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Heavy Rainfall Event in Mid-August 2020 in Southwestern China: Contribution of Anthropogenic Forcings and Atmospheric Circulation

Cheng Qian, Yangbo Ye, Wenxia Zhang, and Tianjun Zhou

AFFILIATIONS: Qian and Ye—Key Laboratory of Regional Climate–Environment for Temperate East Asia, Institute of Atmospheric Physics, Chinese Academy of Sciences, and University of Chinese Academy of Science, Beijing, China; **Zhang**—LASG, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China; **Zhou**—LASG, Institute of Atmospheric Physics, Chinese Academy of Sciences, and University of Chinese Academy of Science, Beijing, China

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Corresponding Author: Dr. Cheng Qian, qianch@tea.ac.cn
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Steps of the flow-analog method: 1) remove the nonlinear trend of all variables based on quadratic polynomial fitting, as done in Ye and Qian (2021); 2) calculate the spatial Pearson correlation coefficient of the detrended SLP anomaly between each day during 11–20 Aug 2020 and the same date ±30 days from 1960 to 2019, and then obtain the 10 best analogs for each day; 3) randomly pick one of these 10 best analogs for each day to reproduce a new sequence of 10 days, and then average these 10-day values; and 4) repeat step (3) 10,000 times.

To take into account the persistence of atmospheric circulation, we adopted the method described in Ye and Qian (2021) to objectively calculate the regional persistence and obtain Control-M.

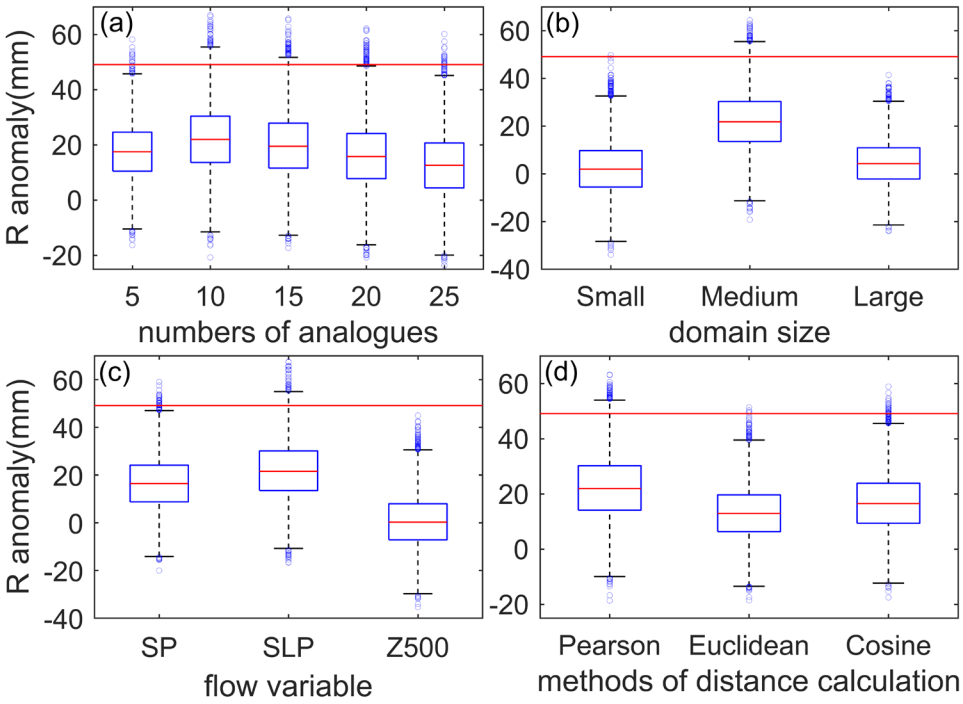

Fig. S1. Testing the parameters in the flow-analog method based on the probability distributions of the flow-conditioned detrended precipitation anomaly (mm) averaged over 11–20 Aug: (a) using different numbers of analogs, (b) using different domain sizes [shown in Fig. 1e: small, medium (used in this paper), and large]; (c) using different flow variables, and (d) using different methods of measuring the extent of circulation similarity: (left) the spatial Pearson correlation coefficient, (middle) the Euclidean distance, and (right) cosine similarity. The closer the flow-conditioned detrended total precipitation anomaly to the observed total precipitation anomaly (red lines in all panels), the better the parameter.

Changes in variability of regional precipitation under anthropogenic forcings: we compared the standard deviations of the detrended P_{region} on 11–20 Aug in southwestern China with and without anthropogenic forcings and found that the standard deviations tended to be larger with anthropogenic forcings than without. The median standard deviation was 31.0 under the historical simulation, whereas it was 29.8 under the historicalNat simulation.

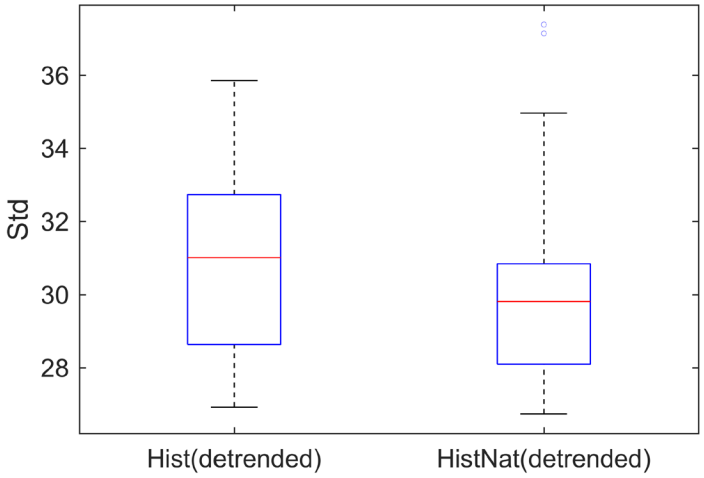

Fig. S2. Boxplot of standard deviations of detrended P_{region} on 11–20 Aug in southwestern China from 15 members of historical and historicalNat simulations for the period 1961–2013.

References

Ye, Y., and C. Qian, 2021: Conditional attribution of climate change and atmospheric circulation contributing to the record-breaking precipitation and temperature event of summer 2020 in southern China. *Environ. Res. Lett.,* **16,** 044058, https://doi.org/10.1088/1748-9326/abeeaf.