06- Hydrological Models for Climate Change Attribution of Extreme Weather Events in Ireland

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Abstract

Probabilistic Event Attribution (PEA) is a data-driven method for investigating the link between specific types of extreme weather events (e.g. regional droughts or heatwaves) and anthropogenic climate change. PEA studies usually use paired ensembles of atmospheric simulations run with and without anthropogenic forcings. Firstly, a weather event of interest is defined, for example a particular value of extreme rainfall across a region. Its probability of occurrence is then calculated in both ensembles. If the event is found to be more likely to occur in the ensemble with anthropogenic forcings, then the increased incidence may be attributable to anthropogenic climate change.

The PEA method has been extended to climate change attribution studies of extreme weather-driven hydrological events such as floods. These 'end-to-end' attribution studies require a hydrological rainfall-runoff model to be coupled with the climatic datasets used for attribution studies.

A large number of hydrological models with different characteristics and data input requirements have been developed. Hydrological models from four main categories: lumped, semi-distributed, fully distributed and artificial neural networks have been reviewed. Model parsimony is particularly important for end-to-end attribution studies because of the large number of simulations that may be required to handle ensembles of climate data, and the resulting computational and data-handling requirements

The Probability Distributed Model (PDM), a lumped hydrological developed by the UK Centre for Ecology and Hydrology was applied to simulate flood events in the Munster Blackwater catchment. A climate change sensitivity exercise was also carried out to assess the response of the hydrological model to increased levels of rainfall in the catchment.

It is recommended that a lumped hydrological model such as PDM is used for end-to-end attribution of fluvial flooding impacts in Ireland. This class of model requires several orders of magnitude fewer input data than fully distributed models and has been shown to perform well with these input data.

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Full paper script to follow!