

Geophysical Research Abstracts,  
Vol. 11, EGU2009-2209, 2009  
EGU General Assembly 2009  
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## **Western Indian Ocean marine and terrestrial records of climate variability: a review and new concepts on land–ocean interactions since AD 1660**

J. Zinke (1), M. Pfeiffer (2), O. Timm (3), W.-Ch. Dullo (4), G.J.A. and Brummer (5)

(1) Vrije Universiteit Amsterdam, Paleoclimatology, Amsterdam, Netherlands ([jens.zinke@falw.vu.nl](mailto:jens.zinke@falw.vu.nl)), (2) Universität zu Köln, Germany, (3) IPRC, University of Hawaii, USA, (4) Leibniz Institut fuer Meereswissenschaften, Kiel, Germany, (5) Royal NIOZ, The Netherlands

In this study we established the interannual to centennial linkages between three tropical and two subtropical western Indian Ocean coral oxygen isotope time series to land temperatures and rainfall over India, equatorial East Africa and southeast Africa.

The western Indian Ocean tropical and subtropical corals show a strong correlation with land temperatures on interannual to multidecadal time scales. Tropical western Indian Ocean corals show clear decadal linkages at frequencies ranging from 7-13 years and 30-45 years with temperatures over western India and East Africa back to 1800. The subtropical corals follow southern Africa surface air temperatures (SAT) trends over more than 300 years, and are coherent with SAT on interdecadal frequencies ranging between 16-20 years.

The relationship between western Indian Ocean SST and rainfall over adjacent land areas is more complex. Running correlation analysis suggests varying strength of the interannual relationship. We find evidence for changing teleconnection patterns between SST/land temperatures and rainfall on interdecadal time scales, possibly associated with changes in the background temperatures through time. The most prominent change occurred in the late 20th century, when teleconnection patterns changed dramatically. Nevertheless, three tropical Indian Ocean corals are coherent with equatorial East African rainfall on interannual (5-6 years) and decadal (9-13 years) frequencies, the main modes of interannual (ENSO) and decadal (ENSO-like) climate variability in the tropical Indo-Pacific. The subtropical corals indicate strongest coherence with southern African rainfall on interannual and interdecadal frequencies ranging between 2-3, 5-6 and 16-20 years, respectively.

Overall, this study reveals the great potential of tropical and subtropical Indian Ocean corals for reconstructing the complex relationship between tropical surface air temperatures and precipitation over land and oceans during the 20th century and potentially beyond. This will provide a framework for a detailed analysis of decadal to multidecadal interactions between land and ocean at time scales well beyond the instrumental record.

Comparison with paleoclimatological reconstructions of either rainfall or temperature over land areas reveals that most relationships established for the 20th century, also hold for the last 350 years. Thus, the network of high-resolution proxy records from the Indian Ocean and the surrounding land mass will prove invaluable for a better understanding of land-ocean interactions over several centuries.