

Quantifying Distributional Health Damages of Extreme Weather Events

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End-users: Houston Health Department, NOAA Billion Dollar Disasters, USEPA Benefit Cost Analysis of climate policy scenarios

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Social Cost of Carbon

- . Estimate, in dollars, of the economic damages that would result from emitting one additional ton of greenhouse gases into the atmosphere
- . Used in benefit cost analysis for climate policy evaluation—a required component of federal regulations
- . Health damages are a major contributor to estimated costs, but only account for temperature-related mortality
- . Rennert, K., Errickson, F., Prest, B.C. *et al.* Comprehensive Evidence Implies a Higher Social Cost of CO₂. *Nature* (2022).
<https://doi.org/10.1038/s41586-022-05224-9>

Project Objectives

- . Compare estimates of mortality associated with temperature extremes and flooding across urban and rural areas in Texas between 2015-2021.
- . Determine contributions of movements outside of home census tract to health damages associated with extreme temperatures and flooding.
- . Determine morbidity contributions to health damages associated with extreme temperatures and flooding.

Number of Billion-Dollar events in the United States between 1980-2020

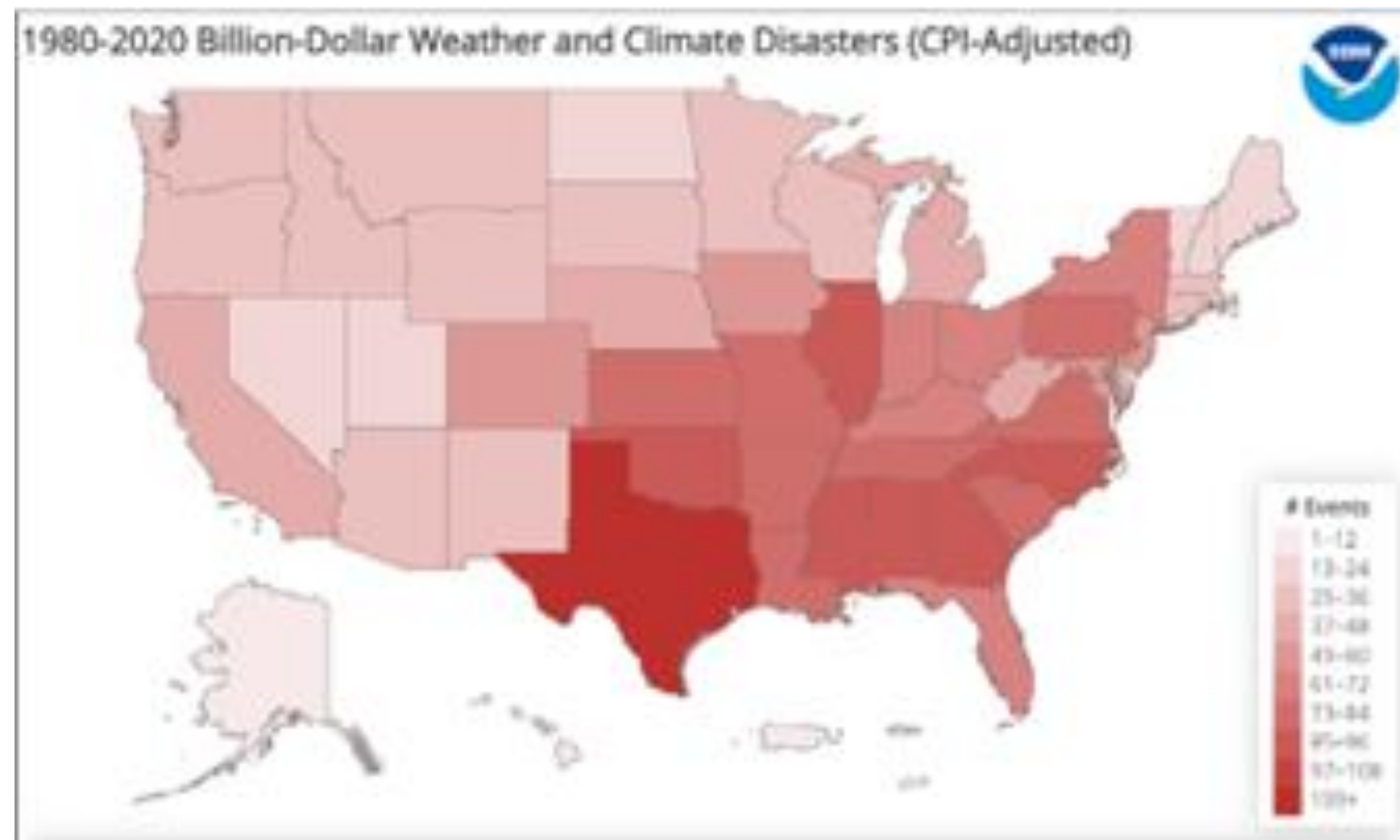
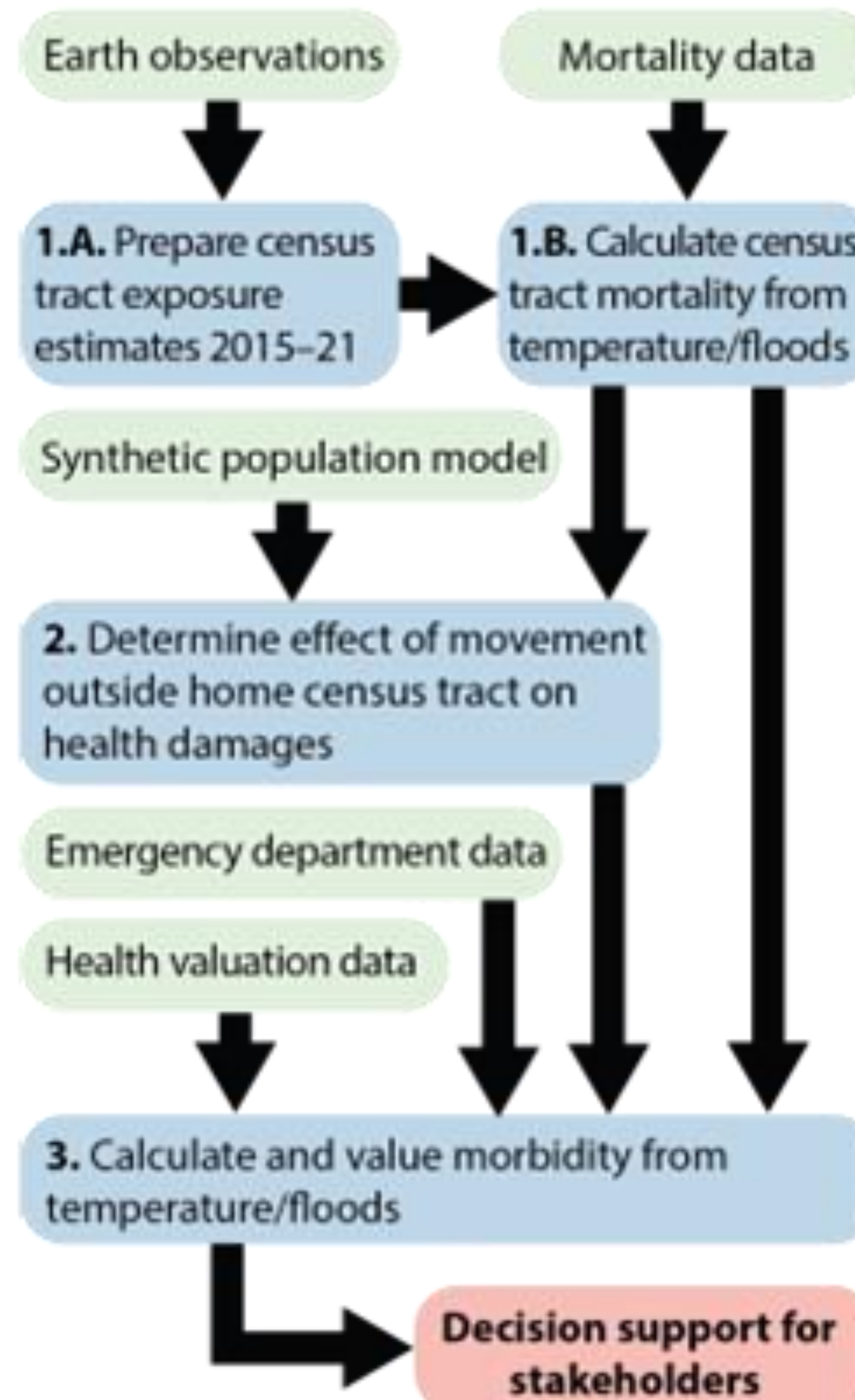


Table 1. Billion-dollar extreme temperature and flooding events in Texas between 2015-2021 [3]

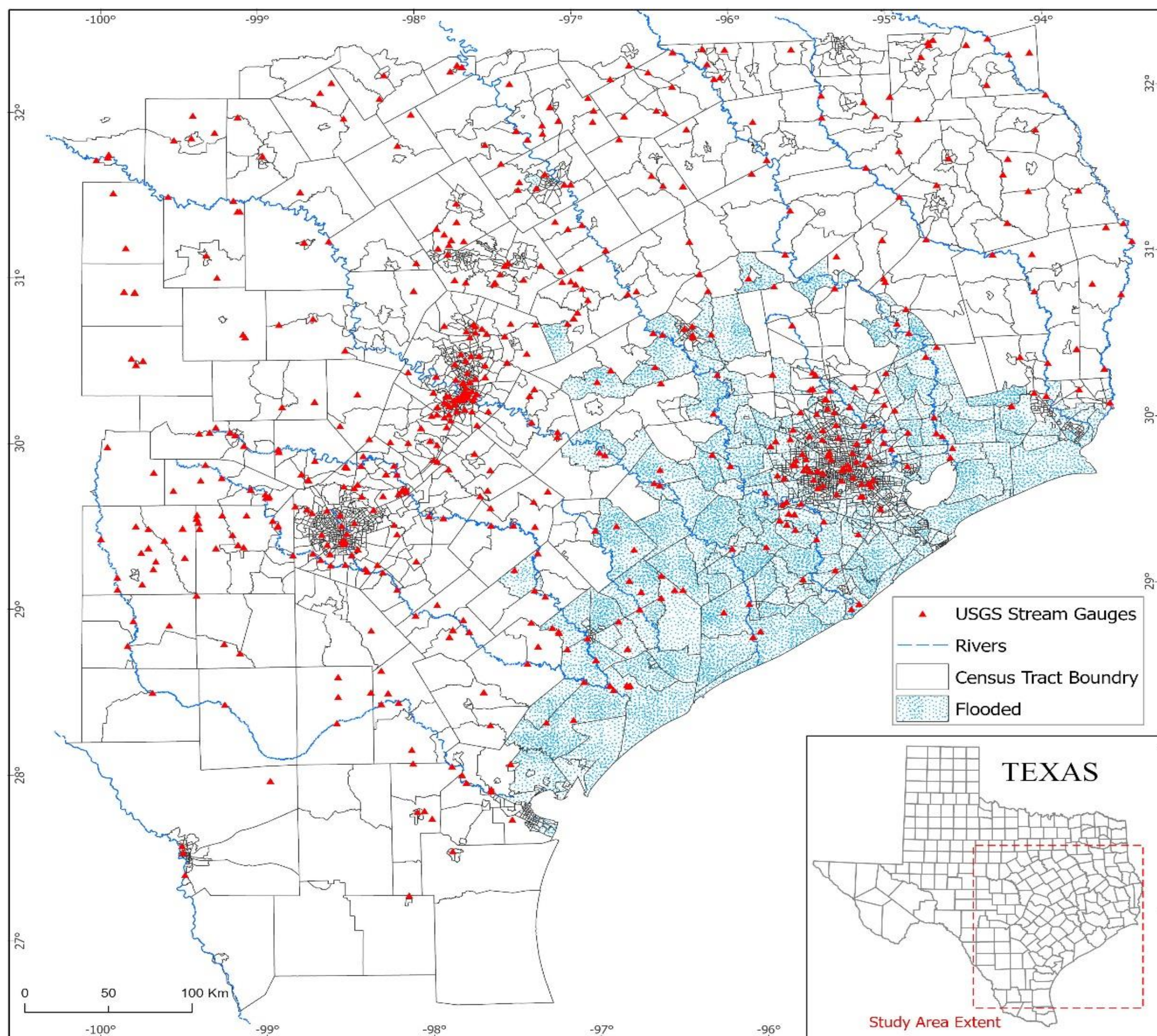
<u>Event Type</u>	<u>Total Cost (\$ Billions)</u>	<u>Fatalities from NWS Storm Data</u>
Flooding and Severe Weather (May 2015)	2.8	31
Flooding (March 2016)	2.5	5
Flooding (April 2016)	3	8
Flooding and Severe Weather (May 2017)	1.8	20
Hurricane Harvey (August 2017)	133.8	89
Drought (Summer-Fall 2018)	3.1	0
Flooding (May-June 2019)	6.4	4
Tropical Storm Imelda (September 2019)	5.1	5
Hurricane Hanna (July 2020)	1.1	0
Hurricane Laura (August 2020)	19.2	42
Hurricane Delta (October 2020)	2.9	5
Drought and Heatwave (Summer-Fall 2020)	4.5	45
Storm and Cold Wave (February 2021)	TBD, > 10	138

Workflow

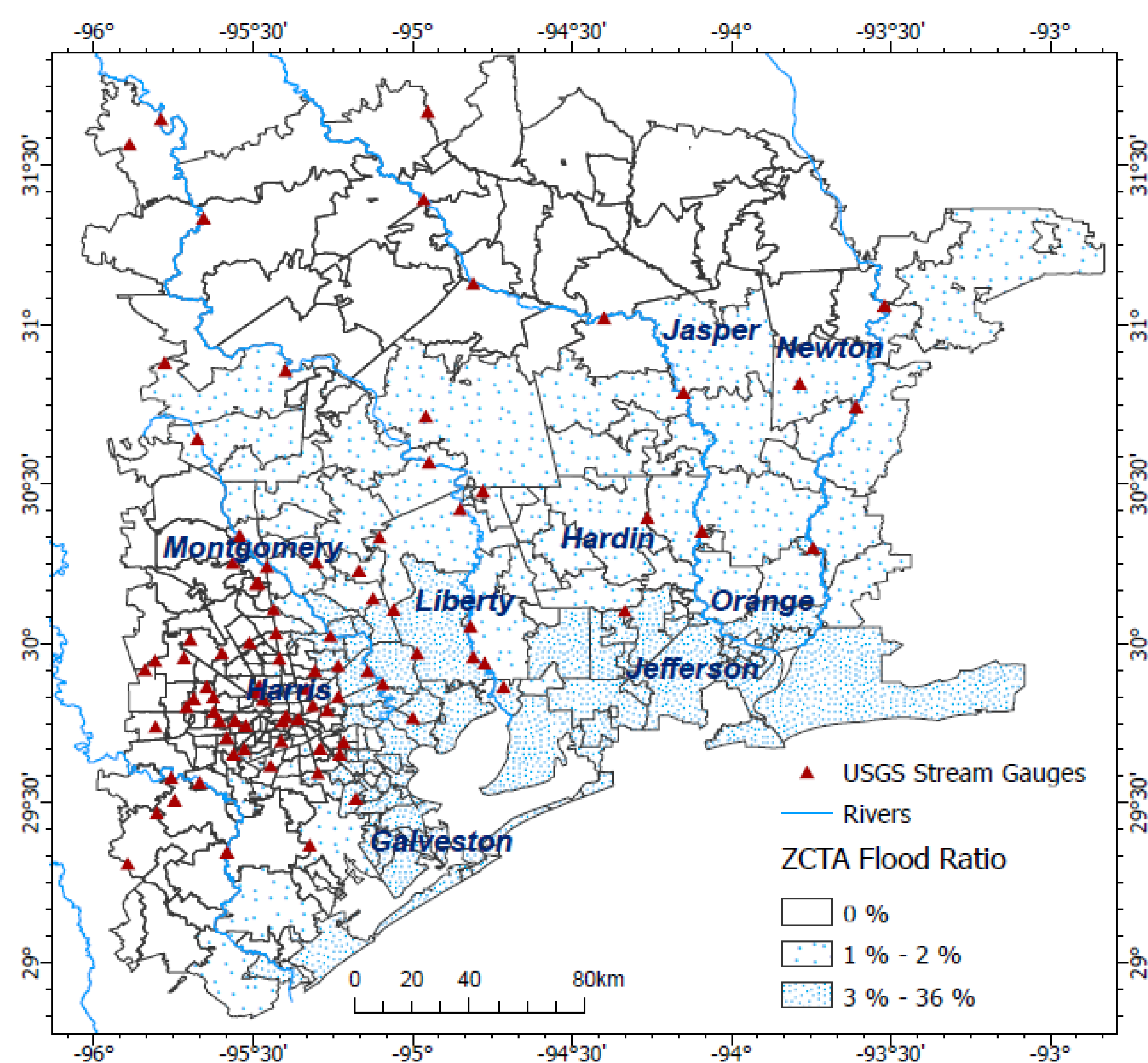


Obj 1: Using EO to spatially define exposure—example of flooding extents during Hurricane Harvey and Tropical Storm Imelda

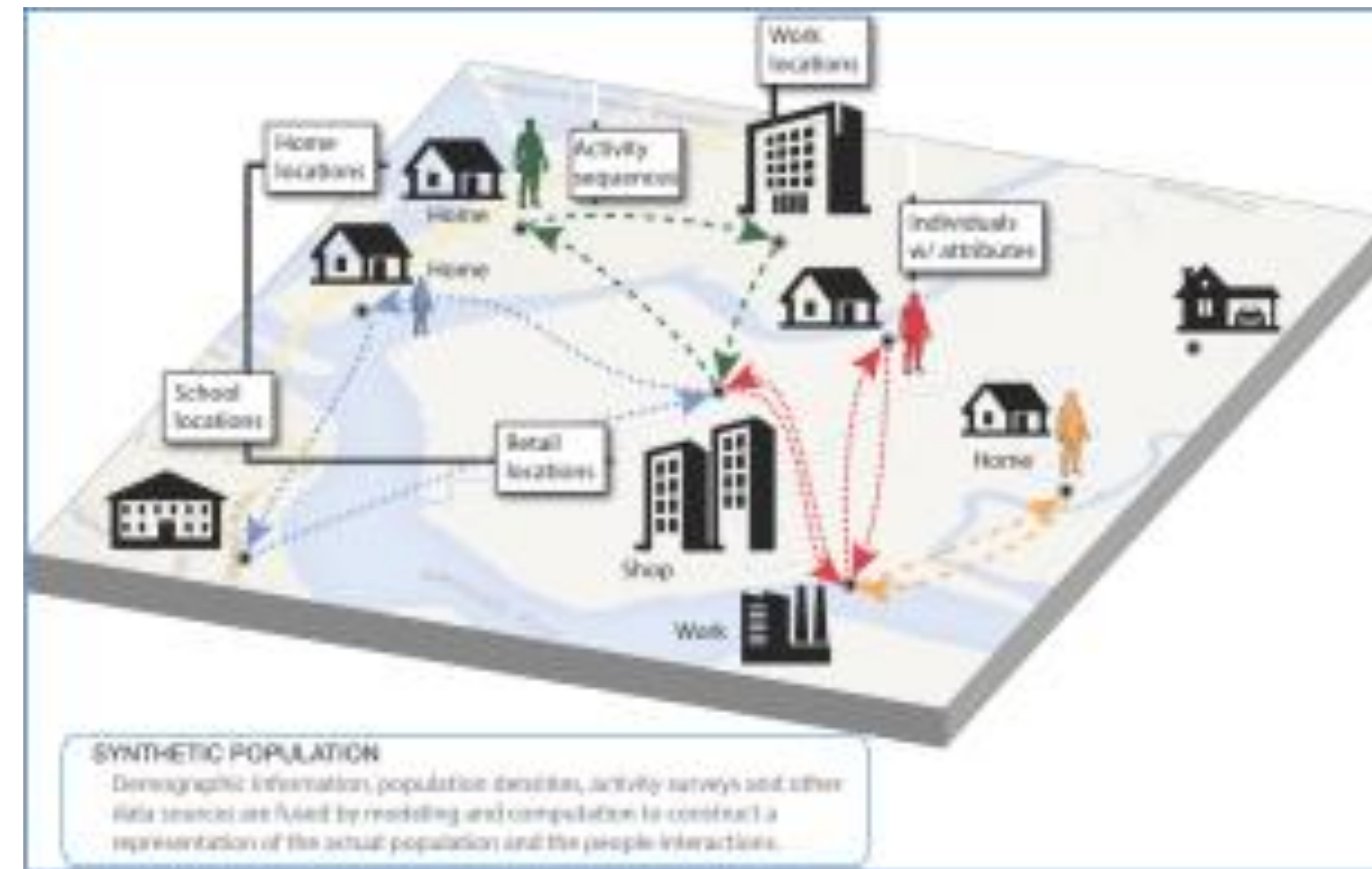
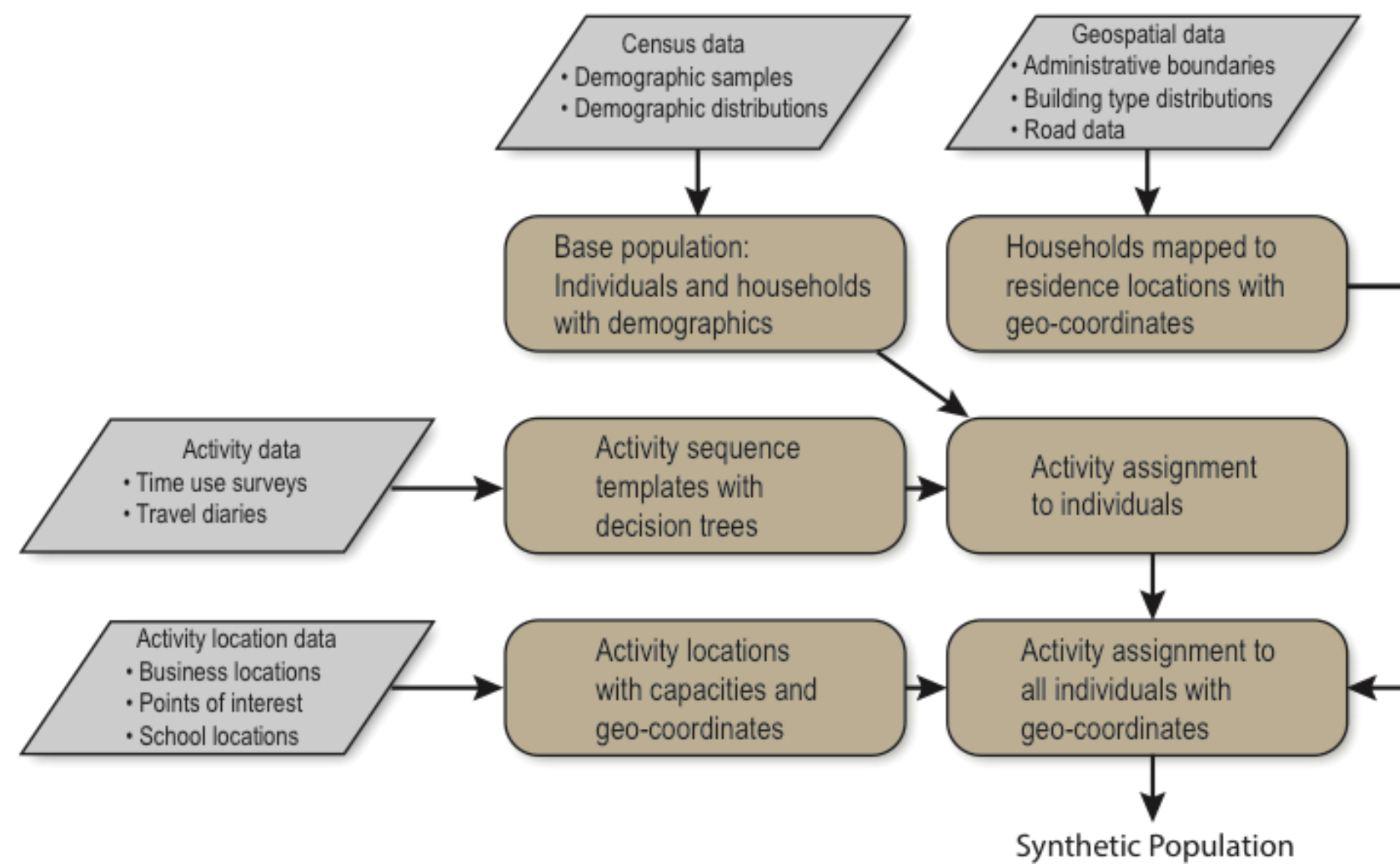
Hurricane Harvey (August 2017)



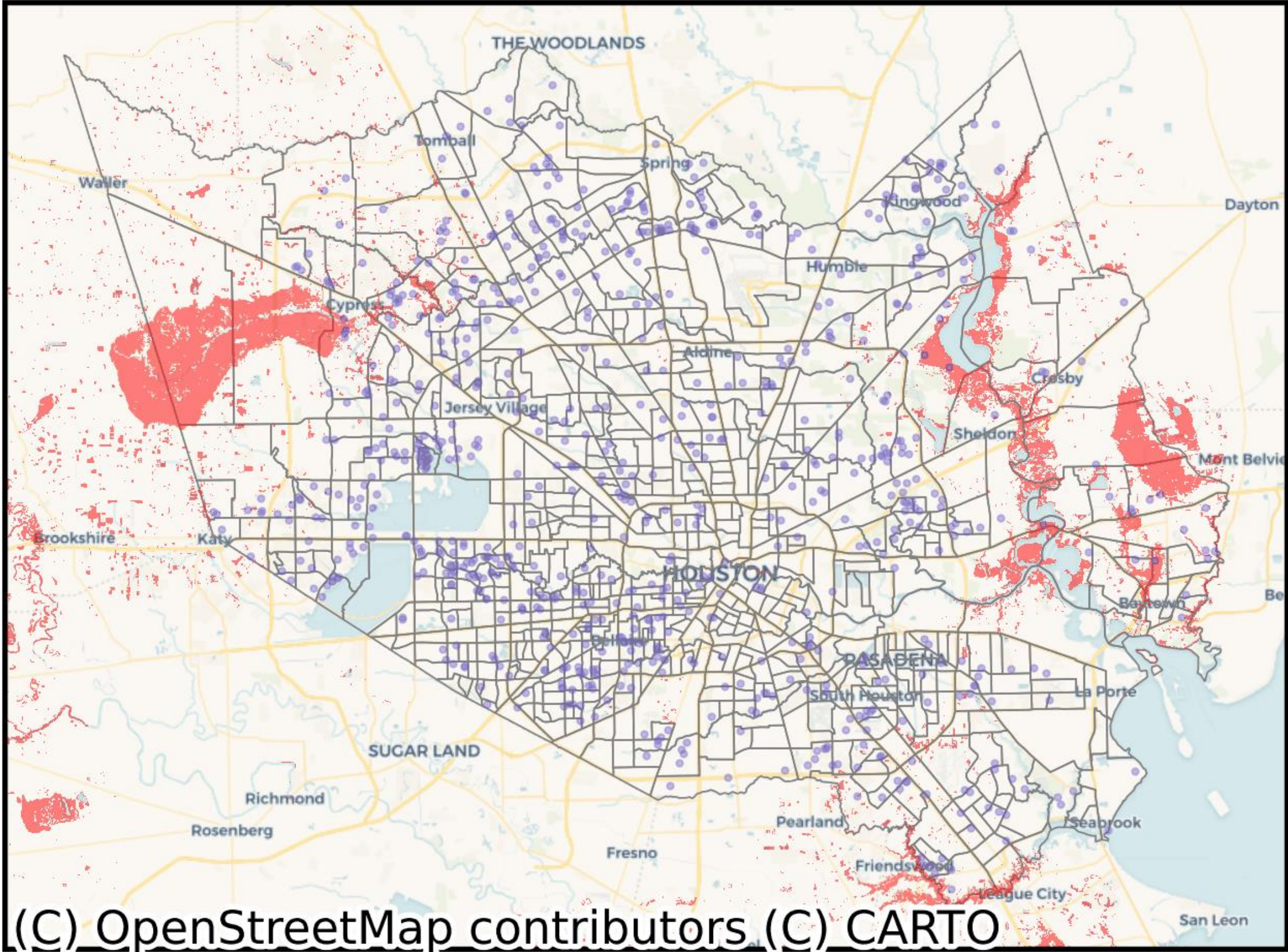
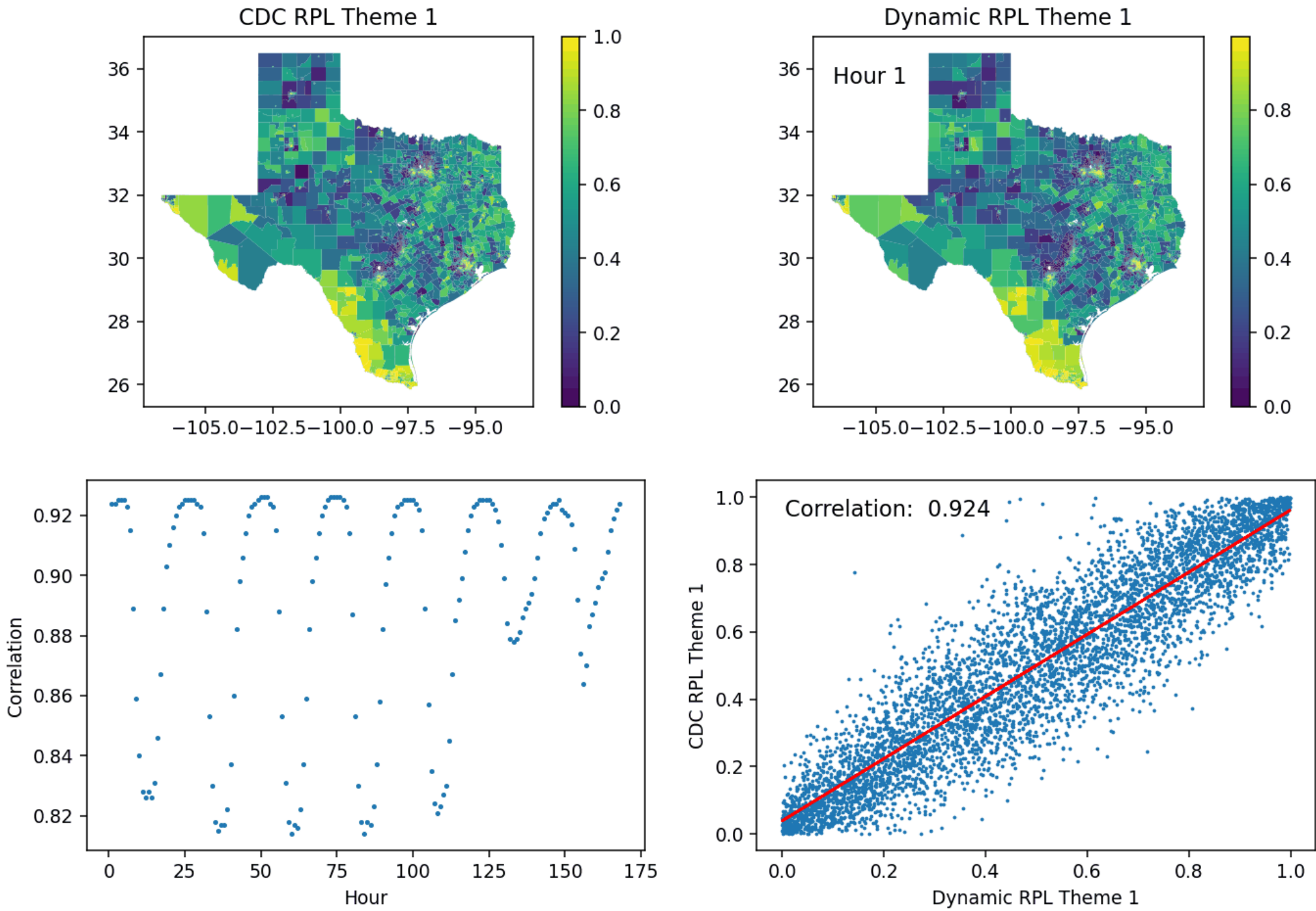
Tropical Storm Imelda (September 2019)



Obj 2: Using a synthetic population to determine contribution of mobility during EWE to exposure estimation

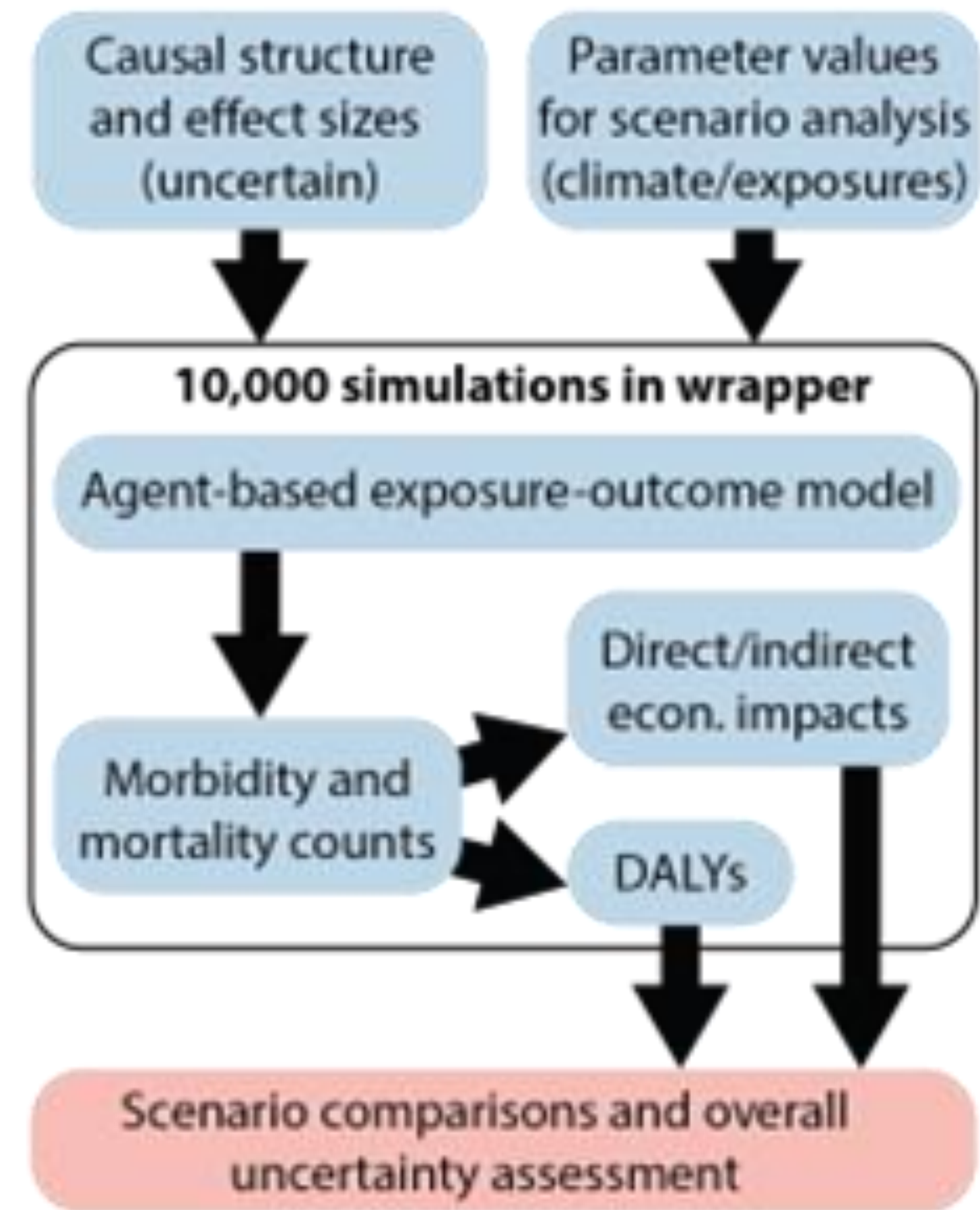


Example of movements during major flooding event



All households evacuating on August 28, 2017,
8:00 AM - 6:00 PM.
(modeled)

Obj 3: Statistical models to describe exposure-response relationships and track uncertainties



ARLs and project timeline

ARL		Year 1	Year 2	Year 3
4	Prototype	Health damages using EO and synthetic population components ^{1,2}		MP & S*
		Local and national application challenges and human process issues identified ^T		
5	Potential Determined	Comparison of baseline to improved health damages estimates ^{1,2}		MP & S*
		Potential to improve the decision making activity determined ^{P,T}		
6	Potential Demonstrated	Monetization and uncertainty evaluation ³		MP & S*
7	Functionality Demonstrated	Improved methods integrated into end-user's damage assessment methods ^T		
		Functionality tested & demonstrated ^{3,P,T}		

¹ Obj 1, ² Obj 2, ³ Obj 3, ^P Performance Measures, ^T Transition Plan, *MP & S Manuscript Preparation and Submission.