Simultaneous Treatment of Random and Systematic Errors in the Historical Radiosonde Temperature Archive

Joshua M. Browning[1] and Amanda S. Hering[1]

November 3, 2014

Abstract

The historical radiosonde temperature archive, and indeed any large and lengthy observational dataset, must be quality controlled before it can be used properly. Most research on quality control for such data focuses on the identification and removal of either systematic errors (homogenization) or random errors without considering an optimal process for treatment of both. Additionally, little has been done to evaluate homogenization methods applied to sub-daily data, and no research exists on using robust estimators in homogenization procedures. In this paper, we simulate realistic radiosonde temperature data and contaminate it with both systematic and random errors. We then evaluate (1) the performance of several homogenization algorithms and (2) the sequence in which the random and systematic errors are identified and corrected. In our simulations we find that the robust Standard Normal Homogeneity Test (SNHT) that we introduce performs better than the traditional SNHT, and it is better than several other modern alternatives. Moreover, we find that systematic errors present in the data lead to poorer performance of random error removal algorithms, but the presence of random errors in the data is not as detrimental to homogenization algorithms.

Some keywords: Change Point Detection; Homogenization; Outlier Detection; Radiosonde Temperature Data

Short title: Simultaneous Random and Systematic Error Detection

[1]Department of Applied Mathematics and Statistics, Colorado School of Mines, Golden, CO 80401, USA. 303.384.2462,
E-mail: {jbrownin, ahering}@mines.edu