

## Spiciness anomalies in the upper South Indian Ocean

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This study investigates generation and spreading of an isopycnal temperature/salinity (T/S), or spiciness, anomaly in the South Indian Ocean for the period from 2004 to 2015 using in-situ observations and an ocean reanalysis. Spiciness anomalies are large in magnitude along 15°S on 24-26  $\sigma_\theta$  and tend to propagate to the west at a speed similar to the westward South Equatorial Current (SEC), as is reported by a past research. The likeliest generation region of these spiciness anomalies is the southeastern Indian Ocean (25°S, 85°-110°E), where the 25  $\sigma_\theta$  surface outcrops in winter, and the anticyclonic subtropical circulation advects subducted water equatorward and feeds SEC. The production of spiciness anomalies is estimated based on the local T/S relationship and surface heat and freshwater fluxes, the result of which agrees well with spiciness anomalies observed at the outcrop line. The surface heat flux, in particular latent heat flux, takes a primary control, and the ocean tends to be anomalously warmed (or cooled) by the atmosphere in the years when positive (negative) spiciness anomalies are generated. It is discussed that Ningaloo Niño and El Niño-Southern Oscillations partly contribute to the surface heat flux anomalies in the ventilation region and thus the generation of spiciness anomalies.

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