The Year of Extremes: Lessons from the Catastrophes of 2017

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CARe Seminar on Reinsurance
4 June 2018
Agenda

- The Great Flood & The Close Call: Hurricanes Harvey & Irma
- Gray Swans: The 2017 California Wildfires
- The Big Picture: What does 2017 tell us about the future?
The Great Flood & The Close Call: Hurricanes Harvey & Irma

Source: NOAA
2017 Accumulated Cyclone Energy (ACE): 223.27 (7th-Highest on record)

Source: NHC

**2017**

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>TYPE</th>
<th>NAME</th>
<th>DATE</th>
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<tr>
<td>1</td>
<td>TS</td>
<td>ARLENE*</td>
<td>APR 19-21</td>
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<td>TS</td>
<td>BRET</td>
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<td>JUN 20-23</td>
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<td>6</td>
<td>H</td>
<td>F- FRANKLIN</td>
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<td>AUG 30-SEPT 12</td>
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* Denotes post-storm analysis is complete
August – September 2017 Conditions in the Northern Caribbean Region
June – July
African Rainfall Anomalies

Above average rainfall is an indicator of more vigorous tropical waves. Rainfall also increases moisture available to subsequent systems.

Source: Dr. Ryan Maue
## Tale of the Barometer / Anemometer: Harvey vs. Irma’s Florida Landfalls

<table>
<thead>
<tr>
<th></th>
<th>Harvey</th>
<th>Irma</th>
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</thead>
<tbody>
<tr>
<td><strong>Central Pressure</strong></td>
<td>938 hPa</td>
<td>929 hPa (Keys)</td>
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<tr>
<td></td>
<td></td>
<td>940 hPa (Marco Island)</td>
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<tr>
<td><strong>Sustained winds</strong></td>
<td>130 mph</td>
<td>130 mph (Keys)</td>
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<tr>
<td>(1-minute avg.)</td>
<td></td>
<td>115 mph (Marco Island)</td>
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<tr>
<td><strong>Rate of Forward Motion</strong></td>
<td>7 mph</td>
<td>8 mph (Keys)</td>
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<td></td>
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<td>12 mph (Marco Island)</td>
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### IBHS Building Code Ratings by State

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<tr>
<th>State</th>
<th>2015 New Score</th>
<th>2012 Original Report Score</th>
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<tr>
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<td>95</td>
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<tr>
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<td>DELAWARE</td>
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</table>
% of Housing Units by Decade Built

Data: U.S. Census Bureau
# of Housing Units by Decade Built

![Bar chart showing the number of housing units by decade built in Monroe FL and Aransas TX. The chart includes data from the U.S. Census Bureau.](chart_image)
% of Housing Units by Decade Built

Data: U.S. Census Bureau
Marco Island, FL
Hurricane Irma

Source: Munich Re (US)
Marco Island, FL
Hurricane Wilma (2005)

Source: Munich Re (US)
# of Housing Units by Decade Built

Data: U.S. Census Bureau
Buffalo Bayou, Houston, TX, during Harvey

Over 60” (1,524 mm) of rain in 5 days – a U.S. record!
Buffalo Bayou, Houston, TX, during Harvey

Over 60” (1,524 mm) of rain in 5 days – a U.S. record!
Hurricane Harvey
Inland Flooding, Port Arthur, TX

Source: US Army
Hurricane Harvey
Inland Flooding & the Insurance Gap

United States NFIP Take-Up Rate, personal lines:

- Florida: 19%
- Louisiana: 24%
- Texas: 6%
Houston reservoir animation can be viewed at:
Hurricane Harvey
Inland Flooding, Houston, TX

Texas World Speedway after Harvey being used to store flooded cars. Photo credit: Brazos Drones.

Source: NOAA
Hurricane Harvey
Inland Flooding, Houston, TX

Source: New Republic
Lessons from Harvey: Location of Contents

- The location of contents within an insured location is critical when assessing flood loss potential, particularly for commercial and industrial risks.

- Examples:
  - Hospitals (MRIs, CAT Scan Machines, Radiology equipment)
  - Office Buildings (Electrical and IT equipment, etc.)

- Catastrophe Risk Models tend to spread out contents value over the number of stories within a building. This could lead to an underestimation of the amount of contents at risk to flood losses.

- Heavy Industry (Oil & natural gas refining, storage, and distribution) also heavily affected, damage to equipment, potential for health & environmental liability from leaking chemicals.
Lessons from Harvey: Other Items of Note

- Personal Lines – Wind
  - Homes built to meet 2006 International Building Code performed very well in Harvey’s high winds. Proper construction and resiliency work!
  - However, lack of statewide building codes mean many older homes in TX not built with any wind hazard considerations – poorer risks, and debris from these homes can damage even well-built structures. Community / state action critical for resiliency of entire community!

- Personal Lines - Flood
  - Don’t build communities inside of reservoirs!
  - Elevating homes significantly above local elevation critical in reducing loss!
  - Cost to build to code may be significant.
  - Flood maps can be outdated – much of the flood loss was outside of 100-year flood zone!
Irma Landfall Points

Irma Peak Surge – Fernandina Beach, FL

Irma Landfall Points
Gray Swans: The 2017 California Wildfires
2017 California Wildfires

California 2017:

- >10k structures lost
- >$13 bn insured loss (aggregate)
- Previous largest wildfire loss: Oakland Hills Fire (1991); $3 billion loss (2017 US$)
2017 California Wildfires

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Why was the Tubbs Fire so Destructive?

![Graph showing 80 MPH Gusts](image)

Source: Kim Roberts / Used with Permission
Tubbs Fire – Sonoma County
Interaction of wind & topography

San Francisco Chronicle
Tubbs Fire – Santa Rosa
Coffey Park Neighborhood
Tubbs Fire – Santa Rosa
Thomas Wildfire - Downtown Ventura

Source: Kim Roberts / Used with Permission
Montecito Mudslides

San Ysidro Creek

Burn area from Thomas Fire

Direction of mudslide flow
Montecito Mudslides

5 inches

Source: Kim Roberts / Used with Permission
The Big Picture: What Does 2017 Tell Us About The Future?
Factors Influencing Natural Catastrophe Risk

Risk is a function of

- Hazard
- Exposed Values
- Vulnerability
Climate Change and U.S. Meteorological Perils: General Predictions

The more large-scale the phenomena, the more confident one can be with predicted likelihood and impacts.

Most confidence
Changes in Hydrological Cycle

- Arid regions will tend to become drier (Southern California, Intermountain West and Desert Southwest)
- Wet regions will tend to become wetter (Pacific Northwest, Northern Plains, Midwest, Eastern Seaboard)

Less confidence
Changes in frequency and severity of

- Winter Storms
- Thunderstorms
- Tropical Cyclones
Annual Number of U.S. Landfalling Tropical Cyclones (TCs), 1900 – 2017

Source: Munich Re
Impact of Oceanic Heat Increase on Atlantic Hurricane Climate

Ocean warming has led to an apparent linear increasing trend in the decadal-scale AMO cycle.

Increased oceanic heat content can provide more “fuel” for hurricanes and allow them to become more intense – but only if other atmospheric conditions are conducive for Intensification.

Source: NOAA
Climate change & Harvey rainfall:

Early climate attribution research shows that Harvey’s rains were:

15% more intense OR 3x more likely.

However, 15% less rain from Harvey would still caused substantial flooding!

Infrastructure / urban sprawl also played a massive role in this event.

Oldenborgh et al., 2017
Sea Level anomaly animation can be viewed at:
Impact of Sea Level Rise on Storm Surge

Source: Kelly Hereid/ Used with Permission
Wildfire & Climate: California Palmer Drought Severity Index (PDSI)
720% POPULATION INCREASE IN WUI AREAS SINCE 1960: 25M TO 140M PEOPLE
Acknowledgements

- Thanks to Dr. Kelly Hereid, Chubb; Dr. Steve Bowen, Aon; & Kim Roberts, JLT Re, in the development of the presentation this one is derived from. Any materials provided by them are noted as such and are used with permission.
Thank you for your attention!

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