

Development of CMA_LSAT dataset and Comparisons of time series of annual mean surface air temperature for China since the 1900s

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Abstract

A new dataset of integrated and homogenized monthly surface air temperature over global land for the period since 1900 (China Meteorological Administration global Land Surface Air Temperature (CMA_LSAT)) is developed. In total, 14 sources have been collected and integrated into the newly developed dataset, including three global (CRUTEM4, GHCN, and BEST), three regional and eight national sources. Duplicate stations are identified, and those with the higher priority are chosen or spliced. Then, a consistency test and a climate outlier test are conducted to ensure that each station series is quality controlled. Next, two steps are adopted to assure the homogeneity of the station series: (i) homogenized station series in existing national datasets (by National Meteorological Service) are directly integrated into the dataset without any changes (50% of all stations), and (ii) the inhomogeneities are detected and adjusted for in the remaining data series using a penalized maximal t test (50% of all stations). Based on the dataset, we reanalyze the temperature changes during the period 1900–2014. The best estimates of warming trends for 1900–2014 (with uncertainties at the 95% confidence range) are approximately 0.102 ± 0.006 °C/decade for the whole year, and 0.104 ± 0.009 , 0.112 ± 0.007 , 0.090 ± 0.006 , and 0.092 ± 0.007 °C/decade for the DJF (December, January, February), MAM, JJA, and SON seasons, respectively.

A number of studies have developed several national and regional SAT series for China, but due to the diversity of meteorological observational sites, different quality control routines for data and the inconsistency of statistical methods used, they differ in long-term trends. This paper assesses the similarities and differences of the existing time series of the annual average SAT for China that are based upon historical meteorological observations since the 1900s. The results indicate that the China average is similar to the series for the Northern Hemisphere (NH) landmass, except that the initial warming of the NH series derived from the CRUTEM3/4 datasets ends earlier (before the early 1940s) than in China's series. A major

difference among the existing China average time series is the 1940s warmth, a period when there were very few observations across the country due to World War II. The SAT anomalies for China during the 1930s-1940s have been reduced by improved homogeneity assessment compared to previous estimates. The new improved time series is in better agreement with both the historical 20th century reanalysis data and the historical climate simulation of CMIP5 models. The new time series also shows the slowdown of the warming trend during the past 18 years (1998-2015). The best estimate of a linear trend for increases in temperature with a 95% uncertainty range is 0.121 ± 0.009 °C per decade for 1900-2015, indicating that the improved homogeneity assessment for China leads to a slightly greater trend than that based on raw data (0.107 ± 0.009 °C per decade).

Further reading:

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