

Building trust: How modellers navigate dozens of decisions

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Abstract: As the saying goes “Trust is a fickle thing”, it takes a long time to build trust, but it can be diminished within a moment. This also, generally, applies to trust in models. Trust in models can vary between decision-makers, the public, and the modellers themselves. This study focuses on the trust of the modellers both in their own and others’ models. Hydrology is a discipline that heavily relies on models, and thus where trust in models is of vital importance, with the additional complexity of a myriad of models being available. Therefore, it is important to understand how trust in models is established.

The modeller makes dozens of decisions when setting up and using a model, ranging from data selection and pre-processing to calibration and validation. These decisions are based on various reasons, for instance personal experience, existing literature, extensive testing, or available computational capacity. These reasons are not all based on epistemology, but also on context. Having these different narratives in the modelling process and potentially in the model results can influence the modeller’s trust in the model results. Another aspect that can influence trust is standardisation, e.g. automation in model set-up, in modelling. Standardisation can streamline the modelling process, increasing the efficiency, reproducibility and transparency. It also creates a consistency between modelling studies. Moreover, standardisation provides modellers and decision makers backing if needed. These aspects can enhance the trust from modellers in their model, but also decrease the trust if the modeller disagrees with the standardization directives.

We researched the motivations behind the modellers choices in setting up and using the model, and the changes in the modelling process due to automation. We focused on decision-support hydrological modelling in The Netherlands. The Netherlands counts 21 water authorities. They are responsible for water management in their area. Aside from the water authorities, there are multiple consultancy companies, which support the water authorities with their modelling activities. This support can range from executing the whole modelling process for the water authorities, to providing the knowledge to water authorities to set-up and execute models themselves.

For this study, we conducted 14 semi-structured interviews between September and December 2021. At the time, nine interviewees worked as modellers at six different water authorities and five as modellers at four different consultancy companies. All interviewees are hydrological modellers, but their experience level varied between 1 and 15 years. The interviewees’ level ranged from junior to senior. The interviews consisted of questions regarding automation in the modelling process and the motivations behind modelling decisions. On top of this, we asked each modeller if they trust their model results and if this would change with automation. The interviews were all recorded and transcribed. This resulted in roughly 1400 minutes of recording and 350 pages of transcript. The transcriptions were analysed with a deductive content analysis.

Based on the interviewees, we see that for example modellers trust their colleagues’ judgements or trust a certain institute. The interviews show amongst others that modelling decisions are largely based on context. We have, specifically, heard from modellers that if a certain person executed a modelling study they trust it, but if someone else did it they would not. This means that depending on who executes a modelling study or which model was used, the modellers’ trust in the modelling process and the model results will change. Therefore, transparency in the modelling process is important in order to build this trust. Automation, e.g. through centralised scripts with documentation, limits the individual modeller’s decisions, which can increase the transparency. However, we see that modelling choices in automation scripts are not continuously evaluated. Once trust has been established, the scripts are not critically reflected upon anymore. Understanding the social aspects behind the modelling process is necessary to move forward in modelling and modelling workflows, as well as being able to share and reflect on the model results including the narrative behind it. Sharing this narrative can enhance the trust other modellers have in the executed modelling study.

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