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Protect or retreat? Economic analysis of the future of the global coast in the 21st century.

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Coastal flooding due to extreme sea-level events (storm surges, tropical cyclones, etc.) is currently one of the major threats to coastal settlements and, due to sea-level rise, flood risk is expected to further increase significantly over the 21st century. Despite this, coastal floodplains throughout the world are experiencing rapidly increasing flood exposure due to socio-economic development, coast-ward migration and urbanization. This raises the question whether coastal societies will manage to reduce flood risks and losses by either protecting the increasing exposure against rising sea-levels or by migrating away from the coastline.

This paper explores this question from an economic perspective on adaptation decisions during the 21st century. Using the DIVA framework, we assess global consequences of cost-benefit driven coastal protection and migration decisions under 21st century sea-level rise. Robust decision analysis at subnational levels is applied to identify protection and retreat decisions that have high benefit-cost ratios under a full range of sea-level rise, socio-economic development and discount rate uncertainty. Results are presented at national and global scales in terms of people affected by flooding and migration, as well as adaptation cost, migration cost and residual flood damage cost.

We find that without considering migration away from the coast, it is economically robust to protect 90% of the world's coastal population during the 21st century. Introducing migration as a further option shifts the economically robust global adaptation response significantly towards less protection, implying that a large number of people living in rural and less densely populated coastal areas would need to migrate away from the coast. Nevertheless even if migration is considered as an option it is economically robust to protect 75% of the world's coastal population during the 21st century. These results suggest that we are likely to see increasing coastal inequality with urban and densely populated areas being protected and rural, less densely populated areas suffering from flood damages and eventually having to retreat from the coast.