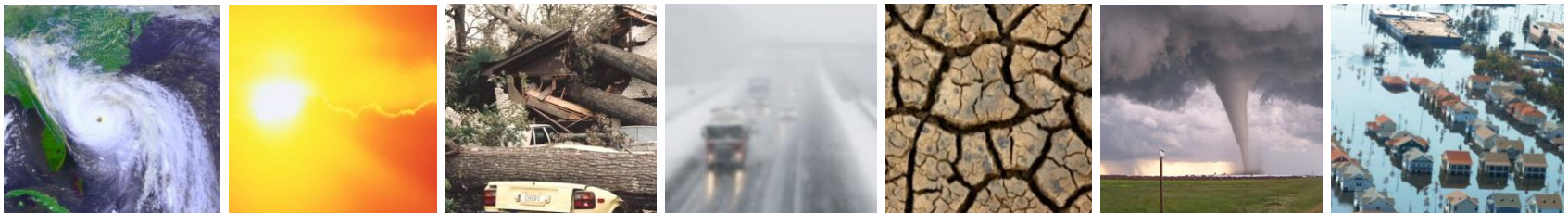


# U.S. Billion-dollar Weather and Climate Disasters of 2017 – in Context

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January 2018

American Meteorological Society – 98<sup>th</sup> Annual Meeting

# U.S. Billion-dollar Weather and Climate Disasters

## Outline:

- **Context for Measuring Disaster Impact**
- U.S. Data Sources / What we are Measuring
- 2017 Disasters in Review...
- Disaster Cost Comparison and Mapping





## NOAA's National Centers for Environmental Information (NCEI) – Center for Weather and Climate

- Statutory mission to describe the climate of the United States and act as the **"Nation's Scorekeeper"** regarding the trends and anomalies of weather and climate.



- As part of this responsibility we also analyze extreme weather and climate events in the U.S. that have **great economic and societal impacts** known as **“U.S. Billion-dollar Weather & Climate Disasters”**
- Such extreme events contribute the majority (>75%) of the damage from all recorded U.S. weather and climate events** (NCEI; Munich Re).

# Different Ways to Measure Disaster Impact

## Disasters



Tornadoes



Wildfires



Floods



Droughts



Heat waves



Snowstorms/  
Blizzards



Geophysical



Hurricanes &  
Tropical Storms

## Impacts

Human Health  
and Wellbeing

Business

Public  
Infrastructure

Private Property

Environmental Capital  
(incl. ecosystem services)

## Measures

What's the right  
- Time scale?  
- Space scale?  
- Size scale?

Loss of  
Life

Mental  
Health

Physical  
Health

Quality of  
Life

GDP

Net  
Economic

Market

Non-  
market

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# To capture losses requires a broad array of **public** and **private** data

Disaster Types		Hurricanes/ Tropical Storms	Severe Local Storms	Winter Storms	Crop Freeze	Wildfire	Drought / Heat Wave	Inland / Riverine Flooding
Primary data used in assessments	ISO/Property Claim Services	x	x	x		x		
	FEMA (PDD)	x	x	x	x	x		x
	FEMA (NFIP)	x						x
	USDA/RMA	x	x	x	x	x	x	x
Supplemental data used in assessments	NIFC					x		
	EIA	x	x	x		x	x	
	USACE							x
	State Agencies	x	x	x	x	x	x	x

We seek to account for total, direct losses (i.e., **insured** and **uninsured**) for assets including:

- **physical damage** to **residential, commercial** and **government buildings**,
- **material assets** (content) within a building,
- **time element losses** (i.e., time-cost for businesses; hotel-costs for loss of living quarters)
- **vehicles, boats, offshore energy platforms**,
- **public infrastructure** (i.e., roads, bridges, buildings) and
- **agricultural assets** (i.e., crops, livestock, timber).
- Does not take into account: natural capital losses; healthcare-related costs; value (\$) associated with loss of life



<u>Note: not all data sources listed here</u>	ISO/PCS	FEMA (state/local disaster assistance)	FEMA (NFIP)	USDA	USACE	NIFC	State Agencies
Data	<u>Provided:</u> Residential, - Commercial property - Business interruption, - Vehicles (insured w/ comprehensive cover) -Boats, Inland marine -Demand surge <u>Not provided:</u> Agriculture, Flooding, Aviation, Ocean Marine, Loss above limits	<u>Provided:</u> Government disaster assistance, debris removal, financial aid Public Assistance, Housing Assistance, Individual Assistance, Small Business loan Assistance	<u>Provided:</u> Insured flood loss for residential and commercial properties	<u>Provided:</u> Insured multi-peril crop/livestock insurance payouts, crop progress and quality reports market value of crop production	<u>Provided:</u> Annual flood event summaries and major flood event reports that detail levee damage, other damages	<u>Provided:</u> Wildfire losses to structures; commercial timber; wildfire suppression costs, deaths; acreage burned	<u>Provided:</u> Total estimated crop losses Surveyed % of properties with multi-peril and flood insurance
Temporal Period	1949- present	1964-present (state) 1989-present (county)	1968-present	1948-present (state) 1989-present (county)	1983-present	1960-present	By specific disaster
Spatial Resolution	State-level	State-level County-level	State-level	State-level County-level	River-basin, State-level	Region, State, county	State-level
Update Lag Time	Weeks to months	Weeks to months	Several months	Weekly, monthly, Annual (depending on data product)	Annual report	Days to weeks	Several months
Data Sources	Surveys of insurers, market share analysis, air/ground damage surveys, interviews, etc.	State and local disaster needs / grants	Flood insurance payouts	Farmer and field surveys; data from partner insurance companies	Floodplain, household and business surveys	Fields reporting, state and local fire authorities	Local and State farm reporting to USDA; city / state damage assessment
Changes in Recording Threshold	\$1 M (1949-1981) \$5 M (Jan. 1982-1997) \$20 M (Jan. 1997-present)	County/per capita indicators adjusted each fiscal year to reflect changes in CPI. Assists in FEMA’s evaluation of disaster impact at county-scale (e.g., \$2.83, \$2.94)	Single-family dwelling limits: 1977-1994 Structure\$150k Content:\$50k 1994-2009 Structure\$250k Content:\$100k	Many programs (e.g., SURE, NAP,LIP) offer assistance from 50% -85% Major crop insurance policy revision in 1994		Stats after 1983 were compiled by states and agencies. Stats before 1983 undergoing reanalysis	

# U.S. Billion-dollar Weather and Climate Disasters

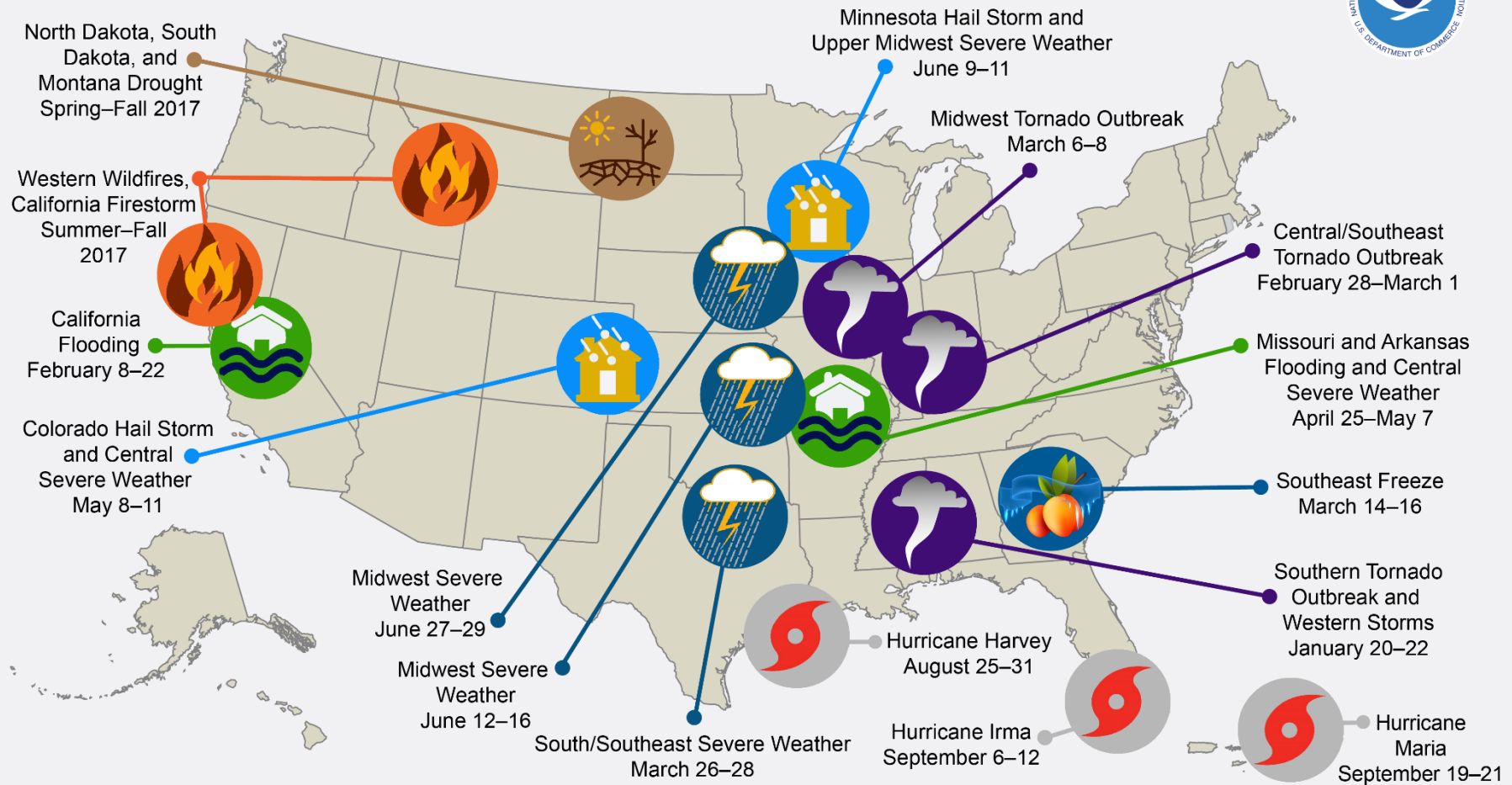
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# U.S. 2017 Billion-Dollar Weather and Climate Disasters



*This map denotes the approximate location for each of the 16 billion-dollar weather and climate disasters that impacted the United States during 2017.*

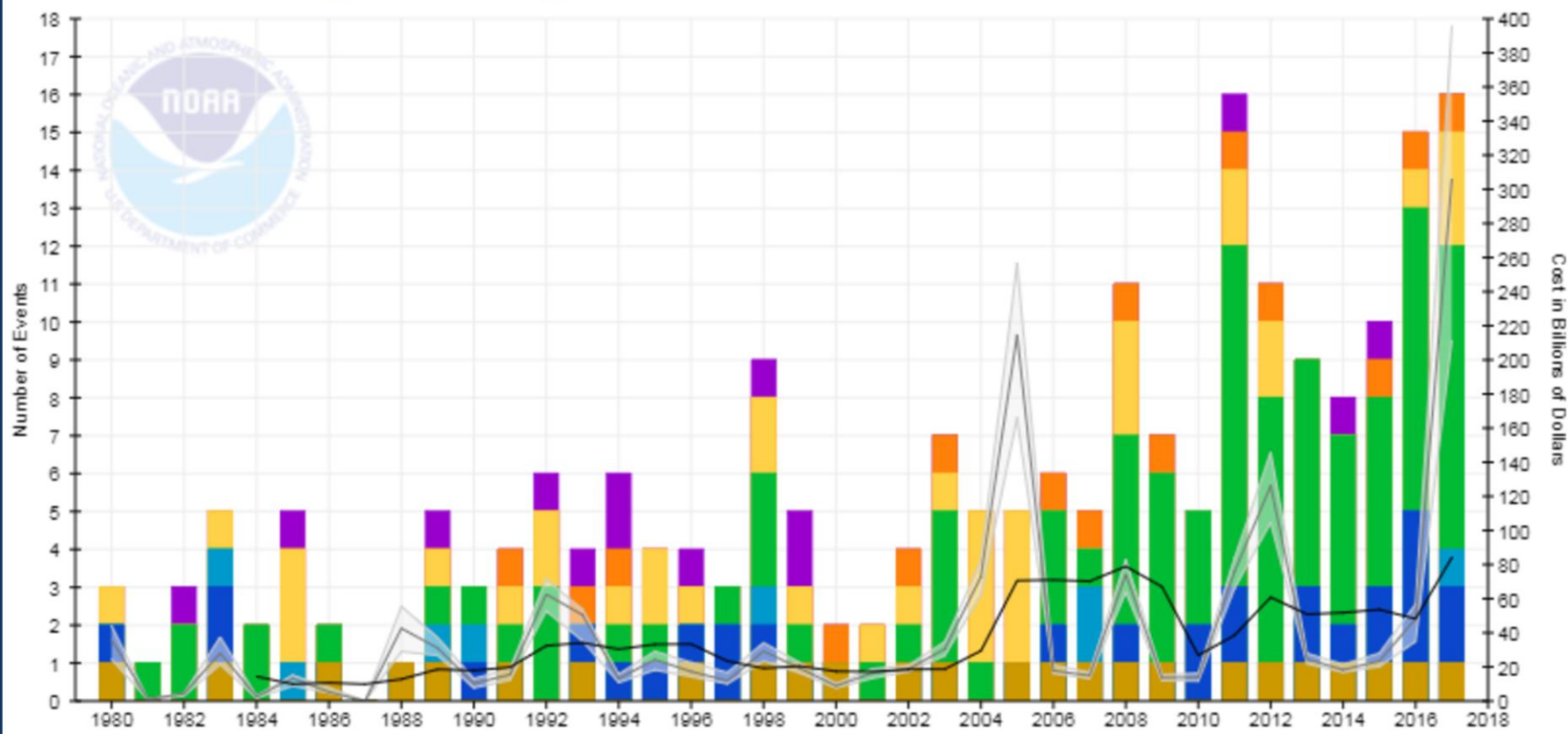
- In **2017**, the U.S. experienced **16 disaster events**; Total, direct costs **>\$300 billion in damages**; **> 360 fatalities**
- The 2017 events: 2 flooding events, 1 freeze event, 8 severe storm events, 3 tropical cyclones, drought & wildfire
- **2017 was historic**: Most costly U.S. hurricane season (\$265 billion) & wildfire season (\$18 billion) on record
- **Hurricanes Harvey, Irma & Maria** now join Katrina and Sandy in the new top 5 costliest U.S. hurricanes on record



# U.S. Billion-dollar event frequency, annual cost, 5-year cost average (1980–2017)

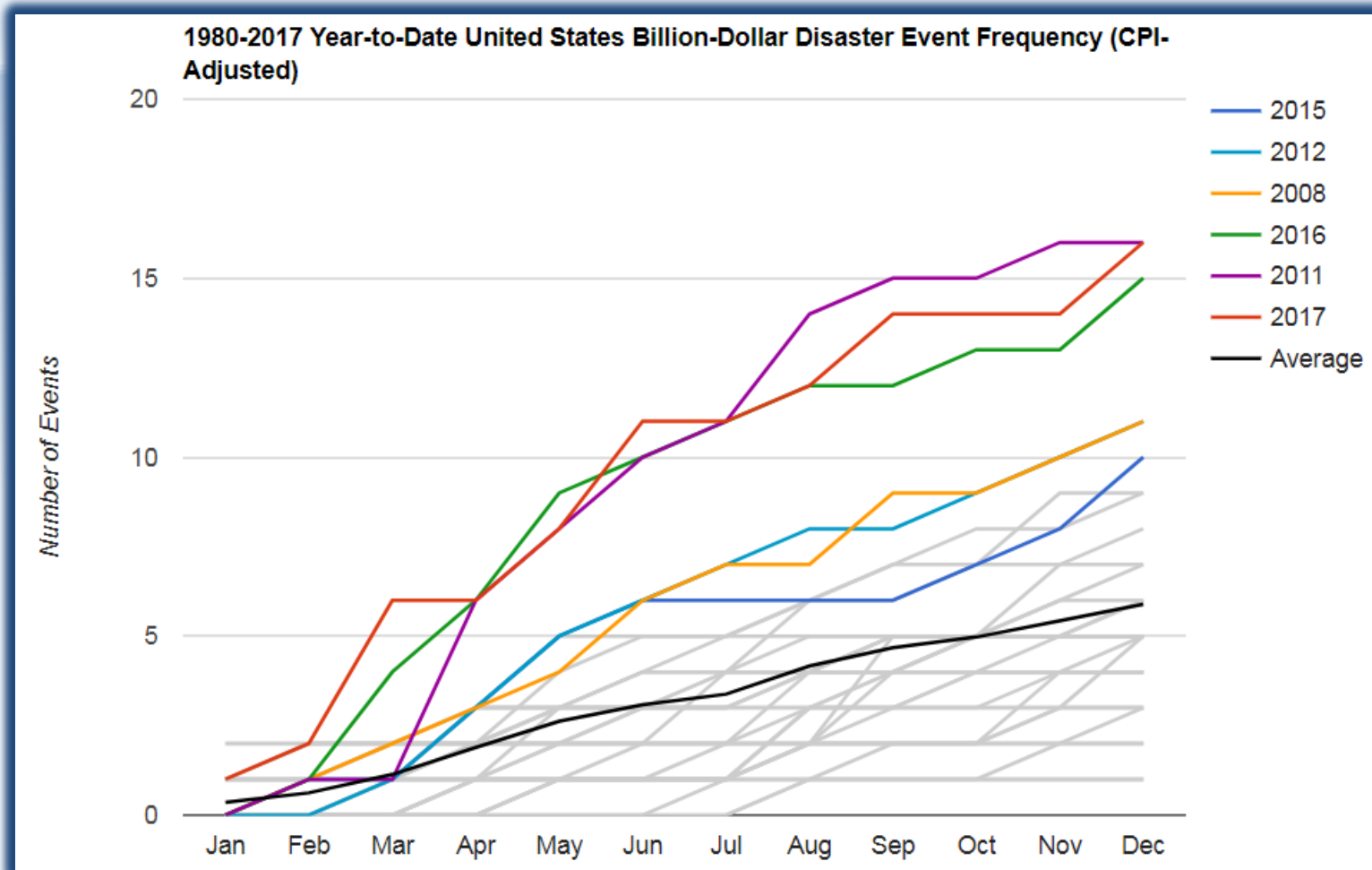
Billion-Dollar Disaster Event Types by Year (CPI-Adjusted)

■ Winter Storm    ■ Wildfire    ■ Trop Cycl    ■ Severe Storm    ■ Freeze  
■ Flooding    ■ Drought    — Cost w/ 95% CI    — 5-Year Mean



- 2017 ties 2011 for most (16) billion-dollar disasters on record; 2017 arguably has more events than 2011 given that our analysis traditionally counts U.S. billion-dollar wildfires, as regional-scale, seasonal events, not as multiple isolated events
- The cumulative damage of these 16 events **in 2017** is **\$306.2 billion** shattering the previous U.S. annual record cost of **\$214.8 billion** (CPI-adjusted) **in 2005** due to the impacts of Hurricanes Dennis, Katrina, Rita and Wilma

# Cumulative billion-dollar disaster frequency (year-to-date) for all years 1980-2017

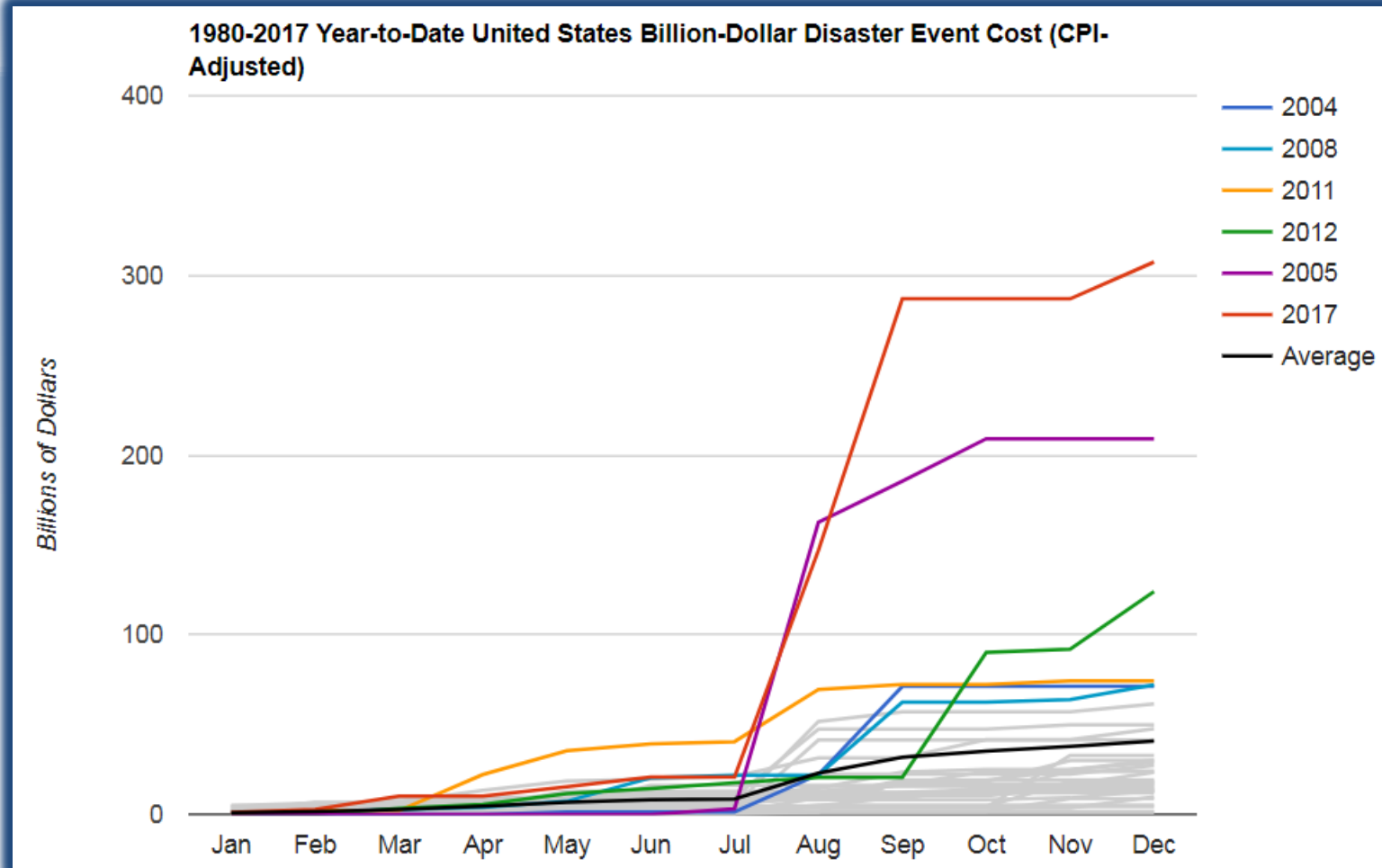


## The most active years:

- **2017** – 16(+) events: 8 severe storm events, 3 tropical cyclones, 2 flooding events, 1 freeze event, drought & wildfire
- **2011** – 16 events: 9 severe storm events, 2 tropical cyclones, 2 flooding events, 1 winter storm, drought & wildfire
- **2016** – 15 events: 8 severe storm events, 1 tropical cyclone, 4 flooding events, drought & wildfire
- **1980 – 2017** annual average: **5.8 events** (CPI-adjusted). **2013 – 2017** annual average: **11.6 events** (CPI-adjusted)



# Cumulative billion-dollar disaster cost (year-to-date) for all years 1980-2017



- More notably than the high frequency of events is the cumulative cost, which exceeds **\$300 billion in 2017 – a new U.S. annual record**
- **The top 3 most costly years** for U.S. (since 1980): **2017 (\$306.2 billion)**; **2005 (\$214.8 billion)**; **2012 (\$126.2 billion)**
- **1980 – 2017** annual cost average: **\$40.5 billion** (CPI-adjusted). **2013 – 2017** annual cost average: **\$84.1 billion** (CPI-adjusted)

# U.S. Billion-dollar Weather and Climate Disasters

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**What we find:** From **1980-2017**, the U.S. has experienced **219** distinct billion-dollar weather & climate events - each causing at least \$1 billion in direct losses

- **Total, direct losses from these 219 events exceeds \$1.5 trillion** (CPI-adjusted, as of Dec., 2017)

Billion-dollar events to affect the U.S. from 1980 to 2017 (CPI-Adjusted)

DISASTER TYPE	NUMBER OF EVENTS	PERCENT FREQUENCY	CPI-ADJUSTED LOSSES (BILLIONS OF DOLLARS)	PERCENT OF TOTAL LOSSES	AVERAGE EVENT COST (BILLIONS OF DOLLARS)	DEATHS
 Drought	25	11.4%	\$236.6 <small>CI</small>	15.4%	\$9.5	2,993 <sup>†</sup>
 Flooding	28	12.8%	\$119.9 <small>CI</small>	7.8%	\$4.3	540
 Freeze	8	3.7%	\$27.6 <small>CI</small>	1.8%	\$3.5	162
 Severe Storm	91	41.6%	\$206.1 <small>CI</small>	13.4%	\$2.3	1,578
 Tropical Cyclone	38	17.4%	\$850.5 <small>CI</small>	55.3%	\$22.4	3,461
 Wildfire	15	6.8%	\$53.6 <small>CI</small>	3.5%	\$3.6	238
 Winter Storm	14	6.4%	\$43.1 <small>CI</small>	2.8%	\$3.1	1,013
 All Disasters	219	100.0%	\$1,537.4 <small>CI</small>	100.0%	\$7.0	9,985

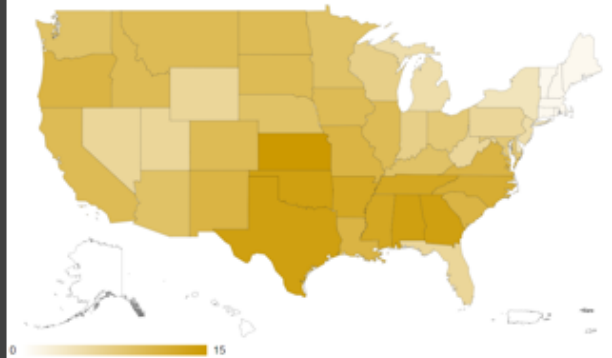


# The Nation is weather and climate conscious...for good reason, as each geographic region faces unique hazards

## Billion-dollar weather and climate disasters frequency mapping: 1980-2017\*

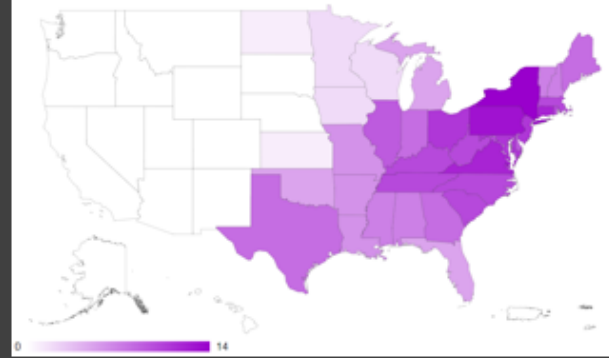
### Droughts and Heat Waves

1980-2017\* Billion-Dollar Drought Disasters By State (CPI-Adjusted)



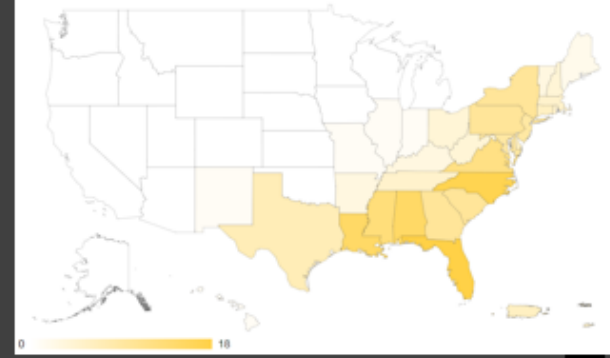
### Winter Storms

1980-2017\* Billion-Dollar Winter Storm Disasters By State (CPI-Adjusted)



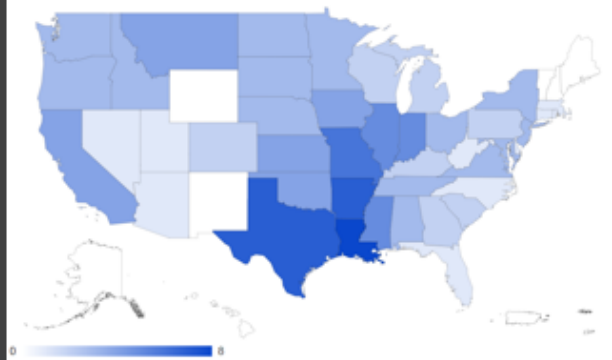
### Tropical Cyclones

1980-2017\* Billion-Dollar Tropical Cyclone Disasters By State (CPI-Adjusted)



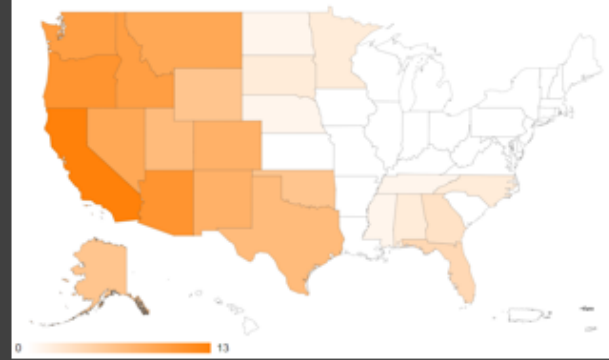
### Flooding

1980-2017\* Billion-Dollar Flooding Disasters By State (CPI-Adjusted)



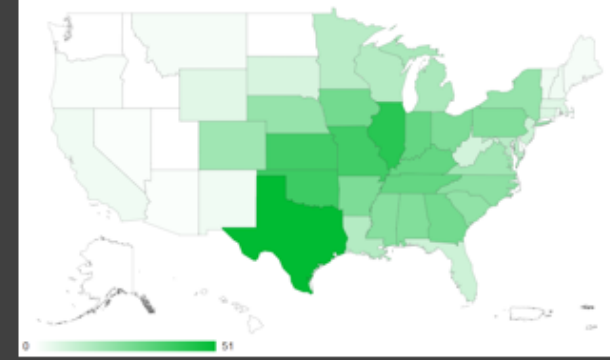
### Wildfires

1980-2017\* Billion-Dollar Wildfire Disasters By State (CPI-Adjusted)



### Severe Local Storms

1980-2017\* Billion-Dollar Severe Storm Disasters By State (CPI-Adjusted)



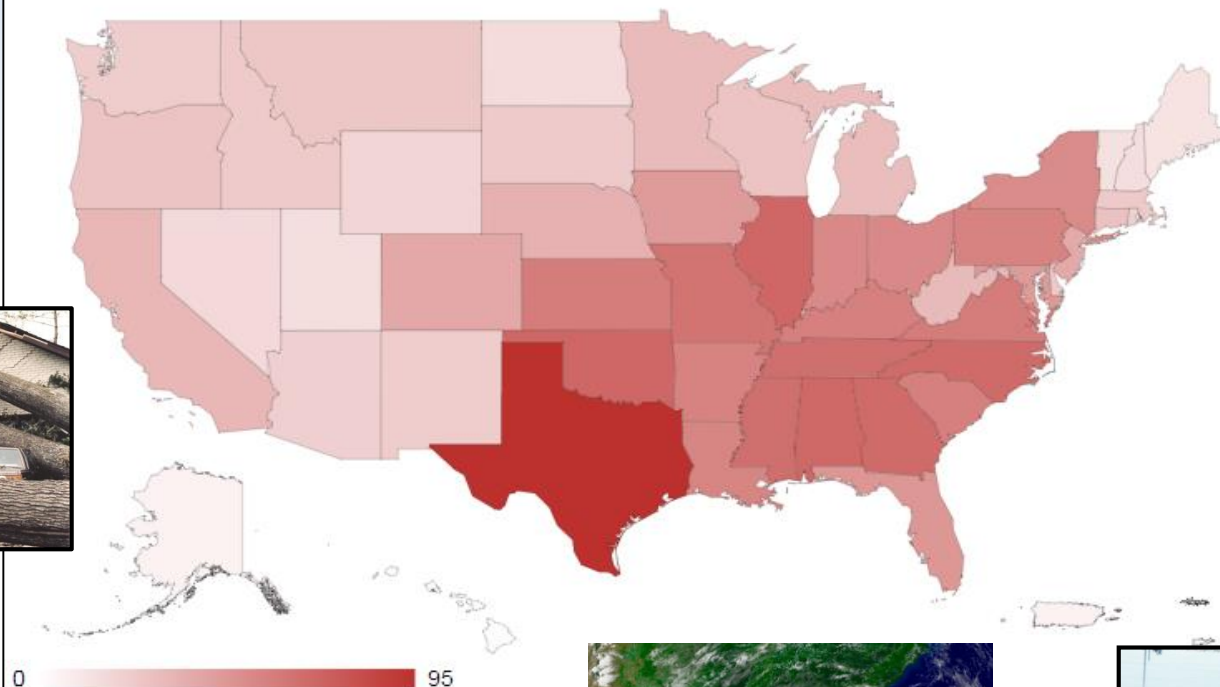
\* 219 weather and climate disasters reached or exceeded \$1 billion during this period (CPI-adjusted); cost > \$1.5 trillion in damages

Please note that the map reflects a summation of billion-dollar events for each state affected (i.e., it does not mean that each state shown suffered at least \$1 billion in losses for each event).

# From 1980–2017, the U.S. **South/Central** and **Southeast** regions experienced a higher frequency of billion-dollar disaster events than any other region

## Cumulative Frequency for all U.S. Billion-dollar Disasters

1980-2017\* Billion-Dollar Weather and Climate Disasters By State (CPI-Adjusted)



Please note that the map reflects a summation of billion-dollar disasters. States shown suffered at least \$1 billion in losses for each event.

→ Reflects the **diversity, frequency, & severity** of weather & climate events impacting this region



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**For interactive data, charts, mapping and event summaries, see:**  
**[www.ncdc.noaa.gov/billions](http://www.ncdc.noaa.gov/billions)**

See new article on: **“2017 U.S. billion-dollar weather and climate disasters: a historic year in context”**  
**[www.climate.gov/news-features/blogs/beyond-data/2017-us-billion-dollar-weather-and-climate-disasters-historic-year](http://www.climate.gov/news-features/blogs/beyond-data/2017-us-billion-dollar-weather-and-climate-disasters-historic-year)**



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**For more detail on data, methodology and uncertainty, see:**

- Smith A.B. and J.M. Matthews, 2015: Quantifying Uncertainty and Variable Sensitivity within the U.S. Billion-dollar Weather and Climate Disaster Cost Estimates. *Natural Hazards*, 77, 1829-1851 (<https://www.ncdc.noaa.gov/billions/docs/smith-and-matthews-2015.pdf>)
- Smith, A.B. and R.W. Katz, 2013: U.S. Billion-dollar weather and climate disasters: Data sources, trends, accuracy and biases. *Natural Hazards*, 67, 387–410 (<https://www.ncdc.noaa.gov/billions/docs/smith-and-katz-2013.pdf>)



# Backup slides

# NCEI products span from local to global, and weekly to decadal scales

