

Challenges for impact modelling – experiences with coastal safety/DIVA

Robert J. Nicholls¹ and DIVA Consortium

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Plan



- Introduction
- DIVA Model
- Preliminary ISI-MIP Results
- Concluding Remarks

Introduction

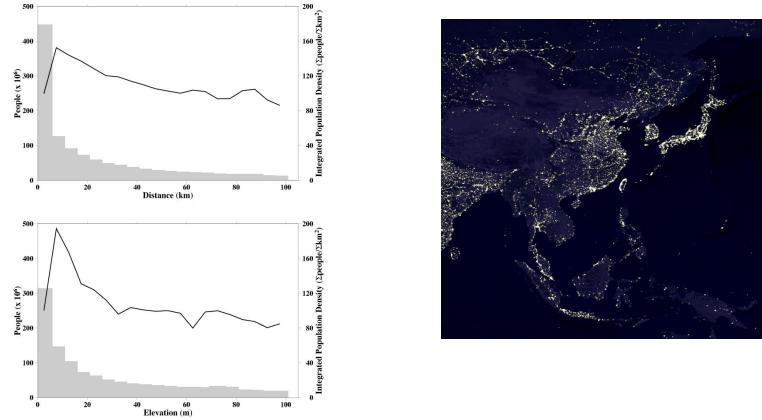
Coastal Trends

Rising local and global risks

- Population
 - Large and growing coastal population (double global trends)
 - Urbanising coastal zone (new residents are urban)
 - Tourism, recreation and retirement
- Subsiding cities in susceptible locations, especially in deltas
- Climate change and sea-level rise
- A reactive approach to adaptation

Coasts and People

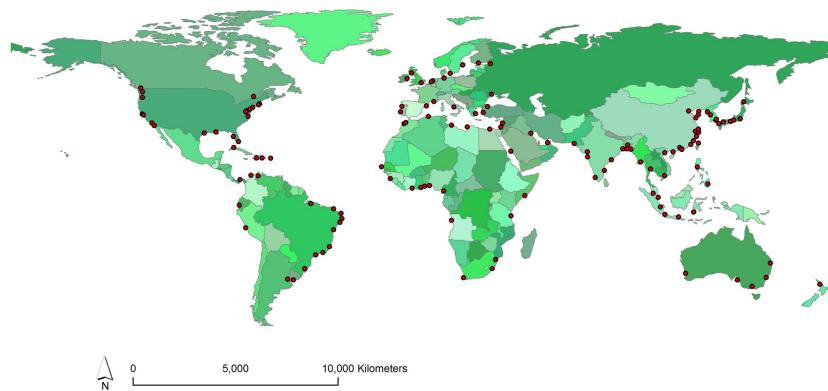
Population and economic density in the coastal zone is greater than other areas of the earth's surface.



Source: Nicholls and Small, 1993, Journal of Coastal Research

Port City Locations

≥1 million population in 2005
136 cities globally and 24 cities in the study area (18%)



Source: Nicholls et al., 2008, OECD Report

DIVA (Dynamic Interactive Vulnerability Assessment) Model

DIVA

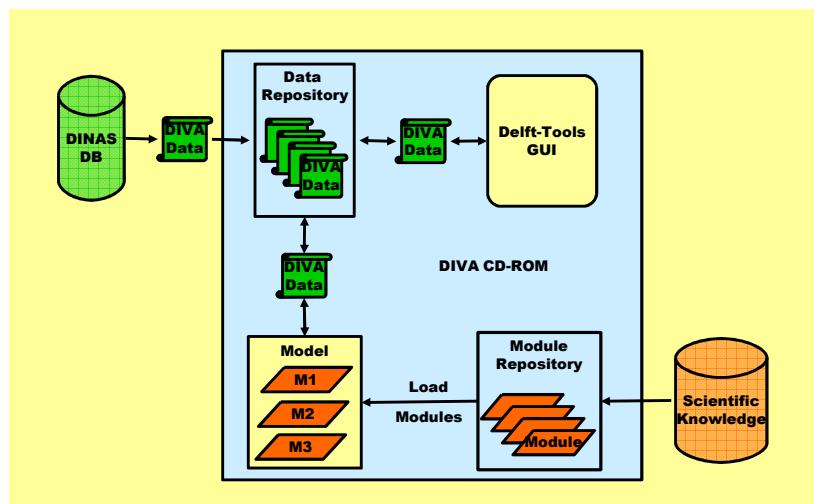
Developed by EU-funded DINAS-COAST Project:

- Potsdam Institute for Climate Change Research (PIK),
- University of Southampton (was Middlesex University),
- Sussex University (was Hamburg University),
- Delft Hydraulics (now Deltares),
- Vrije Universiteit, Amsterdam.
- An integrated tool to explore sea-level rise
- Comprises data and algorithms
- Considers national, regional and global scales
- Adaptation is an integral component

Impacts/Responses to Sea-level Rise in DIVA

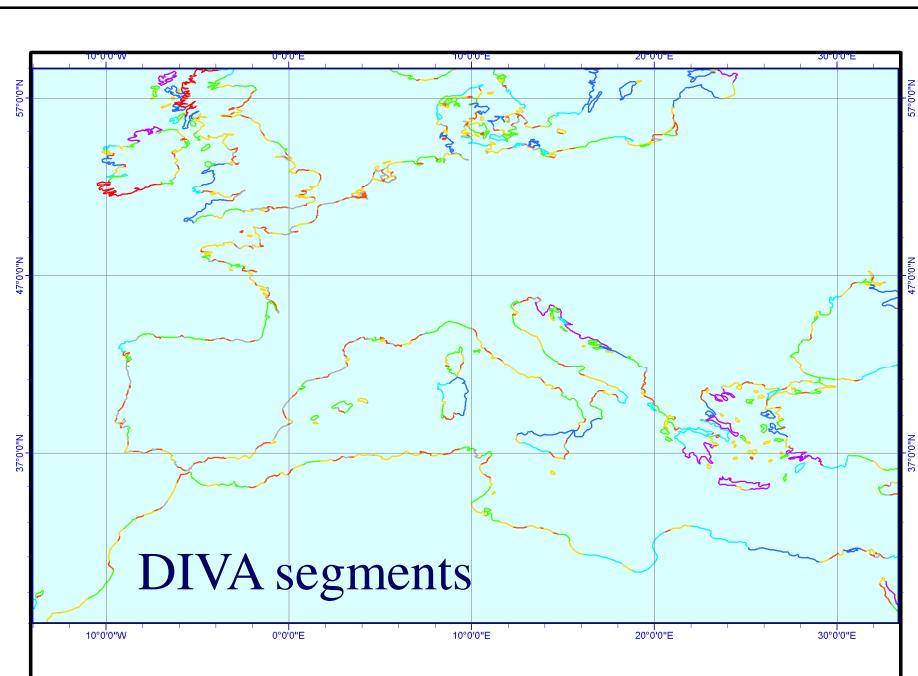
NATURAL SYSTEM EFFECTS		SELECTED ADAPTATIONS
1. Inundation, flood and storm damage	a. Surge (sea)	• Dikes
	b. Backwater effect (river)	
2. Wetland loss (and change)		• Forbid hard defences • Sediment nourishment
3. Erosion (direct and indirect morphological change)		• Beach nourishment
4. Saltwater Intrusion	a. Surface Waters	
	b. Groundwater	
5. Rising water tables/ impeded drainage		

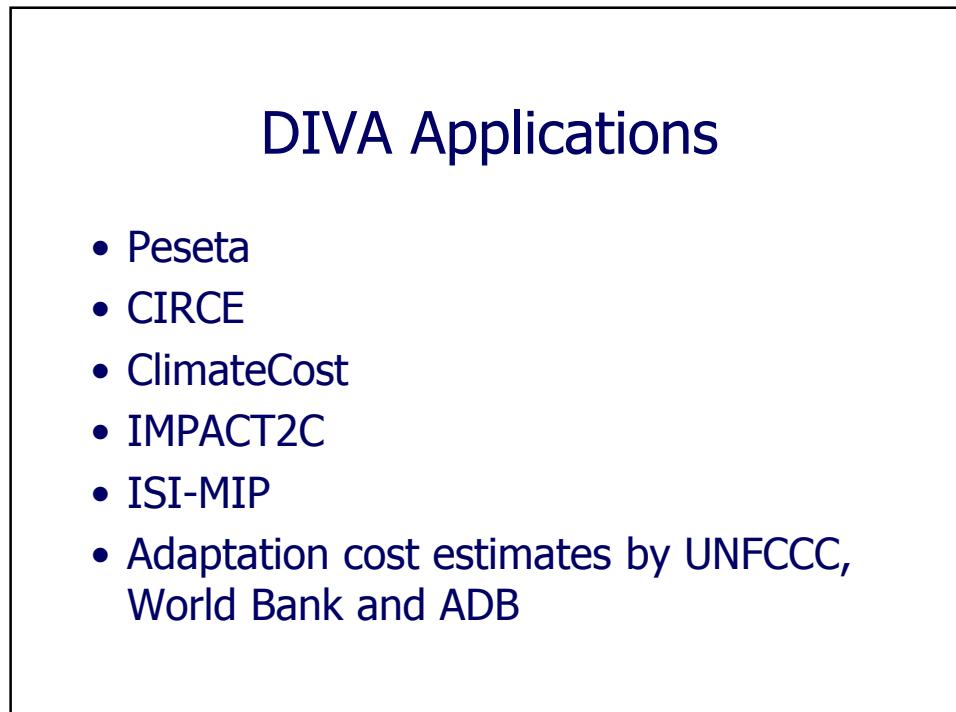
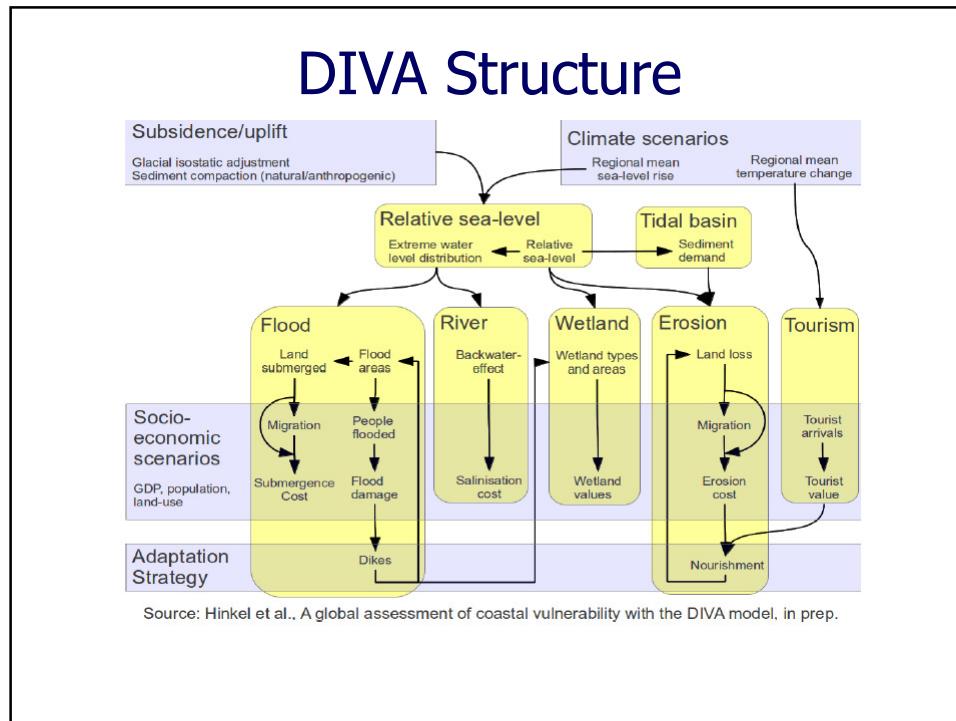
DIVA Concept



DIVA Database

- Derived from existing and new global data stored in a geodatabase;
- Mapped to 12,148 linear segments of 'similar' vulnerability (1-D structure);
- Comprises about 100 natural, ecological and socio-economic factors;
- Deltas have subsequently been added as a geographic feature.

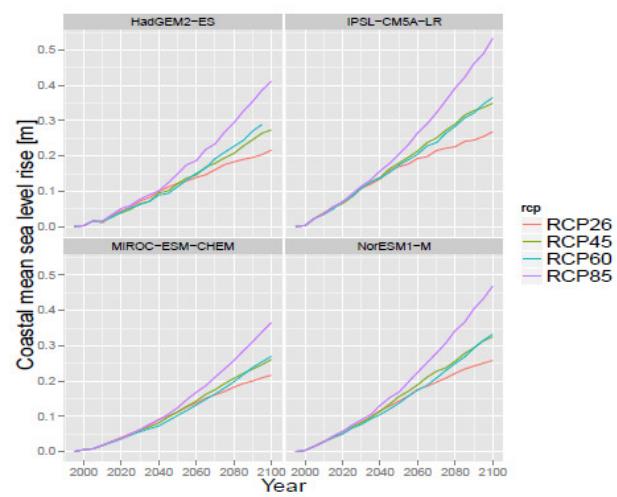




Preliminary ISI-MIP results

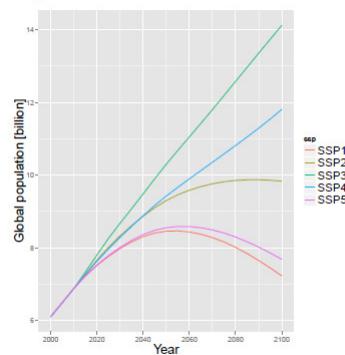
Sea-level rise scenarios

(only steric sea level rise and mountain glacier/icecap melting)

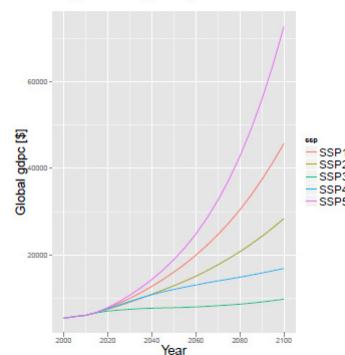


Socio-economic scenarios (SSPs)

Population:



GDP (per capita):



Source: OECD, IIASA

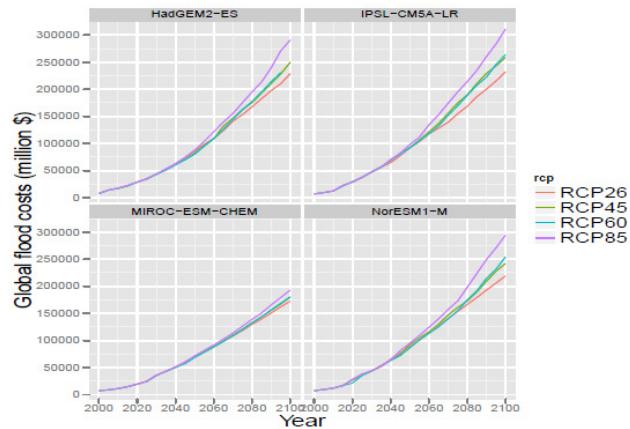
Adaptation Options

- Beach Nourishment Costs – for beach erosion
- Dike Upgrade (Capital Costs) – for flooding
- Dike Maintenance Costs – for flooding
- Port Upgrade Costs



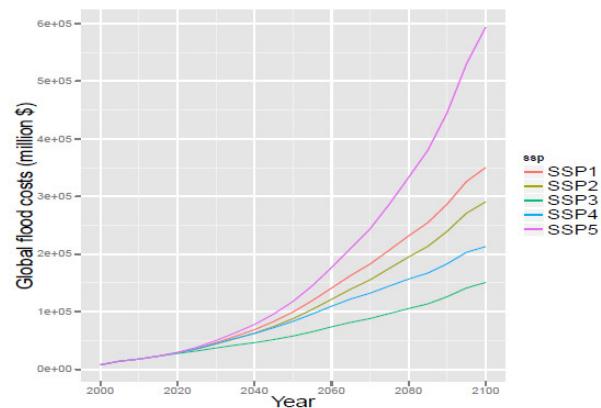
Global Coastal Flood Impacts vs. SLR

SSP2, no adaptation
flood costs – sea flood costs and river flood (backwater effect) costs

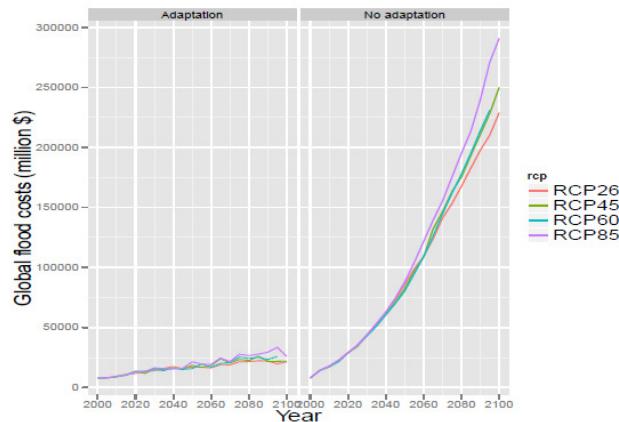


Global Coastal Flood Impacts vs. SSP

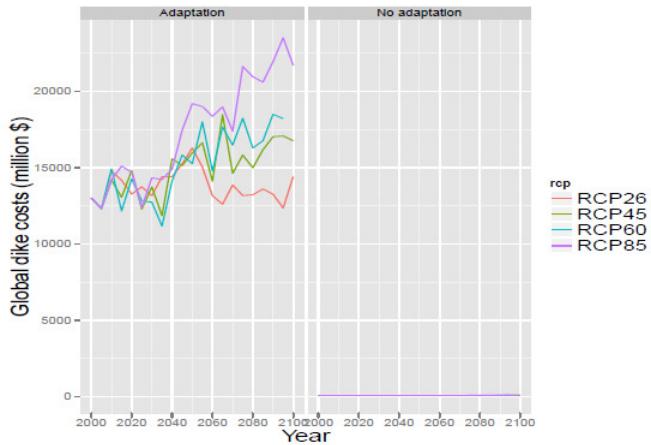
HadGEM2, RCP85, no adaptation



Global Coastal Flood Impacts With and Without Adaptation HadGEM2, SSP2



Global Coastal Flood Adaptation Costs With and Without Adaptation HadGEM2, SSP2



Concluding Remarks

Issues 1

- Sampling the future – appropriate scenarios (e.g. ice sheet decline; delta subsidence)
- The scale of analysis – regional (or global) versions of DIVA at higher resolution – nested analysis
- More processes – groundwater intrusion

Issues 2

- Capturing adaptation – protect, accommodate and retreat (in stylised form)
- Real-world adaptation
- Adaptation deficit



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