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Data Completeness/Quality Report

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Los Alamos National Laboratory Meteorology Monitoring Program: 2014 Data Completeness/ Quality Report

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ABSTRACT

This report summarizes data completeness by tower and by instrument for 2014 and compares that data to the Los Alamos National Laboratory (LANL) and American National Standards Institute (ANSI) 2010 standards. This report is designed to make data users aware of data completeness and any data quality issues. LANL meteorology monitoring goals include 95% completeness for all measurements. The ANSI 2010 standard requires 90% completeness for all measurements. This report documents instrument/tower issues as they impact data completeness.

INTRODUCTION

LANL operates four mesa-top meteorology towers: Technical Area (TA) 6, TA-49, TA-53, and TA-54. A description of the meteorology monitoring network is found in LANL (2014). All towers are instrumented at 1.2 meters (m), 11 m, 23 m, and 46 m. In addition, TA-6 is instrumented at 92 m. Data are collected every 15 minutes. Range checking is done on each measurement every 15 minutes; data that are beyond normal ranges are eliminated from the data set and replaced by a code for missing data. In addition, data are reviewed weekly by a meteorologist to identify bad data not identified by range checking. The data analyst eliminates these data from the data set and replaces them with a code for missing data. The instrument technician also reviews that data and schedules instrument replacement as required. Data completeness is determined by the number of total 15-minute records available versus the total number of possible measurements for the entire year. As a rule, LANL Environmental Compliance Programs (ENV-CP) subject matter experts do not attempt to estimate data that are eliminated as bad data. Original datalogger records, containing bad data, can be recalled from program archival storage.

The majority of missing data occur for short periods of time due to:

- towers being down for instrument swap out/calibration
- tower hoist inspections
- power failures/network communication issues
- freezing of wind propellers in snowstorms
- temperature probe aspiration fan failure
- battery failure for solar/terrestrial radiation instruments

Only other primary instrumentation failures will be documented in this report.

TA-6

Summary of TA-6 2014 data completeness:

Sensor	Tower Levels	Data Completeness
Wind Speed	1–4	>99%
Wind Direction	1	94%
Wind Direction	2–4	>99%
Vertical Wind Speed	1–4	>99%
Temperature	0–4	>99%
Pressure	0	>96%
Relative Humidity	0	>99%
Dew Point Temperature	0	>99%
Precipitation	0	>99%
Snow Depth	0	95%
Shortwave (incoming)	0	>99%
Shortwave (reflected)	0	>99%
Longwave (incoming)	0	96%
Longwave (outgoing)	0	86%
Fuel Moisture	0	70%

The majority of TA-6 tower instruments had outstanding data completeness (>95%) in 2014. The exceptions were the longwave (outgoing), fuel moisture, and level 1 wind direction measurements. The longwave (outgoing) measurement sensor required rewiring due to the age of the instrument set up. Because of other work priorities, rewiring was not accomplished until February 18, 2014.

The datalogger collecting fuel moisture data had a datalogger program and communication failure in July 2013. The datalogger was repaired and data collection recommenced in April 2014.

The TA-6 level 1 wind direction sensor failed the June 2014 calibration tests for three wind directions, NNE, NE, and ENE. The instrument uncertainty is 3 degrees and the program requirement is 5 degrees. Because this error probably developed over time, we were not able to determine the exact date/time when the sensor began to fail. Thus, the level 1 wind direction measurements for these wind directions were eliminated from the 2014 dataset for January 1 through June 5, when new sensors were installed. The level 1 wind direction data are still useable since we have 94% of all measurements and exceed the 90% ANSI/program completion value.

TA-41

Summary of TA-41 2014 data completeness:

Sensor	Tower Levels	Data Completeness
Wind Speed	1-2	>97%
Wind Direction	1-2	>97%
Vertical Wind Speed	1-2	>97%
Temperature	0-1	>95%
Shortwave (incoming)	0	>97%

TA-41 tower instrument data completeness for 2014 met program requirements; however, the control panel that operates the tower telescoping system failed in July 2014 and we were not able to lower the tower for the spring or fall calibration cycle. Thus, we did not meet our User Calibration Plan requirement of calibrating the wind instruments every six months. The control panel will be repaired prior to the March 2015 calibration cycle and all instruments will be calibrated at that time. Because of the canyon bottom location, which essentially limits the wind data to up/down canyon directions, we are confident that with routine monitoring of the data, the instruments are performing adequately. If we are unable to repair the control panel, we will abandon the tower.

TA-49

Summary of TA-49 2014 data completeness:

Sensor	Tower Levels	Data Completeness
Wind Speed	1-3	98%
Wind Direction	1-3	98%
Vertical Wind Speed	1-3	98%
Temperature	0-3	98%
Relative Humidity	0	98%
Dew Point Temperature	0	98%
Precipitation	0	98%
Shortwave (incoming)	0	98%

TA-49 tower instruments had excellent completeness in 2014.

TA-53

Summary of TA-53 2014 data completeness:

Sensor	Tower Levels	Data Completeness
Wind Speed	1–3	>99%
Wind Direction	1–3	>99%
Vertical Wind Speed	1–3	>99%
Temperature	0-3	>99%
Relative Humidity	0	>99%
Dew Point Temperature	0	>99%
Precipitation	0	85%
Shortwave (incoming)	0	>99%

The TA-53 tower instruments had outstanding data completeness (>99%) in 2014.

The TA-53 tipping bucket rain gage failed completely in December of 2014, due to the failure of the switch that records each tip of the rain gage. Because the switch failed gradually over time, there is not a specific date to identify when it went bad. We reviewed the precipitation values from the Los Alamos Airport, located 0.75 miles to the northwest of TA-53 and approximately 150 feet higher in elevation. We estimate that the switch on the TA-53 tipping bucket began to fail in November. The data after November 3, 2014, are considered to be underestimates and we identified these data as missing for the completion calculation. There were only six days when precipitation was recorded at the Los Alamos Airport during this period, so 85% completeness is an underestimate.

TA-54

Summary of TA-54 2014 data completeness:

Sensor	Tower Levels	Data Completeness
Wind Speed	1–3	91%
Wind Direction	1–3	91%
Vertical Wind Speed	1–2	91%
Vertical Wind Speed	3	86%
Temperature	0–3	>99%
Pressure	0	>99%
Relative Humidity	0	>99%
Dew Point Temperature	0	>99%
Precipitation	0	>99%
Shortwave (incoming)	0	>99%
Shortwave (reflected)	0	>99%
Longwave (incoming)	0	97%
Longwave (outgoing)	0	>98%

TA-54 wind instruments did not meet program completion goals (95%) during 2014; however, with the exception of the level 3 vertical wind speed instrument, all wind parameters met the ANSI 2010 requirement of 90% data completion. The lower completion rate (91%) reflects a number of issues/operations during 2014. These included:

- Initial wiring of the tower for a datalogger upgrade and upgrade to DSL network communications. To assure correct operation of the new datalogger, it will be run side-by-side with the old datalogger for a period of months.
- Taking the tower off-line for two 6-month calibration periods.
- Additional tower downtime for datalogger calibrations (in the future, these calibrations will be conducted with the regular instrument calibrations to minimize downtime).
- Taking the tower down to replace the level 3 vertical speed sensor.

The level 3 vertical wind instrument that was installed on May 21, 2014, met calibration requirements prior to installation; however, the instrument began to fail shortly after installation and it was replaced with a new instrument on June 12. Subsequent calibration of the instrument identified a failure point on the instrument between two specified calibration wind speeds. We believe the instrument had a defect when delivered from the manufacturer and that type of defect would typically not be identified until installation.

All temperature, humidity, precipitation, and insolation measurements met program completion goals.

OTHER SAMPLING LOCATIONS

LANL monitors precipitation at the North Community station. Data completeness was 96% for 2014.

REFERENCE

LANL 2014: Meteorology Monitoring at Los Alamos, Los Alamos National Laboratory report LA-UR-14-23378, Los Alamos, New Mexico, May 2014.