

CEC Flood Costing Project
Preliminary Findings from the United States

2nd CEC Virtual Expert Workshop

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Overall Approach for Application of the CEC Method

January – April (2020) – Data Gathering

- Coordinated with federal agency partners for data collection
  - NOAA provided guidance for major “billion dollar” flood events and recommended data sources
  - Support for data collection from other federal agencies
- Conducted a desktop review of federal agency program websites and Data.gov to identify and compile available flooding disaster damage and loss datasets.
  - Initial focus was to obtain federal “open access” datasets (county-level damage/loss data) – not private institution, state/local agency, or tribal government data sources
- Assessed underlying metadata and sources

April (2020) – present

- Data analysis and documentation
- Ongoing coordination with key federal agency representatives and academic experts to identify additional data sources and for assistance with data interpretation

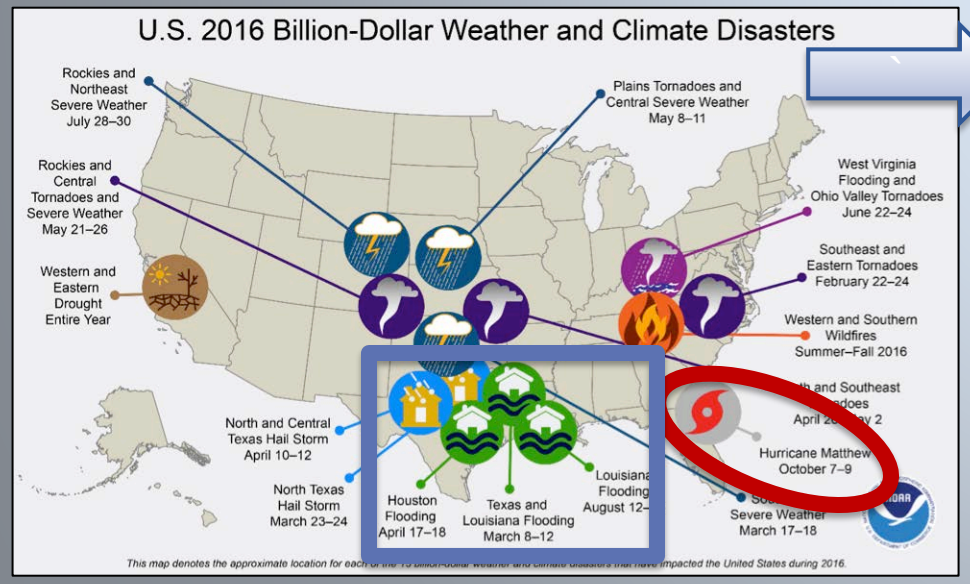
Data Sources for the United States

- Federal Emergency Management Agency **(FEMA) Disaster Declarations**
- FEMA **National Flood Insurance Program** (NFIP)
- **FEMA Individual Assistance** Program (IA)
- **FEMA Public Assistance** Funded Program (PAFP)
- National Oceanic and Atmospheric Administration **(NOAA) Storm Event**
- United States Department of Agriculture **(USDA) RMA**
- Small Business Administration **(SBA) Disaster Loans**

Data Collection Process and Analysis

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	15.4%	$9.5	2,993†
Flooding	28	12.8%	$119.9	7.8%	$4.3	540
Freeze	8	3.7%	$27.6	1.8%	$3.5	162
Severe Storm	91	41.6%	$206.1	13.4%	$2.3	1,578
Tropical Cyclone	38	17.4%	$850.5	55.3%	$22.4	3,461
Wildfire	15	6.8%	$53.6	3.5%	$3.6	238
Winter Storm	14	6.4%	$43.1	2.8%	$3.1	1,013
All Disasters	219	100.0%	$1,537.4	100.0%	$7.0	9,985



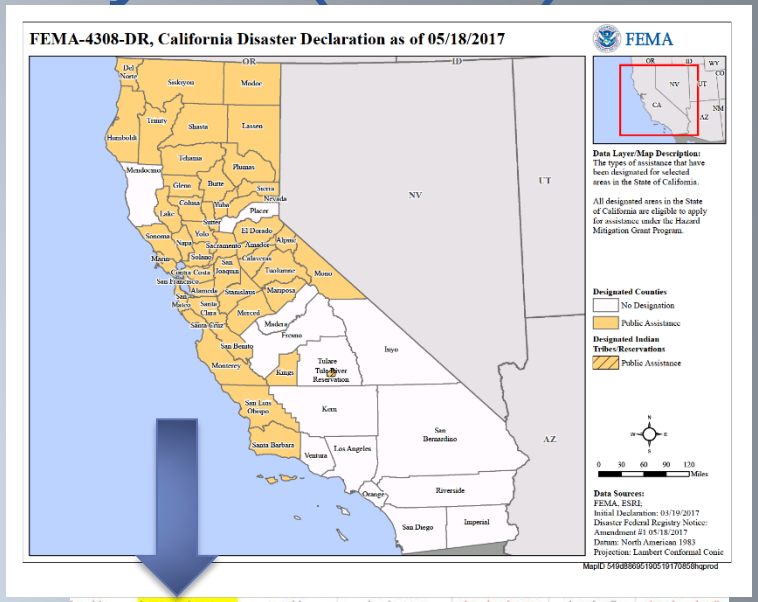
A Total of **17 Disaster Events** from 2013 to 2017 **with Flooding**

Disaster Name	Disaster Type	Total CPI-Adjusted Cost (Millions of Dollars)
Colorado Flooding *(September 2013)*	Flooding	1689.5
Michigan and Northeast Flooding *(August 2014)*	Flooding	1145.2
South Carolina and East Coast Flooding *(October 2015)*	Flooding	2218
Texas and Louisiana Flooding *(March 2016)*	Flooding	2501.3
Houston Flooding *(April 2016)*	Flooding	2916.8
Louisiana Flooding *(August 2016)*	Flooding	10900
California Flooding *(February 2017)*	Flooding	1605

Source: https://www.ncdc.noaa.gov/billions/

Data Collection Process and Analysis (cont.)

- Flood **disaster numbers** were used to **connect data** from other sources.
- Damages and losses were also **connected using**: 1) **date of disaster**, 2) event description and **type of loss**, 3) the **counties of occurrence**.
- Individual **types of damages and losses** for each event and episode were **sorted and aggregated at the county level** and applied to the appropriate indicator.
- **Interpretation** of federal data was **based on metadata**, government **documentation**, and the **description of underlying categories** for each cost.
- **Some data were** identified, but **not included in the database – state and tribal** government **damages**, and other costs due to uncertainty.



loc_id	loc_mun/cou	ev_id	ho_house	des_ho_house	ho_dwell	des_ho_dwell
US00006	Colusa (County)	EVF00001 (Flood)	158759.04	FEMA_NFIP	598670.95	FEMA_NFIP
US00007	Contra Costa (Cou	EVF00001 (Flood)	50000	FEMA_NFIP	474542.86	FEMA_NFIP
US00008	Del Norte (County	EVF00001 (Flood)				
US00009	El Dorado (County	EVF00001 (Flood)	58021.41	FEMA_NFIP	219569.75	FEMA_NFIP
US00010	Glenn (County)	EVF00001 (Flood)	163110.17	FEMA_NFIP	458403.09	FEMA_NFIP
US00011	Humboldt (County	EVF00001 (Flood)			6700	FEMA_NFIP
US00012	Inyo (County)	EVF00001 (Flood)				
US00013	Kings (County)	EVF00001 (Flood)				
US00014	Lake (County)	EVF00001 (Flood)	26290.26	FEMA_NFIP	1253006.04	FEMA_NFIP
US00015	Lassen (County)	EVF00001 (Flood)	4014.75	FEMA_NFIP	844992.1	FEMA_NFIP
US00016	Marin (County)	EVF00001 (Flood)	17238.44	FEMA_NFIP	518638.74	FEMA_NFIP
US00017	Mariposa (County	EVF00001 (Flood)				
US00018	Merced (County)	EVF00001 (Flood)	573.55	FEMA_NFIP	80864.55	FEMA_NFIP
US00019	Modoc (County)	EVF00001 (Flood)				
US00020	Mono (County)	EVF00001 (Flood)				
US00021	Monterey (County	EVF00001 (Flood)	74657.38	FEMA_NFIP	418700.16	FEMA_NFIP
US00022	Napa (County)	EVF00001 (Flood)			1843.31	FEMA_NFIP
US00023	Nevada (County)	EVF00001 (Flood)			27771.56	FEMA_NFIP
US00024	Plumas (County)	EVF00001 (Flood)	19939.22	FEMA_NFIP	389382.69	FEMA_NFIP
US00025	Resighini Rancher	EVF00003 (Flood)				
US00026	Sacramento (Coun	EVF00001 (Flood)	76859.95	FEMA_NFIP	813468.46	FEMA_NFIP
US00027	San Benito (Count	EVF00001 (Flood)	3689.82	FEMA_NFIP	261229.6	FEMA_NFIP
US00028	San Joaquin (Coun	EVF00001 (Flood)	1261.95	FEMA_NFIP	53176.24	FEMA_NFIP
US00029	San Luis Obispo (	EVF00001 (Flood)			54363.77	FEMA_NFIP
US00030	San Mateo (Count	EVF00001 (Flood)	3550.29	FEMA_NFIP	47598.28	FEMA_NFIP
US00031	Santa Barbara (Co	EVF00001 (Flood)	73474.93	FEMA_NFIP	582669.54	FEMA_NFIP
US00032	Santa Clara (Coun	EVF00001 (Flood)	241733.2	FEMA_NFIP	6706508.94	FEMA_NFIP
US00033	Santa Cruz (Count	EVF00001 (Flood)	42278.85	FEMA_NFIP	902792.18	FEMA_NFIP
US00034	Shasta (County)	EVF00001 (Flood)	143996.35	FEMA_NFIP	429218.61	FEMA_NFIP
US00035	Sierra (County)	EVF00001 (Flood)	4943.61	FEMA_NFIP	82897.24	FEMA_NFIP
US00036	Siskiyou (County)	EVF00001 (Flood)			5808.04	FEMA_NFIP
US00037	Solano (County)	EVF00001 (Flood)	16843.22	FEMA_NFIP	141151.32	FEMA_NFIP
US00038	Sonoma (County)	EVF00001 (Flood)			36577.23	FEMA_NFIP
US00039	Stanislaus (County	EVF00001 (Flood)	8400	FEMA_NFIP	102778.1	FEMA_NFIP
US00040a	Sutter (County)	EVF00001 (Flood)			237165.35	FEMA_NFIP
US00041	Tehama (County)	EVF00001 (Flood)	3321.54	FEMA_NFIP	47383.28	FEMA_NFIP

Overview of Events Included in the CEC Database

Colorado Flooding *(September 2013)* **$1.7 billion**

U.S. (2013 to 2017)

Michigan and Northeast Flooding *(August 2014)* **$1.1 billion**

California Flooding *(February 2017)* **$1.6 billion**

South Carolina and East Coast Flooding *(October 2015)* **$2.2 billion**

Houston Flooding *(April 2016)* **$2.9 billion**

Texas and Louisiana Flooding *(March 2016)* **$2.5 billion**

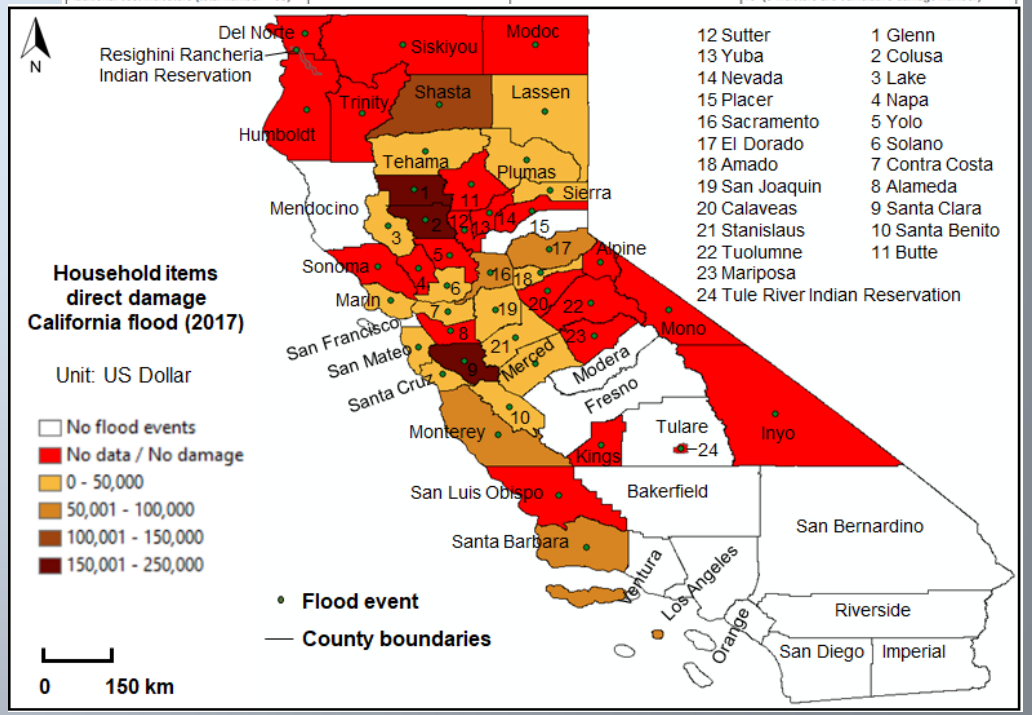
Louisiana Flooding *(August 2016)* **$11 billion**

Summary Overview of the Data from the U.S.

- **Two** of seven **flooding events** included in database
- **Colorado Flooding (2013)**
  - Disaster declaration **(DR) 4145**
- **California Flooding (2017)**

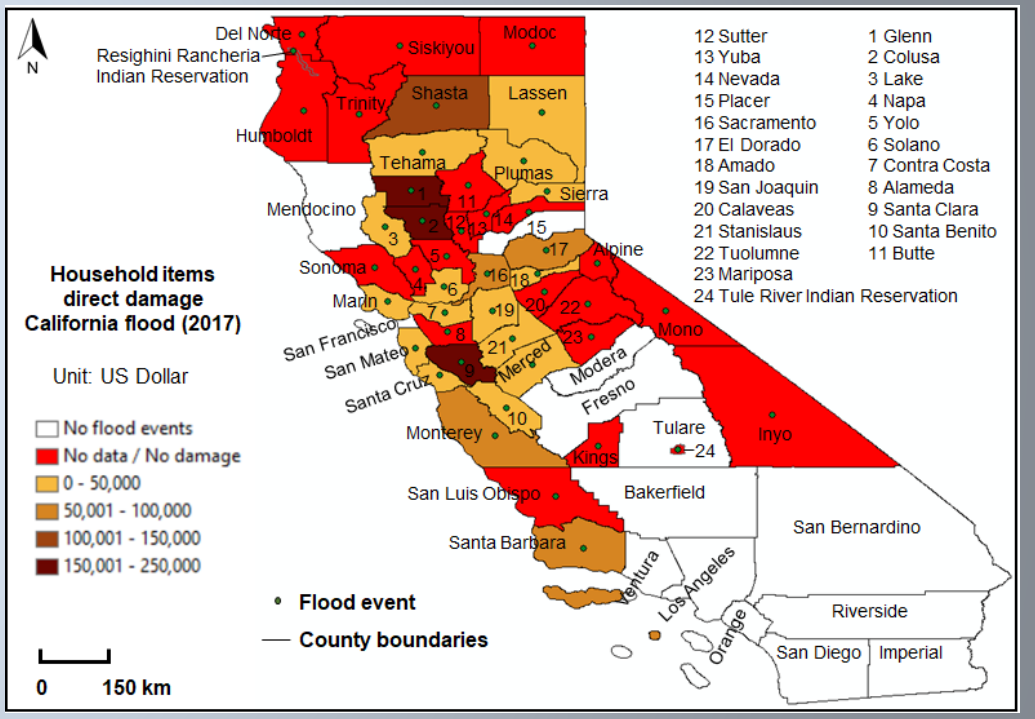
  Involved **three** FEMA **disasters:**
  - 4308 – affecting 42 counties and 1 Tribal community
  - 4312 – Resighini Rancheria Tribal community
  - 3381 – Oroville spillway (dam/levee break)
- **Colorado (2013) and California (2017)**
  - Of 55 Direct Damage Indicators: **9**
  - Of 35 Additional Cost Indicators: **2**
  - Of 15 Indirect Damage Indicators: **0**
  - *Data to be added:* additional SBA and FEMA HA **household damages, temporary housing, and business economic loss**

Damage categories	Flood events, Canada, 2013- 2017 Indictors which have data	Flood events, the United States, 2013- 20 Indictors which have data	Flood events, Mexico, 2013- 2017 Indictors which have data
		State of Colorado, September 2013	State of Chiapas, May 2013
Direct damage indicators (total number = 55)		9	47
Indirect damage indicators (total number = 15)		0	4
Additional cost indicators (total number = 35)		2	18 (8 indicators are cumulative damage number)
Indigenous community flood damage indicators		N/A	N/A
Total		11	69
		State of California, February 2017	State of Guerrero, September 2013
Direct damage indicators (total number = 55)		9	52 (14 indicators are cumulative damage number)
Indirect damage indicators (total number = 15)		0	8
Additional cost indicators (total number = 35)		2	21 (9 indictors are cumulative damage number)
Indigenous community flood damage indicators		N/A	N/A
Total		11	81
Direct damage indicators (total number = 55)	Contains data for 8 significant flood events and and 3 sub-events from 2013 – 2017 across 9 provinces under 8 categories		State of Nuevo León, September 2013
Indirect damage indicators (total number = 15)			52 (7 indicators are cumulative damage number)
Additional cost indicators (total number = 35)			8
Indigenous community flood damage indicators			28 (8 indicators are cumulative damage number)
Total			N/A
			81
Direct damage indicators (total number = 55)			State of Baja California Sur, September 2014
Indirect damage indicators (total number = 15)			42
Additional cost indicators (total number = 35)			6
			15 (8 indictors are cumulative damage number)



Summary Overview of the Data from the U.S. (cont.)

- Limited damage data – Figure represents the spatial distribution of **county-level house damages** and is approximately **$1.2 million**.
- **Damage data for each event varied** – higher house and contents damages were evident for Colorado Flooding than for California Flooding.
- **Database does not include damages** associated with the Oroville Dam spillway – initial estimates were $100 to $200 million and later estimates were much higher.
- Some **data is highly aggregated and data for other sectors**, such as agriculture, may be **missing** or **incomplete.**



The Most Significant Data Challenges for the U.S.

- **Geographic and spatial differences** may result in the omission of some damages and losses.
- **Uncertainty** with the **costing of cumulative** and **multi-impact events** (e.g., hurricanes).
- Federal agencies record damages and losses differently, and in some cases, it is **difficult to accurately link the damages and losses** to a specific flood event **across the multiple datasets**.
- Data for **damages and losses** are **defined and categorized differently** and may not reflect the definitions of the database indicators.
- A **lack of available and accessible data** from other federal programs and **state, tribal, and territorial** governments, **private insurers** and **NGOs may have additional data**.
- **Multiple** U.S. datasets provide **damages and losses for the same indicator**.
- **Uncertainty with repair and replacement damages** and differentiating the “increased cost of compliance”

Improving The Data Situation in the U.S.

- Assistance with **data gaps, interpretation**, and **access to** additional **sources**.
- Additional **insights on data sharing** among federal programs and other state and local governments and non-governmental organizations for emergency flooding response and damage costs.
- Improved **understanding of data collection methods** for flooding damages and losses **across government agencies** and programs
  - Additional details about specific events, types of loss, and damage and loss costs
- **Additional data** for flood-related damages and losses
  - How accessible are these data?
  - Some data not available without a **Freedom of Information** Act (**FOIA**) request
  - What is the level of aggregation of data?