

The summary of the atmospheric circulation over East Asia in summer 2007

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Abstract

The atmospheric circulation over East Asia is significantly different from the climatological conditions in summer 2007 and caused some extreme weather events climate in East Asia. For example, hot and dry weather were dominant in Mongolia and the northern part of China through this summer, extremely heavy rain hit around the Yellow Sea, the East China Sea and the Korean peninsula in August. Japan also experienced dry and hot June, wet and cool July, and dry and extremely hot August in 2007.

First of all, the La Niña event which began from last spring is pointed out as the background factor for the abnormal change of Asian summer monsoon system in 2007. Consistent with the La Niña conditions, convective activities in tropics were suppressed in the central and eastern equatorial Pacific. Meanwhile they were remarkably enhanced over the Arabian Sea in June, over the Maritime Continent in July and over the South China Sea in August. The monsoon circulation in the lower troposphere over the Indian Ocean was stronger than normal except for in the first half of June and the last half of July. The sub-tropical jet over Asia shifted southward in June and July, while it was strengthened at its normal position in August.

The atmospheric circulation in mid-August when the highest record of temperature was broken in Japan was worthy of special mention. The active convection area associated with the active phase of the MJO moved northward from near the Maritime continent to the north of the Philippines and the anticyclone which has been moving westward from the area of the mid-Pacific trough was enhanced in the south of Japan. Meanwhile the quasi-stationary Rossby wave propagated along the Asian jet and enhanced both the trough over the eastern China and the anti-cyclonic circulation around Japan. These two effects made a strong barotropic anticyclone over Japan.

To estimate how this anticyclone strengthened and maintained, the vorticity budget analysis was executed. It shows that the anticyclone which migrated from the area of the mid-Pacific trough was a Rossby wave. It also shows that the following three effects were important in the balance of the vorticity budget, the beta effect yielded by the strong southerly, the generation of anticyclonic vorticity by the upper troposphere divergence accompanied by active convection around the East China Sea and the eastward advection of anticyclonic vorticities in the upper troposphere.