Comparison of Collocated Automated (NCECONet) and Manual (COOP) Climate Observations in North Carolina

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ABSTRACT

The National Weather Service's Cooperative Observer Program (COOP) is a valuable climate data resource that provides manually observed information on temperature and precipitation across the nation. These data are part of the climate dataset and continue to be used in evaluating weather and climate models. Increasingly, weather and climate information is also available from automated weather stations. A comparison between these two observing methods is performed in North Carolina, where 13 of these stations are collocated. Results indicate that, without correcting the data for differing observation times, daily temperature observations are generally in good agreement (0.96 Pearson product–moment correlation for minimum temperature, 0.89 for maximum temperature). Daily rainfall values recorded by the two different systems correlate poorly (0.44), but the correlations are improved (to 0.91) when corrections are made for the differences in observation times between the COOP and automated stations. Daily rainfall correlations especially improve with rainfall amounts less than 50 mm day^{-1}. Temperature and rainfall have high correlation (nearly 1.00 for maximum and minimum temperatures, 0.97 for rainfall) when monthly averages are used. Differences of the data between the two platforms consistently indicate that COOP instruments may be recording warmer maximum temperatures, cooler minimum temperatures, and larger amounts of rainfall, especially with higher rainfall rates. Root-mean-square errors are reduced by up to 71% with the day-shift and hourly corrections.

This study shows that COOP and automated data [such as from the North Carolina Environment and Climate Observing Network (NCECONet)] can, with simple corrections, be used in conjunction for various climate analysis applications such as climate change and site-to-site comparisons. This allows a higher spatial density of data and a larger density of environmental parameters, thus potentially improving the accuracy of the data that are relayed to the public and used in climate studies.

1. Introduction

Accurate and reliable weather and climate information are important in many areas of society—in government, economy, agriculture, tourism, water resources, and emergency response, to name a few. Climate observing stations such as the Cooperative Observer Program [(COOP): managed by the National Weather Service (NWS)] have been used for over a century to provide temperature and precipitation information to operational weather forecasters, researchers, and the public. The COOP stations are the backbone of climate change studies and have the advantage of long periods of record (with several providing over 100 years of data). The COOP data are thus well established and generally accepted as invaluable data sources in the climate community, often providing a good density of coverage.

Currently, there is a growing trend of state-based automated networks that report hourly observations for a wide range of parameters (e.g., Alabama, California, Colorado, Florida, Georgia, Illinois, Indiana, North Carolina, Oklahoma, Washington, etc.). One such system in North Carolina is the North Carolina Environment and Climate Observing Network (NCECONet), which is operated and maintained by the State Climate Office of North Carolina (SCO-NC; information available online at http://www.nc-climate.ncsu.edu). A num-

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