Climate variability in Rodrigues Island, Southern Indian Ocean, over the past 8000 years

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The Holocene hydroclimate variability in the Mascarene High region in the subtropical southern Indian Ocean is poorly known despite its importance as a vital component of the Asian summer monsoon system. This is mainly due to the lack of high-resolution and precisely dated climate records from this region. Here we present for the first time a high-resolution (~3-10 years) speleothem oxygen isotope ($\delta^{18}O$) record from La Vierge (19°45′S, 63°22′E) and Patate (19°45′S, 63°23′E) caves in Rodrigues Island, located ~560 km east of Mauritius. The record spans most of the Holocene from ~11,000 to 300 year BP. Rainfall in Rodrigues occurs mainly during the austral summer season when the Mascarene High moves northwestward from its position during spring. Observational and modeling data demonstrate an inverse relationship between rainfall amount and $\delta^{18}O$ of precipitation at Rodrigues Island, and therefore, we interpret variations in speleothem $\delta^{18}O$ record as a proxy of austral summer rainfall amount. Backward trajectory analyses show that the position of the Mascarene High during drier summer years is located further northwest than during wetter summer years. As such, it is likely that our Rodrigues $\delta^{18}O$ records may indicate variations of the mean position of the Mascarene High during austral summer and the related rainfall changes. Our record is characterized by a long-term trend towards higher $\delta^{18}O$ values during the early to late Holocene, suggesting a progressive drying of Rodrigues that may have been associated with a northwestward shift of the mean position of the Mascarene High. Our records also reveal prominent millennial-centennial events centered at ~1.5ka, 2.3ka, 3.3ka, 5.3ka, 6.2ka and 7.3ka. Additionally, spectral analysis of the $\delta^{18}O$ records reveals significant power at the ~111, 60, 46, and 36 year bands. In comparison with other proxy records and modeling results, possible teleconnections of the Rodrigues climate variability and Asian monsoon changes will be discussed.