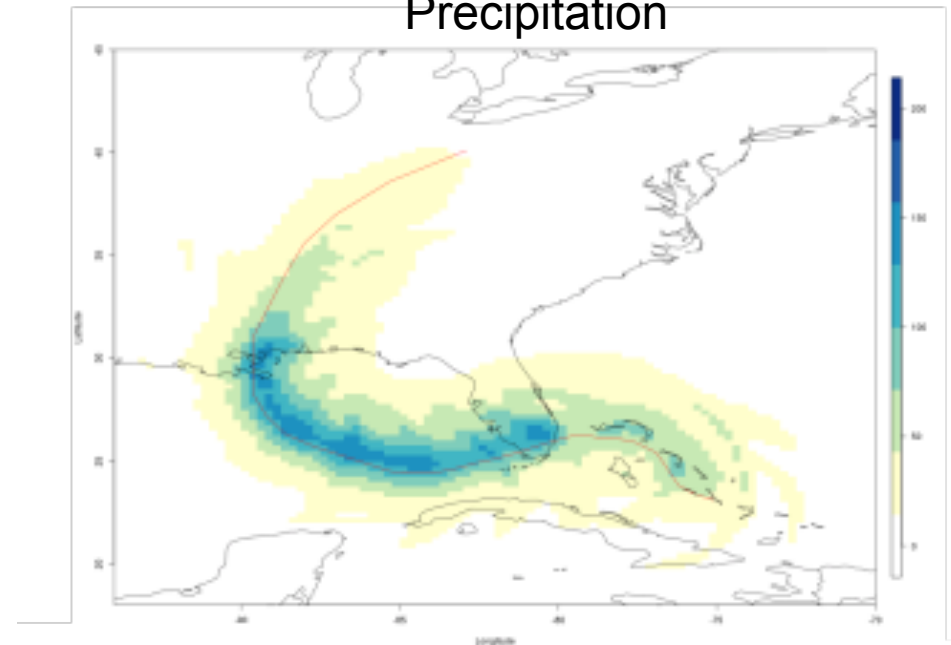
- ❑ A 50,000 year hurricane track set has been developed for the Atlantic Basin.
- ❑ Storm surge and precipitation modeled for the entire event set.



Storm Surge



Precipitation



Tampa Bay Return Period Surge Inundation

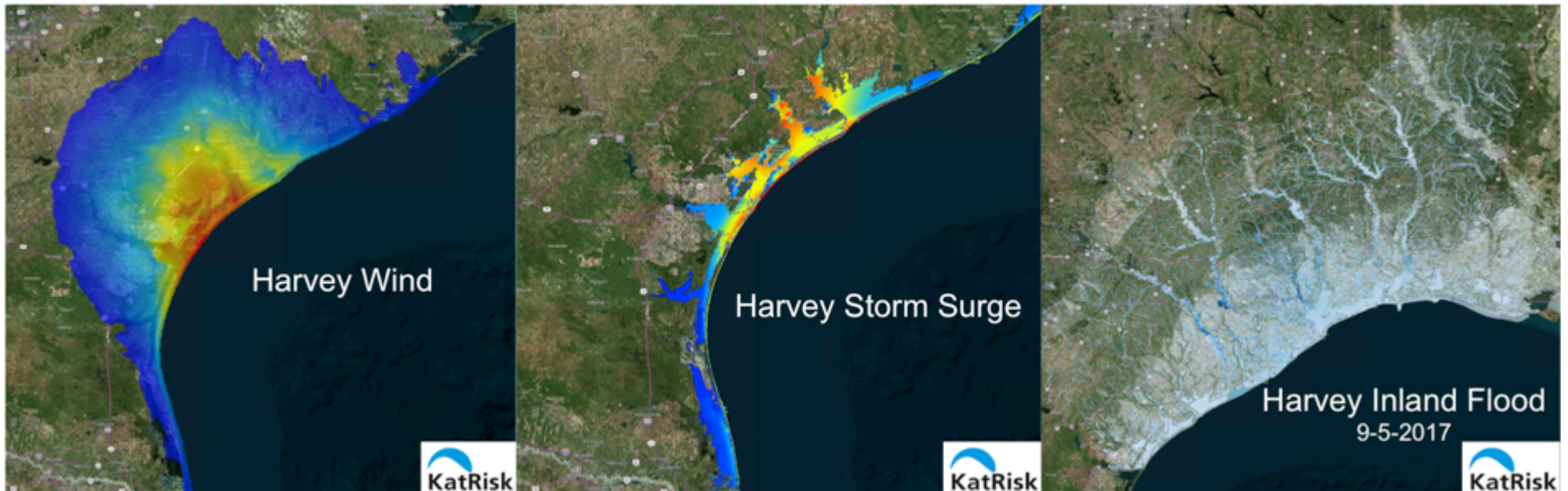


Flood Risk Assessment Solutions

Product	Availability	Delivery
Hazard Layers/Risk Scoring	Worldwide	Deployed or Accessed via an API
<u>SoloKat:</u> Rapid Location Loss Analytics Produces location level AAL	Worldwide	Deployed or Accessed via an API Embedded in client underwriting/quoting workflow
<u>SpatialKat:</u> Probabilistic Event Model	US and Canada Other regions in development	Deployed to client sites A number of clients have installed on AWS KatRisk hosted version in the future

SpatialKat – Event Based Portfolio Model/Software

- ❑ US and Canada models have been released
- ❑ US model covers all sources of flooding within a correlated event set
 - Inland flood
 - Explicit modeling of tropical cyclone rainfall, storm surge and wind
- ❑ Fast runtimes
- ❑ Separate wind and flood financial policies considered in multi-peril analyses
- ❑ Open and flexible modeling assumptions. Hazard data and vulnerability can all be viewed and adjusted/appendended.



A Couple Key Modeling Issues

❑ First Floor Elevation

- Use of FEMA BFE and Default Values
- Fast runtime to allow sensitivity testing



❑ Large Building Footprints and Industrial Facilities

- Geocoding isn't always precise and even when it is one point often not representative of exposure
- Analytical options to use one coordinate or a series of coordinates within a specified distance

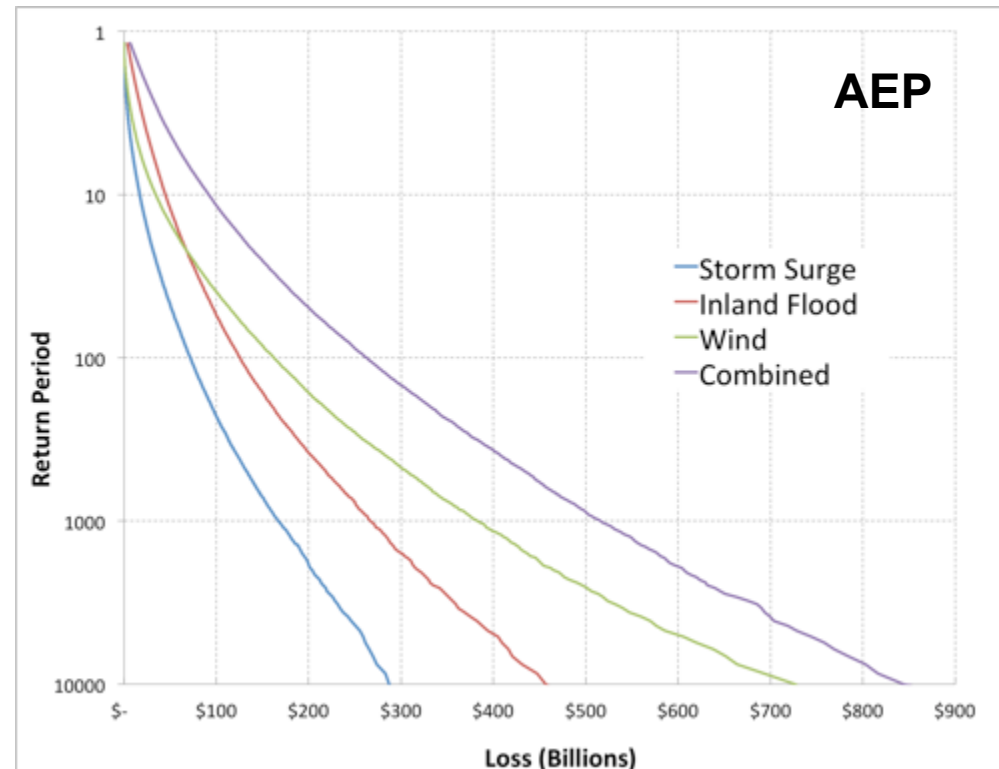
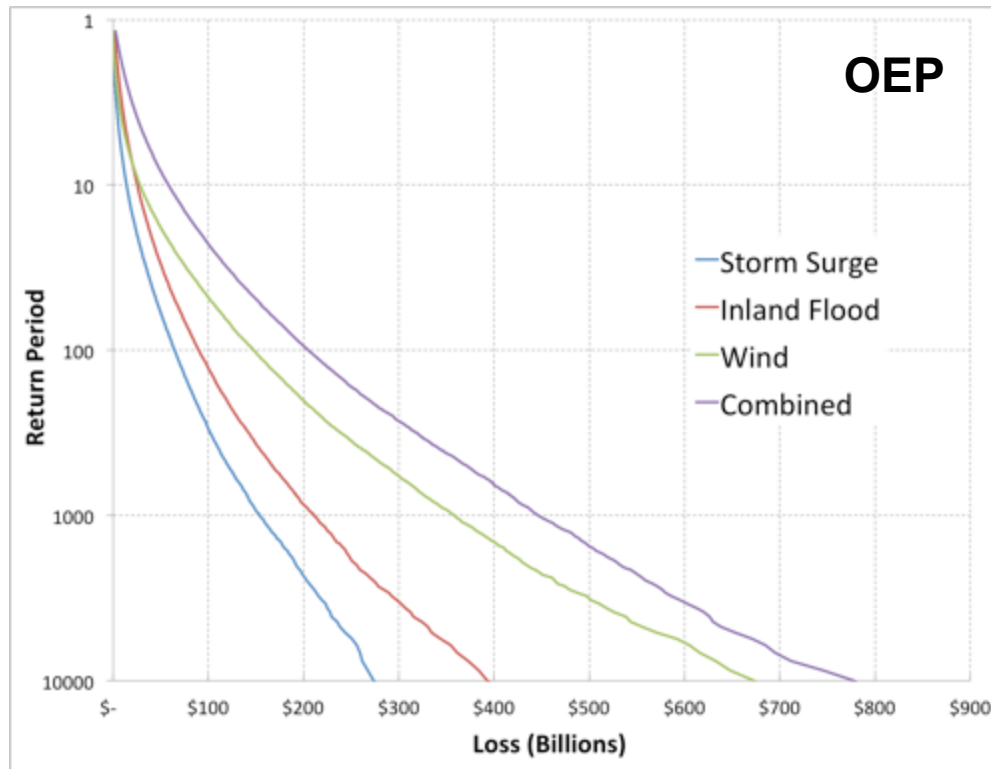
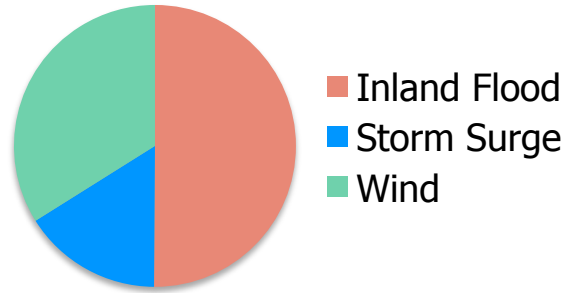


Overall US Model Results

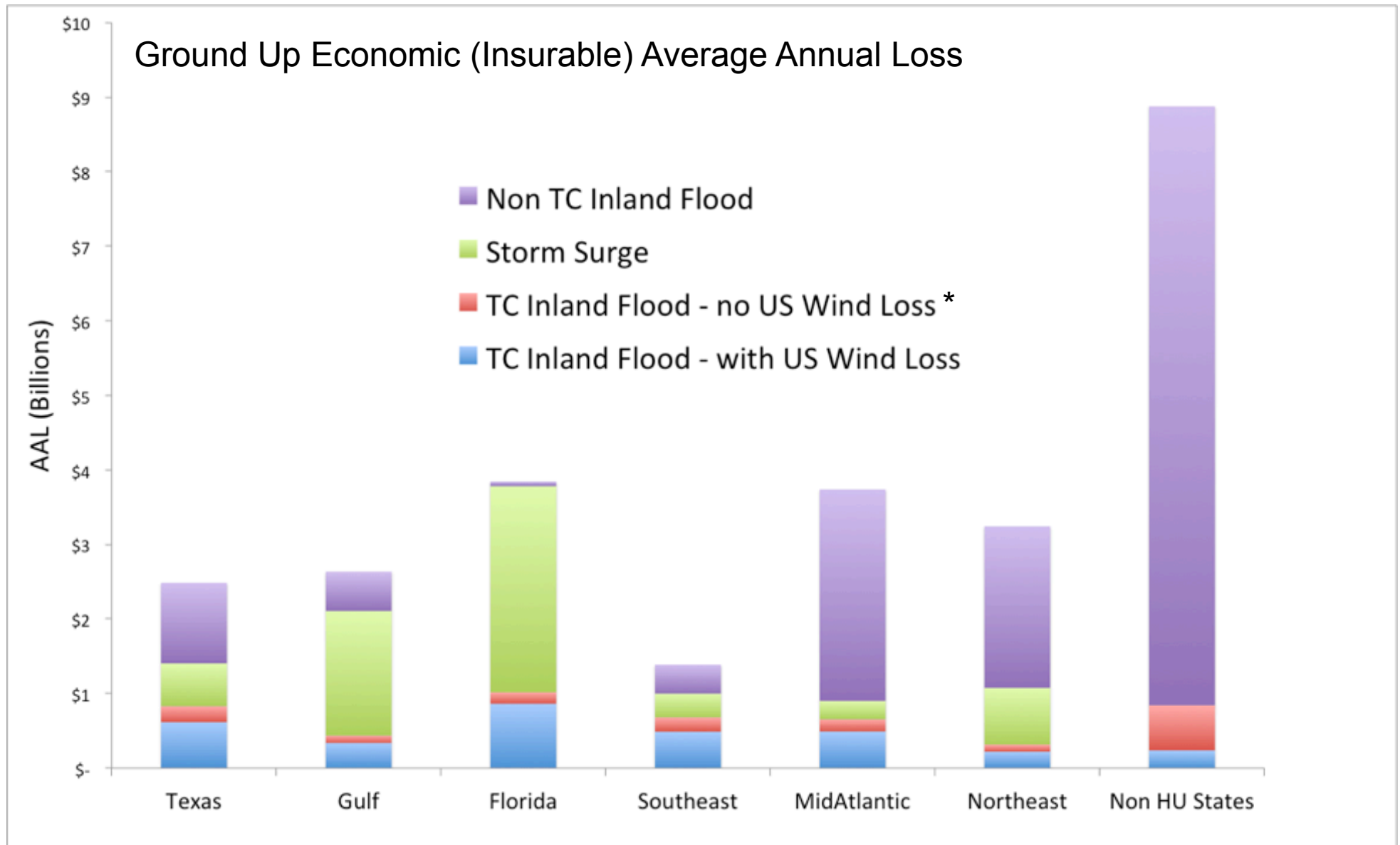
Ground Up Economic
(Insurable) Losses

AAL = \$39 Billion

- Wind drives tail risk
- Flood AEP highest at low return periods

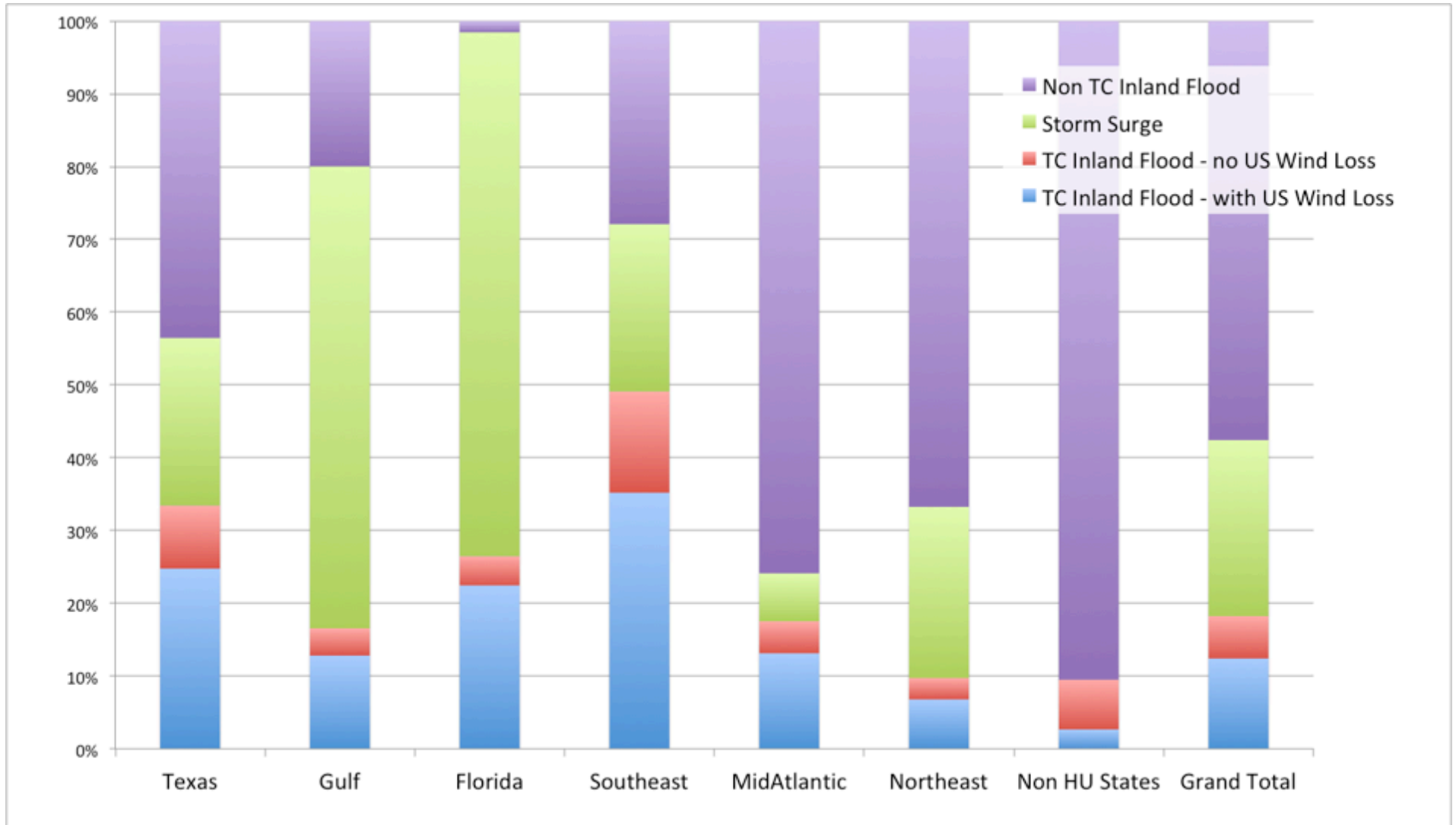


Flood Loss Contributions by Region



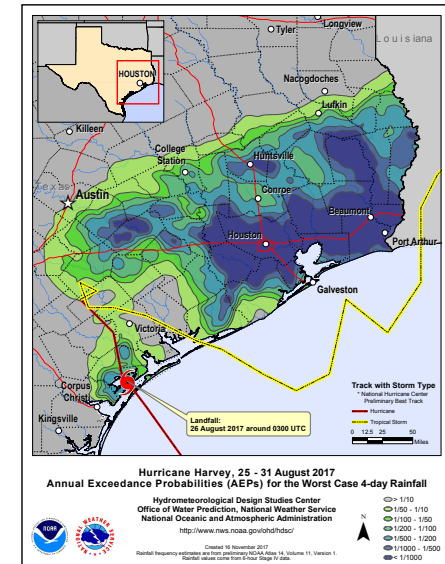
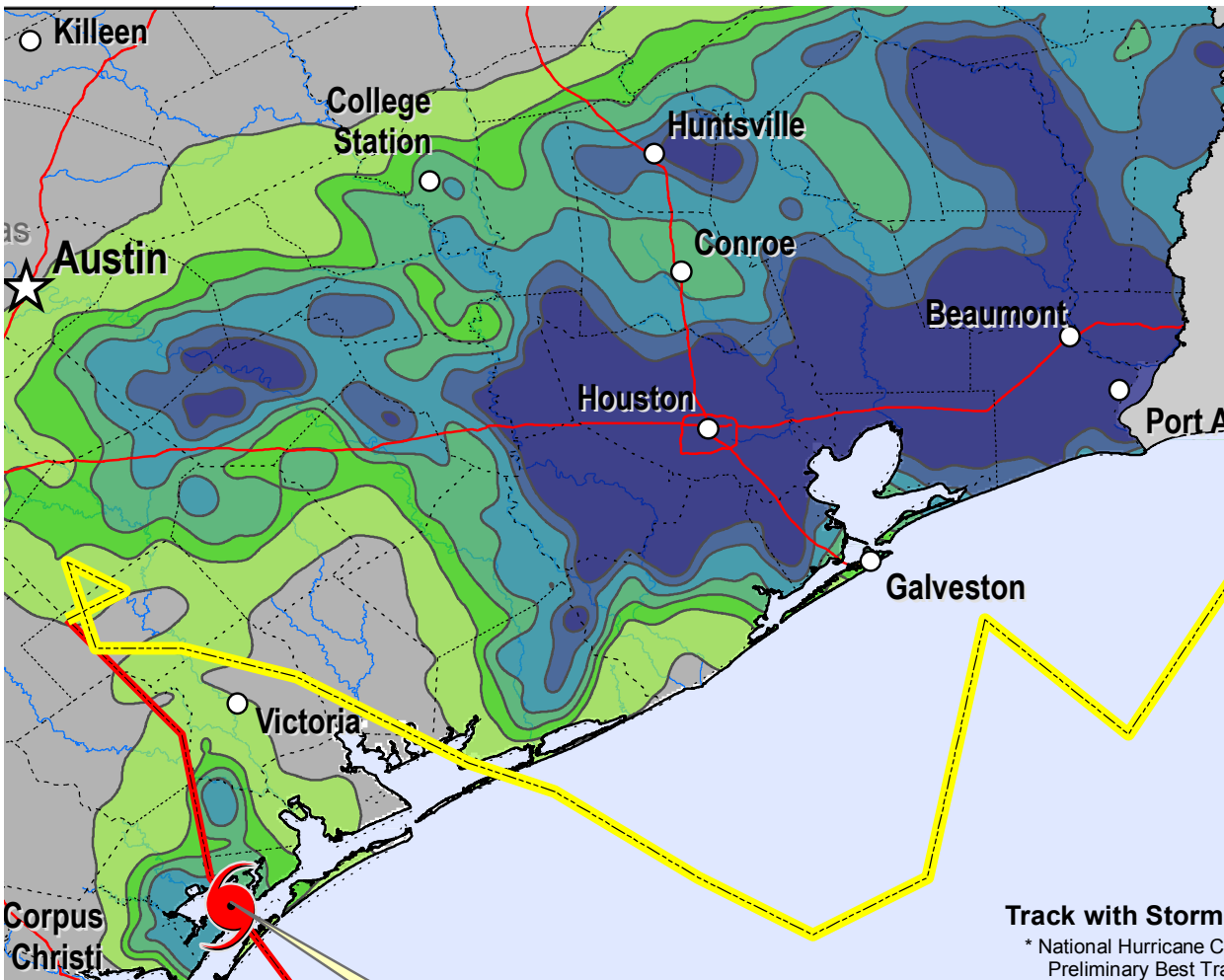
* Includes Pacific TC

Relative Flood Loss Contributions



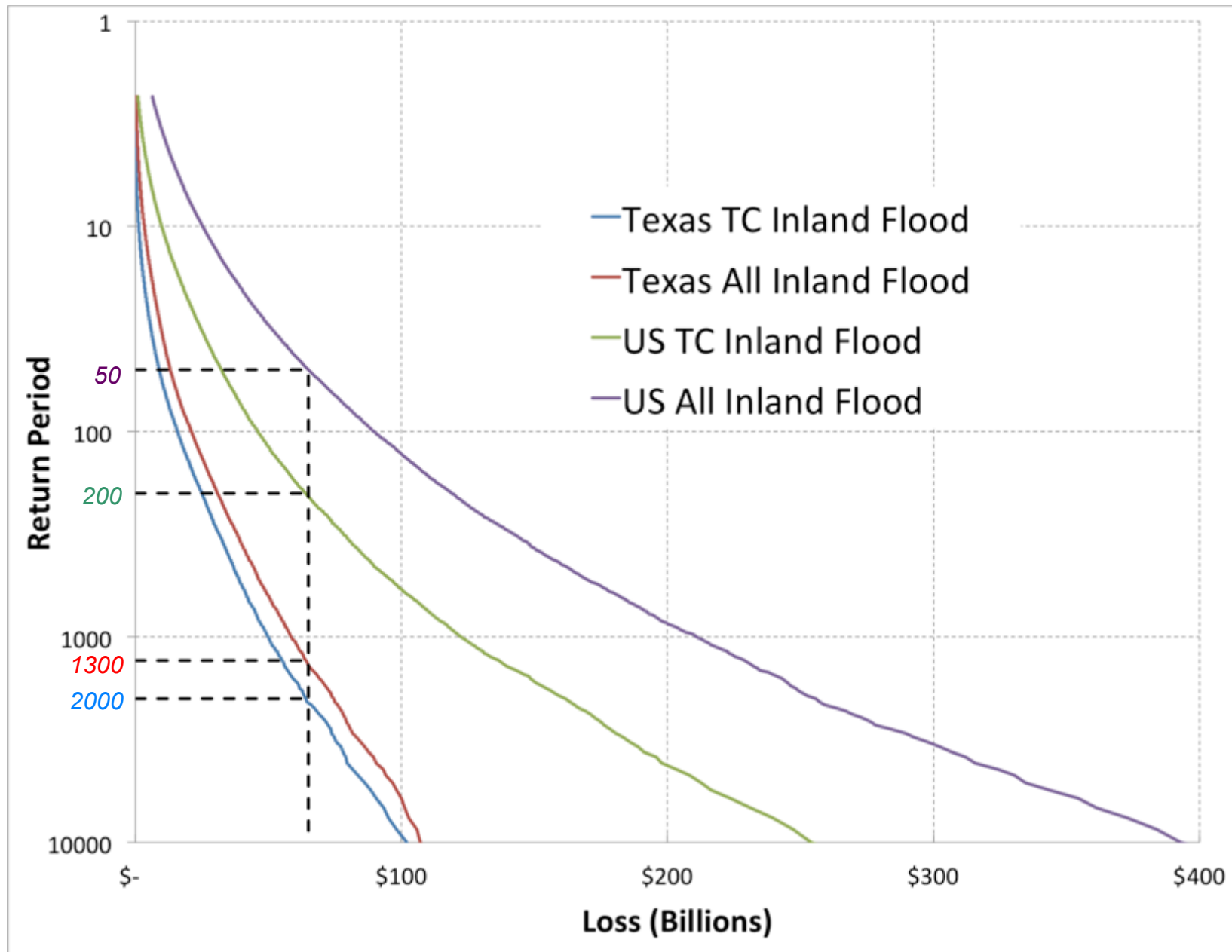
Severity of Harvey Rainfall

- Four day precipitation Annual Exceedance probability > 1000 years over a large area including Houston



- > 1/10
- 1/50 - 1/10
- 1/100 - 1/50
- 1/200 - 1/100
- 1/500 - 1/200
- 1/1000 - 1/500
- < 1/1000

Harvey Loss on OEP



Some Suggested Model Review Questions

- ❑ What do underlying hazard maps look like? How well do they capture flooded vs. non-flooded locations?
- ❑ How have events been generated?
- ❑ Is tropical cyclone rain included?
- ❑ How is the correlation between perils modeled, both the hazard and within the financial model?
- ❑ Can useful event response data be generated from the model?
- ❑ How open and configurable is the model? Can vulnerability and hazard data be viewed?
- ❑ What is the model runtime? Are sensitivity tests feasible?