Geophysical Research Abstracts
Vol. 15, EGU2013-1634, 2013
EGU General Assembly 2013

The application of a multimodel ensemble to quantify uncertainty and produce weighted probabilistic projections of hydrological change.

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Multimodel experiments have provided the data necessary for undertaking probabilistic assessments of the likely impacts which projected climate change may have on hydrological systems. The availability of ensemble data has also facilitated a more comprehensive exploration of uncertainty and a greater understanding of the implications it has for future resource management. In this study a probabilistic framework is used to examine changes in the flow regime of the Burrishoole catchment - characterised as a responsive peatland system typical of many upland catchments found along Ireland's Atlantic seaboard. For the study a sampling procedure is used to generate probability distributions which quantify the range of uncertainty in the projected hydrological response. The sampling scheme combines model projections by weighting; to this end a likelihood value is attached to each member of a multimodel ensemble. Model reliability is quantified based on performance at capturing different aspects of the observed system behaviour. The dynamically downscaled climate data used is obtained from the EU-FP6 ENSEMBLES project; to overcome some of the limitations associated with this dataset it is used alongside statistically downscaled climate scenarios. To address uncertainty in the hydrological simulations multiple realizations of the catchment system - obtained by altering both the model structure and parameter values in search of behavioural solutions - are employed.

The overriding aim of the paper is to examine how ensemble data can be most effectively exploited when conducting impact assessments. The probabilistic framework outlined is used to explore whether the application of a weighting scheme produces a different outcome than if uniform probabilities are applied; also examined is whether the weighting enables the uncertainty space to be constrained in a methodologically rigorous way. In order to understand how we can more effectively manage uncertainty the study quantifies the hydrological sensitivity to the various uncertainties which pervade catchment scale climate assessments. In doing so it highlights those uncertainties which contribute most to the range of potential responses and thus should given priority to ensure uncertainty is adequately addressed.