

5.4 UNITED STATES CLIMATE REFERENCE NETWORK (USCRN) PRECIPITATION INTERCOMPARISON STUDY

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1. Introduction

The U. S. Climate Reference Network (USCRN) is a NOAA sponsored network and research initiative. During the initial phases of the program (FY 02 and FY 03), a number of instrumentation suites will be deployed to test and evaluate the initial configuration of the system in locations across the United States in order to expose the instrumentation to various climate regimes. Eventually, a much larger network of these high quality climate-observing systems will be deployed throughout the nation.

The first and foremost objective of the USCRN instrument suite is to provide benchmark quality air temperature and precipitation measurements free of time-dependent biases and the development of transfer functions between different observing systems within the U. S.

The purpose of this paper is to describe an experiment to examine the biases in the measurement of frozen and liquid precipitation for the various precipitation measurement systems utilized in different observing networks. This study is being conducted at the National Weather Service (NWS) test facilities in Sterling, VA and Johnstown, PA.

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The quantification of these biases will improve the initialization of hydrological models and forecasts, as well as provide a higher degree of confidence in understanding long term trends of precipitation. This study is a cooperative effort with Atmospheric Turbulence and Diffusion Division (ATDD), NWS, and the National Climatic Data Center (NCDC). Candidate instruments will include the present configurations of raingauge and shield used by the USCRN, Automated Surface Observing System (ASOS), and Cooperative Observing Network (COOP). In addition there will be the candidate replacement for ASOS, the NWS manual 8" gauge and the proposed backup USCRN gauge.

2. Initial Instrumentation Configuration

The more comprehensive experiment will be conducted at the Sterling facility. The experimental plan minimizes the distance between the measurements of precipitation for the purpose of reducing spatial variability that is inherent in precipitation events and any wind shadowing effects. The Johnstown experiment will concentrate on frozen precipitation events.

Initial instrumentation will include the current configuration of precipitation gauges and associated wind shields and temperature sensors used by the ASOS,

COOP, and USCRN networks. The ASOS candidate replacement precipitation gauge and wind shield, as well as the candidate secondary gauge for the USCRN will be part of these studies. The NWS 8" manual gauge with a standard Double Fence Intercomparison Reference (DFIR) will act as the standard reference gauge. The current standard USCRN instrument suite, less the GOES transmitter, including the Geonor w/three vibrating wires (3VW) and the controlled heater device centered inside a Small Double Fence Intercomparison Reference (SDFIR) with a Single Alter (SA) will be installed at both the Sterling and Johnstown test facilities. The NWS already has instruments installed at the Sterling and Johnstown test facilities.

The precipitation gauge configuration at Johnstown, PA will consist of the existing NWS gauge installations (at a minimum) and at least one USCRN Geonor w/SDFIR-SA and the candidate USCRN back-up gauge.

3. USCRN Instrument Tower Configuration

There will be one standard USCRN instrumentation suite. A NWS heated sonic anemometer will be added to ensure that there will be wind speed and direction measurements, particularly useful during freezing or frozen precipitation events. The current standard configured USCRN instrument suite, less the GOES transmitter, will be installed to include the data logger, batteries, lightning suppressor, three temperature sensors each in a mechanically aspirated shield, wind speed, global solar radiation, and surface (IR) skin temperature sensors, all

installed at 1.5m above the surface of the ground.

4. Calibration Procedures

Sensors will be calibrated in accordance with the traceable procedures adopted by the USCRN for each sensor. NWS will utilize their calibration and periodic maintenance procedures for the NWS sensors. Each sensor will be calibrated prior to the start of the research project or phase. Calibration checks will be performed as deemed appropriate. These calibration values will be recorded and become part of the metadata records for the research project.

5. Analysis of Precipitation Bias Study

The precipitation comparison will be done for various time scales. Precipitation rates will be compared on 1, 5, and 60-minute intervals. In addition, daily precipitation totals (midnight to midnight) will also be compared. The differences among the various shield configurations will be investigated to determine whether or not the observed differences may vary depending on the type of precipitation event (convective vs. frontal), wind speed, and the form of precipitation (frozen vs. liquid).

Transfer functions will be developed between the different precipitation systems for both liquid and solid precipitation. Phase one will end one year from the start date to determine if there is sufficient data to ascertain statistically significant transfer functions between the systems.

All data from both study facilities will be accessible via the Internet. The data will also be provided to other USCRN-NWS collaborators. Long-term archive of the data and subsequent analysis and

reports will be the responsibility of the NCDC. Data from the research conducted at the Sterling and Johnstown test facilities will be archived at NCDC.