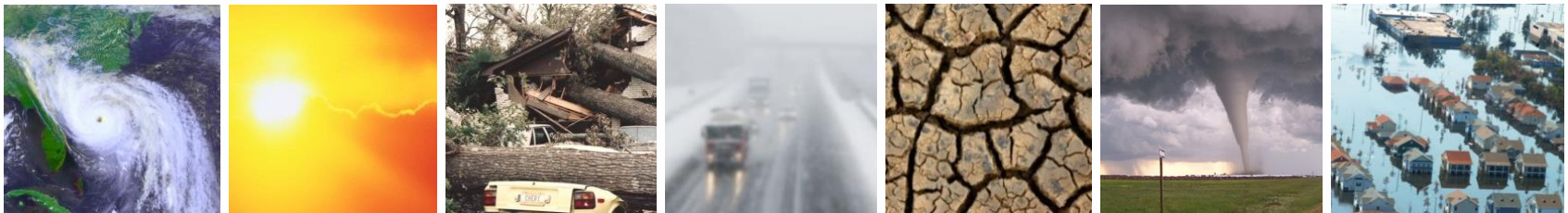


# U.S. Billion-dollar Weather and Climate Disasters of 2017 – in Context

Adam B. Smith, Applied Climatologist

NOAA National Centers for Environmental Information (NCEI)  
Center for Weather and Climate



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# 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

Loss of  
Life

Mental  
Health

Physical  
Health

Quality of  
Life

GDP

Net  
Economic

Market

Non-  
market

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

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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
<b>Data</b>	<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
<b>Temporal Period</b>	1949- present	1964-present (state) 1989-present (county)	1968-present	1948-present (state) 1989-present (county)	1983-present	1960-present	By specific disaster
<b>Spatial Resolution</b>	State-level	State-level County-level	State-level	State-level County-level	River-basin, State-level	Region, State, county	State-level
<b>Update Lag Time</b>	Weeks to months	Weeks to months	Several months	Weekly, monthly, Annual (depending on data product)	Annual report	Days to weeks	Several months
<b>Data Sources</b>	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
<b>Changes in Recording Threshold</b>	\$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	

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

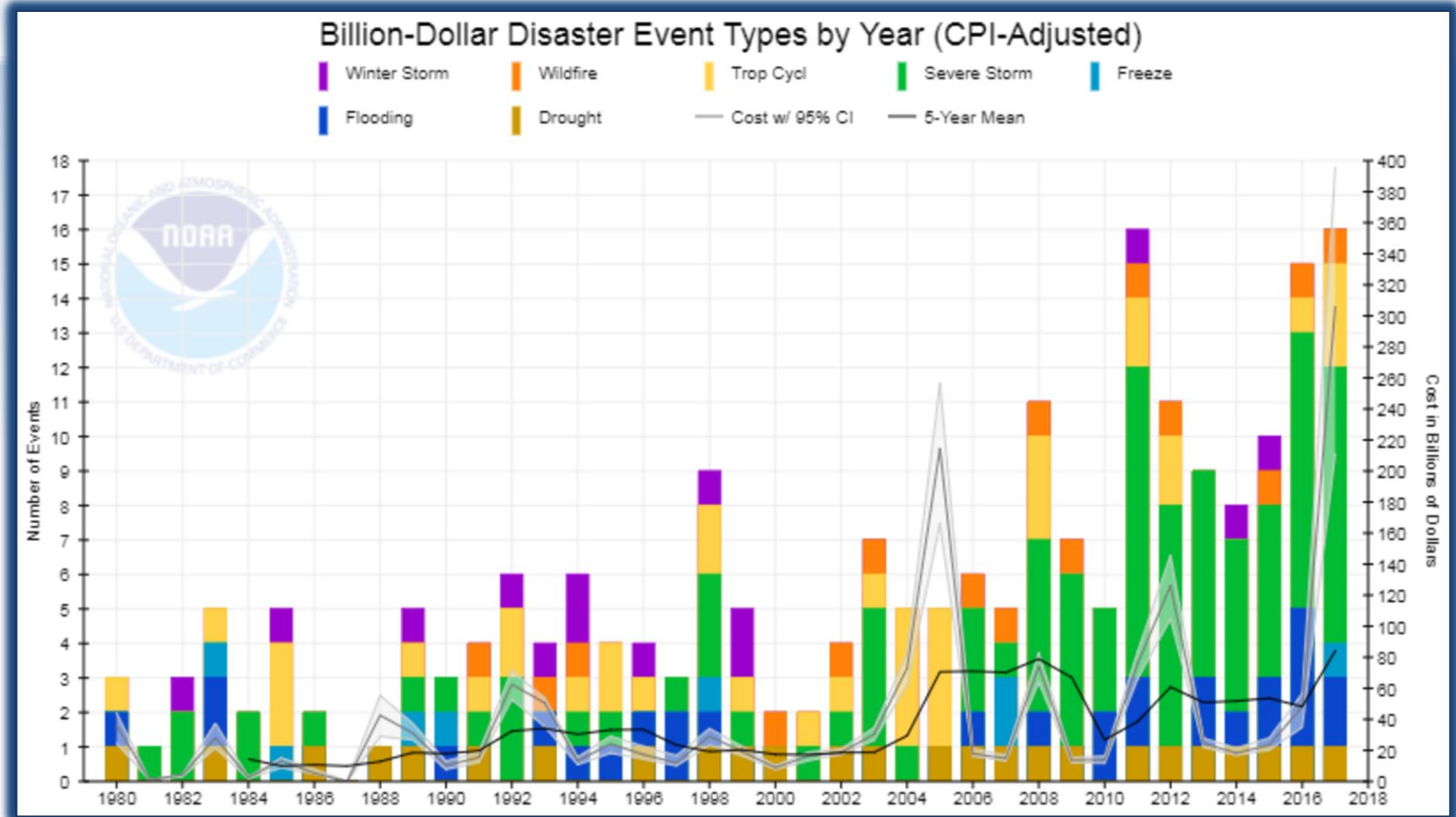


*This map denotes the approximate location for each of the 16 billion-dollar weather and climate disasters that impacted the United States during 2017.*

- 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



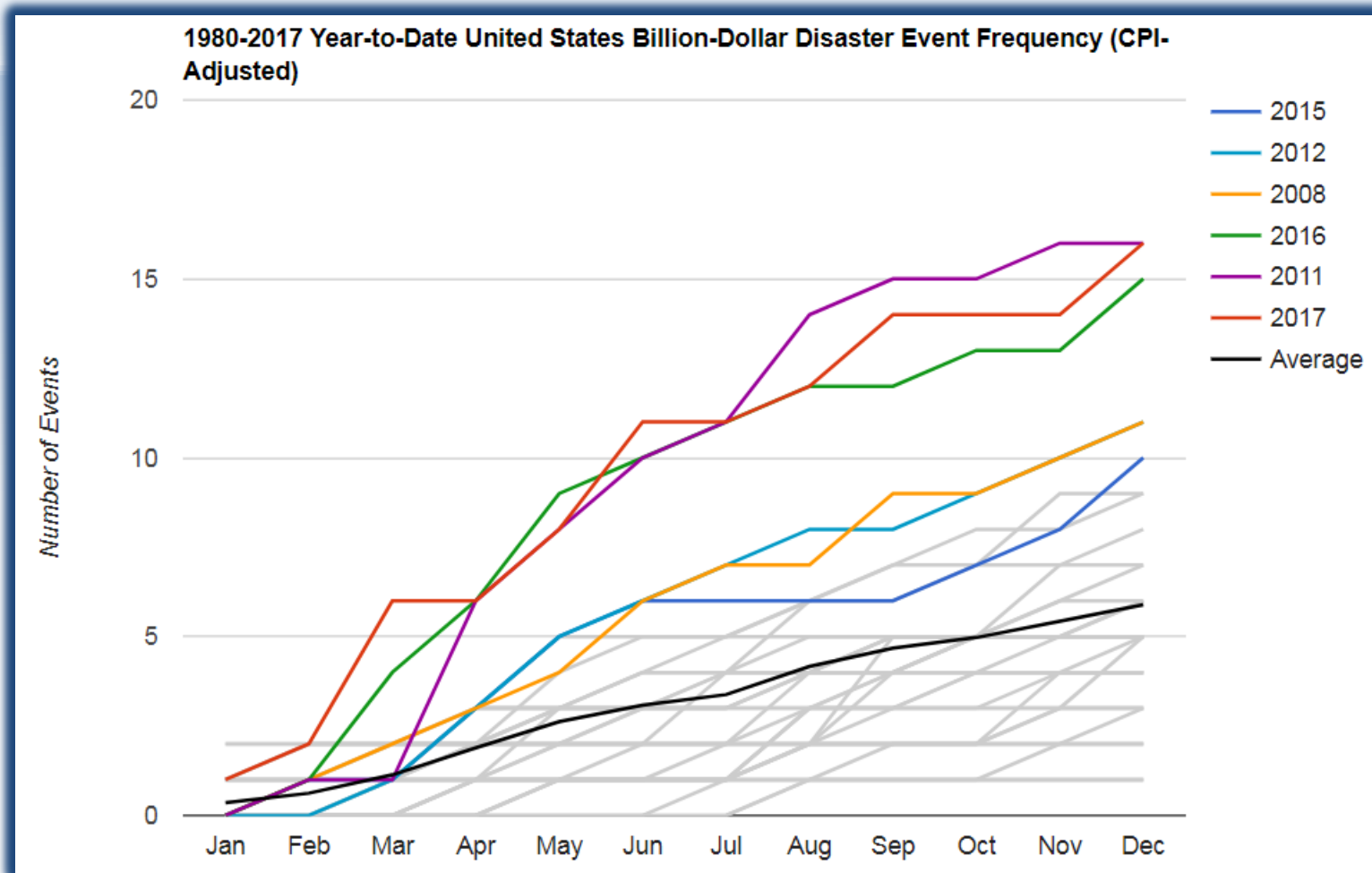
# U.S. Billion-dollar event frequency, annual cost, 5-year cost average (1980–2017)



- 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

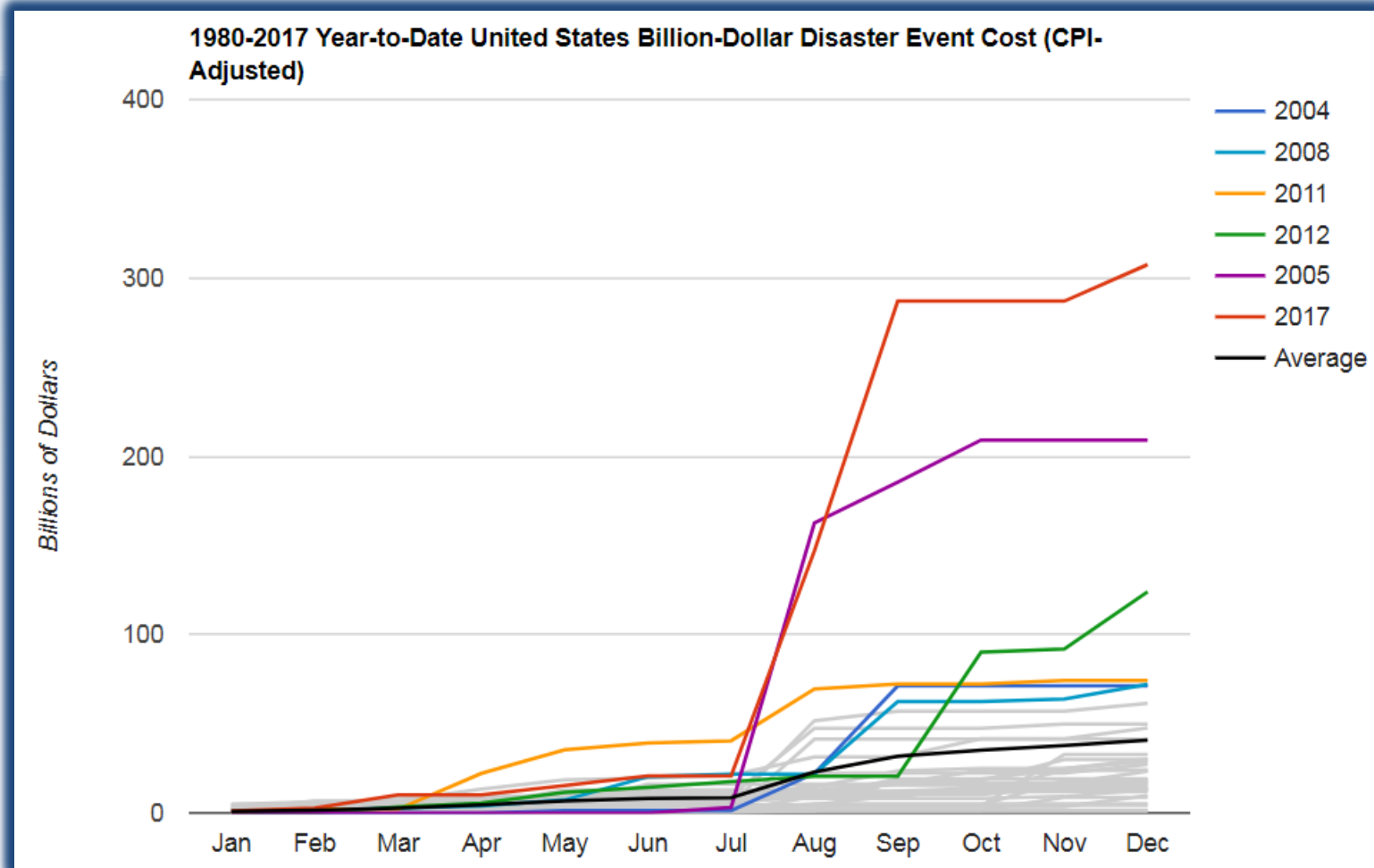


## The most active years:

- **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)



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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

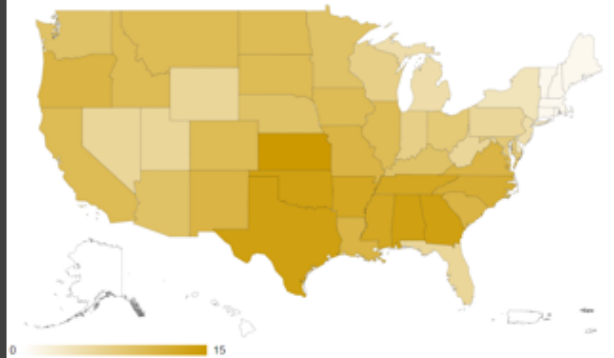


# The Nation is weather and climate conscious...for good reason, as each geographic region faces unique hazards

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

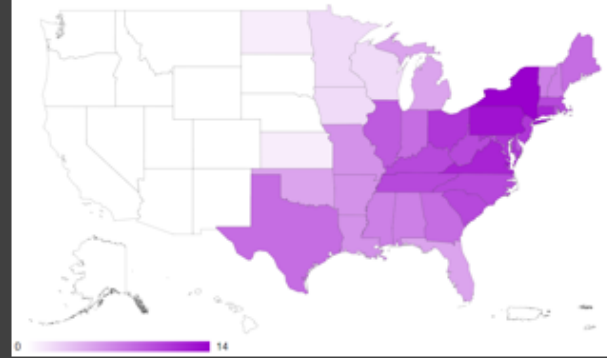
### Droughts and Heat Waves

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



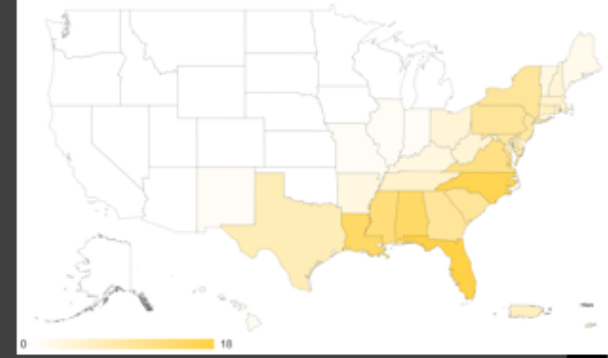
### Winter Storms

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



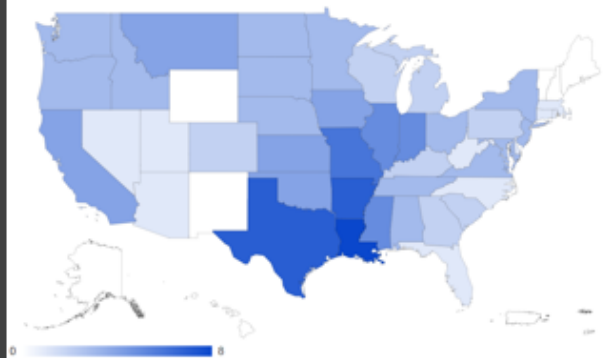
### Tropical Cyclones

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



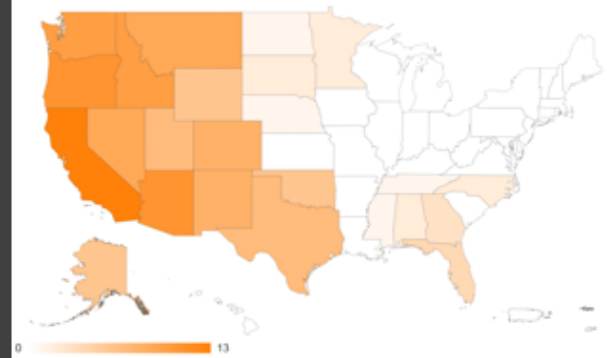
### Flooding

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



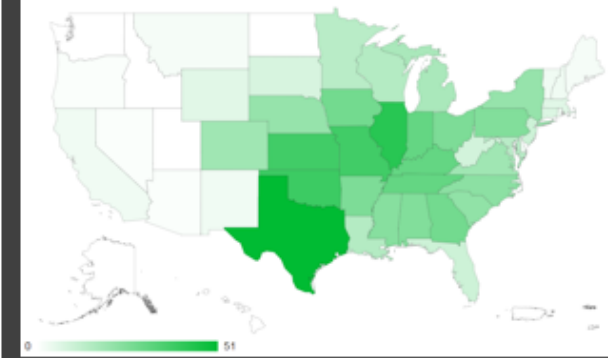
### Wildfires

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



### Severe Local Storms

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



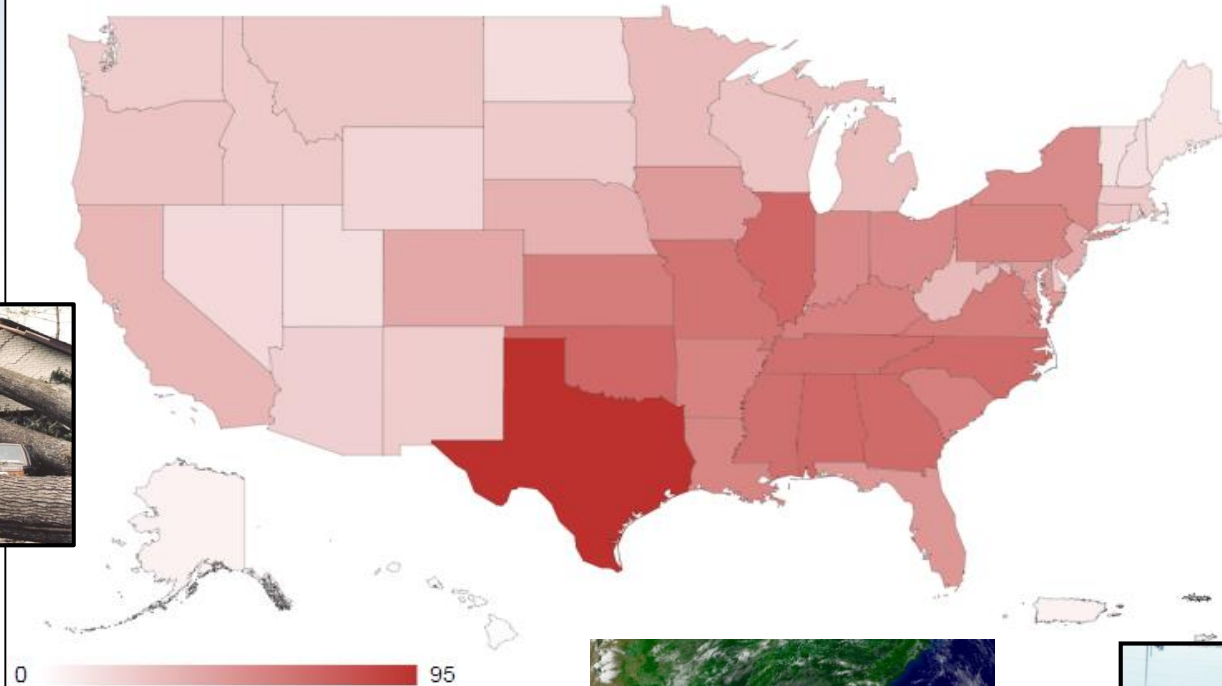
\* 219 weather and climate disasters reached or exceeded \$1 billion during this period (CPI-adjusted); cost > \$1.5 trillion in damages

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).

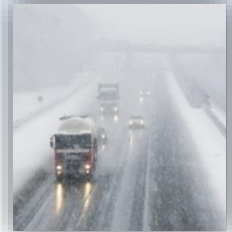
# From 1980–2017, the U.S. **South/Central** and **Southeast** regions experienced a higher frequency of billion-dollar disaster events than any other region

## 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





**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)**



**Adam.Smith@noaa.gov**

**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

