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Propagation of calibration uncertainty in a study of the impact of climate change on flood risk.

S. Dunne (1,2), R. McGrath (1), P. Lynch (2), T. Semmler (1), S. Wang (1), J.A. Hanafin (1,2), P. Nolan (2).

(1) Community Climate Change Consortium for Ireland, Met Eireann, Glasnevin, Dublin 9, Ireland.(2) School of Mathematical Sciences, University College Dublin, Belfield, Dublin 4, Ireland

The objective of this project is to determine which Irish catchments are vulnerable to increased flood risk due to climate change. Here, sources of uncertainty in the calibration of the hydrological model are identified and their propagation through the study is investigated. Boundary data from the European Centre Hamburg Model Version 5 (ECHAM 5) global climate model are used to force the Rossby Centre Atmosphere Model (RCA3) regional climate model, producing dynamically downscaled precipitation and temperature data under past and future climate scenarios. This provides forcing data for a conceptual rainfall/run-off model, the SMHI-developed HBV model. Before any simulation, the HBV model must be calibrated using observed precipitation, temperature and streamflow data. Results are presented which demonstrate the significance of uncertainty propagated from this calibration stage on the study outcome. A sensitivity study reveals that the optimal parameters obtained in the calibration are highly dependent on the choice of precipitation data. It is demonstrated that the resultant uncertainty in the optimal parameters is propagated through the experiment affecting simulated run-off in the past and future climate scenarios. The disparate results obtained from the extreme value analysis underline the impact that this uncertainty could have on flood risk management. This sensitivity study also identifies the choice of performance metric as an additional source of uncertainty which is propagated from the calibration phase to the final extreme value analysis. In conclusion, a calibration strategy is outlined which provides the best agreement between simulated past flows and those observed. While the data used are from the Boyne catchment in Ireland, the results from this sensitivity study are relevant to any region.