

Translating arctic hydrology research into practice

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The last few decades have seen tremendous scientific advances in arctic hydrology, from assessment of ice cover durations to changes in flows to projections of permafrost thaw. These recent advances were made possible due to progress in instrumentation, monitoring, and modelling. In parallel, there has been a shift from engineering/technical solutions to water problems towards nature-based solutions and new approaches to water research that increasingly recognise the role of the public in data acquisition (e.g., citizen science) and the role of social systems as part of a coupled systems approach to understanding arctic hydrology.

While these emerging sub-fields have put a spotlight on social complexities, bridging the gap between academic research and practice has received less attention. This is specifically problematic in applied sciences, such as cold-region hydrology and water resources research in general. A special issue on 'Grand Challenges in Hydrology' was published in 2015, yet the focus of all articles in this issue was more on theoretical constructs as opposed to the real challenges related to practice. Similarly, in 2018, 23 unsolved problems in hydrology were collectively identified by members of the hydrology community at large. This included three challenges related to interfacing with society, but practical and appropriate technological implementation was not one of them.

A recent search of the literature also shows almost all articles focused on technical challenges related to data, models, and methods. After all, academic research is driven by scientific pursuit, for the discovery of the unknown or advancing existing knowledge. However, this search clearly demonstrates that challenges related to the translation of academic research into practice have not received much consideration. The end users (typically government agencies, water or watershed management authorities, forecasting committees, and other stakeholders and rights holders) often do not have the same level of access to technical resources as researchers. This creates a significant disconnect between the advances in academic research and the collective capabilities of our institutions in implementing those scientific advances, especially at the local level. The issue is much problematic across arctic regions, where local institutional capacities are even further reduced.

The common view amongst researchers is that bridging the gap between research and practice (mucky middle) is not the researcher's responsibility and not within the scope of their work. Training end users, transferring knowledge and providing technical/maintenance support neither soothe scientific curiosity nor provide the necessary career incentives as does the pursuit of an original research. We need to understand the existing challenges in translating research into practice, and discuss potential initiatives in bridging the gap with the end users. Although this is a complex issue and requires actions from all stakeholders, arctic research community can also play an important role.

Bridging this knowledge translation gap is only possible if the research is collaborative, transparent, scalable, sustainable and practically applicable. Opaque data, models and methods in scientific research makes it challenging to ensure the efforts are reproducible. Issues related to scaling and system integration, as well as concerns related to technical support and sustainability also make research uptake in further challenging. Collaborations and strong knowledge integration and mobilization efforts are essential considerations from onset of applied research project, to ensure ownership by developers and end-users. Co-design of research, knowledge co-production, co-ownership, transparency, capacity building and knowledge transfer will bridge the ever widening gap between research and practice.