Supplementary Material

1 SUPPLEMENTARY DATA

Supplementary tables and figures are included as Supplementary Data. Table S1 lists the locations and elevations used for inundation determination. Table S2 provides a listing of damage costs by inundation depth used to derive the cost curve on Figure 9.

Figure S1 demonstrates non-stationarity between the projected future weather from Martin (2023) and observed weather. Figure S2 displays simulated water depths for the initiating event threshold and for the current 24-hour, 100-year recurrence interval precipitation depth. Figure S3 provides simulated water depths using an obstruction height that is larger than 5 m for two evaluations within the analysis.

2 SUPPLEMENTARY TABLES

Table S1. Elevations and locations for inundation determination.

House Index	**Row**	**Col**	**Topo. El.** (m)	**Foundation El** (m)	**House Index**	**Row**	**Col**	**Topo. El.** (m)	**Foundation El.** (m)
1	114	27	109.35	109.63	23	114	40	101.85	104.30
2	119	27	109.10	109.38	24	119	40	101.60	104.05
3	124	27	108.85	109.13	25	124	40	101.35	103.80
4	129	27	108.60	108.88	26	129	40	101.10	103.55
5	134	27	108.35	108.63	27	134	40	100.85	103.30
6	139	27	108.10	108.38	28	139	40	100.60	103.05
7	144	27	107.85	108.13	29	144	40	100.35	102.80
8	149	27	107.60	107.88	30	149	40	100.10	102.55
9	154	27	107.35	107.63	31	154	40	99.85	102.30
10	159	27	107.10	107.38	32	159	40	99.60	102.05
11	164	27	106.85	107.13	33	164	40	99.35	101.80
12	114	31	101.85	104.30	34	114	44	109.35	109.63
13	119	31	101.60	104.05	35	119	44	109.10	109.38
14	124	31	101.35	103.80	36	124	44	108.85	109.13
15	129	31	101.10	103.55	37	129	44	108.60	108.88
16	134	31	100.85	103.30	38	134	44	108.35	108.63
17	139	31	100.60	103.05	39	139	44	108.10	108.38
18	144	31	100.35	102.80	40	144	44	107.85	108.13
19	149	31	100.10	102.55	41	149	44	107.60	107.88
20	154	31	99.85	102.30	42	154	44	107.35	107.63
21	159	31	99.60	102.05	43	159	44	107.10	107.38
22	164	31	99.35	101.80	44	164	44	106.85	107.13

Table S2. Listing of damage costs by inundation depth used for damage cost curve derivation.

Depth (in)	**Depth** (m)	**Damage Cost** ($)	**Source**
1	0.0254	$53,454	NFIP Cost Calculator[1]
2	0.0508	$53,564	NFIP Cost Calculator[1]
3	0.0762	$58,448	NFIP Cost Calculator[1]
4	0.1016	$76,707	NFIP Cost Calculator[1]
5	0.1270	$90,496	NFIP Cost Calculator[1]
6	0.1524	$103,505	NFIP Cost Calculator[1]
7	0.1778	$110,174	NFIP Cost Calculator[1]
8	0.2032	$116,843	NFIP Cost Calculator[1]
9	0.2286	$123,512	NFIP Cost Calculator[1]
10	0.2540	$130,181	NFIP Cost Calculator[1]
11	0.2794	$136,850	NFIP Cost Calculator[1]
12	0.3048	$143,519	NFIP Cost Calculator[1]
24	0.6096	$171,775	NFIP Cost Calculator[1]
36	0.9144	$185,704	NFIP Cost Calculator[1]
48	1.2192	$203,280	NFIP Cost Calculator[1]
60	1.5240	$312,624	Linear interpolation
72	1.8288	$421,968	Linear interpolation
84	2.1336	$531,312	Linear interpolation
96	2.4384	$640,656	Linear interpolation
108	2.7432	$750,000	Complete loss cost, assumed

[1] "NFIP" is the National Flood Insurance Program of the US Federal Emergency Management Administration (FEMA). NFIP Cost Calculator (accessed on 3 September 2024) was available online, and values listed are for a 464.5 m^2 (5,000 ft^2), two-story house.

3 SUPPLEMENTARY FIGURES

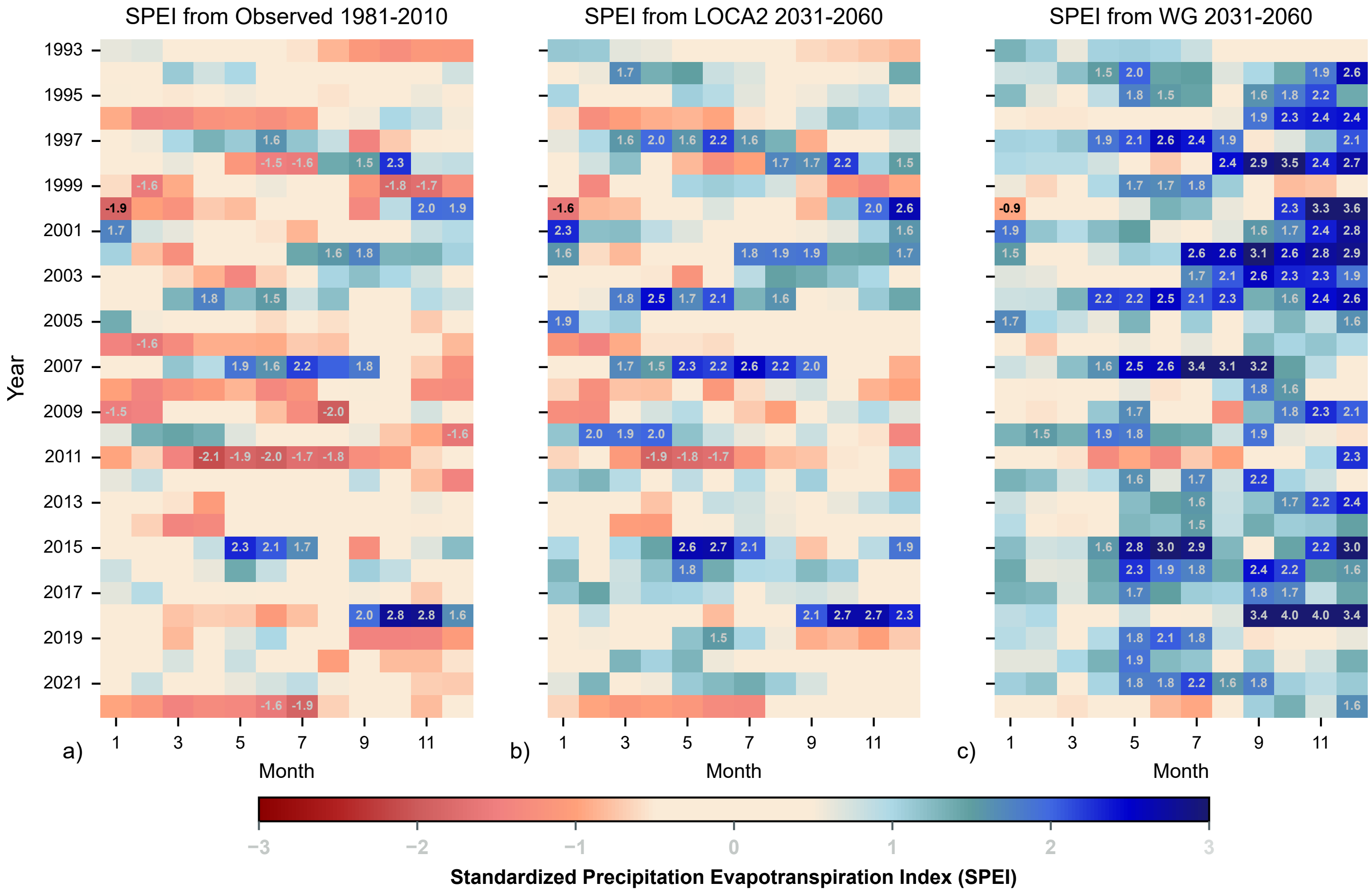

Figure S1. Comparison of the SPEI drought index values for the observed 1993–2022, 3-month cumulative D values: Panel (a) SPEI based on 1981–2010 observations, Panel (b) SPEI based on LOCA2 projected 2031–2060 conditions, and Panel (c) SPEI based on WG-projected 2031–2060 conditions. An SPEI $\leq$-1.5 represents severe drought conditions. According to the observed 1981–2010 climate description in Panel (a), severe drought conditions occurred 17 times from 1993 to 2022 with a minimum calculated SPEI of -2.1. Using LOCA2 2031–2060 conditions, severe drought occurred four times between 1993 and 2022, with a minimum SPEI of -1.9. For the 1993–2022 observations analyzed using WG 2031–2060 conditions, no severe droughts occurred, and the minimum SPEI was -1.4. This comparison demonstrates that the WG 2031–2060 climate description is significantly warmer and drier on average than the LOCA2 2031–2060 description. Reproduced from Martin (2024, 2023). (CC-by-4.0)

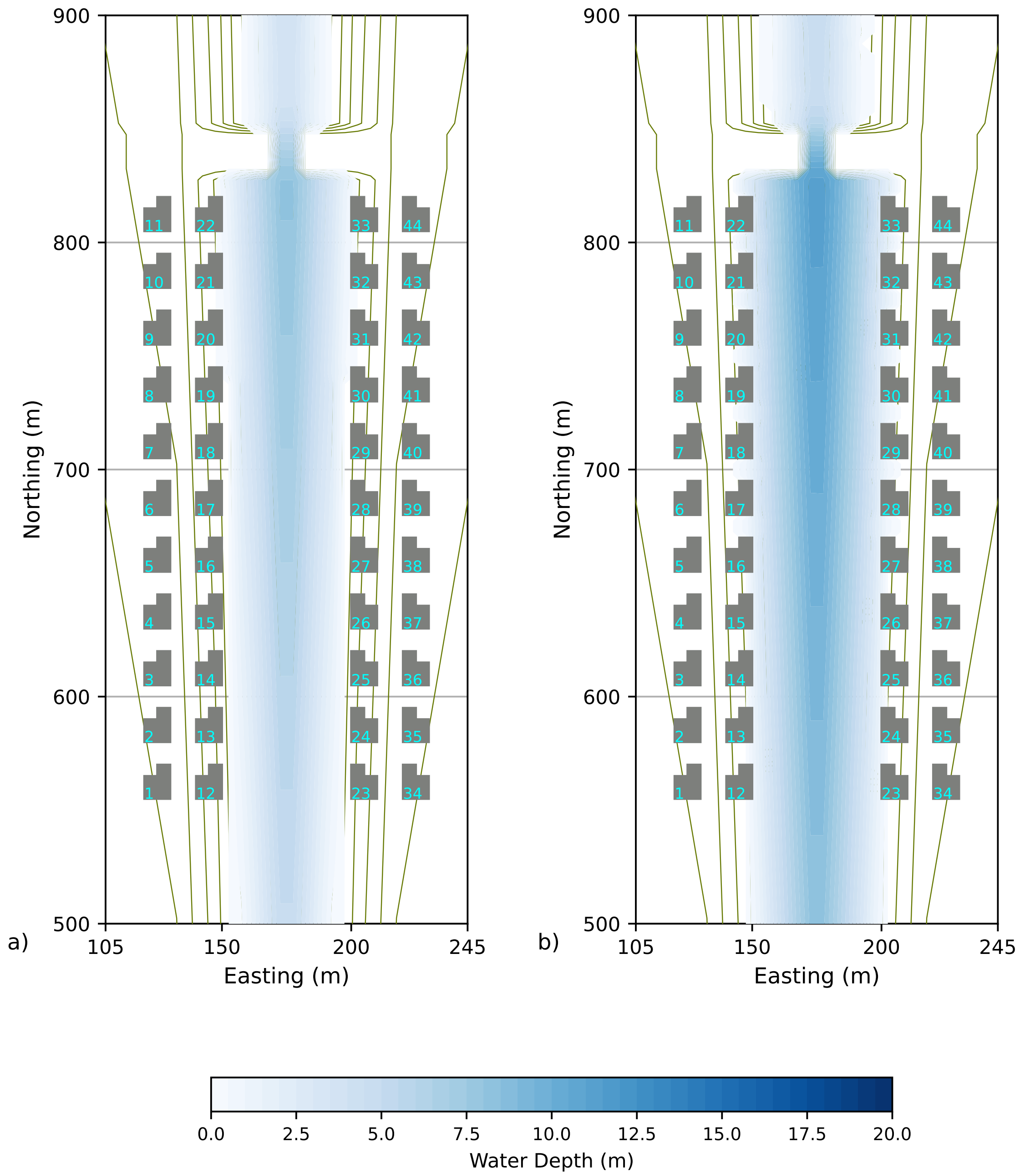

Figure S2. Simulated water depths compared for historical and current 100-year, 24-hour precipitation depths. Panel (a) displays simulated water depth using an inflow discharge of 180 m^3/s, which corresponds to the initiating event depth of 236 mm. Here, the simulated water surface elevation is less than the foundation elevation for all 44 houses. All houses and the bridge configuration are compliant with design bases provided by the historical 100-year, 24-hour precipitation of 233.7 mm. Panel (b) shows simulated water depths from Perica et al. (2018) 100-year, 24-hour precipitation depth of 343 mm, which is scaled to an inflow discharge of 261.6 m^3/s. In this case, the maximum simulated inundation depth is 2 m for House #33, and foundation inundation is simulated for Houses #15, #16, #17, #18, #19, #20, #21, #22, #26, #27, #28, #29, #30, #31, #32, and #33. This simulated inundation corresponds to an estimated damage cost of $3,938,000 using the approach outlined in Section 2.5.

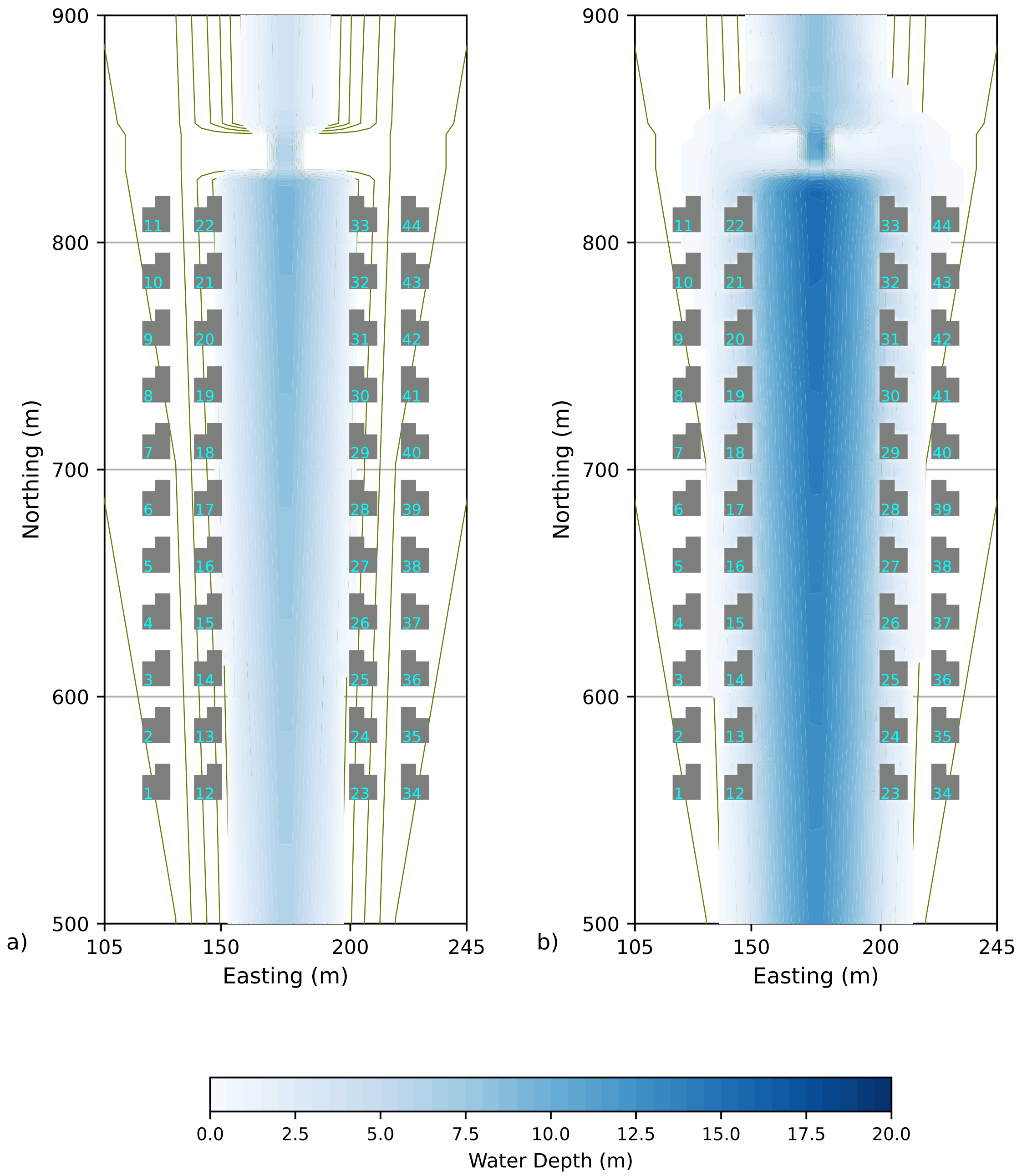

Figure S3. Simulated water depths compared for two simulations using an obstruction height. Panel (a) displays simulated water depth using an inflow discharge of 180.8 m^3/s, corresponding to a daily precipitation depth of 237 mm which is similar to the initiating event depth of 236 mm. The sampled obstruction height is 5.1 m. This obstruction height represents the approximate starting point for flooding damage under the historical design conditions. Here, the maximum simulated inundation depth is 0.05 m at House #33, and foundation inundation is simulated for Houses #22 and #33. Total estimated damage cost is $105,900. Panel (b) shows the maximum simulated water surface elevation across the 7,166 evaluations. Here, water depth is simulated using an inflow discharge of 436.7 m^3/s (corresponds to a daily precipitation depth of 572.5 mm) and an obstruction height of 19.9 m (note that obstruction height is truncated to the cutoff height of 13.333 m for implementing the change to topography seen by the model). In this case, the maximum simulated inundation depth is 6.1 m for Houses #22 and #33, and foundation inundation is simulated for Houses #9, #10, #11, #12, #13, #14, #15, #16, #17, #18, #19, #20, #21, #22, #23, #24, #25, #26, #27, #28, #29, #30, #31, #32, #33, #42, #43, and #44. This simulated inundation corresponds to an estimated damage cost of $17,273,000 using the approach outlined in Section 2.5.

REFERENCES

Martin, N. (2023). Incorporating Weather Attribution to Future Water Budget Projections. *Hydrology* 10, 219. doi:10.3390/hydrology10120219

[Dataset] Martin, N. (2024). Climate Change and Water Budgets: Accounting for Increased Drought Risk based on Recent Observations

Perica, S., Pavlovic, S., St. Laurent, M., Trypaluk, C., Unruh, D., and Wilhite, O. (2018). *NOAA Atlas 14: Precipitation-Frequency Atlas of the United States, Volume 11 Version 2.0: Texas*. Tech. rep., NOAA, Silver Spring, MD