

Modelling economic risk to sea-level rise and storms at the coastal margin

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ABSTRACT

In this paper, we explore the economic risk to a group of coastal communities from the compounding impacts of sea-level rise and storm inundation associated with climate change using System Dynamics and scenario planning. Human-environmental problems such as these have multiple feedbacks, non-linearities and across-scale lags that are difficult to decipher with conventional computational algorithms. We create a novel integrated assessment approach using System Dynamics to provide insights into coastal capital risk as exposure changes over time under different climate scenarios. A hydrological risk assessment that incorporates the socio-economic wellbeing and insurability of stakeholders in the coastal hazard zone forms the basis for an Integrated Assessment Model. Economic impact modelling of baseline scenarios developed on environmental projections then provide insights into asset risk, insurance, and coastal property amenity. Analyses of these direct impacts given these scenarios indicate the long-term cost of inaction under climate change which allows communities to plan futures accordingly.

Model outputs from scenario planning suggest that knowledge of the long-term risk posed by coastal hazards drives a behavioural, socio-economic response that exceeds the initial economic exposure of capital assets. Over the long-term, negative corrections in property market valuations are the result of expected future capital damage and losses

from repeat flooding, increasing risk-based insurance premiums, and risk-informed withdrawal by insurance providers. In the medium term, vulnerable communities are willing to accept the risk of loss in order to gain the amenity value of their coastal property location.