

NERR MET 97-99 Anomalous Data Documentation

This section identifies data that have been determined to be inaccurate and removed from the final data set by the Data Manager, provides justification for the removal of the inaccurate data, and identifies “questionable” data. Questionable or suspect data are data that may be compromised in quality but remain in the data set. Wherever possible, both questionable and inaccurate data are correlated with information from relevant documentation that may help to explain any problems with the data. In general, the only source of documentation is the CR10x datalogger program itself. Each change made to the program or the weather station should be noted as a comment at the beginning of the program. Unfortunately, this documentation was often incomplete. Current (2002) documentation procedures are much more stringent. Data that have been removed from the final data set are still present in unedited and/or raw data files.

The following information is organized by parameter within each year, but begins with notes on the relative humidity, LiCor, wind speed, and wind direction data that apply to all three years.

Relative Humidity:

As a result of the following information, all relative humidity data for the period of 1997 through 1999 should be treated with caution.

- 7/2/97 (J Day 183) through 8/11/99 (J Day 223): Initial relative humidity data often exhibited readings over 100 (101, 102, 103). These readings are within the accuracy expectations of the sensor 3% at 90% to 100% relative humidity. On 10/19/97 the datalogger program was changed so that any reading over 100 was automatically changed to 100. As a result, readings of 100% from this date to the present may have actually been over 100 and possibly significantly higher. This is problematic in that if data are altered at the datalogger level, there are no raw data to consult and faulty readings due to sensor malfunction or poor calibration may be represented as valid data.
- 7/2/97 (J Day 183) through 10/19/97 (J Day 292): These readings may all be slightly high. There are more readings of 100% in these data than might be expected, and as mentioned above, the sensor was producing readings over 100 until the datalogger program was changed to convert these readings.
- 10/19/97 (J Day 292) through 12/31/99 (J Day 365): These readings may all be slightly low. There was a marked decline in values when the sensor was changed on 8/11. The readings following the sensor change showed maximums of 97 and 98 as opposed to 100. We would expect to see some 99 and 100% readings in the data (especially in late summer and early fall). However, these lower readings would still be within the accuracy expectations of the sensor (3% at 90% to 100% RH). This probably holds true for the relative humidity readings until the sensor was changed again on 5/17/01. However, the 2000 and 2001 data are unavailable for confirmation at this time.
- 10/19/97 (J Day 292) through the present: All values over 100% are currently altered in the raw data to read 100%. These values may indicate super saturated air, calibration problems, or a sensor malfunction. Because these values are changed in the raw data, we cannot confirm that they are all valid data points. A recommendation was made to the CDMO to change this protocol on 4/17/2002. (see Supplemental Information Section)

Li-Cor Solar Radiation:

All LiCor data from 7/2/1997 through 4/3/2002 time period were determined to be inaccurate and removed.

See the following for justification of this decision.

- 7/2/97 (J Day 183) through 2/10/98 (J Day 41): Data Manager removed anomalous LiCor solar radiation data. The wrong equation for the multiplier was used during this time, as noted in the documentation at the beginning of the datalogger program. The multiplier was corrected on 2/10/98. In addition, not enough digits were being retained to allow for the correct number of decimal places to be reported.
- 2/10/98 (J Day 41) through 12/31/99 (J Day 365): Data Manager removed anomalous LiCor solar radiation data. A new LiCor SZ sensor replaced the older SB model and the sensor location on the

weather station was changed on 4/19/2000. After the move, there was a large increase in readings. The sensor was moved because it was being shaded (per conversation with Baruch data manager, Ginger Ogburn-Matthews, no written documentation). It also had a cracked (corroded) cable that may have contributed to the lower readings. Because there is such a large discrepancy between readings before and after the move, it was determined that the sensor was being shaded, that the effect on the readings was both evident and substantial, and that there was no way to rescue the data.

- The readings during this time period were also extremely erratic and often out of the expected range for a 15-minute total. There also appeared to be changes made to the program, in an attempt to correct these readings, which affected the data and were not documented.
- 10/19/97 (J Day 292) through the present: All values less than 0 are currently altered in the raw data to read 0. These values may indicate an incorrect multiplier, calibration problems, or a sensor malfunction. Because these values are changed in the raw data, we cannot confirm that they are all valid data points. A recommendation was made to the CDMO to change this protocol on 4/17/2002. (see Supplemental Information Section)

Wind Speed:

Throughout the entire 1997 through 1999 data set, with the exception of the month of April in 1998, the wind speed sensor offset number showed up as a reading whenever there was no wind, and occasionally, when the sensor was malfunctioning. As a result there are no zero wind speed readings for this time period. See the Supplemental Information portion of this document for more information.

- 7/2/97 (J Day 183) through 4/1/98 (J Day 91): 0.22325 was the wind speed offset for this period and when present in the data represented either a zero or a sensor malfunction (per email from Mark in documentation). There is no documentation to identify which sensor was in use at this time and/or how the offset was obtained. These data were all determined to be anomalous and removed for other reasons detailed below.
- 4/1/98 (J Day 91) through approximately 5/3/98 (J Day 123): Zero wind speed readings are present in this data, but there is no documentation of any relevant change being made to the datalogger program or of which sensor was in use. Because our knowledge of the data collection procedure for this time is so limited, this data should be used with caution,
- 5/3/98 (J Day 123) through 12/31/99 (J Day 365): There are no zero wind speed readings in this period. Once again there is no documentation of a change being made to the datalogger program or the sensor itself. It is probable that on 4/1/98 or 5/3/98 the sensor was changed. We know that the 03001 Wind Sentry was used during this period, and that the offset number changed to 0.2. Thus, 0.2 is the lowest value reported in this portion of the dataset and indicates a zero reading. From 0.2 the readings increase by increments of 0.16. Since only one decimal place is maintained in the final data set, the first few measurements are reported as 0.4 (0.36), 0.5 (0.52), 0.7 (0.68), etc. The Data Manager did not find any instance during this time period where the offset value was present as a reading when the sensor was malfunctioning.

Wind Direction Data:

As mentioned above, the wind sensor from 1997-1999 did not use a conditional statement to set the wind speed to zero if there was no wind. As a result, there were no zero wind speed readings and the wind speed offset number was reported as a reading instead. In addition, because the wind speed sensor was recognizing the offset number as a wind speed, it is likely that a wind direction was recorded as well, when in fact, there can be no wind direction if there is no wind speed. As a result, users should be aware of 15-minute instantaneous wind direction readings taken when the wind speed offset number was recorded.

1997

All Parameters:

- 7/2/97 through 8/22/97: Data were based on a 10-second collecting interval as opposed to 5 seconds.
- 10/2/97 (J Day 275) 0845: There were two rows of data for 0845 (one at the end of the September file, the other at the beginning of the October file) with different readings for all of the parameters.

The Data Manager chose the row with the readings that looked the most likely to be correct to leave in the data table, and removed the other row from the edited version. In this particular case, the row at the beginning of October seemed much more likely to be valid.

- 10/29/97 (J Day 302) 0915 through 1000: These date/times were repeated with different readings. It was determined that the readings for the repeated date/times were valid, but for the next hour. For instance, the air temperature readings followed the expected progression for that time of day, and increased through the repeated times at the expected rate to meet the air temps for the following hour. This held true for all of the parameters. As a result, the Data Manager made the assumption that the date/times had been repeated, but the readings continued on correctly. In order to correct this problem, the repeated date/times were removed. However, this left an hour of extra data (four rows) at the end of the year. One row of data (15 minutes) was made up on each of the next sections of missing data. In this way the Data Manager attempted to save the data considered to be valid, spread out the affect of the change throughout the year, and minimize it by making the corrections where missing data occurred. The missing data date/times that were replaced are:
 - J Day 309 @ 1615
 - J Day 317 @ 1500
 - J Day 328 @ 1545
 - J Day 344 @ 1500

Air Temperature:

- 7/17/97 (J Day 198) 1130 through 7/18/97 (J Day 199) 1145: Data Manager removed anomalous air temperature data. Readings were well outside the range of measurement for the sensor and corresponded to a period when there were problems with all of the other parameters.
- 9/11/97 (J Day 254) 0330: Suspect air temperature reading of 18.2. There is a large difference between this reading and those taken 15 minutes before (20.9) and after (20.5). However, the difference between these readings is less than that of the CDMO error checking criteria, therefore, the questionable reading will remain in the dataset.

Relative Humidity:

See Relative Humidity at the beginning of the Anomalous Data section for more information.

- 7/2/97 (J Day 183) through 10/19/97 (J Day 292): Relative humidity readings sometimes registered above 100% (at 101, 102, and 103). This may have been due to a problem with the sensor calibration. However, on 10/19/1997, the datalogger was programmed to change any value over 100%, to 100%.
- 7/17/97 (J Day 198) 1130 through 1445: Data Manager removed anomalous relative humidity data. Readings were well outside the range of measurement for the sensor and corresponded to a period when there were problems with all of the other parameters.
- 7/18/97 (J Day 199) 1115 through 1145: Data Manager removed anomalous relative humidity data. Readings changed drastically from the values immediately before and after (66 to 14 and 0 to 69) the group of data and were extremely low for the time of year (0).
- 9/4/97 (J Day 247) 0930: There were two rows of data for 0930 with different readings for the relative humidity, wind speed, and wind direction parameters. The Data Manager chose the row with the readings that looked the most likely to be correct to leave in the data table, and removed the other row from the edited version.
- 9/17/97 (J Day 260) 1500: Data Manager removed anomalous relative humidity data. The reading was 113, which is well outside the range of measurement (0 to 100). The readings also corresponded to a period of missing air temperature data and anomalous barometric pressure data due to the datalogger being reprogrammed.

Barometric Pressure:

- 9/17/97 (J Day 260) 1445 through 1500: Data Manager removed anomalous barometric pressure readings changed dramatically (1016 to 1033 and 1081 to 1015) from those immediately before and after. They were also abnormally high. The 1081 reading is well above the CDMO standard

for “flagging” (1040). In addition they corresponded to a period of missing air temperature data and anomalous relative humidity data.

Wind Speed:

See Wind Speed at the beginning of the Anomalous Data section for more information.

- 8/15/97 (J Day 227) 1115 through 11/20/97 (J Day 325) 0915: Data Manager removed anomalous wind speed data. Wind speed data began on 8/15, but readings were registering at over twice the expected values. Readings were often outside of the range of measurement of the sensor. Acknowledging the possibility that the readings could mistakenly be in miles per hour, instead of meters per second, they were divided by 2.24 (conversion factor) in order to determine if the readings would then be feasible. The values were still higher than expected. The assumption that the readings were in mph could not be justified and the data were removed as erroneous. In addition, these data corresponded to erroneous wind direction data and preceded a lightning strike, which took the sensor offline for several months (see below).
- 11/20/97 (J Day 325) 0915 through 2/27/98 (Jday 58) 1500: Data Manager removed anomalous wind speed data. Readings were a mostly a consecutive string of 0.22325. These values represent the offset for the wind speed sensor and can indicate either missing data or the value “0”. There was also documentation (via email from Mark Crane) of a wind speed and direction sensor malfunction, due to a lightning strike, in January of 1998. Since the 0.22325 values begin in mid-November of 1997 and continue through February of 1998, it was assumed that the lightning strike occurred earlier than was documented. The start date for this data removal was correlated with a drastic change in wind direction readings as well.

Wind Direction:

See Wind Direction at the beginning of the Anomalous Data section for more information.

- 8/15/97 (J Day 227) 1115 through 11/20/97 (J Day 325) 0915: Data Manager removed anomalous wind direction data. Wind direction data began on 8/15, but readings were almost entirely between 0° and 75°. There were also several negative readings. These data corresponded to a period of erroneous wind speed data and preceded a period of missing data due to a lightning strike.
- 11/20/97 (J Day 325) 0915 through 2/27/98 (Jday 58) 1500: Data Manager removed anomalous wind direction data. Readings recorded from 11/20/97 through mid December were entirely between 75° and 390°. Readings from mid December through mid January 1998 were between 300° and 400°. In mid January through 2/27/98 they were between 0° and 390°, but concentrated between 0° and 50°. These data also corresponded to a period of erroneous wind speed data and documentation (via email from Mark Crane) of a wind speed and direction sensor malfunction due to a lightning strike.

Eppley Solar Radiation:

- There is no Eppley data available for 1997. Data collection began on 6/30/98.

Rain:

- 8/1/97 (J Day 213) 0015 through 11/29/97 (J Day 333) 1515: Rain readings (array 151) were shifted over one decimal place. Sensor measures in increments of .254 (trace = .254), readings for this period were consistent with these increments, but the decimal was in the wrong location (trace appeared as 0.0254). Verified data for the entire period to ensure that readings were all appeared off by one decimal place, and then corrected in edited version by multiplying by 10. The problem was apparently corrected before the rain event on J Day 333 at 1530, but there is no documentation of any changes being made.

1998

Air Temperature:

- 8/4/98 (J Day 216) 0930: In 15 min worksheet on J Day 216 there were two rows of data for 0930 with different readings for the air temperature, LiCor solar radiation, wind speed, wind direction, and Eppley solar radiation parameters. The Data Manager chose the row with the readings that

looked the most likely to be correct to leave in the data table, and removed the other row from the edited version.

Relative Humidity:

See Relative Humidity at the beginning of the Anomalous Data section for more information.

- 2/28/98 (J Day 59) 1230 through 3/2/98 (J Day 61) 1315: Data Manager removed anomalous relative humidity data. The readings went from in the 90's to -1 at 1230, there was a missing data point at 1245, and then 12 at 1300, followed by a string of zero readings, and a jump back up to 32 at 1330 on 3/1. The readings were determined to be unbelievable and removed.
- 4/1/98 (J Day 91) 1145 through 4/3/98 (J Day 93) 1145: Data Manager removed anomalous relative humidity data. All readings were zero (highly improbable) and the time corresponded to a time when the wind speed sensor was down.
- 4/3/98 (J Day 93) 1230: In 15 min worksheet there were two rows of data for 1230 with the same readings for every parameter except relative humidity and wind direction. The Data Manager chose the row with the relative humidity and wind direction readings that looked the most likely to be correct to leave in the data table, and removed the other row from the edited version.

Barometric Pressure:

- The Data Manager found no anomalous barometric pressure data in 1998.

Wind Speed:

See Wind Speed at the beginning of the Anomalous Data section for more information.

- 11/20/97 (J Day 325) 0915 through 2/27/98 (J Day 58) 1500: Data Manager removed anomalous wind speed data. Readings were a mostly a consecutive string of 0.22325. These values for wind speed can indicate either missing data or the value "0". There was also documentation (via email from Mark Crane) of a wind speed and direction sensor malfunction, due to a lightning strike, in January of 1998. Since the 0.22325 values begin in mid-November of 1997 and continue through February of 1998, it was assumed that the lightning strike occurred earlier than was documented. The start date for this data removal was correlated with a drastic change in wind direction readings as well.
- 2/27/98 (J Day 58) 1515 through 4/3/98 (J Day 93) 1145: Data Manager removed anomalous wind speed data. The sensor was back on-line after the damage caused by the lightning strike was repaired, however, the readings were much higher than expected and corresponded to erroneous wind direction data (see 8/15/97 – 11/20/97 anomalous data).
- 4/1/98 (J Day 91) 1145: There were two rows of data for 1145 with the same readings for every parameter except wind speed. The Data Manager chose the row with the wind speed reading that looked the most likely to be correct to leave in the data table, and removed the other row from the edited version.
- 8/4/98 (J Day 216) 0930: In 15 min worksheet on J Day 216 there were two rows of data for 0930 with different readings for the air temperature, LiCor solar radiation, wind speed, wind direction, and Eppley solar radiation parameters. The Data Manager chose the row with the readings that looked the most likely to be correct to leave in the data table, and removed the other row from the edited version.

Wind Direction:

See Wind Direction at the beginning of the Anomalous Data section for more information.

- 11/20/97 (J Day 325) 0915 through 2/27/98 (J Day 58) 1500: Data Manager removed anomalous wind direction data. Readings recorded from 11/20/97 through mid December were entirely between 75° and 390°. Readings from mid December through mid January 1998 were between 300° and 400°. In mid January through 2/27/98 they were between 0° and 390°, but concentrated between 0° and 50°. These data also corresponded to a period of erroneous wind speed data and documentation (via email from Mark Crane) of a wind speed and direction sensor malfunction due to a lightning strike.
- 2/27/98 (J Day 58) 1515 through 4/3/98 (J Day 93) 1145: Data Manager removed anomalous wind direction data. The sensor was back on-line after the damage caused by the lightning strike

was repaired, however, the readings recorded were between -75° and 60° . These data also corresponded to erroneous wind speed data.

- 4/3/98 (J Day 93) 1200: In 15 min worksheet there were two rows of data for 1200 with the same readings for every parameter except wind direction. The Data Manager chose the row with the wind direction reading that looked the most likely to be correct to leave in the data table, and removed the other row from the edited version.
- 4/3/98 (J Day 93) 1230: In 15 min worksheet there were two rows of data for 1230 with the same readings for every parameter except relative humidity and wind direction. The Data Manager chose the row with the relative humidity and wind direction readings that looked the most likely to be correct to leave in the data table, and removed the other row from the edited version.
- 8/4/98 (J Day 216) 0930: In 15 min worksheet on J Day 216 there were two rows of data for 0930 with different readings for the air temperature, LiCor solar radiation, wind speed, wind direction, and Eppley solar radiation parameters. The Data Manager chose the row with the readings that looked the most likely to be correct to leave in the data table, and removed the other row from the edited version.

Eppley Solar Radiation:

- 8/4/98 (J Day 216) 0930: In 15 min worksheet on J Day 216 there were two rows of data for 0930 with different readings for the air temperature, LiCor solar radiation, wind speed, wind direction, and Eppley solar radiation parameters. The Data Manager chose the row with the readings that looked the most likely to be correct to leave in the data table, and removed the other row from the edited version.

Rain:

- 1/12/98 (J Day 12) 1115: Data Manager removed anomalous rain data point. The reading (91.4 mm, approx. 4 inches) was unbelievably high for a 15 minute total. In addition, the surrounding readings were all zero.

1999

Air Temperature:

There were a lot of questionable and anomalous data in the early part of 1999. The sensor was switched on 8/11/99. Data prior to this data should probably be used with caution.

- 1/17/99 (J Day 17) 2000 through 1/18/99 1215: Data Manager removed anomalous air temperature data. The values were much higher than would be expected for this time of year (up to 40.4°C) and are followed by a large amount of missing data. The temperature readings begin rising during the evening of 1/17/99 at 1830, but did not change dramatically (over 3°C by CDMO standards) until 2000. Therefore the data was removed beginning at 2000, but the readings beginning at 1830 are questionable.
- 2/12/99 (J Day 43) 1000 through 1315: Suspect air temperature data. Readings rose rapidly from 24.2 at 945 to values in the 30's (30.9 at 1215) then dropped rapidly back down from 27.2 at 1315 to 23.9 at 1330. These were extremely high readings for February, the change in readings is drastic, the solar radiation (Eppley) readings were not very high, and the humidity was decreasing at the time. The Data Manager also attempted to verify if there were unusually high temperatures recorded at other weather stations in the area, and was unable to find comparable readings in North Carolina, Georgia, or Florida (www.wcc.nrcs.usda.gov/scan/).
- 4/11/99 (J Day 101) 0800 through 1315: Data Manager removed anomalous air temperature data. The values were implausibly high (up to 41.6°C) when verified against NCDC/NOAA max air temp readings, especially for the time of day that they were recorded. There was a large air temperature change at the end of this group of data (30.8°C to 24.4°C), but not at the beginning. The Data Manager used the first reading determined to be viable after the anomalous data (24.4°C) to help estimate where the anomalous data began.
- 4/12/99 (J Day 102) 0915 through 1230: Data Manager removed anomalous air temperature data. There was a large change in temperature at the beginning and end of this group of data (24.3 to 45.4 and 37.2 to 24.7 respectively) and values were simply unbelievable (approached 60°C). Compared with NCDC/NOAA climatological observations to justify data removal.

- 4/15/99 (J Day 105) 1000 through 1830: Data Manager removed anomalous air temperature data. The values were much higher than would be expected (up to 35.3°C), and after verification with NCDC/NOAA max air temp data, they were determined to be anomalous. There were also temperature changes of over 3°C (CDMO standard for flagging erroneous data) at the beginning and end of this group of data.
- 9/16/99 (J Day 259) 0230 through 9/20/99 (J Day 263) 0915: Data Manager removed anomalous air temperature data interspersed with missing data. Values were mostly negative (many were -39.9) with some extremely high readings (200+). Readings below -10 or above 40 are suspect (based on LTER error flagging criteria – see Cross Reference section).

Relative Humidity:

See Relative Humidity at the beginning of the Anomalous Data section for more information.

- 8/4/99 (J Day 216) 1000 through 8/11/99 (J Day 223) 1315: Data Manager removed anomalous relative humidity data. Values were either 100 or 0 and corresponded to a period of missing air temperature data. The temperature and relative humidity probe was replaced during this time, the documentation indicates that it was replaced on 8/11, however, it was probably removed on 8/4, and the new wiring configuration required wasn't completed until 8/11.
- 9/16/99 (J Day 259) 0230 through 9/20/99 (J Day 263) 0915: Data Manager removed anomalous relative humidity data. Extremely erratic readings were interspersed with missing data and corresponded with missing/anomalous air temperature data for the same time period.

Barometric Pressure:

- 3/30/99 (J Day 89) through 4/11/99: Suspect barometric pressure readings. Readings seem abnormally high and erratic. In addition, these data are followed by a period of anomalous data.
- 4/11/99 (J Day 101) 1130 through 4/22/99 (J Day 112) 0915: Data Manager removed anomalous barometric pressure data. The readings were often well outside of the range of measurement, interspersed with missing data, and extremely erratic. There were also problems with the air temperature probe off an on throughout this time period.
- 8/4/99 (J Day 216) 0930 through 8/11/99 (J Day 223) 1000: Data Manager removed anomalous barometric pressure data. Readings were outside the range of measurement for the sensor. The documentation indicates that the sensor was replaced at this time.

Wind Speed:

See Wind Speed at the beginning of the Anomalous Data section for more information.

- The Data Manager found no anomalous wind speed data in 1999.

Wind Direction:

See Wind Direction at the beginning of the Anomalous Data section for more information.

- The Data Manager found no anomalous wind direction data in 1999.

Eppley Solar Radiation:

- 4/22/99 (J Day 112): Data Manager removed anomalous Eppley solar radiation data. Readings were outside of the range of measurement, or impossibly high for the time of day (1.637 at 430). They also corresponded to periods of missing air temperature data (no documentation for) interspersed with apparently valid data, and periods of anomalous LiCor solar radiation readings that were removed by the Data Manager. The Eppley readings removed occurred at the following times:
 - 0230 through 0245
 - 0315 through 0445
 - 0545 through 0600
 - 0830 through 0900

Rain:

- The Data Manager found no anomalous rain data in 1999.