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Editorial

Editorial to the Special Issue "Hydrological Applications and Cooperation Projects in Developing Countries"

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Citation: Dezetter, A.; Radice, A. Editorial to Special Issue "Hydrological Applications and Cooperation Projects in Developing Countries". *Hydrology* **2023**, *10*, 39. https://doi.org/10.3390/hydrology10020039

Received: 28 January 2023
Accepted: 30 January 2023
Published: 31 January 2023

Most of the global population lives in developing countries that are highly prone to hydrological phenomena (such as monsoons, floods, cyclones, droughts, aridity, etc.). On the one hand, efficient use of water resources and hazard mitigation are obvious priorities for these regions. On the other hand, the development of water management policies is hindered by limited resources and other objectives with possibly even higher priority. These considerations stimulated the proposal of a Special Issue tailored to hydrological applications in developing countries. A variety of publications already exists on such a topic; but gathering several contributions from different scholars (particularly, some from the countries we are talking about) under the umbrella of a Special Issue with a clear focus can foster the development of a community of scientists wishing to contribute to a general improvement of water cycle management by bringing their expertise to the table.

Studies of the water cycle can be approached at an extremely wide range of scales, from global and regional ones to intermediate scales as those of hydro-graphic catchments, further down to local ones that can be related to individual objects (river reach, storage basin, roof, etc.). The multiscale possibilities pose an evident challenge to researchers. From the technical point of view, another major challenge one faces while working in less-developed contexts is the difficulty of exporting materials and methods used in more-developed countries. This is mostly caused by the scarcity of adequate data for model parameterization; frequently, hydrological and hydraulic models need to be run with publicly available, global data and with parameter values soundly estimated by expert judgement, but with limited possibility of validation. Transformations of the environment (due to, for example, climate change or land-use modifications by human activities) complicate the analysis since they imply a progressive variation of boundary conditions. Scientific research plays a crucial role in the solutions of a plethora of problems at stake.

Engineering and/or policy-based interventions are sometimes supported by the platform of international cooperation to development. Non-governmental organizations are active on the ground to create links between local administrations and territorial agencies, further with technicians and scientists. In our recent visits to study sites in Senegal and Mozambique, we have witnessed the capillary presence of these organizations and the intensity of their activity.

The seven manuscripts published in this Special Issue (four studying sites in Africa, two in Central America and one in Southern America) cover a variety of hydrological and hydraulic applications in developing countries, for different problems to be mitigated and different scales of analysis/intervention (sorted from larger to smaller in the following description).

Watson-Hernández et al. [1] applied hydrological and/or hydraulic models to assess the impact of climate change on the flow regime of the upper Pejibaye river basin in Costa Rica. In the manuscript by Baioni et al. [2], an application of a distributed hydrological model is documented for the catchments of the Foro dam in Eritrea, with the aim of quantifying surface runoff and sediment transport in the ungauged basin under investigation. The basin-scale hydrological model and the river/floodplain hydraulic model of Rrokaj et al. [3] supported the proposal of a win–win measure for flood mitigation by river restoration and water storage in a downstream reach of the Rio Muaguide in Mozambique.

The manuscript of Ndhlove and Woyessa [4], related to the Kabompo river basin (Zambia and surrounding countries), is aimed at addressing how climate change may impact the hydrological regime (characterized by flow-duration curves), for the quantitative analysis of hydropower potential.

The contributions of Serrano-Núñez et al. and Negatu et al. [5,6] are undertaken at the scale of river reaches/sections. The former presents the calibration of the roughness coefficient in two-dimensional hydro-dynamic models of two short reaches of the Ahogados and Tempisquito rivers in Costa Rica. The latter addresses the determination of rating curves for river sections in the Lake Tana basin in Ethiopia, to help overcome the lack of widespread monitoring stations.

Finally, Sayol et al. [7] consider hydrological balance at a very limited spatial scale, that is that of a single greenhouse with indoor crops, and quantitatively analyzes the relationship between roof rainwater and the daily crop water demand throughout a year, proposing guidelines for storage tank design.

"Sustainability" is nowadays a frequently used keyword. At an international level, its concept is summarized by the UN Sustainable Development Goals (SDGs) to be met by 2030. The SDGs are extremely general and a direct connection between a single research work and a global goal can hardly exist. However, the manuscripts presented in this Special Issue contribute, as a prospect, to several of the SDGs, such as SDG2: Zero hunger (due to the obvious nexus between water and agriculture), SDG7: Clean energy (due to a link between water and renewable energies), SDG11: Sustainable cities and communities (considering how best practices can contribute to capacity building and smart cities), SDG13: Climate action (for the obvious relation between climate change and hydrological/hydraulic regimes).

Author Contributions: The two guest editors equally shared the work of soliciting, editing, and handling the contributions to this Special Issue. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement: Not applicable.

Acknowledgments: We gratefully acknowledge the efforts of all authors that added to the Special Issue, contributing to the advancement of the hydrological/hydraulic community.

Conflicts of Interest: The authors declare no conflicts of interest.

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