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Recent acceleration of Arabian Sea warming induced by the Atlantic-western Pacific trans-basin multidecadal variability

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The rapid warming of the Arabian Sea (AS) brings an increased risk of extreme weather and climate events, e.g., flood, heat wave and cyclone. AS warming has significantly accelerated since the 1990s, in particular in the spring season, stemming from the multidecadal variability of AS sea surface temperature (SST). Here, we show that this variability is closely related to the Atlantic multidecadal oscillation (AMO). A set of Atlantic pacemaker experiments with slab mixed-layer ocean model successfully reproduce the AS spring multidecadal variability and its connection with the AMO. An atmospheric teleconnection from the Atlantic to the AS in the preceding winter and associated thermodynamic air-sea feedback are found important. The teleconnection can be recreated by the atmospheric model when the SSTs of AMO and its trans-basin footprint over western Pacific (WP) are prescribed simultaneously. The WP SST warming associated with AMO positive phase induces a Gill-type Rossby wave response over the AS, showing an anomalous low and converging southerlies that weaken the winter northerly. A positive wind-evaporation-SST feedback further develops, leading to the AS SST anomalies being formed and maintained to the subsequent spring. The concurrent cold-to-warm phase shift of AMO and its WP SST footprint since the 1990s contributes constructively to the rapid warming of AS. Our results suggest a key role of trans-basin interactions in the attribution of historical regional SST warming and constraint of projected future warming.