

# Similarities and differences of summer persistent heavy rainfall and atmospheric circulation characteristics in the middle and lower reaches of the Yangtze River between 2016 and 1998

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During the summer of 2016 and 1998 in the context of the decaying phase of the super El Niño event, the three persistent heavy rainfall events occurred in the middle and lower reaches of the Yangtze River from June 19 to July 7 in 2016 (hereinafter referred to as during the period of 2016), from June 12 to 27 (hereinafter referred to as during the period I of 1998) in 1998, and from July 17 to August 2 (hereinafter referred to as during the period II of 1998) in 1998, which brought great challenges to the national flood control business. Based on daily precipitation at 2407 meteorological observation stations in mainland China, daily reanalysis atmospheric data from NCEP/NCAR and other data, we have conducted a comparative analysis of the similarities and differences of summer persistent heavy rainfall and associated atmospheric circulation characteristics in the middle and lower reaches of the Yangtze River between 2016 and 1998. Results are as follows. (1) The persistent heavy rainfall belt is the northernmost during the period of 2016 and the southernmost during the period I of 1998 among the three events, while the rainfall intensity during the period of 2016 is roughly the same as that during the period I of 1998, and it for both periods is stronger than that for the period II of 1998. (2) There are many similarities in the atmospheric circulation characteristics during the three periods of persistent heavy rainfall. For example, there exist low troughs near the eastern coast of China, the Northwest Pacific Subtropical High (NWPSH) and South Asia High (SAH) are larger in range and stronger in intensity than normal, and the intensity of the upper westerly jet (UWJ) and low southwest jet and the easterly water vapor transport along the south side of the NWPSH are also stronger than normal. (3) The significant differences in the atmospheric circulation during the three periods of persistent heavy rainfall events are that the low trough near the coastal of eastern China during the persistent heavy rainfall of 2006 (1998) is shallow (deep). When upper-level divergence zone between the north sides of NWPSH and SAH ridge lines and the south sides of westerly jet belt, low-level jet belt and shear line with convergence, and Australian High in the southern hemisphere are northerly (southerly) in position, the persistent heavy rainfall zones are also northerly (southerly). NWPSH, SAH, and upper-level westerly jet during the period of 2016 and the period I of 1998 are significantly stronger than those during the period II of 1998. The rainfall intensity in the former two periods is also greater than that in the later period.

Keywords: persistent heavy rainfall, atmospheric circulation, El Niño, the middle and lower reaches of the Yangtze River

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