

Future San Francisco Bay Shorelines and Regional Interdependence



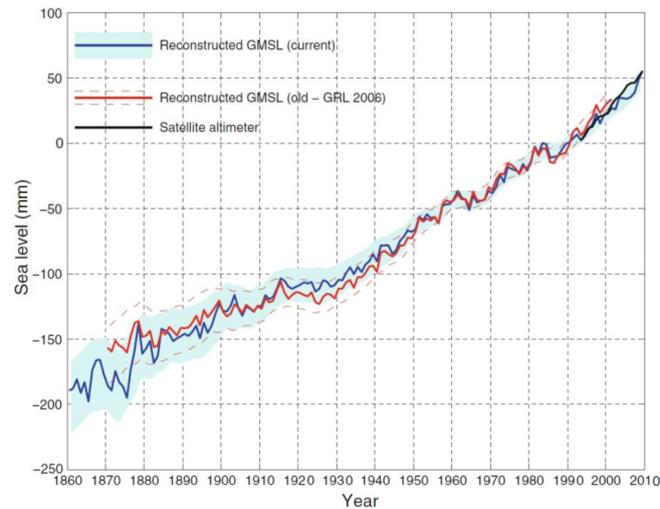
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Sponsor: NSF-CRISP

BCDC
Board Meeting
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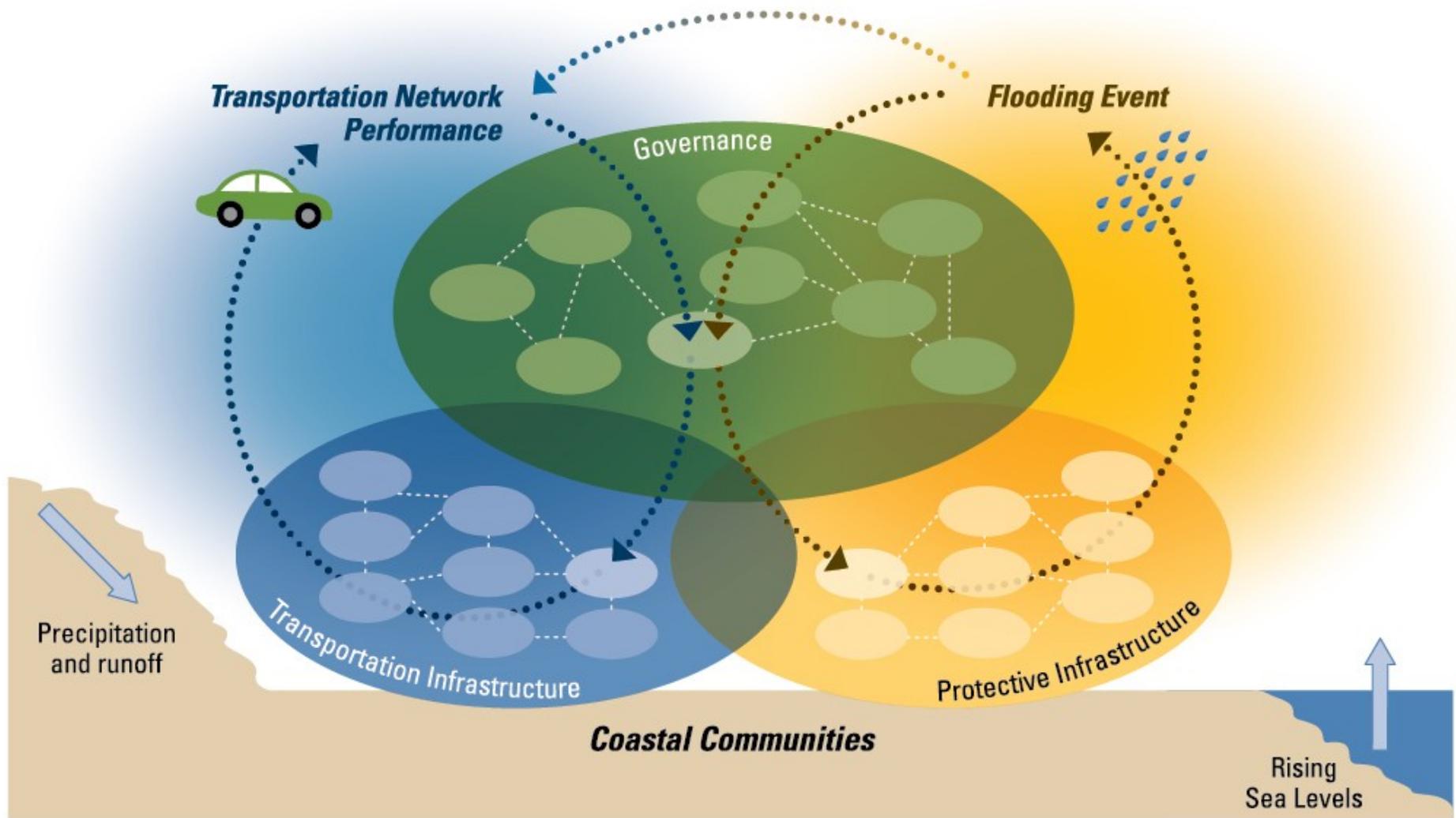
Coastal Flooding: An Emerging “Nuisance”?



- Increasing frequency, increasing cost



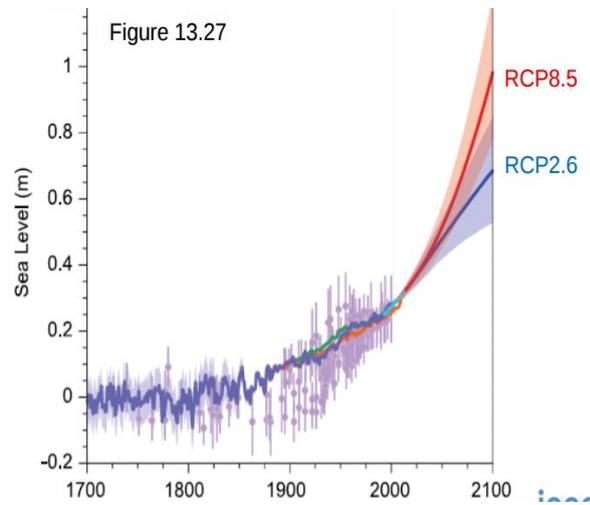
Challenges to Coastal Community Resilience



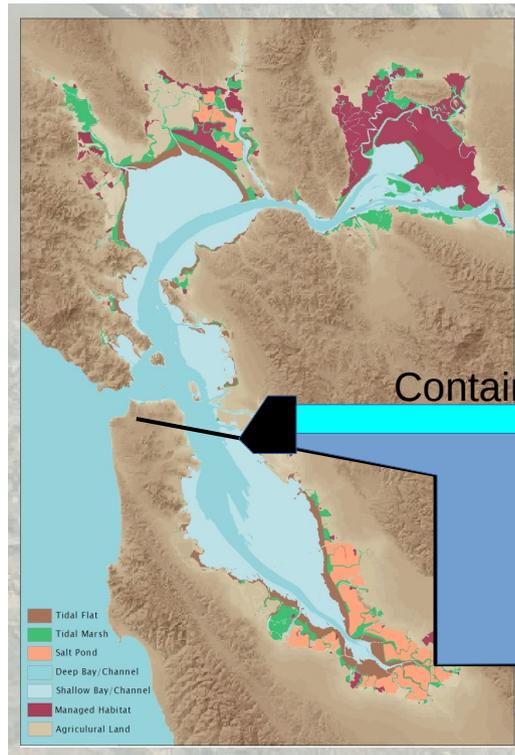
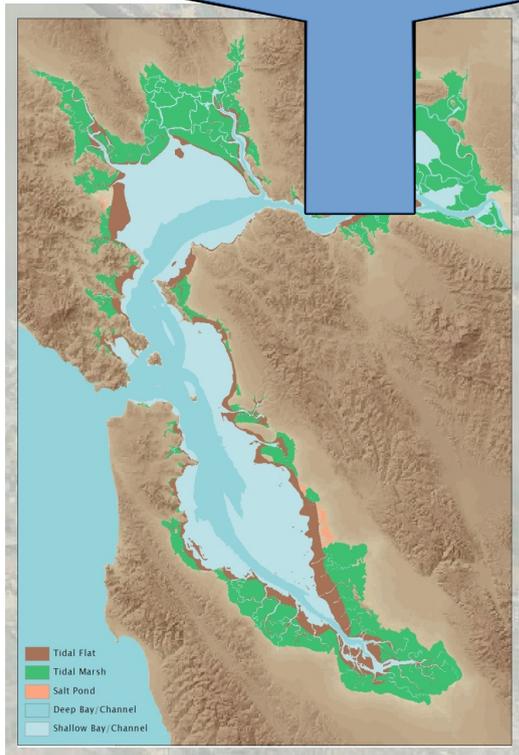
- RISER Project integrates hydrodynamic model of flooding, behavioral model of traffic flows and empirical evaluation of decision-making network
 - Driven by scenarios for environmental forcing and shoreline configurations

Important Theme: Local-regional Linkages and Network Effects Create Interdependencies

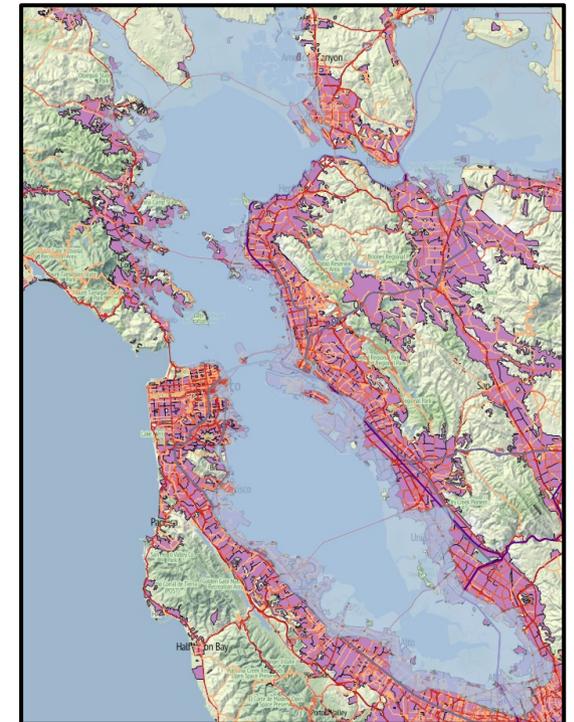
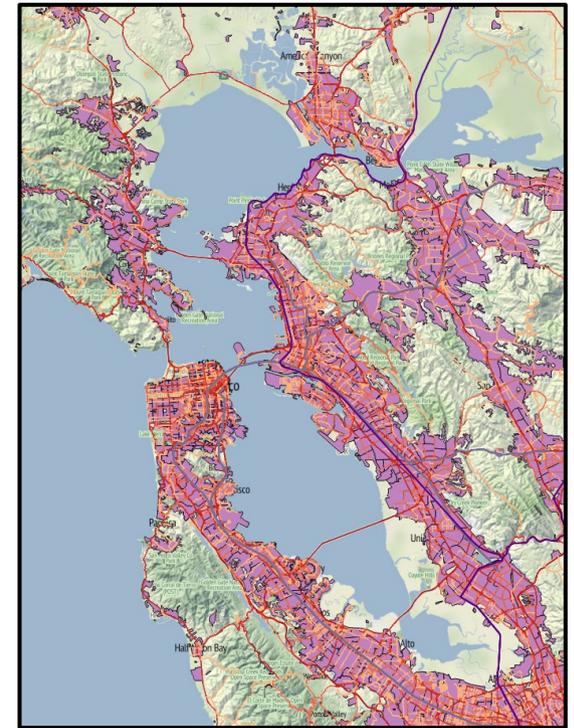
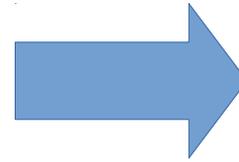
Shoreline and Sea Level Scenarios



Accommodation

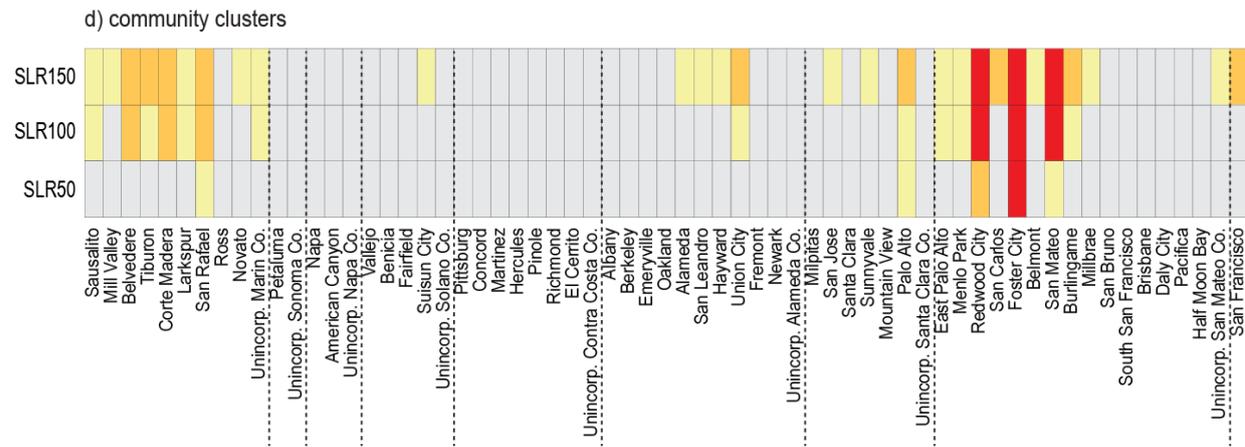
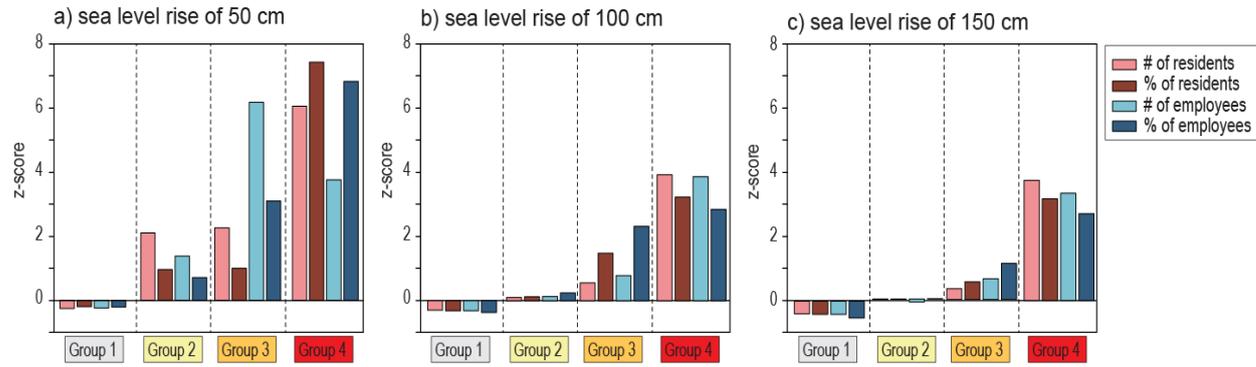
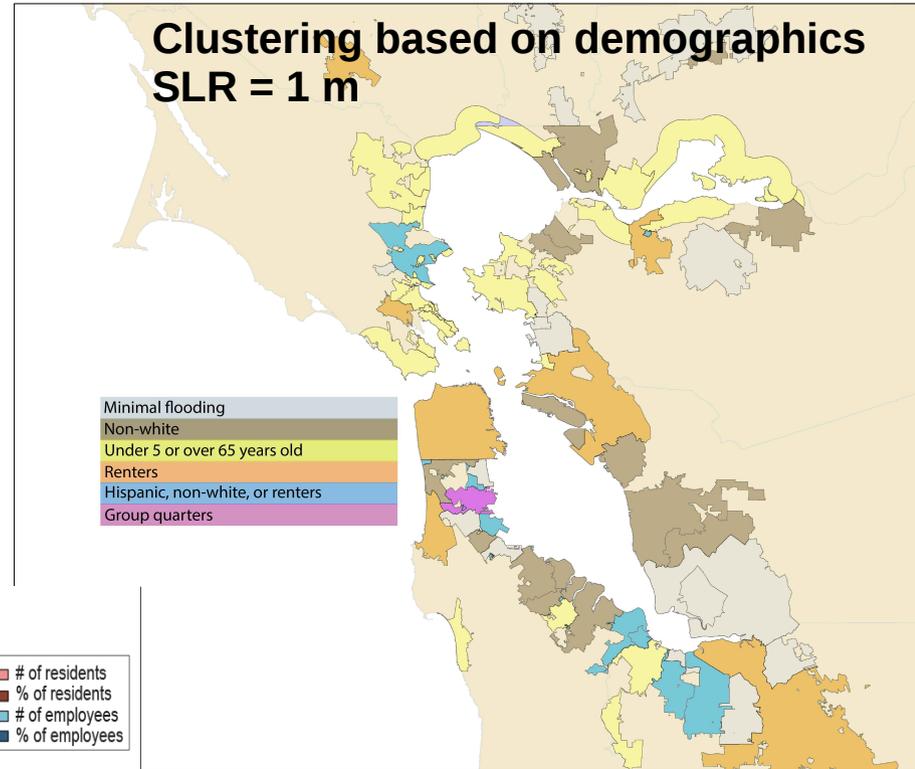


Containment



Shared Experiences

- Inundation map merged with census data
 - Clusters based on similarities between communities
 - Clustering varies with time (sea level) and data considered

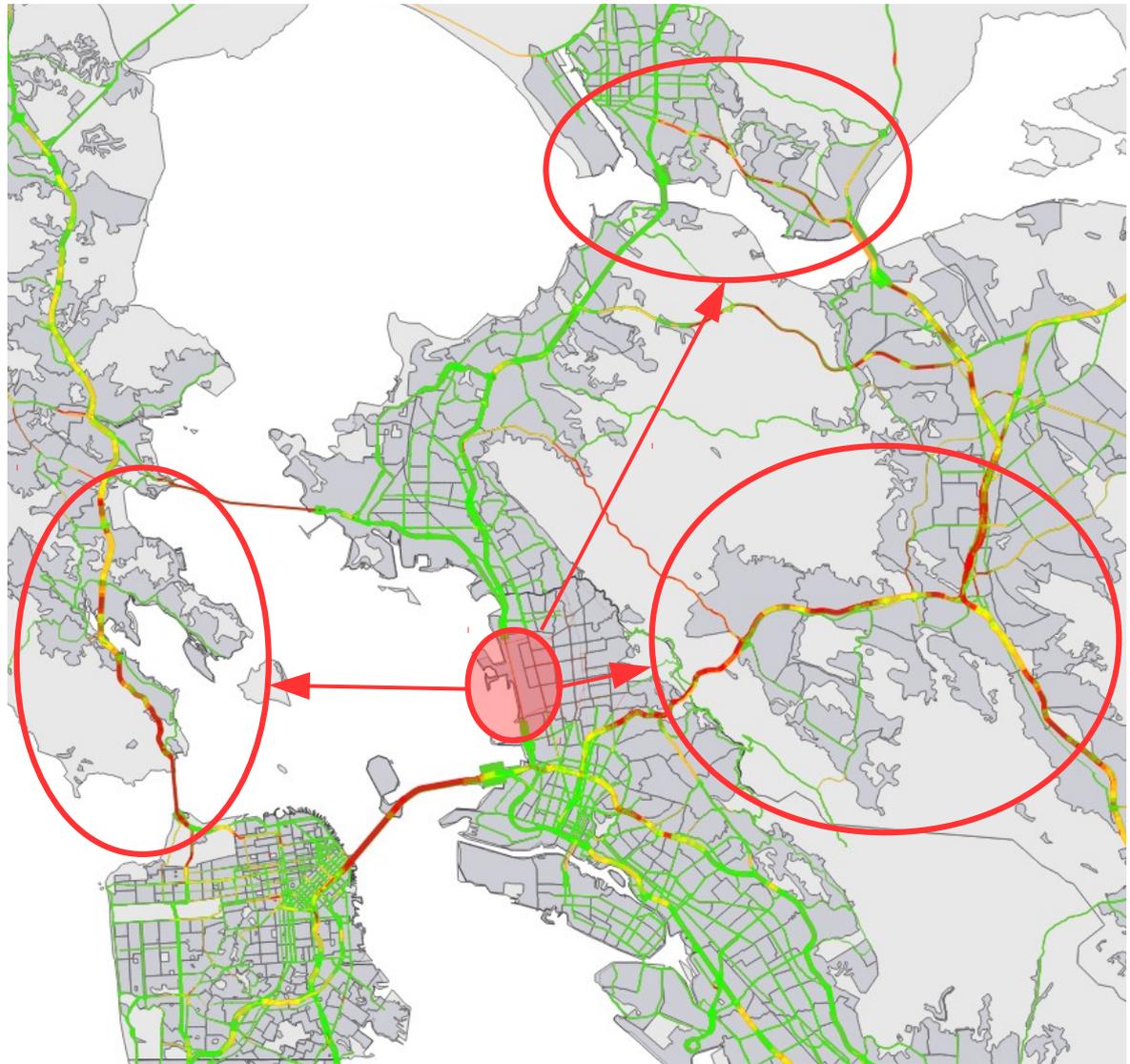


- Regional Opportunity
 - Communities with similar risks may benefit from sharing knowledge
 - Future clustering may motivate unanticipated connection

Hummel et al., in press at *Regional Environmental Change*

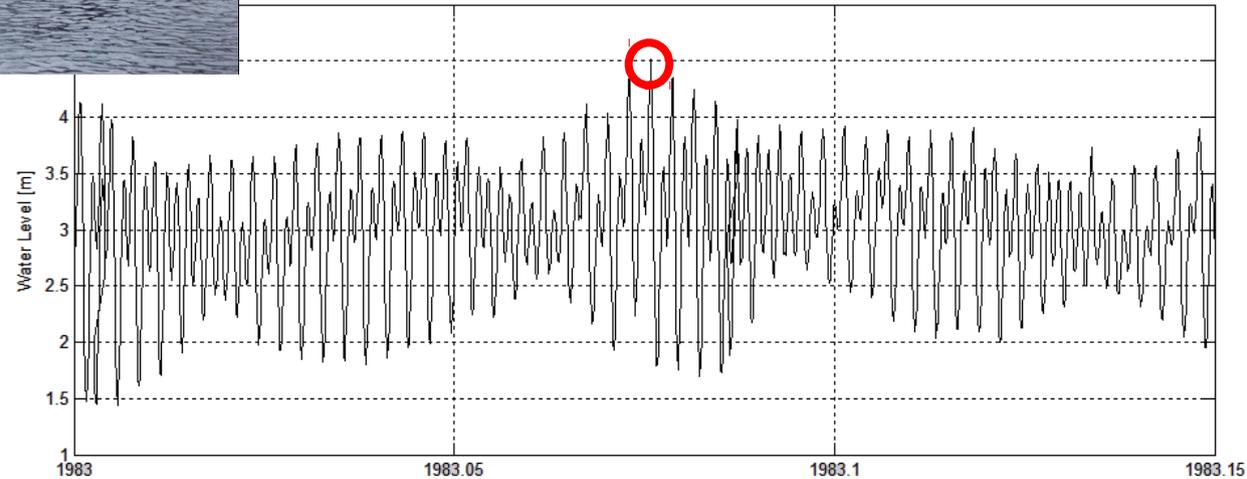
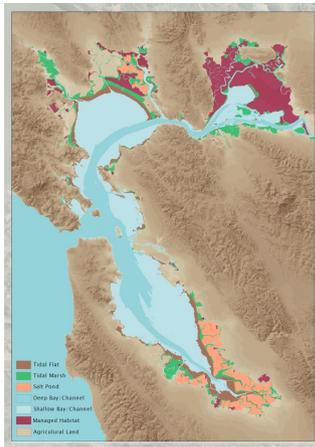
Interdependent Vulnerabilities

- Disruption by flooding on Berkeley water front
 - 90% capacity reduction
- Behavioral model adjusts traffic patterns
 - Model built from cell phone data
- Travel time increases:
 - Green: 0%
 - Orange-Yellow: 0-50%
 - Red: >50%



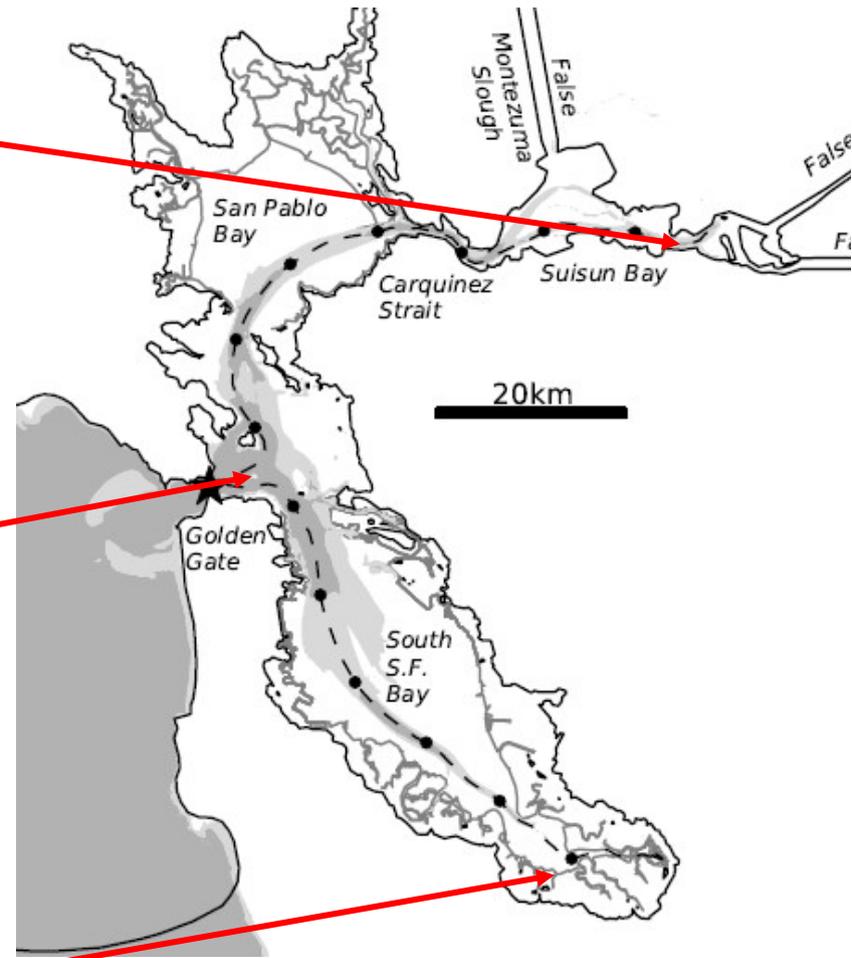
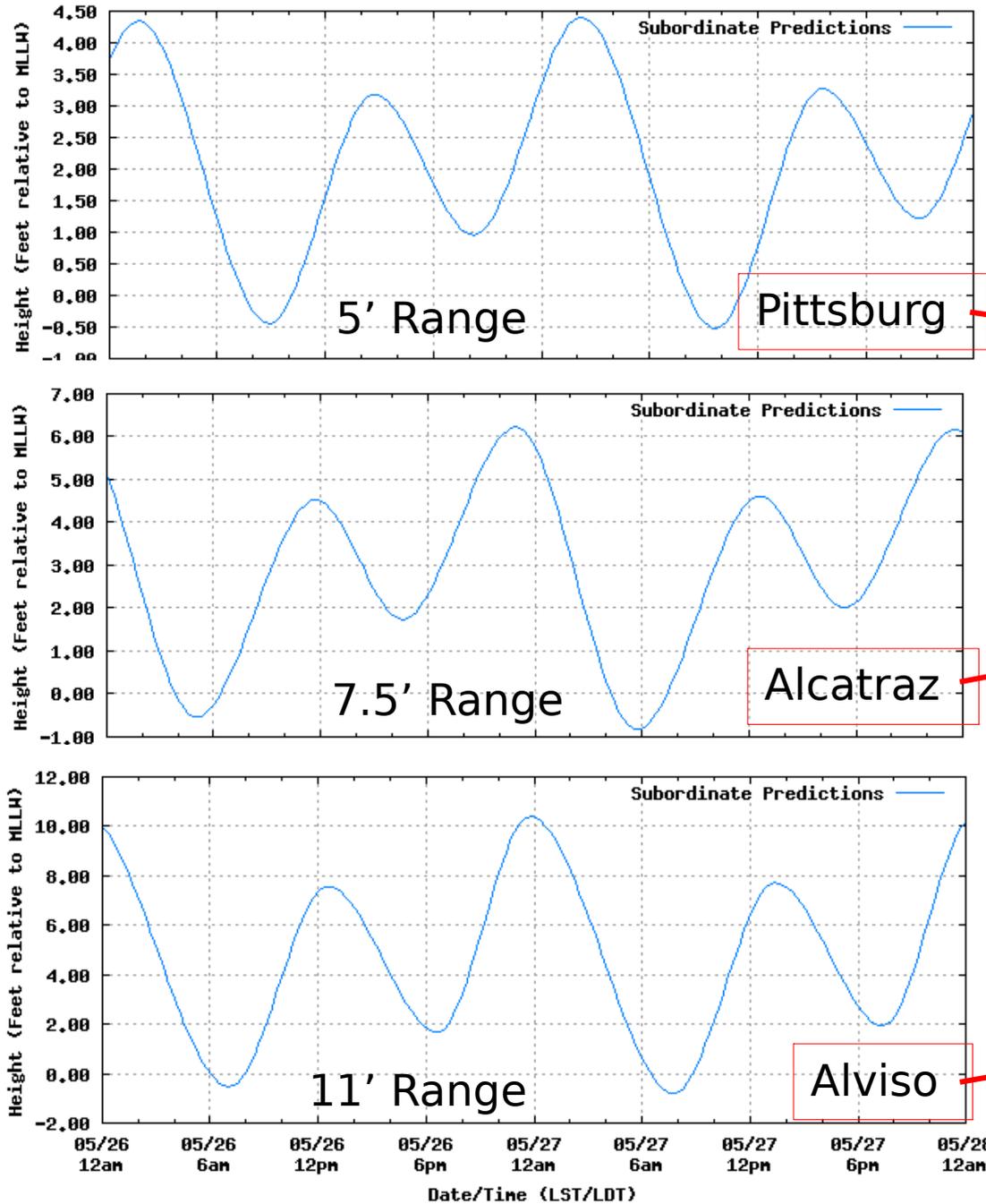
- Regional Costs due to Local Vulnerability
 - Localized inundation event creates regional changes in travel times and costs
 - Creates incentive for regional investment in local protections

Importance of the tides in SF Bay

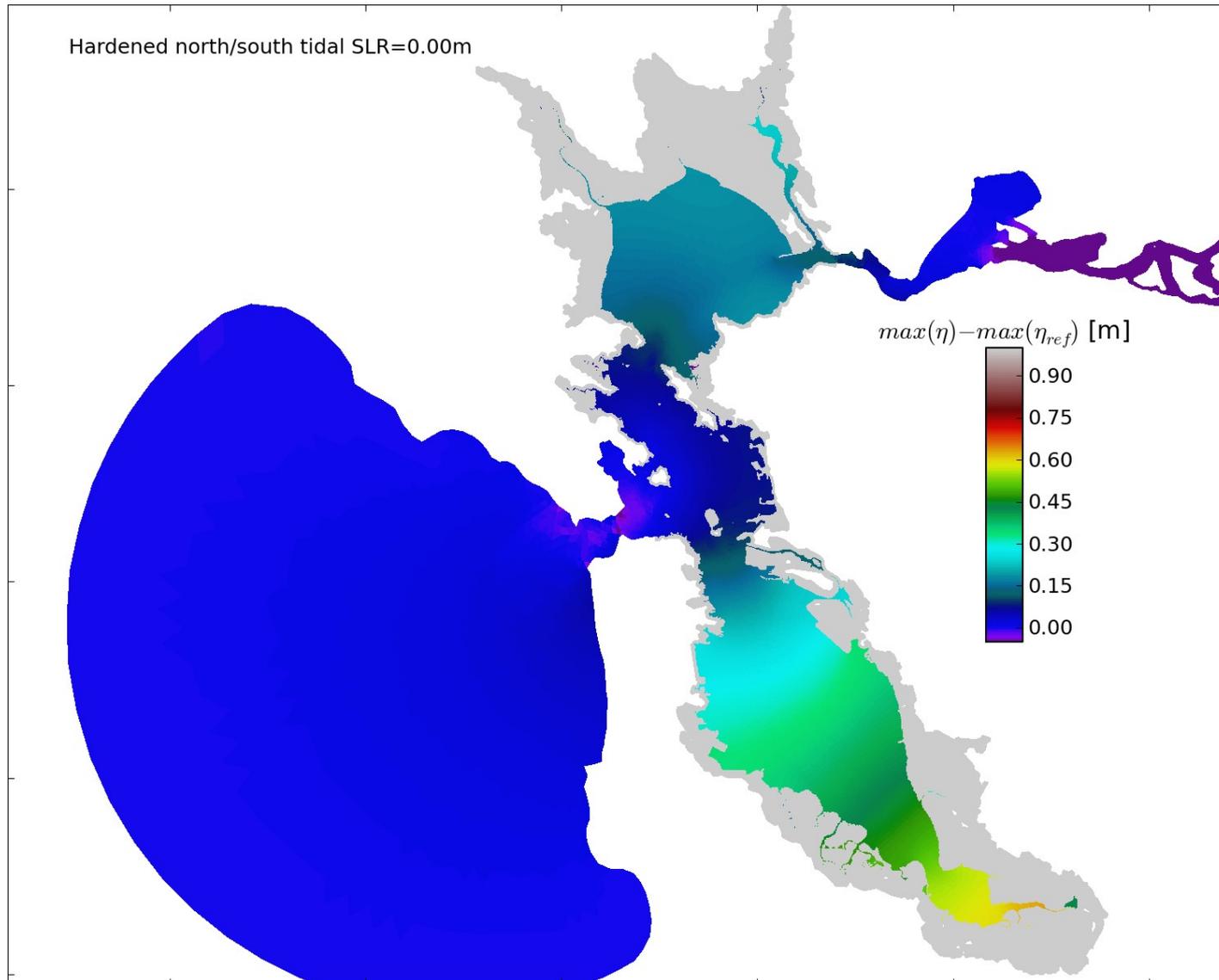


- Tides dominate signature of high water events
 - Need to consider interaction of tides with the basin

Tidal Amplification and Dissipation



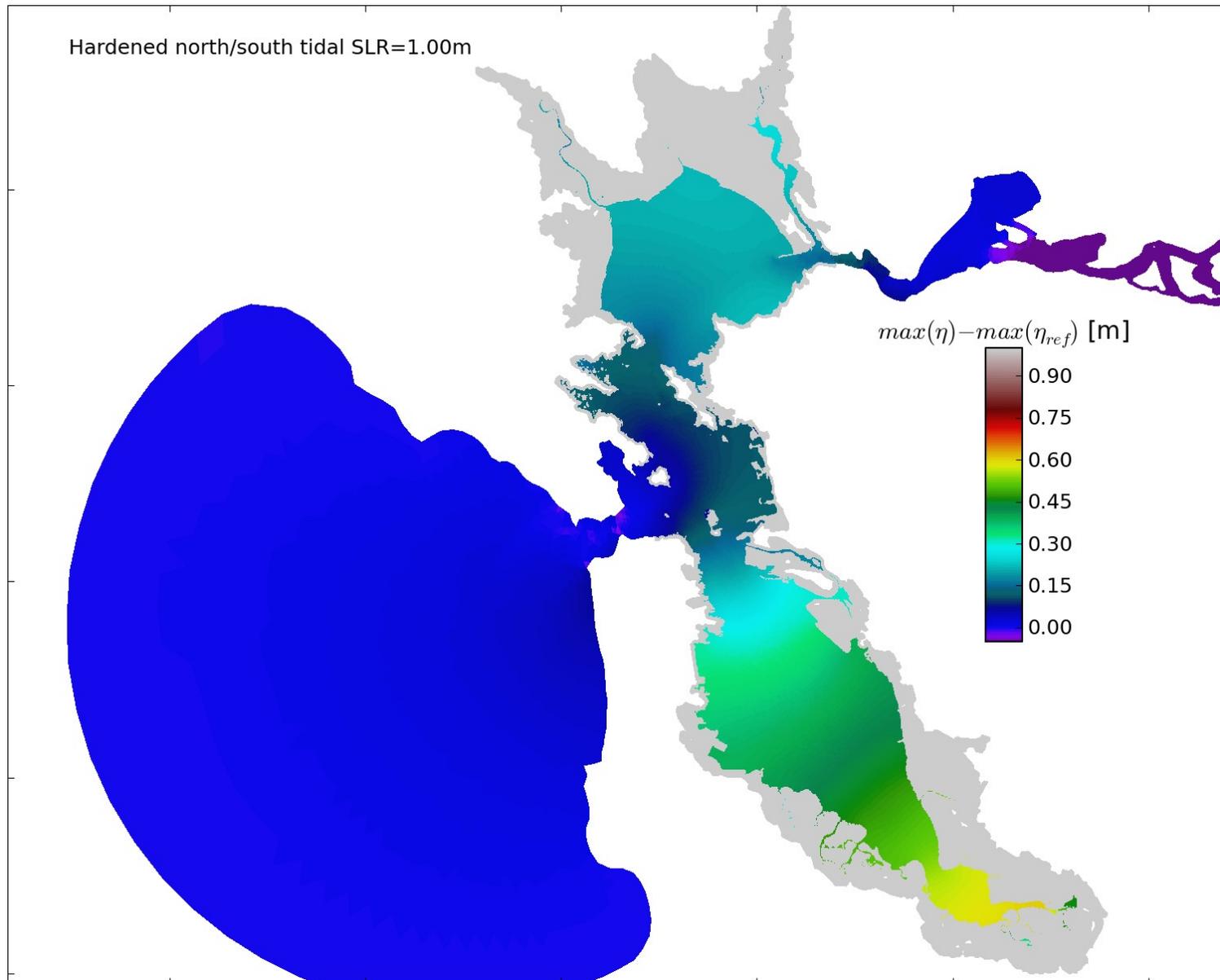
Current conditions with tidal forcing



Colors show water elevation *above* high water level in ocean (M2 tides)

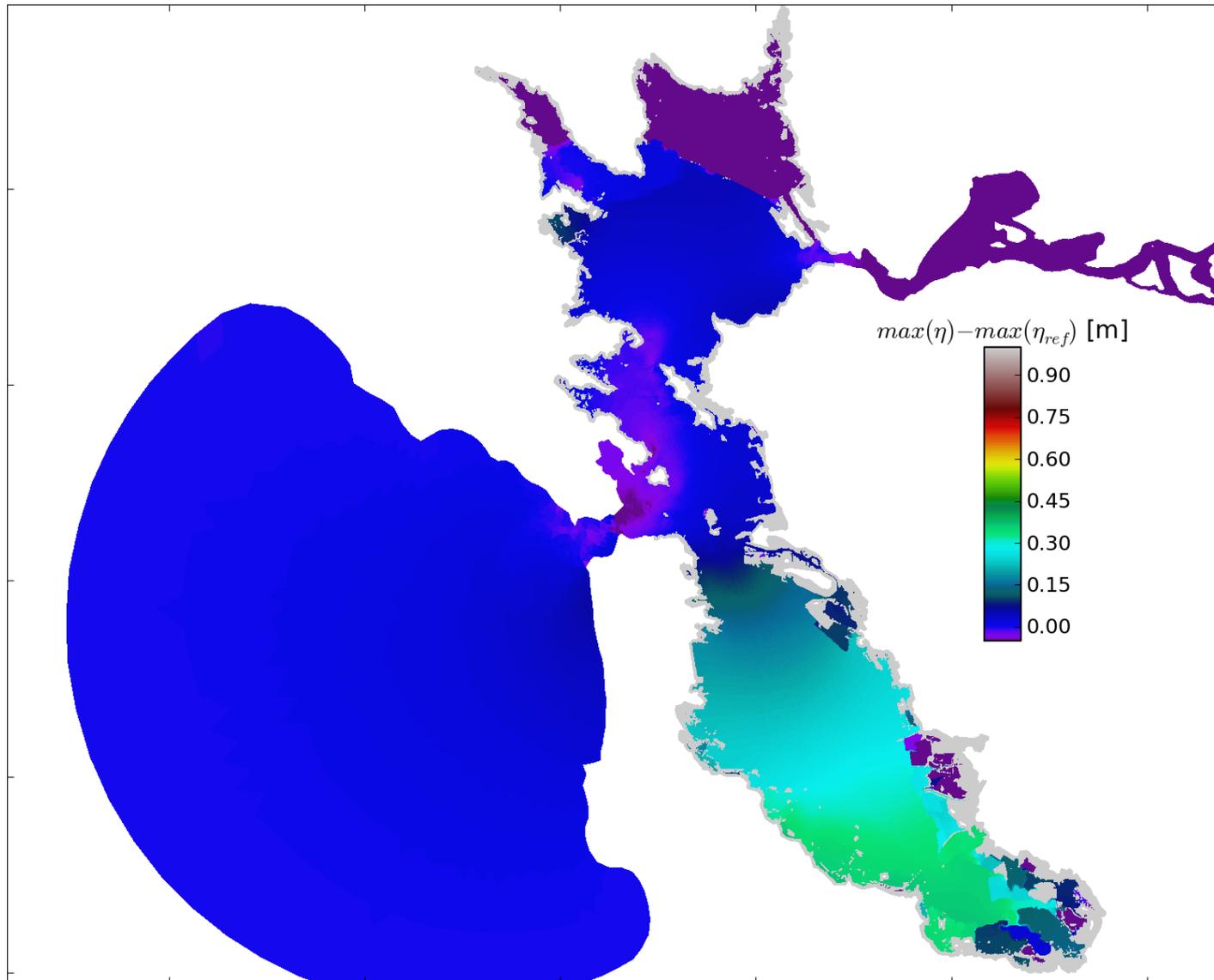
Gray areas show extent of grid

Full Containment, 1 meter SLR



Very similar to current conditions. SLR adds linearly to current water levels

Full Accommodation

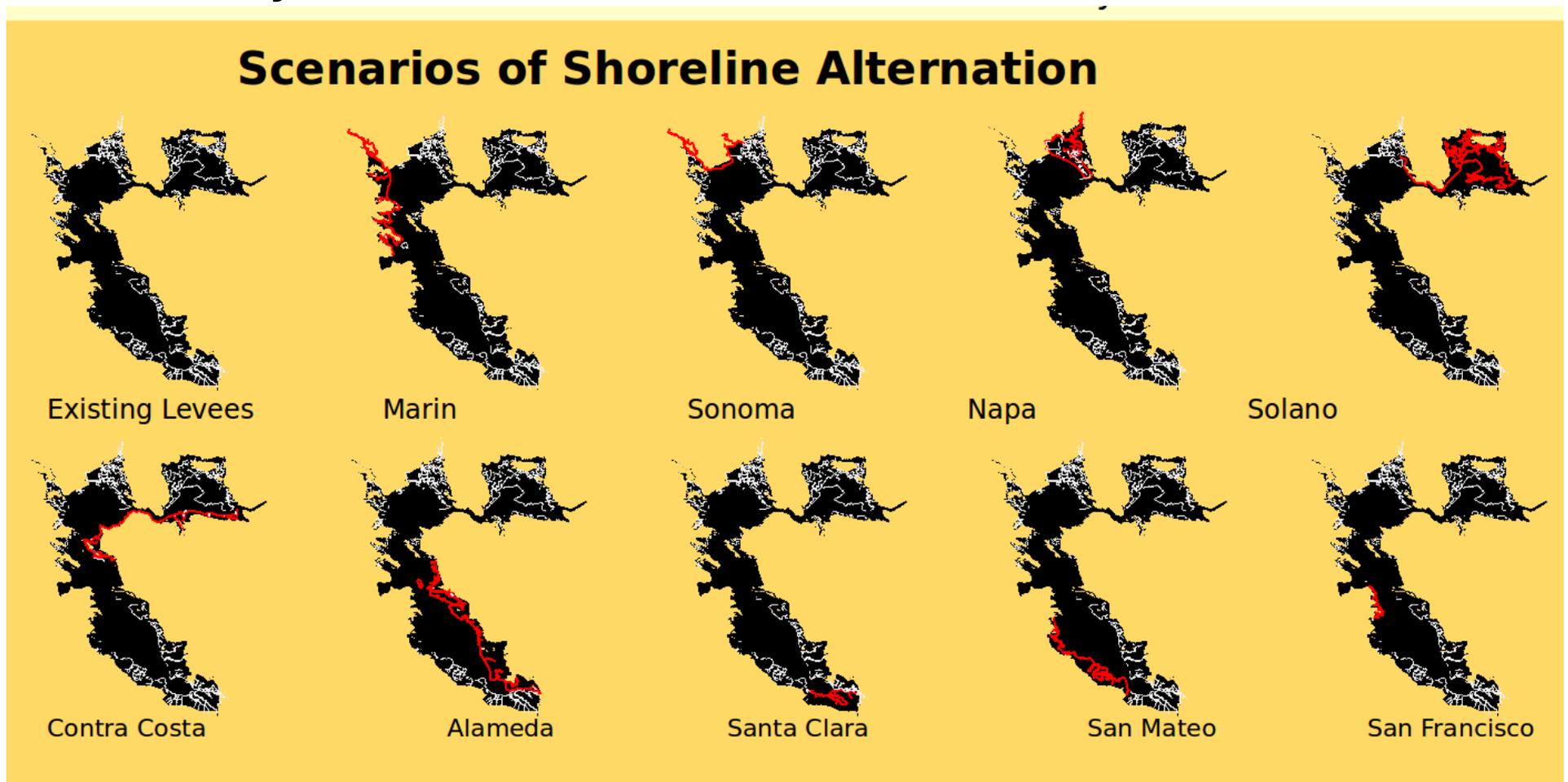


Water level in south bay is only 40-45 cm above ocean water level.

With full containment (previous), was ~60 cm above ocean water level.

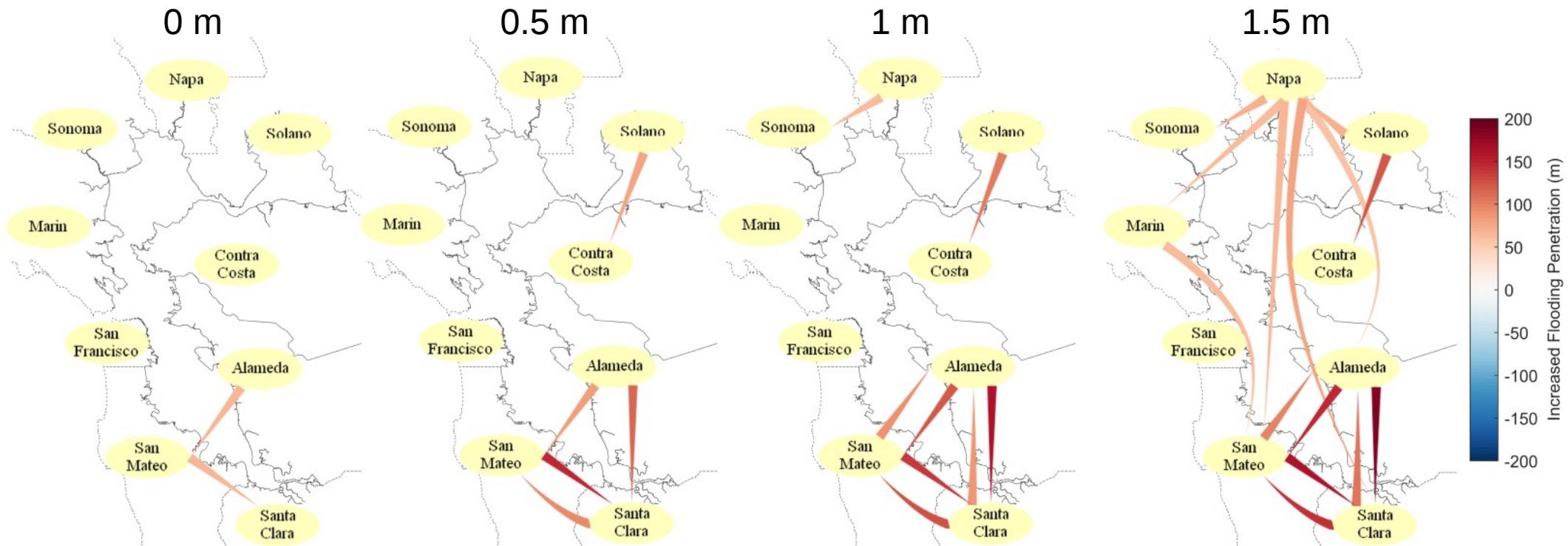
County-by-county protective measures

- Existing topography/levees in white
 - Red lines show hardened shorelines for county-by-county scenarios



Interdependent Adaptation

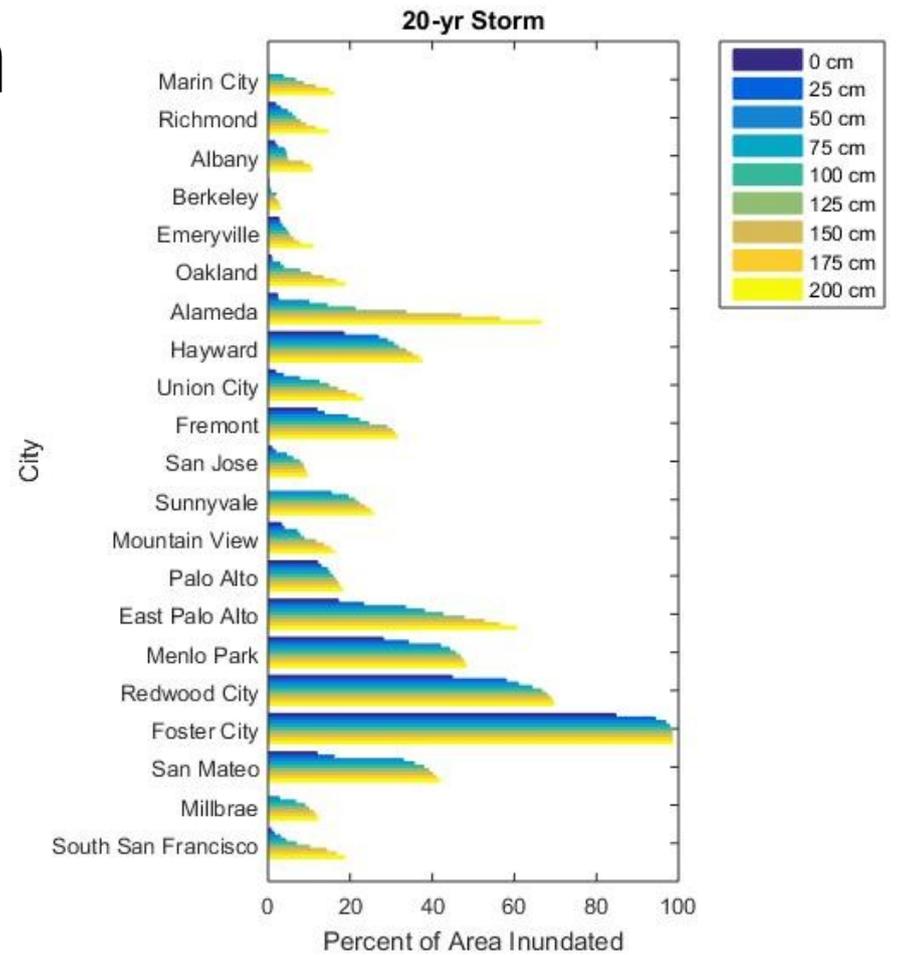
- Defining direct influence of action by one county on flooding in another
 - County-by-county shoreline protective action
 - Quantify change in flooding in other counties for 4 SLR scenarios



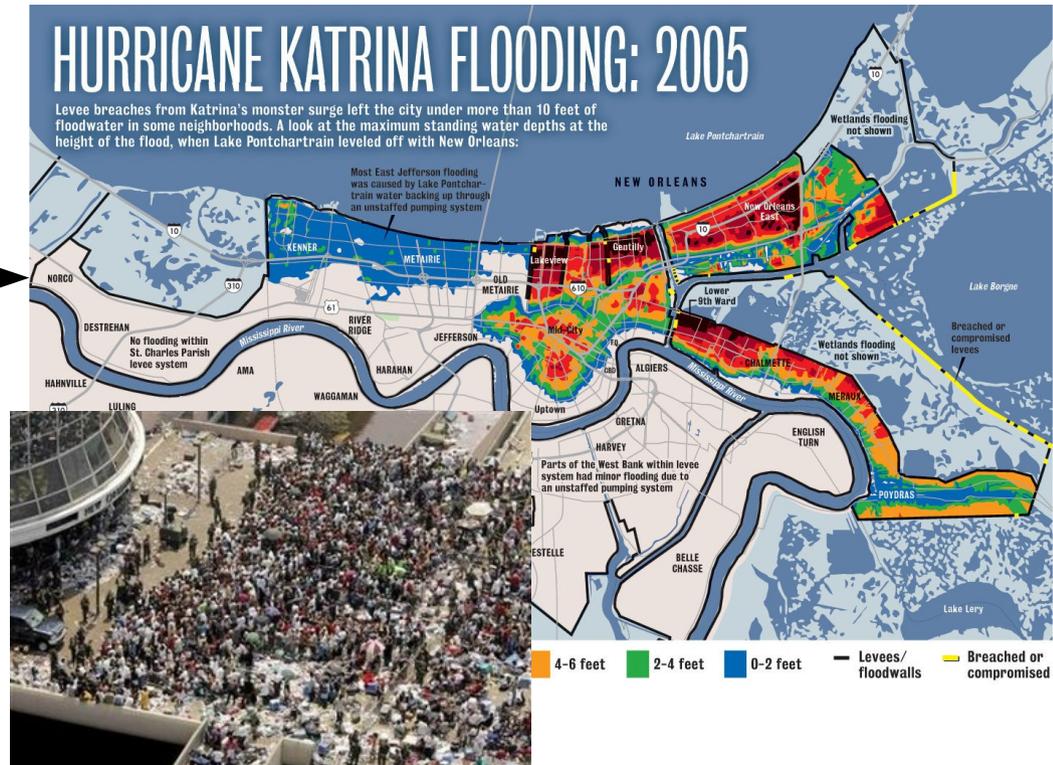
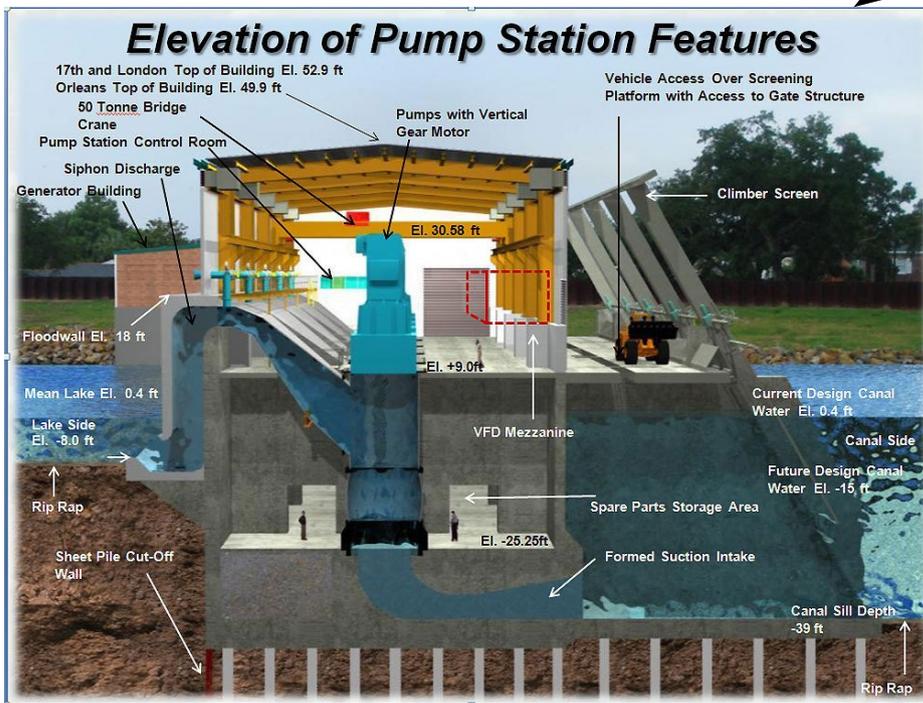
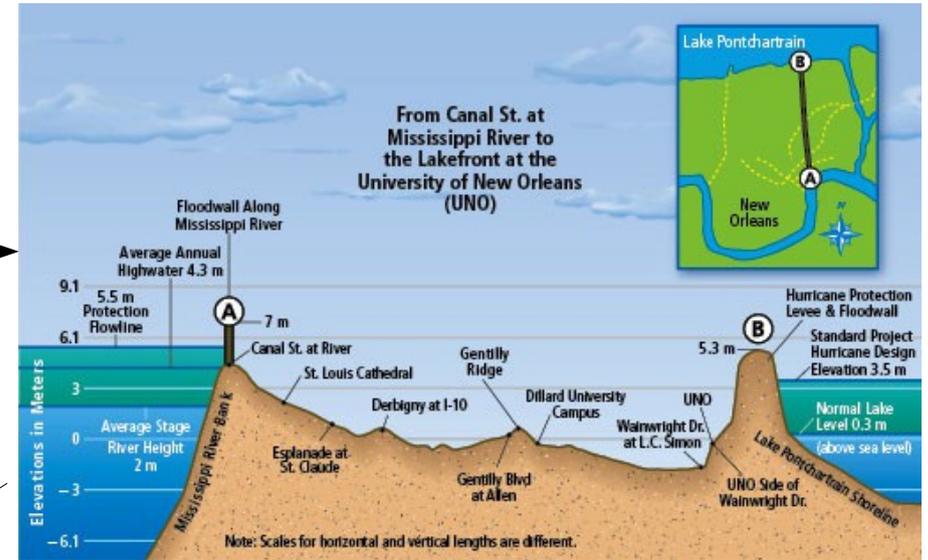
- Regional Impacts of Local Actions
 - Direct interactions means counties planning activities must account for others
 - Strongly motivates coordinated actions

Barriers to Regional Action

- Heterogeneity in time urgency
 - Communities have different runway lengths
- Heterogeneity in socio-economic power
 - Many vulnerable bayfront communities have limited ability to invest for long-term

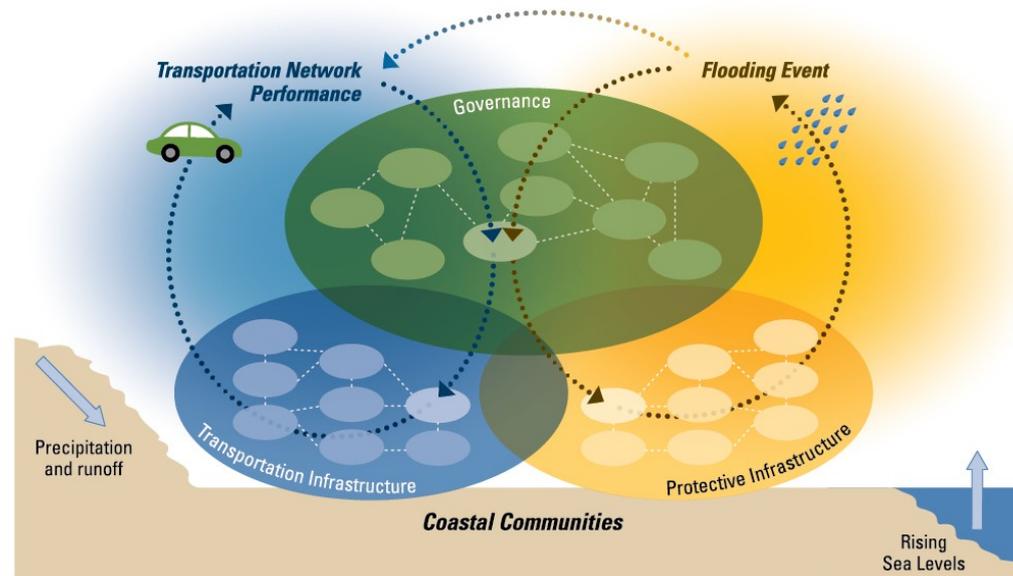


Path Dependency in Decision-Making



Opportunities and Challenges

Immediacy of threat to local communities creates inequities in response – Regional interdependence provides counterbalance.



Opportunities from Regional Analyses:

- Consider future scenarios
 - Move discussion beyond immediate threats and consider end state for region
 - Scenario-based approach can help eliminate “leader-follower” dynamics
- Establish local-regional interactions
 - Regional costs of local action or inaction (vulnerabilities)
 - Local impacts of regional strategies