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Editorial: Urban drainage in a context of climate and land cover changes

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Editorial on the Research Topic
Urban drainage in a context of climate and land cover changes

Traditional drainage systems rely on networks of interconnected pipes and manholes to collect and quickly transport runoff to an outlet where it is discharged into bodies of water. This approach to runoff management is proving to be insufficient to manage the impacts of land cover and climate change (Russo et al., 2021). Increasing sealing from urban development causes high runoff volumes and speeds, which is combined with the existence of more intense and frequent storm events due to changing climate (Jato-Espino et al., 2019). Ultimately, these effects favor the occurrence of flooding and diffuse pollution phenomena. Adapting urban planning to these changes is essential to ensure the hydrological sustainability of the cities of the future (Marhaento et al., 2018).

Despite efforts by the scientific community to better manage stormwater in cities, there are still research gaps that need to be filled to provide insight into mitigating the impacts of land cover and climate change on urban drainage. Such is the case in the assessment of Combined Sewer Overflows (CSOs) with a focus on the potential of Green Infrastructure (GI) and Sustainable Drainage Systems (SuDS) for water retention at source. Another area that needs further study is the implementation of resilient drainage practices in public policies. This Research Topic aims to produce knowledge on these matters, emphasizing the role of GI and SuDS to cope with increasing hydrological stress caused by land cover and climate change. This collection contains three original research papers and one research report that are overviewed below.

Förster et al. performed a series of artificial precipitation experiments to simulate the decrease in runoff coefficient caused by green roofs when the flow length and slope in the substrate layer were varied. The consideration of flow lengths under 5 m and non-pitched roofs is new and gives insight into the potential of green roofs to minimize stormwater flooding in cities. Using Hanover (Germany) as a case study, the authors found that minimizing the slope and maximizing the flow length reduced the runoff coefficient from

30% to <10% for a return period of 100 years. These figures were confirmed numerically using the Catchment Modeling Framework (CMF). These results represent a paradigm shift in green roof design and provide practical information that can help update current guidelines and standards.

Roseboro et al. used the Storm Water Management Model (SWMM) to gain understanding of the performance of permeable pavements to attenuate CSOs favored by climate change impacts in the city of Buffalo (USA). The results of the simulations showed that the CSO volumes under the most critical Representative Concentration Pathways (RCP 8.5) can increase in the range of 11 to 73% depending on the duration of precipitation and the considered return periods. Permeable pavements have a reduction potential of 2 to 31% of such CSO volumes and are particularly effective in storm events with short return periods and short precipitation durations. These results are of great interest to facilitate the strategic rehabilitation of urban surfaces through permeable pavements, which are the easiest type of SuDS to implement in cities.

Muhandes et al. developed a computational model (CityWatStorm) to assess the role of SuDS in reducing CSOs and flood volume. When compared to the results of InfoWorks ICM model using Norwich (UK) as a case study, CityWatStorm was found to capture the benefits of SuDS with an accuracy of 95%, while CSOs and flood volumes were estimated with an accuracy between 78 and 83%. Furthermore, the proposed tool was developed to overcome some limitations in existing software such as speed in optimization or uncertainty analysis in long-term simulations. Therefore, CityWatStorm can be useful for both companies and administrations to develop drainage plans and conduct long-term assessments of large catchment areas.

Galarza-Molina et al. conducted a literature review to examine the incorporation of resilience in urban drainage systems into public policies worldwide. The knowledge gained in this way was validated in a workshop with experts and then used for recommendations at the city level in Colombia. Tools and concepts such as the urban water transition framework and the hydro-social contract were highlighted as means to facilitate the transition to sustainable cities in terms of water management. In addition, technical panels, focus groups, workshops, and information sessions with the citizenry were identified as key aspects to facilitate the generation of ideas. Regarding information, the authors also emphasize the importance of using tools to visualize the state of urban drainage in order to facilitate the implementation of solutions for its improvement.

The findings of these investigations help provide insights into the importance of exploring alternative drainage approaches to address land cover and climate change. The results of the contributions in this Research Topic rotate from technical questions to decision-making, thus helping to improve the understanding of the benefits of sustainable stormwater management at different levels.

Author contributions

DJ-E, SC, and JR reviewed the articles in the Research Topic. DJ-E, SC, JL, and JR co-edited the Research Topic and analyzed how the articles fit within. All authors contributed to the article and approved the submitted version.

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