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Recent evolution of tropical climate variability in the Indian Ocean region

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Extremes of the tropical Indian Ocean Dipole (IOD)[1,2] cause dramatic socio-economic hardships in the Indian Ocean region, which is home to a third of the world's population. Yet virtually no information exists on the nature and causes of IOD variability, thus it is not clear how the climatic impacts of IOD events may evolve in the future. Here we use geochemical tracers in corals from sites across the equatorial Indian Ocean[3−5]to reconstruct IOD anomalies since 1858 AD. The coral records document an increase in the frequency of strong IOD events since 1960, along with a coeval shift towards a more IOD-like mean ocean-atmosphere state across the equatorial Indian Ocean. This recent increase in IOD activity is supported by rainfall records from the region and appears to be associated with an ENSO-independent increase in Asian monsoon strength[6]. Ocean-atmosphere simulations[7] are shown to further support a link between increasing Asian monsoon winds and IOD activity, while coral reconstructions document more protracted IOD-droughts during prehistoric IOD events influenced by a strengthened Asian monsoon. Hence, whilst predictions of increasing monsoon strength imply that Asia and India are likely to become wetter during the 21^{st} century[8], our coral and climate model results suggest that any monsoon-driven increase in IOD activity will serve to increase drought in Australia and Indonesia.

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