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The integration of scientific knowledge on hydrogeomorphological processes in fluvial risk management strategies through the "Freedom space for rivers" concept

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Extensive knowledge and tools developed by hydrogeomorphologists led to the development of new approaches for fluvial hazards mapping that recognize the diversity of river systems and consider the temporal morphodynamic adjustments. Hydrogeomorphological mapping can be integrated into a management approach by considering distinct processes with specific regulation and management practices. The Freedom space for rivers (FSR) concept promotes the integration of multiple processes into a single space by combining the flooding and the mobility spaces as well as the riparian wetlands. Flooding spaces are delimited by a combination of methods, calling for the use of LiDAR elevation models and geomorphological observations related to past flood events. Mobility spaces are defined by the analysis of historical river positions and the interpretation of landforms associated with morphodynamics. In the FSR approach, fluvial processes can naturally operate, thus limiting risk for citizens and infrastructure, while providing a series of ecological services and socioeconomic benefits.

Many methodological and institutional challenges arise for the applicability of the FSR concept in the management of rivers. To investigate these challenges, working groups bringing together different water stakeholders were created in collaboration with local watershed organizations and municipal authorities in three contrasting river environments in Québec (Canada). Stakeholders' engagement help identify local concerns regarding FSR management, collectively set up implementation strategies and transfer knowledge gained on river dynamics and fluvial hazards. The collaborative research approach aims to better understand challenges and opportunities for FSR management concepts. Farmers' reluctance to limit their interventions and practices along watercourses, a lack of political will at local level, the absence of government incentives to support local FSR actions, and the institutional challenge to combine both flood and erosion into a single regulatory framework are the main obstacles for the integration of the FSR concepts in management practices. In the three studied territories however, regulatory protection of FSR is feasible in undeveloped or uncultivated land to prevent future development in high-risk areas and to ensure the quality of ecological services associated with floodplains. Raising stakeholders' awareness about natural hazards and hydrogeomorphological processes appears essential in order to incorporate new management practices that aim to give more space to rivers in order to reduce vulnerability and improve the resilience of riparian communities.