Investigating interannual-decadal variability of Indian Ocean temperature transport in an eddy-resolving model

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In this study, the interannual-decadal variations of the meridional temperature transport in the Indian Ocean are examined using an eddy-resolving global ocean circulation model for the period 1979-2014. The first EOF mode of the meridional temperature transport is found to be highly influenced by remote forcing from ENSO in the Pacific through both oceanic and atmospheric waveguides, with stronger southward temperature transport during La Niña and weaker transport during El Niño. ENSO influences the southeast Indian Ocean steric height anomalies along the Australian coastal waveguide, whereas ENSO atmospheric teleconnection induces opposite steric height anomalies in the southwest tropical Indian Ocean, which act together to drive the meridional temperature transport variations of the southern Indian Ocean. In the tropical South Indian Ocean between Equator and 10°S, the steric height anomalies off Java and Sumatra is driven by the wind stress anomalies along the equatorial Indian Ocean and off Java and Sumatra, and the resultant geostrophic transport overcomes the direct Ekman contribution to drive meridional temperature transport across the Indian Ocean; in the tropical North Indian Ocean, the interannual-decadal variations in the meridional temperature transport are primarily associated with surface Ekman transport, driven by co-varying Indian Ocean Dipole wind variability with ENSO. The meridional temperature transport variability is significantly associated with the leading mode of Indian Ocean meridional overturning streamfunction, which corresponds to a deep circulation cell extending from 27°S across the Equator to about 20°N. A dynamical decomposition of the meridional streamfunction supports the different mechanisms of transport variability with latitude.