

Lagos



Bangkok

Coastal Cities at Risk – Building Adaptive Capacity for Managing Climate Change in Coastal Megacities

Assessing the Vulnerability of Coastal Cities in a Changing Climate

Vancouver



Manila



Social Sciences and Humanities
Research Council of Canada

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sciences humaines du Canada



Coastal Cities at Risk (CCaR)

- Co-Principal Investigators: G. McBean, Western University, Canada; A. Snidvongs, Chulalongkorn University and R. Cooper (SEA-START)
- Mega-cities in coastal zone and on river deltas: Vancouver, Bangkok, Manila, Lagos- working with START and IRDR ICoE, MEOPAR NCE and partnering with other city research teams – Interdisciplinary - natural, engineering, socio-political-economic and health scientists
- 2011-2016



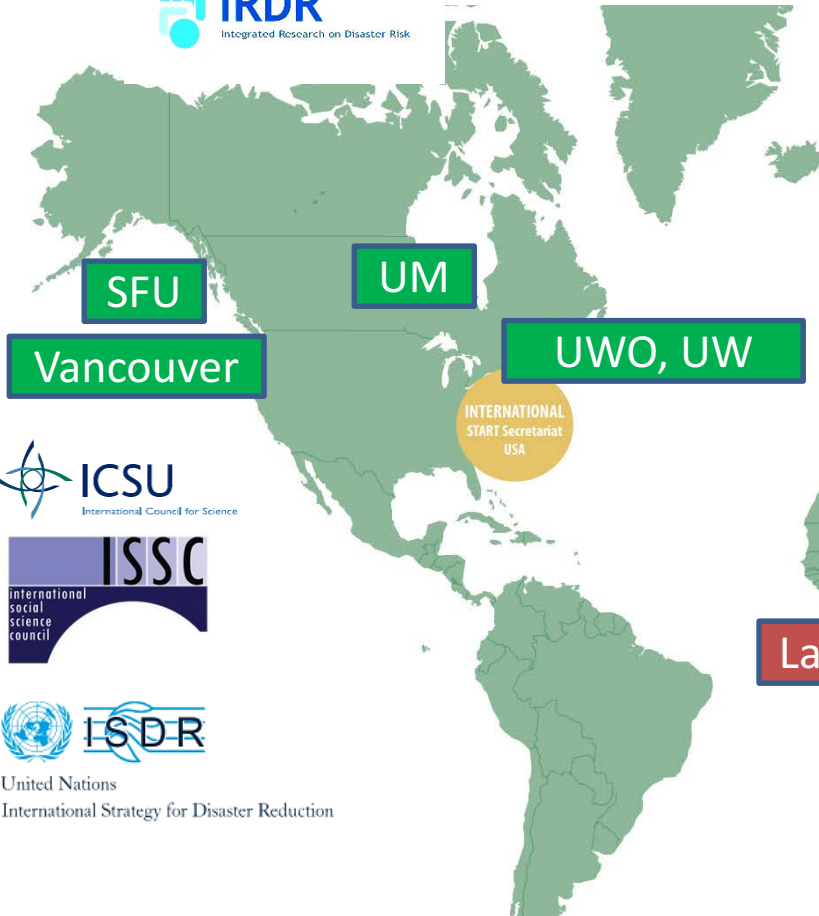
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www.coastalcitiesatrisk.org

Canada

Working with START and IRDR

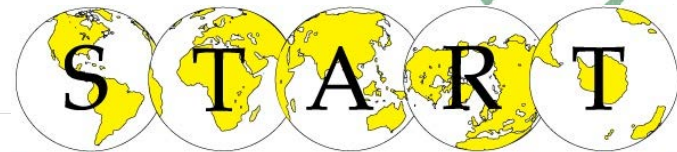
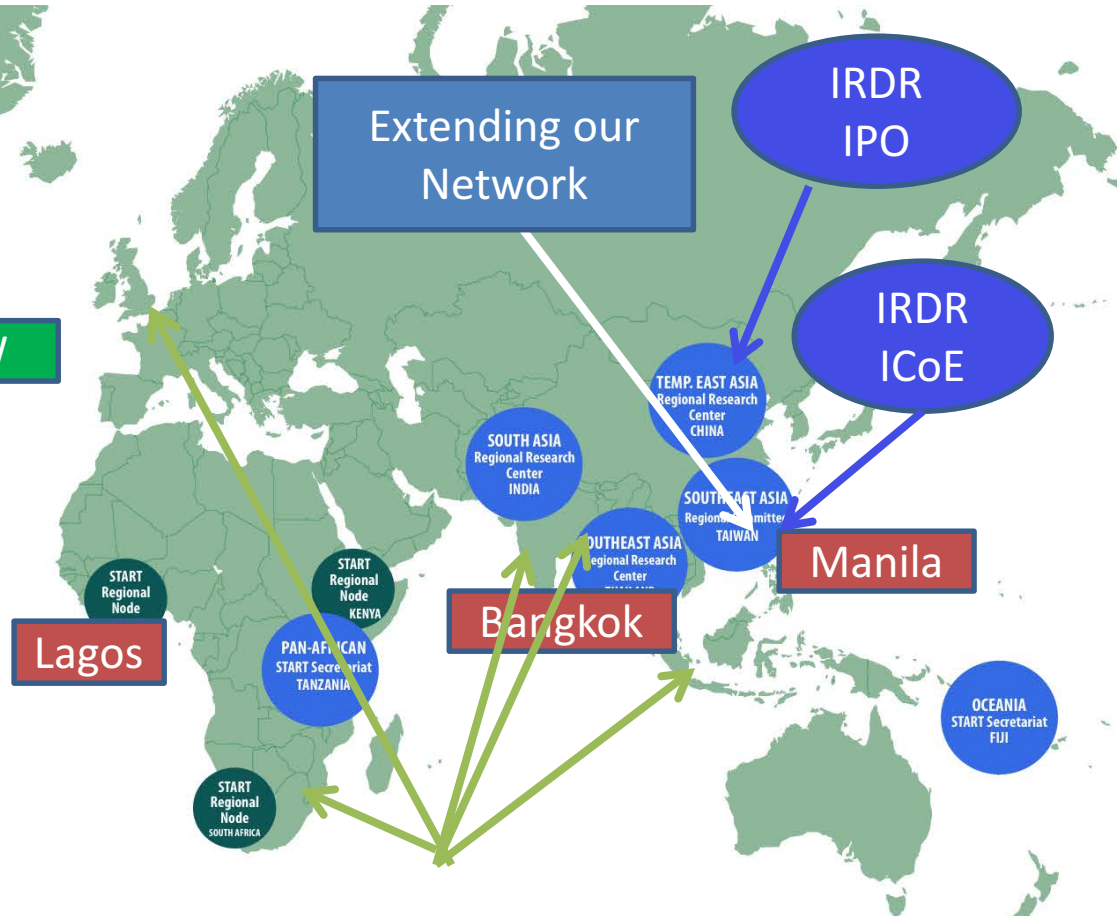


United Nations
International Strategy for Disaster Reduction



The Canadian Team

Cities and International Team



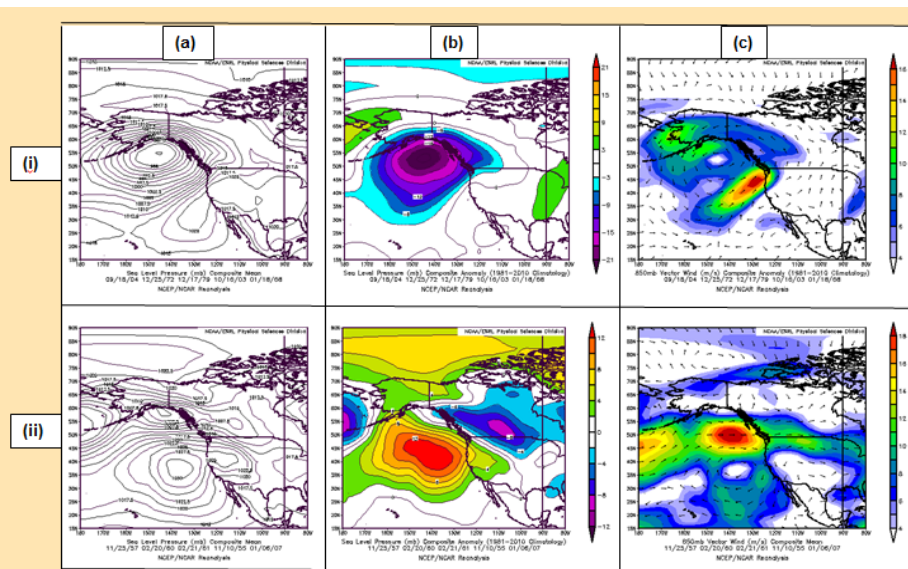
CCaR – Objectives

- To develop the knowledge base and enhance the capacity of mega-cities to successfully adapt to and when necessary cope with risks posed by the effects of climate change, including sea level rise, in the context of urban growth and development.
- A. *Advance knowledge of climate change adaptation and disaster risk reduction:*
- B. *Develop strategies and methodologies for climate change adaptation:*
- C. *Enhance practitioner and academic capacity and transfer knowledge:*

The research program integrates climate change adaptation and disaster risk reduction approaches towards building disaster resilient cities – reflects IPCC recommendation re CCA and DRR.

A. Advance knowledge of CCA and DRR

- Range of hazards in each city; coarse resolution GCMs fail to capture variation



Composites for top (i) daily precipitation and (ii) wind events at Vancouver using NCEP-NCAR reanalysis data. Parameters are (a) mean sea level pressure, (b) sea level pressure anomaly, and (c) 850 hPa vector flow



Existing dike

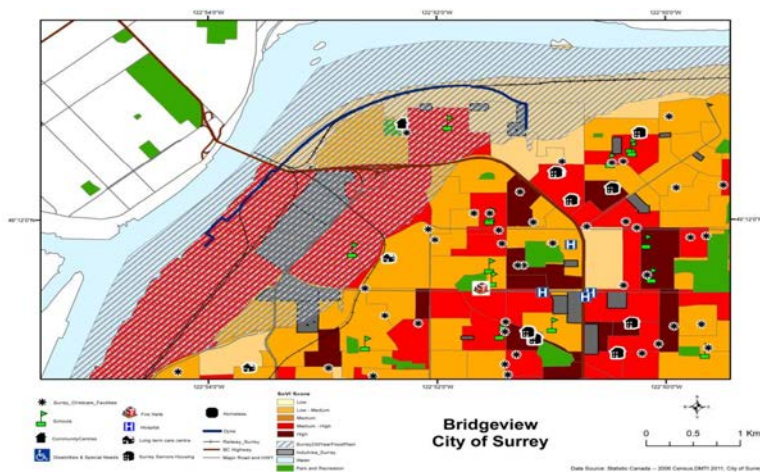
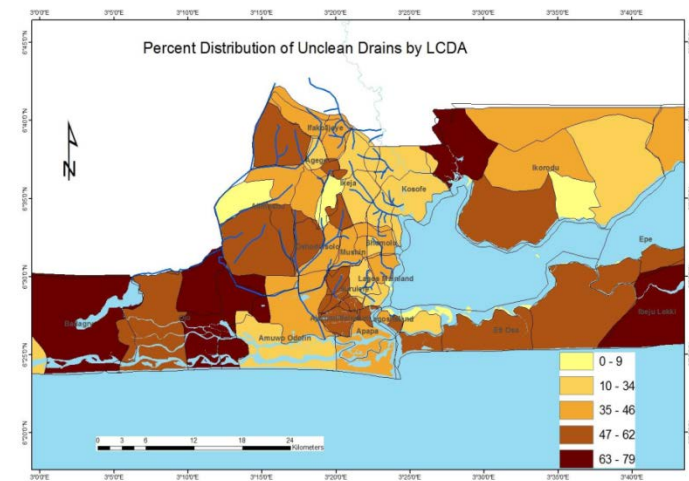
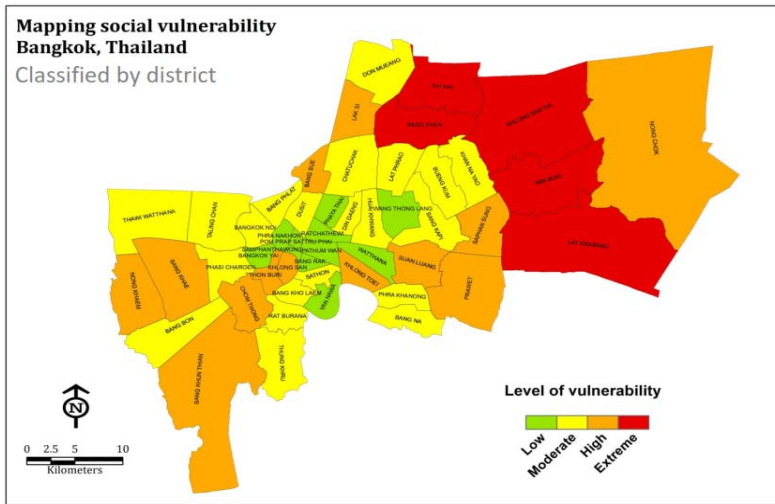
Jan 2060 simulated flood map



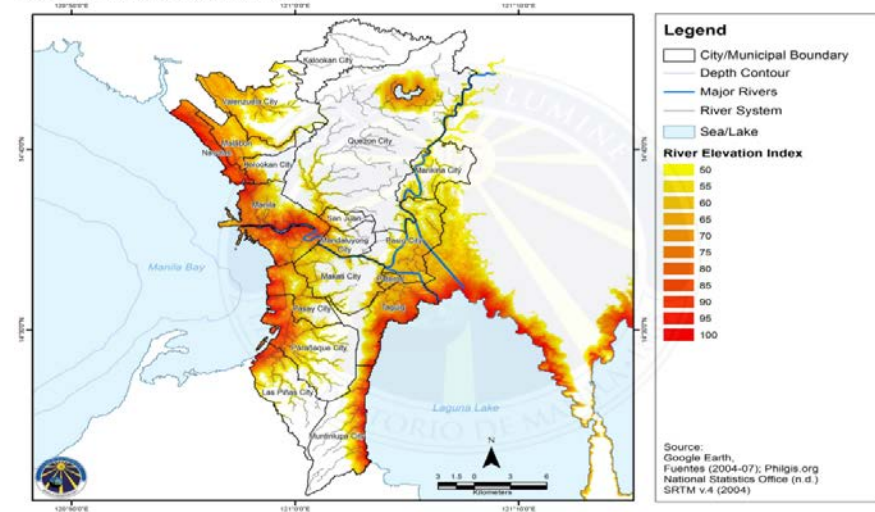
Elevated dike

A. Advance knowledge of CCA and DRR

- Vulnerability explored in all four cities

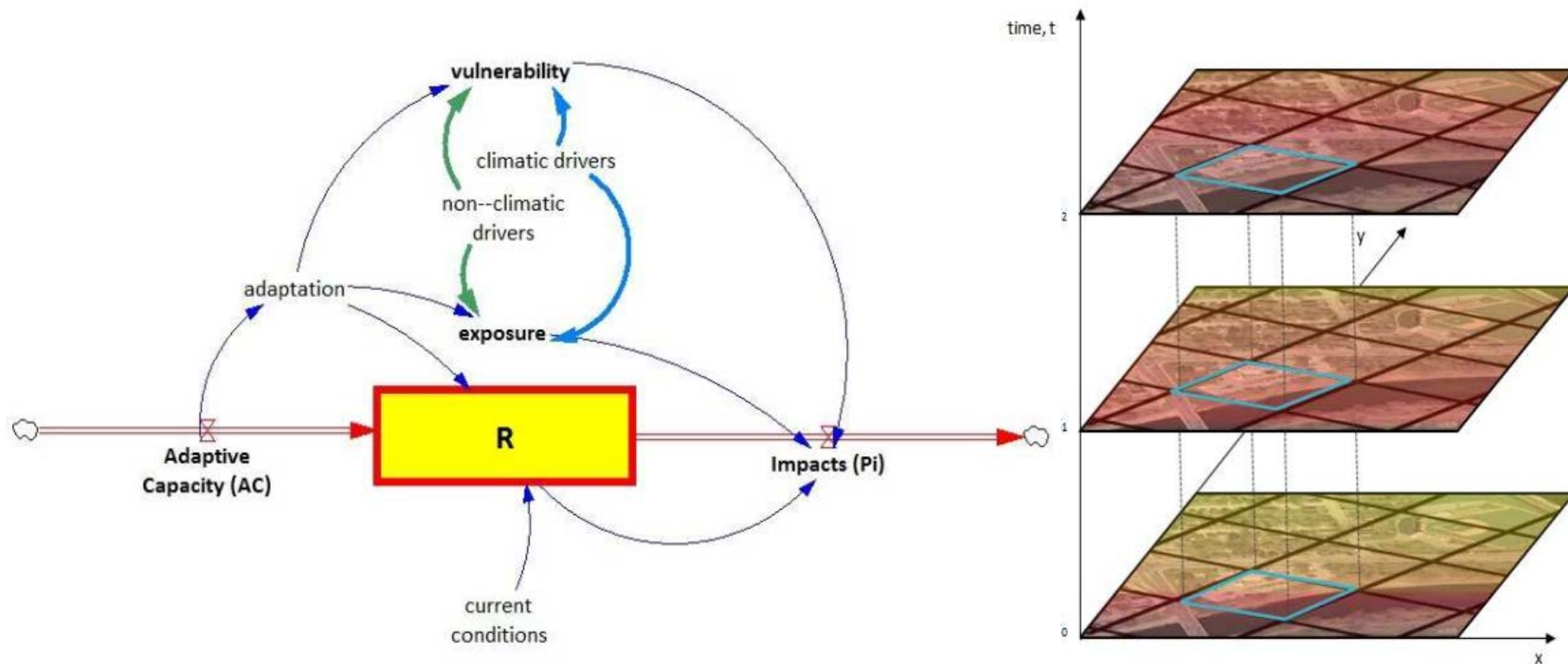


Metro Manila River Elevation Index



B. Develop methodologies for CCA

- City Resilience Model provides new methodology to quantify resilience over space and time



C. Advance practitioner & academic capacity

- Students trained: 45+ graduate students
- Workshops held with local practitioners in all four cities



C. Transfer knowledge

COASTAL CITIES AT RISK

Reducing Urban Vulnerability to Climate Change

INTRODUCTION

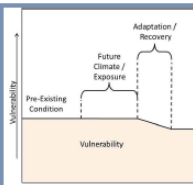
The World Economic Forum considers climate change to be the most impactful global threat, according to the 2015 Global Risks Report. The Coastal Cities at Risk (CCaR) project has been investigating the threat of climate change to enhance the capacity of cities to successfully adapt to and cope with risks posed by the effects of climate change.

CCaR researchers investigated how to reduce vulnerability to climate change, contributing to both adaptation planning theory and practice. The term vulnerability has been used in various ways, although CCaR's definition recognizes the complex socio-economic factors that contribute to pre-existing susceptibility, as well as a community's capacity to respond to climate stressors. CCaR's critical review of these concepts provided a starting point to investigate what makes a city vulnerable.

Understanding a city's pre-existing vulnerability is critical in order to identify areas that require significant investment in resources from local decision-makers and stakeholders. CCaR has conceptualized several approaches to highlight social vulnerabilities, health vulnerabilities, and economic vulnerabilities. These tools have been applied to Metro Vancouver to demonstrate their value to local decision makers.

ASSESSING HEALTH VULNERABILITY

CCaR developed composite health impact maps to support municipal adaptation decision-making and also to be used as an input for greater resilience modeling. The composite health maps incorporated the physical environment, burden of disease, and age distribution to show a more integrated view of population risk due to sea level rise and river flooding under climate change. Aging was incorporated as an important demographic factor because older individuals are less independently mobile and special attention



Vulnerability is a pre-existing condition that creates different levels of capacity among individuals, groups and communities to respond to a changing climate.

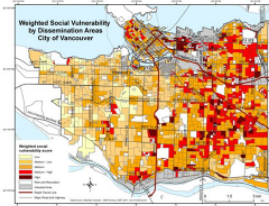
RESULTS AT A GLANCE

- Vulnerability is related to socio-economic processes that contribute to varying levels of susceptibility and capacity to respond to climate stressors
- Understanding a city's vulnerability is critical in order to identify areas that require resource investments
- Population information from census data can be used to develop a social vulnerability index, although this should be verified by local practitioners

needs to be given to how they can be moved quickly and safely from the flooded areas. Staying in flooded areas in the long term increases the likelihood of seniors developing additional diseases.

ASSESSING SOCIAL VULNERABILITY

CCaR developed a framework to identify factors that influence social vulnerability to flood hazards in Metro Vancouver. The research methods included statistical analysis of population data, and surveys, interviews and focus groups with residents and municipal practitioners. One output of this research was a social vulnerability index that used census data and local practitioner knowledge to identify vulnerable areas in the City of Vancouver, Surrey, Delta, and the District of North Vancouver.



Social Vulnerability Index for the City of Vancouver. The index was created using population data from the 2006 Census and was verified with local practitioners to incorporate land use and other relevant information. This provides an example of how vulnerability can vary across a city.

ASSESSING ECONOMIC VULNERABILITY

To assess the economic impacts of extreme flooding in a city, CCaR has developed a novel dynamic computable general equilibrium (CGE) model. This model advances previous CGE models by its dynamic nature, which accounts for not only the immediate impacts of extreme floods but also the recovery process. It also can be used at a variety of scales and many different countries. When applied today in Metro Vancouver under the same weather conditions as Vancouver's 1948 extreme flood event, the base line scenario predicted \$14.6 billion in total capital damage. Gross Domestic Productivity (GDP) loss compared to a non-flood scenario over a 55-year time period is \$43 billion.

INFLUENCING POLICY

Going forward it is critical to understand how these tools can support current policies and decision-making processes. The CCaR team investigated barriers and drivers of climate change adaptation policy, using three levels of government that govern the City of Vancouver and Surrey. It was determined that the federal and provincial governments can better support adaptation through legislation and eliminating conflict between policies. Local municipalities can promote adaptation through political leadership and access to climate projections and information. CCaR recommends the use of boundary organizations to better connect local practitioners with climate change knowledge to support evidence-based decision making.

COASTAL CITIES AT RISK



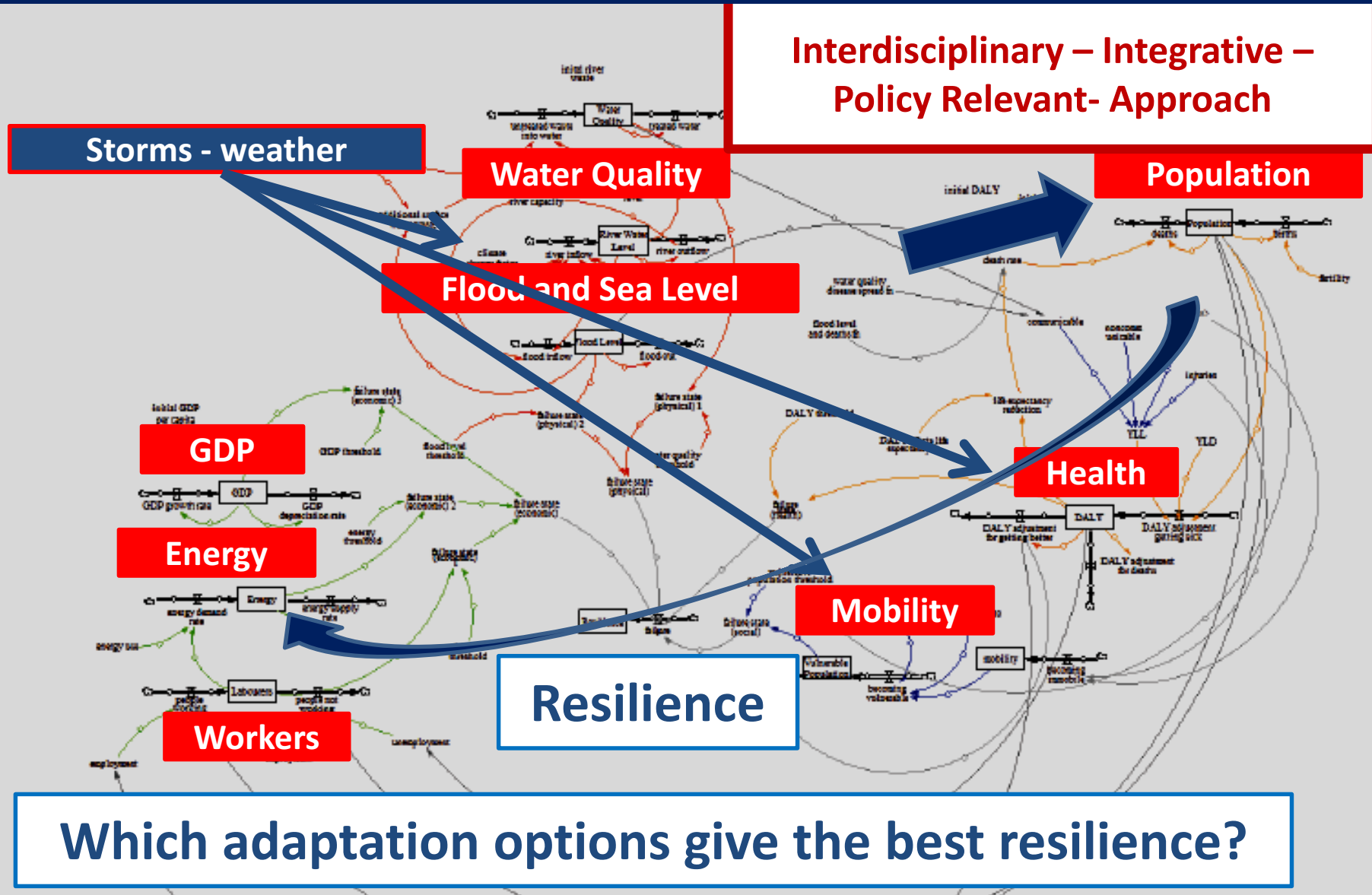
VULNERABILITY

- **Vulnerability is related to socio-economic processes that contribute to varying levels of susceptibility and capacity to respond to climate stressors.**
- **Understanding a city's vulnerability is critical in order to identify areas that require resource investments.**
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ASSESSING ECONOMIC VULNERABILITY - To assess the economic impacts of extreme flooding in a city, CCaR has developed a novel dynamic computable general equilibrium (CGE) model.

INFLUENCING POLICY - Going forward it is critical to understand how these tools can support current policies and decision-making processes. The CCaR team investigated barriers and drivers of climate change adaptation policy, using three levels of government that govern the City of Vancouver and Surrey.

Knowledge, Strategies/Methodologies, Capacity, Knowledge Transfer – An integrating approach to solutions: City Resilience Modelling



Lessons Learned from CCaR Project

Key Positives:

- Unifying Resilience model that provided framework for social, health, economics and physical hazard teams to work within
- Learning from each team – may be a struggle but helped to bridge some epistemological differences
- Regular meetings to develop relationships and trust to work collaboratively



Lessons Learned from CCaR Project

Key Lessons Learned:

- Model in progress and development hindered the unifying aspect
- A lot of support required and significant investments in time needed to collaborate
- Challenges with geography



Lessons Learned for Project Design

- Transdisciplinary vs interdisciplinary
- Getting people to work together
- Working towards a collaborative model
- Clear communication of expectations and likely outcomes
- Managing local stakeholder expectations
- Project design and coordination
- Intellectual property issues
- Learning from other projects





Coastal Cities at Risk (CCaR):
Building Adaptive Capacity for Managing
Climate Change in Coastal Megacities

<http://coastalcitiesatrisk.org>

Thank you for your participation