METROPOLE PROJECT: AN INTEGRATED FRAMEWORK TO ANALYZE VULNERABILITY AND ADAPTIVE CAPACITY TO CLIMATE CHANGE AND SEA LEVEL RISE: COMMUNITY CASE STUDIES IN BRAZIL, UK AND US

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VULNERABILIDADES CLIMÁTICAS: O BRASIL NO SÉCULO XXI

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Overview

The coastal areas around the world are likely to be among the most affected by climate change and its impacts due to a complex interplay among atmospheric, marine and terrestrial processes, as well to local exposure of coastal areas in terms in infrastructure and occupation.

It is important to understand that communities in different urban areas in coastal regions and from different socio-economic activities face different levels of risk and vulnerability.

The METROPOLE project (funded by the BELMONT Forum) represents a partnership between Brazil, UK and US to investigate impacts of sea level rise and climate change in some three coastal regions around the world (Brazil: Santos-SP, the United Kingdom: Selsey-West Sussex, and the United States: Broward County-Florida). The hypothesis of the project is that risk knowledge is best understood as being co-produced by science and by the social, political and cultural context. The project intends to use:

a) The state of the art in visualization tools developed by Brazil and the United States;
b) Surveys, sophisticated questionnaires and tools for evaluation of options for adaptation;
c) Risk studies using the Index of Adaptive Capacity developed in the UK and to be replicated in Brazil.
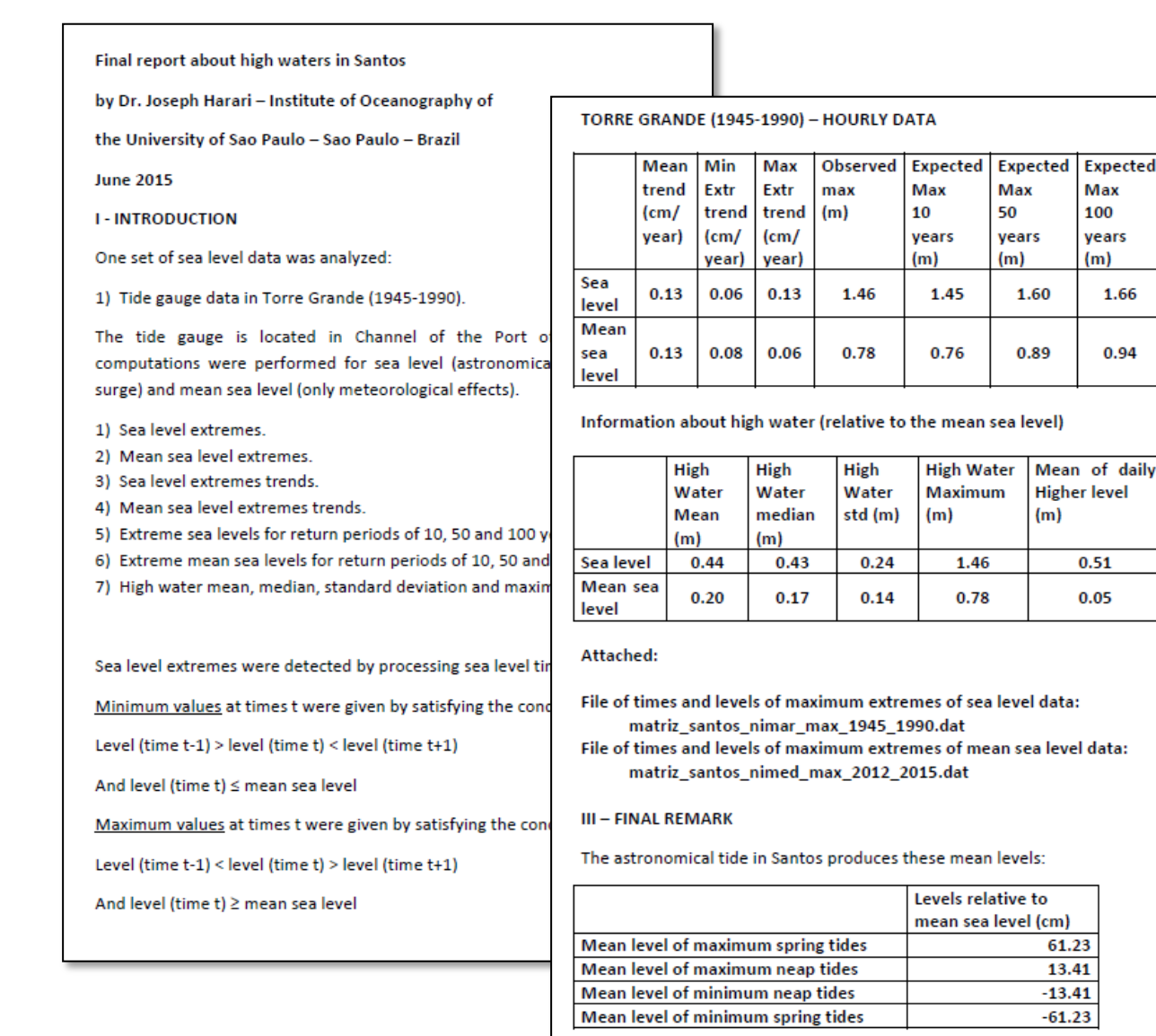
The expected results include the generation of a new evaluation system for quantifying the influence of the integration of scientific, economic and cultural data in adaptive planning and decision-making. This system aims at improving the ease of interaction between scientists and decision-makers.

The central theme of the METROPOLE project is, therefore, to show, in an integrated way, how some coastal areas under different climate regimes and human pressures would be affected by SLR caused by climate change, and if society and the government would be prepared or not to take proper and fast adaptation measures.

Keywords: Sea level rise, climate change, climate extremes, coastal regions, adaptation

What is COAST?

- The COastal Adaptation to Sea level rise Tool (COAST) is software that models flooding damage to assets from storm surge and sea level rise over time

- It can calculate one-time damages from a single event in time; as well as cumulative damage from all possible storms over a given time period

- It then is used to calculate the benefits and costs from various adaptation strategies to determine which strategy is the most fiscally efficient over time

- COAST uses digital parcels maps to identify the elevation of individual parcels in a given study area
- Parcels maps contain market values for both buildings and land

- COAST uses storm surge heights of varrying storm strengths (i.e., 10-year, 50-year, 100-year, etc.) to model one-time damages and cumulative damages from a variety of storms over time

Case study in Brazil: Santos – São Paulo

Due to its location, the region was transformed into a strategic economic center, with a large concentration of industries along the coastal zone. Tourism is also an important economic activity. In contrast, the region has large deficits in infrastructure and about 16% of the population live on unstable slopes of the Serra do Mar, which are highly susceptible to landslides and floods.

Slums bordering the São Jorge River

Strong storm surge associated with high tide in Sept. 2009, which invaded the Avenue in front of the beach, at Ponta da Praia neighborhood, that caused temporary interdiction of the way
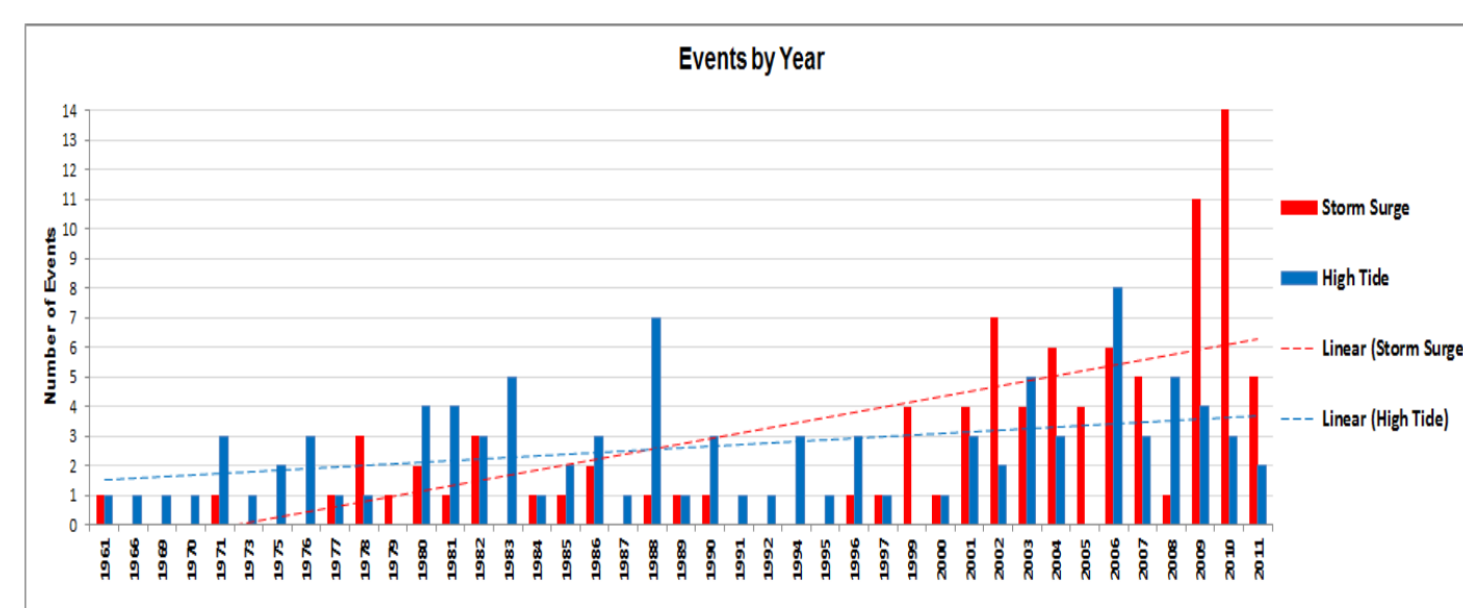

Coastal inundation that affected a parking lot in NW Area

Santos is a portrait of the social asymmetry of the country, featuring upscale neighborhoods, especially near the ocean seafront which, however, are a few kilometers from neighborhoods where living conditions are very poor, and where access to basic infrastructure is more restricted.

In short, in METROPOLE, scientific groups are working directly in the municipalities of study case, with involvement of the decision and policy makers through surveys, interviews and meetings for data collection and participatory planning workshops, in such a way as to co-produce data and adaptation options.

Storm surges and "high tides" in the Baixada Santista Metropolitan Region between 1961 and 2011, based on newspapers files (Souza et al., 2015).
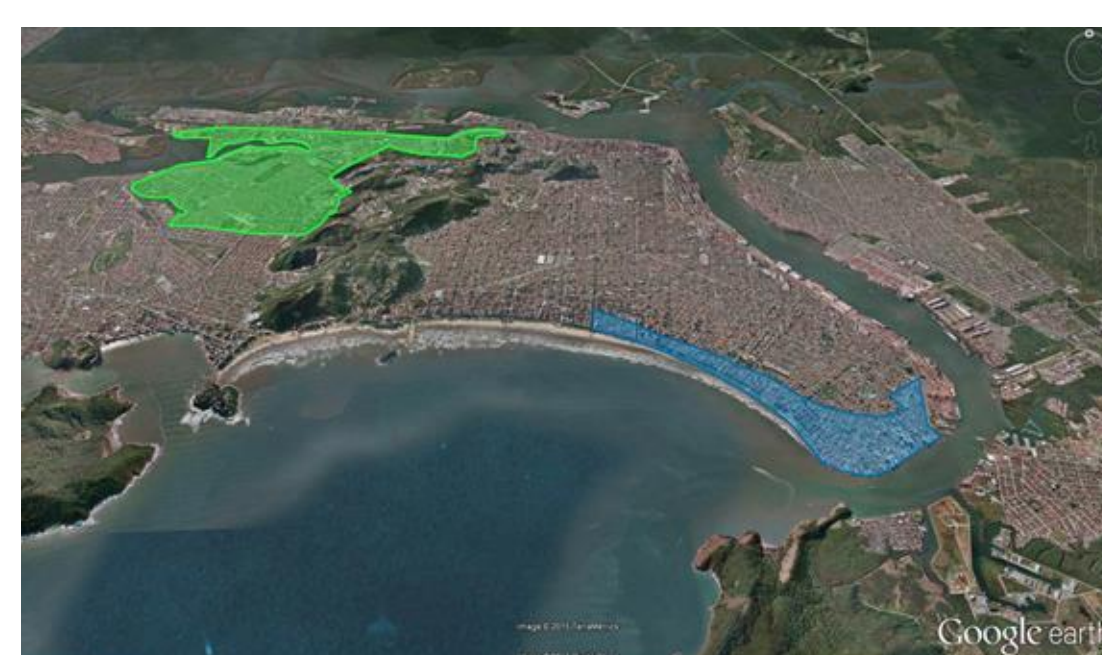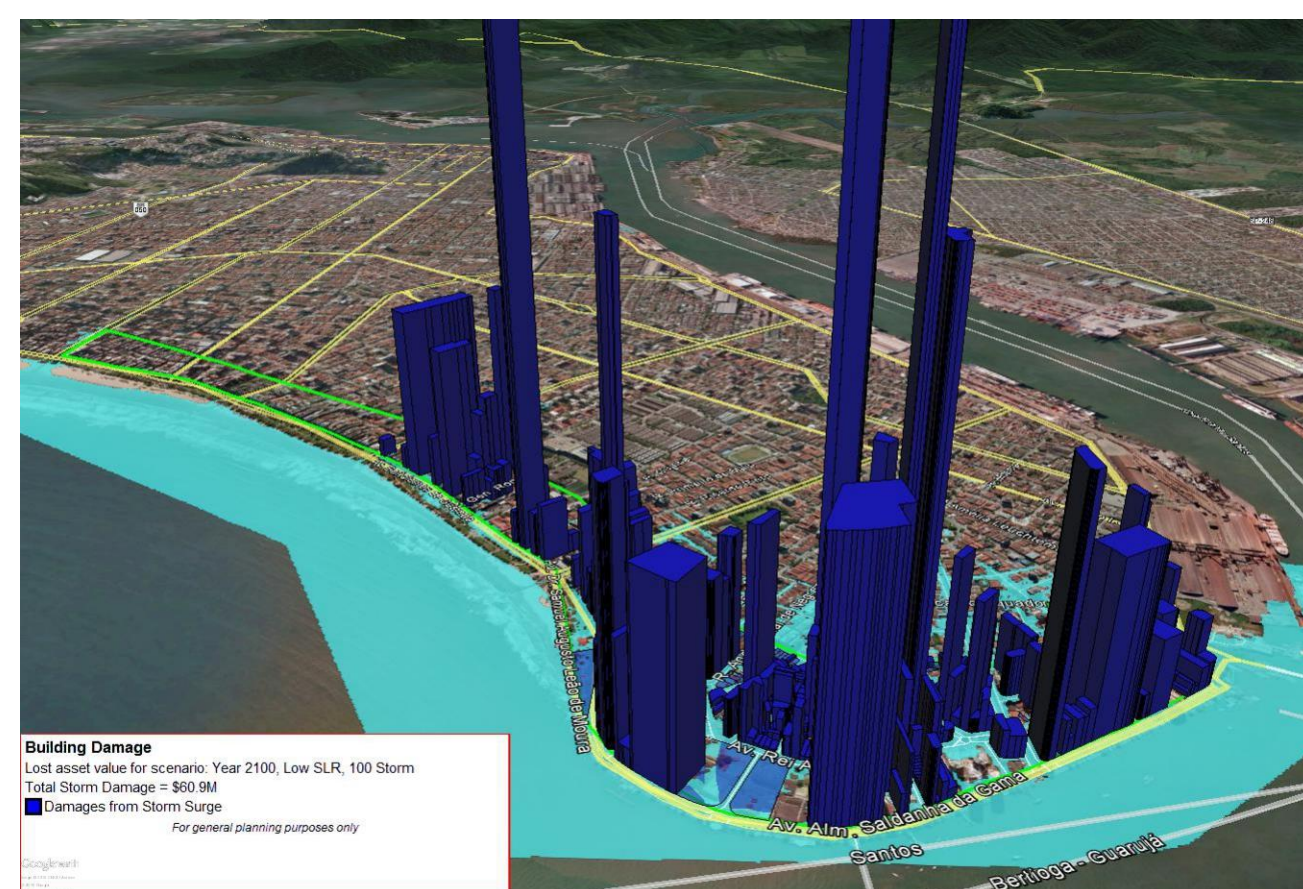

Two different views of the two areas selected for application of COAST in Santos

Preliminary Damage Estimates for Santos

100-year Storm in 2100 with Low (0.36 m) Sea Level Rise

Southeast Zone

Northwest Zone

Building damage at a particular location, for this particular one-time event or SLR for the Southeast/Northwest region. The height of each blue bar indicates the amount of damage at that. If the bar is high, the floodwater is deep or the building is very valuable, or both

Cumulative Damages

Year	Sea Level Rise	Southeast Zone (Damages)	Northwest Zone (Damages)	Southeast Zone (Buildings Lost to SLR)	Northwest Zone (Buildings Lost to SLR)
2010-2050	Low (0 m-0.18 m)	$268.6 Million	$38.7 Million	$0	$0
2010-2050	High (0 m-0.23 m)	$304.8 Million	$49.5 Million	$0	$0
2010-2050	IPCC (0 m-0.30 m)	$361.7 Million	$66.3 Million	$0	$0
2051-2100	Low (0.18 m-0.36 m)	$601.5 Million	$128.2 Million	$0	$0
2051-2100	High (0.23 m-0.45 m)	$738.7 Million	$186.8 Million	$0	$0
2051-2100	IPCC (0.30 m-1.00 m)	$1.318 Billion	$483.8 Million	$220.1 Million	$10.4 Million
2010-2100	Low (0 m-0.36 m)	$870.1 Million	$166.9 Million	$0	$0
2010-2100	High (0 m-0.45 m)	$1.043 Billion	$236.4 Million	$0	$0
2010-2100	IPCC (0 m-1.00 m)	$1.680 Billion	$550.1 Million	$220.1 Million	$10.4 Million

Adaptation Strategy Examples

Seawalls

Voluntary Relocation Programs

Another type of social analyses is the application of ACI (Adaptive Capacity Index)

http://www.coastlineconsulting-ct.com/images/bs1.gif
http://media.nj.com/ledgerupdates_impact/photo/2011/08/9940723-large.jpg

Acknowledgements