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Interhemispheric symmetry vs. Meridional shifts in the African ITCZ during the late Quaternary: reconciling palaeo-records using climate model simulations

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The location of the Inter-Tropical Convergence Zone (ITCZ) is one of the main controls on tropical and subtropical precipitation in Africa. Its latitudinal position oscillates seasonally but has also varied on millennial time scales in response to changes in the seasonal distribution of low-latitude insolation due to orbital configuration, as well as abrupt climate changes initiated at high latitudes, such as Heinrich events. However, palaeoclimate proxy archives often disagree about the mode of these variations, with some records suggesting meridional shifts in mean ITCZ position and others proposing interhemispherically symmetric expansion and contraction. Here, we use climate model simulations of the last glacial cycle (120 kyr) to demonstrate that there is not one global mode of operation, but rather ITCZ movement is regionally variable. Some regions display expansion/contraction and some display meridional shifts in response to changes in low-latitude insolation (precession-dominated), depending on local continental configuration. In addition, palaeo-records of precipitation do not necessarily directly correspond to variation in ITCZ position, and interpretation of these records in terms of the ITCZ will be dependent on their latitude, particularly over Africa, which has a large seasonal movement of the rainbelt. Our simulations can reconcile palaeo-records that have appeared to be in opposition, with implications for interpretation of future palaeo-archives of African and global low-latitude palaeo-hydroclimate variation on millennial and multi-millennial time-scales.