SUPPLEMENT

ATTRIBUTION OF THE 2017 NORTHERN HIGH PLAINS DROUGHT

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This document is a supplement to "Attribution of the 2017 Northern High Plains Drought," by Hailan Wang, Siegfried D. Schubert, Randal D. Koster, and Yehui Chang (*Bull. Amer. Meteor. Soc.*, **100**, S25–S29) • ©2019 American Meteorological Society • *Corresponding author:* Dr. Hailan Wang, hailan.wang-1@nasa.gov • DOI:10.1175/BAMS-D-18-0115.2

ESTIMATION OF SHIFT IN PROBABILITIES OF EXTREMES. The shift in probabilities of extremes between the two periods 1901–70 and 1980–2014 is defined as $[P(x_2 > x_c) - P(x_1 > x_c)]/P(x > x_c)$, where x_2 refers to values during the recent period (1980–2014) and x_1 refers to values during the earlier period (1901–70). The shift is normalized by $P(x > x_c)$, where x refers to values during the entire time period (1901–2014) and x_c is chosen so that $P(x > x_c)$ is 2.5%. The shift in probability for precipitation (surface air temperature) refers to the left (right) tail of the distribution [i.e., values less (greater) than x_c]. The shift from the early period to the recent period is rather small for precipitation (0.4 for the GEOS-5 AMIP simulations and −0.2 for the CAM5 AMIP simulations), and considerable for surface air temperature (2.1 for the GEOS-5 AMIP simulations and 1.9 for the CAM5 AMIP simulations).

ROLE OF THE LONG-TERM SST WARMING TREND IN THE 2017 SST-FORCED SURFACE WARMING ANOMALIES IN THE NORTHERN HIGH PLAINS. A rough assessment of the contribution of the long-term global SST warming trend to the SST-forced surface warming anomalies in the northern High Plains during May–July 2017 (e.g., blue line in Fig. 1e) is made based on the long-term CAM5 ensemble mean simulations. Here we assume that the long-term (1901–2017) trend of surface air temperature (T2M) in the northern High Plains in the CAM5 ensemble mean simulations is forced by the long-term trend in SST and thus reflects the effect of the SST warming trend. Our results show that the 2017 ensemble mean T2M anomaly (relative to the 1901–2014 climatology) in the northern High Plains is 1.5 K, whereas the estimated 2017 T2M anomaly due to the linear trend over 1901–2017 (obtained via a linear regression) is 1.2 K, suggesting that the long-term SST warming trend plays an important role in accounting for the 2017 SST-forced surface warm anomalies in the northern High Plains.

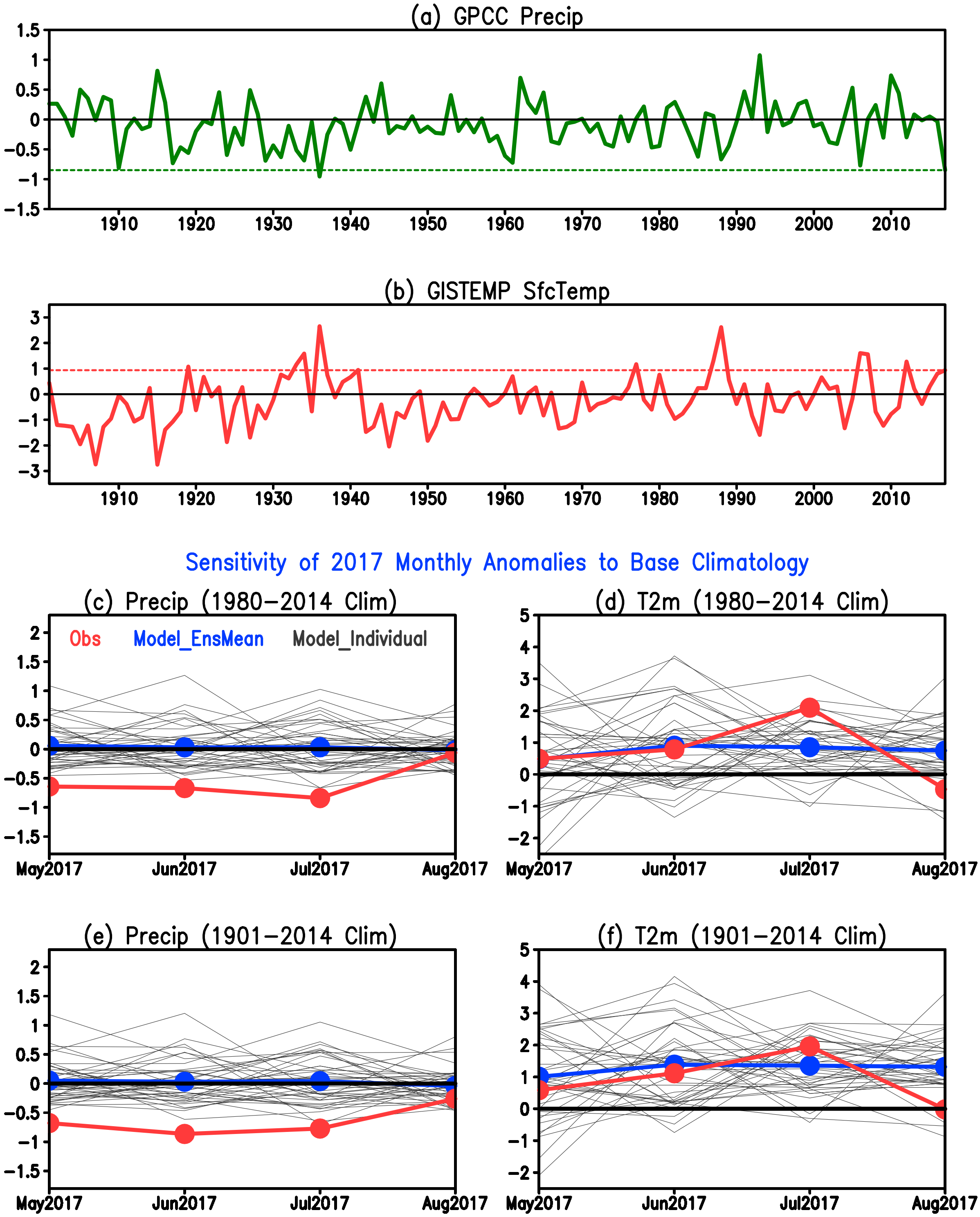

Fig. ES1. (a) The time series of May–July (MJJ) precipitation anomaly from GPCC averaged over the 2017 drought region (245°–265°E, 42°–53°N). The anomalies are obtained as the deviation from the 1980–2014 climatology. The magnitude of the 2017 precipitation deficit is indicated using the dashed line for easy comparison with other years. (b) As in (a), but for surface air temperature from NASA GISTEMP. (c) As in Fig. 1c, but for the 40-ensemble CAM5 AMIP simulations, with the 2017 monthly anomalies computed with respect to the 1980–2014 monthly climatology. (d) As in (c), but for surface air temperature. (e) As in (c), but the 2017 monthly anomalies are computed with respect to the 1901–2014 monthly climatology; GPCC precipitation is used for the observations. (f) As in (e), but for surface air temperature; NASA GISTEMP surface air temperature is used for the observations.

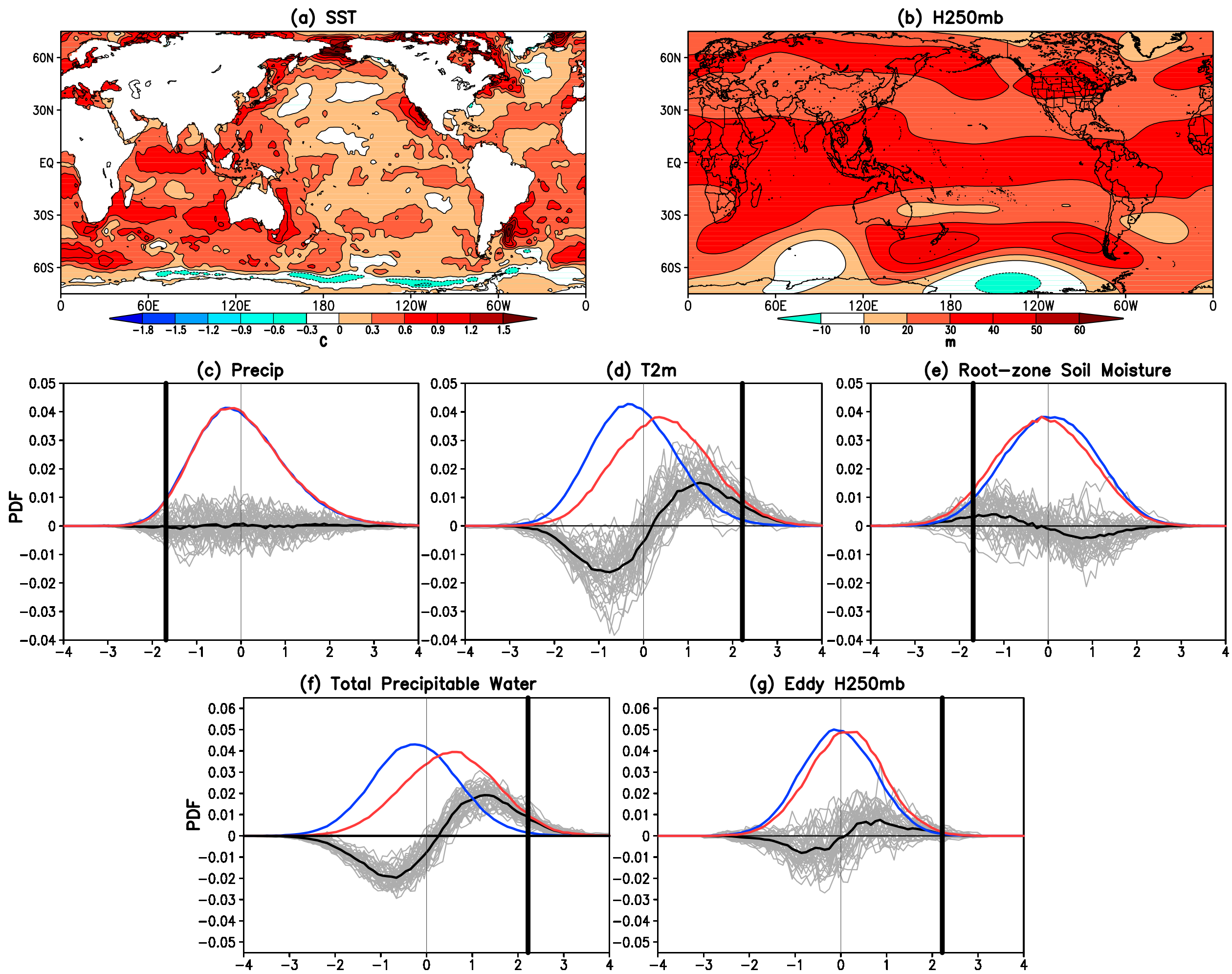

Fig. ES2. As in Fig. 2, but using the long-term 40-ensemble CAM5 AMIP simulations over the period 1901–2014. Note that the CAM5 AMIP simulations at NOAA/ESRL/PSD Climate Data Repository do not have SST available, so (a) plots the observed SST used for the long-term GEOS-5 simulations (i.e., it is identical to Fig. 2a).