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Role of the Indonesian Throughflow in controlling regional mean climate and rainfall variability

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The role of the Indonesian Throughflow (ITF) in controlling regional mean climate and rainfall is examined using a coupled ocean-atmosphere general circulation model. Experiments employing both a closed and open ITF are equilibrated to steady state and then 200 years of natural climatic variability is assessed within each model run, with a particular focus on the Indian Ocean region. Opening of the ITF results in a mean Pacific-to-Indian throughflow of 21 Sv (1 Sv = 10^6 m^3 sec^{-1}), which advects warm west Pacific waters into the east Indian Ocean. This warm signature is propagated westward by the mean ocean flow, however it never reaches the west Indian Ocean, as an ocean-atmosphere feedback in the tropics generates a weakened trade wind field that is reminiscent of the negative phase of the Indian Ocean Dipole (IOD). This is in marked contrast to the Indian Ocean response to an open ITF when examined in ocean-only model experiments; which sees a strengthening of both the Indian Ocean South Equatorial Current and the Agulhas Current. The coupled feedback in contrast leads to cooler conditions over the west Indian Ocean, and an anomalous zonal atmospheric pressure gradient that enhances the advection of warm moist air toward south Asia and Australia. This leaves the African continent significantly drier, and much of Australia and southern Asia significantly wetter, in response to the opening of the ITF. Given the substantial interannual variability that the ITF exhibits in the present-day climate system, and the restriction of the ITF gateway in past climate eras, this could have important implications for understanding past and present regional rainfall patterns around the Indian Ocean and over neighbouring land-masses.