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Developing and documenting a Hydrological Model for reproducible research: A new version of Dynamic TOPMODEL

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At a minimum reproducible research requires the use of models with strict version control and documented end points (e.g executable calls) so that simulations can be repeated with (hopefully) identical code and data.

Opening the research process beyond this requires that both the model source code and documentation can be scrutinised. Achieving this in a meaningful way means going beyond documentation on the code structure, installation and use. Since models are only approximations of physical systems it is important that users appreciate their limitations and are thoughtful in their use. It is therefore suggested that integration of a model into the scientific process requires developers to go further by:

- Documenting, in a way that be directly related to the code, the underlying equations and solutions used by the model and their motivation.
- Automating simple reproducible tests on components of the model across a range of dynamic situations beyond those expected.
- Providing reproducible case studies highlighting good practice and limitations of the model which can be used both to allow users to access the applicability of the model and to evaluate model changes.

We look at an implementation of these ideas with regards to the ongoing development of Dynamic TOPMODEL. We highlight challenges at both the technical and administrative level and outline how we are addressing them at <https://waternumbers.github.io/dynatop/>.