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Fitting asymmetrical copulas for rainfall downscaling

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In recent work, copulas have been applied in downscaling as a method to describe the observed scale dependence in rainfall. Although this approach was found to be effective, asymmetries are observed in the resulting copulas, i.e. behaviour where the margins are no longer exchangeable. This behaviour can be modelled using a variety of techniques, e.g. Khoudraji's device. Although a number of papers exist on asymmetric copulas, it was found that the practical use, such as fitting and testing, of these copulas has not yet been discussed much.

In this study we propose and test a method for fitting asymmetrical copulas. Furthermore, the construction of such copulas using a generalisation of Khoudraji's device (E. Liebscher, 2008, Construction of asymmetrical multivariate copulas, Journal of Multivariate Analysis) is discussed as the proposed fitting method is based on this method. Our method is based on a piecewise estimation of the problem, rather than attempting to solve the entire problem at once. Moreover, by applying an iterative approach, the problem becomes tractable and well-fitting copulas can be retrieved.