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Generating precipitation with the help of other meteorological variables

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Weather generators traditionally model dry and wet conditions separately. This necessitates not only the existence of a rain occurrence model, but also the double parametrisation of the process generating non-precipitation variables for dry and wet conditions.
We propose a method to generate rain together with other meteorological variables within a single stochastic model, thus greatly reducing the number of needed parameters. Drier conditions can, to a certain extend, be seen by the values of non-precipitation variables becoming more distant to their mean values during wet conditions. Hence, this information can be used to estimate a probability of dryness. This probability is derived from values of air temperature, long and short wave radiation, relative humidity and wind speed components at every time step. Then, a continuous time series of precipitation is constructed in the standard-normal domain, comprised of the probability of dryness and transformed precipitation amounts. This time series can then be modelled with a single stochastic model such as a simple vector-autoregressive process.
The generated time series is compared with measured data concerning their marginals, auto- and cross correlations as well as low-frequency variability.