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Global wave number-4 pattern in the southern subtropics

Balaji Senapati¹, Mihir Dash¹, and Swadhin Behera²

¹Centre for Oceans, Rivers, Atmosphere and Land Sciences, Indian Institute of Technology Kharagpur, Kharagpur, West Bengal, India (senapatibalaji@gmail.com)

²Application Laboratory, VAiG, Japan Agency for Marine-Earth Science and Technology, Yokosuka, Kanagawa, Japan (behera@jamstec.go.jp)

Presence of a stationary zonal wavenumber-4 (W4) pattern is revealed in the sea surface temperature (SST) anomaly over southern subtropics (20°S-55°S) using empirical orthogonal function analysis. This W4 pattern is found to be seasonally phase-locked to the austral summer (persists up to mid-autumn) and independent of other known tropical and extra-tropical climate phenomena. A thermodynamic coupling of atmosphere and the upper ocean helps in generating the W4 pattern, which later terminates due to the breaking of the ocean-atmosphere positive feedback. Due to anomalous convection over western subtropical Pacific near the westerly jet, the signal appears first in the atmosphere during early November. Later, the disturbance gets trapped in the westerly waveguide which circumnavigates the globe and produces an atmospheric W4 pattern in early December (20-30 days later). Then, the signal transported to the ocean through the ocean-atmosphere feedback and sustained in the ocean (after it disappears from the atmosphere) as it has high specific heat capacity. During the positive phase of the W4 event, the cold SST anomaly develops over the southeastern and -western side (SE-NW) of Australia creating an anomalous divergence circulation. It favours the moisture transport towards the south-eastern region of the continent. Consequently, the specific humidity increases and causes an above-normal rainfall in a SE-NW axis over Australia. An opposite process is seen in case of a negative W4 event.