

CAREER: Data-Driven Models of Human Mobility and Resilience for Decision Making

Vanessa Frias-Martinez
University of Maryland, College Park

Modeling evacuation patterns and decisions using mobile device location data: A case study of hurricane Irma

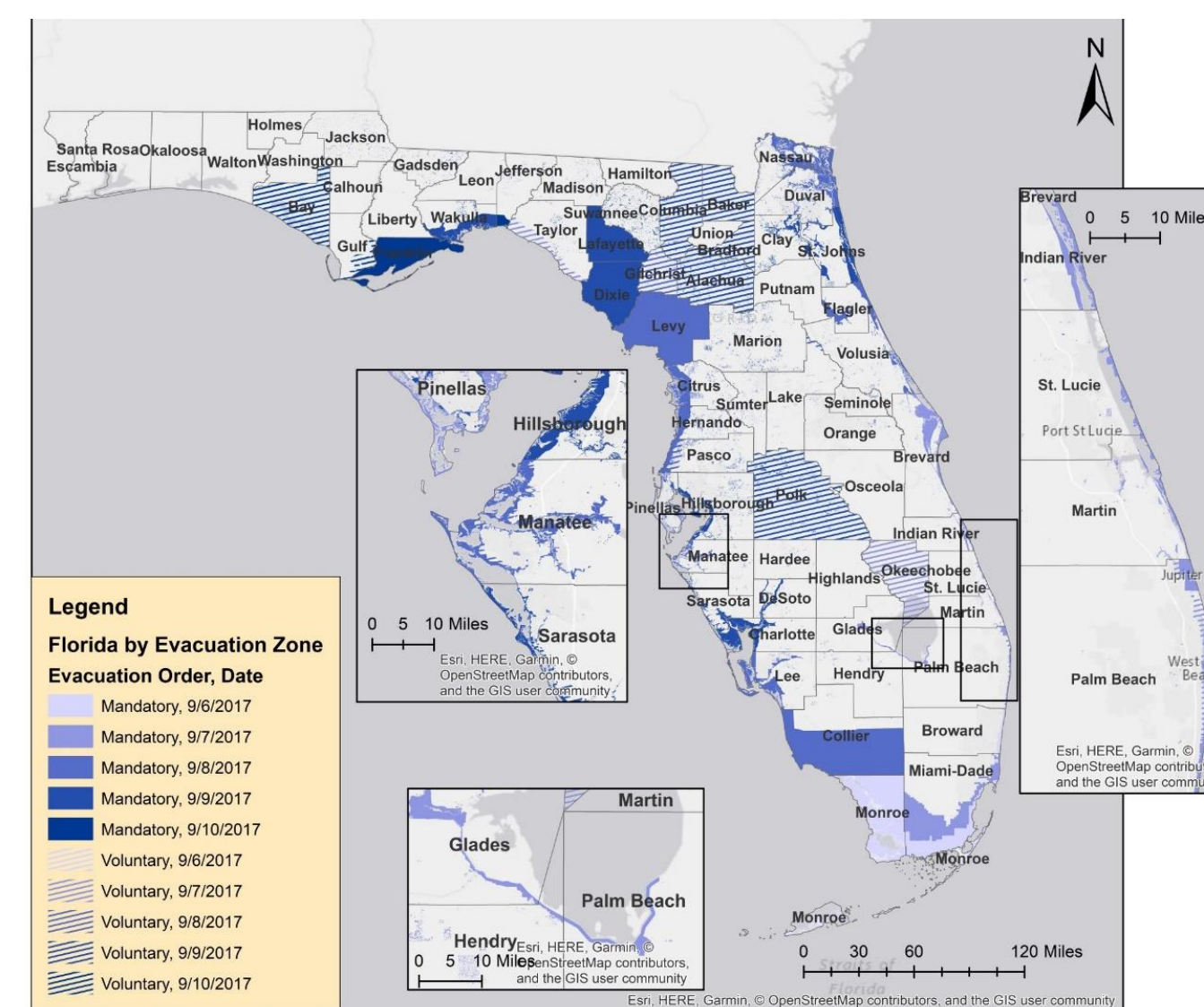
1. Data

A. Location-based services data

Timestamp	Device ID	Device Type	Latitude	Longitude	Location Accuracy (m)	Time Zone Offset
1504068337	e07941996a2ffd303021914e0c12gcf	1	28.43023	-81.60654	5	-14400
1504068342	e07941996a2ffd303021914e0c12gcf	1	28.43038	-81.60531	25	-14400
1504068351	e07941996a2ffd303021914e0c12gcf	1	28.43029	-81.60427	5	-14400
1504068360	e07941996a2ffd303021914e0c12gcf	1	28.43058	-81.60463	100	-14400
1504068369	e07941996a2ffd303021914e0c12gcf	1	28.43139	-81.60374	5	-14400

B. ACS 5-year estimates per census tract in Florida

C. Evacuation zone data



2. Methodology

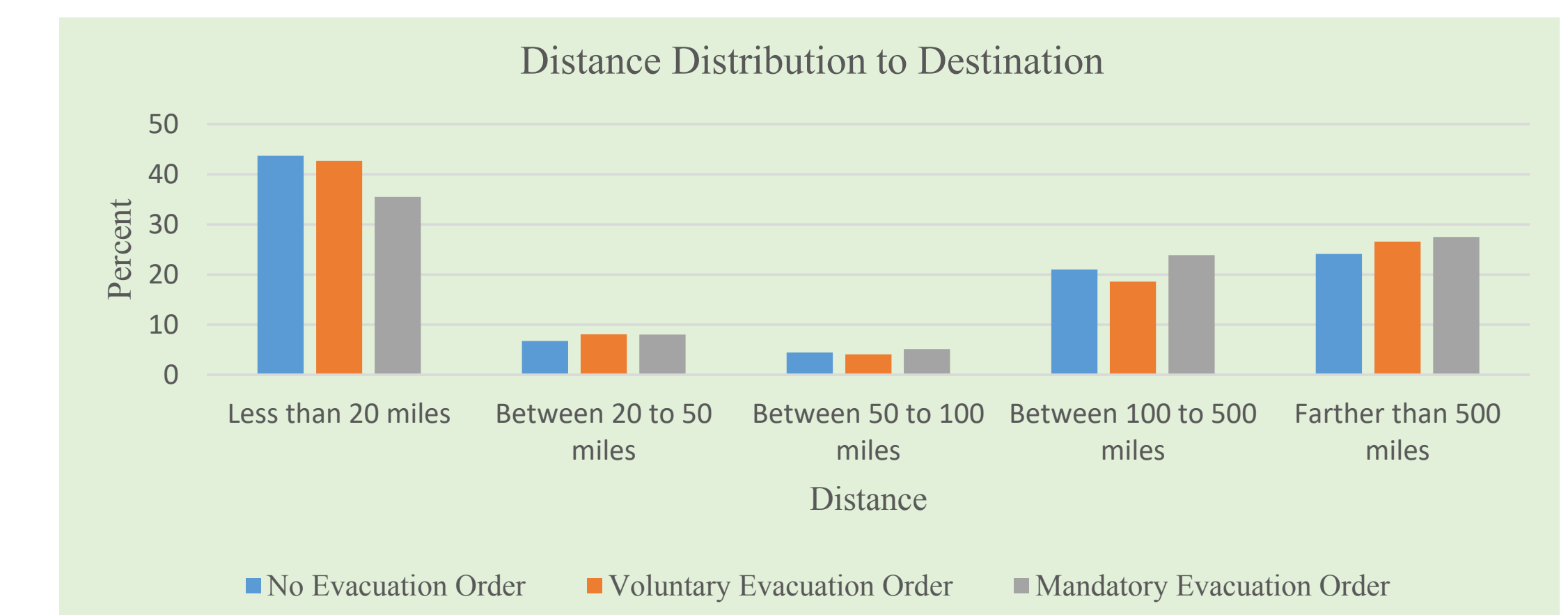
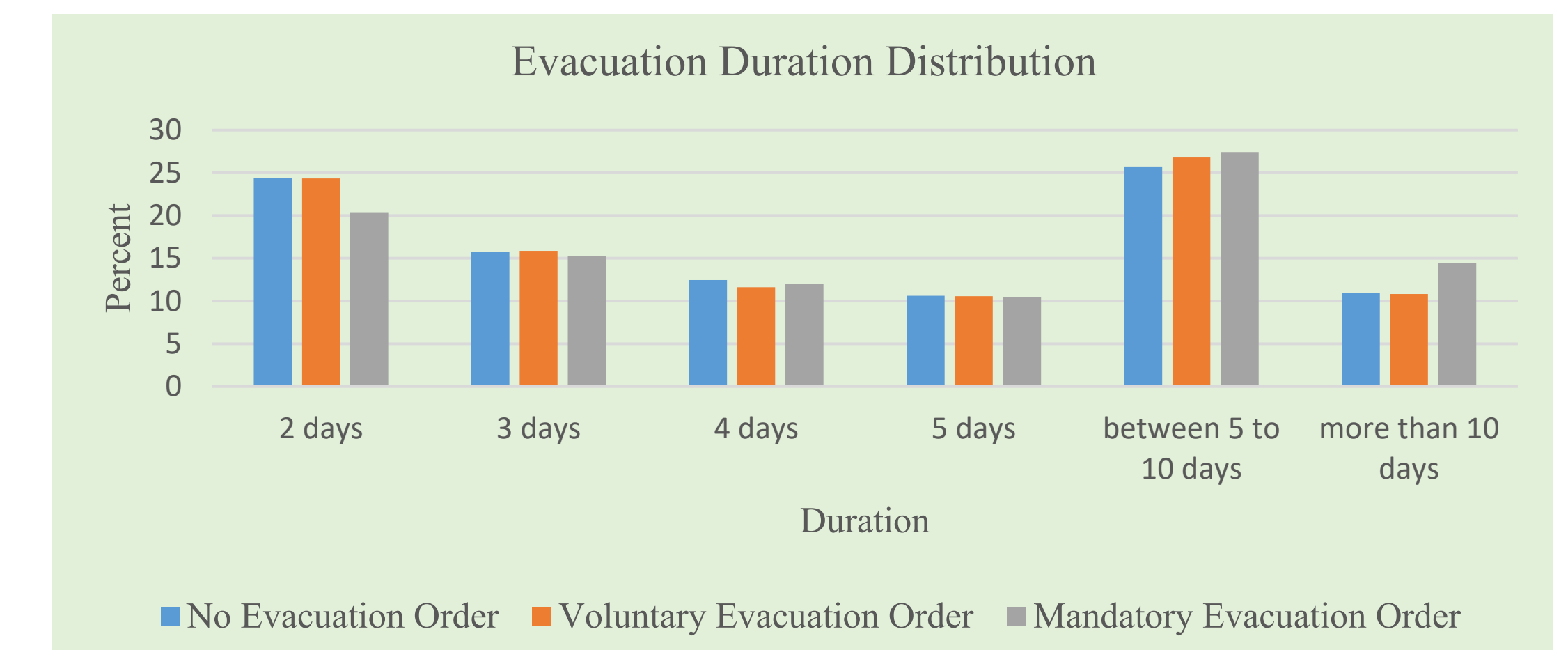
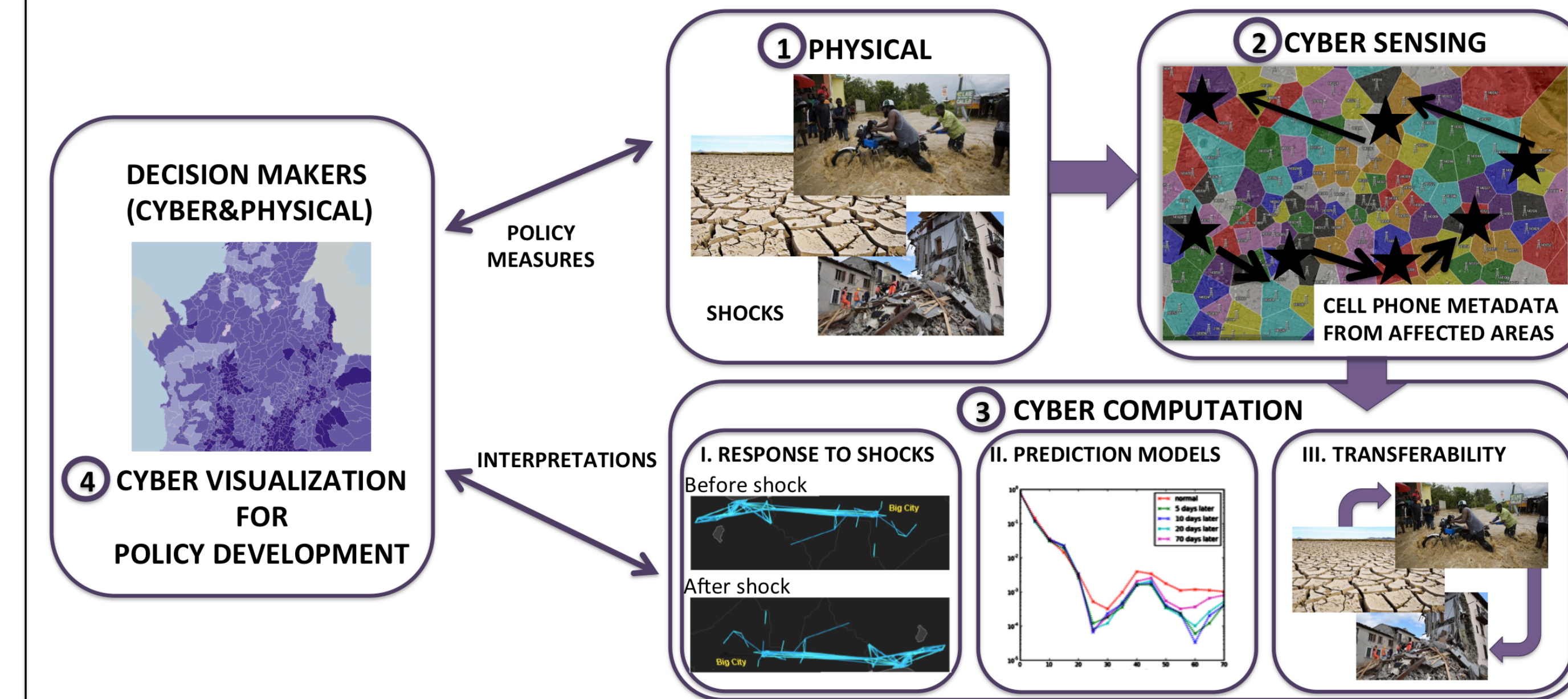
- Identify home location with LBS in Aug DBSCAN 7pm-7am data; select centroid with highest frequency
- Identify evacuees as those with distance from their home locations > 1mi
- Aggregate analysis of evacuation behaviors
- Statistical analysis of individual mobility behaviors and evacuation decisions via logistic regressions

3. Results

	No Evacuation Order		Voluntary Evacuation Order		Mandatory Evacuation Order		Entire State	
	Number	Ratio	Number	Ratio	Number	Ratio	Number	Ratio
Evacuated	187285	32.98	38524	33.68	72628	57.92	298437	36.95
Not Evacuated	380547	67.02	75868	66.32	52771	42.08	509186	63.05
Total	567832	100	114392	100	125399	100	807623	100

Variable	Model#1 – logistic model without mobility behavior metrics		Model#2 – logistic model with mobility behavior metrics	
	Estimated coefficient	p-value	Estimated coefficient	p-value
Intercept	3.61E-01	<0.001 ***	4.45 E-01	<0.001 ***
Evacuation order	4.06 E-01	<0.001 ***	4.08 E-01	<0.001 ***
Elevation	-8.60 E-05	<0.001 ***	-8.55 E-05	<0.001 ***
Median age	8.48 E-03	<0.001 ***	8.65 E-03	<0.001 ***
Median income	3.62 E-08	0.766	2.68 E-07	0.028 *
Vehicle availability	-1.57 E-02	<0.001 ***	-1.88 E-02	<0.001 ***
Race - white	2.59 E-01	<0.001 ***	2.44 E-01	<0.001 ***
Average number of trip	-	-	1.03E-02	<0.001 ***
Average of convex hull area	-	-	4.28E-04	<0.001 ***
Number of observation	803686		803686	
Log Likelihood	-516912.5 (df=7)		-513806.2 (df=9)	
AIC	1033839		1027630	
McFadden R2	0.025		0.031	
Models Comparison	P-value (Chi) = <0.001 ***			

Research Framework



4. Broader Impacts

- Knowledge sharing with disaster preparedness and response partners
- Online course for mobility data analysis