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EDITED AND REVIEWED BY
Saket Pande,
Delft University of Technology, Netherlands

*CORRESPONDENCE
Pieter Van Oel
✉ pieter.vanoel@wur.nl

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Editorial: Scale issues in human-water systems

Pieter Van Oel[1]*, Murugesu Sivapalan[2,3], Giuliano Di Baldassarre[4,5], Fuqiang Tian[6], Shinichiro Nakamura[7] and Sara Marks[8]

[1]Water Resources Management Group, Wageningen University, Wageningen, Netherlands, [2]Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [3]Department of Geography and Geographic Information Science, University of Illinois at Urbana-Champaign, Urbana, IL, United States, [4]Centre of Natural Hazards and Disaster Science (CNDS), Uppsala University, Uppsala, Sweden, [5]Department of Earth Sciences, Uppsala University, Uppsala, Sweden, [6]Department of Hydraulic Engineering, State Key Laboratory of Hydroscience and Engineering, Tsinghua University, Beijing, China, [7]Department of Civil and Environmental Engineering, Nagoya University, Nagoya, Japan, [8]Eawag, Swiss Federal Institute of Aquatic Science and Technology, Dübendorf, Switzerland

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Editorial on the Research Topic
Scale issues in human-water systems

All around the world humans are influenced by shifting waterscapes due to changing hydro-climatological regimes. At the same time, humans increasingly contribute substantial changes to the water cycle, which in turn influence human activities and decision making in respect of water. Both natural-physical (e.g., hydrological) and human-social (e.g., political) processes exhibit considerable spatial and temporal variability, which is organized around multiple space and time scales resulting from their long-term coevolution (Blöschl and Sivapalan, 1995; Gunderson et al., 1995; Sivapalan and Blöschl, 2015). Future human wellbeing worldwide, supported by deliberate action, requires us to substantially improve our understanding of the interplay between people and water across multiple space and time scales (Yu et al., 2022). Such cross-sectoral understanding is crucial for developing knowledge and tools to adequately inform and support actors involved in disaster-risk reduction and multi-level water governance. Existing mismatches between governance and water systems call for interdisciplinary efforts informing scale-sensitive governance (Wiegant et al., 2022).

This Research Topic brings together contributions that review and address issues that arise when studying the relationships between water and people in the context of spatial and temporal scales. Figure 1 schematically represents the scope of this Research Topic, with the four contributions positioned among the concepts of People, Water, Space, and Time.

Fischer et al. provides a systematic review of spatial and temporal scale issues in sociohydrology. Based on a synthesis of 152 reported sociohydrological case-studies, they highlight that complexities and uncertainties complicate efforts to simulate feedbacks and interactions in coupled human-water systems. Their synthesis underlines the multi-scale nature of sociohydrological systems across space and time. This applies to hydrological and social processes studied as well as to the scales and levels for which relevant data is (un)available.

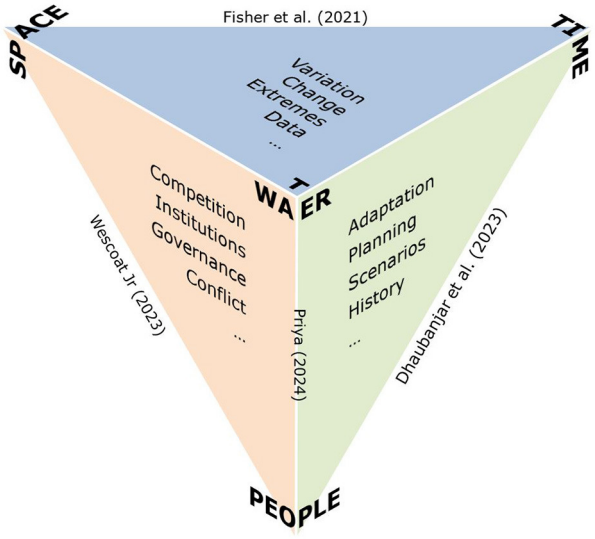

FIGURE 1
Scale issues in human-water systems involve challenges in studying processes involving people and water in space and time. The four contributions to this Research Topic provide insights into dealing with these challenges along with suggestions for improvement, each from a unique sociohydrological perspective.

Even though the setup of their systematic review is very broad, Fischer et al. found that a majority of the studies they reviewed had been published in hydrological journals and contain established hydrological approaches rather than social-science approaches. The most commonly reported spatial extents link to administrative boundaries (e.g., national and state) and natural or physical boundaries (e.g., watersheds). For reported temporal extents decadal and annual assessments predominate, but also event-based and millennial timescales were identified. Fischer et al. call for more interdisciplinary unity to overcome current limitations of sociohydrology research, with emphasis on reporting spatial and temporal scales and levels used. They note that the absence of a common understanding of the endogenization of humans in human-water systems has hampered knowledge accumulation in the field of sociohydrology.

In a macro-historical geographic review on institutional water-management levels Wescoat provides a very rich overview of governance processes that have importantly contributed to shape today's Colorado River basin's region. This review details the progression from early small-scale institutions into more recent multi-level institutions. Wescoat portrays the Colorado River in North America as an example of a complex water-stressed basin with multiple institutional levels of water management, each being characterized by rules, organizations, and spatial jurisdictions. The work is based on a systematic bibliographic review focusing on the relationship between institutional levels and geographic (or spatial) scales. Included reports on the Colorado River basin region reflect community-level perspectives from prehistoric Indian water cultures, early Hispanic water communities, 19th century water communities, and 20th century water organizations. Wescoat goes into depth on the effects of conflict (among water communities) and competition (among states) on later developments that led to interstate, federal, tribal, and eventually leading international level institutions (involving the countries of U.S. and Mexico).

Dhaubanjar et al. discusses the potential of run-of-river hydropower generation in the Upper Indus basin considering climate change effects. They argue that such insights are urgently needed, particularly because current policy ambitions do not account for climate change. The (future) hydropower potential in the upper Indus basin was estimated using model simulations and climate change projections. Hydropower potential is further discussed using theoretical, technical, financial and sustainability perspectives, considering constraints on locating and dimensioning of run-of-river hydropower infrastructure. Scenario explorations indicate that energy availability could decline locally as population numbers increase faster than per-capita sustainable hydropower potential. The future prospects of a spatial mismatch between hydropower availability and energy demand adds to the complexity of achieving sustainable and equitable hydropower development in the Indus basin. Dhaubanjar et al. underline that addressing such complexity requires conducting a comprehensive sociohydrological approach.

Priya conducted an analysis of print-media reports of monsoon floods in Bihar, India. This review focused on articles from a popular Hindi newspaper reflecting narratives on flooding, including its natural drivers and human impacts. In doing this, different water meanings and water-management discourses are discussed. From 376 water-reporting news items identified 139 articles fall under the theme of "monsoon floods." For these articles Priya conducted a discourse analysis. Most news stories reported on short-term impacts of floods and on flood management. Reporting was found to be spatially disconnected and overall not fact-based with news items on flood mitigation often including statements in favor of structural interventions such as embankments. Two narratives identified were found to be particularly problematic, including framings of 'floods as unwelcome disasters exacerbated by rainfall and discharge from upstream Nepal' ignoring anthropogenic and local causes of floods and its impact, and the "interlinking of rivers and constructed embankments as effective solutions." Priya identified important imitations and consequences of the unnuanced and poorly diversified reporting are discussed.

The contributions to this Research Topic illustrate the diversity of approaches and richness in relevant sociohydrological topics. They also show the challenges and efforts required to make progress toward adequately informing and supporting actors involved in water-related disaster-risk reduction and multi-level water governance.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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