

Adaptation and Resilience of Coastal Energy Supply

# ARCoES

## Communicating and Embedding Uncertainty in Project Outputs and in Answering Stakeholder-orientated Research Questions



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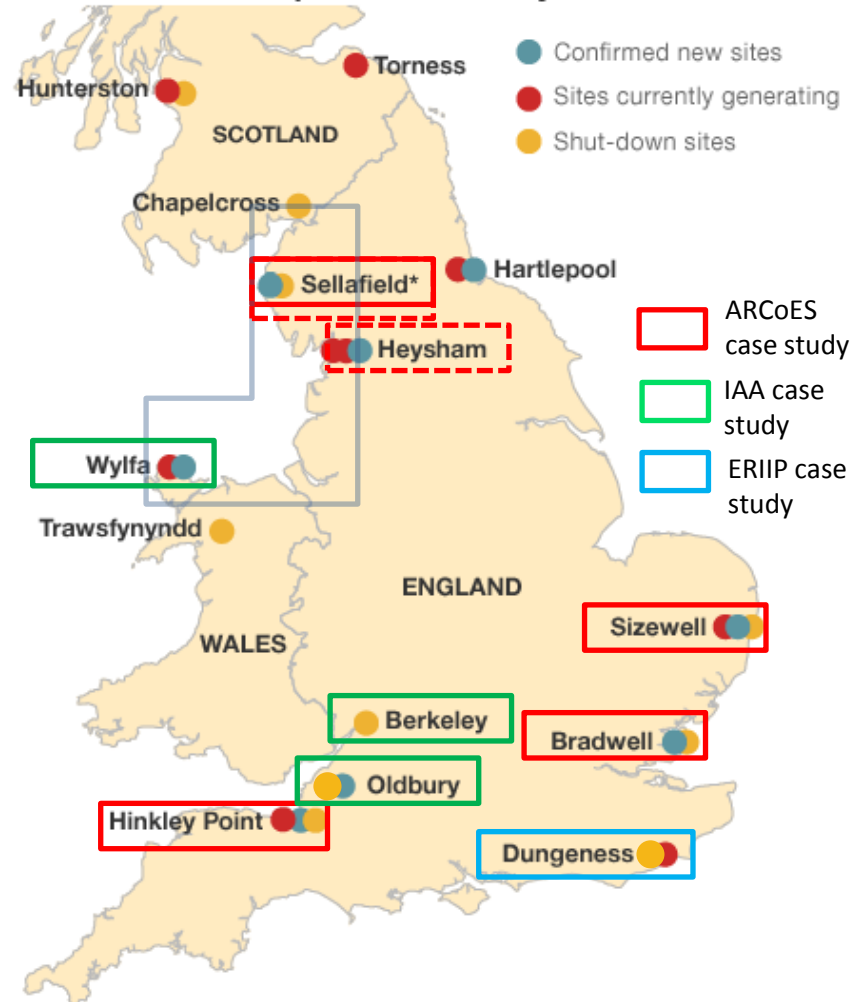
# ARCoES Outputs supporting Decision Making

Projections of future flooding due to sea-level rise and storms for **2020s, 2050s & 2080s** and our best understanding of long-term change to **2100, 2200 & 2500 AD.**

A Decision-Support System built in co-operation with sectoral, regional and local partners and stakeholders. Developed on NW region and nuclear power station case studies.

A mixed audience – specialists in coastal change research to general public

Sites for new nuclear power stations by 2025



\*Shut-down site known as Calder Hall

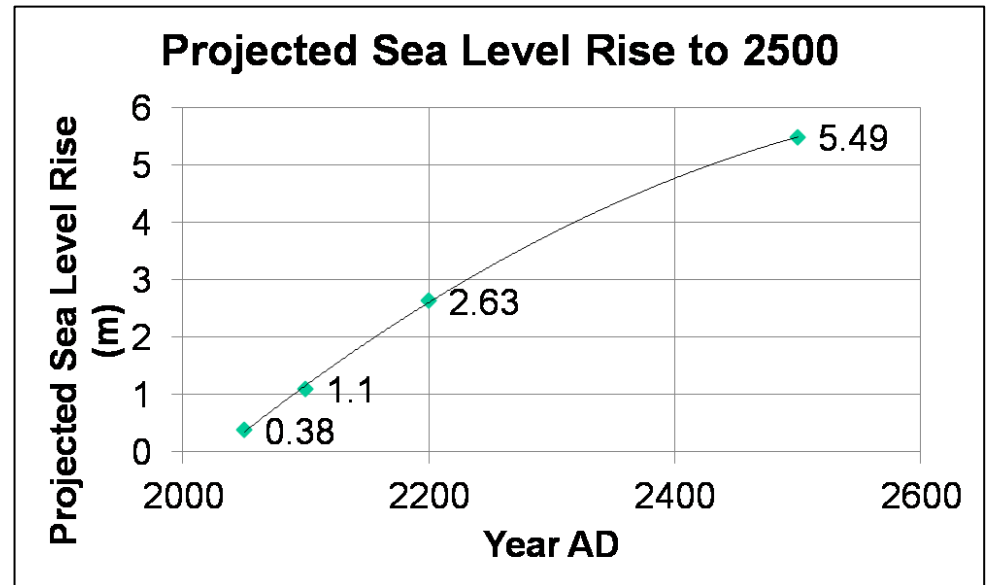
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# ARCoES Flood Risk Assessments

Depending on the scenario, sea-level rise is projected to rise by:  
0.57-1.1 m by 2100  
0.53-5.49 m by 2500

Jevrejeva et al. (2012) Global and Planetary Change 80-81, 14-20.

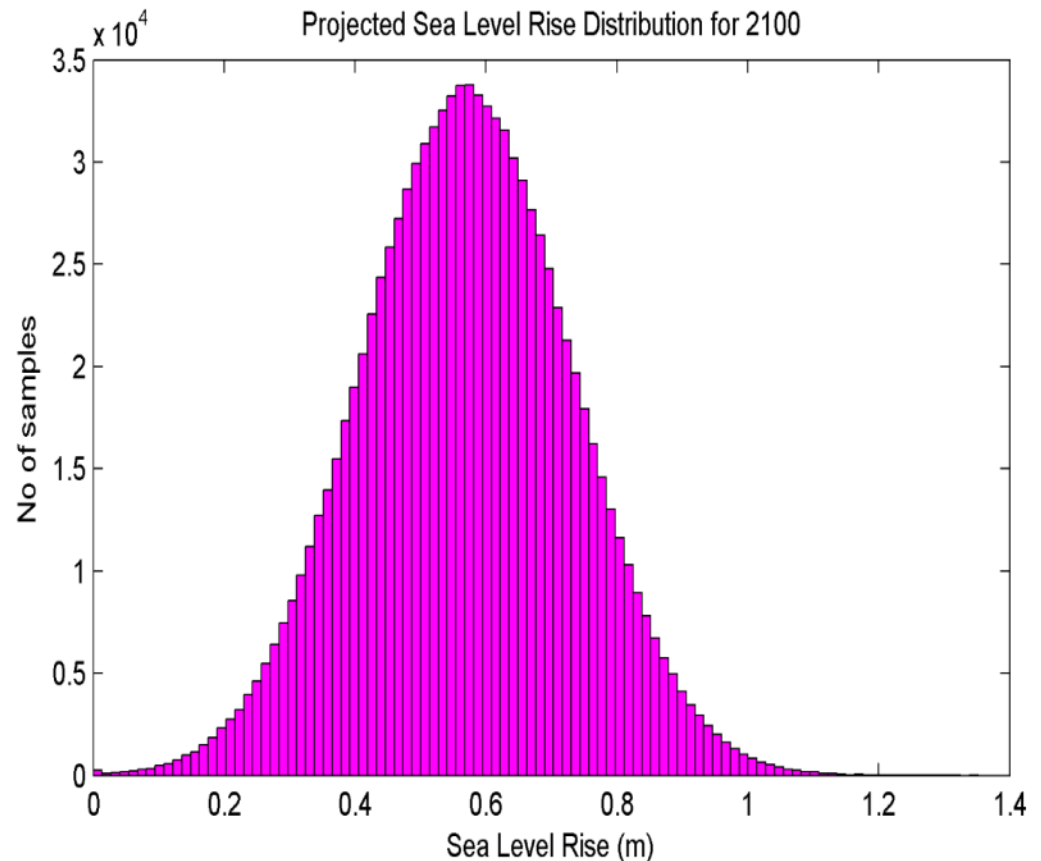
Based on low probability but plausible events from the higher Representative Concentration Pathway scenario values.



# UKCP09 High Emission Scenario Sea-Level Rise Projections for 2100

UKCP09 provides SLR projections on an annual basis up to 2100, the projections used in this project are the **high emission scenario projections**

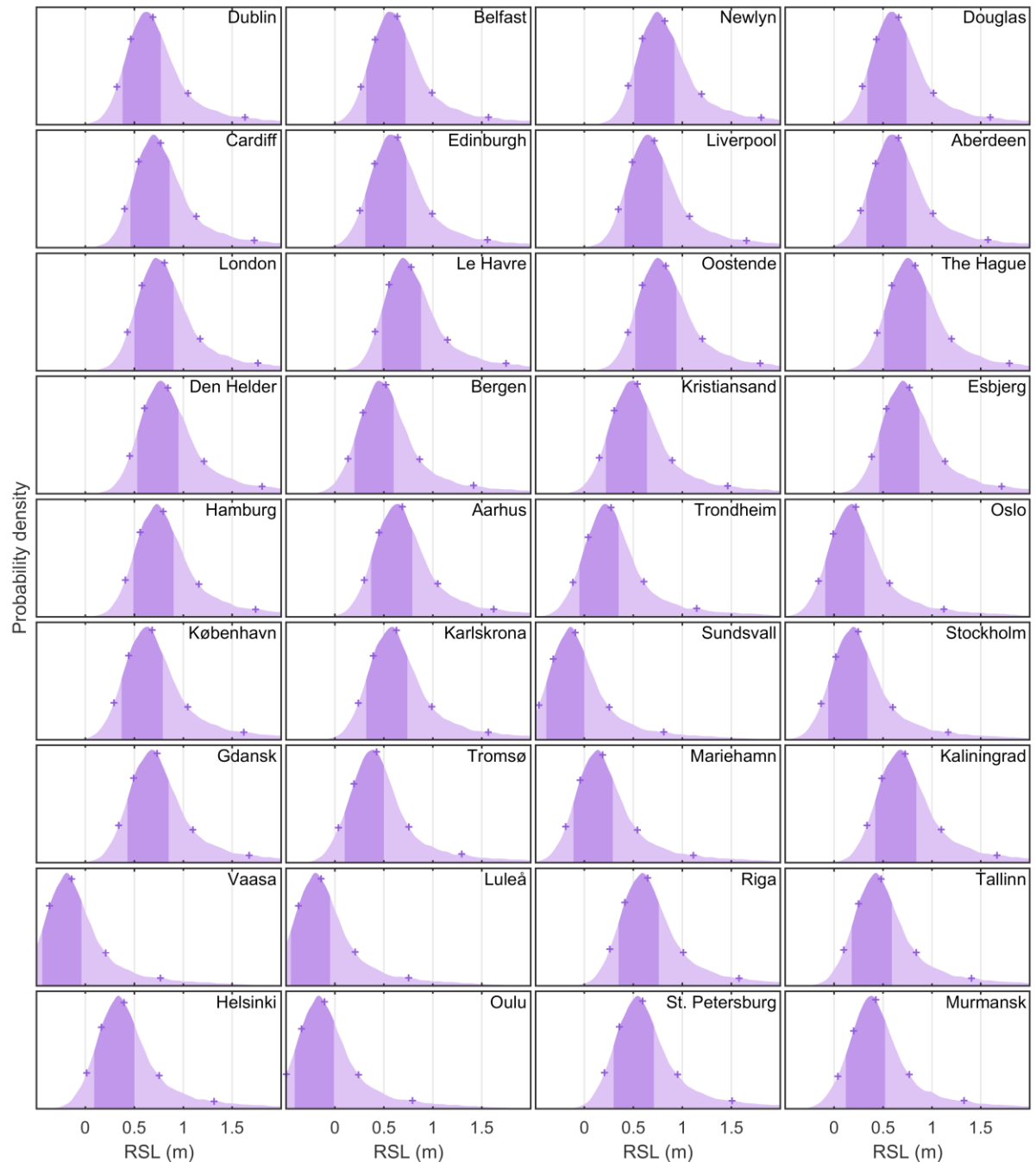
- Normal distribution showing the projected SLR distribution at annual intervals.
- The distribution of maximum flood water depths (5<sup>th</sup>, 50<sup>th</sup> 95<sup>th</sup> %)



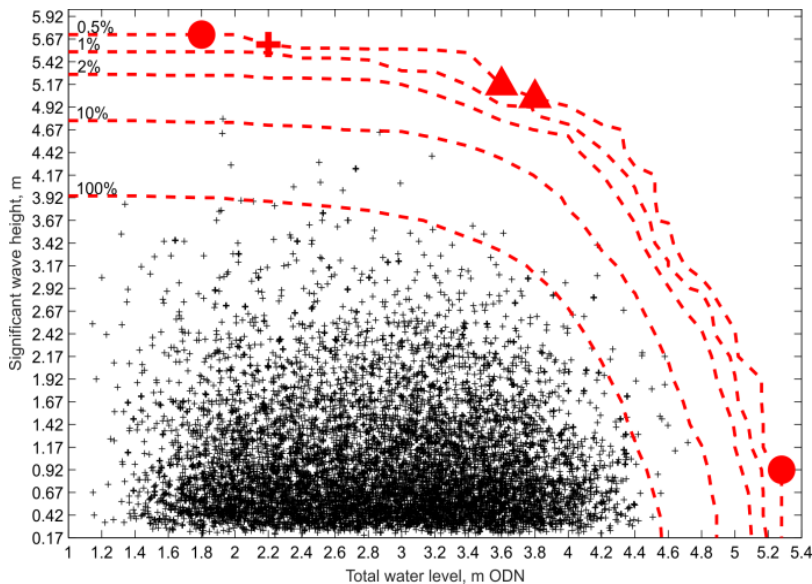
## Regional sea level rise projections for cities

**Figure S4:** Projected regional sea level rise over the 21st century and uncertainty distributions for cities in Northern Europe under RCP8.5. The 5,17,50,83,95th percentiles are marked with crosses and listed in table S2. Darker shading indicates the 17-83% range when using AR5 for all components in the budget (i.e. excluding Bamber and Aspinall, 2013).

Grinsted et al. (2015)  
Climate Research, Vol. 64:  
15–23,  
doi: 10.3354/cr01309



# The 0.5% probability or 1 in 200 year flood event

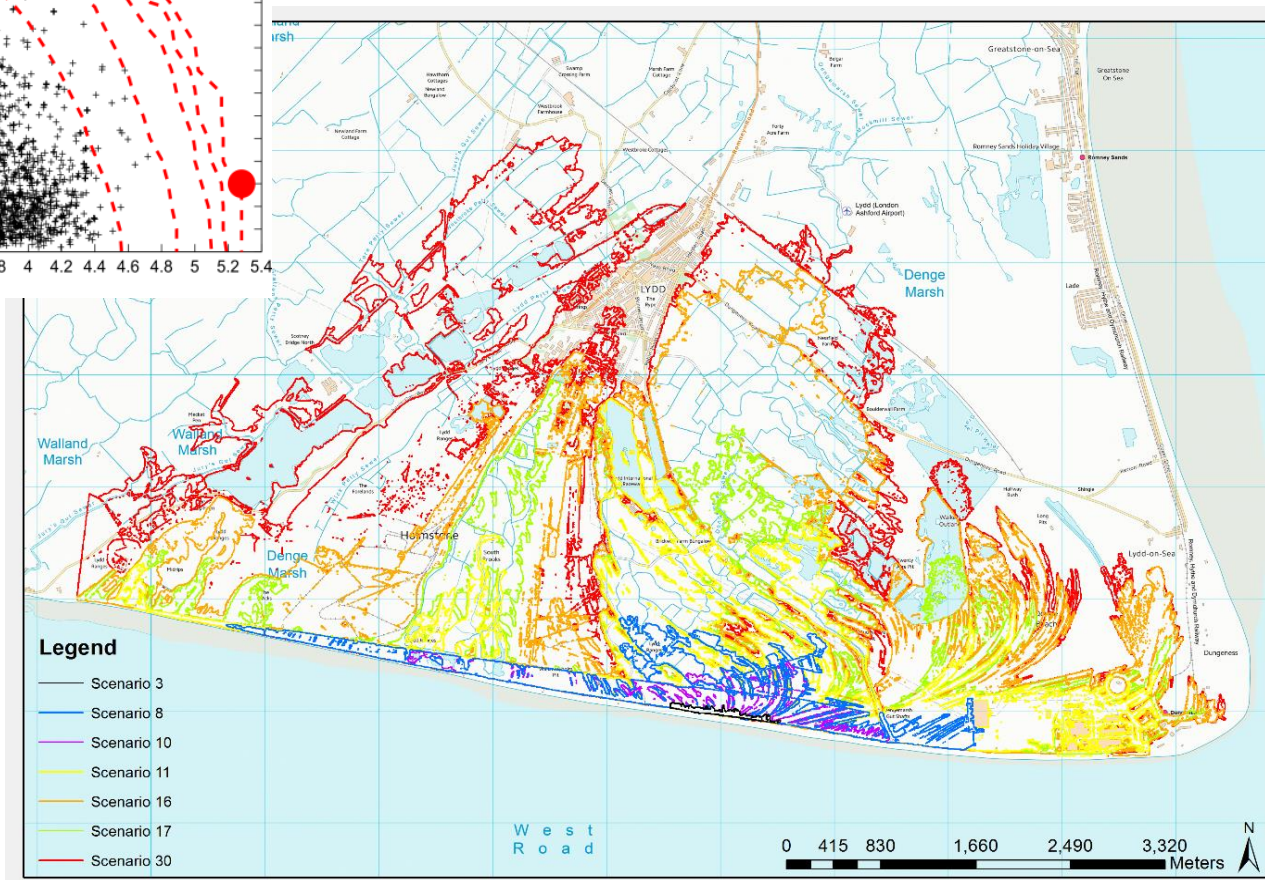


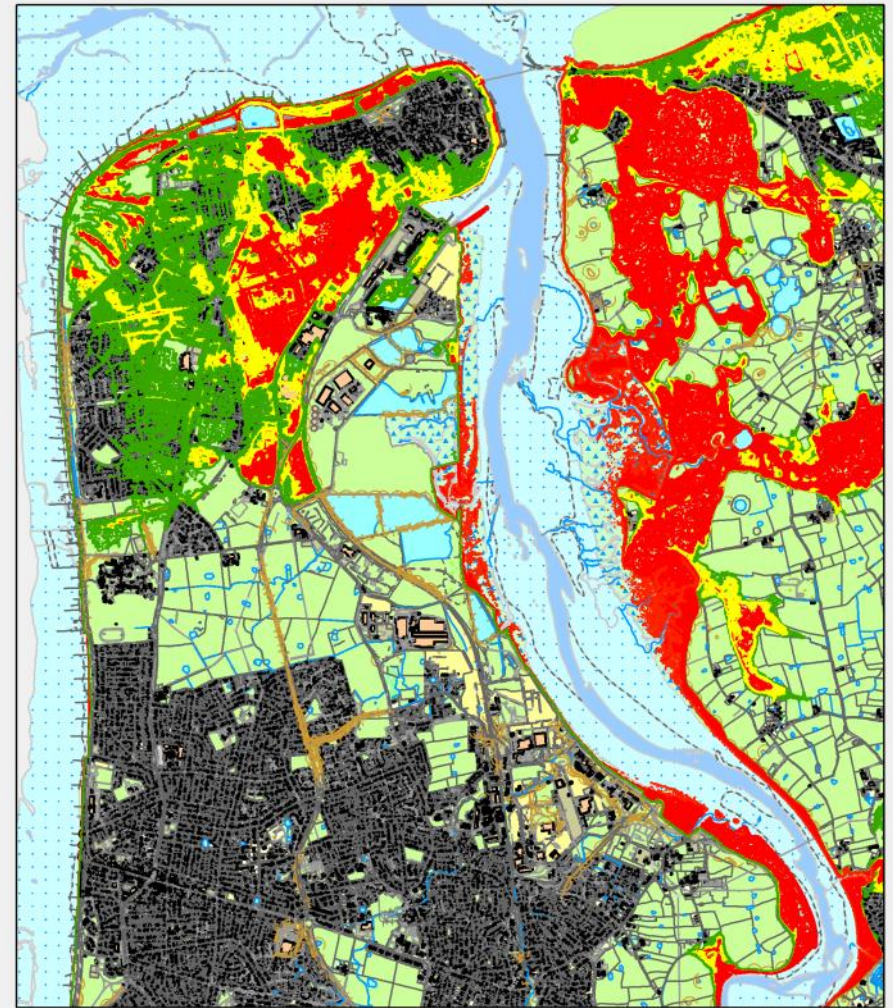
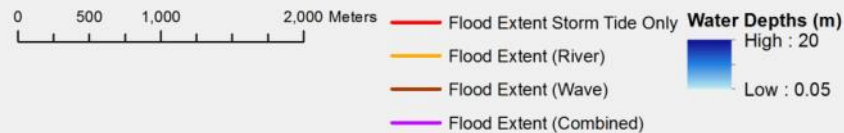
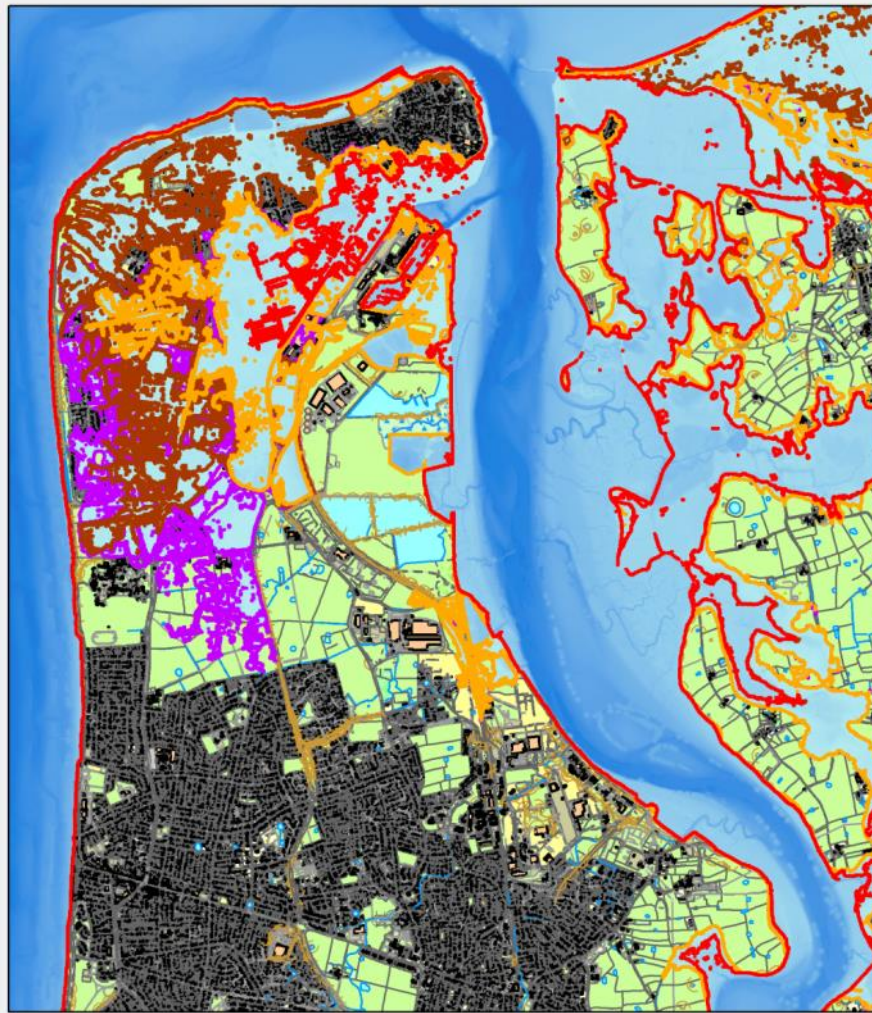
## *Joint Probability Analysis*

### Example Scenarios

3 = EWL: 2.20 m  
Hs: 5.61 m

30 = EWL: 5.28 m  
Hs: 0.92 m





0.65 m SLR and 1 in 250 yr storm with (i) wave overtopping and (ii) high river flow  
 Prime et al. (2015) DOI: 10.1371/journal.pone.0117030





# User Specification for DSS

Flood depth, extent and flood hazard rating – accurate account of defences

Provide longer-term perspective for nuclear industry – site set within coastal context

Support strategic planning (for NG & DNOs)

Support operational deployment during extreme events (for NG & DNOs)

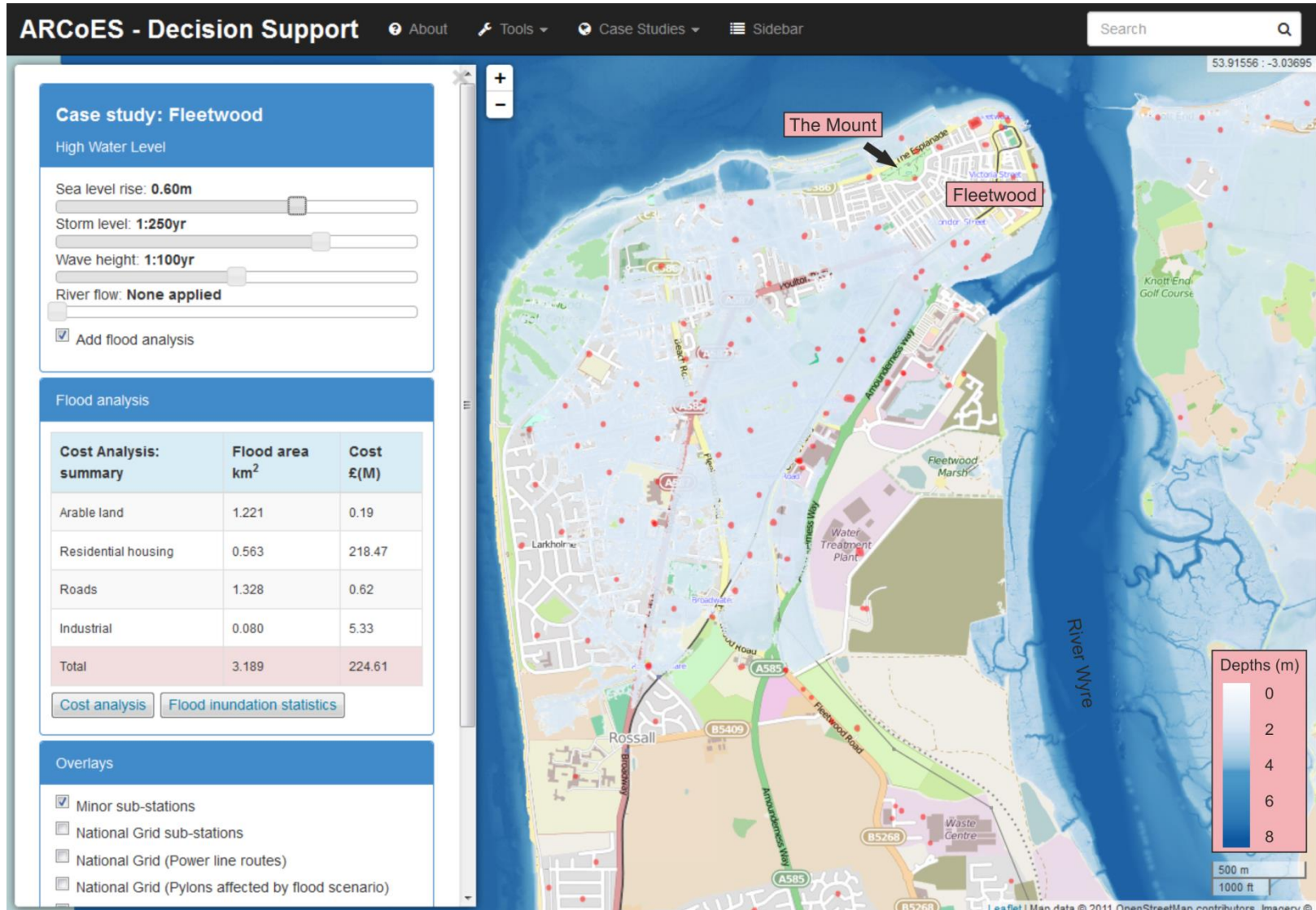
Provide information for raising awareness about limits to current coastal strategy for local authorities

Provide detail on relative significance of sea-level rise and storms (and waves and river flow) for future flooding

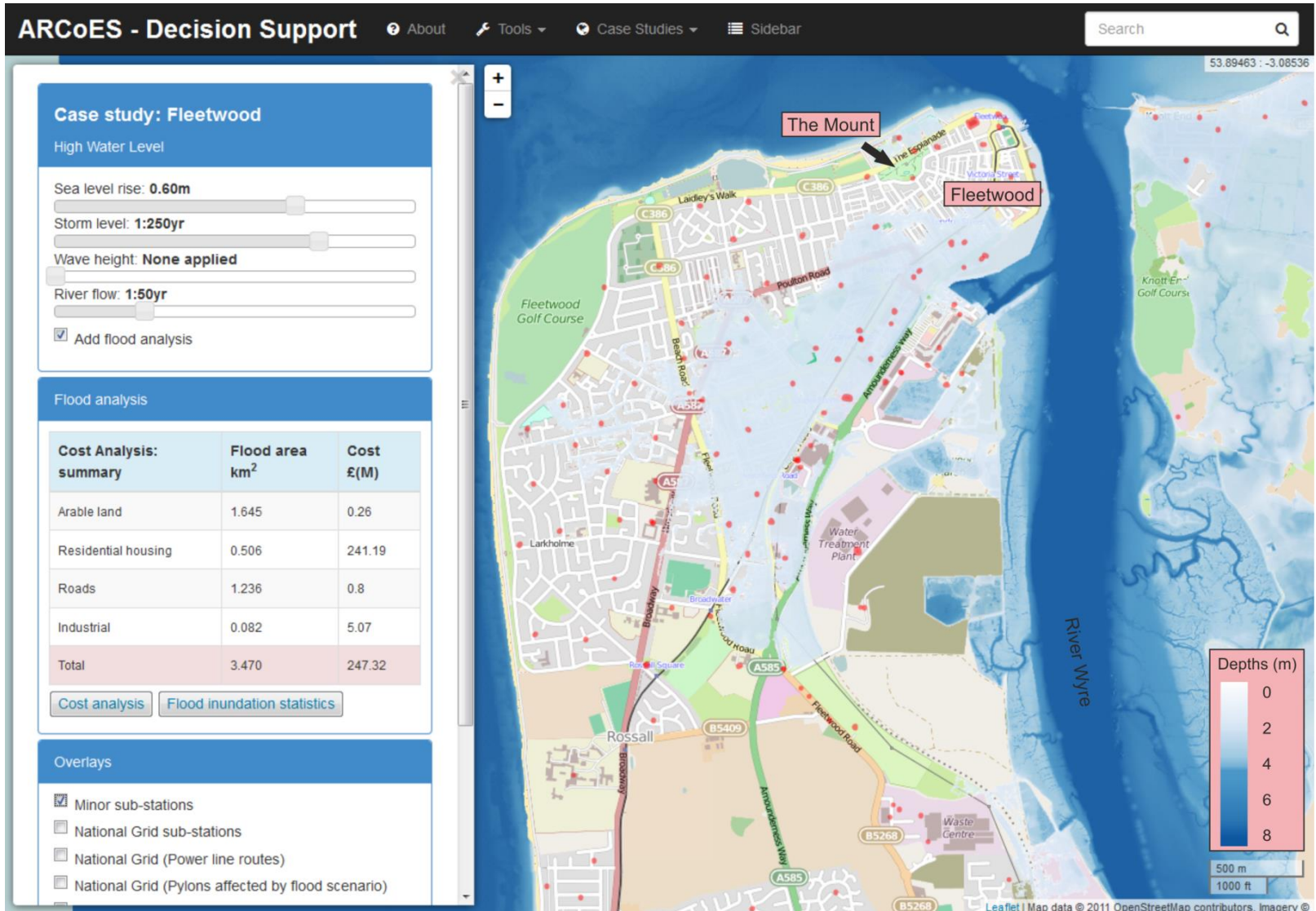
Open access and transparent, linking to key detail/data on the basis for flood modelling

Detail on cost of building resilience/adaptation

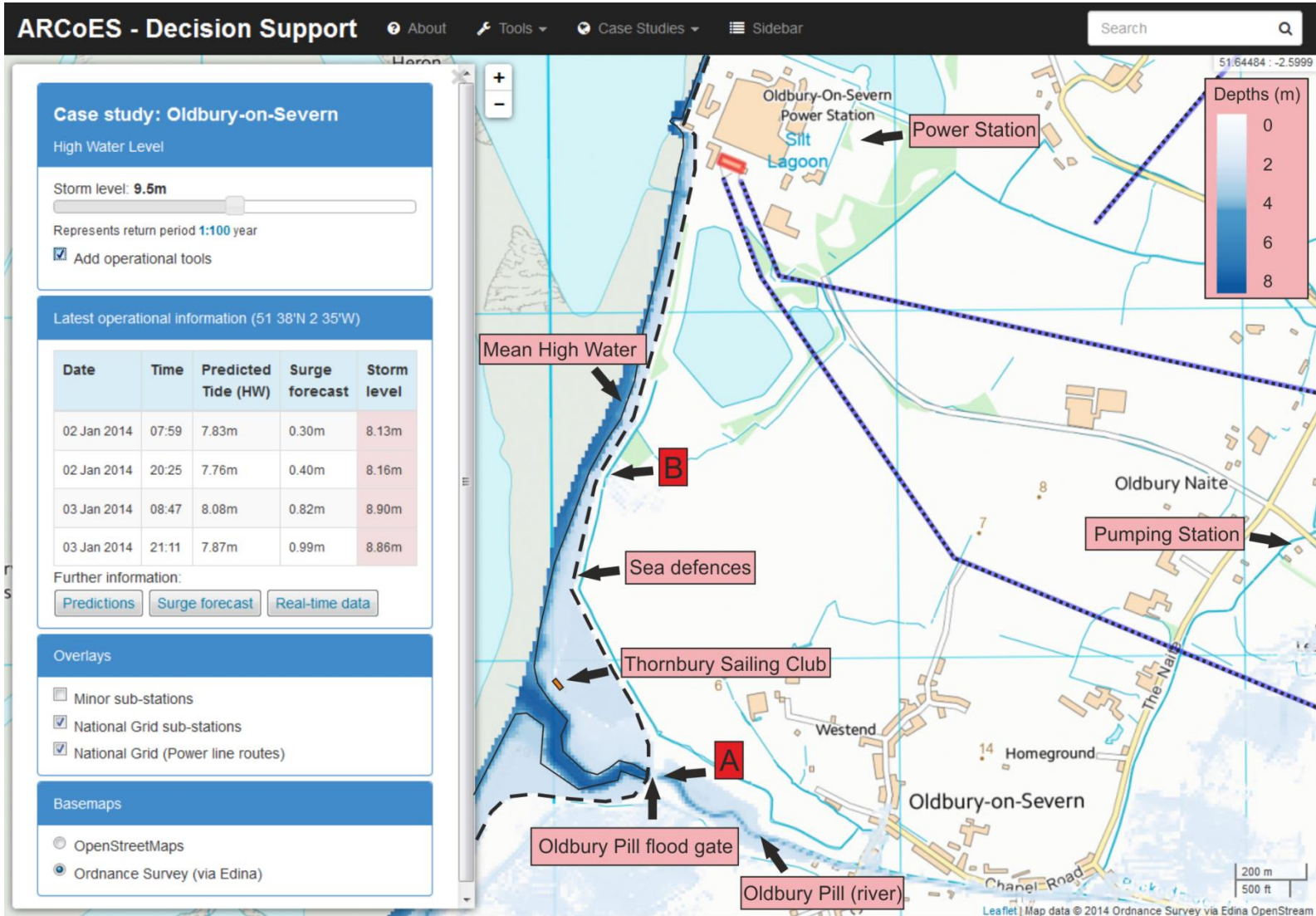
# ARCoES Decision-Support System – Strategic Planning



# ARCoES Decision-Support System – Strategic Planning



# ARCoES Decision-Support System – Operational Planning



## Tipping Point Exploration – Horizon Scanning

