

Supplementary Materials for Springer-Nature Natural Hazards

Multi-Hazard and Loss Event Sets for the Contiguous US

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Key Points:

- A customizable tool has been developed to curate multi-hazard event sets based on spatio-temporal overlapping events from the NOAA NCEI Storm Database
- A multi-hazard event set was generated and visualized for the contiguous US at the county-scale based on 36 hazard and peril types between 1996 and 2024
- Spatial distribution, frequent hazard types and multi-hazard pairs, intra-annual seasonal timing, and total losses are presented
- The majority of multi-hazards occur in the spring and summer, and involve thunderstorms, tornadoes, and tropical cyclones in the Southwest US, the Central US, and along the US Gulf and East Coasts

Appendix A - Supplementary Material

Table A1. Example of a 10-day AE event set with synthetic data.

EVENT ID	EPISODE ID	GEO ID	STATE FIPS	COUNTY FIPS	BEGIN DATETIME UTC	END DATETIME UTC	EVENT TYPE	HAZARD
1	1	12105	12	105	09-01-2005 07:30:00	09-02-2005 12:00:00	Thunderstorm Wind	tw
2	2	01005	01	005	04-13-2021 08:00:00	04-18-2021 01:30:00	Wildfire	wf
3	3	12105	12	105	09-01-2005 08:10:00	09-01-2005 08:35:00	Lightning	ltn
4	1	12105	12	105	09-02-2005 15:00:00	09-03-2005 12:30:00	Flash Flood	pfl
5	4	39075	39	075	12-06-2008 13:00:00	06-22-2008 08:00:00	Snow	sn
6	5	40109	40	109	08-05-1996 14:00:00	08-05-1996 14:25:00	Hail	hl
7	4	40109	40	109	12-06-1996 06:00:00	12-07-1996 01:00:00	Cold/Wind Chill	cw
8	6	17079	17	079	11-02-2014 06:15:00	12-02-2014 10:30:00	Fog	fg

Table A2. Example of a 10-day SH event set with synthetic data, as derived from Table A1.

EVENT ID	EPISODE ID	GEO ID	STATE FIPS	COUNTY FIPS	BEGIN DATETIME UTC	END DATETIME UTC	EVENT TYPE	HAZARD
2	2	01005	01	005	04-13-2021 08:00:00	04-18-2021 01:30:00	Wildfire	wf
5	4	39075	39	075	12-06-2008 13:00:00	06-22-2008 08:00:00	Snow	sn
6	5	40109	40	109	08-05-1996 14:00:00	08-05-1996 14:25:00	Hail	hl
7	4	40109	40	109	12-06-1996 06:00:00	12-07-1996 01:00:00	Cold/Wind Chill	cw
8	6	17079	17	079	11-02-2014 06:15:00	12-02-2014 10:30:00	Fog	fg

Table A3. Example of a 10-day MHP event set with synthetic data, as derived from Table A1.

EVENT ID	EPISODE ID	PAIR ID	OVERLAPPING EVENT IDs	GEO ID	STATE FIPS	COUNTY FIPS	BEGIN DATETIME UTC	END DATETIME UTC	EVENT TYPE	HAZARD
1	1	1	3,4	12105	12	105	09-01-2005 07:30:00	09-02-2005 12:00:00	Thunderstorm Wind	tw
3	3	1	1,4	12105	12	105	09-01-2005 08:10:00	09-01-2005 08:35:00	Lightning	ltn
1	1	2	3,4	12105	12	105	09-01-2005 07:30:00	09-02-2005 12:00:00	Thunderstorm Wind	tw
4	1	2	1,3	12105	12	105	09-02-2005 15:00:00	09-03-2005 12:30:00	Flash Flood	pfl

Table A4. Example of a 10-day MH event set with synthetic data, as derived from Table A3.

EVENT ID	EPISODE ID	GEO ID	STATE FIPS	COUNTY FIPS	BEGIN DATETIME UTC	END DATETIME UTC	EVENT TYPE	HAZARD
1	1	12105	12	105	09-01-2005 07:30:00	09-02-2005 12:00:00	Thunderstorm Wind	tw
3	3	12105	12	105	09-01-2005 08:10:00	09-01-2005 08:35:00	Lightning	ltn
4	1	12105	12	105	09-02-2005 15:00:00	09-03-2005 12:30:00	Flash Flood	pfl

Hazard Event Sets Log Count by County (1996-2024)

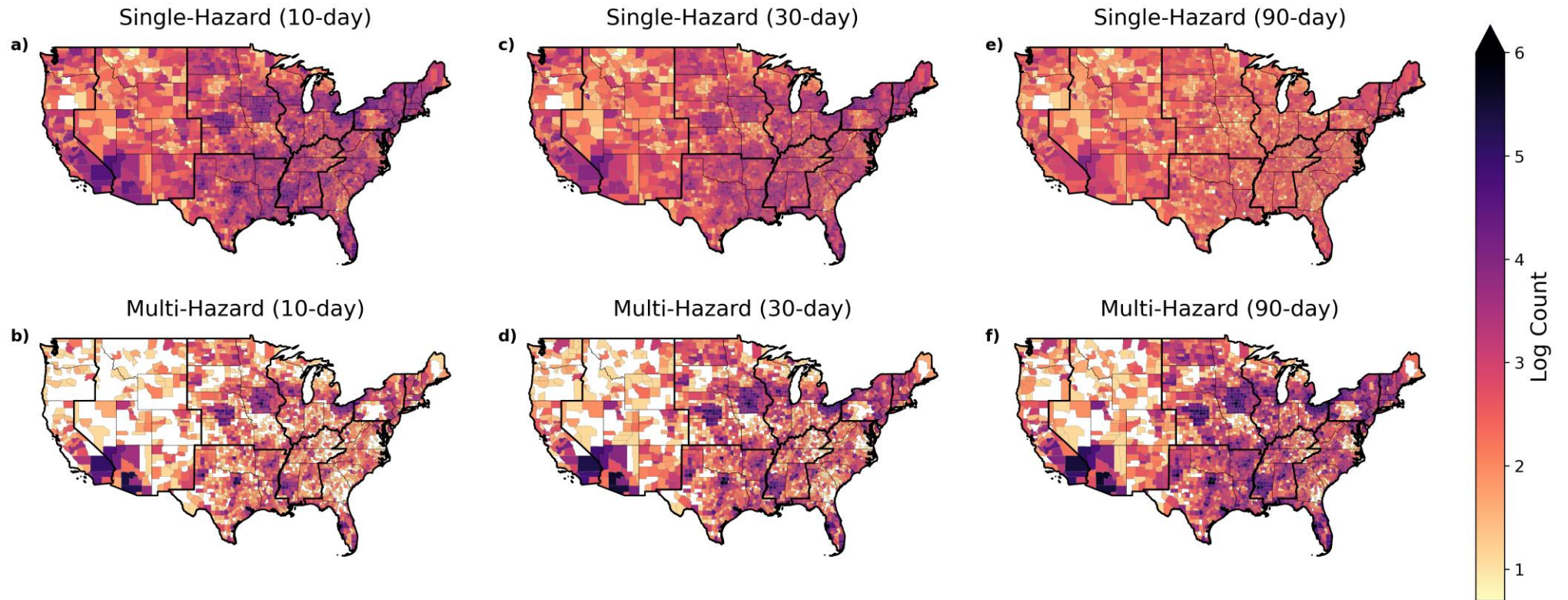


Figure A1. Maps of county-aggregated (1996-2024) hazard natural log count for single-hazard and multi-hazard 10-day (a,b), 30-day (c,d), and 90-day (e,f) event sets.

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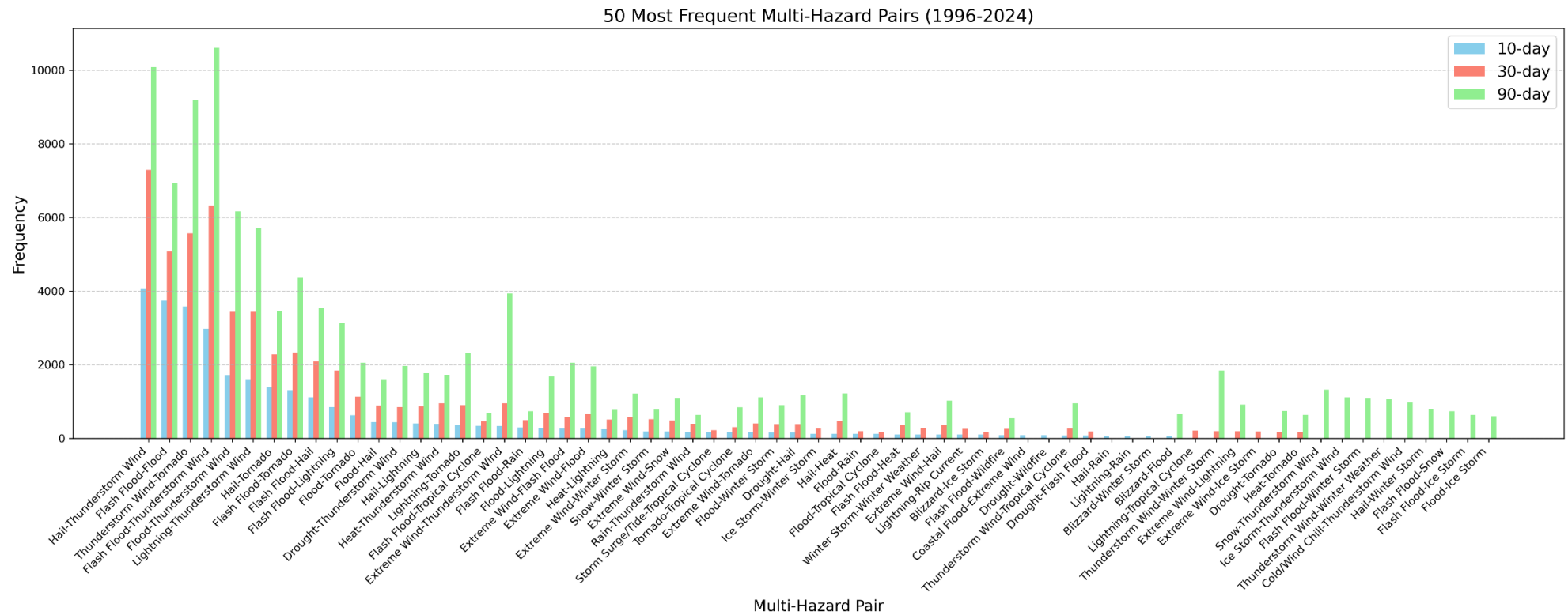


Figure A2. Histogram of the 50 most frequent MHPs for the 10-day (blue), 30-day (red), and 90-day (green) MHP event sets, listed in ranked order according to the 10-day event set.

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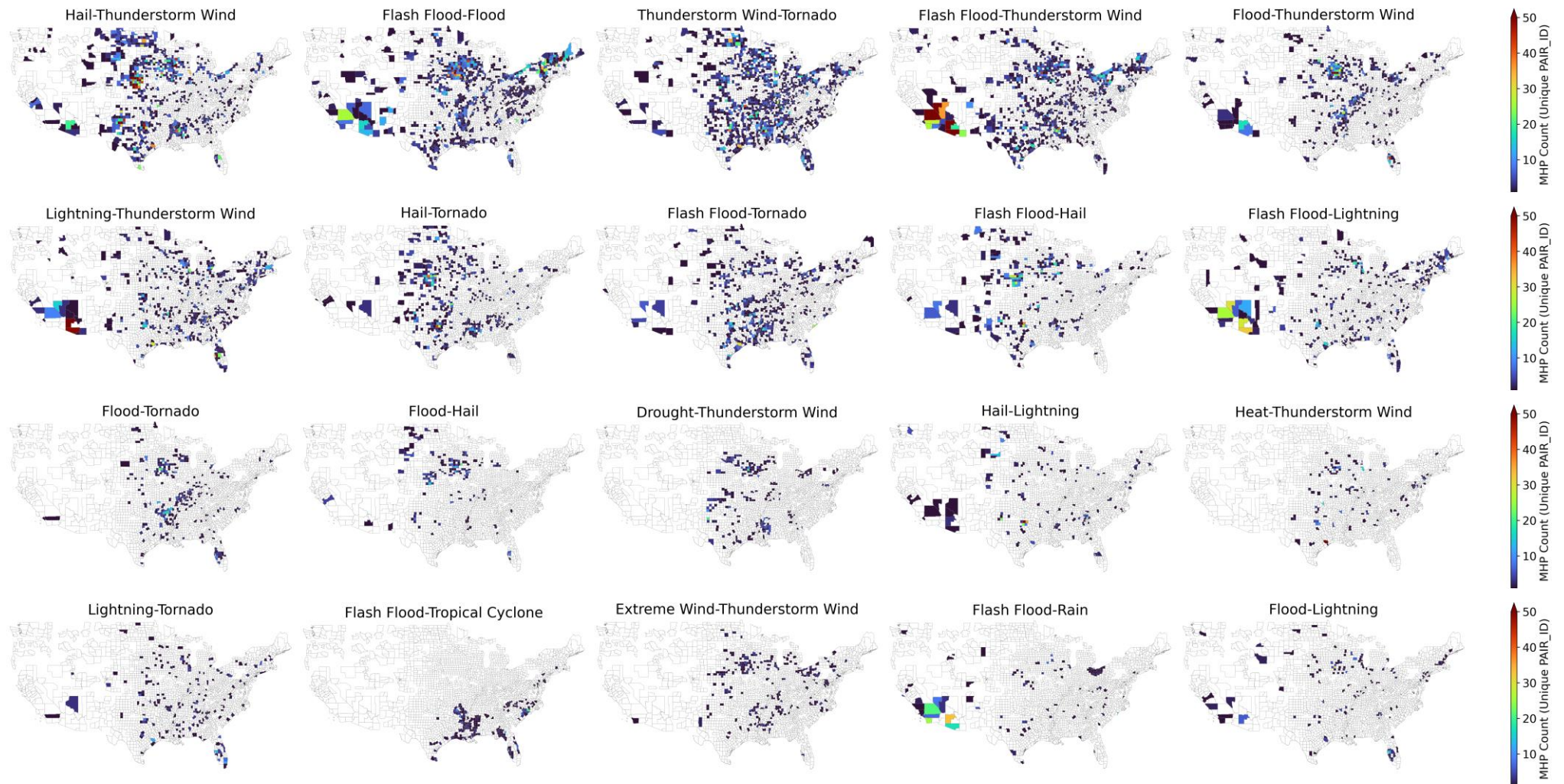


Figure A3. Maps of the spatial distribution and count for the 50 most frequent 10-day MHPs, listed in order of descending frequency from top left to bottom right.

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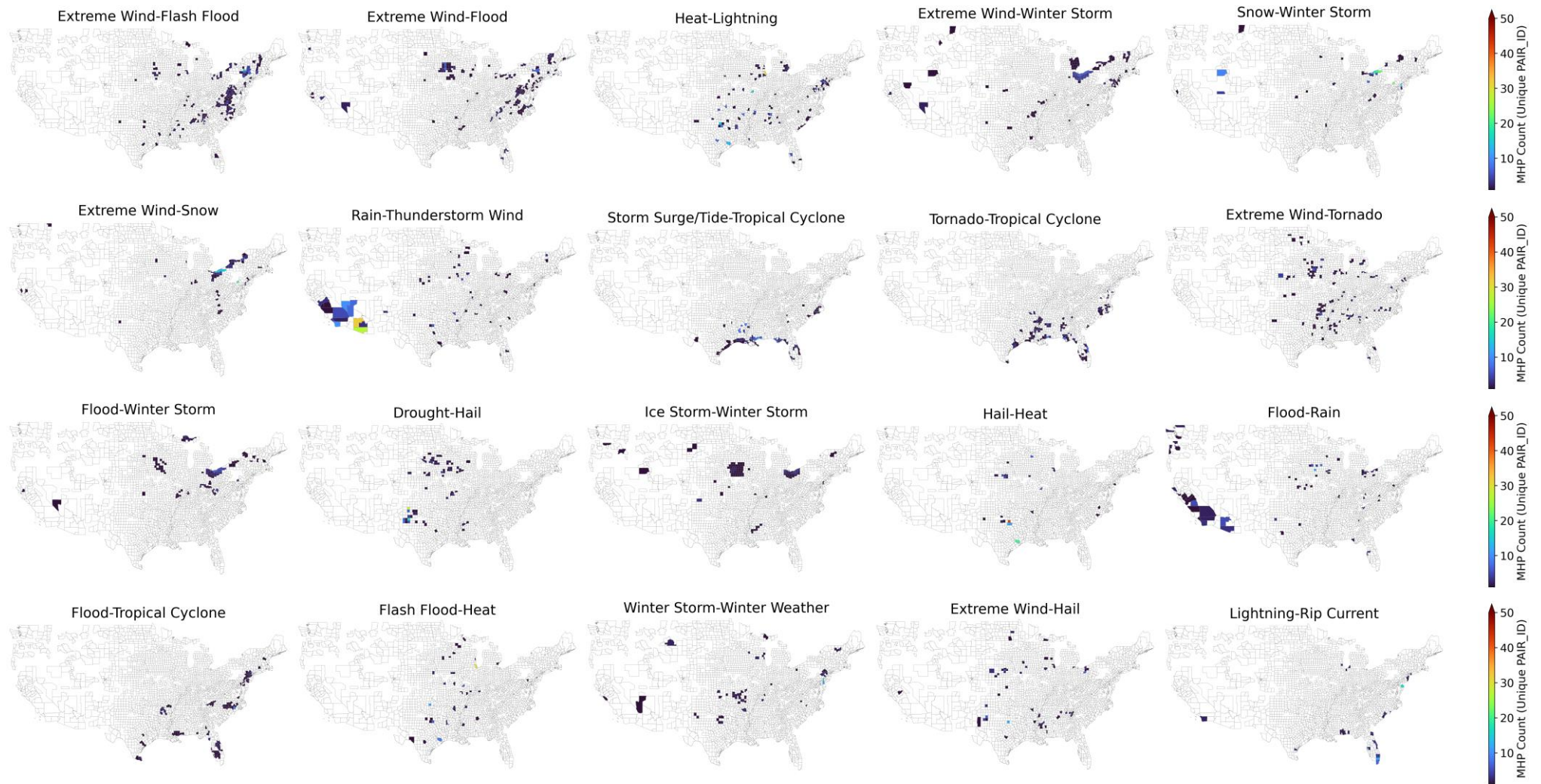


Figure A3. (Continued) Maps of the spatial distribution and count for the 50 most frequent 10-day MHPs, listed in order of descending frequency from top left to bottom right.

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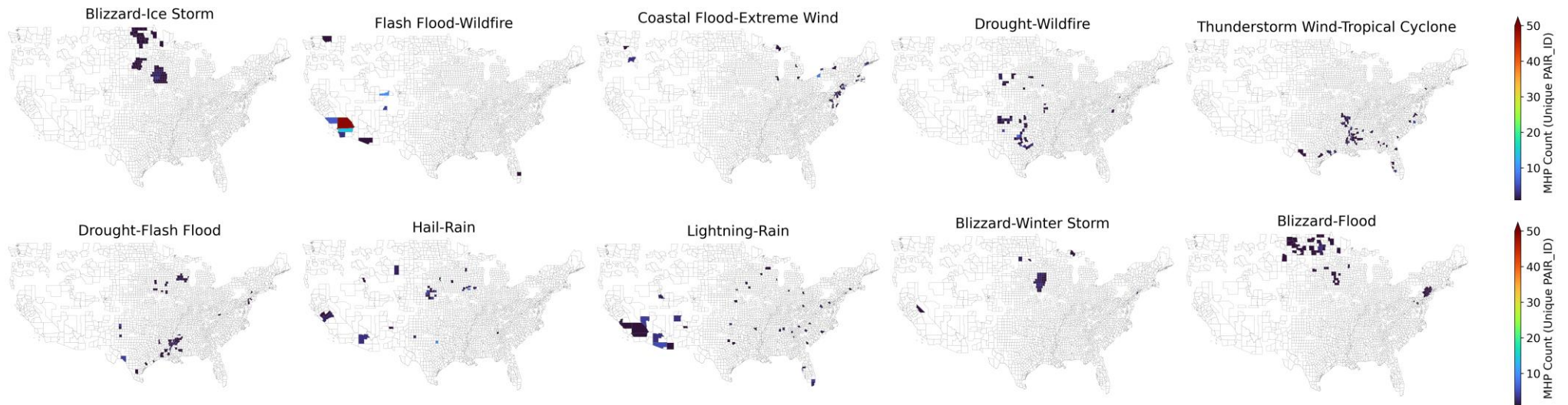


Figure A3. (Continued) Maps of the spatial distribution and count for the 50 most frequent 10-day MHPs, listed in order of descending frequency from top left to bottom right.

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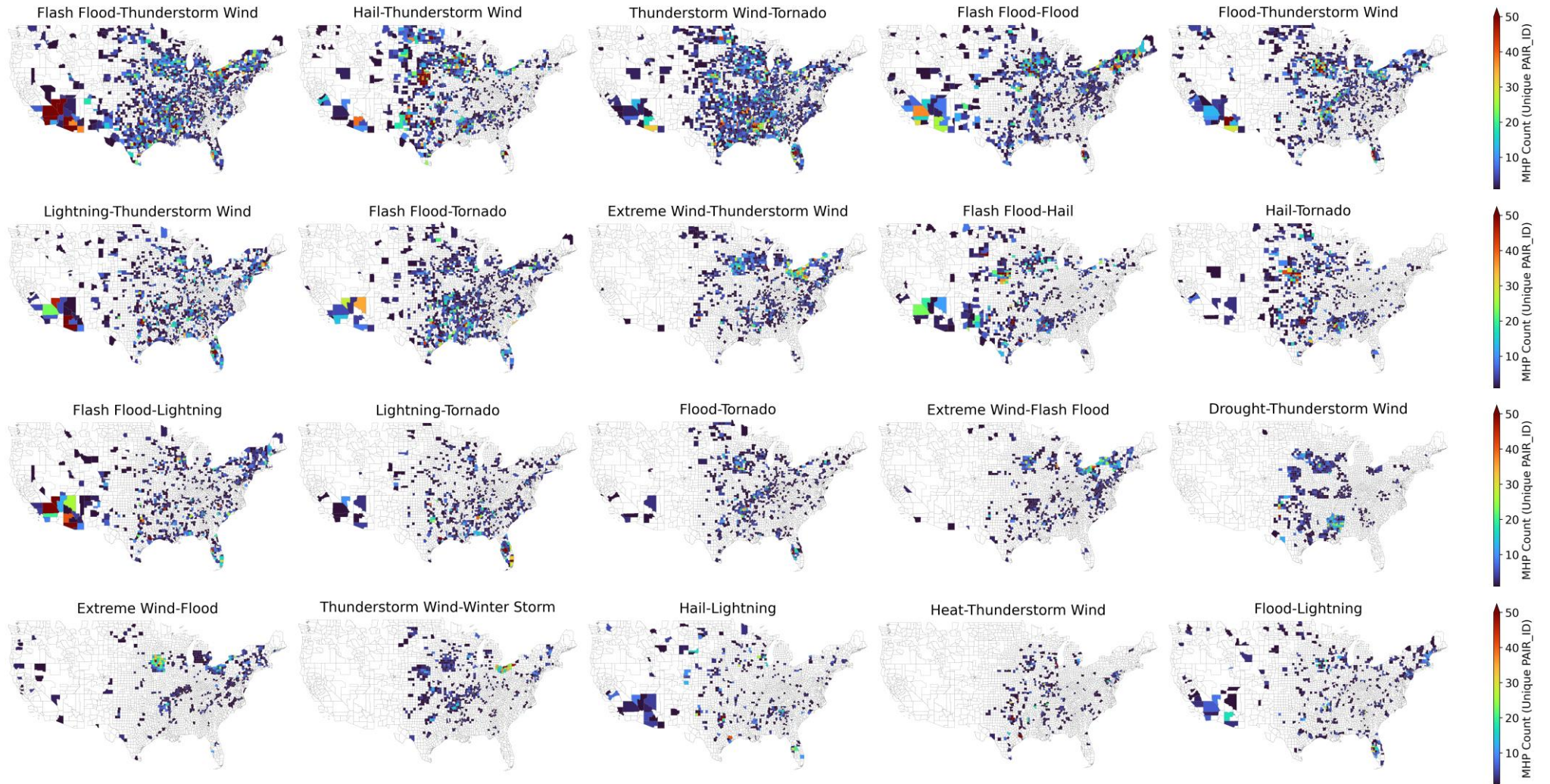


Figure A4. Maps of the spatial distribution and count for the 50 most frequent 90-day MHPs, listed in order of descending frequency from top left to bottom right

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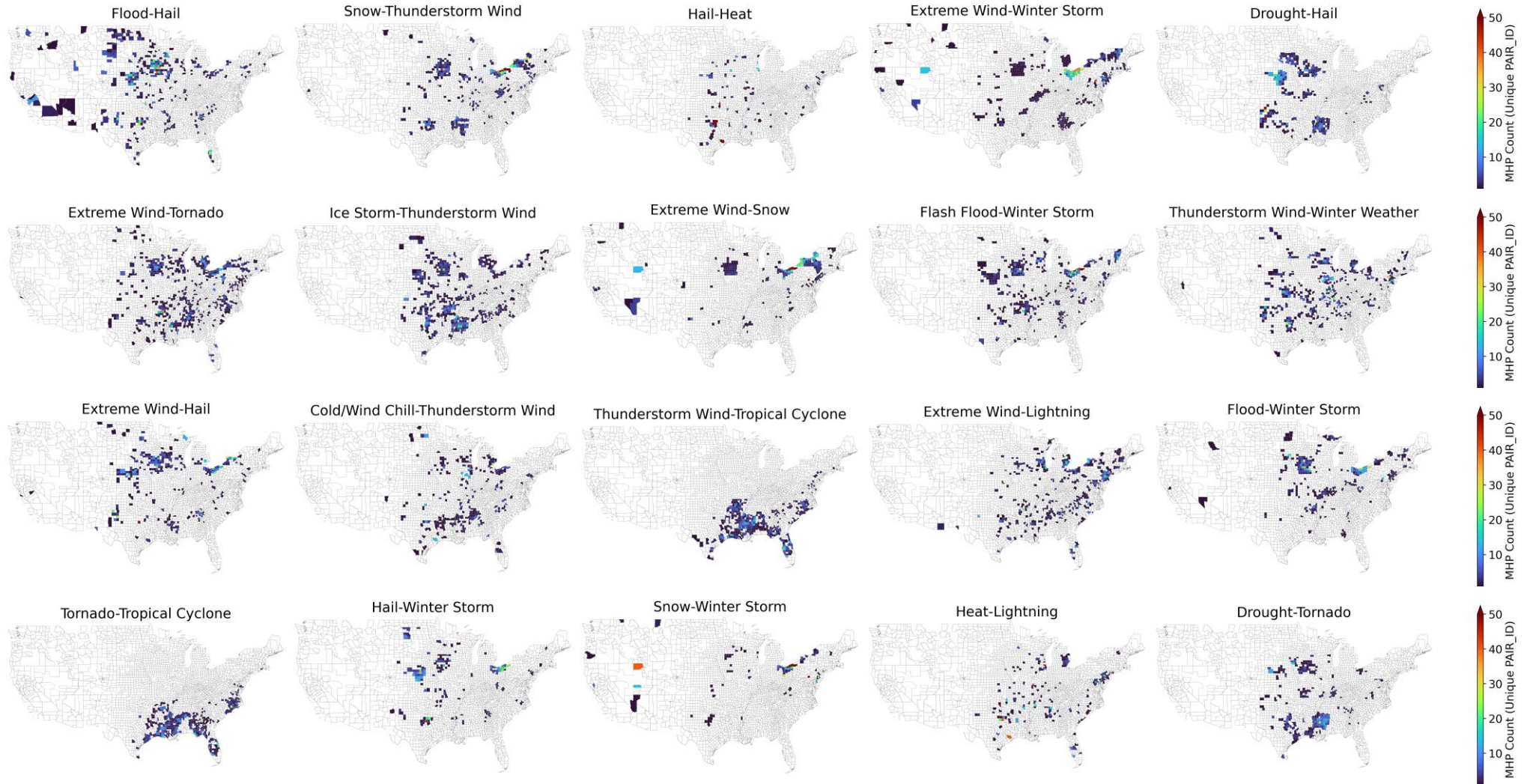


Figure A4. (Continued) Maps of the spatial distribution and count for the 50 most frequent 90-day MHPs, listed in order of descending frequency from top left to bottom right

Appendix A

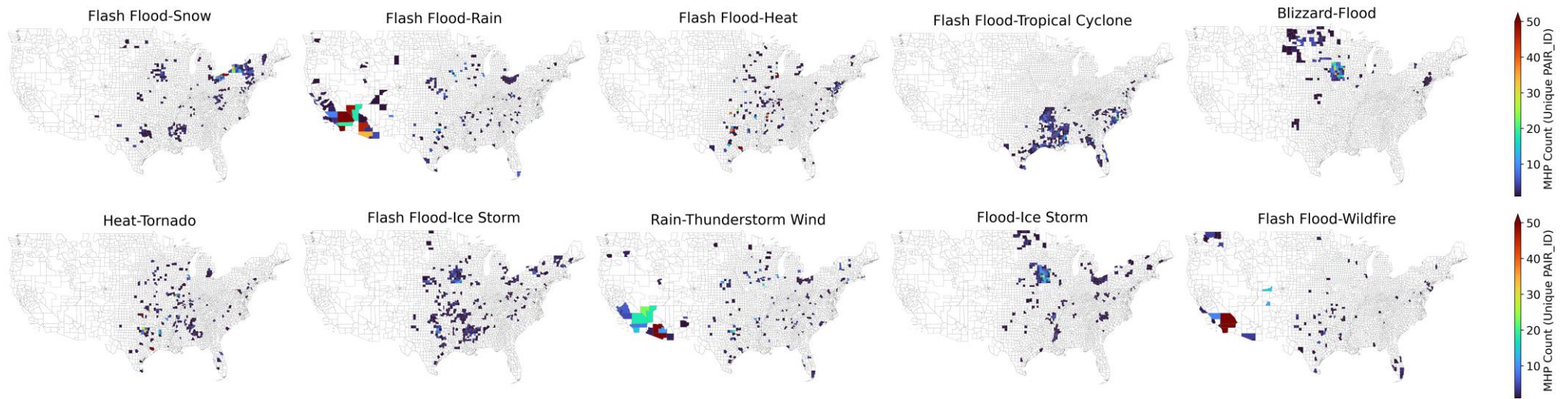


Figure A4. (Continued) Maps of the spatial distribution and count for the 50 most frequent 90-day MHPs, listed in order of descending frequency from top left to bottom right.