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Coral record of southeast Indian Ocean SST, SSH and salinity and their modulation by ENSO and the Western Pacific temperature gradient

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Variability of southeastern Indian Ocean (SEIO) sea surface temperatures (SST), sea surface height (SSH) and salinities off Western Australia is a footprint of interannual and decadal climate variations in the tropical Indo-Pacific. La Niña events often result in a strengthened Leeuwin Current, high coastal sea levels, low salinities and unusually warm SSTs, now termed Ningaloo Niño events. The long-term teleconnections of the southeastern Indian Ocean (SEIO) with ENSO and the West Pacific Warm Pool are poorly understood. Here we demonstrate the role of Indo-Pacific coupling in modulating SST, SSH and salinity in the poorly studied SEIO, through a robust 215 year (1795-2010) geochemical coral proxy sea surface temperature (SST), SSH and salinity record. We show that higher SST and SSH accompanied by lower salinities in the SEIO are linked to the behaviour of ENSO and the Western Pacific Warm Pool on decadal to centennial timescales, and are most pronounced when an anomalously strong zonal SST gradient between the western and central Pacific co-occurs with strong La Niña's. Better understanding of the interplay between the zonal SST gradient in the western Pacific, ENSO phase and intrinsic Indian Ocean variability is expected to improve our ability to better predict unusual marine heat waves, sea level surges and important consequences for marine socio-ecological systems in the Future.