

WIPP ENVIRONMENTAL MONITORING DATA SUMMARIES

Meteorological Conditions in the Vicinity of the WIPP Site

Methods

CEMRC operates two identical meteorological towers at sampling sites in the vicinity of the WIPP (Fig. 2). The Near Field site is approximately 1 km northwest of the WIPP site at an elevation of 1088 m (latitude 32°22'40.385"N; longitude 103°47'55.425"W). The Cactus Flats site is approximately 19 km southeast of the WIPP site at an elevation of 1041 m (latitude 32°13'05.451"N; longitude 103°41'42.583"W).

Each station consists of a 10-meter tower equipped with sensors for temperature, relative humidity, barometric pressure, total solar radiation, Ultra-Violet B (UVB) radiation, wind speed and direction, and vertical wind speed. Data are collected every second, with averaging times of ten minutes. In addition, the maximum wind speed and total precipitation occurring over the 10-min averaging period are recorded.

Temperature, relative humidity and all wind parameters are measured at a height of 10 meters above ground level. Precipitation, barometric pressure, solar radiation and UVB are measured at heights of 0.4, 1, 2, and 3 m, respectively. The barometric pressure sensors are compensated for temperature, but are not referenced to mean sea level. The solar radiation sensors (pyranometers) measure the energy flux per unit area (W m^{-2}) of both direct and diffuse sky radiation. The UVB sensor measures direct and diffuse UVB in the 280-320 nm band.

The data are stored in electronic dataloggers and downloaded twice weekly. Once downloaded, the data are screened for outliers and other anomalies and uploaded to a main database. Performance checks of the sensors are conducted semi-annually, and sensors are re-calibrated at the manufacturers' specified intervals.

This report summarizes meteorological data collected over the 12-month period from December 2000 through November 2001. In addition, data collected at the sites from

December 1999 through November 2000 (12 month period) are compared with data from the same time interval during 2000-2001.

Results

For the 2001 sampling period, data recovery exceeded 99% for all sensors, except the UVB sensor at Cactus Flats. The Cactus Flats UVB sensor failed in July due to a nearby lightning strike and has not yet been repaired. Short-term data losses from all sensors occurred throughout the year due to sensor malfunction, repair, maintenance, and/or performance testing (typically less than one hour).

Averaged over the year, winds were from the east and southeasterly direction (E, ESE, SE and SSE quadrants, inclusive) 53% of the time at the Cactus Flats and Near Field sites (Fig. 3). However, there were some distinctive seasonal variations in wind direction (Figs. 4-5). Both sites were dominated by SE winds in the fall, but switched to more variable wind directions in the spring. The two sites contrasted strongly in the winter and summer quarters. Near Field was dominated by directional winds in the winter and variable winds in the summer, while Cactus Flats experienced the opposite behavior. The inter-annual and intra-annual variability in wind direction are important parameters in modeling dispersion pathways for potential airborne releases from the WIPP.

Wind velocities were very similar between sites. Wind velocities (10-min means) were less than 5.4 m s^{-1} over 77% of the time, with speeds frequently from 3.1 to 5.4 m s^{-1} . Wind velocities $> 10.7 \text{ m s}^{-1}$ typically came from the west. The highest wind velocities recorded at each site were 33.0 m s^{-1} (75 mph) on 10 April at the Cactus Flats site, and 31.8 m s^{-1} (72 mph) on 6 April at the Near Field site.

Air temperatures at Near Field ranged from -6.7 to $40.1 \text{ }^\circ\text{C}$ and from -6.8 to $39.7 \text{ }^\circ\text{C}$ at Cactus Flats. The maximum temperatures were recorded in June 2001 at both locations. The lowest temperatures were recorded in November 2001 at both sites. The

annual mean temperatures were 17.9 °C at Near Field and 17.5 °C at Cactus Flats. At both locations, December 2000 was the coldest month (mean = 5.2 °C at Near Field; mean = 4.9 °C at Cactus Flats) and July was the hottest month (mean = 29.7 °C at Near Field; mean = 29.2 °C at Cactus Flats) (Fig. 6).

The annual mean relative humidity at Near Field was 44% and ranged from 4 to 100%. Humidity at the Cactus Flats site was nearly identical to Near Field, averaging 45% and ranging from 3 to 100%. Mean relative humidities were lowest when temperatures peaked in late spring and early summer (Fig. 7). It should be noted that the accuracy of the relative humidity sensors declines at relative humidities below 12% and above 94%, and readings outside these ranges should be interpreted with caution.

Barometric pressure did not exhibit an obvious seasonal trend at either site (Fig. 8). The annual mean was 894.1 mb at Cactus Flats and 898.6 mb at the Near Field site. The apparent 4.5-mb difference between the sites can be attributed to a 41-m difference in elevation. This difference is not significant if corrected using standard barometric conversions that incorporate elevation (U.S. Department of Commerce Weather Bureau,

1963, *Manual of Barometry, Vol. 1*, Washington D.C.).

Total solar radiation flux (W m^{-2}) was integrated over daily intervals to calculate total energy received per unit area (MJ m^{-2}). As is typical, solar radiation received at the sites peaked in the summer and was lowest during the winter months (Fig. 9). This pattern is due to a combination of increasing solar radiation intensity, less cloud cover and additional hours of daylight during the summer months. Over the year, the daily total solar radiation ranged from 2 to 55 MJ m^{-2} at both Near Field and Cactus Flats.

Solar UVB flux (W m^{-2}) was integrated over daily intervals to calculate total energy received per unit area (MJ m^{-2}). The UVB radiation followed a pattern similar to that of the total solar radiation (Fig. 10).

Over the year, a total of 19.5 cm of precipitation was measured at Cactus Flats and 22.1 cm of precipitation was measured at Near Field (Fig. 11). Both locations recorded the highest precipitation during the months of March and July.

Tables presenting meteorological data summarized herein are available on the CEMRC web site at <http://www.cemrc.org>.

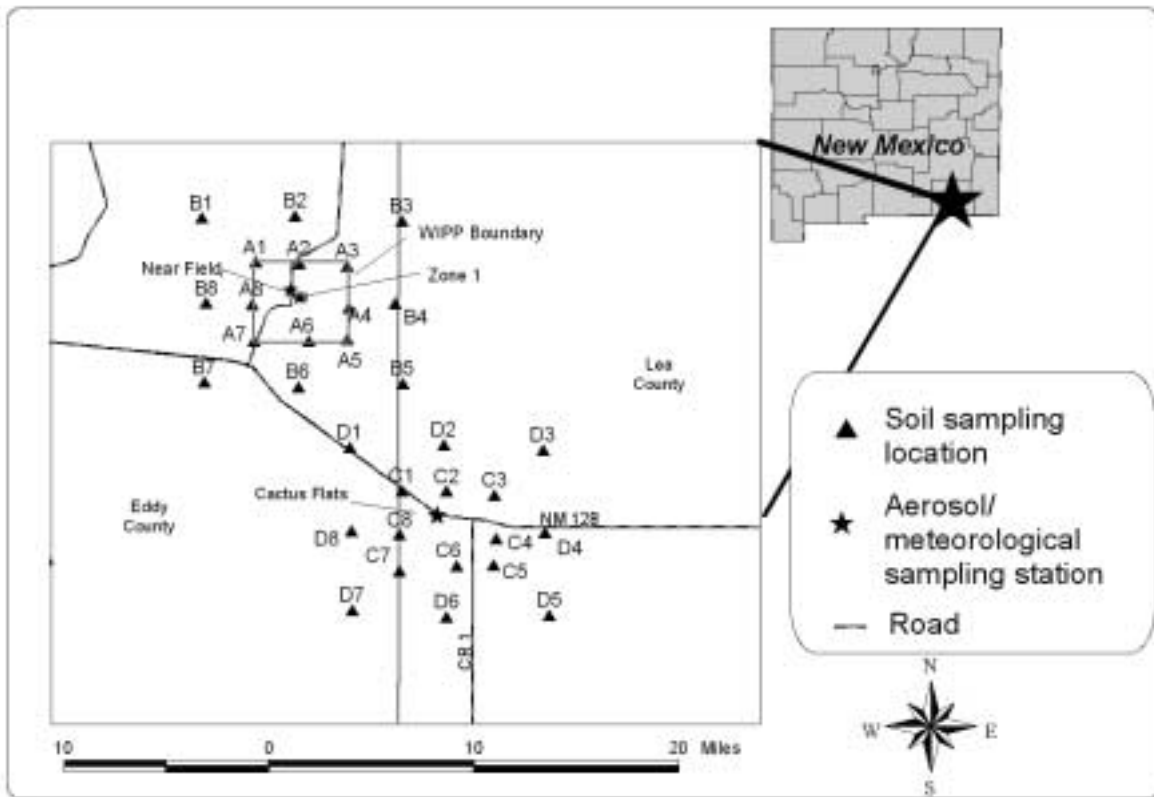


Figure 2. Sampling Locations in the Vicinity of the WIPP
Aerosol sampling and meteorological monitoring is conducted at Near Field and Cactus Flats.

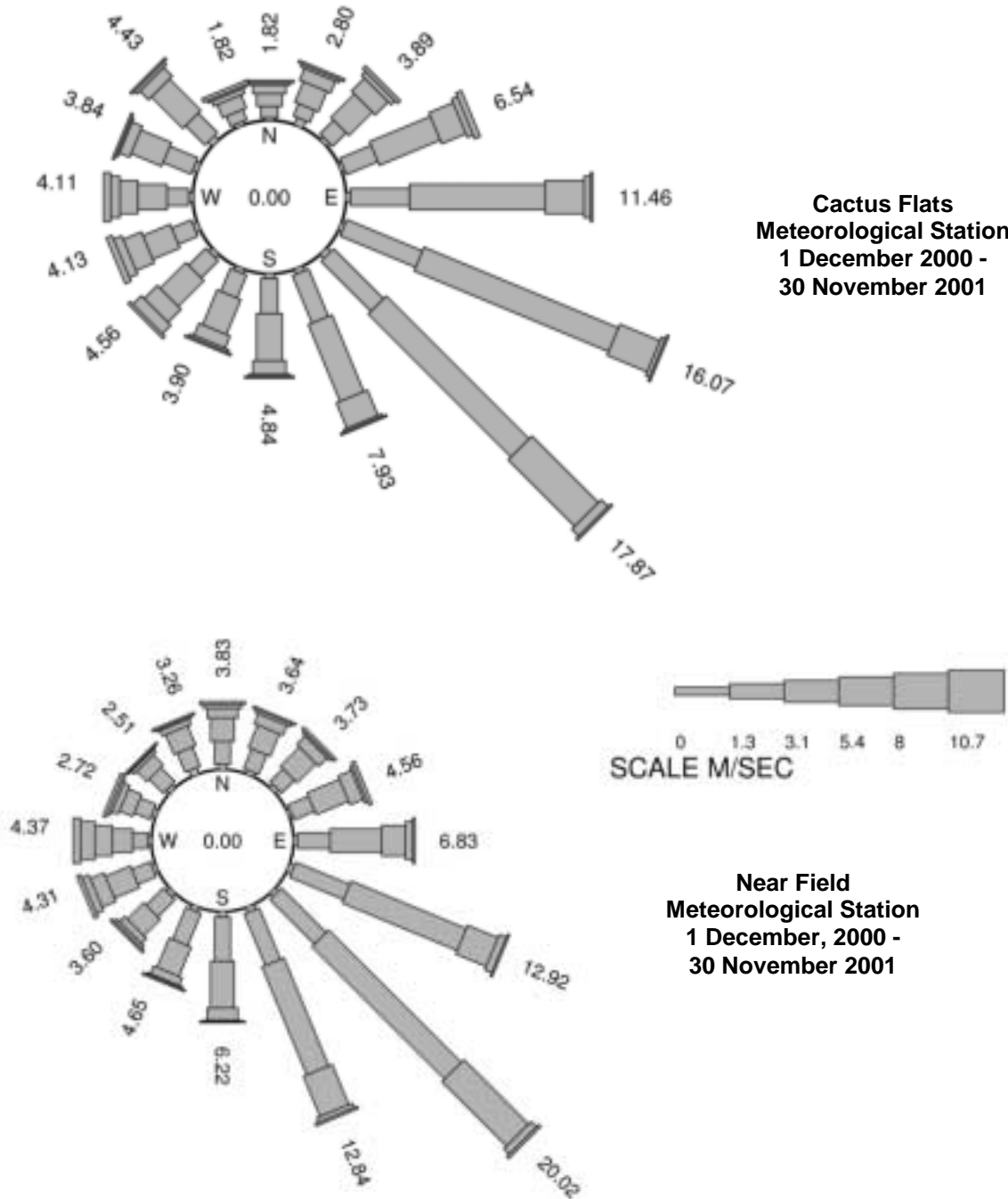
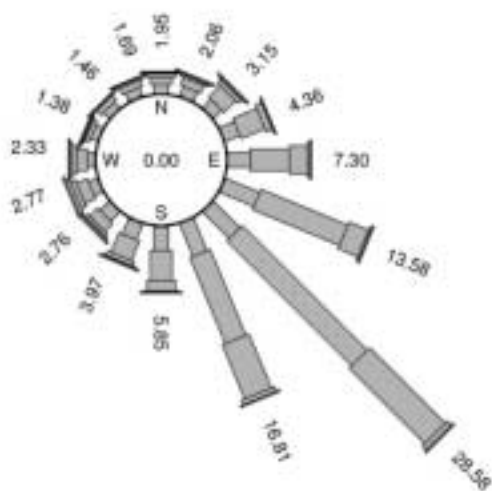


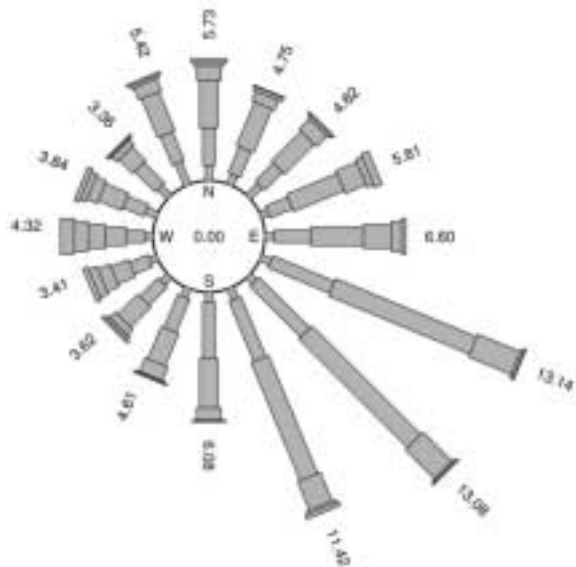
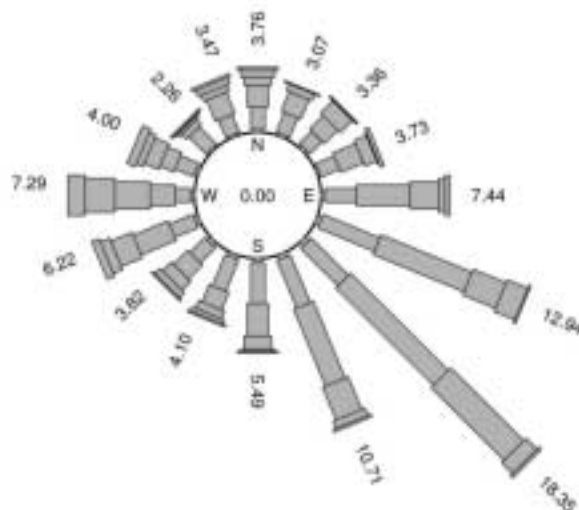
Figure 3. Annual Wind Roses for Near Field and Cactus Flats

Value in center of a rose is % time with no recordable wind. Value at outer end of each tube is % time wind blew from the direction of the tube outer opening. Within each tube, segment lengths indicate relative frequency of wind speeds ($m\ sec^{-1}$) given on scale.

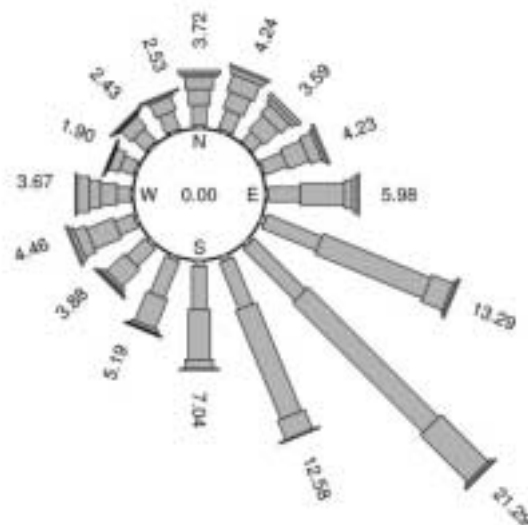
**Near Field
Meteorological Station
1 December 2000 -
28 February 2001**



**Near Field
Meteorological Station
1 March, 2001 -
31 May 2001**



**Near Field
Meteorological Station
1 June 2001 -
31 August 2001**



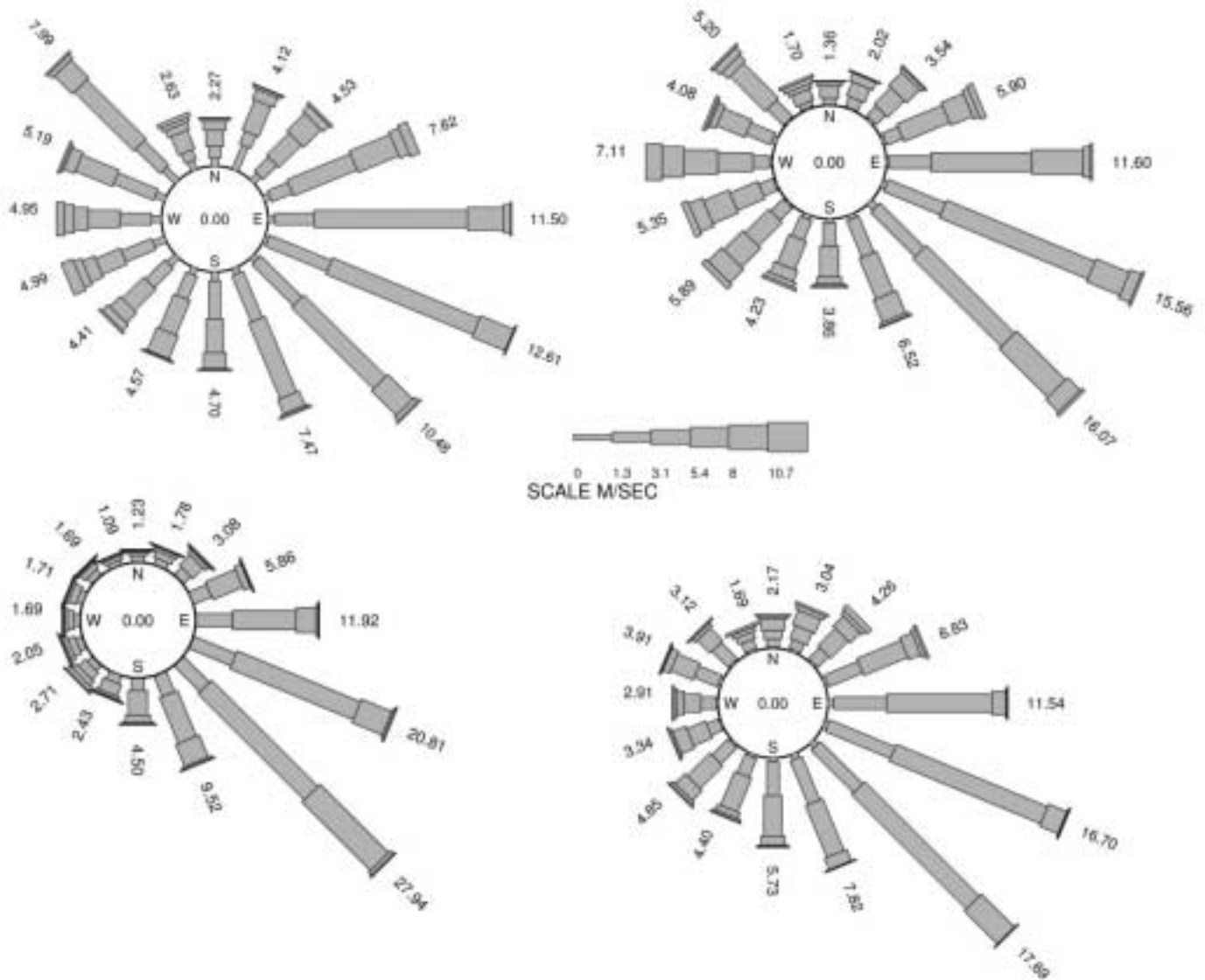
**Near Field
Meteorological Station
1 September 2001 -
30 November 2001**

Figure 4. Seasonal Wind Roses, Near Field

Value in center of a rose is % time with no recordable wind. Value at outer end of each tube is % time wind blew from the direction of the tube outer opening. Within each tube, segment lengths indicate relative frequency of wind speeds (m sec^{-1}) given on scale.

**Cactus Flats
Meteorological Station
1 December 2000 -
28 February 2001**

**Cactus Flats
Meteorological Station
1 March 2001 -
31 May 2001**



**Cactus Flats
Meteorological Station
1 June 2001 -
31 August 2001**

**Cactus Flats
Meteorological Station
1 September 2001 -
30 November 2001**

Figure 5. Seasonal Wind Roses, Cactus Flats

Value in center of a rose is % time with no recordable wind. Value at outer end of each tube is % time wind blew from the direction of the tube outer opening. Within each tube, segment lengths indicate relative frequency of wind speeds (m sec⁻¹) given on scale.

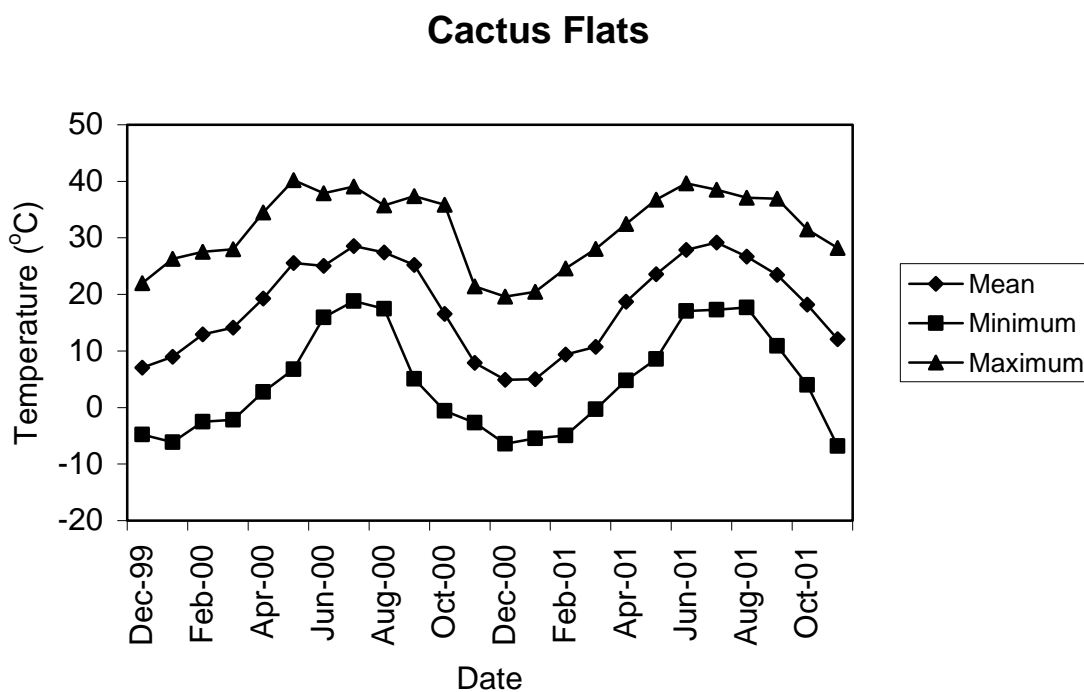
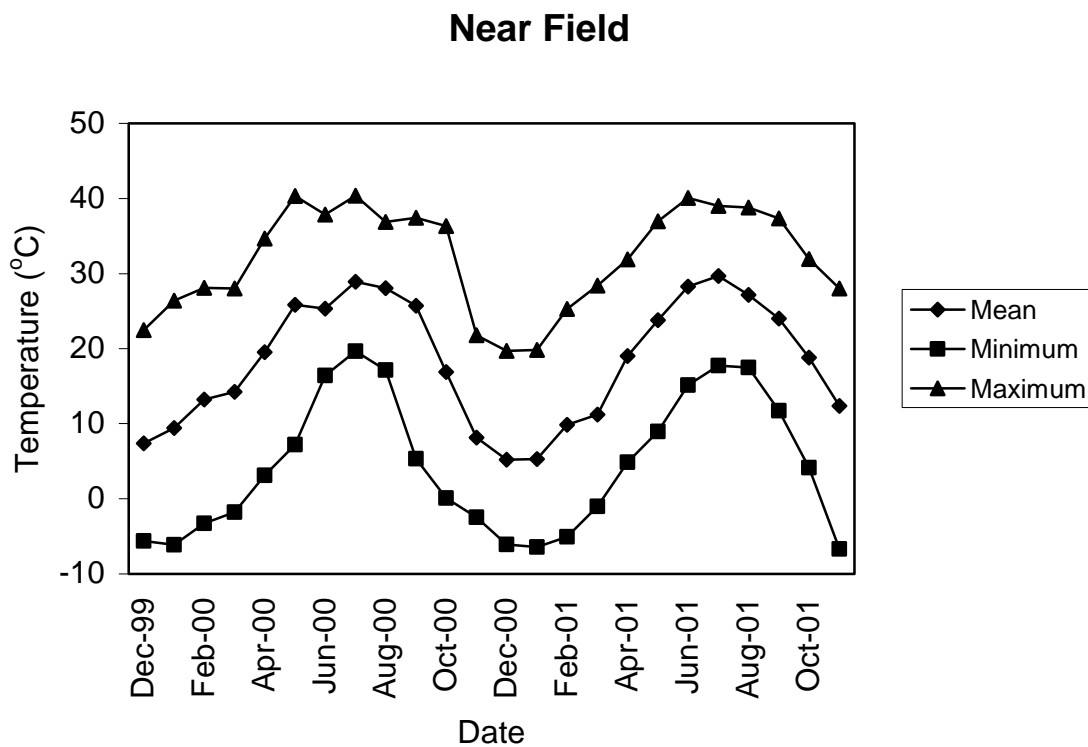


Figure 6. Monthly Mean, Minimum and Maximum Temperature at Near Field and Cactus Flats during December 1999 - November 2001

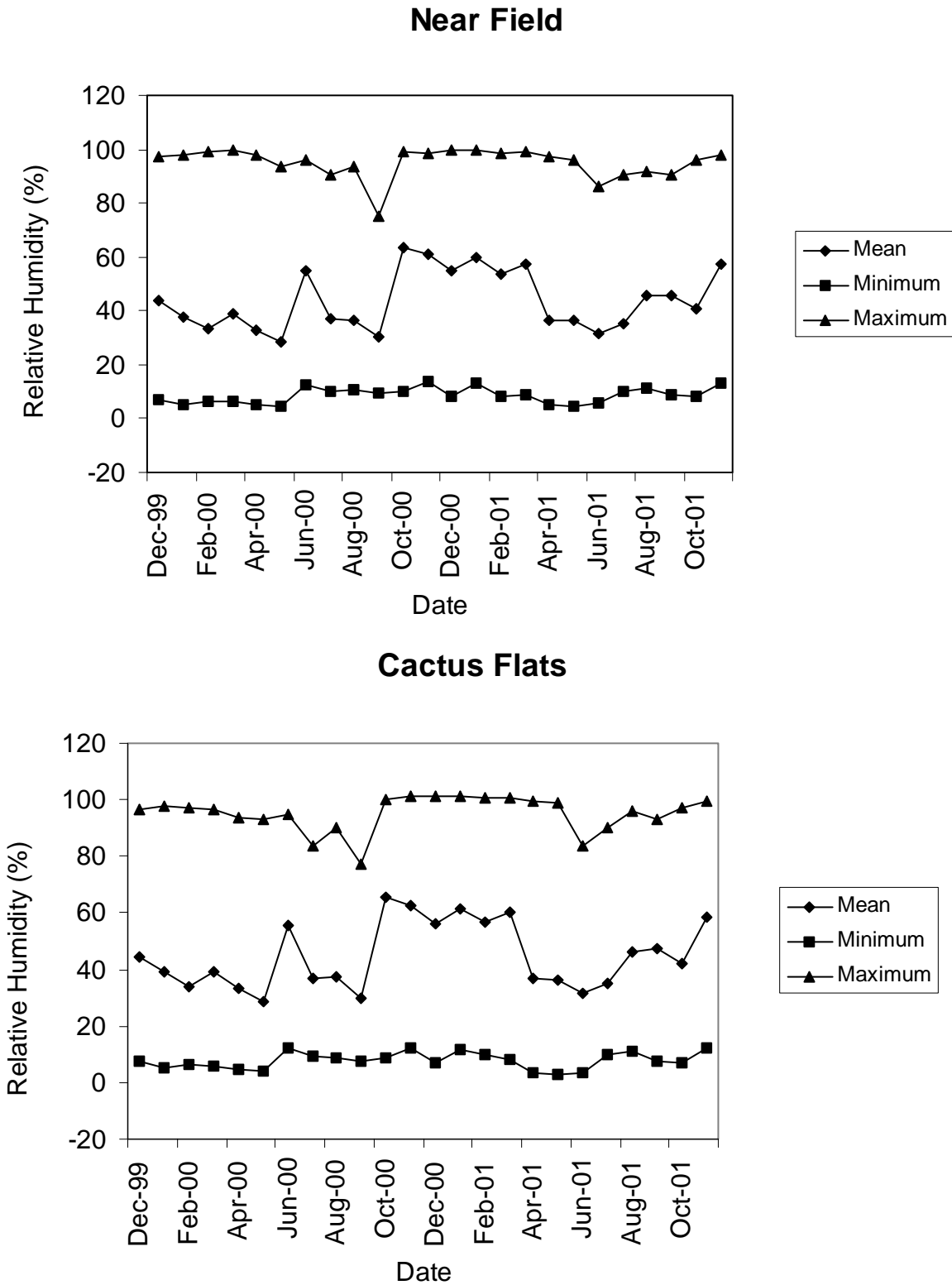


Figure 7. Monthly Mean, Minimum and Maximum Relative Humidity at Near Field and Cactus Flats during December 1999 - November 2001

Relative humidity sensor may have reduced accuracy at < 12% and > 94%.

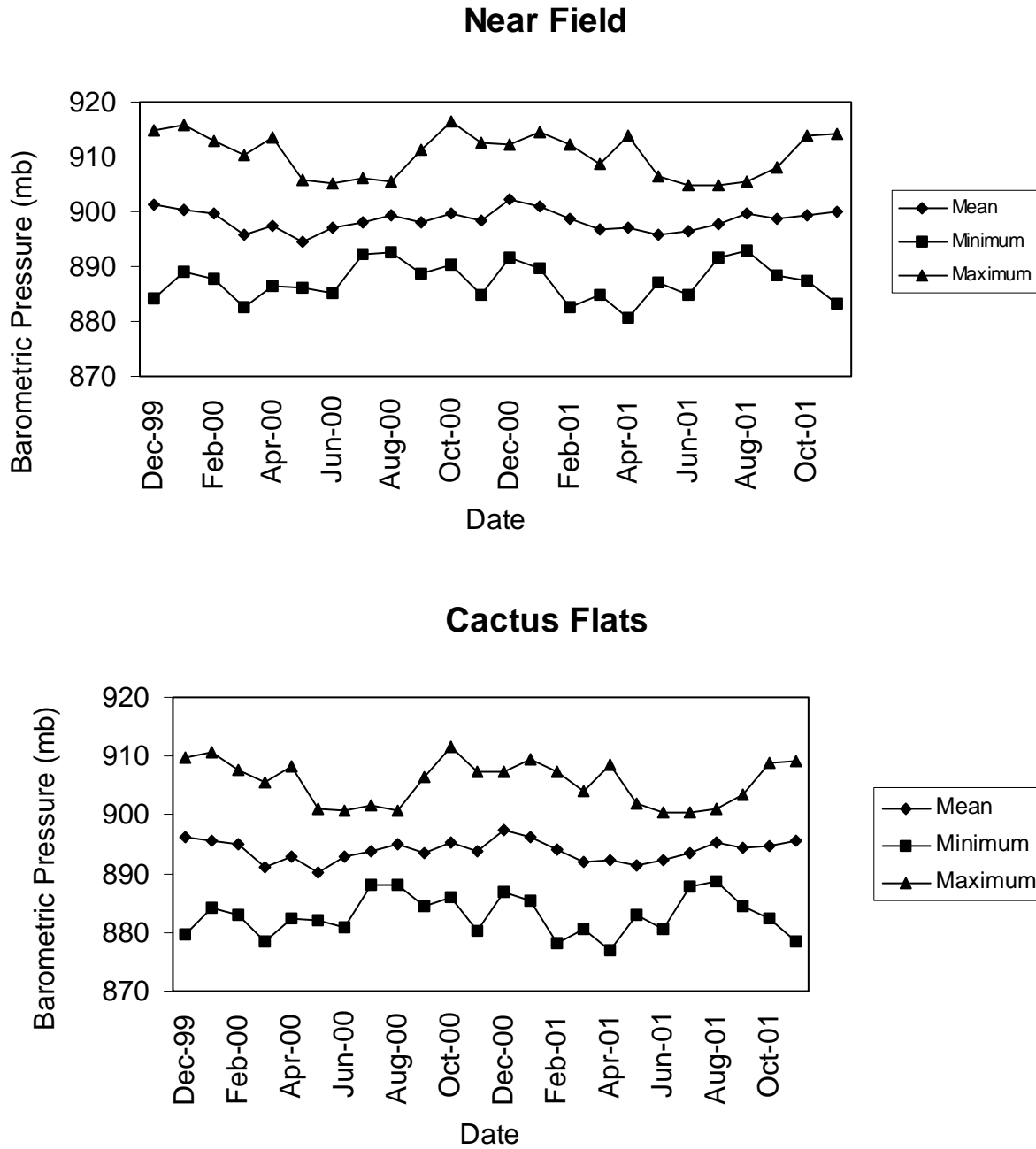


Figure 8. Monthly Mean, Minimum and Maximum Barometric Pressure at Near Field and Cactus Flats during December 1999 - November 2001

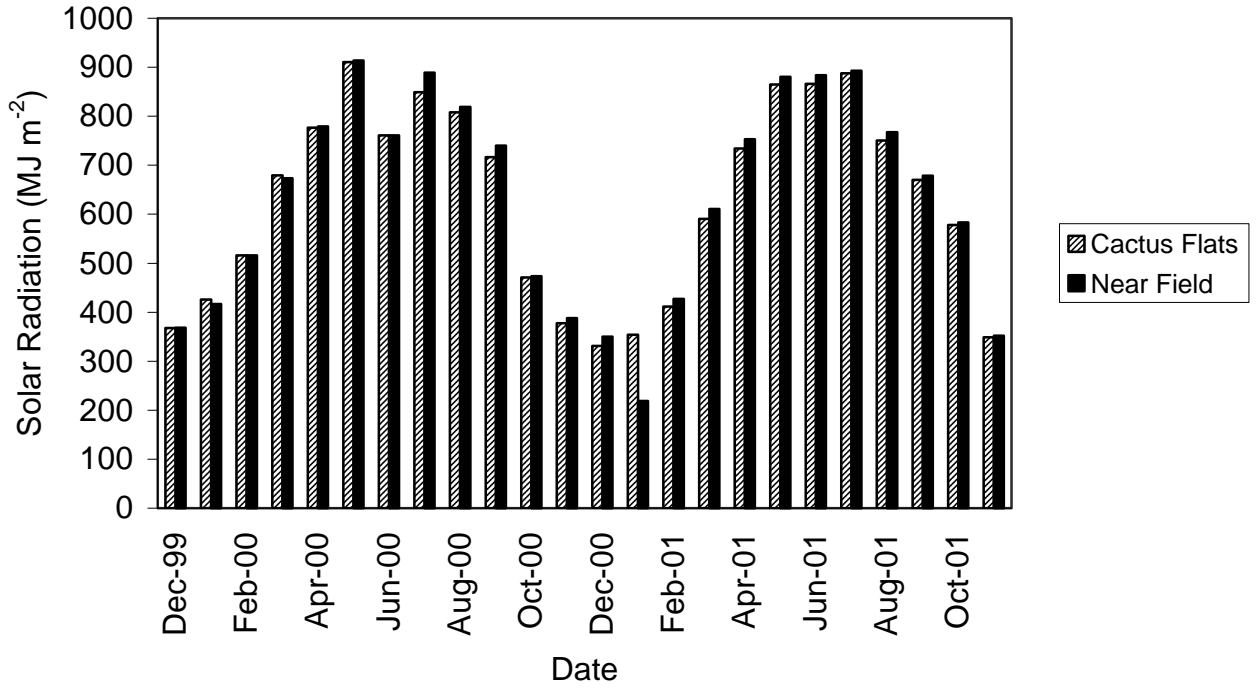


Figure 9. Monthly Total Solar Radiation at Near Field and Cactus Flats during December 1999 - November 2001

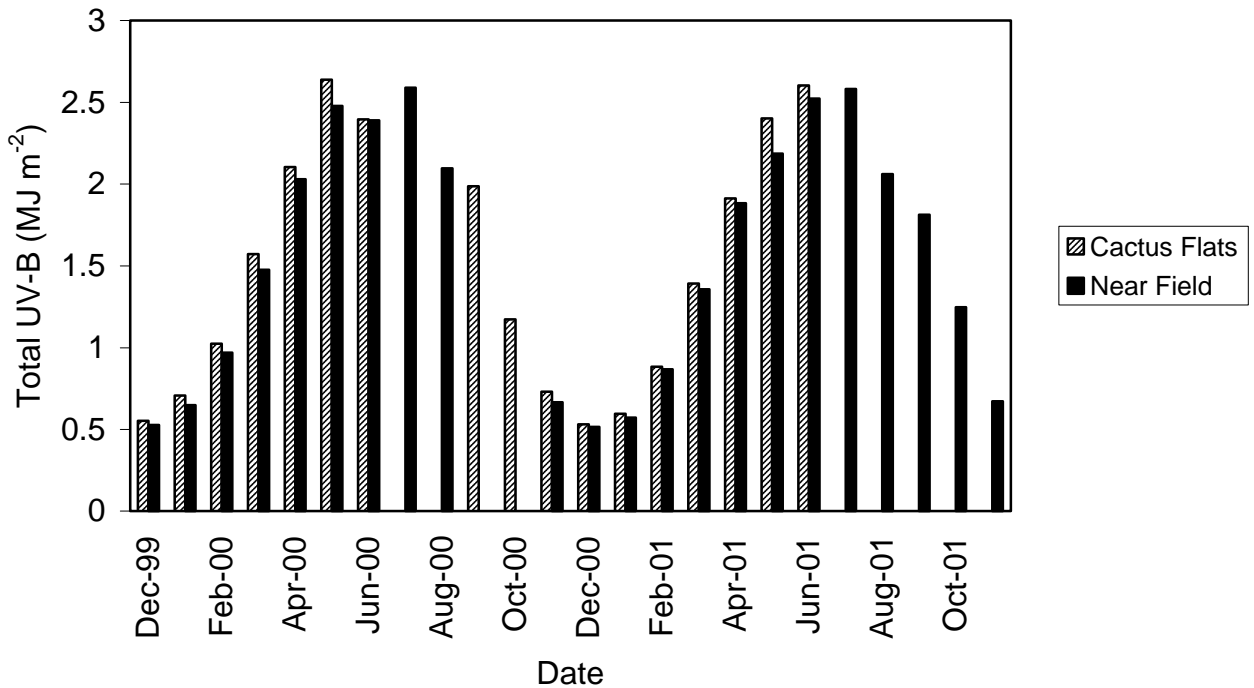


Figure 10. Monthly Total UV-B Radiation at Near Field and Cactus Flats during December 1999 - November 2001

Cactus Flats sensor inoperative June-July 2000 and July-November 2001;
 Near Field sensor inoperative August-October 2000.

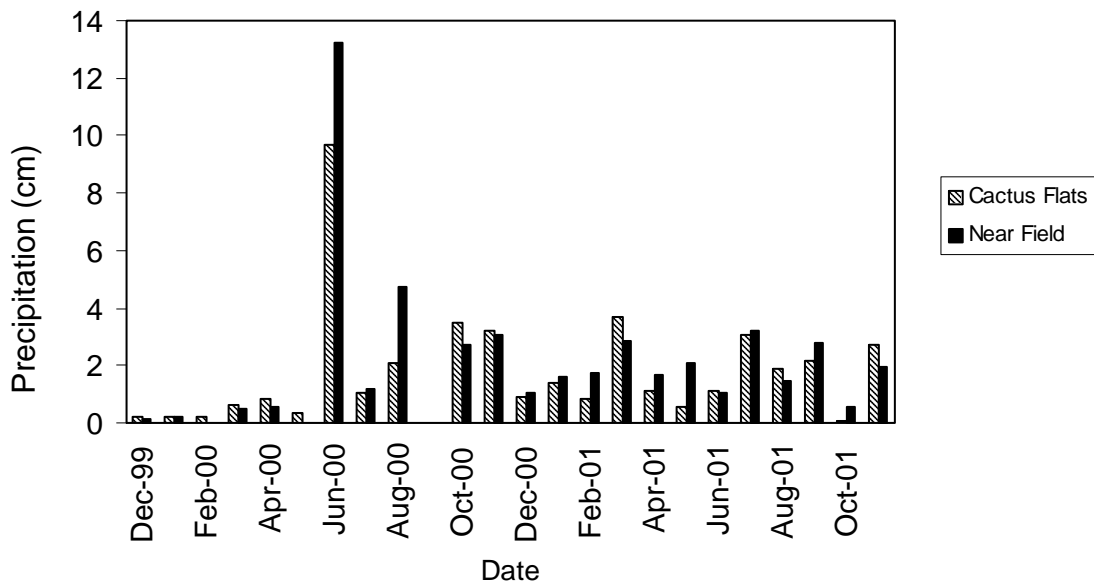


Figure 11. Monthly Total Precipitation at Near Field and Cactus Flats during December 1999 - November 2001