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Variability in Reconstructed SSS Between the Northern and Southern Lombok Strait Linked to East Asian Winter Monsoon Mean State Reversals

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The Indonesian Seas provide oceanic pathways for the Indonesian Throughflow (ITF), which drives heat and buoyancy transport from the tropical Pacific Ocean to the Indian Ocean. Approximately 80% of total ITF transport flows through the Makassar Strait in the western Indonesian Seas before exiting into the Indian Ocean in part through the Lombok Strait (∼20% of total transport). This transport varies on seasonal to interdecadal timescales and interacts with both regional and global climate systems. The ITF thus serves as an important oceanic exchange for Indo-Pacific climate. During the East Asian Winter Monsoon (EAWM), low salinity waters from the South China Sea (SCS) inhibit southward surface flow of the ITF in the southern Makassar Strait. This surface obstruction of the ITF reduces heat fluxes to the Indian Ocean and likely impacts Lombok Strait surface variability. Efforts to constrain past EAWM influences on surface water circulation are thus critical in order to better anticipate future changes in the interactions between monsoon-driven circulation in the Indonesian Seas and Indo-Pacific climate. Here, we present two multi-century, seasonally resolved records of coral-reconstructed sea surface salinity (SSS) from the northern (110 years) and southern (193 years) Lombok Strait. Differences in SSS variability between the two sites during boreal winter (January-March) suggest the influence of multiple source waters. Instrumental and reconstructed temperature-salinity relationships indicate that SCS surface waters consistently dominate the northern Lombok Strait, while Indian Ocean surface waters instead dominate the southern Lombok Strait prior to 1960. Source water dissimilarities between the two sites are likely related to changes in monsoon-driven surface water advection. At the northern site, the EAWM consistently influences SSS variability. However, the EAWM influence at the southern site reverses in direction (inverse to direct) in 1960 coincidentally with a transition from a positive (strong) to a negative (weak) mean EAWM state. Our records collectively indicate that changes in monsoon-driven surface water advection likely drive differing salinity responses to EAWM wind strength between the northern and southern Lombok Strait. Given that SCS surface waters obstruct surface ITF flow, such past variability in the EAWM influence on surface circulation likely impacts regional air-sea fluxes, precipitation patterns and the distribution of Indo-Pacific heat and buoyancy.