

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

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Center for Weather and Climate



U.S. Billion-dollar Weather and Climate Disasters

Outline:

- **Context for Measuring Disaster Impact**
- Data Sources / What we are Measuring
- 2017 U.S. 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 (>80%) of the damage** from **all recorded** U.S. weather and climate events (NCEI; Munich Re, 2018).

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)

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

Measures

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 <u>total, direct losses</u> (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

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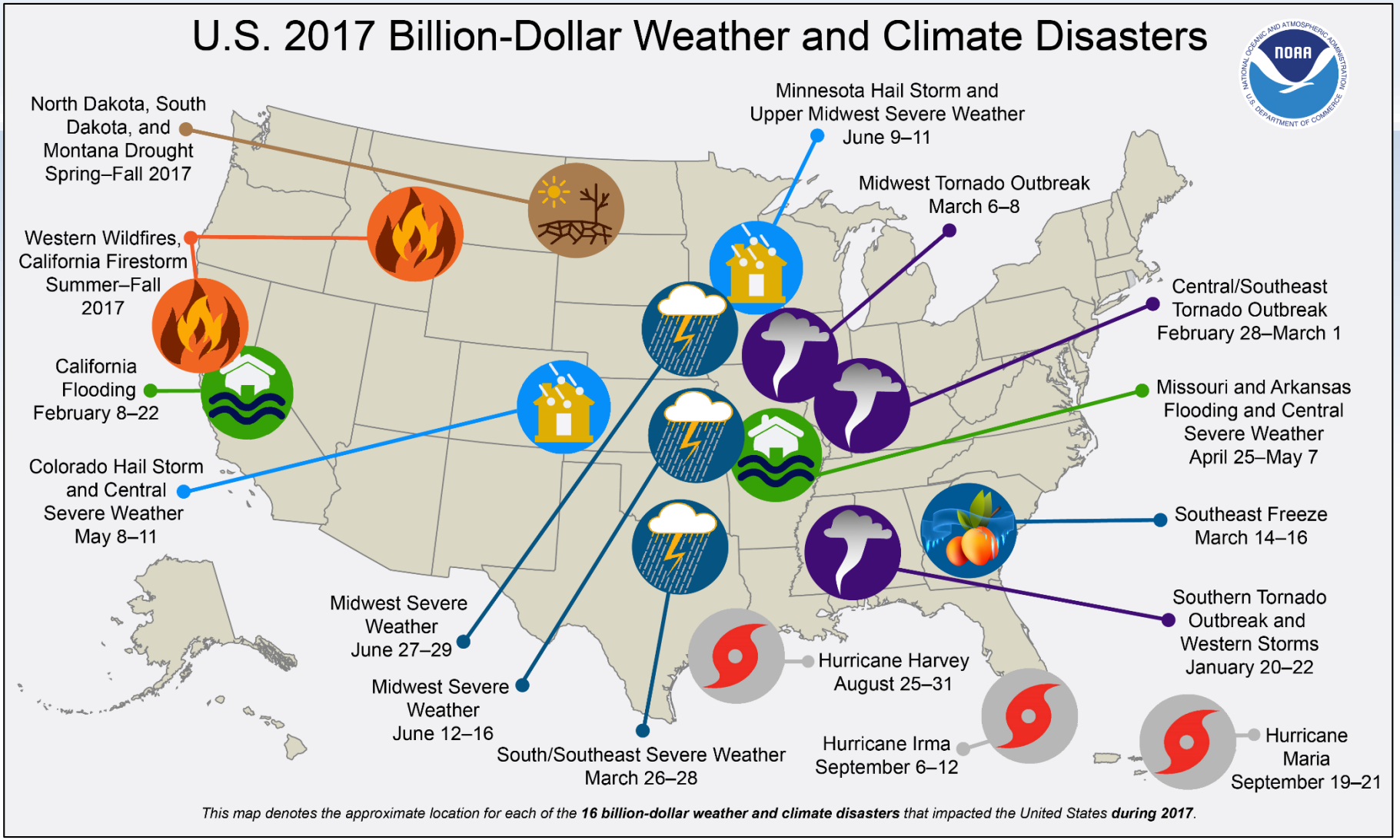






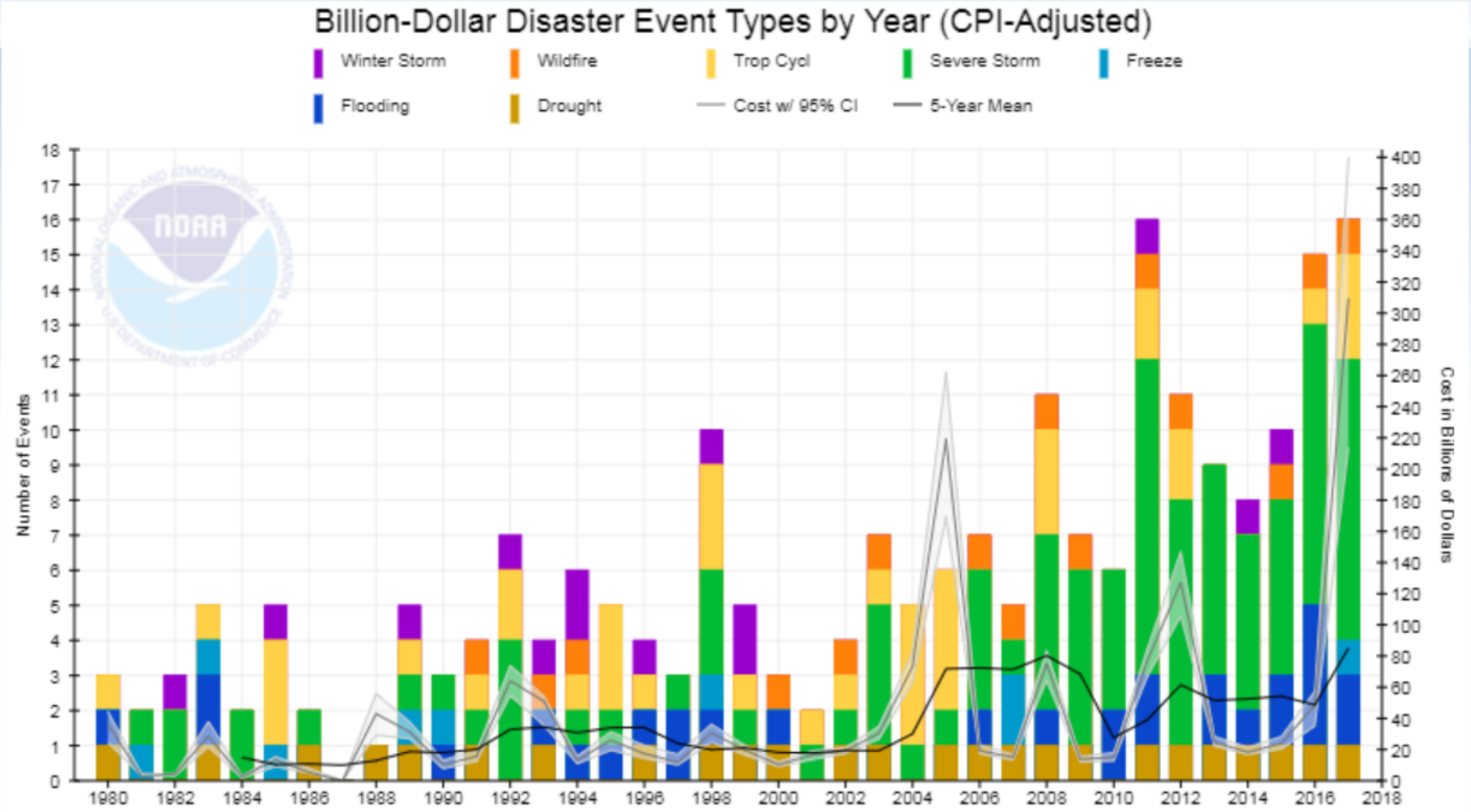


U.S. 2017 Billion-Dollar Weather and Climate Disasters



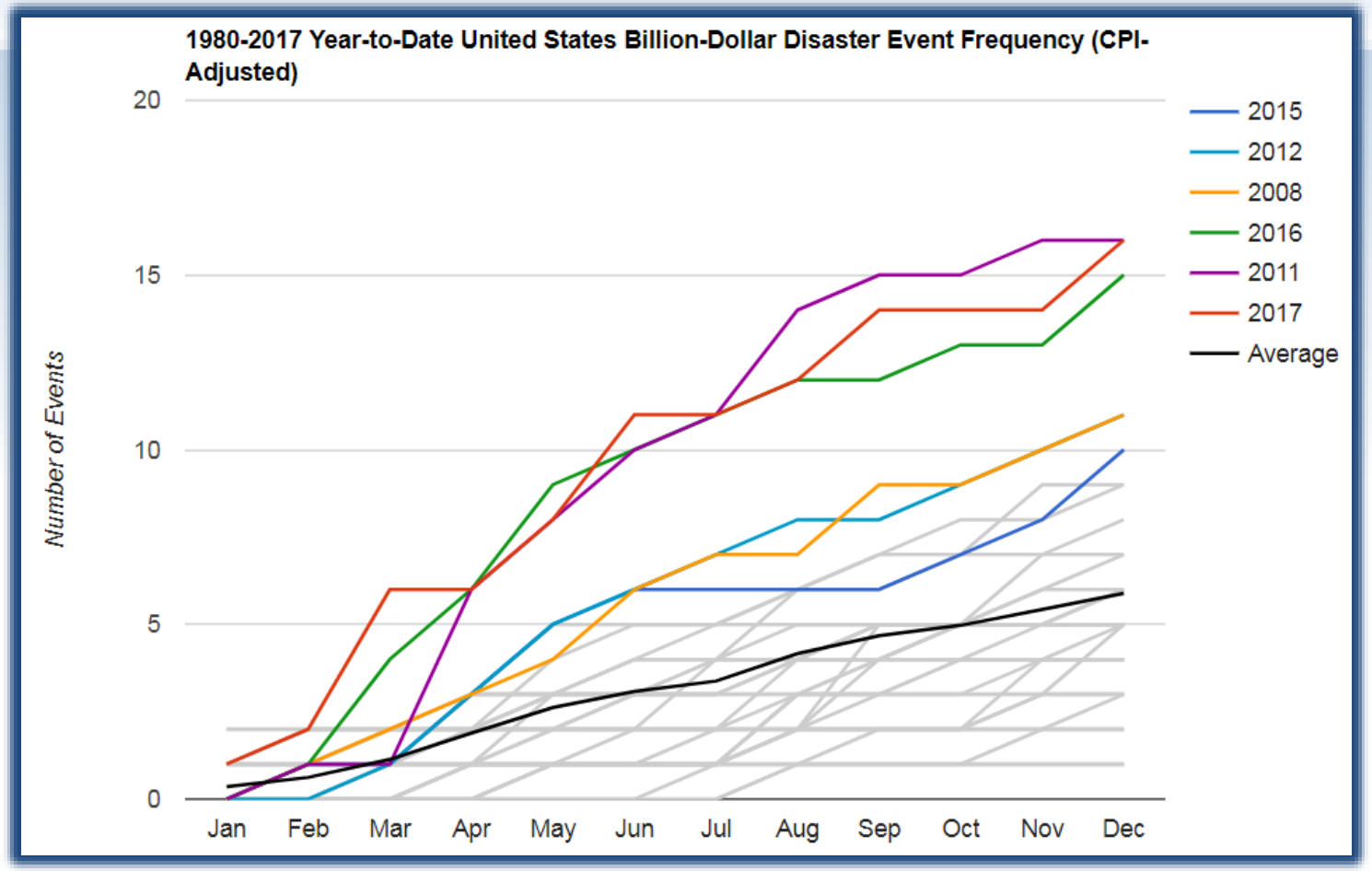
- In **2017**, the U.S. experienced **16 disaster events;** Total, direct costs >**$300 billion in damages; > 360 fatalities**
- The 2017 events: 2 flooding events, 1 freeze event, 8 severe storm events, 3 tropical cyclones, drought & wildfire
- **2017 was historic: Most costly U.S. hurricane season ($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 that 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

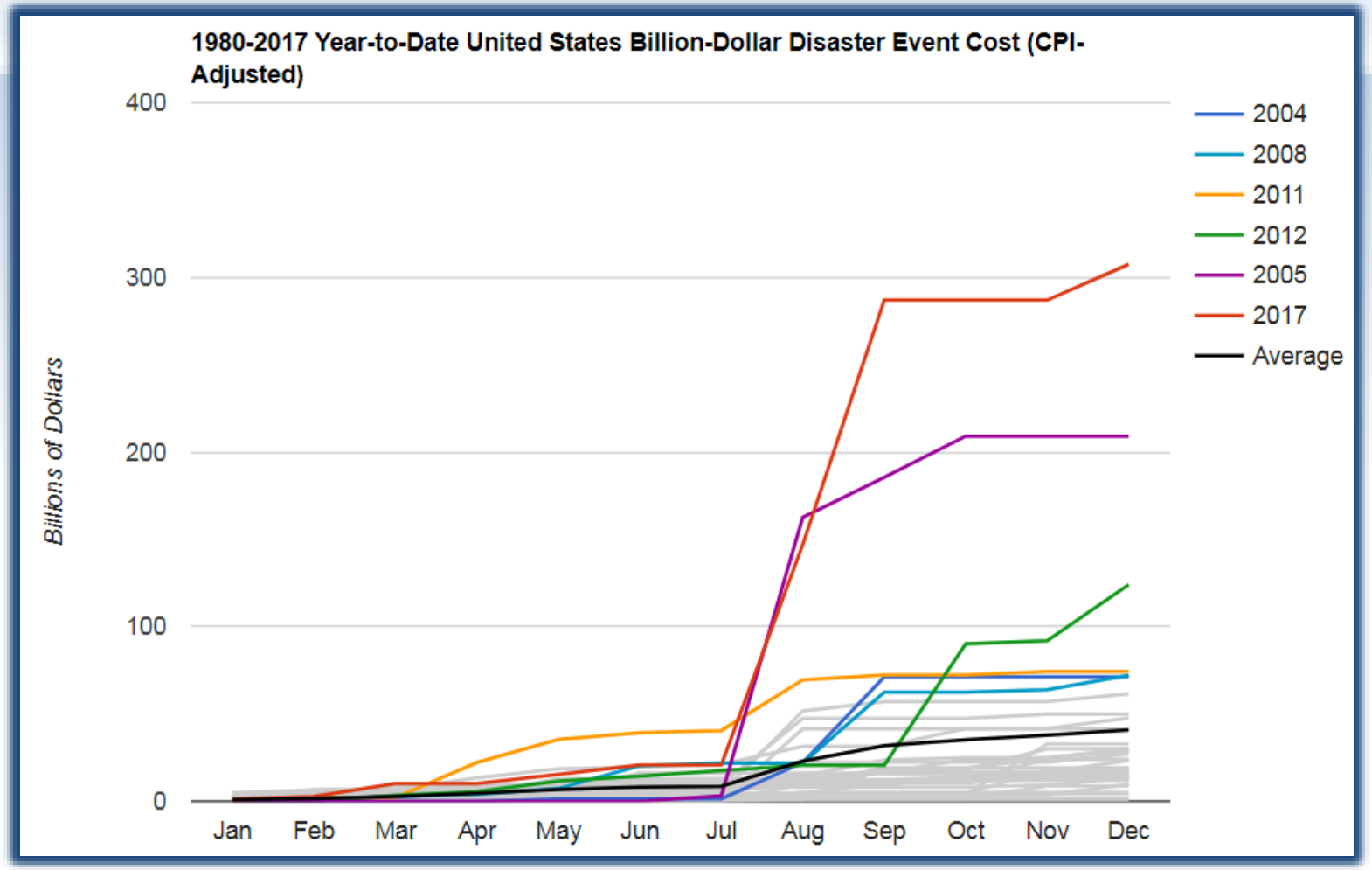
Cumulative billion-dollar disaster frequency (year-to-date) for all years 1980-2017



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: **6.0 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 <u>new U.S. annual record</u>**
- **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 227 distinct billion-dollar weather & climate events - each causing at least $1 billion in direct losses

- **Total, direct losses** from these **227 events** exceeds **$1.5 trillion** (CPI-adjusted, as of Dec., 2017)

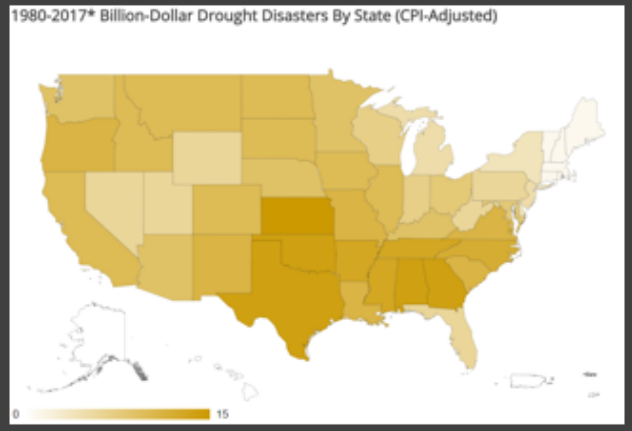
Billion-dollar events to affect the U.S. from 1980 to 2017 (CPI-Adjusted)

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	11.0%	$239.1 CI	15.3%	$9.6	2,993†
Flooding	29	12.8%	$122.5 CI	7.8%	$4.2	543
Freeze	9	4.0%	$29.3 CI	1.9%	$3.3	162
Severe Storm	95	41.9%	$213.2 CI	13.6%	$2.2	1,607
Tropical Cyclone	40	17.6%	$862.0 CI	55.1%	$21.6	3,469
Wildfire	15	6.6%	$54.3 CI	3.5%	$3.6	238
Winter Storm	14	6.2%	$43.6 CI	2.8%	$3.1	1,013
All Disasters	227	100.0%	$1,564.0 CI	100.0%	$6.9	10,025

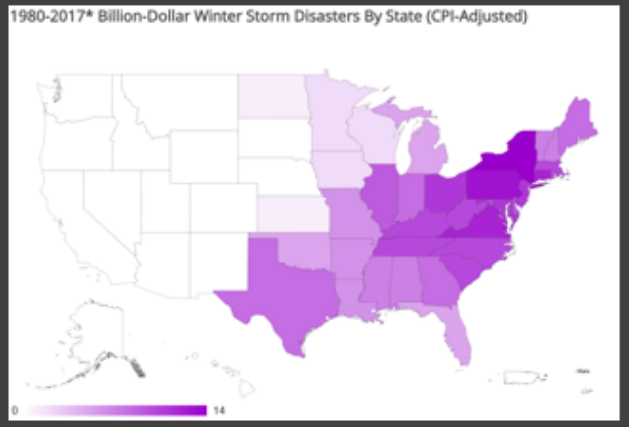
The Nation is weather and climate conscious…for good reason,
as each geographic region faces unique hazards

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

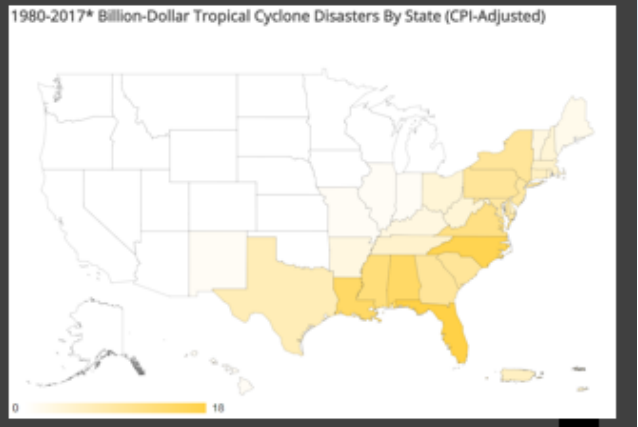
Droughts and Heat Waves



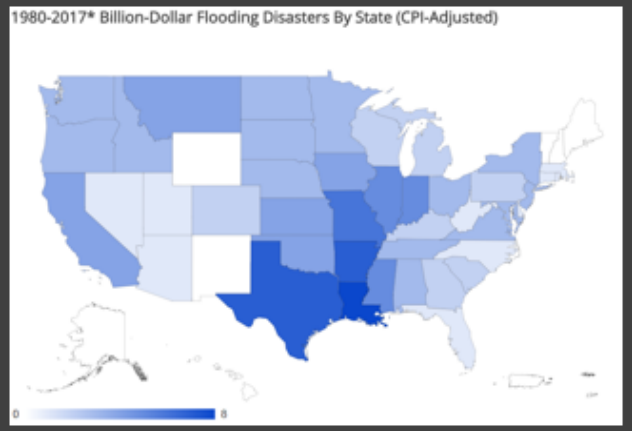
Winter Storms



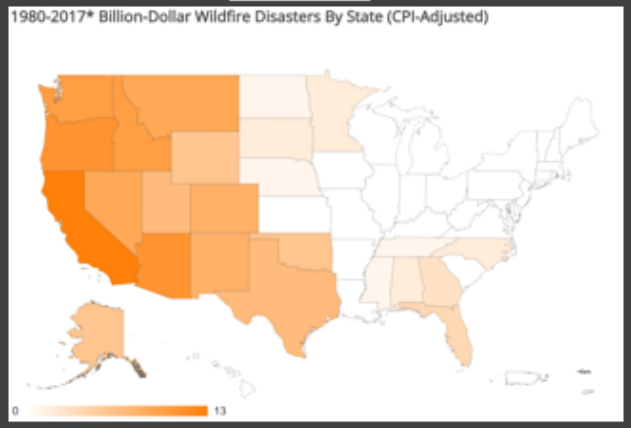
Tropical Cyclones



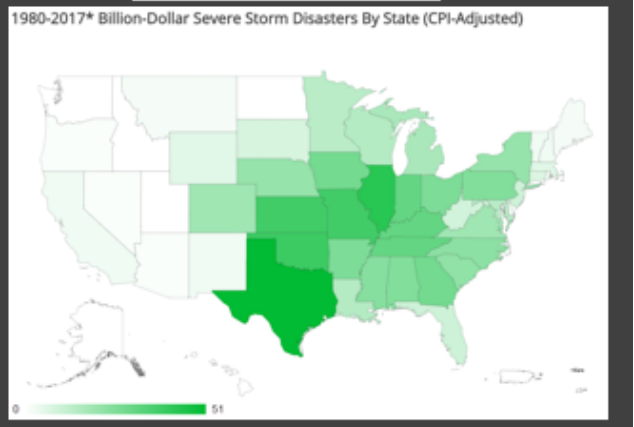
Flooding



Wildfires



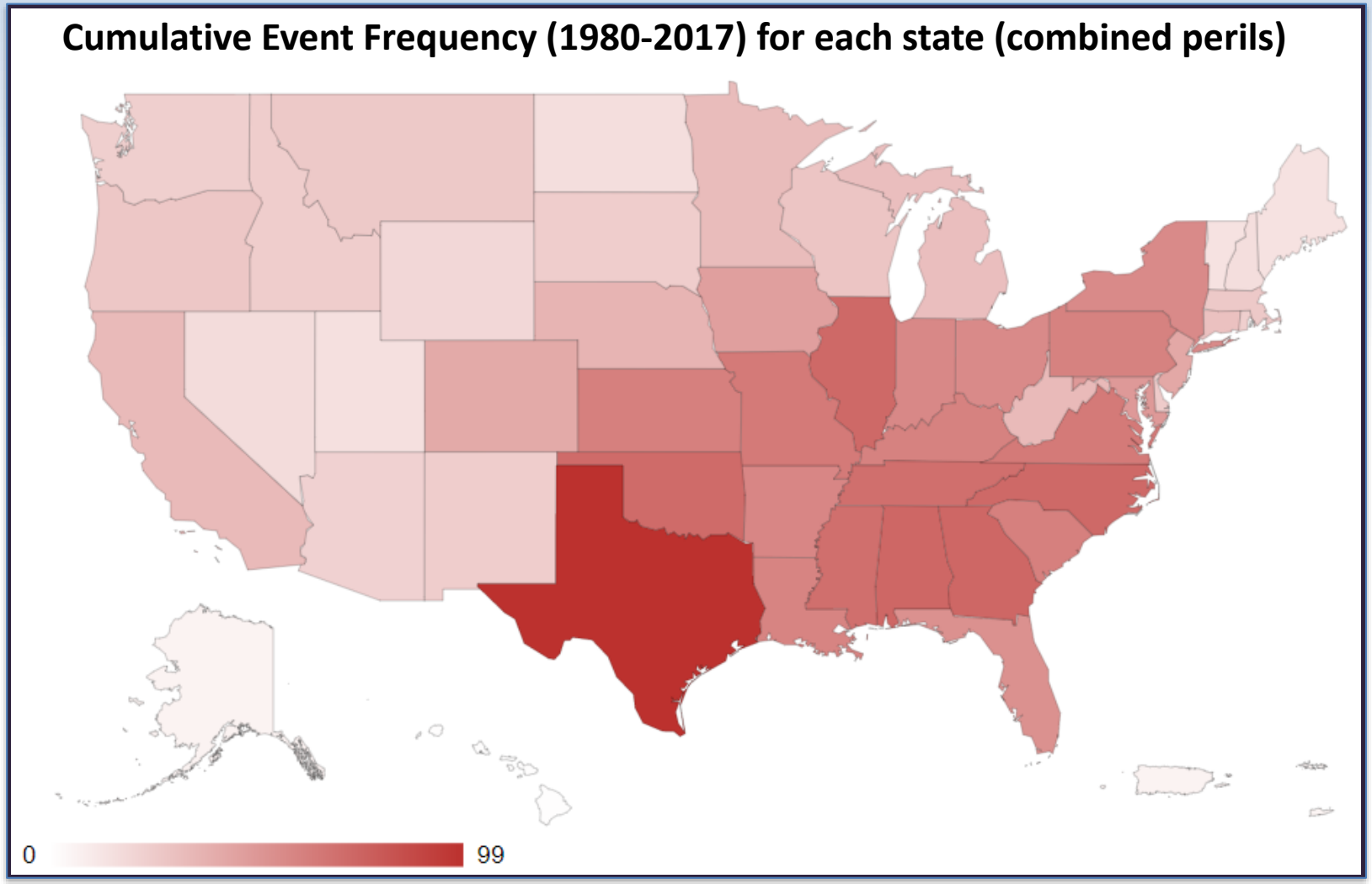
Severe Local Storms



* 227 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).

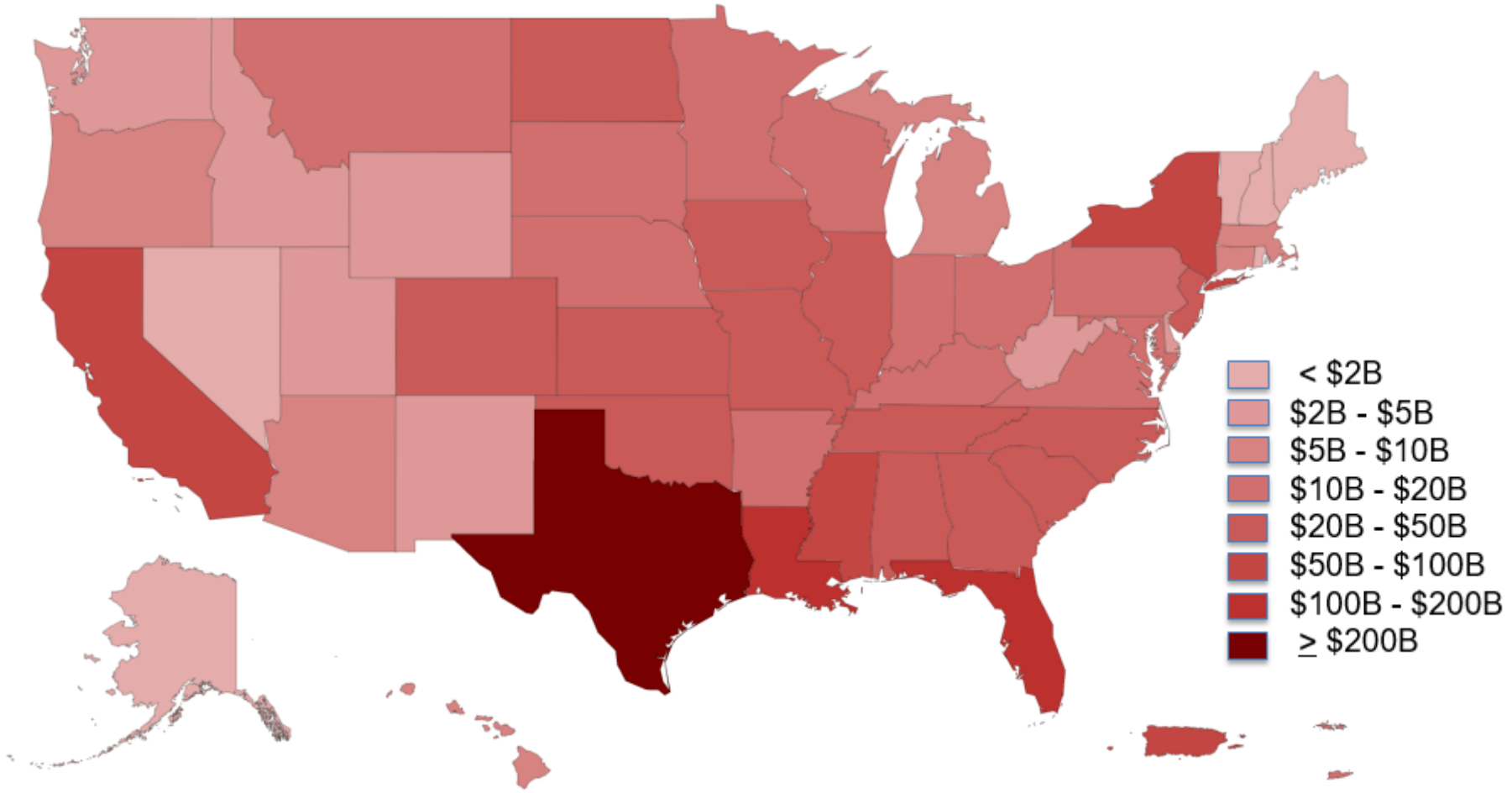
From 1980–2017, the U.S. **South/Central** and **Southeast** regions experienced a higher frequency of billion-dollar disaster events than any other region



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

From 1980–2017, the U.S. **South/Central** and **Southeast** regions experienced a higher cost from billion-dollar disaster events. CA, NY, NJ, PR and V.I. as well.

Cumulative Event Costs (1980-2017) for each state (CPI-adjusted)



→ Reflects the **severity** & **vulnerability** of weather & climate events impacting different regions

For interactive data, charts, mapping and event summaries, see:

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



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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

Note: not all data sources listed here	ISO/PCS	FEMA (state/local disaster assistance)	FEMA (NFIP)	USDA	USACE	NIFC	State Agencies
Data	Provided: Residential, - Commercial property - Business interruption, - Vehicles (insured w/ comprehensive cover) -Boats, Inland marine -Demand surge Not provided: Agriculture, Flooding, Aviation, Ocean Marine, Loss above limits	Provided: Government disaster assistance, debris removal, financial aid Public Assistance, Housing Assistance, Individual Assistance, Small Business loan Assistance	Provided: Insured flood loss for residential and commercial properties	Provided: Insured multi-peril crop/livestock insurance payouts, crop progress and quality reports market value of crop production	Provided: Annual flood event summaries and major flood event reports that detail levee damage, other damages	Provided: Wildfire losses to structures; commercial timber; wildfire suppression costs, deaths; acreage burned	Provided: 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	

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

	Daily/Weekly	Monthly	Seasonal – Annual	Annual to Decadal
Local	Snowfall Impact Index – FEMA, disaster response	Heating & Cooling Degree Days – Energy Sector	Temperature & Precipitation Outlooks – Agriculture	Billion $ Disasters, Climate Extremes Index – Insurance
Regional	Hurricane Tracks – Emergency Planners	Space Weather – Aviation Industry	Drought Outlook – Agriculture	Climate Normals – Construction, Infrastructure, Agriculture
National & Global	Drought Monitor – Agriculture	Global and U.S. Climate Summaries – Numerous Sectors	Annual State of the Climate Reports – Scientists	IPCC & National Climate Assessments – Gov't Policymakers