

Flood and Coastal Erosion Risk Management Research Programme

Exploratory sea level projections for the UK to 2300

Project Summary SC150009/S

This project has developed new projections of mean and extreme sea levels (the combined height of mean sea level, tide and surge, but not including waves) to the year 2300. This information is critical for long-term planning and the UK's adaptation response to increasing sea levels.

Flood and coastal erosion risk management authorities, developers and infrastructure operators all need information about the likely impacts of climate change on sea levels to incorporate appropriate levels of protection into their designs. Some assets have expected life spans that go beyond the end of the 21st century. These schemes need information about how extreme sea levels and waves may change over longer timescales.

The Met Office was commissioned to develop new projections of sea level rise for the UK out to the year 2300. The work complements the updated projections of mean and extreme sea level rise to 2100 developed under the UK Climate Projections 2018 (UKCP18) project. The project also carried out a literature review of past and future expected impacts of climate change on waves.

Methods

The main problem in creating climate change projections beyond 2100 is the availability of model simulations this far into the future. To overcome this, a simpler climate model was used to extend the complex model simulations used in UKCP18, ensuring consistency between the 2 sets of sea level projections. The resulting time series of mean sea level rise to 2300 was converted into extreme water levels for 46 tide gauge sites from around the UK, using the current best estimates of the frequency of observed extreme water levels at those locations. The research assessed low, medium–low and high emissions of greenhouse gas concentration trajectories.

Results and conclusions

This work shows that sea levels are expected to continue to rise past the end of the 21st century under all of the UKCP18 greenhouse gas emission scenarios. For London and Cardiff, the projection ranges at 2300 are approximately 0.5 m to 2.2 m, 0.8 m to 2.6 m and 1.4 m to 4.3 m for low (RCP2.6), medium–low (RCP4.5)

and high (RCP8.5) emissions respectively. The values for Edinburgh and Belfast are substantially lower due to rising land levels in the north, with corresponding ranges at 2300 of approximately 0.0 m to 1.7 m, 0.2 m to 2.1 m and 0.7 m to 3.6 m. It should be noted that it is not possible to rule out substantially larger increases in sea level associated primarily with a potential acceleration in ice mass input from West Antarctica.

The flood risk posed by extreme sea levels increases as a direct result of the increasing coastal water levels. Rates of increase therefore vary with time and location. However by 2300 and at all locations studied, the highest of the UKCP18 climate scenarios will result in sea levels every year that have a current probability of only 0.01% of occurring.

There is some uncertainty about the impact of climate change on waves. There is some agreement in the published literature for a decrease in future annual mean significant wave height (the average of the largest third of waves), but a potential increase in extreme wave heights for offshore waves around the UK. This report does not consider the impact on inshore waves where it is expected that changes to water depth from increasing sea levels will affect wave heights and the position of the surf zone. Further work is needed to address these nearshore impacts.

How this research will be used

This research will be useful for infrastructure operators and those managing the risks of our changing climate.

A more detailed assessment of the results can be found in the project report and in the UKCP18 Marine Report. The underlying dataset is publically available from the UKCP18 data portal.¹

This summary relates to information from project SC150009, reported in detail in the following output(s):

Report: SC150009

Title: Exploratory sea level projections for the UK to 2300

¹ www.metoffice.gov.uk/research/collaboration/ukcp

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