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Towards Reproducibility in Computational Hydrology

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The ability to reproduce published scientific findings is a foundational principle of scientific research. Independent observation helps to verify the legitimacy of individual findings; build upon sound observations so that we can evolve hypotheses (and models) of how catchments function; and move them from specific circumstances to more general theory. The rise of computational research has brought increased focus on the issue of reproducibility across the broader scientific literature. This is because publications based on computational research typically do not contain sufficient information to enable the results to be reproduced, and therefore verified. Given the rise of computational analysis in hydrology over the past 30 years, to what extent is reproducibility, or a lack thereof, a problem in hydrology? Whilst much hydrological code is accessible, the actual code and workflow that produced and therefore documents the provenance of published scientific findings, is rarely available.

We argue that in order to advance and make more robust the process of hypothesis testing and knowledge creation within the computational hydrological community, we need to build on from existing open data initiatives and adopt common standards and infrastructures to: first make code re-useable and easy to find through consistent use of metadata; second, publish well documented workflows that combine re-useable code together with data to enable published scientific findings to be reproduced; finally, use unique persistent identifiers (e.g. DOIs) to reference re-useable and reproducible code, thereby clearly showing the provenance of published scientific findings. Whilst extra effort is require to make work reproducible, there are benefits to both the individual and the broader community in doing so, which will improve the credibility of the science in the face of the need for societies to adapt to changing hydrological environments.