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Using Independent Component Analysis for spatial bias correction

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Most climate model bias correction methods focus on errors in the distribution of rainfall or temperature at single locations and apply the corrections separately. However for many water resources management problems, the spatial dimension of catchment processes is an important driver. For example, correctly representing the spatial correlation of rainfall deficits is key to properly manage droughts from both technical and policy perspectives.
Here we present a new method of bias correction that corrects the spatial statistics of climate model simulations. A two part model is used. Partial component analysis followed by independent component analysis is used to isolate the three most influential spatial signals and these are bias corrected by pairing them with the observed spatial signals. These bias corrected signals are then rotated to the original space and a second stage bias correction applied that corrects the distribution of the rainfall amounts. The ICA corrected simulations are shown to provide a better representation of droughts with large areal extents.