Global temperature trend biases and statistical homogenization methods

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In an accompanying presentation we show that well-homogenized national datasets warm more than temperatures from global collections averaged over the region of common coverage. Here we present additional work about possible causes of temperature trend biases and shortcomings of relative statistical homogenization methods.

There are several possible causes of cooling biases, which have not been studied much. Siting could have improved. Increases in irrigation could lead to a spurious cooling trend. Early thermometer screen have a warm bias compared to Stevenson screens. Currently we are in a transition to Automatic Weather Stations. The net global effect of this transition is not clear at this moment.

The latter two transitions are difficult to homogenize using relative statistical homogenization because the entire network is affected. In the Global Historical Climate Network (GHCNv3), homogenization does not change the global mean temperature much in these periods.

Previous validation studies of statistical homogenizations unfortunately have some caveats. The main problem is that the used artificial datasets had a relatively large and too optimistic signal to noise ratio (SNR). Our recent work on multiple breakpoint detection methods shows that real-world SNRs may be as small as about 0.5. For these realistic cases, statistically significant breaks are identified, but the corresponding segmentation is about as good as a random segmentation.

The joint correction method using a decomposition approach (ANOVA) can remove the bias when all breaks (predictors) are known. Any error in the predictors will, however, lead to a systematic undercorrection of any large-scale trend bias.