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Role of the phase transition of intraseasonal oscillation on the South China Sea summer monsoon onset

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The present study investigates the role of intraseasonal oscillation (ISO) on the South China Sea (SCS) summer monsoon onset based on the daily reanalysis data for a 33-year period from 1979 to 2011. The SCS summer monsoon (SCSSM) onset always occurs during the developing phase of ISO at which the ISO develops from inactive convection and easterly anomalies to active convection and westerly anomalies. In the SCSSM onset season (April–July), the change rate of the zonal winds of ISO over the SCS is around twice as large as the increase rate of the climatological westerly winds. Therefore, the monsoon onset, which is a process requiring the westerly winds to increase up to a certain threshold, only occurs during ISO's developing phase. Furthermore, the monsoon onsets tend to occur at the active (inactive) convection and developing phase of ISO in the early (late) onset years. In the early-onset years, a strong active phase of ISO is needed to prompt monsoon onset because of the undeveloped climatological easterly winds at the onset period, whereas in the late-onset years the developed climatological westerly winds will prompt the monsoon onset as long as the suppressive role of the inactive phase of ISO starts relieving. Due to the constraint of ISO's developing phase on the SCSSM onset, an earlier ISO's developing phase occurring in the monsoon onset season will induce an earlier SCSSM onset. The low-frequency variation, with a period greater than 90 days, can also modify the role of ISO's developing phase, especially when the developing phase of ISO occurs at the early season of the monsoon onset.