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High-resolution downscaling for hydrological management

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Hydrological modellers and water managers require high-resolution climate data to model regional hydrologies and how these may respond to future changes in the large-scale climate. The ability to successfully model such changes and, by extension, critical infrastructure planning is often impeded by a lack of suitable climate data. This typically takes the form of too-coarse data from climate models, which are not sufficiently detailed in either space or time to be able to support water management decisions and hydrological research.

BINGO (Bringing INnovation in onGOing water management; <www.projectbingo.eu>) aims to bridge the gap between the needs of hydrological modellers and planners, and the currently available range of climate data, with the overarching aim of providing adaptation strategies for climate change-related challenges. Producing the kilometre- and sub-daily-scale climate data needed by hydrologists through continuous simulations is generally computationally infeasible. To circumvent this hurdle, we adopt a two-pronged approach involving (1) selective dynamical downscaling and (2) conditional stochastic weather generators, with the former presented here.

We take an event-based approach to downscaling in order to achieve the kilometre-scale input needed by hydrological modellers. Computational expenses are minimized by identifying extremal weather patterns for each BINGO research site in lower-resolution simulations and then only downscaling to the kilometre-scale (convection permitting) those events during which such patterns occur. Here we (1) outline the methodology behind the selection of the events, and (2) compare the modelled precipitation distribution and variability (preconditioned on the extremal weather patterns) with that found in observations.