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Paleoclimate drivers of the Indonesian and South China Sea throughflows, the curious case of the IOD

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The Indonesian and South China Sea throughflows play an important role in global ocean circulation as the only low-latitude pathway for the exchange of heat and salt between the Pacific and Indian oceans. This transport is modulated by different climate systems including the El Niño Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO) and the East Asian Monsoon. The interactions of these climate systems across the Southeast Asian region are still being understood, particularly the role of sea surface salinity (SSS) in inhibiting flow from the Makassar Strait into the Indian Ocean.

Reconstructions of SSS from corals provide an opportunity to study long-term trends in climate and ocean circulation. Coral records from north and south of the Luzon Strait, the Makassar Strait, and Lombok Strait for the period 1926 to 2010 are examined to evaluate their shared variability. Principal component analysis synthesizes these records for the boreal winter (December to March) and boreal summer (June to September). The first and second principal components or empirical orthogonal functions (EOF) describe over 55% of the shared variance in both seasons. In the winter, the EOF of both modes correlates to PDO and the first EOF correlates to the Indian Ocean Dipole (IOD). A high-pass filter of the first EOF for <10 years per cycle for the winter and summer significantly correlates to ENSO and IOD respectively. While several sites individually correlate with ENSO and PDO, no individual SSS record correlates to the IOD. This consistent relationship of the IOD to the winter EOF indicates a regional influence on salinity variance that is not identified locally. One hypothesis to explain IOD's regional influence is that the interaction of the IOD and ENSO through the atmospheric bridge or the Madden Julian Oscillation (MJO) is influencing the region. Spectral analysis, and climatic and oceanographic models will be used to further investigate this connection.