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The Environmental Virtual Observatory pilot project: An application of the hydrological multi-modelling FUSE framework for ∼1100 UK catchments

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A strategy being piloted in the UK as the Environmental Virtual Observatory pilot (EVOp), funded by NERC, is to demonstrate the use of cyber-infrastructure and cloud computing resources to investigate better methods of linking data and models and to demonstrate scenario analysis for research, policy and operational needs. The research will provide new ways the scientific and stakeholder communities come together to exploit current environmental information, knowledge and experience in an open framework. Here we report on the national modelling workpackge of the EVOp that has developed strategies for simulating hydrology and biogeochemistry for the UK for 1,100 catchments.

We primarily report on our research to apply the FUSE methodology at the national scale in the U.K., using this within a Generalised Likelihood Uncertainty Estimation (GLUE) approach to evaluate nearly 1100 catchments ranging in size from 100 to 104 km2. The national coverage reveals how model parameters, structures and structural errors vary across space. Also, as some of the smaller catchments are nested within larger ones, comparisons across the different catchment scales reveals patterns of model structural and parametric uncertainty of great interest in understanding hydrological variability and consistencies of model hypotheses within subnational regions. Crucially we believe this approach necessitates the use of uncertainty evaluation methods to try to take into account the differences in the quality of observational data between catchments. We also show how different objective function metrics of model performance affect the resultant behavioural model parameters and assoiated structures. In essence this is a framework for national hypothesis testing by multi-model rejection. This research is a key contribution to the national scale modelling being conducted in the NERC 'Environmental Virtual Observatory' pilot project.