

Global consequences of sea-level change

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Particular acknowledgements to:

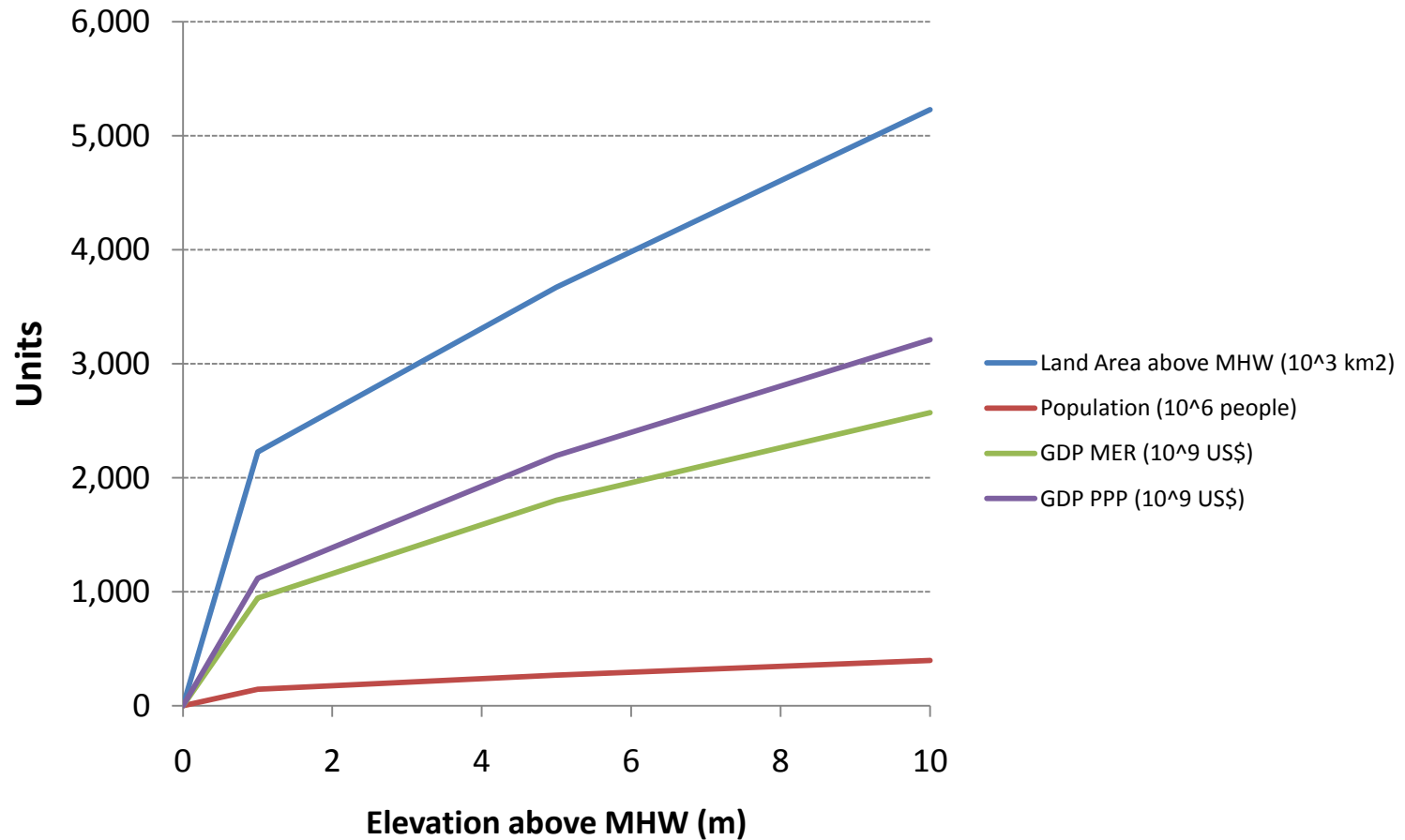
- Sally Brown (Southampton)
- Susan Hanson (Southampton)
- Jason Lowe (Met Office Hadley Centre)
- Jochen Hinkel (PIK)
- Athanasios Vafeidis (Kiel)
- Richard Tol (ESRI et al)

Plan

- Potential impacts of sea-level rise
 - Exposure
 - Adaptation and adaptive capacity
 - Pessimist's versus optimist's perspective
- Illustrative impacts using the DIVA model
 - Without adaptation
 - With adaptation
- Concluding remarks

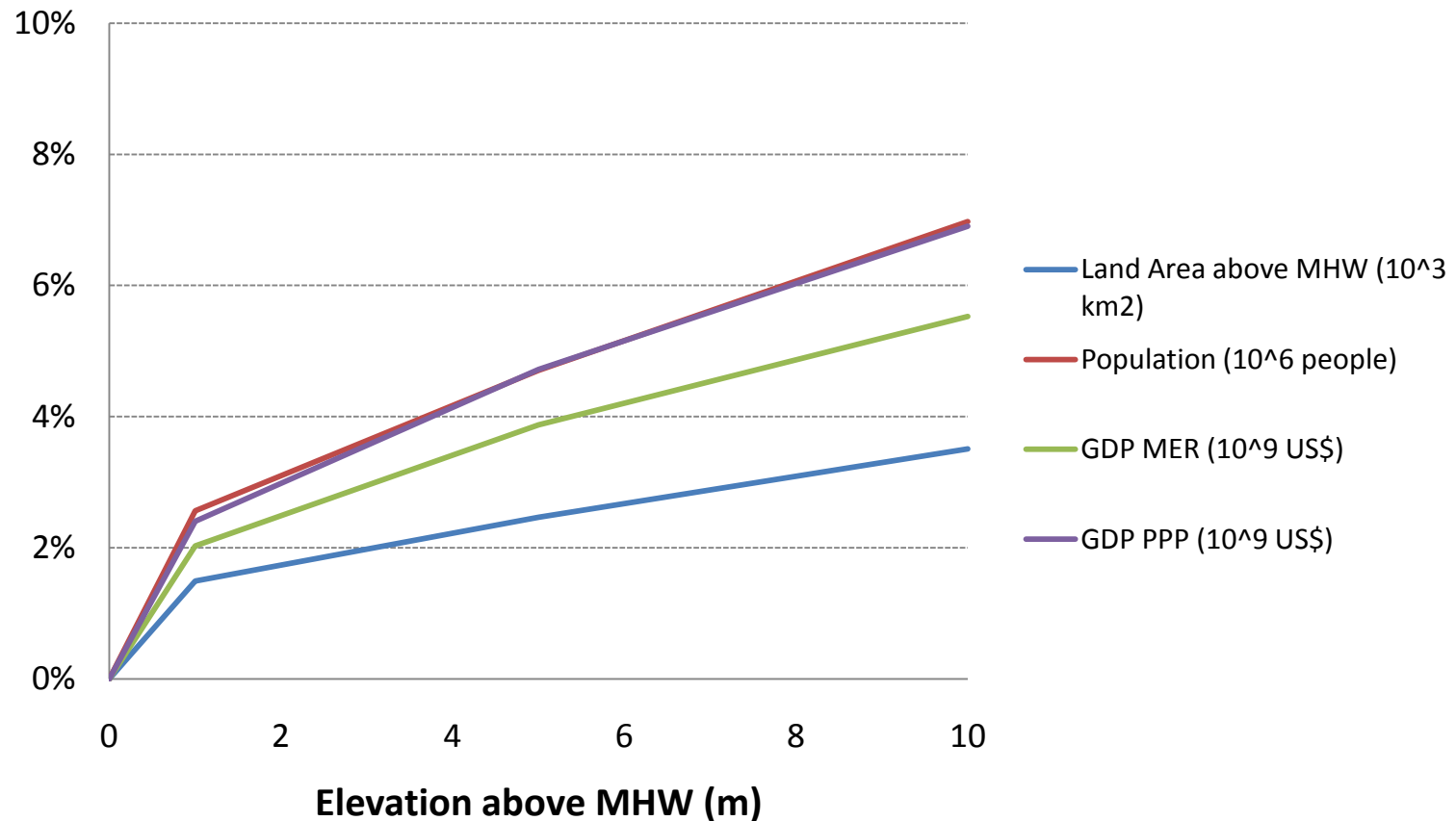
Coastal Exposure

(Anthoff et al., 2007)



Normalised Coastal Exposure

(after Anthoff et al., 2007)

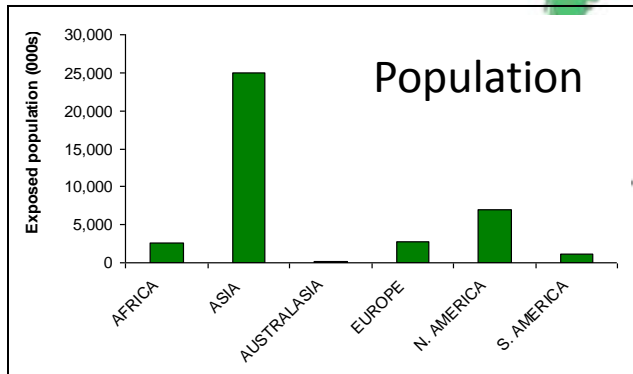
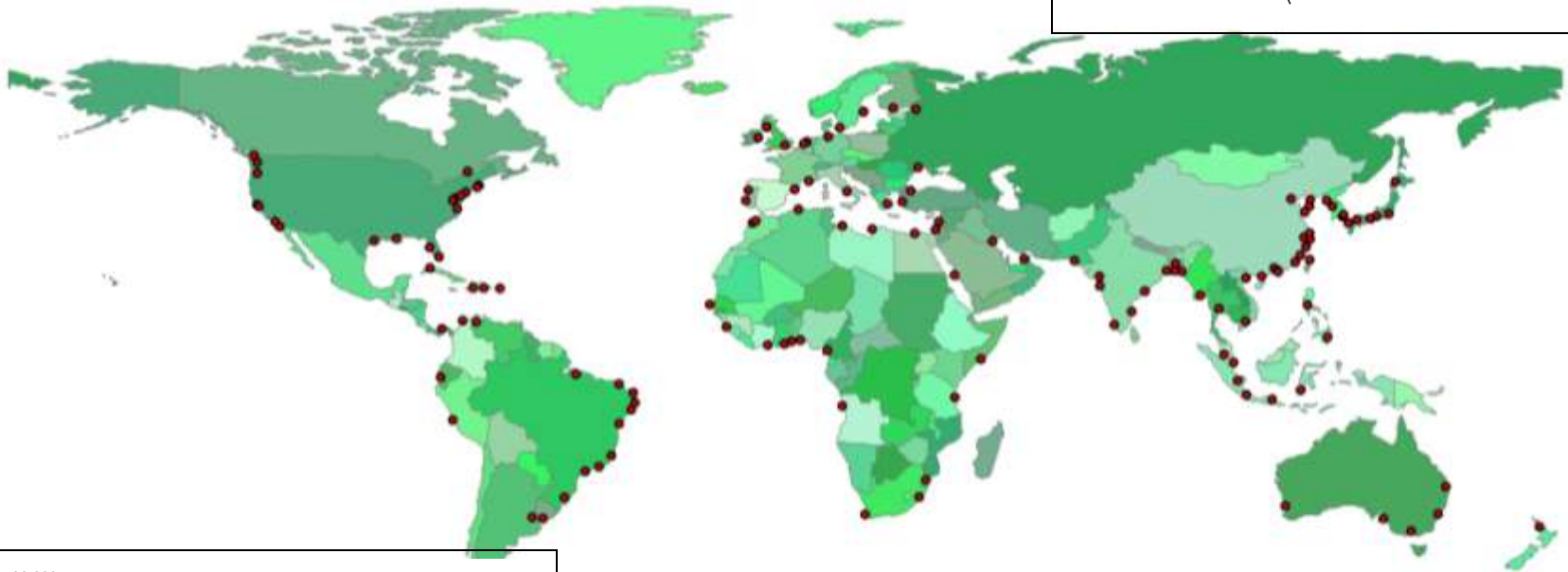
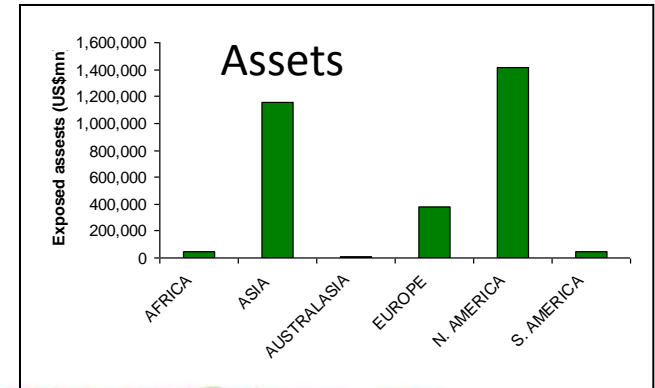


Port City Exposure

≥1 million population in 2005

136 locations

(Nicholls et al., 2008; OECD report)



10,000 Kilometers

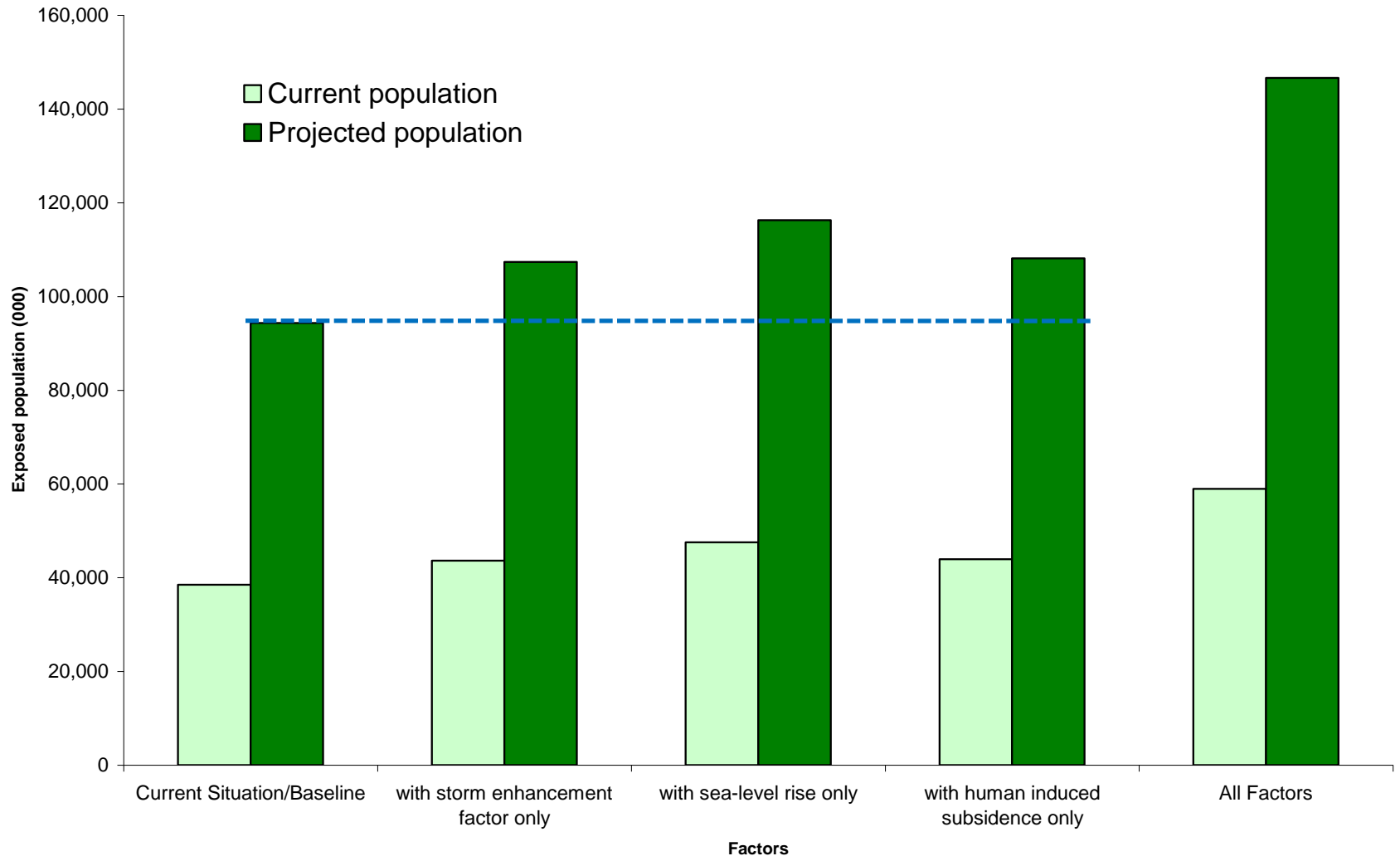
Key global results for the flood plain

- 40 million people
 - 0.6% of global population
 - (10% of port city population)
- US \$3000 billion of assets
 - 5% of global GDP

Port City Population Exposure

Potential influence of different change factors: 2005 to 2070s

(Nicholls et al. (2008) OECD Working Paper on Port Cities)



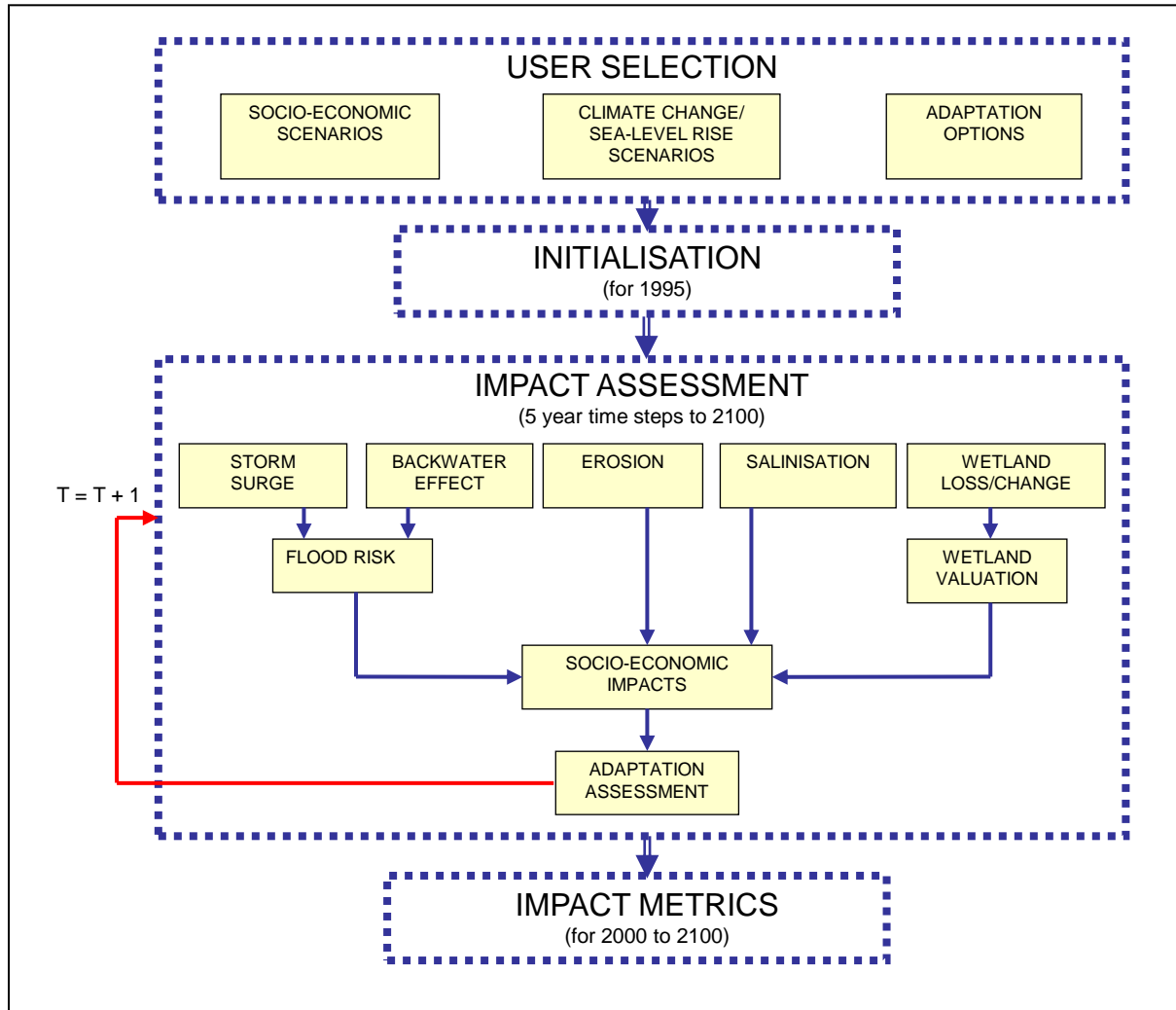
Adaptation



Impacts: A response to climate drivers, exposure and adaptation

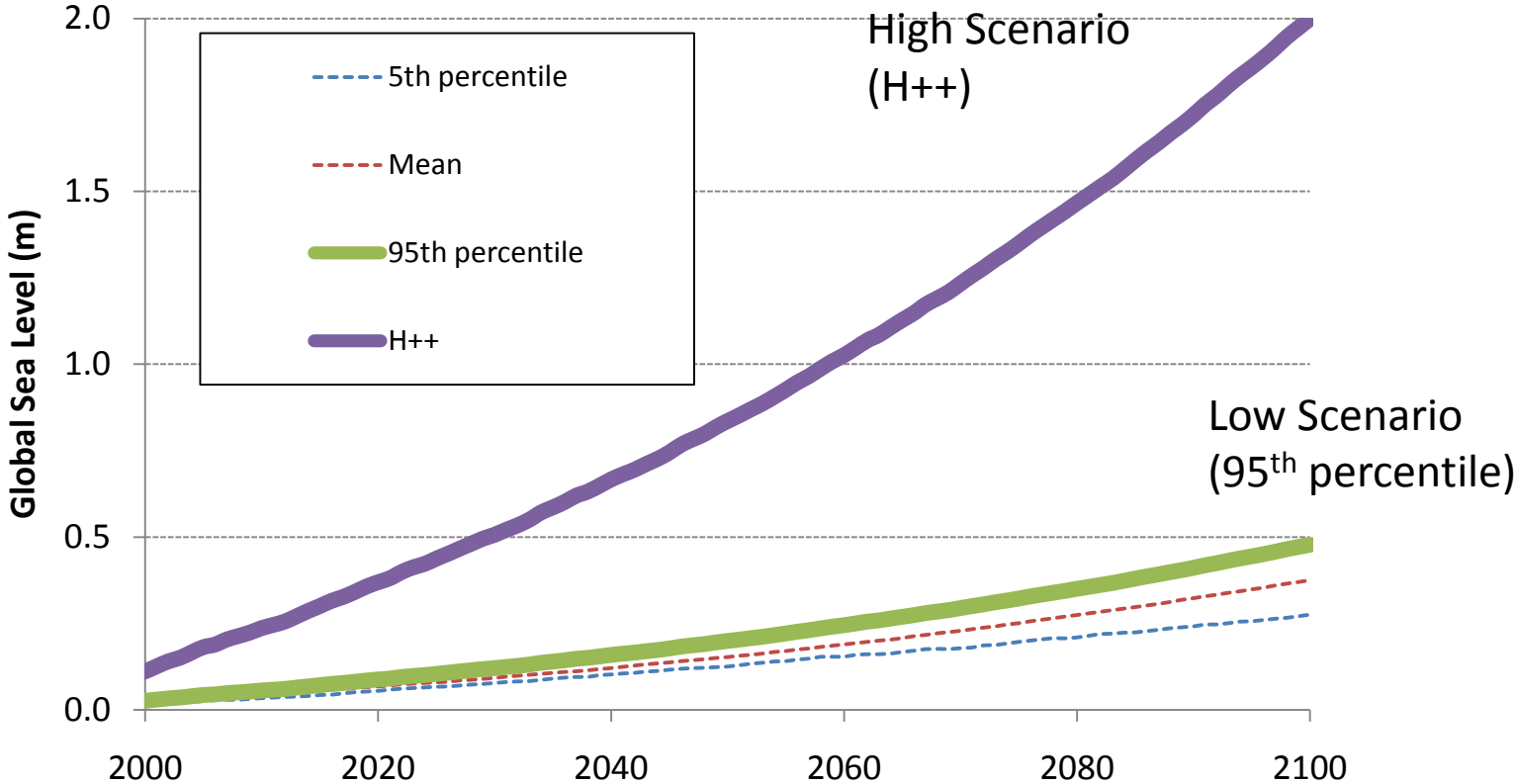
- Pessimists
 - (large climate change)
 - adaptation is impossible or fails
 - impact = exposure
 - high impacts/numerous disasters/unplanned and forced retreat
- Optimists
 - (less climate change)
 - adaptation is successful in developed areas
 - impacts \ll exposure
 - lower impacts, but significant adaptation costs

DIVA Structure



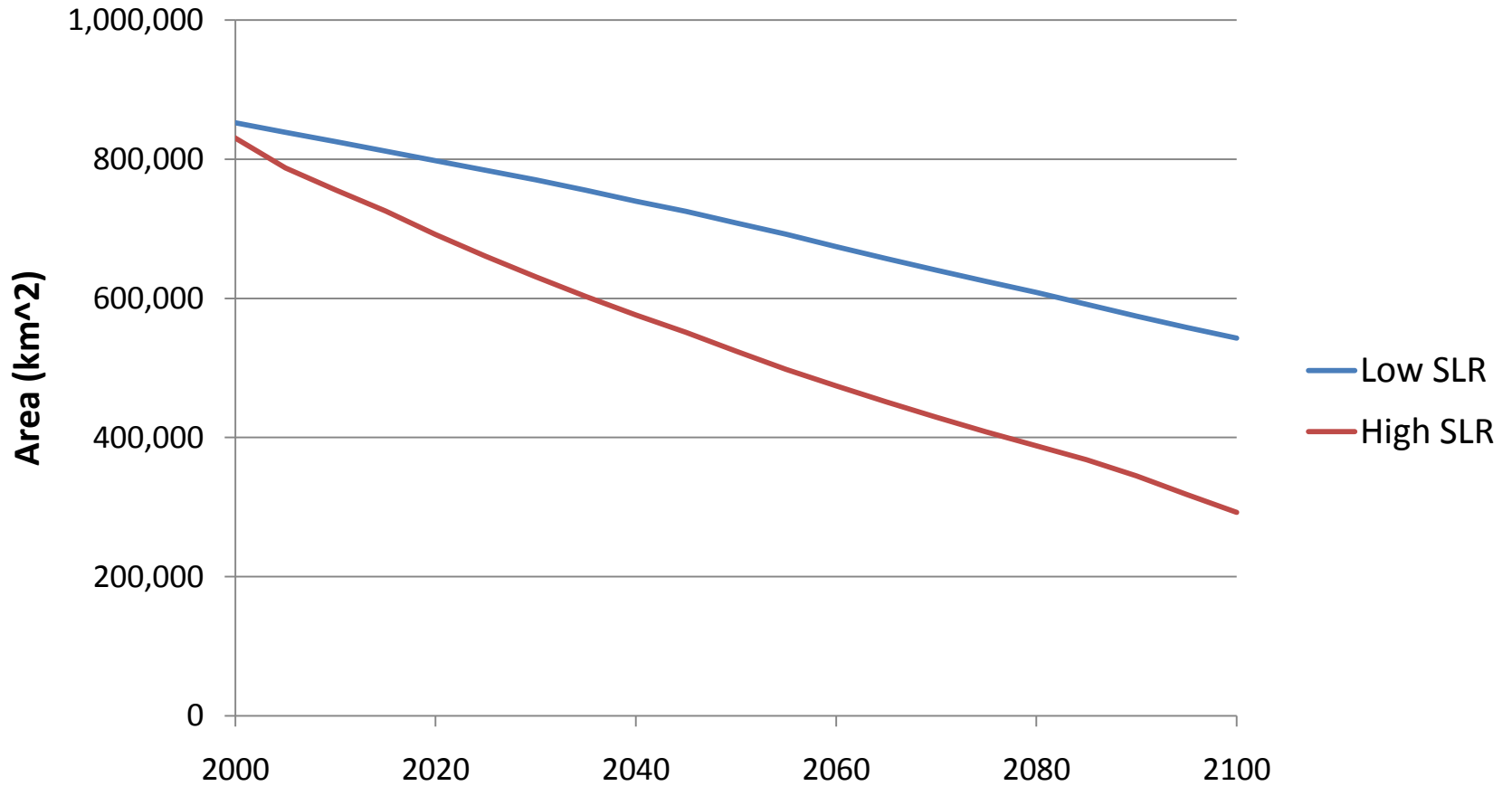
Global sea-level rise scenarios

(SLR Source: Met Office Hadley Centre)



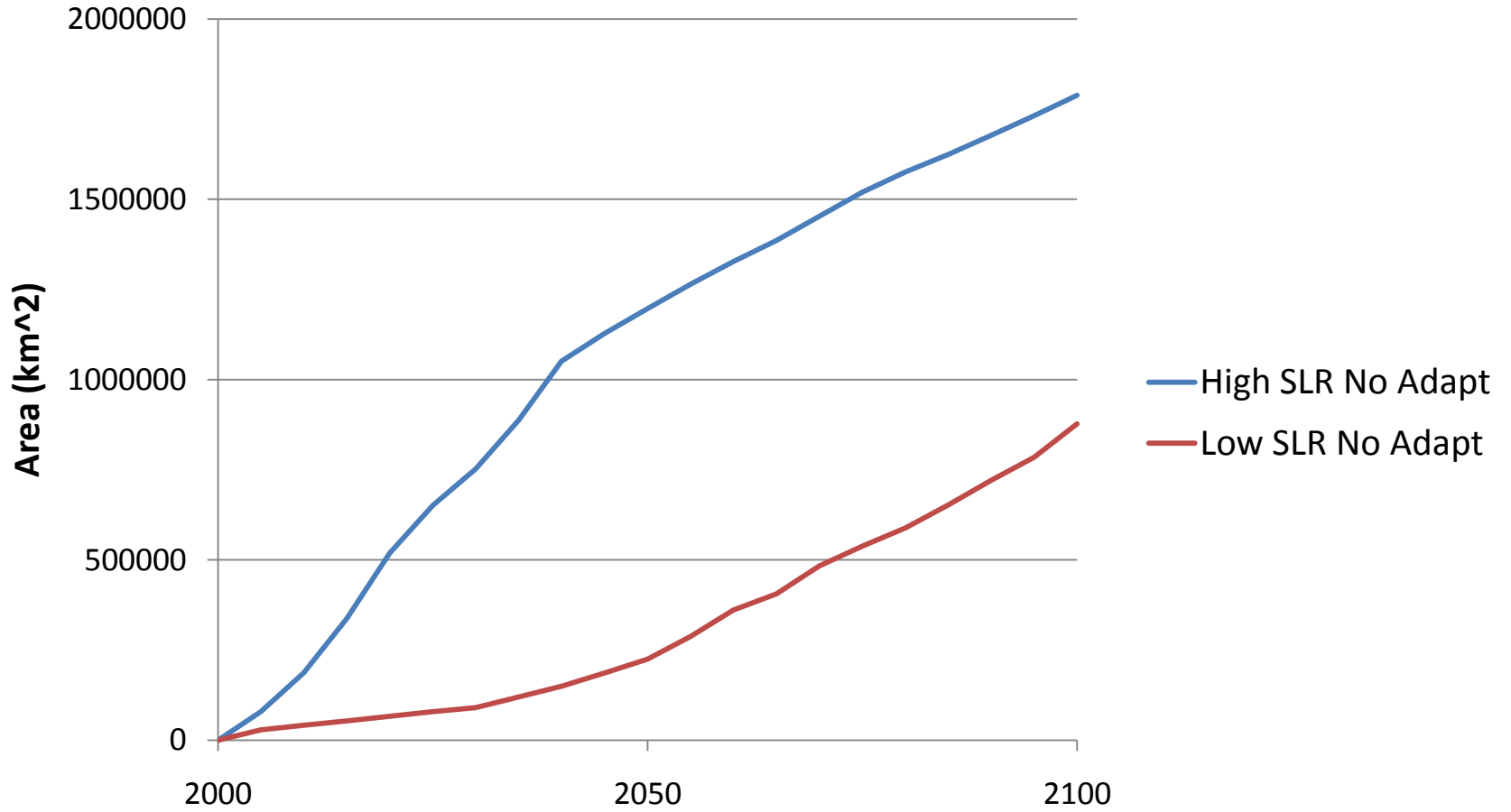
Coastal Wetland Loss

DIVA global results



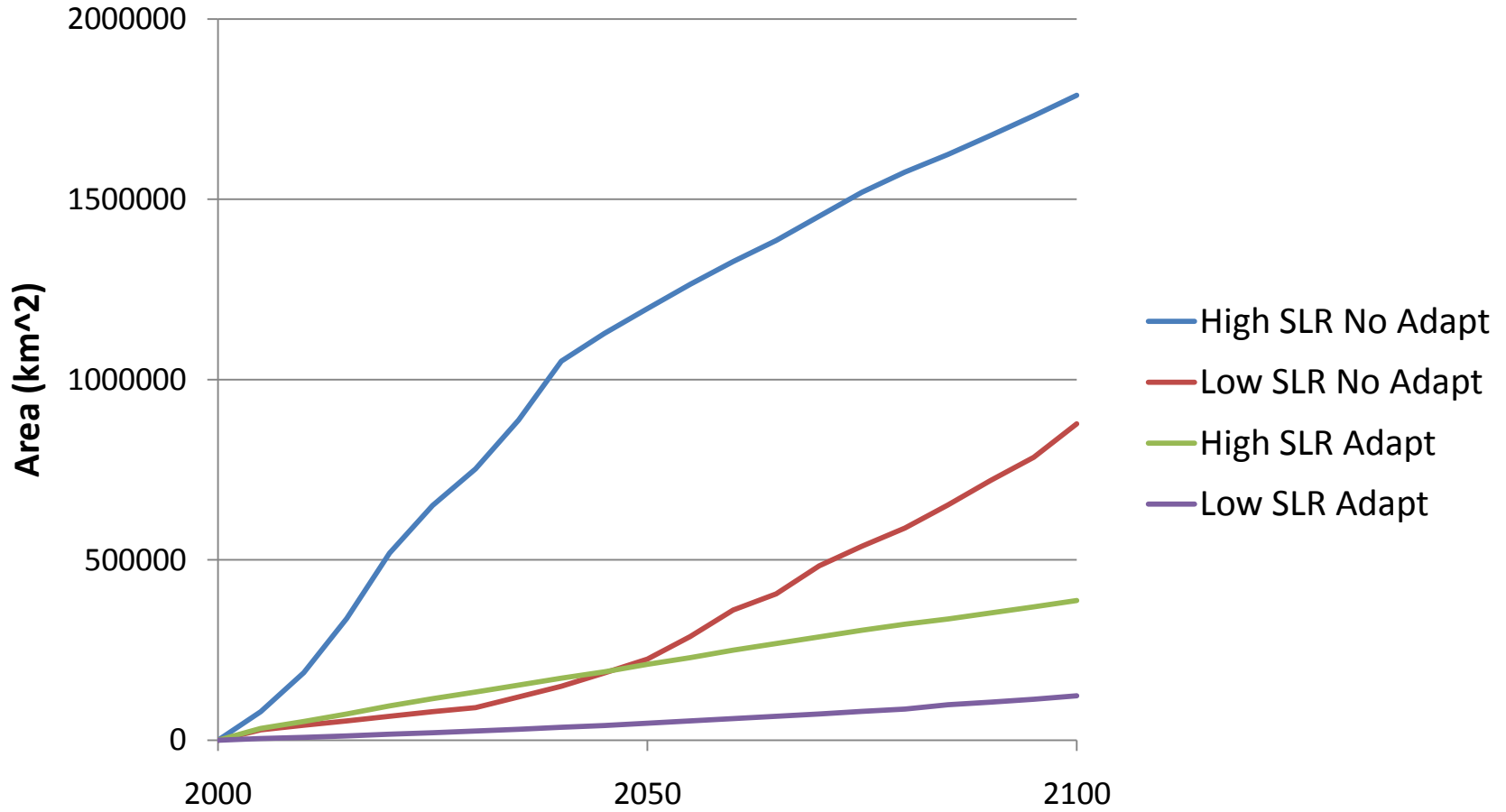
Dryland Loss

DIVA global results (No Adaptation)



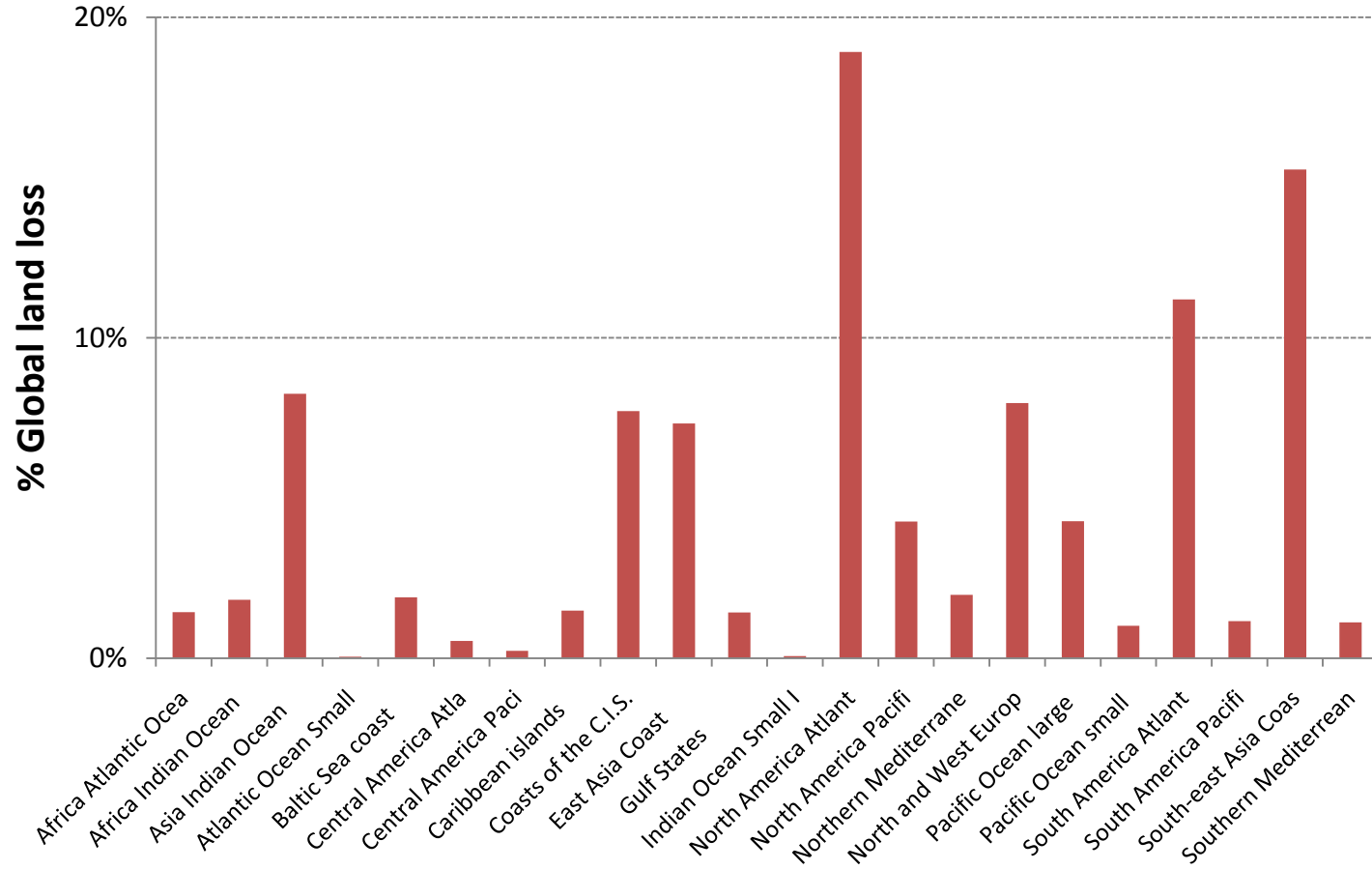
Dryland Loss: Adaptation (via dikes) versus No Adaptation

DIVA global results – A1B socio-economic scenario



Dryland Loss (by region)

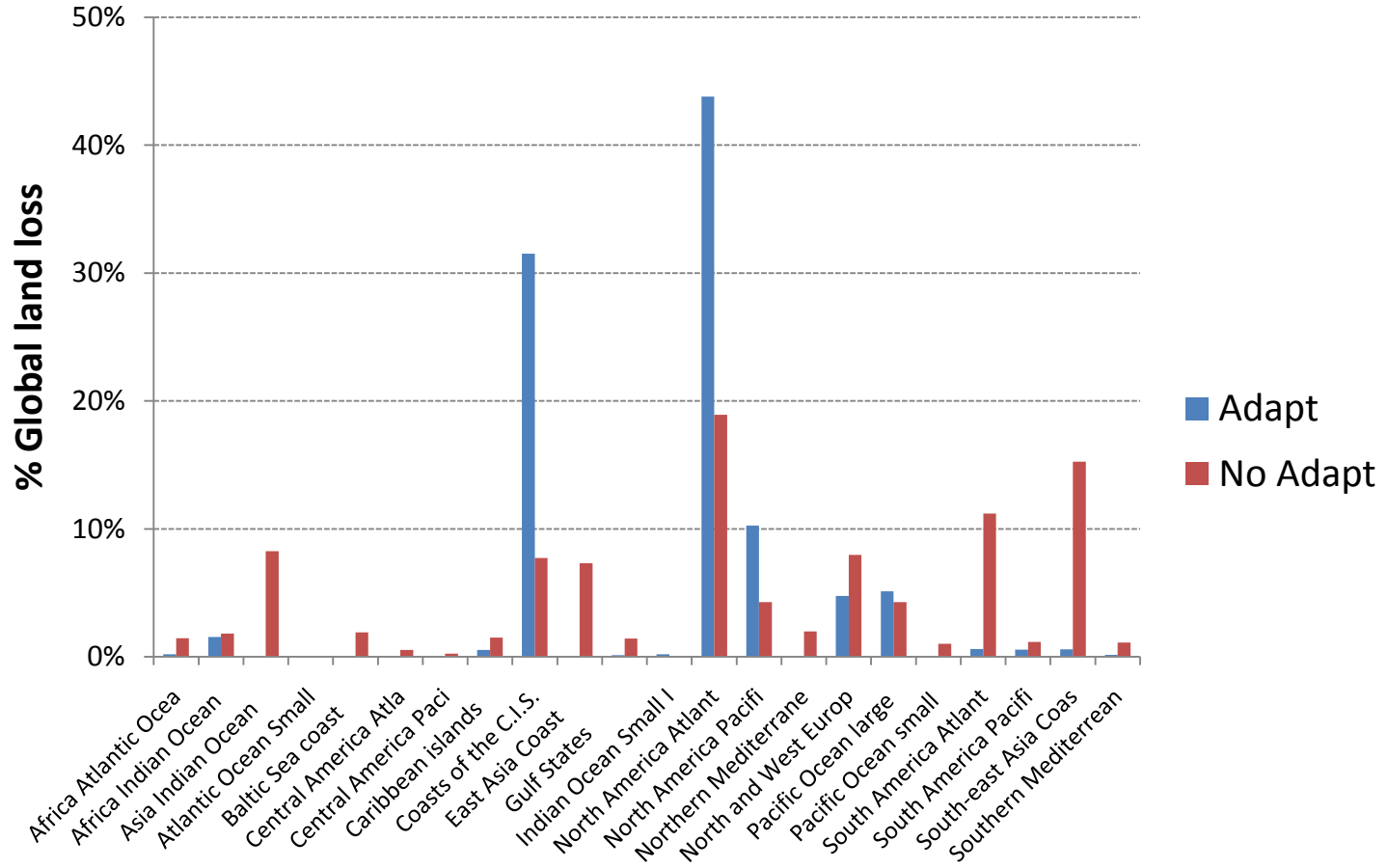
Without Adaptation



Dryland Loss (by region)

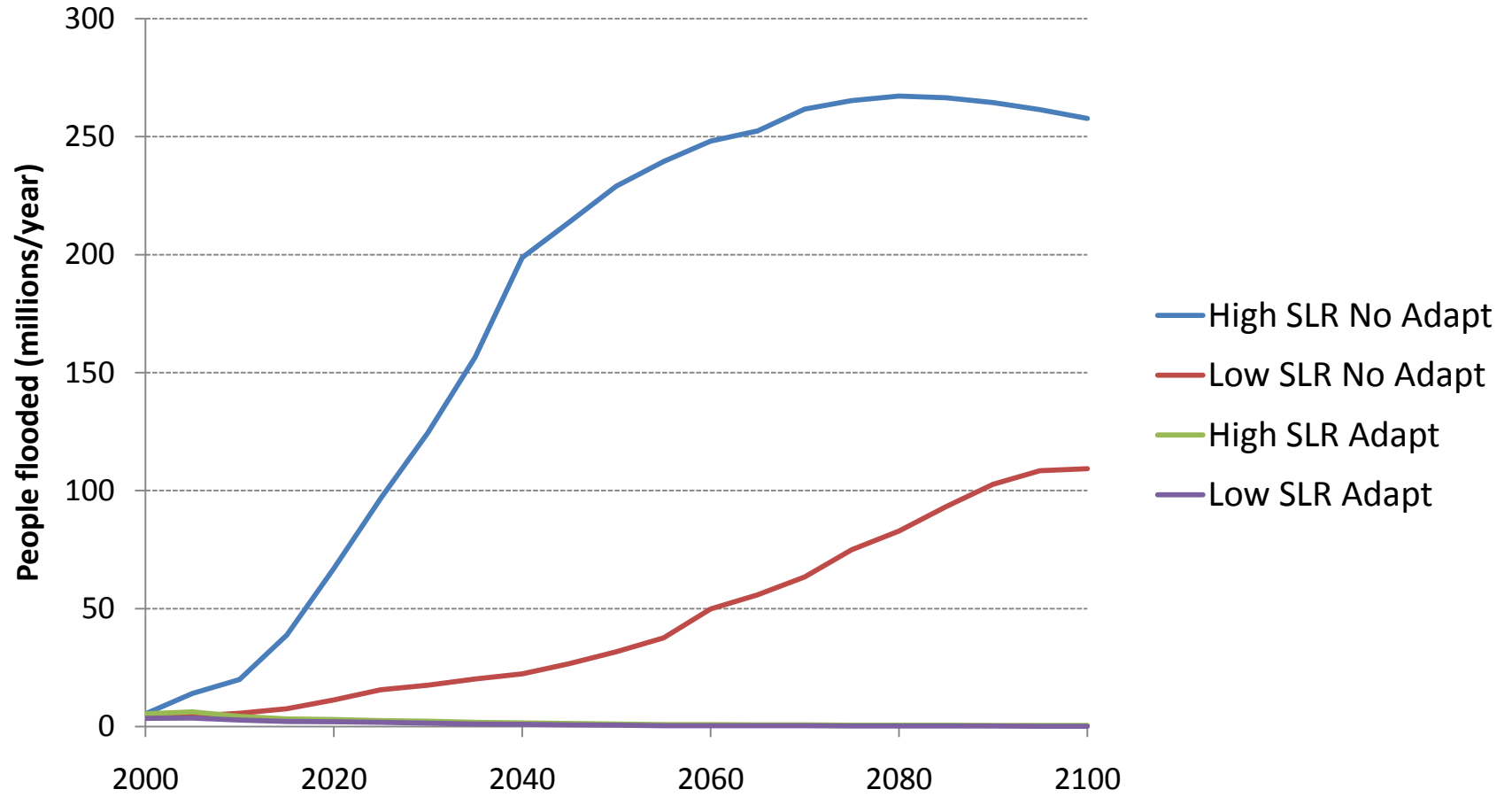
Without and with adaptation (via dikes)

(1.8 and 0.4 million km² of loss, respectively)



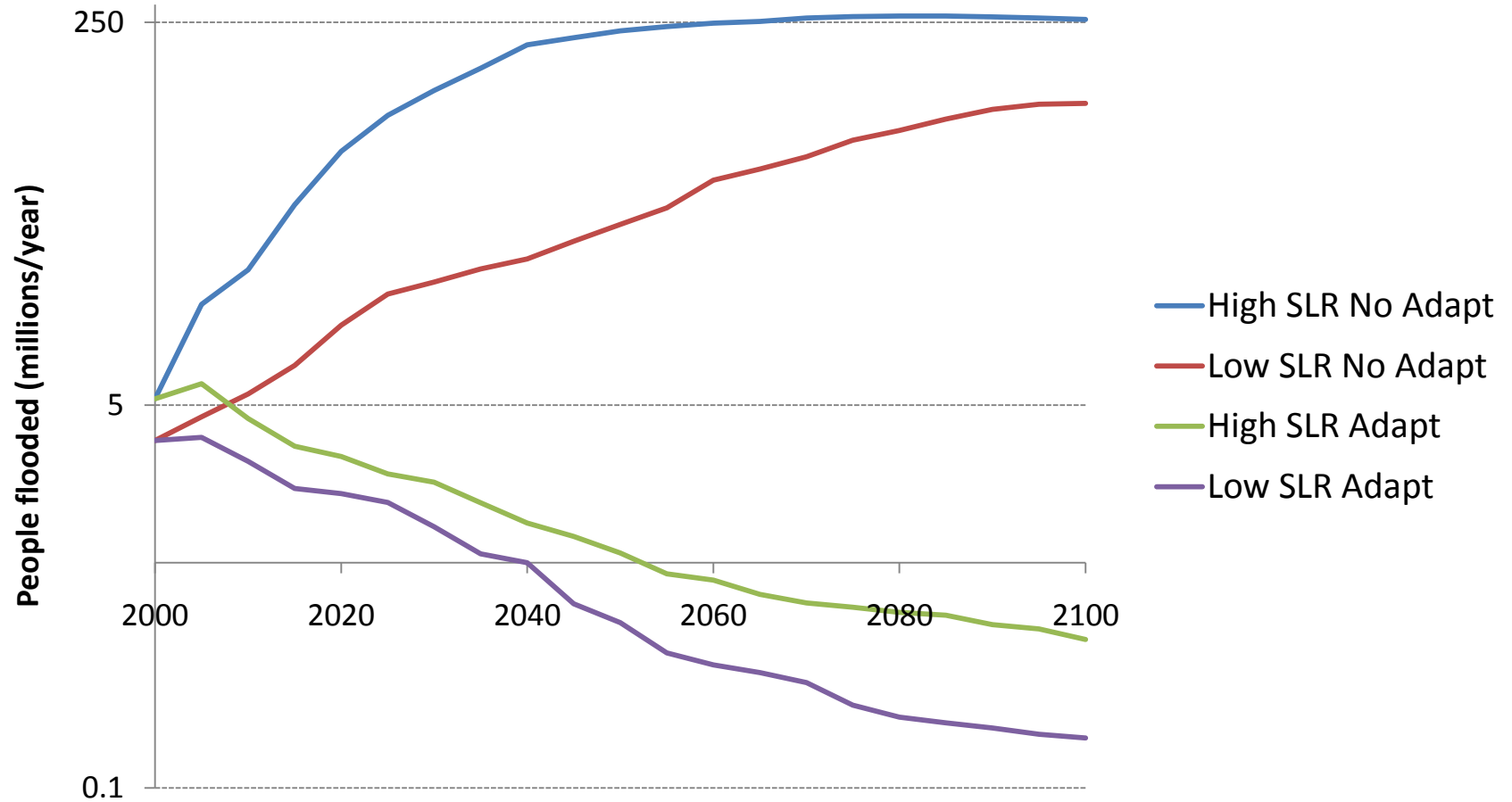
People at Risk of Flooding

DIVA global results – A1B socio-economic scenario



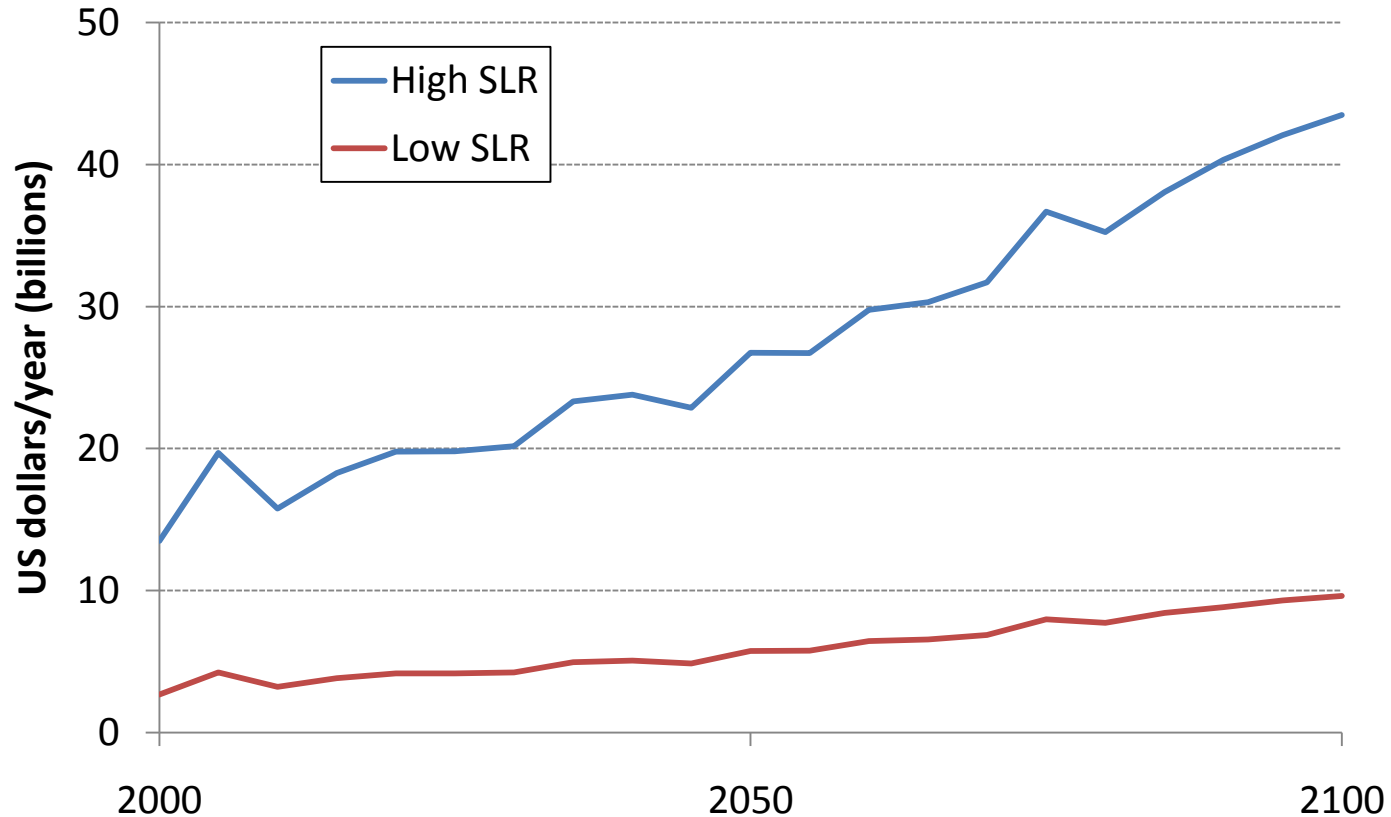
People at Risk of Flooding

DIVA global results – A1B socio-economic scenario



Protection Costs (Sea Dikes)

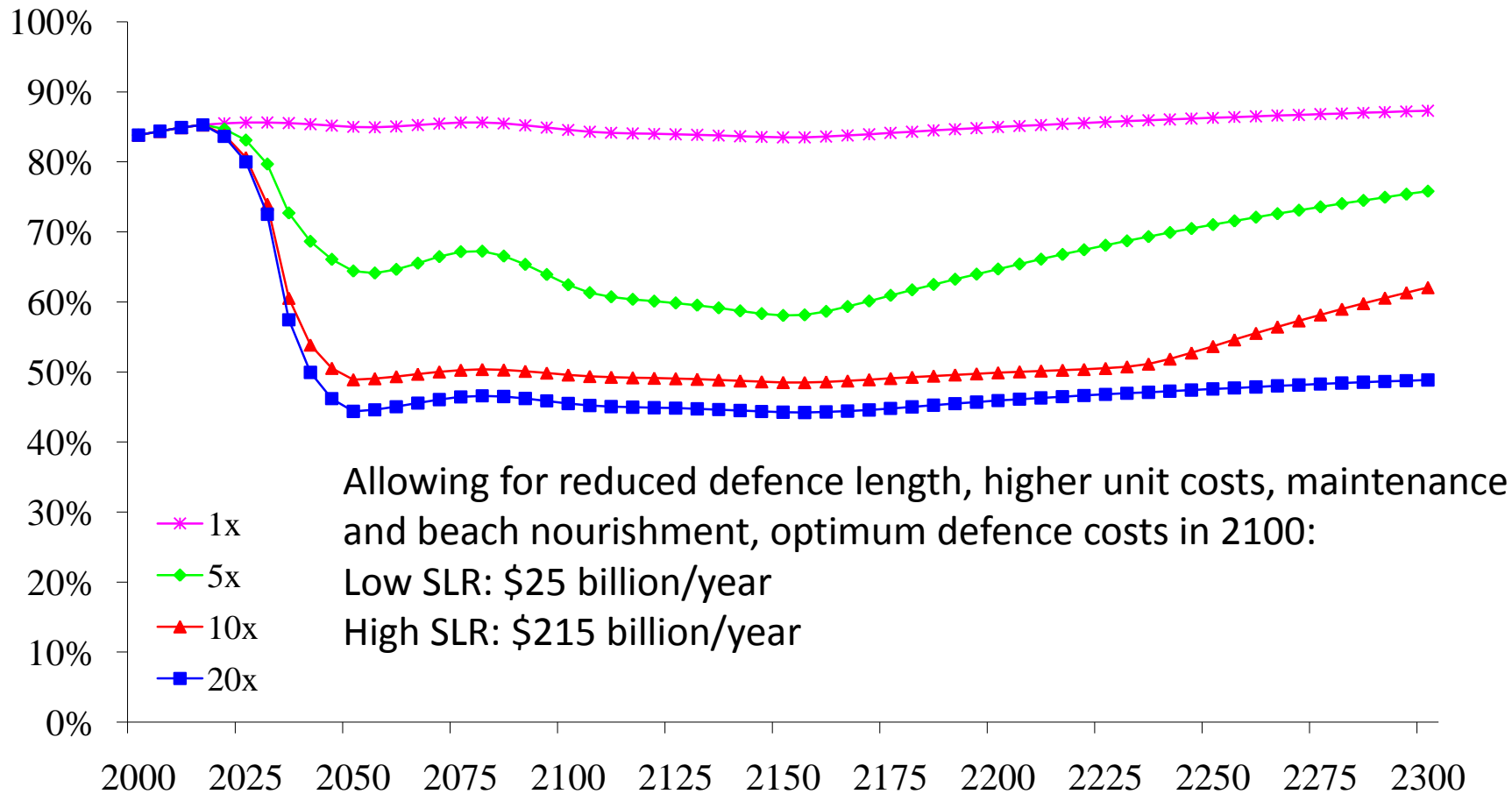
DIVA global incremental costs – A1B socio-economic scenario



Incremental costs are the costs due to global sea-level rise only

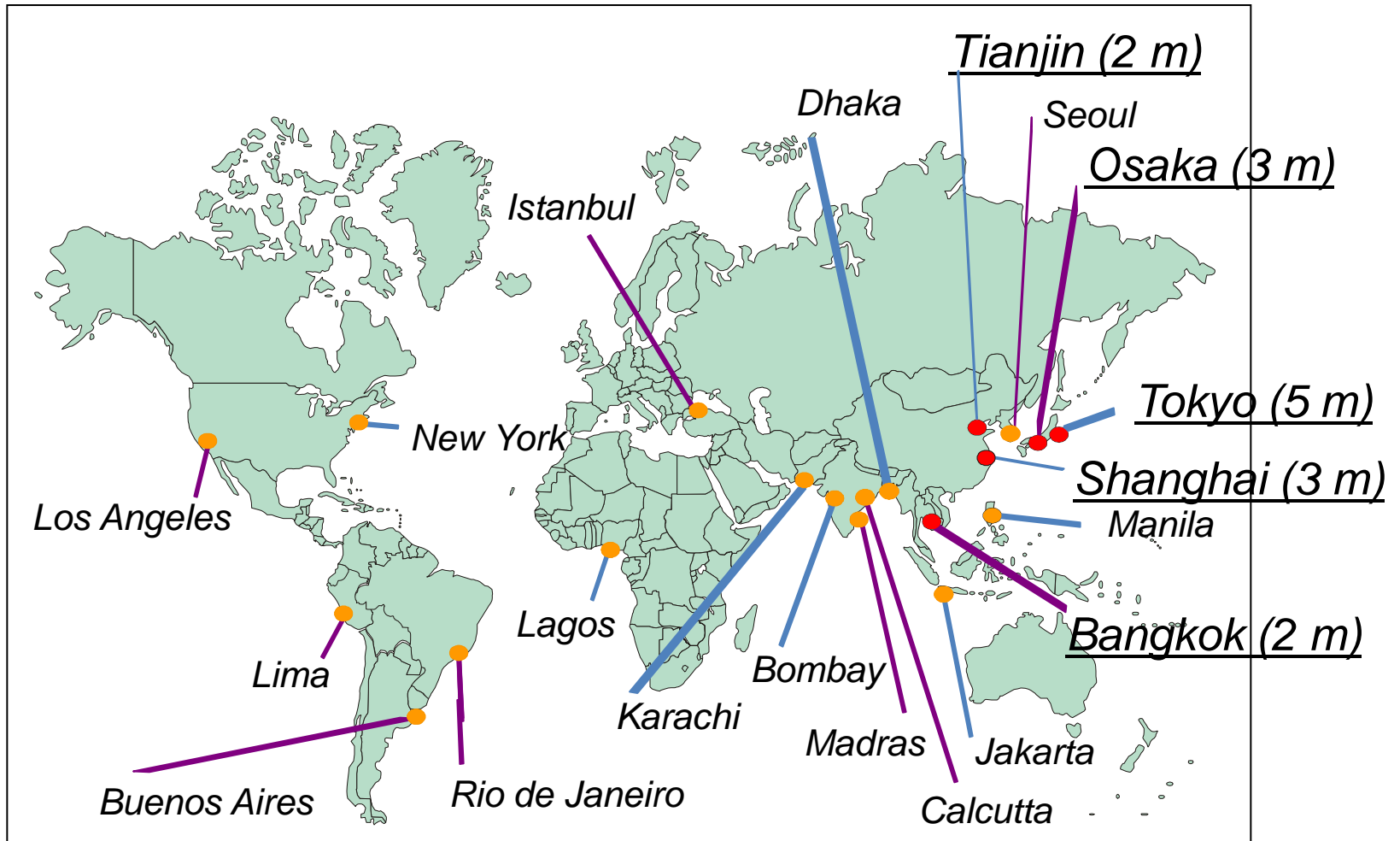
Protected Length of Coast

Optimum defended length of “developed” coasts in the FUND model
Nicholls et al (2008) Climatic Change



Subsiding Coastal Megacities

(during the 20th Century)



The pessimist's counter argument

The amount and success of adaptation will depend on more than cost-benefit analysis.

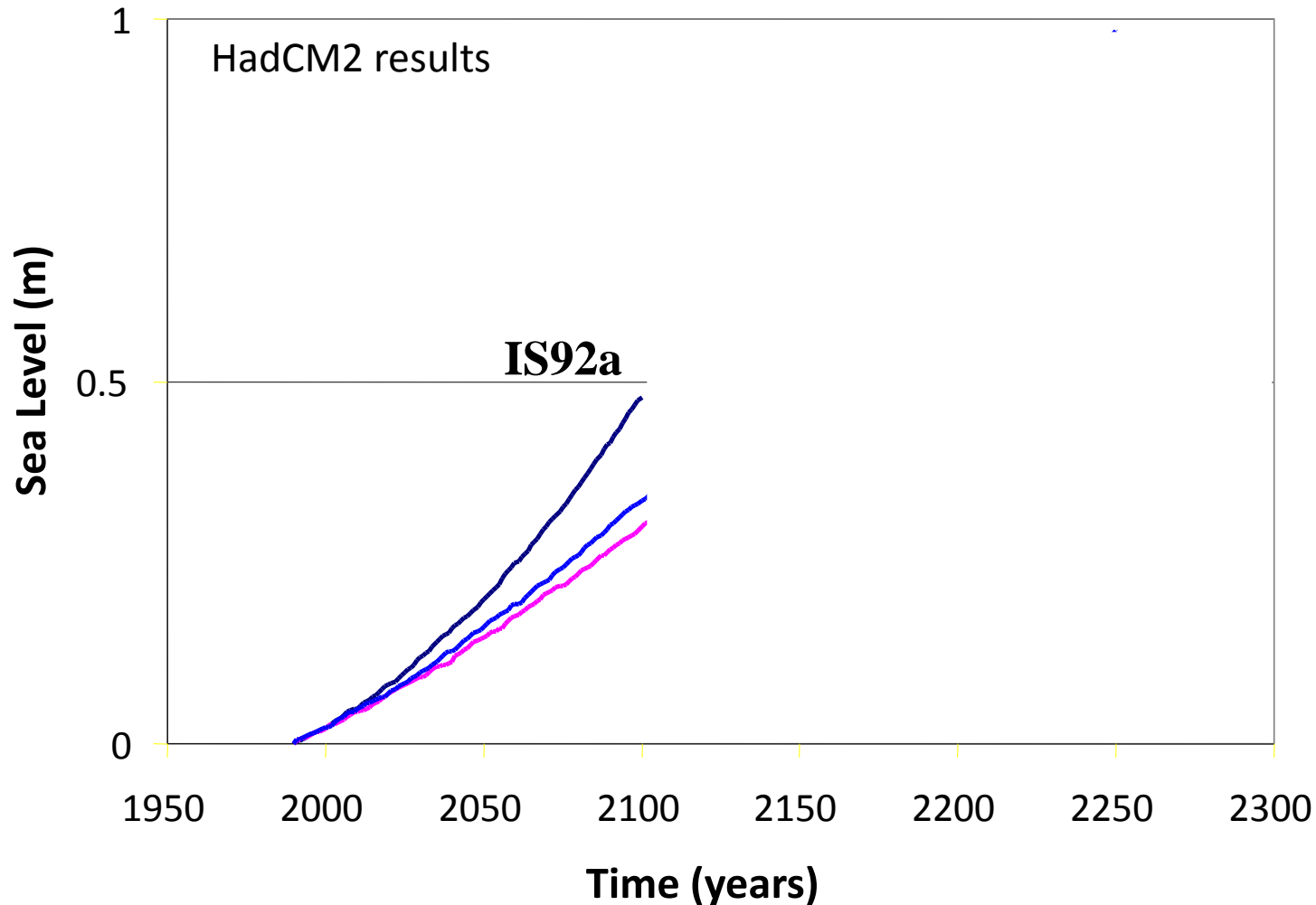
Key problems include:

- Protection costs are more than incremental costs (the adaptation deficit), and also are costs underestimated?
- Is the investment and the capacity to use it available?
- Even if funds are available, there are inefficiencies in the real world, including indecision and competition for limited resources
- Economic criteria are not the only factor which drives response decisions, with wider perceptions of risk driving the actual response
- The possible loss of confidence under the scenario of a large sea-level rise.

'Commitment to Adapting to Sea-Level Rise'

Unmitigated (IS92a) and stabilised scenarios (S750 and S550) compared.

(Nicholls and Lowe, 2004)



Concluding Remarks

- Sea-level rise is a major threat that will continue for centuries;
- While exposure is high, actual impacts are highly uncertain as they depend on the amount and success of adaptation;
- The optimist's and the pessimist's perspective both have points in their favour;
- A better understanding of adaptation and decision-making under uncertainty is essential, especially for small islands, deltas and other vulnerable settings.

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