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Combining theoretical and applied ecohydrology in semi-arid climates

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In water-controlled environments, soil-water is the main actor in the hydrological cycle, just as the vegetation is the main actor in the dynamics of the ecosystems. The exchanges of water between soil and vegetation are driven by climate forcings like evaporative demand and rainfall. Evaporation is strongly related to air temperature, which exhibits a small stochasticity over a strong seasonality. Rainfall, on the other hand, is highly intermittent with a seasonal variability.
We investigate the dynamics of a water-controlled ecosystem through the analysis of the local interactions between soil-water and vegetation forced by air temperature and rainfall. The evolution of the ecosystem is described by a couple of stochastic differential equations. The steady states are identified. The probability density functions of soil-water and vegetation are derived analytically at the steady states. Field data of Vaira have been used to test the theoretical findings.