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Modelled rainfall skill assessment against a 1000-year time/space isotope dendro-climatology for southern Africa

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Palaeoclimate reconstruction using isotopic analysis of tree growth increments has yielded a 1000-year record of rainfall variability in southern Africa. Isotope dendro-climatology reconstructions from baobab trees (*Adansonia digitata*) provide evidence for rainfall variability from the arid Namib Desert and the Limpopo River Valley. Isotopic analysis of a museum specimen of a yellowwood tree (*Podocarps falcatus)* yields another record from the southwestern part of the subcontinent. Combined with the limited classic denro-climatologies available in the region these records yield palaeo-rainfall variability in the summer and winter rainfall zones as well as the hyper-arid zone over the last 1000 years. Coherent shifts in all of the records indicate synoptic changes in the westerlies, the inter-tropical convergence zone, and the Congo air boundary. The most substantial rainfall shift takes place at about 1600 CE at the onset of the Little Ice Age. Another distinctive feature of the record is a widespread phenomenon that occurs shortly after 1810 CE that in southern Africa corresponds with a widespread social upheaval known as the Difequane or Mfekane. Large scale forcing of the system includes sea-surface temperatures in the Agulhas Current, the El Nino Southern Oscillation and the Southern Annular Mode. The Little Ice Age and Mfekane climate shifts result from different forcing mechanisms, and the rainfall response in the different regions at these times do not have a fixed phase relationship. This complexity provides a good scenario to test climate models. A first order (wetter versus drier) comparison between each of the tree records and a 1000-year palaeoclimate model simulation for the Little Ice Age and Mfekane transitions demonstrates a generally good correspondence.