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Spaced Out: Linking model space to catchment space within an uncertainty analysis framework

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Catchment classification is considered a fundamental step towards improved catchment hydrology science; however little is understood about the differences and similarities of catchment behaviour and how these are then linked to model predictions. Experimenting with different model structures in multiple catchments can improve our understanding of why different catchments exhibit different runoff characteristics as a result of landscape and climatic characteristics.

In this study, the flexible modelling framework, FUSE, is applied to fifteen catchments which represent significant hydrologic and climatic diversity across the UK. Our aim is to quantify the dissimilarity between catchments by evaluating multiple model structures and parameter sets within the GLUE framework, explicitly accounting for model structural errors. To allow a meaningful evaluation of model 'realism', the ability of the models to capture the hydrologic behaviour of the catchment will be assessed against a number of hydrologic signatures. These results will be a first evaluation of how multiple model structures can be used to group catchments by exploring the similarities and differences in the resulting uncertainty cloud of behavioural models for each catchment based on the concept that the behavioural models reflect similarities in hydrologic behaviour. Importantly, we explore whether different model structures envelope similarity metrics and recognise dissimilarity between catchment behaviours. Thus we explore whether we can identify the dominant hydrological processes, how uncertain these relationships are and if this approach allows us to build a framework for extrapolating our understanding and for improving local predictions. This approach further advances our ability to link model space to catchment space whilst being realistic about the uncertainties involved.