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Contribution of changes in sea surface temperature and aerosol loading to the decreasing precipitation trend in Southern China

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The effects of increasing sea surface temperature (SST) and aerosol loading in a drought region in Southern China are studied using aerosol optical depth (AOD), low level cloud cover (LCC), visibility, and precipitation from observed surface data; wind, temperature, specific humidity and geopotential height from the NCEP/NCAR reanalysis fields; and SST from the NOAA archive data. The results show a warming of the SST in the South China Sea and the Indian Ocean, and a strengthening of the West Pacific Subtropical High (WPSH) in the early summer during the last 40 years, with the high pressure system extending further westward over the continent in Southern China. Because the early summer average temperature contrast between the land and ocean decreased, the southwesterly monsoon from the ocean onto mainland China weakened and a surface horizontal wind divergence anomaly occurred over Southern China stabilizing the boundary layer. Thus, less moisture was transported to Southern China, causing a drying trend. Despite this, surface observations show that AOD and LCC have increased, while visibility has decreased. Precipitation has decreased in this region in the early summer, consistent with both the second aerosol indirect effect (reduction in precipitation efficiency caused by the more numerous and smaller cloud droplets) and dynamically induced changes from convective to more stratiform clouds. The second aerosol indirect effect and increases in SST and greenhouse gases (GHG) were simulated separately with the ECHAM4 general circulation model (GCM). The GCM results suggest that both effects contribute to the changes in LCC and precipi-

tation in the drought region in Southern China. The flooding trend in Eastern China however is more likely caused by strengthened convective precipitation associated with increases in SST&GHG.