European Research Area for Climate Services ERA4CS - Transnational Collaborative Research Projects 2016
Topic A - Researching and Advancing Climate Services Development by Advanced co-development with users

INSeaPTION

INtegrating Sea-level Projections in climate services for coastal adaptaTION

Coastal climate services in the Maldives: 1st INSeaPTION user workshop

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INSeaPTION

brgm Géosciences pour une Terre durable

Global Climate Forum

creocean Environnement & océanographie

IMAU Institute for Marine and Atmospheric research Utrecht

IMEDEA CSIC Universitat de les Illes Balears

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Maldives

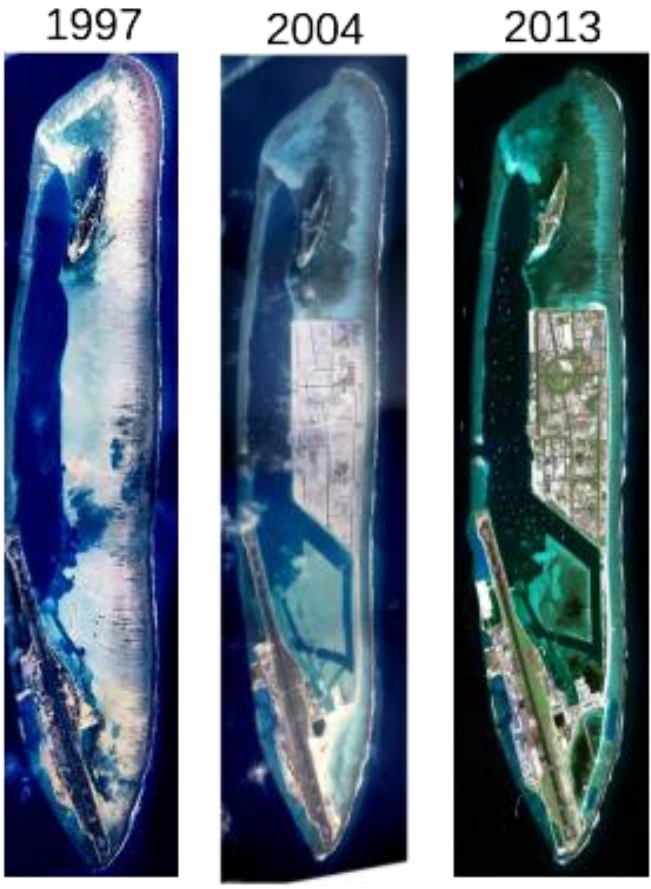
- 1200 low-lying atoll islands (200 inhabited, 100 resorts)
- 1.5m above mean sea-levels
- largest share of population on a few urban islands, e.g. Male, pop. 135,000.
- Economy: tourism, shipping, fishing, services
- Land scarcity is a major concern:
  - High urbanisation rates
  - greatest economic opportunities in urban areas

Maldives

Malé:
1.5m above GMSL

(c) Shahee Ilyas https://commons.wikimedia.org/w/index.php?curid=621195

Hulhumalé:
2.1m above GMSL



http://hdc.com.mv/

- Individual meetings with n=16 stakeholders in Malé and Fulidhoo
  - Ministries, Government Agencies, Local Government,
  - Civil Society Organisations
  - Environmental Consultants
- Main stakeholders
  - Ministry of Environment and Energy
  - Environmental Protection Agency
  - Ministry of Housing and Infrastructure

- Major coastal risks
  - Flooding
  - Salinization
  - Coastal erosion

Erosion in Fuvamulah and Land Reclamation in Thulusdhoo

Main User Needs

Context → User Needs → Decision Problem → Decision Method

Main user needs identified

Decision problems:

- Design height of land reclamation projects
- Prioritizing islands for the allocation of coastal protection
- Prioritizing islands for sanitation infrastructure investments

Other needs:

- Attributable fraction of risk of future SLR
- Capacity building for erosion monitoring

Land reclamation design height decision

Decision Context

- Ministry of Housing and Infrastructure (MHI) developing new land reclamation design height guideline

- Current MHI guideline:
  - design height of 1.5-1.75 meter above MSL for new islands

User needs:

→ develop a national guideline for land reclamation that more precisely includes information on SLR and exceedance probabilities,

→ investigate how flood exposure information could be included as an alternative to a rule-based (uniform) design height policy.

Decision problem framings:

- **Decision problem 1: choosing a uniform design height policy for new land reclamation projects**
- **Decision problem 2: choosing a design height strategy for new land reclamation projects**
- **Decision problem 3: efficient design height policy for new land reclamation projects**

Decision analysis methods and information needs

Method	Information need	Methodology for producing needed information
Adaptation Tipping Points	• Mean sea-level scenarios and extreme sea-level distributions • Long-term regional sea-level rise scenarios (Optional) Changes in waves (Optional) policy objectives	• Statistical analysis of tide gauge data, • Wave modelling • Downscaling of global sea level projections • In-depth interviews
Adaptation Pathways	Same as Adaptation Tipping Points • Future adaptation options • Land reclamation costs	See above • Interviews of actors • Cost information of existing land reclamation project (e.g. Hulhumale)
RDM CBA	Same as Adaptation Pathways • flood risk data (e.g. area sizes, population, investment costs, asset values, etc.) • Model effectiveness of adaptation options	Same as Adaptation Pathways • data collection • Damage functions • Modeling adaptation option effectiveness

Key decision using sea-level information: Resource allocation for combatting coastal erosion

Decision Context and decision problem

- Environmental Protection Agency (EPA) is tasked with prioritizing islands fpr protection from coastal erosion
- 46/189 islands reported erosion problems. Which should receive investment?
- Currently, multi-criteria approach to determine the prioritization
  - future SLR not taken into account

Decision Problem

  - Island prioritisation to prevent coastal erosion
- Decision-Support Method
  - Improved current multi-criteria method.
  - Multi-criteria analysis with future SLR
- Decision-Support Method
  - Multi-criteria method with indicators of long-term coastal erosion e.g. based on an island typology

Outlook and next steps

- Developing decision-analysis of land reclamation design height problem → Adaptation tipping point analysis based on extreme sea-level projections

- Coastal erosion prioritisation decision support → Multi-Criteria Analysis based on biophysical and socio-economic indicators

- Intermediate results and second field trip to Maldives Feb. 2019

Thanks for your attention

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