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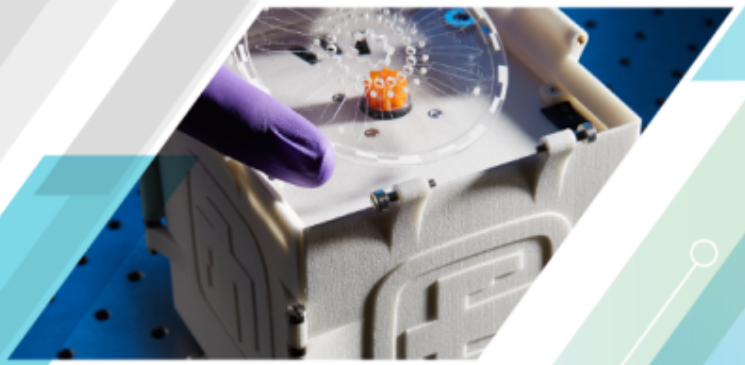
Energy & Homeland Security

Critical Infrastructure Decision-Making under Long -Term Climate Hazard Uncertainty



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PROBLEM STATEMENT

More frequent and severe extreme weather events

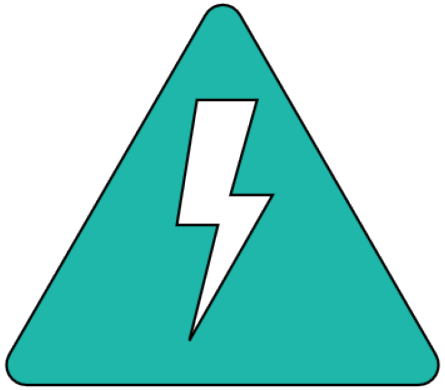
Limited integration of climate hazard information into infrastructure resilience investments

Current decision-making tools focus on single hazards or static planning horizons (e.g. emergency response)

We will use hard and soft data to develop a risk-based method for determining future infrastructure resilience investments to climate hazards that integrates decision-making processes

LIMITATIONS OF STATE OF THE ART

Natural hazard evaluation is typically limited to a type of event (e.g., high winds) and does not capture compounding features



Fragility curves that capture damage probabilities assume fully functional system states

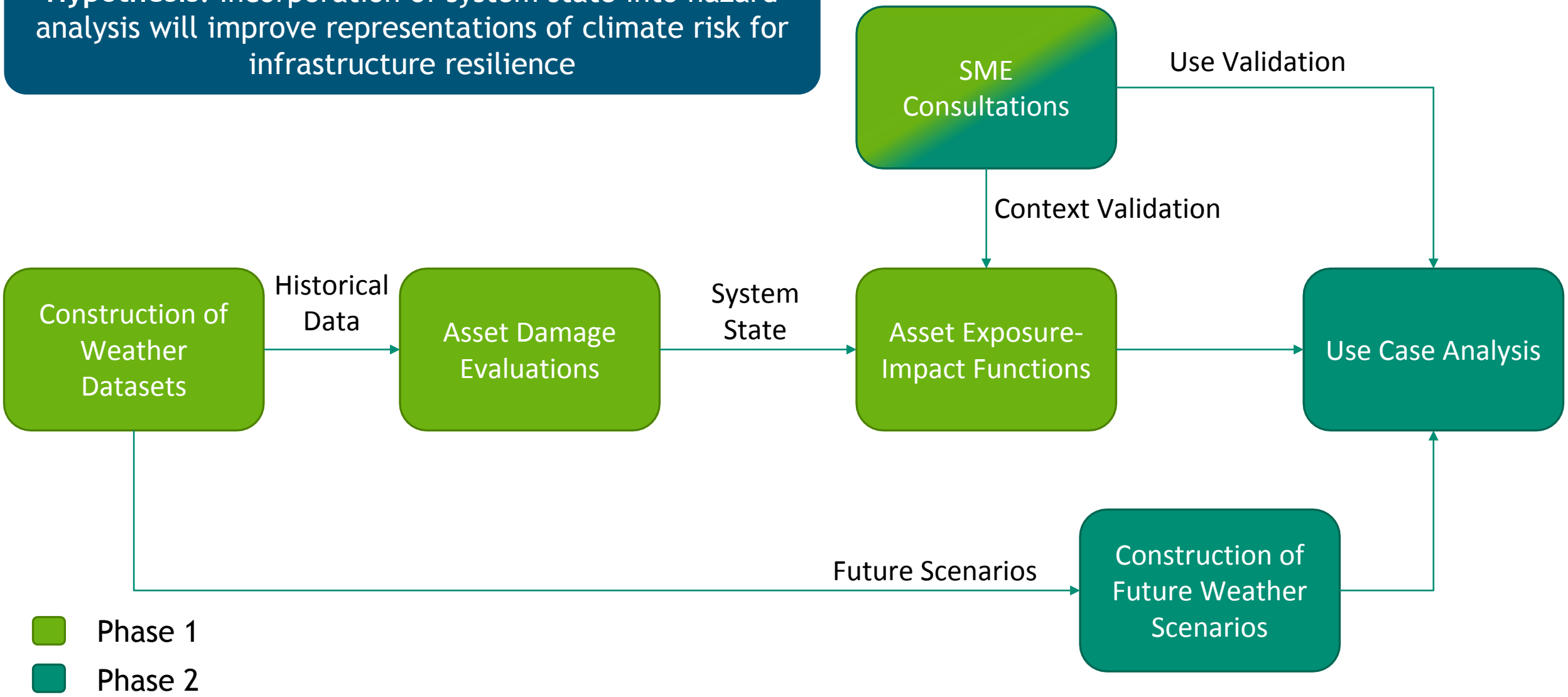
Current reliability-resilience analyses evaluate ways to optimize hazard response calculations. But do not generally focus on the creation of natural threat scenarios

Limited understanding of the information that is necessary to make infrastructure decisions around resiliency to climate hazards

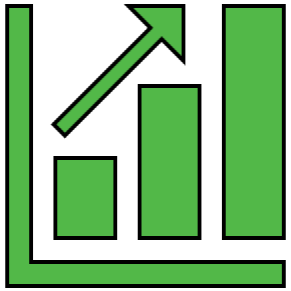
Why Sandia? Leveraging current critical infrastructure resilience assessments, data-driven human-centered design & decision-making, applied data analytics, and systems-thinking

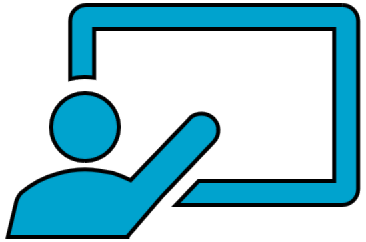
PROPOSED SOLUTION

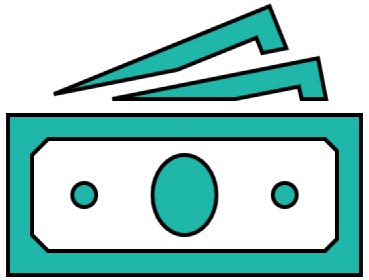
Hypothesis: Incorporation of system state into hazard analysis will improve representations of climate risk for infrastructure resilience



RISKS







Risk	Low confidence in spatially or temporally appropriate hazard projections	Decision-making strategies are not representative of infrastructure damage analyses	Capturing spatio-temporal dependencies in scenarios will be computationally prohibitive	There is too much uncertainty associated with climate hazard impact evaluations
Mitigation	Incorporate high uncertainty margins into scenarios to evaluate sensitivities	Consider multiple strategies to evaluate decision-making regarding climate hazards	Spatial dependency req’ts relaxed through regional case studies; copulas will reduce comp. complexity of temporal correlations	Historical information about infrastructure system states will reduce uncertainty of climate hazard impacts

POTENTIAL FRAMEWORK/APPROACH

1. **Research Threats:**
   - What is Miami worried about?
   - What problems will arise/worsen with climate change?
2. **Infrastructure Impact**
   - For these threats, how would each of them impact infrastructure assets and function?
   - Suggest focusing on electric grid and water sectors.
3. **Current State:**
   - What is Miami doing now about these threats?
   - Is it sufficient? If not, why aren't they doing more? (Cost, lack of data, uncertainty, lack of authority, etc.)
4. **Proposed Solution:**
   - What is needed to get decision-makers to act?