



CastaliaR: An R package for multivariate stochastic simulation at multiple temporal scales

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In contrast to great advances on stochastic simulation techniques in hydrology and their importance on water management and uncertainty assessment studies, operational software packages for generating synthetic data are limited and hardly accessible. This limits their adoption to a narrow audience, excluding the vast majority of researchers and practitioners. In an effort to bridge this gap, we introduce CastaliaR package that constitutes the R-based, open-source implementation of a state-of-the art methodology for multivariate stochastic simulation. Its background builds upon the works of Koutsoyiannis and Manetas, (1996), Koutsoyiannis (1999, 2000) and Efstratiadis et al. (2014). Briefly, the overall scheme reproduces the statistical characteristics of the historical data at three temporal scales (annual, monthly and daily). The generation procedure lies upon a symmetric moving average process for the annual scale and a periodic autoregressive process for the finer scales, while a Monte Carlo disaggregation approach re-establishes consistency across the three temporal scales.

References

- Efstratiadis, A., Dialynas, Y., Kozanis, S., & Koutsoyiannis, D. (2014). A multivariate stochastic model for the generation of synthetic time series at multiple time scales reproducing long-term persistence. *Environmental Modelling & Software*, 62(0), 139–152. <http://dx.doi.org/10.1016/j.envsoft.2014.08.017>
- Koutsoyiannis, D. (1999). Optimal decomposition of covariance matrices for multivariate stochastic models in hydrology. *Water Resources Research*, 35(4), 1219–1229. <https://doi.org/10.1029/1998WR900093>
- Koutsoyiannis, D. (2000). A generalized mathematical framework for stochastic simulation and forecast of hydrologic time series. *Water Resources Research*, 36(6), 1519–1533. <https://doi.org/10.1029/2000WR900044>
- Koutsoyiannis, D., & Manetas, A. (1996). Simple disaggregation by accurate adjusting procedures. *Water Resources Research*, 32(7), 2105–2117. <https://doi.org/10.1029/96WR00488>