

*Adaptation Futures,  
May 2015.*

 UNIVERSITY OF  
**Southampton**

# Timing of adaptation to high-end sea-level rise: When to start?



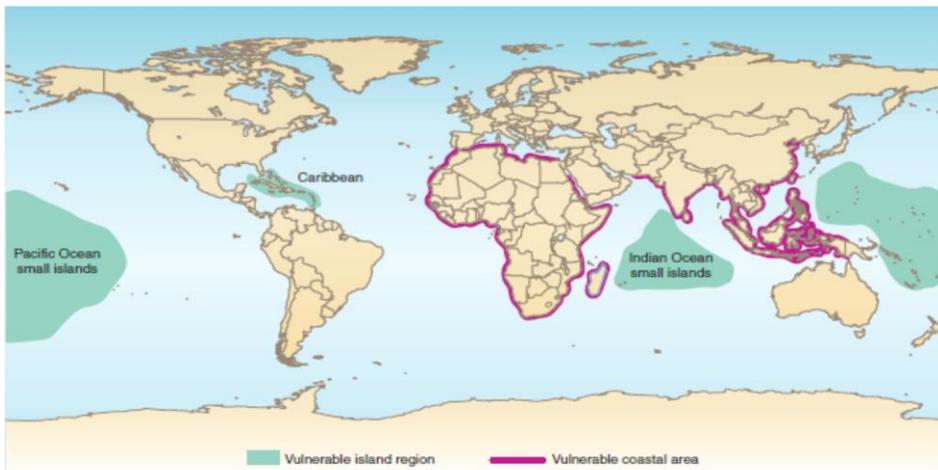
**Sally Brown**

*Faculty of Engineering and the Environment, University of Southampton and  
Tyndall Centre for Climate Change Research. sb20@soton.ac.uk*

*Daniel Lincke, Jochen Hinkel, Svetlana Jevrejeva, Ivan Haigh,  
Robert J Nicholls, Nassos Vafeidis, Richard Tol*

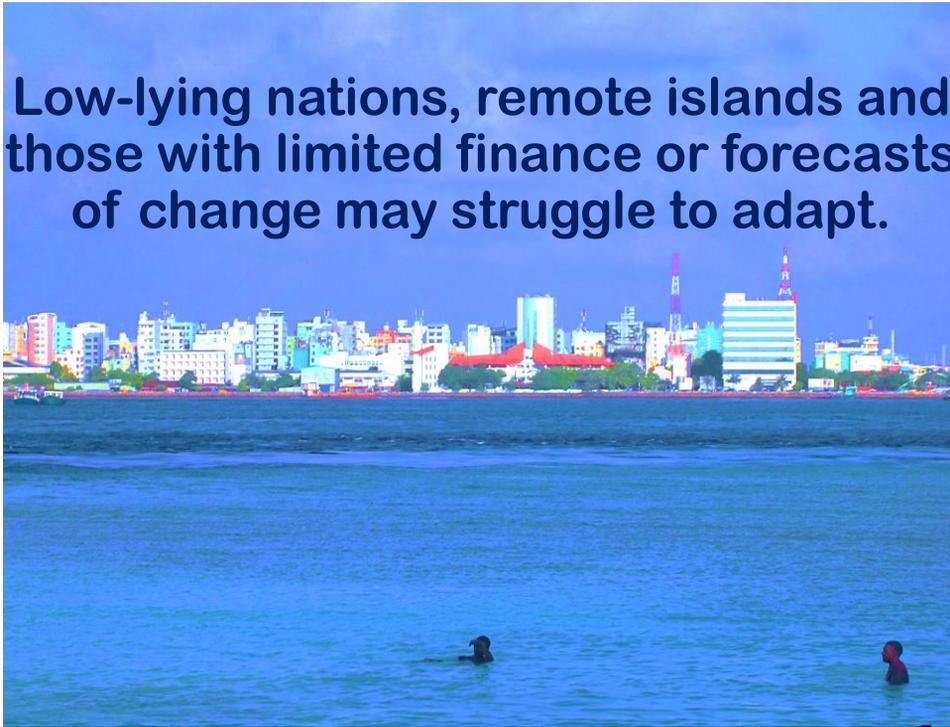
Photographs: Sally Brown, Laurens Speelman, Attila Lazar

## Who is most at risk?



Nicholls and Cavenaze (2010). doi: 10.1126/science.1185782

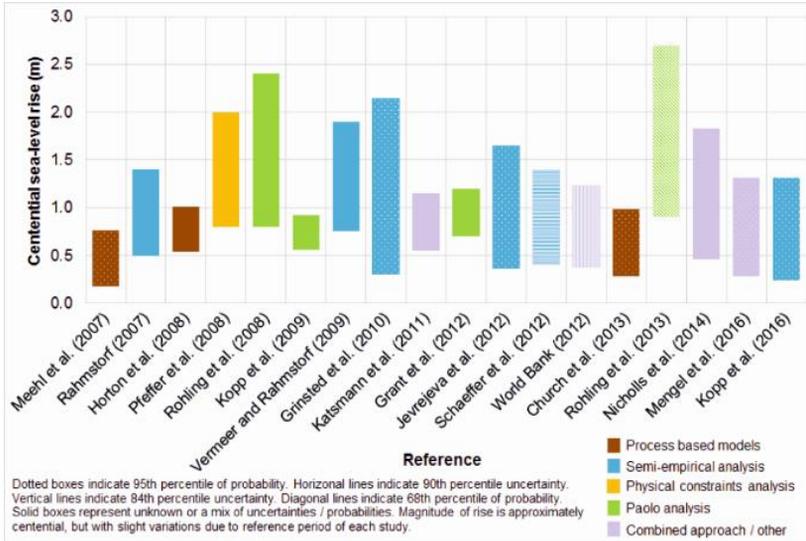
**Low-lying nations, remote islands and those with limited finance or forecasts of change may struggle to adapt.**



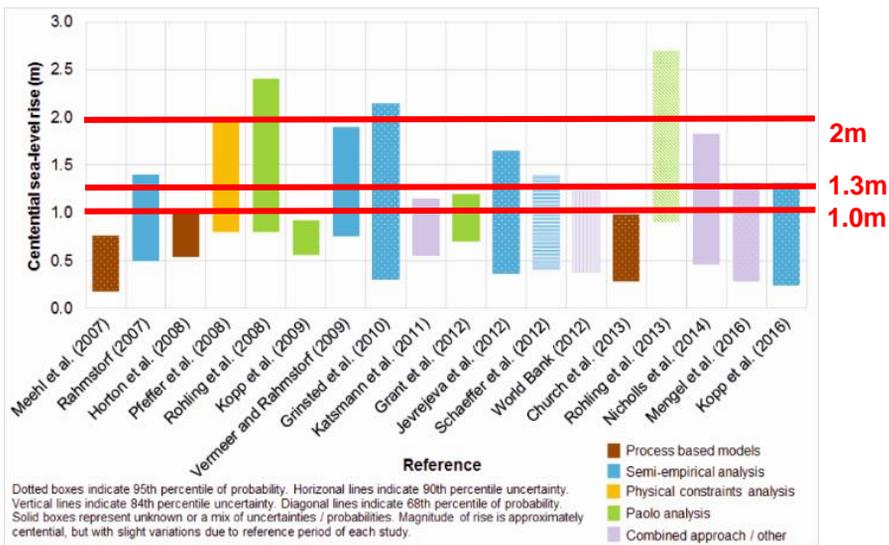
## **Structure**

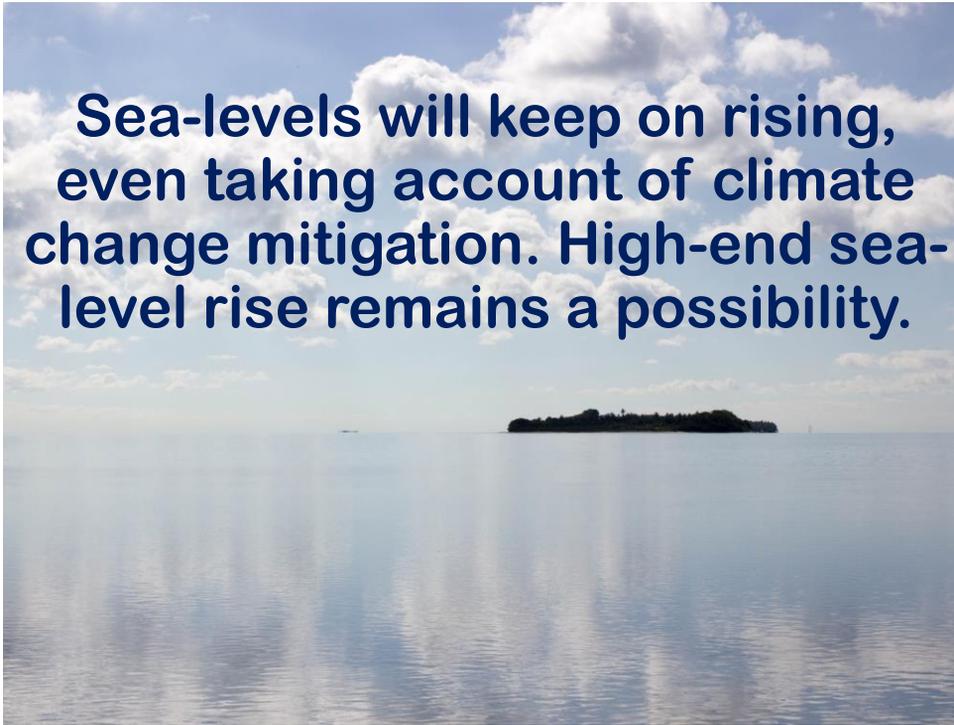
- **How high is high-end sea-level rise?**
- **How can we model impacts and costs?**
- **What are the financial costs?**
- **Who is worse affected, and may struggle to adapt?**

# What are the projections for high-end sea-level rise?



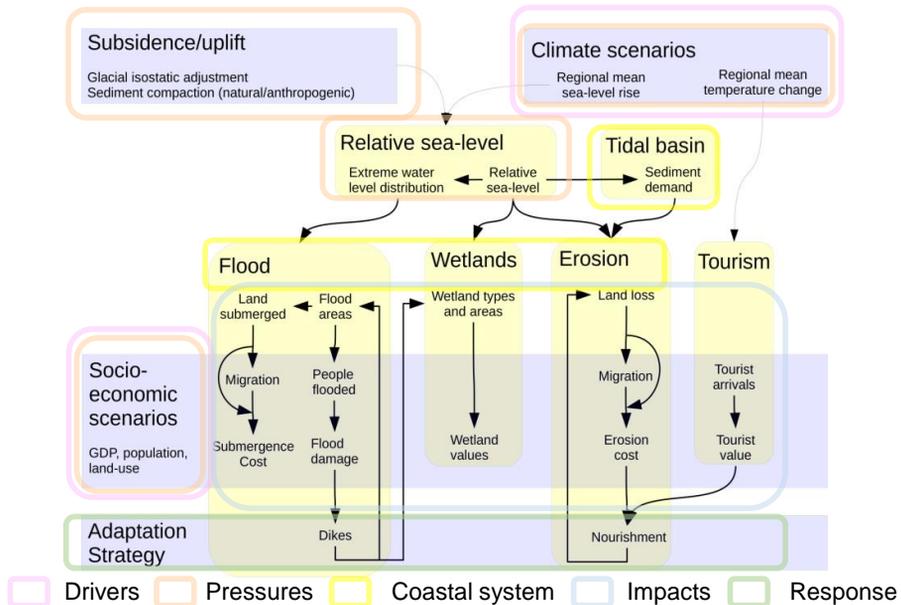
# What are the projections for high-end sea-level rise?





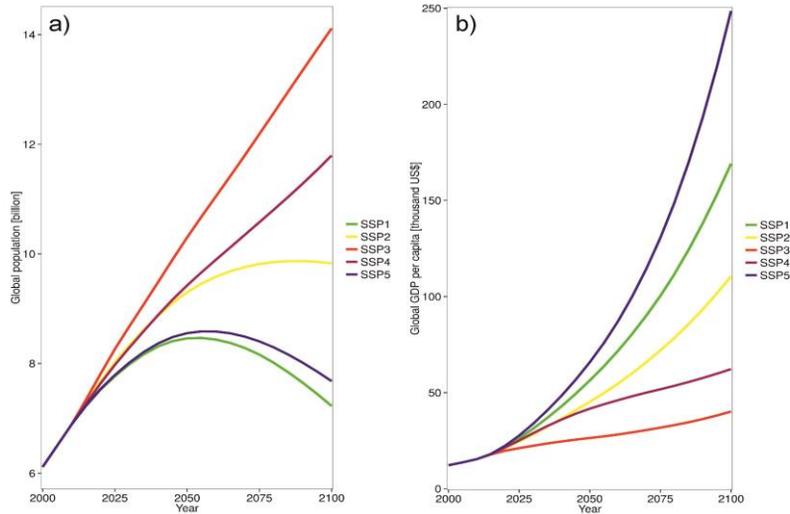
Sea-levels will keep on rising, even taking account of climate change mitigation. High-end sea-level rise remains a possibility.

# DIVA model

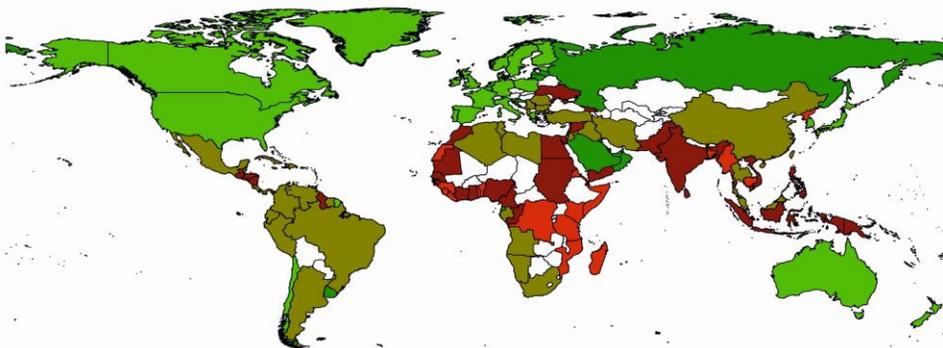


# Socio-economic change

## Population      GDP/capita



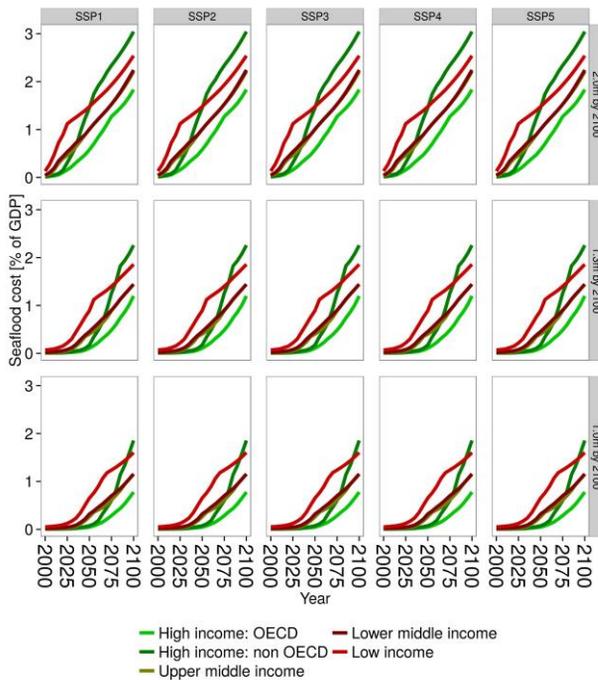
## World Bank income groups



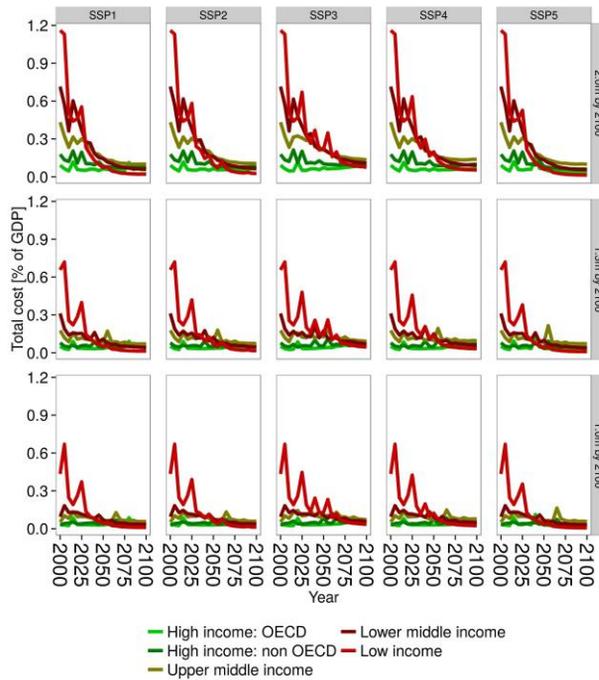
### World Bank income group (2014)

- High income: OECD ( $\$12,746 < \text{GDP}$ ). Contains 11% of the world's coastal countries and 58% of GDP.
- High income: non OECD ( $\$12,746 < \text{GDP}$ ). Contains 3% of the world's coastal countries and 5% of GDP.
- Upper middle income ( $\$4,125 < \text{GDP} < \$12,746$ ). Contains 53% of the world's coastal countries and 30% of GDP.
- Lower middle income ( $\$1,045 < \text{GDP} < \$4,125$ ). Contains 27% of the world's coastal countries and 7% of GDP.
- Low income ( $\text{GDP} < \$1,045$ ). Contains 6% of the world's coastal countries and <1% of GDP.
- Landlocked

**Modelling takes account physical, social and economic changes. Lower income countries tend to be in Asia and central/northern Africa.**



**Annual costs of sea floods without additional adaptation**



**Total costs  
= Residual  
sea flood  
costs +  
dike  
building  
costs**

**Spend now to adapt low income nations to high-end sea-level rise, or experience similar or higher damage costs after 2050.**



An aerial photograph showing several small, circular islands scattered across a vast blue ocean. The islands are surrounded by shallow, turquoise water, and their landmasses are small and isolated.

**Small islands will find adaptation particularly difficult and costly.**





**Adaptation remains a matter of choice, guided by good governance, advice and financial help.**

## Conclusions

- Sea-levels will keep on rising, even taking account of climate change mitigation. High-end sea-level rise remains a possibility.
- Modelling takes account physical, social and economic changes. Lower income countries tend to be in Asia and central/northern Africa.
- Spend now to adapt low income nations to high-end sea-level rise, or experience similar damage costs after 2050.
- Small islands will find adaptation particularly difficult and costly.
- Areas of high risk require large-scale investment and forward planning, but this cannot be undertaken everywhere.
- Adaptation remains a matter of choice, guided by good governance, advice and financial help.

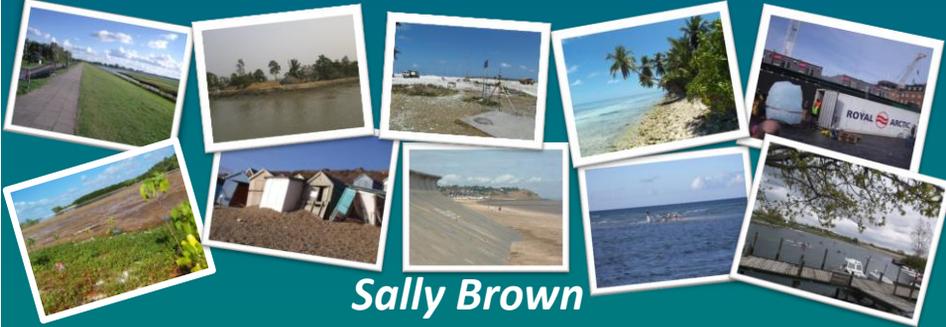


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