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Diagnostic statistics of daily rainfall variability in an evolving climate

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Abstract. To investigate the character of daily rainfall variability under present and future climate described via global warming a suite of diagnostic statistics was used. The rainfall was modeled as a stochastic process coupled with atmospheric circulation. In this study we used an automated objective classification of daily patterns based on optimized fuzzy rules. This kind of classification method provided circulation patterns suitable for downscaling of General Circulation Model (GCM)-generated precipitation. The precipitation diagnostics included first and second order moments, wet and dry-day renewal process probabilities and spell lengths as well as low-frequency variability via the standard deviation of monthly totals. These descriptors were applied to nine elevation zones and entire area of the Mesochora mountainous catchment in Central Greece for observed, $1\times CO_2$ and $2\times CO_2$ downscaled precipitation. The statistics' comparison revealed significant differences in the most of the daily diagnostics (e.g. mean wet-day amount, 95th percentile of wet-day amount, dry to wet probability), spell statistics (e.g. mean wet/dry spell length), and low-frequency diagnostic (standard deviation of monthly precipitation total) between warm ($2\times CO_2$) and observed scenario in a progressive rate from lower to upper zone. The differences were very greater for the catchment area. In the light of these results, an increase in rainfall occurrence with diminished rainfall amount and a sequence of less consecutive dry days could describe the behaviour of a possible future climate on the examined catchment.

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