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Importance of the Indian Ocean for simulating rainfall anomalies over eastern and southern Africa

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Abstract. The relative contributions of the Indian Ocean and Pacific Ocean sea surface temperatures (SSTs) to the rainfall variability over eastern, central, and southern Africa during austral spring-summer are examined. The variability of African rainfall is statistically related to both oceans, but the variability in the two oceans is also related. To separate the effects of the Indian and Pacific Oceans, a suite of numerical model simulations is presented: GOGA, the atmosphere is forced by observed SSTs globally; IOGA, the atmosphere is forced by observed SSTs only in the Indian Ocean basin; and POGA, the atmosphere is forced by observed SSTs only in the tropical Pacific basin. While the SST variability of the tropical Pacific exerts some influence over the African region, it is the atmospheric response to the Indian Ocean variability that is essential for simulating the correct rainfall response over eastern, central, and southern Africa. Analyses of the dynamical response(s) seen in the numerical experiments and in the observations indicate that the Pacific and Indian Oceans have a competing influence over the Indian Ocean/African region. This competition is related to the influence of the two oceans on the Walker circulation and the consequences of that variability on low-level fluxes of moisture over central and southern Africa. Finally, given the high correlation found between SST variability in the Indian and Pacific Oceans with the Pacific leading by ~3 months, we speculate on an approach to long-lead dynamical climate prediction over central-east and southern Africa.