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Characteristics of a Novel Sampling for Future Extremes

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Synthetic time series generation is an essential tool to explore different climate scenarios and their impacts. While sophisticated generation methods have been developed in the past, they often rely on physical and statistical assumptions and require extensive data for calibration and parameter estimation. We propose a straightforward method for time series generation based on constrained sampling of observations. This approach preserves the physical consistency between variables and maintains the short-term temporal structure present in the observation. We sample temperature, precipitation, surface pressure, incoming solar radiation, and wind from station observations in Switzerland. We obtain different sets of synthetic time series by constraining mean temperature and precipitation quantiles according to different future greenhouse gases emission scenarios. The sampled time series are compared with historical observations and statistically downscaled EURO-CORDEX projections. We show that, when constrained on temperature, our sampling produces more precipitation extreme events than the statistically downscaled time series. We also analyze the dependence structure between variables, including the multivariate extreme events.