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A stochastic daily rainfall occurrence generator with higher time scale dependence

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It has been observed that the commonly used order one Markov model of rainfall occurrence, in general, underestimates the very long dry spells (runs of consecutive dry days) in the generated series. Also, the interannual variance of monthly (or seasonal) total precipitation is greater than predicted by the Markov chain model. We present here a modified form of Markov model for generation of daily rainfall occurrences with the aim of representing both short and long-term dependence in the generated rainfall sequences. The model is based on a modification of the transition probabilities of the traditional Markov model through an analytically derived factor that represents the influence of aggregated rainfall properties. The utility of the method is illustrated using long-term rainfall data from 30 locations around Sydney in Australia and comparing the various short and long term rainfall statistics. The analyses of the results show that the model is able to reproduce adequately the shorter as well as aggregated time scale rainfall characteristics at individual locations, while the extension to multi-site rainfall preserves the spatial rainfall structure over the region at shorter time scale with some bias at higher aggregated time scales.