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Los Alamos National Laboratory Meteorology Monitoring Program: 2016 Data Completeness/ Quality Report

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ABSTRACT

This report summarizes data completeness by tower and by instrument for 2016 and compares that data with the Los Alamos National Laboratory (LANL) and American National Standards Institute (ANSI) 2015 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 2015 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) 06, TA-49, TA-53, and TA-54. An additional tower is located in Mortandad Canyon (TA-5 MDCN), and a rain gauge at North Community (NCOM).

A description of the meteorology monitoring network is found in Dewart and Boggs (2014). Mesa-top towers are instrumented at 1.2 meters (m), 11 m, 23 m, and 46 m. In addition, TA-06 is instrumented at 92 m. The TA-5 MDCN tower is 10 m in height and is instrumented at 1.5 m and 10 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 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 as a result of:

- towers down for instrument swap out/calibration
- tower hoist inspections
- power failures/network communication issues
- wind propellers freezing 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.

Summary of 2016 data completeness for all stations to meet 90% annual completeness

Sensor	TA-06	TA-49	TA-53	TA-54	TA-05	NCOM
Wind Speed Level 1	✓	✓	✓	✓	✓	
Wind Speed Level 2	✓	✓	✓	✓		
Wind Speed Level 3	✓	✓	✓	✓		
Wind Speed Level 4	✗					
Wind Direction Level 1	✓	✓	✓	✗	✓	
Wind Direction Level 2	✗	✓	✓	✓		
Wind Direction Level 3	✓	✗	✓	✓		
Wind Direction Level 4	✗					
Vertical Wind Speed Level 1	✓	✓	✓	✓	✓	
Vertical Wind Speed Level 2	✓	✓	✓	✗		
Vertical Wind Speed Level 3	✓	✓	✓	✓		
Vertical Wind Speed Level 4	✗					
Temperature Level 0	✓	✓	✓	✓	✓	
Temperature Level 1	✗	✗	✓	✓	✓	
Temperature Level 2	✗	✓	✓	✓		
Temperature Level 3	✗	✓	✓	✓		
Temperature Level 4	✗					
Pressure Level 0	✓			✓		
Relative Humidity Level 0	✓	✓	✓	✓	✓	
Dew Point Temperature Level 0	✓	✓	✓	✓	✓	
Precipitation Level 0	✓	✓	✓	✓		✓
Snow Depth Level 0	✗					
Shortwave (incoming) Level 0	✓	✓	✓	✓	✓	
Shortwave (reflected) Level 0	✓			✓		
Longwave (incoming) Level 0	✓			✓		
Longwave (outgoing) Level 0	✓			✓		
Fuel Moisture Level 0	✓					

TA-6

Summary of TA-6 2016 data completeness

Sensor	Tower Levels	Percentage Complete
Wind Speed	1	95%
Wind Speed	2	91%
Wind Speed	3	95%
Wind Speed	4	76%
Wind Direction	1	90%
Wind Direction	2	86%
Wind Direction	3	90%
Wind Direction	4	71%
Vertical Wind Speed	1	95%
Vertical Wind Speed	2	91%
Vertical Wind Speed	3	94%
Vertical Wind Speed	4	76%
Temperature	0	94%
Temperature	1	86%
Temperature	2	81%
Temperature	3	84%
Temperature	4	69%
Pressure	0	98%
Relative Humidity	0	97%
Dew Point Temperature	0	93%
Precipitation	0	>99%
Snow Depth	0	86%
Shortwave (incoming)	0	98%
Shortwave (reflected)	0	98%
Longwave (incoming)	0	96%
Longwave (outgoing)	0	98%
Fuel Moisture	0	>99%

Eight of the TA-6 tower instruments did not meet 90% data completeness for 2016. On June 20, the work began for converting to a CR3000 datalogger at TA-6 and most data issues were resolved by June 28, except temperature and wind direction issues continued until July 15. This resulted in multiple instruments not meeting the 90% data completeness.

During an instrument change out on October 19, the level 4 instrument boom did not engage because the plunger assembly was bent and unable to connect. This resulted in the wind direction and speed, vertical wind speed, and temperature at level 4 to not meet the 90% data completeness. The issue was fixed on January 12, 2017.

TA-49

Summary of TA-49 2016 data completeness

Sensor	Tower Levels	Percentage Complete
Wind Speed	1 – 3	97%
Wind Direction	1, 2	97%
Wind Direction	3	39%
Vertical Wind Speed	1 – 3	>95%
Temperature	0	97%
Temperature	1	82%
Temperature	2	90%
Temperature	3	96%
Relative Humidity	0	97%
Dew Point Temperature	0	96%
Precipitation	0	98%
Shortwave (incoming)	0	98%

TA-49 had two instruments not meet 90% completeness in 2016. Temperature issues occurred throughout the year at levels 1 and 2 and resulted in several hours of temperature data to be eliminated from the dataset. The temperature issues were fixed after replacing the connectors on the temperature sensors to help eliminate continuity issues.

The level 3 wind direction was eliminated from March to October 2016 as a result of a failed calibration by 11–12°. It is not possible to identify a specific failure time during the six-month operational period. Thus, the level 3 wind direction data were eliminated from the dataset for the entire six-month period.

TA-53

Summary of TA-53 2016 data completeness

Sensor	Tower Levels	Percentage Complete
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	>99%
Shortwave (incoming)	0	>99%

All TA-53 tower instruments exceeded the 90% data completeness in 2016.

TA-54

Summary of TA-54 2016 data completeness

Sensor	Tower Levels	Percentage Complete
Wind Speed	1 – 3	>99%
Wind Direction	1	79%
Wind Direction	2, 3	>99%
Vertical Wind Speed	1, 3	>99%
Vertical Wind Speed	2	79%
Temperature	0 – 3	>98%
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	>99%
Longwave (outgoing)	0	>99%

TA-54 temperature, pressure, relative humidity, dew point, precipitation, and radiation variables had excellent completeness records in 2016.

The wind direction at level 1 and the vertical wind speed at level 2 at TA-54 did not meet required specification as the instruments failed the March calibration tests. The vertical wind speed failed in all four wind speeds and the wind direction failed in six directions.

TA-5 MDCN

Summary of TA-5 MDCN 2016 data completeness

Sensor	Tower Levels	Percentage Complete
Wind Speed	1	>99%
Wind Direction	1	>99%
Vertical Wind Speed	1	>99%
Temperature	0, 1	>99%
Shortwave (incoming)	0	>99%

All TA-5 MDCN tower instruments exceeded 99% data completeness in 2016.

NCOM

The NCOM rain gauge exceeded 99% data completeness for 2016.

REFERENCE

Dewart, J. and M. Boggs 2014: "Meteorological Monitoring at Los Alamos," Los Alamos National Laboratory report LA-UR-14-23378.