

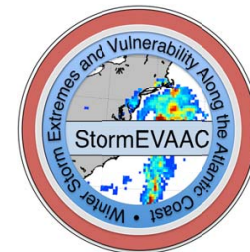
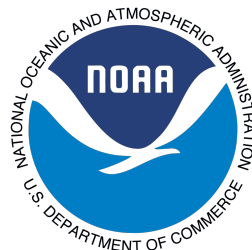
# TO ADAPT OR NOT TO ADAPT: DECISION-MAKING BY RESIDENTS OF URBAN COASTAL AREAS

---

Malgosia Madajewicz, Center for Climate Systems Research, Columbia University  
Philip Orton, Stevens Institute of Technology  
Fanglin Zhang, Stevens Institute of Technology

Prepared for 17<sup>th</sup> Annual Climate Prediction Applications Science Workshop

Research was funded by: NOAA COCA grant NA12OAR4310107; subcontract from a NOAA Coastal Resilience Networks grant awarded to the Trust for Public Land; NOAA RISA grant NA15OAR4310147; and NASA IDS grant NNX14AD48G.



# Objective

- Develop information that residents of coastal areas need to make well-informed decisions about adapting to coastal flooding.
- Residents need information about current and future flood risk, and benefits and costs of adaptation actions.

# Motivation

- Planning and preparation for coastal flooding engages primarily various levels of government and large private sector agents, such as insurance companies.
- Given limited public funding, decisions made by coastal residents are critical to adaptation.
- Focusing on comparing expected costs of inaction to costs of particular adaptations.
- Good data on costs of inaction is scarce.
- Not including loss of home value.

# How do people make adaptation decisions?

- Residents can take a range of actions to reduce future flood impacts:
  - Retrofits to their homes: raising electric utilities, reserving first floor for flood-proof uses, flood-proofing, raising the home
  - Managing private and community land
  - Financial planning
  - Relocating
- Information is neither necessary nor sufficient for people to act.
  - Learning
  - Peer effects
  - Incentives
- Informing residents can begin the diffusion of an adaptation process.

# Data

- This study relies on primary data from a household survey conducted in two neighborhoods most heavily affected by Hurricane Sandy in NYC: the Rockaways and southeastern Staten Island.
- Documents costs of recovery for a range of flood levels.
  - Analysis based on costs of recovery to homeowners.
- Valid because over 90% of residents did not improve resilience of homes when rebuilding.

# Costs of recovery from Hurricane Sandy

<b>Costs</b>	<b>Mean</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>
Total	\$62,000	\$50,000	0	\$410,000
Out of pocket	\$28,000	\$15,000	0	\$200,000
Covered by flood insurance	\$29,000	\$14,000	0	\$240,000
Covered by financial assistance	\$7,700	\$1,500	0	\$75,000

- 20% of households experienced flood levels under 3 feet.
- 50% experienced flood levels greater than 5 feet.

# Methods

- Flood hazard assessment
  - Applying results of prior studies that quantified probability versus water elevation for 2016 (Orton et al. 2016a; Orton et al. 2016b).
  - Consider 10 events at return periods of 1, 5, 10, 30, 50, 100, 300, 500, 1000, 10000 years in each year.
  - Water elevation increases over time because of SLR (median).
- Estimate expected annual damage (EAD)
  - Using NYC buildings dataset from FEMA's CommunityViz project – building footprint, number of units, freeboard, ground elevation.
  - Limiting analysis to residential buildings with fewer than 10 units.
  - Using flood-depth-damage function from household surveys.
- Present value of future damage
  - Discount rate 3%.
  - 30-year time horizon.

# Benefits of adaptation

- Present value of damages over the next 30 years depends critically on elevation of lowest floor in the house.

PV of mean EAD	PV of median EAD	Mean PV of median EAD 0 – 0.5m (30% of sample)	Mean PV of median EAD 1m (32% of sample)	Mean PV of median EAD 1.5 – 2m (21% of sample)	Mean PV of median EAD 2.5 – 4m (18% of sample)
\$269,602	\$66,695	\$729,045	\$75,055	\$18,979	\$4,684

- Mean cost of raising a home is \$150,000.
- Mean cost of raising mechanicals is \$15,000.



# Conclusion

- Realistic assessments of future flood damages, change in home value, and costs of adaptation can help coastal residents to take informed adaptation actions.
- Useful for the public sector to develop policies that help people to act.
- The assessment shows potential value of flood predictions.
- Actions depend on elevation, time horizon, level of SLR that want to plan for ...
- We need better data to inform decisions.

Thank you!

Please contact Malgosia Madajewicz at  
[mm1174@columbia.edu](mailto:mm1174@columbia.edu) with questions and comments.