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A multivariate multi-timescale quantile-quantile bias correction approach

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A novel multivariate quantile-based nesting bias correction approach is developed for the removal of systematic biases in the global circulation model outputs at multiple time scales. Compared to the widely used quantile-matching method that is univariate, offers correction only at a single time scale of interest and considers only distributional biases, the proposed method simultaneously considers multiple variables, multiple time scales and in addition to the adjustment of the model CDF, also corrects for the biases in the lag-0 and lag-1 persistence attributes across all the time scales considered. The proposed methodology builds on our earlier works on nesting bias correction, which progressively corrects GCM simulations from lower to higher time scales to impart the observed distributional and persistence properties across the selected multiple time scales. The proposed approach combines the best of both quantile matching and nesting approaches and offers an improved basis for applying bias correction simultaneously on many variables across multiple time scales. The use of the approach in hydrology and water resources related downscaling applications is expected to have important consequences for the occurrence and intensity of extreme events such as heat waves, floods, and droughts. Being simple and versatile, the proposed approach can be used to produce auxiliary ensemble scenarios for various climate impact-oriented applications.