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Green roofs'retention performances in different climates

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The ongoing process of global urbanization contributes to increasing stormwater runoff from impervious surfaces, threatening also water quality. Green roofs have been proved to be an innovative stormwater management tool to partially restore natural state, enhancing interception, infiltration and evapotranspiration fluxes. The amount of water that is retained within green roofs depends mainly on both soil properties and climate. The evaluation of the retained water is not trivial since it depends on the stochastic soil moisture dynamics.
The aim of this work is to explore performances of green roofs, in terms of water retention, as a function of their depth considering different climate regimes. The role of climate in driving water retention has been mainly represented by rainfall and potential evapotranspiration dynamics, which are simulated by a simple conceptual weather generator at daily time scale. The model is able to describe seasonal (in-phase and counter-phase) and stationary behaviors of climatic forcings. Model parameters have been estimated on more than 20,000 historical time series retrieved worldwide. Exemplifying cases are discussed for five different climate scenarios, changing the amplitude and/or the phase of daily mean rainfall and evapotranspiration forcings. The first scenario represents stationary climates, in two other cases the daily mean rainfall or the potential evapotranspiration evolve sinusoidally. In the latter two cases, we simulated the in-phase or in counter-phase conditions. Stochastic forcings have been then used as an input to a simple conceptual hydrological model which simulate soil moisture dynamics, evapotranspiration fluxes, runoff and leakage from soil pack at daily time scale.
For several combinations of annual rainfall and potential evapotranspiration, the analysis allowed assessing green roofs' retaining capabilities, at annual time scale. Provided abacus allows a first approximation of possible hydrological benefits deriving from the implementation of intensive or extensive green roofs in different world areas, i.e. less input to sewer systems.