SEASCApe II

A comprehensive assessment of future flood risk and optimal adaptation strategies to sea level rise

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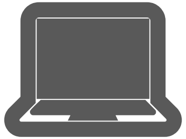
SEASCApe II

Storm surges

Flood risk

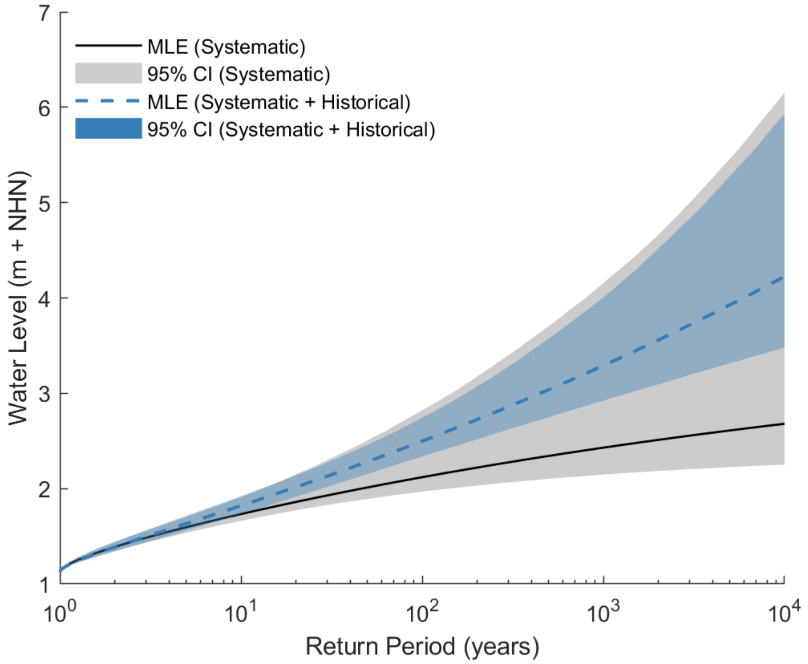


Decision analysis

Storm surges

Extreme Sea Level (ESL) Estimates

- Uncertainties in ESL estimates arise due to limited tide-gauge data
- Travemünde has a long history of ESLs (1044, 1320, 1625, 1872, …)
- Incorporating historical information in the analysis of ESLs leads to improved estimates with reduced uncertainties.

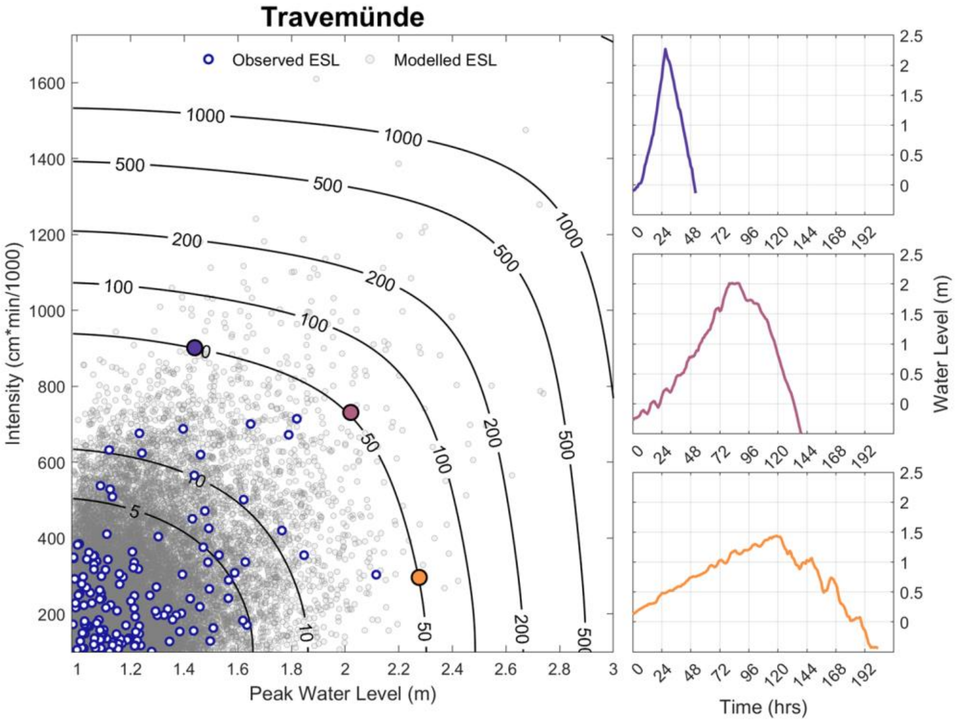


Stochastic Extreme Sea Level Model

- ESLs vary substantially in both magnitude and intensity (fullness)

- We model the full ESL time-series (hydrograph based on observed events)

- Artifical ESL hydrographs provide physically plausible events for flood risk analysis



Flood risk

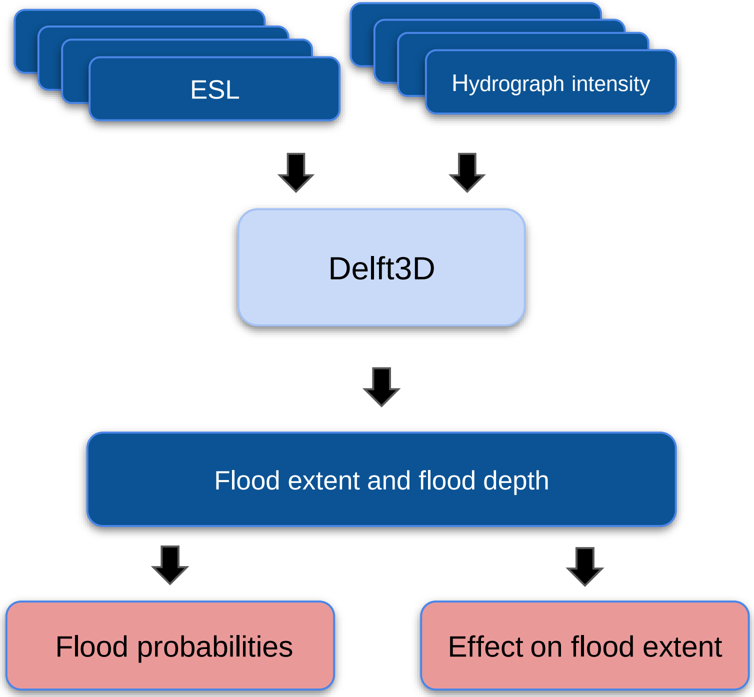
Estimating flood exposure today using hydrodynamic modelling

We simulate flood extent and flood depth for today, using the hydrodynamic model Delft3D

Model input for today:

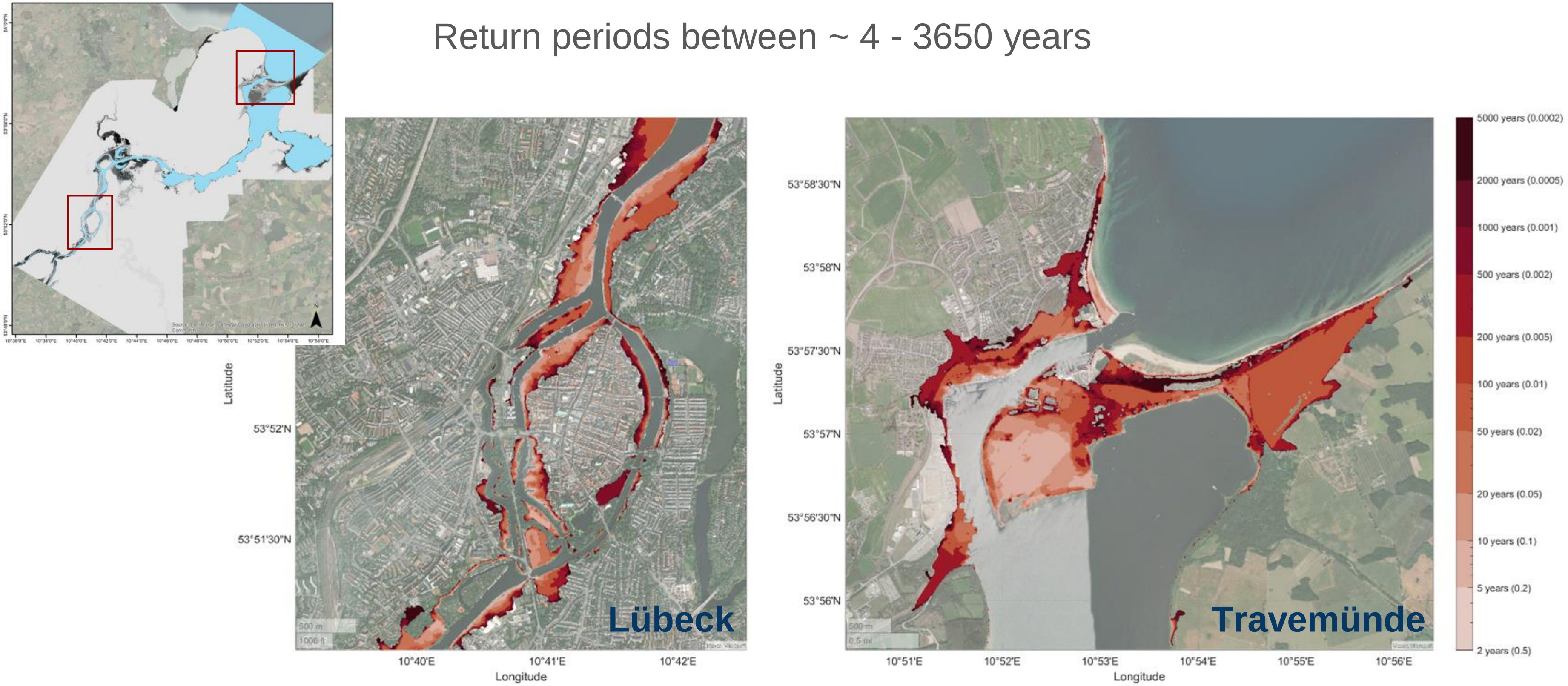
1. Wide range of ESLs with magnitudes of **1.60 m - 3.40 m** at 5 cm increments, corresponde to a wide range of return periods

2. Two return periods (50yr and 200yr) and **100** different **hydrograph intensities**

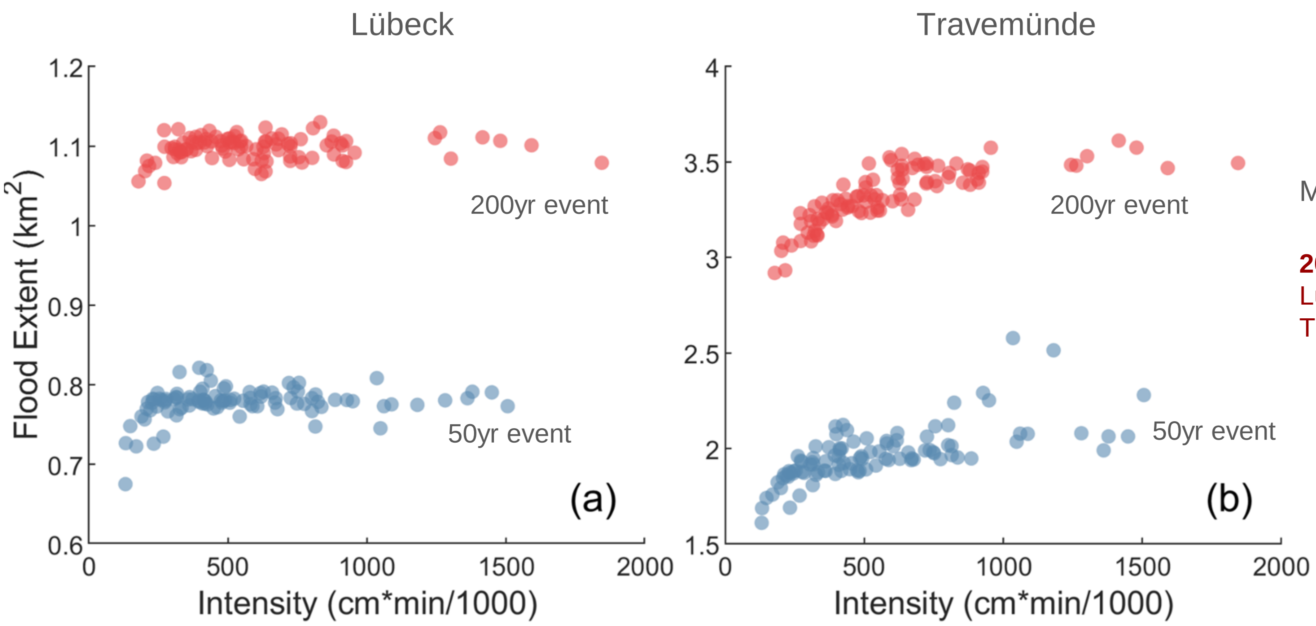


1. Expected annual probability of flooding

Return periods between ~ 4 - 3650 years



2. The effect of the temporal storm evolution | 100 hydrograph intensities



Max difference in flood extent:

200yr event:
Lübeck 7 %
Travemünde 24 %

50yr event:
Lübeck 21 %
Travemünde 60 %

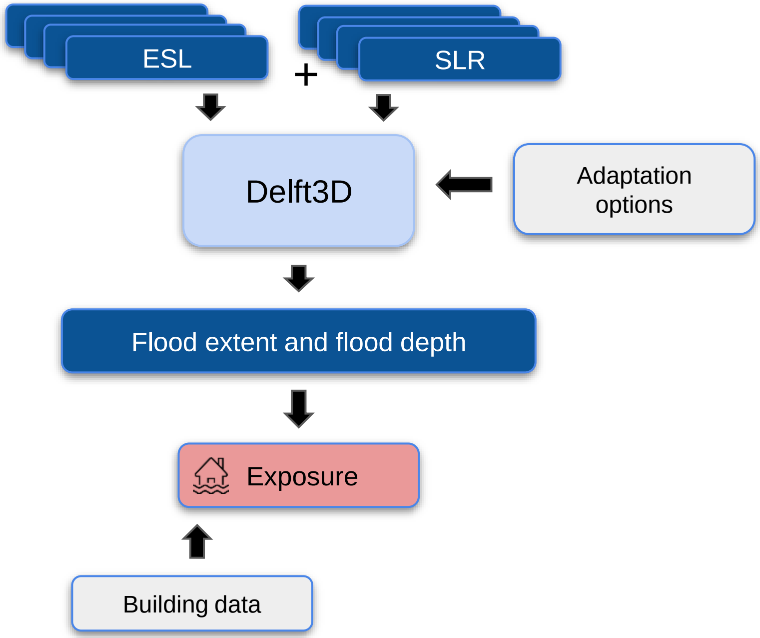
→ The effect of the hydrograph intensity depends on event magnitude and topography

Estimating future flood risk accounting for SLR

We comprehensively estimate future flood risk for ESL + SLR scenarios under adaptation accounting for affected buildings and reconstruction costs.

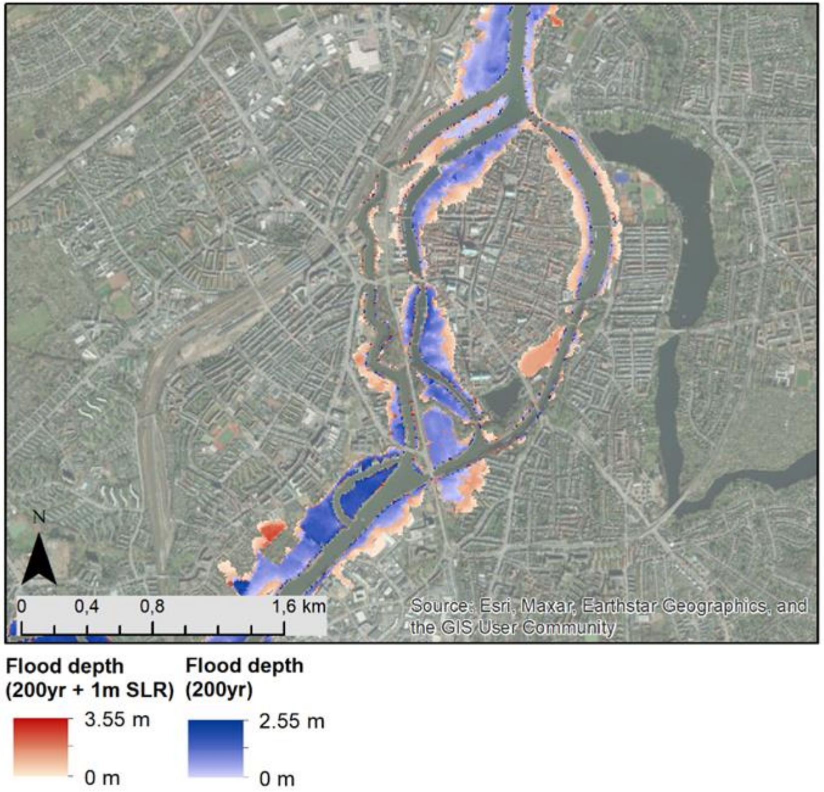
Model input for future flooding:

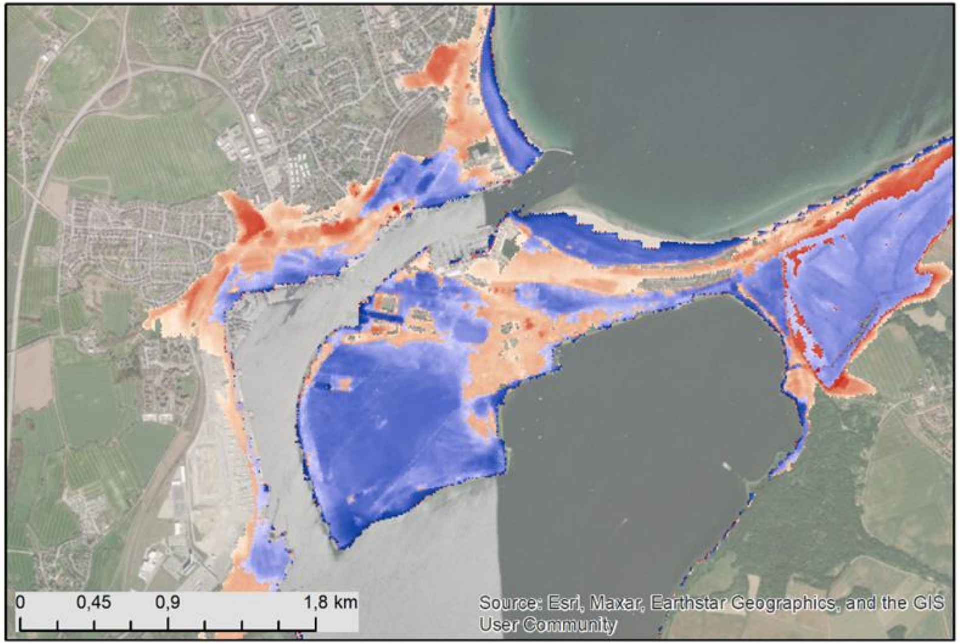
- 200 ESL + SLR scenarios
- ESL: **1.60 m - 3.40 m**
- 3 adaptation options



Today and future simulations → 911 scenarios

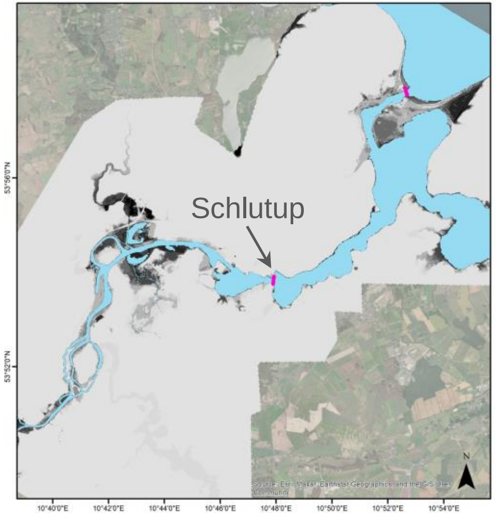
Storm surge 200yr (2.55 m) + 1 m SLR (3.55 m)





Possible adaptation options

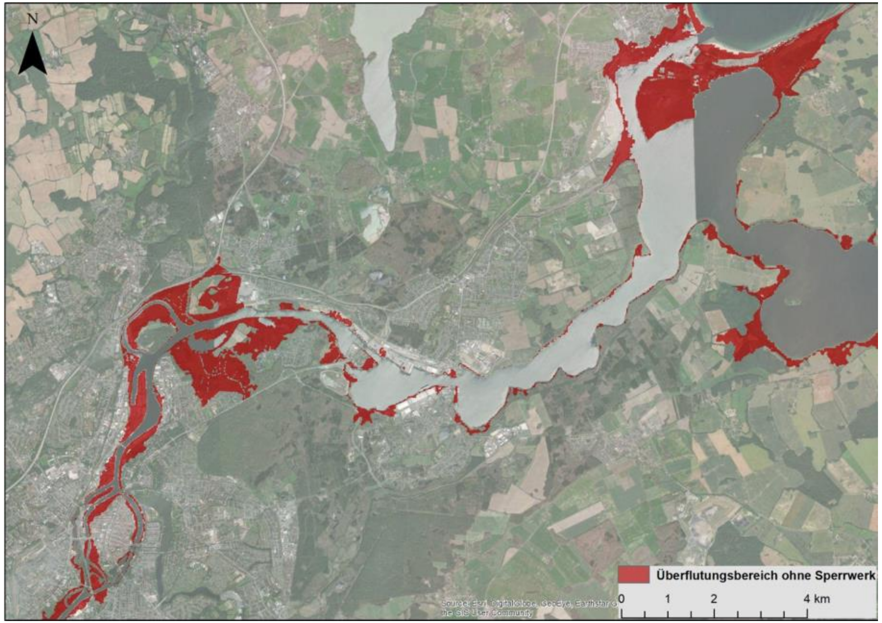
1) Storm surge barrier at Travemünde or Schlutup



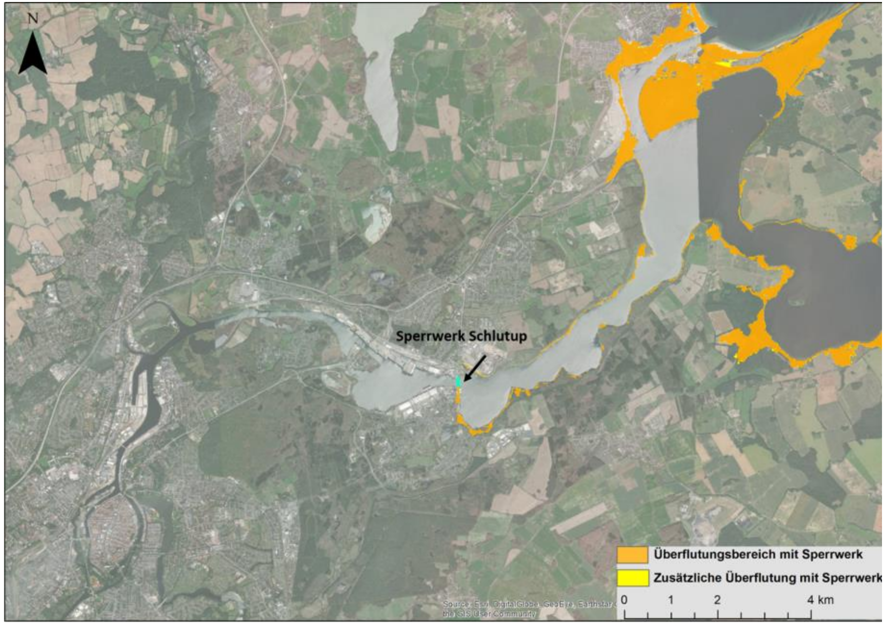
2) Seawalls at Travemünde and Lübeck

Effect of storm surge barrier | 200yr + 1m SLR

Without barrier



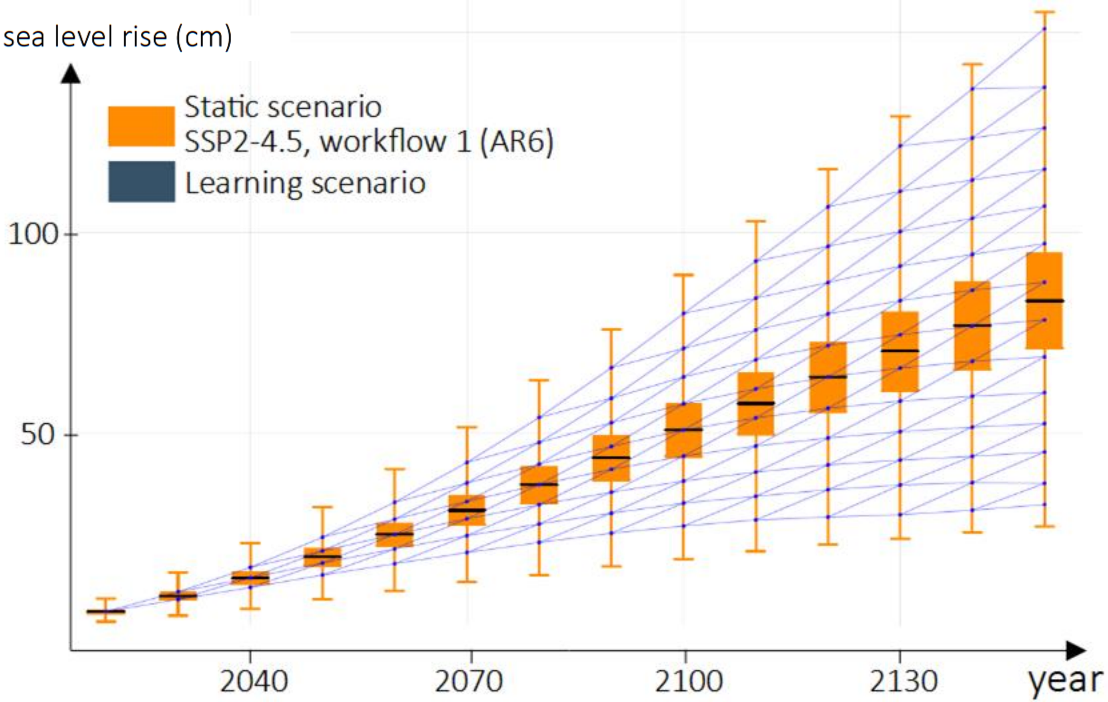
With barrier Schlutup



💻 Decision Analysis

Optimise adaptation. We use dynamic programming to determine cost-efficient adaptation with respect to flood damages and investment costs.

Consider future learning about sea level rise. We apply learning scenarios of sea level rise to develop optimal decision rules that depend on future sea level rise observations.



→ see Jochen Hinkel's presentation (Wednesday, 9:45 am)

Questions ?