

Sea-level rise risks to coastal cities

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Understanding the consequence of sea-level rise for coastal cities has long lead times and huge political implications. Civilisation has emerged and developed during a period of several thousand years during which in geological terms sea level has been unusually stable. We have now moved out of this period and the challenge will be to develop a long-term proactive assessment approach to manage this challenge. In 2005 there were 136 coastal cities with a population exceeding one million people and a collective population of 400 million people. All these coastal cities are threatened by flooding from the sea to varying degrees and these risks are increasing due to growing exposure (people and assets), rising sea levels due to climate change, and in some cities, significant coastal subsidence due to human agency (drainage and groundwater withdrawals from susceptible soils). In these cities we wish to avoid major flood events, with associated damage and potentially deaths and ultimately decline of the cities.

Flood risks grow with sea-level rise as it raises extreme sea levels. As sea levels continue to rise, protection will have to be progressively upgraded. Even with this, the magnitude of losses when flood events do occur would increase as coastal cities expand, and water depths and hence unit damage increase with sea-level rise/subsidence. This makes it critical to also prepare for larger coastal flood disasters than we experience today and raises questions on the limits to adaptation.

There is not an extensive literature or significant empirical information on the limits to adaptation in coastal cities. These limits are not predictable in a formal sense – while the rise in mean sea level raises the likelihood of a catastrophic flood, extreme events are what cause damage and trigger a response, be it abandonment, a defence upgrade or something else. There are several types of potential limits that could be categorised into three broad types:

- Physical/engineering limits;
- Economic/financial limits;
- Socio-political limits.

These limits will be discussed and their implications considered and place in the context of long-term planning for these issues.