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From climate model ensembles to climate change impacts: A case study of water resource management in the Sout West of England

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The majority of climate change impacts and adaptation studies so far have been based on at most a few deterministic realisations of future climate, usually representing different emissions scenarios. Large ensembles of climate models are currently available either as ensembles of opportunity, or perturbed physics ensembles, providing a wealth of additional data that is potentially useful for improving adaptation strategies to climate change. With the release of the UK 21st Century Climate Scenarios (2008), UKCIP08, users from different sectors will have access to probabilistic projections of climate change for the UK. Due to the novelty of this ensemble-like climate change information, there is little previous experience of practical applications or of the added value of this information for impacts and adaptation decision-making. Here we describe a methodology to perform a top-down approach to impacts assessment using large ensembles of climate change information. We use as a case study a water resource system in the South West of England. The climate data are obtained from the largest perturbed physics ensemble publicly available to date, climateprediction.net. River flows are simulated using a rainfall runoff model and feed into the water resource system model. This model is designed to analyse the interactions between water supply and demand for the water supply zone of interest, allowing for the exploration of various adaptation paths given the climate change information available. We analyse the response of the water resource system when driven by the climate model ensemble data, and operating under different scenarios of demand and supply management. Our research shows that the additional information contained in the climate model ensemble provides a better understanding of the possible ranges of future conditions, compared to the use of single model scenarios. Furthermore, with careful presentation, decision-makers will find the results from large ensembles of models more accessible and be able to more easily compare the merits of different management options and the timing of different adaptation. The overhead in additional time and expertise for carrying out the impacts analysis will be justified by the increased quality of the decision making process. We remark that even though we have focused our study in a water resource system in the UK, our conclusions about the added-value of climate model ensembles in guiding adaptation decisions can be generalized to other sectors and geographical regions.