



Regional Contrasts of the Warming Rate over Land Significantly Depend on the Calculation Methods of Mean Air Temperature

Kaicun Wang and Chunlüe Zhou

Beijing Normal University, College of global change and earth system science, Beijing, China (kcwang@bnu.edu.cn)

Global analyses of surface mean air temperature (T_m) are key datasets for climate change studies and provide fundamental evidences for global warming. However, the causes of regional contrasts in the warming rate revealed by such datasets, i.e. enhanced warming rates over the northern high latitudes and the "warming hole" over the central U.S., are still under debate. Here we show these regional contrasts depends on the calculation methods of T_m . Existing global analyses calculated T_m from daily minimum and maximum temperatures (T_2). We found that T_2 has a significant standard deviation error of $0.23\text{ }^\circ\text{C/decade}$ in depicting the regional warming rate from 2000 to 2013 but can be reduced by two-thirds using T_m calculated from observations at four specific times (T_4), which samples diurnal cycle of land surface air temperature more often. From 1973 to 1997, compared with T_4 , T_2 significantly underestimated the warming rate over the central U.S. and overestimated the warming rate over the northern high latitudes. The ratio of the warming rate over China to that over the U.S. reduces from 2.3 by T_2 to 1.4 by T_4 . This study shows that the studies of regional warming can be substantially improved by T_4 instead of T_2 .