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Onset and Retreat Dates of the South China Sea Summer Monsoon and Their Relationships with the Monsoon Intensity in the Context of Climate Warming

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Global gridded daily mean data from the NCEP/NCAR Reanalysis (1948-2012) are used to obtain the onset date, retreat date and duration time series of the South China Sea summer monsoon (SCSSM) for the past 65 years. The summer monsoon onset (retreat) date is defined as the time when the mean zonal wind at 850hpa shifts steadily from easterly (westerly) to westerly (easterly) and the pseudo-equivalent potential temperature at the same level remains steady at greater than 335K (less than 335K) in the South China Sea area [110-120°E, (10-20°N)]. The clockwise vortex of the equatorial Indian Ocean region, together with the cross-equatorial flow and the subtropical high, plays a decisive role in the burst of the SCSSM. The onset date of the SCSSM is closely related to its intensity. With late (early) onset of the summer monsoon, its intensity is relatively strong (weak), and the zonal wind undergoes an early (late) abrupt change in the upper troposphere. Climate warming significantly affects the onset and retreat dates of the SCSSM and its intensity. With Climate warming, the number of early – onset (-retreat) years if the SCSSM is clearly greater (less), and the SCSSM is clearly weakened.