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DOE/SC-ARM-20-001

National Weather Service Radiosonde Evaluation Field Campaign Report

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ARM

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Acronyms and Abbreviations

ARM	Atmospheric Radiation Measurement
CFH	cryogenic frostpoint hygrometer
COTS	commercial off-the-shelf
FAR	Federal Aviation Regulation
GPS	Global Positioning System
NWS	National Weather Service
SFSC	Sterling Field Support Center
SGP	Southern Great Plains
TRS	Telemetry Receiving System

Contents

1.0 Summary

The purpose of the campaign was to perform a full evaluation of participating vendor's radiosondes to qualify for potential use in the National Weather Service (NWS) upper air field operations. The NWS has specific requirements that vendors systems were evaluated against to determine if the vendor's radiosonde performs within specifications. For this evaluation, the NWS was pursuing commercial off-the-shelf (COTS) ground/tracking systems in the 403 MHz frequency band over the previously used Telemetry Receiving System (TRS) and house-built software using the 1680 MHz frequency. The U.S. Department of Energy Atmospheric Radiation Measurement (ARM) user facility's Southern Great Plains (SGP) observatory served as the warm and dry test region. The radiosondes were assessed for precision of the radiosonde (unit under test versus itself) and accuracy of the radiosonde's humidity measurements (unit under test versus a cryogenic frostpoint hygrometer [CFH]).

During the campaign, conducted August 5–16, 2019, the Sterling Field Support Center (SFSC) personnel launched up to six weather balloon flights per day. Two teams, a day shift and an evening shift, prepared, launched, and monitored COTS systems during the flights. SFSC staff flew a 4- or 5-sonde crossbeam configuration during each flight, treating each sonde as a package with the total maximum weight of the payload of 4.9 lbs, satisfying the requirement of the Federal Aviation Regulation (FAR), §101.1, Part 4 (ii and iii) of 6 and 12 lbs.

To perform a launch, the SFSC used custom-made crossbeams and used either a 1000- or 1500-gram weather balloon. The configuration of the radiosondes on the crossbeam depended on the comparison test type. Once the balloon was filled and the flight train prepared, the crossbeam was attached to the flight train. The radiosondes were powered on and baselined confirming that the ground systems are receiving 1-second data and GPS signal. The radiosondes were then hung 1 meter below the crossbeam with 1 meter between each sonde to account for swaying and the pendulum effect. The individual COTS systems collected the radiosonde data, the data were monitored throughout the flight by SFSC staff, and once the flight has terminated, the data were archived, saved, and stored for data processing. The different methods for data processing include:

1. Precision – determine the variability between two identical instruments under test in the same environment.
2. Satellite – used as a consensus reference and could be used for a long-term continuity study.
3. Reference – determine the relative humidity differences between the unit under test and the reference (CFH).

2.0 Results

Results are proprietary.

3.0 Publications and References

None.

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