TITLE; RISK ANALYSIS FOR COASTAL FLOODING UNDER CLIMATE CHANGE

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INTRODUCTION

Climate change and increases in population density in coastal areas might increase the difficulty of coastal management decision-making. Although recent research has proposed several flood risk assessment methods in response to climate change, few approaches have addressed all significant effects. Therefore, this study aims to establish a thorough method to evaluate the risks of future coastal flooding events, including all climate change effects. The study proposes an advanced risk analysis scheme that covers all annual flood events during a target term. To confirm the effectiveness of the proposed model, this study applies the model to actual risk analysis in the North Somerset coast in the UK under 10 different cases.

METHODS

Figure 1 presents a flowchart of the procedures used in conducting the flood risk analysis for this study. The flowchart is divided into four main parts: 1) setting up calculation conditions, 2) hazard modelling, 3) executing inundation calculations, and 4) vulnerability analysis. Repeating this flow by a final year can obtain accumulated damage risk for a target term. Furthermore, this loop is repeated many times for safety purposes to acquire probabilistic results.

FIELDS & CALCULATION CONDITION

This study selected a 20 km length of the North Somerset coastline which lies on the eastern side of the Severn Estuary in the UK. This study applied the LISFLOOD-FP (Bates et al., 2010) model developed by Quinn et al. (2013) for inundation calculation. Hazard modelling in this study includes 5 main factors: 1) storm tide, 2) Sea Level Rise (SLR), 3) Future change of storm surge, 4) Duration of storm surge, 5) Boundary condition. In order to clarify the impacts of main factors on coastal flooding in this site, this study established 10 different cases combined with these factors.

RESULTS & DISCUSSIONS

Figure 2 shows the average flooded area and expected annual damage (EAD) over the 85-year study period for all cases to demonstrate the general impacts of the main factors on flooding. The future change in storm surge (i.e. case 5) and the duration of storm surge (i.e. case 6) were shown to have a minor impact on coastal flooding at the study site. The effects of SLR (i.e. cases 2, 3, and 4) had the highest impact factor in this analysis.

Figure 3 compares the averages of flood areas and EAD in all cases over four different terms. The impacts of main factors on flood area and EAD are quite changeable depending on lead time. Therefore, future coastal management should cover these time dependent features of flood sources and this proposed scheme could support more understandable decision-making.

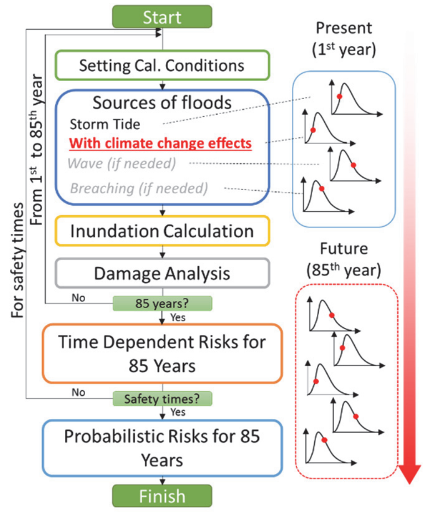

Figure 1 Flowchart of the proposed risk analysis scheme

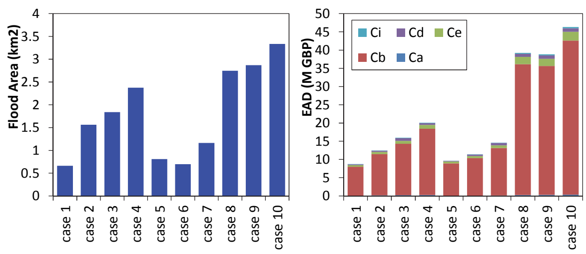

Figure 2 Impacts of flood area (km^2) and EAD (MGBP) to climate change

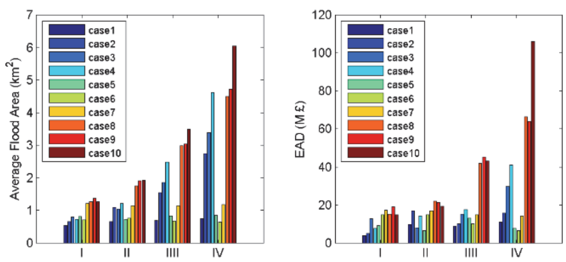

Figure 3 Comparison of flood area and EAD with 4 terms (I: 2015-2013, II: 2031-2050, III: 2051-2080, IV: 2081-2100).

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