RISES –AM –

RESPONSES TO COASTAL CLIMATE CHANGE:
INNOVATIVE STRATEGIES FOR HIGH END SCENARIOS
–ADAPTATION AND MITIGATION–

COASTAL VULNERABILITY IN “FUTURE WORLDS”

Coordinator: Prof. A. Sanchez-Arcilla

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Contents

- Project overview
- Evolution (scenarios and impacts)
- Coastal vulnerability
- Projection & modelling across scales
- Conclusions and future work
To project impacts through coastal cases

• Wide range of **climate** factors **evolving** continuously (terrestrial, marine, morphology, population...)

• With high **adaptation deficit** (costs)

(small islands, developed deltas...)

Images courtesy of Ministry of Environment and Energy, Maldives
To evaluate responses through coastal cases

- **Transient** “pressures”
  (wave storms, population...)

- **Scarce** territory with reduced “natural” response capacity

- With high level of **conflicts** (present) to get more **acute** in the **future**
Among assessment cases:
- Deltas / Estuaries
  - Higher impact (vulnerability)
  - Natural Scale Integrators (forewarning)

Novel interventions: promote vertical accretion (flooding “compensates” subsidence)

Nov 2001 storm

Holocene subsidence rates
(Somoza et al 1998)

To assess novel/sustainable “solutions” at local, regional and global scales
RISES –AM – methodology explicitly includes

• **Adaptation pathways** (sequence of policy actions)

  → to achieve **targets** (limiting future “regrets”)
  → under **changing physical** drivers
  → under **changing socio-economic** conditions

![Adaptation Pathways Map](image)

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<th>Path actions</th>
<th>Relative Costs</th>
<th>Target effects</th>
<th>Side effects</th>
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Deltaic sediment starvation
Tipping points for reservoirs & deltas (Ebre delta)
Scenarios and projections

A. Global scale – Only Sea Level Rise

1. RCP 4.5 and 8.5
2. Other scenarios (e.g. SRES A1B)
3. Upper limit of 2.0m (up to)

95% or “max”
(Moore et al 2013)

Global SLR (emphasis on high-end) for various quartiles/authors
B. Regional
B.1. Sea Level Rise
RCP 4.5 & RCP8.5 + upper limit

Regional (downscaled) projections → Regional MSL components combined (e.g. fig below for median projections).
B.2. Waves + Storm Surges

Regional scale projections for waves & storm surges (1 GCM + 1 RCM) Realisation for the time slice 2070-2100.

- Only RCP8.5 (1 model- CMCC)
- Computational grid for Europe
TOP: Ensemble mean storm surge index (cm) for + (red line, cm) and - (black line, cm) surges & waves (dm) in present climate (simulations)

Coastal points are ordered clockwise starting from Gibraltar.

BOTTOM: Climate change percent index (%) for positive (red line) and negative (black line) surges and waves (blue line)
SSPs and SRES

SSPs narratives (5) distinguished on challenges to adaptation and mitigation, rather than on emissions pathways (e.g. SRES).

SSP1 and SSP5 – highest GDP / lowest population
SSP3 – “Fragmentation“ (GDP lowest / highest population)
SSP4 – “Inequality” (highly unequal world, within and across countries)

Emphasis on SSP 3, 4 and 5 (consistency with high end conditions)
Warming level of 4°C ➞ RCP 8.5 ➞ SSP 3, 4, 5

Source: O’Neil et al., 2013
Model List – Time Scales

- Decadal Scale
- Yearly Scale (months to years)
- Event Scale (hours to days, $\tau = \text{decades}$)

Storm event for Black Sea coast

Long-term low lying coast (Netherlands)
Costal Adaptation (+) → Potential Impacts

Vulnerability

Resilience

Adaptation to
- Available space (present conditions)
- Storm impact range (future conditions)
CONCLUSIONS (ON-GOING WORK)

- Use downscaled future scenarios (physical and socio-economic components) to project impacts
- Combine decadal scale and storm scales
- Transfer across spatial scales (from local to regional and global)
- Use present hydro-morpho and economic models to assess vulnerability
- Make uncertainties explicit (whenever possible)
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