4. Acquisition and Data Management Division

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4.1. CONTINUING PROGRAMS

4.1.1. STATION CLIMATOLOGY

The climatology of surface weather observations at the CMDL observatories is based on hourly-average measurements of the wind direction and speed, atmospheric pressure, air and dewpoint temperatures, and the precipitation amount. The 17-year station climatologies are an important record for the interpretation of measured values of aerosols, trace gases, and for long-term changes in the records themselves. Such measurements also serve to delineate periods of local contamination. The sensors currently in use were selected not only for high accuracy, but also for ruggedness, to minimize failure in the extreme conditions of the polar region. Since 1-minute average values are also recorded to determine the variability within the hourly-average values, the sensors must also have a minimum response time of less than 1 minute. To the extent that it is practical, WMO siting standards [*WMO*, 1969] are followed; i.e., winds are measured at 10 m and temperatures at 1.25 to 2 m heights (Table 4.1). Thermometers are also positioned at the top of the local sampling tower to measure the temperature gradient to determine the stability of the surface boundary layer.

On DOY 302 the first of a new set of sensors was installed at MLO and the sensors described in Table 4.1 were decommissioned, with the sole exception of the Aerovane model 120 on the 8.3-m mast. (The Aerovane was retained because it ties the changes in the near-surface wind flow, due to continued building at MLO, to the climatology for the past 25-30 years.) A detailed discussion of the new meteorological sensors follows the observatory climatologies. If Table 4.1 is compared with the previous CMDL Summary Reports [e.g. *Peterson and Rosson*, 1993], small changes in the heights of sensors will be noted. The values in Table 4.1 reflect the results of a detailed audit of all sensors conducted at the time the older sensors were decommissioned for BRW (April 1994), SMO (June 1994), and SPO (January 1994). There were no changes in the instrumentation at BRW, SMO, or SPO in 1993.

Barrow

Descriptions of the BRW station and its climate are given in previous CMDL Summary Reports [e.g., *DeLuisi*, 1981]. Wind roses of hourly average resultant wind directions and speed are presented in 16 direction classes and 4 speed classes (Figure 4.1). Winds from the "clean-air" sector, north-northeast to southeast occurred 57.0% of the time as compared with 62.3% for the 16-year climatology. Wind speeds greater than 10 ms^{-1} occurred 18.8% of the time as compared with 11.7% of the 16-year climatology. The average speed of 6.9 ms^{-1} (Table 4.2) for the year is the highest average in the 17 years at this location. For September and December the maximum are new records as well.

TABLE 4.1. CMDL CAMS Meteorological Sensor Deployment December 31, 1993*

	BRW		MLO		SMO		SPO	
Sensor	Serial No.	Elevation, m	Serial No.	Elevation, m	Serial No.	Elevation, m	Serial No.	Elevation, m
Primary anemometer†	576	16.5	1829	8.3	070	14.3	826	10.9
Secondary anemometer†	782	40.5						
Pressure transducer‡	2366	9.5	225	3398.4	752	78.5	28	2838
Mercurial barometer	641	9.5	278	3398.4	961	78.5	215	2838
Air temperature A§	8801	2.5	8805	1.7	8803	9.1	293	1.8
Air temperature B§¶	8802	14.7	8809	37.8	8806	2.3	291	20.7
Air temperature C**	G008	3.2	G046	2.0	GO50	10.7	G001	2.4
Dewpoint	G008	3.2	G046	2.0	GO50	10.7	G001	2.4
Rain gauge		~4		0.8		~4		

See Table 4.6 for upgraded specifications.

*Except at MLO where the values refer to conditions as of October 29, 1993.

†Aerovane, model no. 120, Bendix, Inc., Baltimore, Maryland.

‡Pressure transducer, model no. 1201F1b, Rosemount, Inc., Minneapolis, Minnesota. Heights of all pressure sensors are given with respect to MSL.

§Linearized thermistors, Yellow Springs Inst. Co., model no. 44212, Yellow Springs, Ohio, except at SPO where platinum resistor thermometers, Yellow Springs Inst. Co., model no. RTD-358, Yellow Springs, Ohio, are used.

¶Thermometer, positioned at the top of the local sampling tower to facilitate an estimation of boundary layer stability.

**Hygrothermometer, Technical Services Laboratory model no. 1063, Fort Walton Beach, Florida.

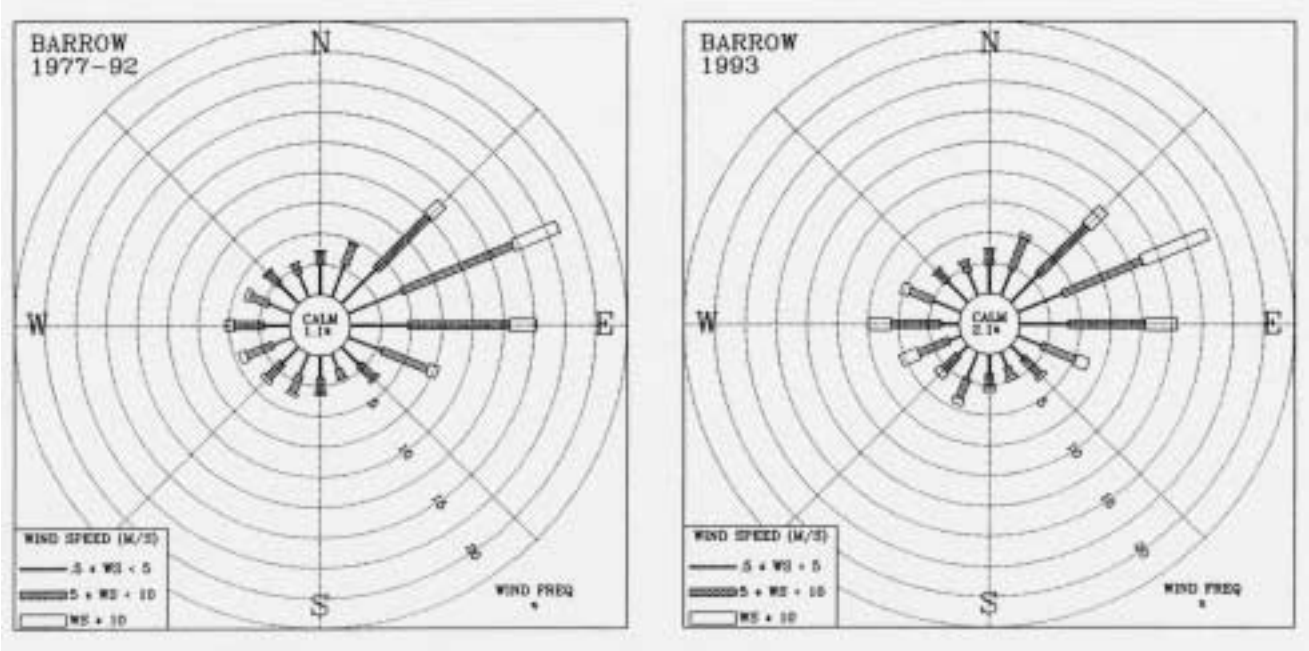

Fig. 4.1. Wind rose of surface winds for BRW for 1993 (left) and 1977-1992 (right). The distribution of resultant wind direction and speed are given in units of percent occurrence for the 16-year period. Wind speed is displayed as a function of direction in three speed classes.

TABLE 4.2. BRW 1993 Monthly Climate Summary

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1993
Prevailing wind direction	WSW	NE	ENE	NE	ENE	E	E	W	WNW	ENE	SSW	ENE	ENE
Average wind speed (m s^{-1})	7.3	6.9	5.8	6.3	7.0	5.0	5.9	6.0	8.6	8.9	5.8	8.7	6.9
Maximum wind speed* (m s^{-1})	18	18	13	14	14	14	21	14	19	22	17	21	22
Direction of max. wind* (deg.)	105	57	69	54	104	54	253	228	333	270	203	87	270
Average station pressure (hPa)	1006.3	1018.6	1015.3	1019.0	1020.8	1015.2	1015.6	1012.3	1008.1	1007.8	1007.9	1012.7	1013.3
Maximum pressure* (hPa)	1024	1044	1045	1028	1033	1028	1027	1026	1021	1023	1021	1035	1045
Minimum pressure* (hPa)	981	993	990	1009	1009	998	992	997	991	991	981	983	981
Average air temperature (°C)	-26.1	-24.9	-24.9	-15.0	-5.7	0.9	5.3	1.6	-0.1	-5.0	-14.6	-22.3	-10.8
Maximum temperature* (°C)	-3	-3	-16	-6	2	17	21	8	9	2	-2	-12	21
Minimum temperature* (°C)	-47	-48	-37	-27	-20	-5	-1	-2	-7	-22	-36	-34	-48
Average dewpoint temperature (°C)	-28.4	-27.3	-27.5	-17.0	-7.4	-0.9	2.3	0.1	-2.5	-7.1	-16.8	-24.8	-13.1
Maximum dewpoint temperature (°C)	-4	- 3	-17	-8	1	5	13	8	6	0	-3	-14	13
Minimum dewpoint temperature (°C)	-51	-53	-40	-29	-22	-6	-4	-5	-13	-25	-39	-37	-53
Precipitation (mm)	0	0	0	0	0	0	9	22	19	5	0	0	54

Instrument heights: wind, 16.5 m; pressure, 9.5 m (MSL); air temperature, 2.5 m; dewpoint temperature, 3.2 m. Wind and temperature instruments are on a tower 25 m northeast of the main building.

*Maximum and minimum values are hourly averages.

The annual-average temperature of -10.8°C (Table 4.2) is the second highest on record. Monthly-average temperatures for July, October, and November were also the second highest for the 16-year record. The annual-average pressure was not significantly different from the long-term mean, but a new record low monthly pressure occurred for January. The summertime precipitation total for the year measured 54 mm, which is below the 16-year average of 66 mm.

Mauna Loa

The climatological summary of MLO is better understood when it is considered in two distinct regimes, the night (downslope) period (1700-0600 HST) and the day (upslope) period (0700-1800 HST). The 16-year night and day wind roses illustrate the two distinct wind patterns (Figures 4.2 and 4.3).

Night Regime. The 16-year wind rose (Figure 4.2), shows that 91.3% of all winds observed had a southerly component. In 1993, the percent occurrence of nocturnal winds was 90.3%. Pressure gradient controlled winds ($WS \geq 10$ ms^{-1}), from predominately westerly and south-easterly directions, occurred 8.4% of the time in 1993, while the 16-year record shows a 7.0% occurrence. The annual-average wind speed is not significantly different from the long-term mean (Table 4.3). The monthly average wind speed for January set a new maximum record while the value for November is a new minimum value. The upslope or northerly component winds (north-northwest through east-northeast) 4.7% of the time are primarily the result of daytime, upslope flow extending into the early evening hours.

Day Regime. The 1993 daytime wind rose (Figure 4.3) indicates that winds from the west-northwest through east-northeast occurred 56.9% of the time compared with the expected occurrence of 58.8% based on the 16-year record. Pressure gradient controlled winds ($WS \geq 10$ ms^{-1}) occurred 8.5% of the time in 1993, while the 16-year record shows an expected occurrence of 5.5%. While the percentage of occurrence of pressure-gradient determined winds, generally associated with storms, is the same for both time-regimes for 1993, the expected value is less in the daytime case. The day wind rose is more uniformly distributed in the light wind classes than the night wind rose. This is due to the occurrence of variable wind directions during the transition periods at dawn and dusk, most of which are included in this regime.

The average air temperature for 1993 (Table 4.3), combining both day and night records, was 7.1°C, 0.1°C above the long-term average while the average pressure, 680.5 mb, equals the 16-year average. Monthly mean wind speeds for January set a new maximum for that month, and November set a new minimum for that month. The monthly mean pressure for January and October set new record minimum values for those months. The monthly mean temperature for June set a new maximum and September set a new minimum. The precipitation total for the year measured 299 mm which is significantly below the 16-year average of 520 mm. This is the second lowest precipitation amount reported in the past 7 years.

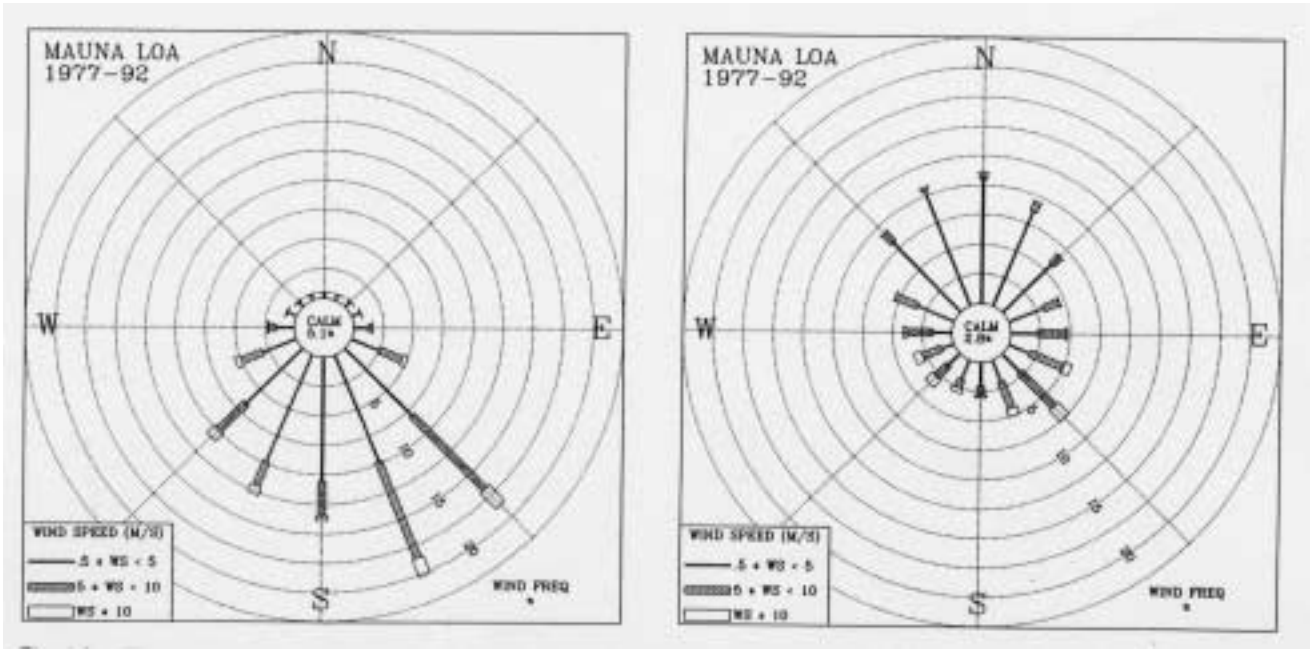

Fig. 4.2. Wind roses of the surface winds for MLO for 1977-1992 night (left) and day(right). The distribution of resultant wind direction and speed are given in units of percent occurrence for the 16-year period. Wind speed is displayed as a function of direction in three speed classes.

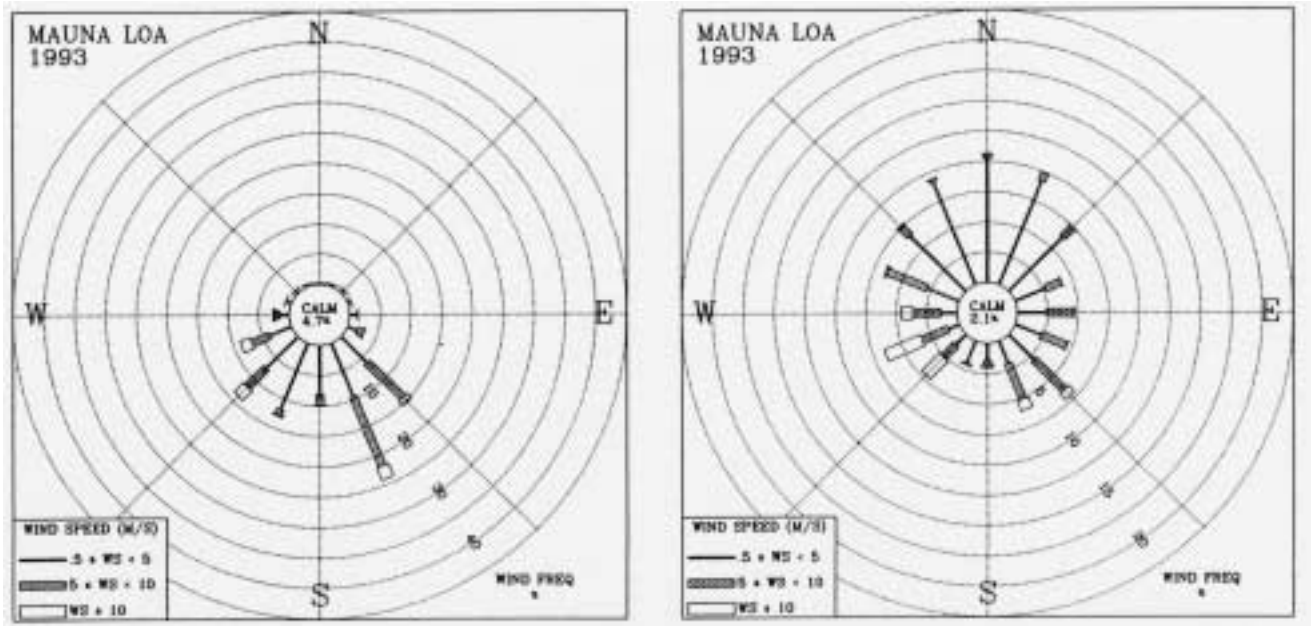

Fig. 4.3. Wind roses of the surface winds for MLO for 1993 night (left) and day (right). The distribution of resultant wind direction and speed are given in units of percent occurrence for the year. Wind speed is displayed as a function of direction in three speed classes.

Samoa

A comparison of SMO's 1993 wind rose (Figure 4.4) with that of the 16-year period shows a higher percentage (68.8%) of "clean air" sector winds (north-northwest through southeast) in 1993 than in the 16-year record (59.3%). Yet the 1993 value is less than the 75.8% observed in 1992. The occurrence of winds in the 10 ms^{-1} or greater class is 7.0% in 1993 while the expected occurrence based on the 16-year record is 4.8%. The average wind speed for the year, 5.3 ms^{-1} (Table 4.4) is near normal. Monthly average wind speed for May was a new record high, while the monthly average wind speeds for January and February were new minimum values.

Average station pressures for the months of January and February were also in the lowest 10% compared with the 16-year record (Table 4.4). The average station pressure for the year was 1000.6 mb, a large 1.3 mb above the long-term average at Cape Matatula. The average air temperature, 27.6°C, is 0.5°C above the 16-year average. The precipitation total for the year measured 1934 mm which is below the 16-year average of 2095 mm.

South Pole

The distribution of the surface wind direction in 1993 (Figure 4.5) shows a lower percentage of winds (92.6%) from the "clean air" sector (grid north-northwest through east-southeast) than the 16-year average (93.9%). A higher percentage of winds in the >10 ms^{-1} class (3.2%) was observed in 1993 than the long-term average (4.0 %). While the average wind speed of 5.4 ms^{-1} is equal to the long-term average, the average value for March is a new maximum for that month.

The 1993 annual-average station pressure was 677.0 mb, 2.1 mb below the 16-year average (Table 4.5). The 1993 value is the third lowest annual-average pressure recorded in the 17-year history. The annual-average temperature was -49.3°C, 0.3°C below the long-term annual average. While the monthly-average tempera-tures for August and December were in the lowest 10 percentile of the record, no other monthly means were records. The minimum temperature of the year was observed to be -76°C in August.

Meteorological Measurement System Upgrade

The last major upgrade in the meteorological sensors at the CMDL stations occurred 6 years ago when the Technical Service Laboratory (TSL) model number 1063 hygrothermometer was selected as the preferred instrument for measuring humidity. This is the same instrument used by the National Weather Service to measure temperature and humidity at airport locations. While individual instruments have been replaced, the basic complement of instruments has not changed in the past 20 years. Recently it has become increasingly difficult to purchase replacement instruments and reliable parts. For the same reasons it has been more difficult to keep the Control and Monitoring System (CAMS) operational as well. Thus it was decided to reconsider the specific

TABLE 4.3. MLO 1993 Monthly Climate Summary

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1993
							Night						
Prevailing wind direction	SW	WSW	SSE	SSE	SSE	SSE	SSE	SE	SSE	SSE	SE	SE	SSE
Average wind speed (m s^{-1})	7.7	6.0	5.2	4.6	5.1	5.2	3.7	3.5	3.2	4.4	4.0	5.4	4.9
Maximum wind speed* (m s^{-1})	20	15	15	12	14	14	12	9	10	15	11	15	20
Direction of max. wind* (deg.)	263	269	227	161	161	151	149	141	159	226	154	123	263
Average station pressure (hPa)	676.8	678.5	679.7	680.9	680.1	681.1	680.8	681.5	681.0	679.7	679.2	679.6	679.9
Maximum pressure* (hPa)	682	682	686	684	684	684	684	685	684	683	682	683	686
Minimum pressure* (hPa)	666	674	669	678	676	679	678	679	677	675	677	676	666
Average air temperature (°C)	2.4	3.3	3.0	5.5	5.0	8.3	6.5	5.2	5.2	5.2	4.7	4.7	4.9
Maximum temperature* (°C)	10	9	10	13	10	15	13	10	10	10	9	10	15
Minimum temperature* (°C)	-4	-3	-3	1	1	5	3	3	2	2	0	1	-4
Average dewpoint temperature (°C)	-16.4	-20.9	-15.9	-19.4	-18.3	-20.1	-9.9	-6.2	-3.6	-10.0	-22.3	-18.1	-15.7
Maximum dewpoint temperature (°C)	4	0	7	7	4	7	7	6	8	8	2	3	8
Minimum dewpoint temperature (°C)	-35	-35	-37	-36	-34	-33	-26	-20	-20	-27	-35	-35	-37
Precipitation (mm)	77	0	0	0	1	0	14	0	3	4	0	0	98
							Day						
Prevailing wind direction	WSW	W	N	N	NW	NE	SE	NE	N	WNW	NNW	ESE	NNW
Average wind speed (m s^{-1})	7.8	6.1	5.2	4.4	5.0	5.1	3.9	3.5	3.5	4.6	3.2	4.9	4.8
Maximum wind speed* (m s^{-1})	19	17	16	10	13	15	13	9	8	17	11	16	19
Direction of max. wind* (deg.)	244	245	235	161	151	150	137	89	156	181	164	130	244
Average station pressure (hPa)	676.7	678.5	679.7	681.0	680.2	681.3	681.0	681.6	681.1	679.7	679.2	679.6	680.0
Maximum pressure* (hPa)	682	682	686	684	684	684	684	684	684	684	682	683	686
Minimum pressure* (hPa)	666	674	670	678	676	679	679	679	678	674	676	675	666
Average air temperature (°C)	6.0	7.8	7.8	10.9	10.3	13.4	10.5	9.9	9.5	9.2	9.2	8.4	9.3
Maximum temperature* (°C)	13	14	16	17	16	19	18	15	16	15	14	15	19
Minimum temperature* (°C)	-3	-2	-3	1	2	6	4	3	3	2	2	1	-3
Average dewpoint temperature (°C)	-11.0	-15.0	-8.7	-11.6	-9.6	-10.3	-1.5	0.9	0.3	-3.7	-13.5	-14.4	-8.9
Maximum dewpoint temperature (°C)	6	5	11	11	6	9	10	8	9	8	7	6	11
Minimum dewpoint temperature (°C)	-36	-32	-37	-35	-32	-32	-26	-19	-23	-25	-33	-33	-37
Precipitation (mm)	64	0	0	0	0	0	41	0	39	39	4	13	201

Instrument heights: wind, 8.3 m; pressure, 3398.4 m (MSL); air temperature, 1.7 m; dewpoint temperature, 2.0 m. Wind and temperature instruments are on a tower 15 m southwest of the main building.

*Maximum and minimum values are hourly averages.

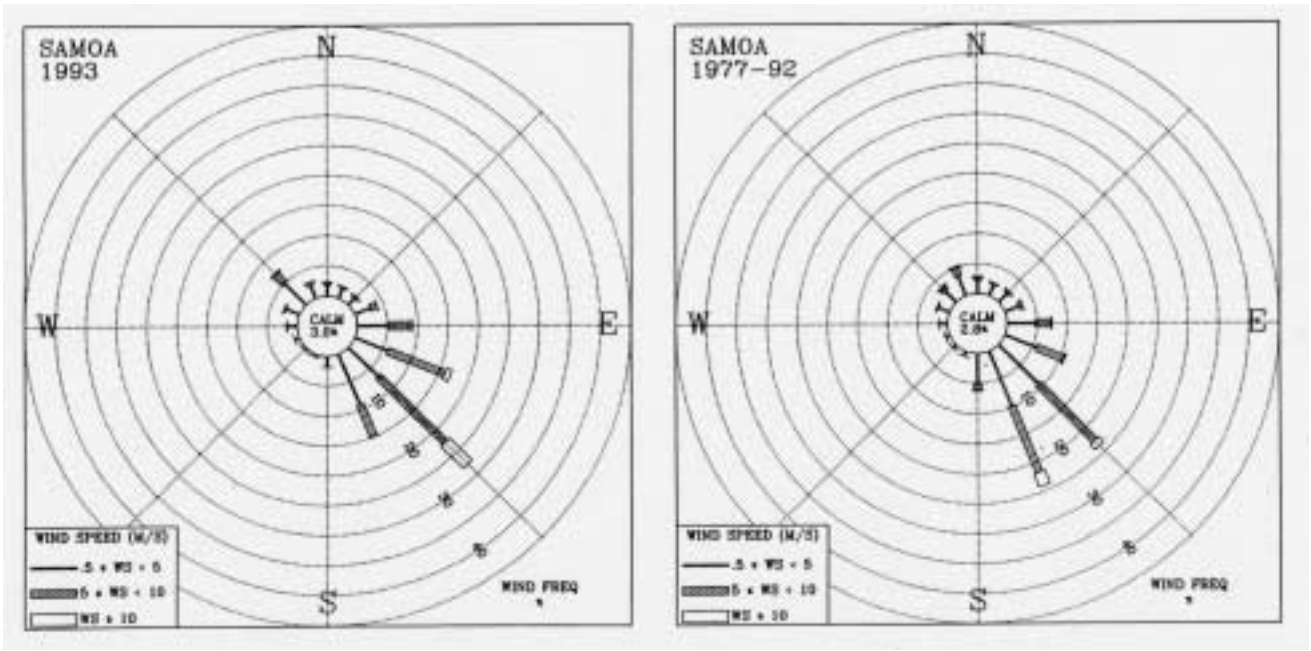

Fig. 4.4. Wind roses of the surface winds for SMO for 1993 (left) and 1977-1992 (right). The distribution of resultant wind direction and speed are given in units of percent occurrence for the year and 16-year period, respectively. Wind speed is displayed as a function of direction in three speed classes.

TABLE 4.4. SMO 1993 Monthly Climate Summary

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1993
Prevailing wind direction	SE	NW	NW	SE	SE	SE	SE	ESE	SE	SE	SE	SE	SE
Average wind speed ($m\ s^{-1}$)	2.5	2.3	4.0	3.9	8.0	6.6	7.4	5.2	6.3	6.1	6.1	4.4	5.3
Maximum wind speed* ($m\ s^{-1}$)	14	10	12	13	15	14	13	10	13	12	14	15	15
Direction of max. wind* (deg.)	306	305	318	310	139	99	139	124	137	149	123	33	139
Average station pressure (hPa)	997.9	997.7	1000.4	999.7	1001.8	1001.9	1001.8	1002.6	1002.7	1001.7	1000.5	998.7	1000.6
Maximum pressure* (hPa)	1004	1003	1004	1003	1006	1006	1006	1006	1007	1006	1005	1002	1007
Minimum pressure* (hPa)	998	989	996	996	997	998	998	998	998	998	997	994	988
Average air temperature (°C)	28.7	28.8	28.0	28.4	27.5	26.9	25.9	27.0	27.0	27.0	27.8	28.6	27.6
Maximum temperature* (°C)	37	36	35	35	32	32	33	33	35	35	36	35	37
Minimum temperature* (°C)	22	23	23	24	24	22	21	22	23	22	24	23	21
Average dewpoint temperature (°C)	23.3	22.9	23.5	24.0	22.7	22.1	21.1	22.1	21.9	21.5	22.7	23.8	22.6
Maximum dewpoint temperature (°C)	26	25	25	25	25	24	24	25	24	24	25	26	26
Minimum dewpoint temperature (°C)	19	20	19	22	19	19	18	17	19	18	20	22	17
Precipitation (mm)	202	144	290	179	86	63	94	86	198	277	112	202	1934

Instrument heights: wind, 14.3 m; pressure, 78.5 m (MSL); air temperature, 9 m. Wind and temperature instruments are on Lauagae Ridge, 110 m northeast of the main building. Pressure sensors are in the main building.

*Maximum and minimum values are hourly averages.

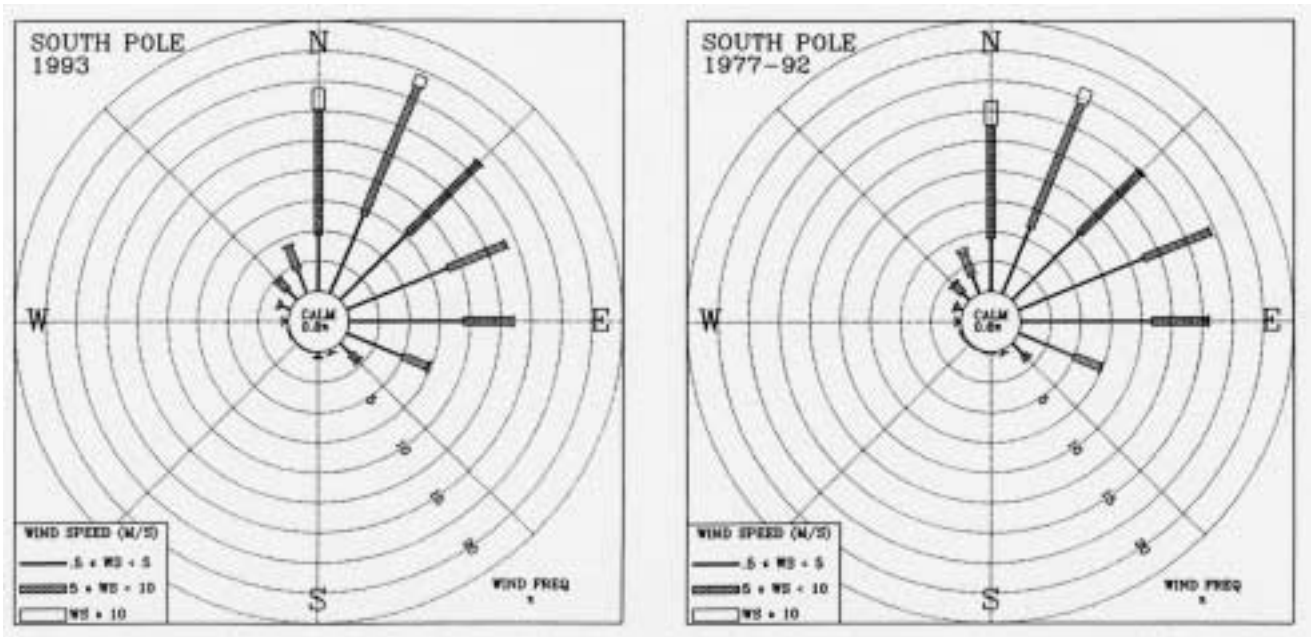

Fig. 4.5. Wind roses of the surface winds for SPO for 1993 (left) and 1977-1992 (right). The distribution of resultant wind direction and speed are given in units of percent occurrence for the year. Wind speed is displayed as a function of direction in three speed classes.

TABLE 4.5. SPO 1993 Monthly Climate Summary

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1993
Prevailing wind direction	ENE	N	NE	NNE	NNE	ENE	N	E	NNE	NNE	NNE	N	NNE
Average wind speed (m s^{-1})	4.7	5.1	6.6	5.4	6.0	5.4	4.3	5.3	5.8	6.6	4.9	4.6	5.4
Maximum wind speed* (m s^{-1})	10	10	13	11	14	12	12	11	13	15	11	12	15
Direction of max. wind* (deg.)	2	347	19	9	6	7	353	348	9	351	24	357	351
Average station pressure (hPa)	693.0	680.1	680.2	677.5	673.8	673.7	670.9	667.4	672.1	672.1	682.6	681.1	677.0
Maximum pressure* (hPa)	706	693	696	690	690	694	690	687	687	685	694	690	706
Minimum pressure* (hPa)	683	665	670	667	661	660	656	650	655	660	674	674	650
Average air temperature (°C)	-27.4	-41.5	-52.4	-57.6	-56.4	-60.4	-56.4	-63.8	-59.0	-50.4	-38.4	-28.8	-49.3
Maximum temperature* (°C)	-18	-26	-35	-46	-34	-30	-40	-47	-44	-33	-29	-20	-18
Minimum temperature* (°C)	-36	-55	-62	-68	-71	-74	-73	-76	-74	-61	-48	-37	-76
Average dewpoint temperature (°C)	-28.4	-41.7	-52.0	-58.1	-56.6	-60.4	-57.1	-63.0	-57.8	-50.1	-39.2	-30.1	-49.5
Maximum dewpoint temperature (°C)	-19	-27	-36	-47	-35	-31	-41	-46	-43	-33	-29	-23	-19
Minimum dewpoint temperature (°C)	-37	-56	-63	-68	-69	-70	-71	-72	-71	-61	-49	-40	-72
Precipitation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0

Instrument heights: wind, 10.9 m; pressure, 2938 (MSL); air temperature, 1.8 m. The anemometer and thermometer are on a tower 100 m grid east-southeast of CAF. Pressure measurements are made inside CAF.

*Maximum and minimum values are hourly averages.

instruments used to measure the station pressure, temperature gradient and wind speed and direction, along with a dedicated data acquisition system, in designing a replacement weather measuring system.

Due to the recent, mostly favorable, experience with the TSL 1063 hygrothermometer (Technical Services Laboratory, 630 Lovejoy Road, Fort Walton Beach, Florida 32549) it was decided to continue to use this instrument for dry air and dewpoint temperature measurements at ground level at the observatories. A good reason could not be found for changing to another precipitation gauge so the tipping bucket rain gauge used from the 1976-1977 period (Belford Instrument Company, 1600 South Clinton St. Baltimore, Maryland 21224) was incorporated into the design of the replacement system.

After limited testing and review, a variable-capacitance ceramic sensor, similar to the old Rosemount transducer (Rosemount Inc., 12001 W. 78th St., Eden Prairie, Minnesota 55344) was selected. The new sensor is a Setra model 270 barometer (Setra Systems, 45 Nagog Park, Acton, Massachusetts 01727). When the five pressure transducers purchased for the stations and Boulder were compared with the mercury barometer in Boulder, the average daily difference was less than 0.1 mb with a standard deviation of 0.2 mb. These values are consistent with the specified accuracy of the sensor (Table 4.6).

To eliminate the need for semi-annual calibration of the thermometers used to measure the temperature gradient, standard RTD (Resistor Temperature Device) sensors were selected for which matching electronics could be purchased. The sensor is a Logan 4150 series platinum resistance probe in a steel sleeve that was machined to reduce the thermal mass and inherent thermal transfer in a ventilated flow (Logan Enterprises, 8844 US North West, Liberty, Ohio 43357). For the range of air temperatures at the CMDL stations, an accuracy of 0.1°C can be realized (Table 4.6). Linearized thermisters, YSI part number 44212 (Yellow Springs Instrument Co., Yellow Springs, Ohio 45387) were previously used to measure the air temperature. (Radiation shielding was accomplished using the Gill aspirated temperature-dewpoint radiation shield model number 43406 (R.M. Young Company, 2801 Aero-Park Drive, Traverse City, Michigan 49684). Due to small non-linearity in the calibration, a "warm" and "cold" season calibration had to be used to guarantee 0.1°C accuracy over the specified range of -50° to +50°C. Since 1976, platinum resistance probes have been used at SPO to obtain accurate temperatures below -50°C. Cambridge System Inc., model number 137-MI-TC (Cambridge System Inc., Newton, Massachusetts) temperature-dewpoint measuring system aspirated radiation shields were used to shield the thermometers. Measurements indicate that the thermometer is aspirated at an average rate of about 1 ms^{-1}.

After a careful review of the anemometers used at SPO, it was decided that the R.M. Young (RMY) model number 05105 (R.M. Young Company) propeller anemometer would withstand the severe antarctic conditions. (RMY model number 05305, a high performance anemometer designed for air quality measurements, was used at MLO where there is a higher percentage of light winds during the upslope-downslope transitions.) Unlike the Bendix Friez aerovane model number 120 (Bendix Corp., Baltimore, Maryland 21204), which was used for wind speed and direction measurements since the initial installations in 1973-1975 and that uses a magneto and is subject to magnet strength changes and line loss errors, the RMY sensor produces a pulse for unit run-of-wind. Wind tunnel testing indicated that the aerovane had a threshold wind speed of 1-1.3 ms^{-1}, while similar tests showed the RMY sensors to reach threshold speeds at about 0.4-0.7 ms^{-1}.

The design of the revised electronics for the meteorological sensors has focused on distributing the signal acquisition electronics so that only serial digital signals are transmitted over long distances and thus

TABLE 4.6. CMDL Upgraded Meteorological Sensor Specifications*

Sensor	Range	Resolution	Accuracy	Threshold Sensitivity
RMY wind speed	0 to 60 ms^{-1}	0.01 ms^{-1}		1 ms^{-1}
RMY wind direction	0 to 355 degrees	0.1 degree		1 ms^{-1}
Setra station pressure	600 to 1100 mb	0.005%	±0.03% FS	
RTD temperatures	-200 to +600°C	0.1 C	±0.3 C FS ±0.1 C (-85 to +50 C)	
TSL hygrothermometer	-60 to +60 C	0.1 C	0.5% RMS, 1% MAX (>0 C) 2% MAX (<0 C)	

RMY, R.M. Young Company, Traverse City, Michigan; RTD, resistor temperature device; TSL, Technical Services Laboratory, Fort Walton Beach, Florida.

*Values refer to conditions at MLO as of October 30, 1993.

eliminate the need for on-site calibrations whenever possible. Individual analog-to-digital converter modules MetraByte (MB) module numbers 1000/2000 (Kiethley MetraByte Co., 440 Myles Standish Blvd., Taunton, Massachusetts 02780) interface the sensors to the computer interface by a RS-485 interface. Non-volatile memory is used to store sensor identification and calibration information. It is also possible to invoke digital filtering of the signals. The measurements from each sensor-module pair are, therefore, filtered and calibrated to give values scaled in physical units. A computer requests data from the individual sensors at intervals determined by the filtering that is employed.

A rack mounted computer is used to acquire and store all of the data. The primary data file is initialized daily after the system does a survey of the active sensors. One-minute average values from each sensor are stored in the data file. To the maximum extent possible, these values are fully calibrated. The system also provides features to allow the operator to enter supplementary observations and calibration information such as weather and mercury barometer observations. The system also provides a simple text editor for metadata entries. In all cases these observations and entries are stored with the data files since they pertain to the data and determine, in part, its quality. Multitasking of the data acquisition program and data display-input program is accomplished under the Microsoft Windows environment.