Ningaloo Niño/Niña: Mechanism, Predictability and Impacts

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Ningaloo Niño is associated with positive SST anomalies off the west coast of Australia. Because of its impacts on local precipitation and marine ecosystems, advancing our understanding of this phenomenon is a priority for the coming decade. It develops owing to local air-sea interaction and/or remote forcing from the El Niño/Southern Oscillation (ENSO). Based on a mixed-layer temperature balance calculation taking the mixed layer depth variation into account, it is shown that an anomalous meridional advection associated with the stronger Leeuwin Current and an enhanced warming by climatological shortwave radiation associated with a shallow mixed layer are two key mechanisms that lead to the development of Ningaloo Niño. The seasonal phase-locking nature of Ningaloo Niño/Niña is related to the seasonal variations of MLD and surface heat fluxes, which regulate the amplitude and sign of the sensitivity change to surface heat fluxes. It is also related to the seasonal variations of the Leeuwin Current and meridional temperature gradient through advection anomalies. Although Ningaloo Niño (Niña) events that co-occur with La Niña (El Niño) events were relatively well predicted by a coupled model owing to the high prediction skill of ENSO events, those developing independent of ENSO events could not be predicted. An intercomparison of the CMIP5 models suggests that further improvements in resolving this climate mode are required in many coupled models.