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Future flood extents: capturing the uncertainty associated with climate change

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Abstract: Floods are the most common and widely distributed natural risk to life and property worldwide, causing over £6B worth of damage to the UK since 2000. Climate projections are predicted to result in the increase of UK properties at risk from flooding. It thus becomes urgent to assess the possible impact of these changes on extreme high flows and thus the impact on flood extents, and evaluate the uncertainties related to these projections. This paper aims to assess the changes to flood extent for the 1:100 year return period event for the River Don in Scotland (UK) as a result of climate change. It is based on the analysis of the Future Flow dataset (1961-2098) for the Parkhill gauge station on the River Don (Collet et al., 2016). Extreme value (EV) analyses (with the GEV and GP distribution functions) are fitted for the 11 climate-change ensembles over the baseline (1961-1990) and the 2080s (2069-2098) to account for climate non-stationarity. Monte Carlo simulations, sampling from the EV distributions of 1:100 year return period events, are undertaken using a 1D-2D hydraulic model (LisFLOOD) of a 5km stretch of the river Don. Full Monte Carlo simulations are undertaken for the baseline and future planning horizon and results are analysed. Results show the change to extent from the baseline to the future, and capture the significant uncertainty associated with the climatic projections and the EV distributions. This suggests that capturing these uncertainties (both in the baseline and in future estimates) is essential when planning engineering interventions.

***Keywords**:* Monte-Carlo simulation; Climate Change uncertainty; Extreme Value Distribution uncertainty; 1D-2D hydraulic model; River Don.