



Interdecadal change in the sub-seasonal variability over the EASM

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The monsoon rainfall over East Asia experiences different interdecadal changes after the late 1970s, between July and August. In details, the August rainfall exhibits a significant increasing trend, while the July rainfall does not show any interdecadal change. The possible cases on inducing the different interdecadal change are investigated in terms of tropical SST forcing, extratropical thermal state, and sub-seasonal basic flow. It was shown that the eastern Pacific (EP) and Indian Ocean (IO) warming produce a different response in July and August, due to the different thermal mean state in July and August. The EP warming induces a strong Pacific-Japan (PJ)-like pattern during July, while the IO warming prefers a Eurasian (EU)-like pattern during August. The former is weaker in August and the latter in July. The upper-tropospheric cooling over East Asia, which is an extratropical atmospheric forcing, has largely two impacts on the EASM rainfall and circulation. One is change in the meridional thermal gradient by the IO warming and upper-tropospheric cooling. It induces the enhancement of the upper-level zonal wind in the exit of Jet stream, and in turn, the EU-like pattern during July and August. The other impact is the change in the sub-seasonal basic flow. During only August, the significant warming occurs over the western North Pacific (WNP). The WNP warming and upper-tropospheric cooling conversely reduce the north-south thermal gradient in the WNP, and then induces a weakening in the vertical easterly shear. The weakened easterly shear during August interrupts the northward propagation of the Rossby wave. Eventually, the August rainfall exhibits a significant interdecadal change through the enhanced EU-like pattern, while the July rainfall has an insignificant interdecadal signal through the combined effect of two wave patterns (i.e. PJ and EU pattern).