Tropical Vs Extratropical Forcing on the Sub-seasonal Variability Over the Easm Region: A View of Interdecadal Change

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After the late 1970s, the EASM rainfall has experienced a distinct sub-seasonal change. 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 versus extratropical forcing. The observed evidence suggests that the eastern Pacific (EP) and Indian Ocean (IO) forcing produce a different response in July and August, due to the different thermal mean state in July and August. The EP forcing induces a strong Pacific-Japan (PJ)-like pattern during July, while the IO forcing generates a Eurasian (EU)-like pattern during August. 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).

Key words: East Asian summer monsoon, PJ pattern, EU pattern