Case Studies for Hurricane Risk

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Benefits of a Case Study

• Test methods → Different solutions for full-scale
• Focus pieces of project → Consistent assumptions
• Ensure links among pieces
• Confirm required inputs; Illustrate outputs
• Ground models in reality
• Facilitates work with practitioners
• Tell story of contribution → Translation to practice

*Downsides: Data is messy, generalizability?*
Ex. 1. Long-term Mitigation, Insurance, Buyout Policy Analysis
Ex. 1. Case Study

- Hurricane
  - Wind
  - Coastal flooding
- 932,000 single-family wood-frame homes
- Physical retrofit strategies
- Multiple excess of loss cat. insurers
Hazard Input

All historical or synthetic events

Reduced set of events with adjusted annual frequencies

97 probabilistic hurricane scenarios, each with:
- Annual occurrence probability
- Wind map
- Coastal flooding map
Building Inventory Input

Num. SFDs by Census tract (portion) $i$, Building type $m$, Building resistance type $c$

• Inventory
  – Structural details based on codes, common practice, age distribution
  – New data sources...Zillow, Microsoft

• Damage model

• Retrofit represented as change from $c$ to $c'$

• Survey-based homeowner decision models based on same retrofit choices
Ex. 2. Short-term Evacuation Decision Support

1. Generate scenario ensemble (WRF)

2. Generate inland flooding (CREST)

3. Generate storm surge flooding (ADCIRC)

4. Integrate all hazard inputs to create inundation level & wind map ∀ s, t

5. Generate hurricane scenario tree

6. Run evacuation model (MSP)

- Population behavior
- Traffic model (DUE)

OUTPUT

- Tree of evacuation order recommendations
- Evaluation of performance of recommendation (risk, travel times)
Population, Infrastructure Input

- Evacuation zones
- Road network, shelters, exits
- Population
Hazard Input

- Hurricane ensembles
  - Wind
  - Coastal, inland flooding
- WRF-CREST-ADCIRC links
- Isabel, Matthew, Florence
Study Area Choice

**Pluses**
- Region at risk
- Recent experience → Data, interest
- Practitioner partners
- Variability
- Size
- Path dependence!

**Minuses**
- Evacuation
  - No dense population at coast
  - Little public transit at coast
- Risk mgmt policy
  - No multi-family
- Big events in Florida, Houston, Caribbean
- Generalizability?
Test Beds for SimCenter

**Potential Benefits**

- Efficiency in data collection and maintenance
- Lower barriers to entry for some analyses
- Allows direct comparison among alternate methods

**Challenges**

- Different studies often differ in input required—operationalization, format
- If possible, allow users to pick and choose, build over time

IEEE 30 bus power flow test case
Acknowledgements