South Pole Meteorology

Station History Timeline

31 October 1956
First aircraft landing at the South Pole: Navy R4D called "Que Sera Sera."
Temperature: -58°F

20 November 1956
Initial team of Navy Seabees arrives to begin construction of the IGY station; beginning of continuous occupation of South Pole.

30 November 1956
Dr. Paul Siple, science leader of the first winter-over crew, arrives. Siple, with help from other personnel on station, recorded weather observations until the Weather Bureau crew arrived.

7 January 1957
Edwin Flowers (Meteorologist-in-Charge) and John Guerrero arrive and start setting up the U.S. Weather Bureau Met station.

9 January 1957
Kollsman aneroid barometers and Bendix-Friez (later listed as a Belfort) barograph installed. Barometer elevations listed to be same as station elevation: 9186 feet/2800 meters. This elevation was likely calculated by averaging altimeter readings and was not to be changed for many years.

11 January 1957
Toluene minimum thermometer installed in "thermoscreen" instrument shelter upwind from station.

January 1957
Aerovane wind system mounted on 10-foot mast.
Station construction continues with most materials received via airdrops.
Station was officially dedicated on the 23rd, but the ceremony was at McMurdo.

February 1957
Two more meteorologists, Herbert Hanson and William Johnson arrive. Of the 18 winterovers that first year, 4 were working in Met. The crew worked on the inflation shelter and installed the GMD automatic radiosonde tracking equipment in the radome that was above the Met office.

6 March 1957
Aerovane wind system plus a backup system were mounted on new 10-meter mast upwind of station.
"Thermohm" resistance thermometer was installed in the thermoscreen and connected to a recorder in the office.

27 March 1957
Upper air program commences. Rawinsondes launched daily and tracked with GMD-1A tracking system. Appears as though this was the standard Weather Bureau system of the time. Balloons were released through an overhead hatch in the inflation shelter. A hydrogen generator provided gas for the balloons.

April 1957
Four more resistance thermometers installed at various heights, including the snow surface and 10 meters below the snow surface.

On the 15th the upper air program was changed from one to two rawinsonde flights per day.

A ceiling light was installed.

7 May 1957
First set of radiometers installed, beginning an ambitious program of radiation measurement that apparently only last a few years.

12 May 1957
First observation of -100F.

22 June 1957
Pilot balloon sounding system installed; starting in October two flights per day were done.

July 1957
Two precipitation gages were installed: a standard 8" gage (unshielded) near the surface and a homemade 8" gage 30 feet up on the instrument mast. The difficulty of accurately measuring precipitation at the South Pole was immediately apparent and Edwin Flowers estimated that up to 90% of the catch from the near-surface gage was from drifted snow.

Also in 1957
It was found through experimentation that balloon flights went considerably higher during the winter if the balloons were first conditioned in diesel fuel. This became routine, and yielded an average altitude of 19.5 km.

Surface observations were initially done every 3 hours; increased to hourly on September 1st. Temperature was recorded from four levels.

All surface and upper air observations were recorded on punch cards, averaging about 43 cards per day.

Air samples were collected for determination of CO_2 content and snowfall samples were collected for chemical analysis.

President Eisenhower announced that the USAP would continue beyond the IGY.

Local standard time is shown as GCT + 12 hours.

November 1958
Instrumentation changes documented: new maximum and minimum liquid-in-glass thermometers and a new ceiling light.

January 1959
A CO_2 analyzer was transferred to Pole from Little America V.
Observation times were changed from LST to GCT.

11 January 1960
Liquid-in-glass thermometers were taken out of service. Hourly and max/min temperatures were taken from aspirated thermohms.

September and October 1960
Radiation program was enhanced with establishment of new instrument field.
Instruments from 1957 were replaced and by mid-October 8 different radiometers were in service.

1 December 1961
Synoptic and surface aviation observations were taken every 3 hours, with additional aviation obs, including specials, when requested. In addition to the standard elements for aviation observations, the 700 millibar height was reported in the remarks. The "Antarctic code manual" was used for aviation observations.

The location identifier for South Pole was NGD2 (McMurdo was NGD). The WMO index number was, and still is, 89009.

Met office location – "in mess hall building."

31 December 1962
All radiometers except for one net radiometer were removed.

1 August 1963
Notes from the WB Form 500-10 prepared on this date:

They had an aspirated psychrometer but determined that temperatures were too low to make humidity measurements.

The ceiling light was not in use at this time.

The precipitation gages had been removed by this time "due to nearly constant wind flow and paucity of snowfall." A snow stake field was established approximately 600 feet grid NNW of the office; 50 stakes about 10 feet apart were measured monthly.

Number of hydrogen generators on hand: 3 (no helium).

Pibals were no longer being done. In 1963 they went to one rawinsonde per day for the winter months. Radiometersondes were flown every third day from 3/22/63 to 9/21/63.

The one radiometer still in service was used as an aid in wintertime cloud detection…"thus any cloud passing over radiometer would cause shift of trace on recorder in office." It was noted that the full radiation program was supposed to be started up again in 1964.

They had two lines of visibility markers, grid north and grid south, out to 1 mile.

They had ozonesondes that would not calibrate properly so the program was terminated.

14 September 1964

A less ambitious radiation measurement program than its predecessor was commenced with the installation of one radiometer (or pair of radiometers) and the Campbell-Stokes sunshine recorder.

February 1965

A new inflation shelter was built in the same location as the original one, which by this time was below the snow surface.

31 January 1966

A balloon exploded while being filled with hydrogen and most of the inflation shelter was destroyed, requiring an emergency rebuild.

31 December 1967

New aspirated thermohm installed 270' grid north of the station.

February 1969

The GMD-1A was raised 8.5 feet to avoid limiting angles caused by surrounding structures and drifting snow.

1970 – 1971 Summer

Site preparation begins for the new dome station.

18 October 1972

Field, station, and barometer elevations all still listed as 9186 feet. A footnote says this is the average height for a 100-mile radius.

The upper air equipment is now listed as GMD-1B; implies some sort of upgrade but no date for that is given.

1972 – 1973 Summer

Major construction of new dome station begins: 102 men were living in the construction camp.

A sub-surface storage area was built for helium cylinder storage (at the old station.) It appears as though the hydrogen generators were taken out of service this summer and balloons were filled with helium, requiring up to 450 helium cylinders per year.

31 October 1973

Notes from the WB Form A-1 prepared on this date:

Appears as though aspirated thermohm installed 12/31/67 was the primary temperature sensor; was mounted on the wind mast at 4 feet above the surface.

Wind monitor was original Bendix-Friez Aerovane from 1957, with recorders in the weather office and in the galley.

Upper air tracking equipment was GMD-1B connected to a Honeywell mini-computer. Rawinsonde flights were twice per day in summer, once per day in winter, except twice per day from 28 August through 5 September (probably in support of McMurdo Winfly). Balloons were still treated with diesel fuel during the winter at this point.

Radiometersonde program was conducted by NOAA ERL (predecessor to CMDL).

Synoptic/aviation observation schedule in absence of aircraft operations was every 6 hours, at the GMT synoptic hours. Synoptics were every 3 hours during aircraft operations and aviation observations were hourly.

1973 – 1974 Summer

Dome station construction continues, with a construction crew of 146 men.

A UC Davis group shows up to do preliminary work on a planned micrometeorology study.

5 November 1974

The Old Pole station is turned over to civilian management (Holmes and Narver) for its last summer of operation.

18 December 1974

Most of the meteorological instruments are moved to new station on this date.

24 December 1974
Upper air system is set up at new station; includes new balloon inflation tower outside the garage arch.
Weather Bureau office moves from Old Pole to the dome (first floor of science building).
Report from end of December indicates no new instrumentation; sensors from old station were moved to upwind of the dome.

A new elevation survey was completed by the Navy Navigation Satellite Geodesy. The new station elevation was listed as 9342 feet and the actual barometer elevation was 9347 feet. This was the first update to the elevations since 1957.

9 January 1975
Dedication of new station.

1 November 1975
From the final Weather Bureau station history document: "Transfer of meteorological responsibilities from the U.S. National Weather Service to the New Zealand Weather Service. As directed by the National Science Foundation and coordinated with NOAA."

1976 – 1978
Met office was run by NZ Weather Service. No information currently available from this period.

1978 – 1979 Season
Met responsibilities were turned over to the primary contractor, Holmes and Narver. Support and supervision of Met operations was from the Navy Weather Section, with personnel at McMurdo and Pt. Mugu.

1979 Winter
Notes from the turnover report:

This was probably the first year in which computers were used extensively for most aspects of the job. HP 2100S computers were used for data reduction, coding and transmission of observations, record keeping, and production of reports.

Much of the same equipment from 1974 and earlier was still in use. Some newer equipment noted: Rosemount temperature probe and Esterline Angus recording chart; Bell & Howell digital barometer.

Balloons were still being conditioned with diesel fuel during the winter to improve termination heights.

Radiosonde baseline checks were done with a custom-built baseline box.

Observation schedule: Synoptics every 6 hours and raobs at 00Z during winter; 00Z and 12Z raobs during summer and McMurdo Winfly, and hourly surface observations during aircraft operations. FMH manuals were used for taking and coding observations, with some specific exceptions as required by the Navy.

CLIMAT TEMP (upper air) and CLIMAT (surface) messages were sent out monthly. The snowstake field of 50 stakes ¼ mile from the dome was in use (monthly measurements).

In May and June, extra upper air observations were done in support of the Global Weather Experiment of 1978-1979.

The Met staff recommended moving the office to the upper floor of Skylab (never happened).

1980 Winter

Support contract changed from Holmes and Narver to ITT this year.

Only part of a turnover report is available. No changes to instrumentation mentioned. A few notes from that report:

During winter darkness, cloud height and type were often entered as missing. An estimate of total cloud cover was entered.

It was stated that during the winter only ice crystals, ice fog, and blowing snow occur (snow grains were only observed during the summer). "Snow is never reported at the South Pole."

The suncards were changed at midnight Local Standard Time (would later be changed to midnight UTC).

1981 Summer/Winter

Surface aviation observations were issued at 58 minutes past the hour, LST.

Visibility markers were limited to buildings, antennas, and the crashed Herc (2.5 miles).

Guidance for aviation and Synoptic observations was FMH-1 and FMH-2.

They didn't report any low (stratus type) clouds…figured that the station elevation was too high to have such clouds.

Two types of radiosondes were used: 81 series and 91 series. Diesel conditioning was still practiced during the winter.

1982 Winter

A new hydrogen generator was in place and more or less ready to go but the Met staff had a lot of safety concerns about it. They continued to use helium for balloon filling.

Turnover report contains a complete equipment inventory showing backup units for the Belfort microbarograph, Rosemount temperature probe, and Aerovane wind system.

1984 Winter

The hydrogen generator was being used. Helium tanks were kept on hand as back-up.

Equipment problems included the failure of the digital barometer and the aspirator motor for the temperature probe.

1984 – 1985 Summer/Winter

The wind monitors were changed out (presumably with calibrated units) on 11-20-84. The winter-over staff recommended raising the primary wind monitor to the standard height; implies that it went through this year at a lower than standard height.

The aspirator motor for the temperature probe was replaced in late summer and worked through the winter.

The broken digital barometer was sent to Pt. Mugu for work and a new one was ordered.

A new computer was received, a Digital Equipment Corp. Micro PDP/11.

The Met crew had pre-deployment training at Chanute Air Force Base.

1985 – 1986 Summer

The department went to GMT for all records after finding that in the past a lot of errors were related to the conversion between LST and GMT.

A Navy technician came early in the summer and calibrated the pressure instruments and went over maintenance procedures for the temperature and wind equipment with the Met Tech.

The repaired digital barometer came back but it soon developed new problems.

The station elevation was listed as 9301 ft. This was to remain the same until 2005.

1986 Winter

The GMD upper air equipment, as usual, required a lot of maintenance and spare parts but got them through another year of radiosonde flights.

The hydrogen generator had all kinds of problems that kept the Met Tech busy all year. It was not working at the end of the winter, and in fact never worked again.

1986 – 1987 Summer/Winter

After consultation with Navy and NSF personnel, it was decided that low (stratus) clouds should be reported at Pole "with attention paid to cloud composition and appearance."

In the summer many of the 12Z soundings were cancelled due to a shortage of radiosondes and helium. In the winter, 2nd launches (after the first flight had a failure) were often not done for the same reason.
A new VAX computer system was installed in the station.

Two of the three wind monitors froze up during the winter and the primary one was only 7 ft. off the snow surface.

Again, the Met staff lobbied for an office location with a view, to no avail.

24 August 1989

Wind speed record of 48 kts/55 mph observed.

1989 – 1990 Summer

A new upper air system was received and installed, finally replacing the old and ailing GMD. This was the Atmospheric Instrumentation and Research (A.I.R.) radiotheodolite system (A.I.R.-3A-RT2); included A.I.R. radiosondes, hardware and software.

Two Omega temperature probes were installed: platinum RTD probes Model PR-14-3-100-V4-6-E. Rosemount system most likely remained the primary temperature reading while the new sensors were evaluated and compared.

1 April 1990

Support contract changed to Antarctic Support Associates.

1990-1991 Summer

Princo mercurial barometer was installed: model 453X. It appears as though this was never used as the primary pressure reading but was used for comparison with other barometric instruments to make sure they were remaining accurate between annual calibrations.

1991 Winter

Jim Notchey, winterover meteorologist, developed programs on the VAX computer for data entry and storage, data processing, and reporting.

1991 – 1992 Summer/Winter

The A.I.R. system was used with model IS-4A-1680 radiosondes. Errors were found in the processing and coding programs and a list of requested corrections was sent to A.I.R.

Temperature sensors consisted of the old Rosemount/Esterline Angus system and the two Omega probes, which were connected to digital displays. Appears as though Omega

"Temp 1" was the primary sensor by this time although the Esterline Angus chart was often used for local observations. This was the set-up through the remainder of the 1990s. All temperature probes were aspirated and they were all raised to 2m during the summer.

Pressure sensors included the Kollsman aneroid barometer and altimeter setting indicator, the Princo mercurial barometer, a Belfort microbarograph, and two Omega pressure sensors. It appears as though the Kollsmans were the primary instruments for observations.

Wind instruments consisted of the old Aerovane wind monitor (now referred to as the UMQ-5) and chart recorder, plus two RM Young Model 05103 windbirds. The UMQ-5 and one of the RM Young's were on Met Tower 1 and the other RM Young was on Met Tower 3. (All towers were upwind of Skylab.) All were kept at approximately the 10 meter standard height (WMO standards were now followed for the siting of instruments).

The RM Young windbird on Met Tower 1 was the primary instrument but the UMQ-5 chart was used to obtain peak wind and gust values.

In January 1992, a ceilometer (Qualimetics model 8329-A) was installed on the roof of the Clean Air Facility. It measured clouds heights up to 12,000 feet, but was reported to not detect a lot of the thin clouds that are common at Pole. The ceilometer, when working, was used year-round.

An Omega datalogger, model OM-272, was set up to bring surface data from various instruments together and send it to the VAX computer. The instruments that were wired to the datalogger were the 2 RM Young wind monitors, the 2 Omega pressure sensors, and the 2 Omega temperature sensors. The data file was updated every minute; this was the beginning of the "Watcher" system.

November 1992

Steve Warren (P.I. from Univ. of Wash.) and Carl Groeneveld (NOAA officer) surveyed the heights of various Met instruments and published the information in the 1993 Antarctic Journal of the United States.

The Ohio State University Long Term Mass Accumulation Network (OSU-92) was set up by Principal Investigator Ellen Mosley-Thompson. This is the array of six snow stake lines, each extending out 20km from the station, that the Meteorology department measures annually.

April 1993

The department began doing weekly dual launches with NOAA, using NOAA's 19k plastic balloons. This increased the number of winter soundings that reached relatively high altitudes.

June 1993
The Qualimetrics ceilometer had major problems and was turned off in mid-June. It wasn't used again for the rest of the winter.

Also in 1992 – 1993
The Watcher files were used to obtain wind and temperature data for local observations. It was decided that the Omega temperature data logged in the Watcher files was more accurate than the recording chart (which was connected to the Rosemount probe). The Omega datalogger recorded the 6-hour maximum and minimum temperatures on its paper chart.

Following the advice of the Navy technician who calibrated the barometers, the "Navy pressure sensor" was used as the primary pressure instrument. This was probably the digital barometer. The Belfort microbarograph was used for local observations and was kept adjusted to match the Navy pressure sensor.

Most instruments were calibrated annually; the Navy took care of the barometers and the Met Technician calibrated the wind and temperature instruments.

February 1994
South Pole Station's first Internet connection.

1993 – 1994 Summer/Winter
The "Navy" digital barometer became inoperable on Dec. 8th and was sent to McMurdo for repair. The Kollsman aneroid barometer and the Belfort microbarograph were then used for station pressure readings. The barometers did not get calibrated this year.

A software upgrade for the A.I.R. upper air program didn't work properly, making it necessary to revert to the old version. Problems with the A.I.R. software would be an ongoing theme for the lifetime of the system.

The Qualimetrics ceilometer worked through the summer but became inoperable as the temperatures dropped in late February.

Some changes were made in regards to the recording of observations on the paper forms. The aim was to better conform with the observing handbooks FMH-1 and WSOH-7.

1994 – 1995 Summer
Both the digital barometer and mercurial barometer were returned and re-installed. The Navy technician calibrated the barometers on Jan. 1st, but was unable to calibrate the Omega barometers.

Radiosondes from the previous year were found to perform poorly. A common factor was the 9V batteries failing early.

It was noted that the speed of the wind recording chart was slightly off due to the frequency of the power plant generators. This was a common occurrence through the years, requiring frequent adjustments to the charts.

1995 Winter

The ceilometer functioned until late August but generally failed to detect the thin wintertime clouds.

A new database was developed using Microsoft Access. Visual Basic programs were written to enhance the database's capabilities for data processing and reporting.

The Omega datalogger program was wiped out by a static discharge. It was eventually re-programmed and brought back online.

1995 – 1996 Summer

The department acquired a new ceilometer (same model, Qualimetrics 8329-A) and installed it on the Clean Air building. There was a heating element included in the housing around the ceilometer. This allowed it to work through the winter, but again very few of the thin winter clouds were detected.

In late January a Navy technician calibrated the windbirds and barometers, except the Omega barometers.

In January a Qualimetrics digital wind display was installed and used for hourly and synoptic observations. It displayed both the 2-minute and 10-minute average winds from the UMQ-5 wind monitor (now the primary instrument).

25 August 1996

The record high station pressure of 719.0 mb was observed.

1 January 1997

The climatological day was re-defined as 0000 – 2359 UTC. Apparently, the department had been using LST (NZ) for the previous 3 years.

30 January 1997

The A.I.R. upper air software was upgraded in preparation for use of the newer IS-5A-1680 radiosondes.

4 February 1997

Problems were found with the data file processing done by the A.I.R. software.

19 February 1997

The new Balloon Inflation Facility (BIF) was occupied.

22 February 1997
The department began using the IS-5A-1680 radiosondes. These sondes had a different hygristor than on the 4A's and it was noted that the relative humidity readings were much lower from the new instruments. (The old hygristor was better.)

13 May 1997
A fix was installed on the A.I.R. software and three months worth of data files were reprocessed.

01 June 1997
The change was made from SAO code to the METAR/SPECI format for surface aviation observations. Many of the Access database modules were reprogrammed to accommodate the new format. Additionally, according to the 1997 turnover report, "outside the continental U.S. conventions were adopted" in regards to surface observations.

5 July 1997
It was discovered that the A.I.R. software would stop recording data when the temperature dropped below -90C, a common occurrence in the polar stratosphere during mid-winter. It was also noted that the low-level wind speed calculations were often suspiciously high.

25 November 1997
The ceilometer was removed from the old Clean Air Facility and sent to McMurdo for maintenance. Due to difficulties in attempting to get it operational again the following year, this ceilometer was never used again at the South Pole.

Late November 1997
Three upper air soundings were missed after the signal cable from the BIF was accidentally cut.

The two RM Young wind monitors were replaced with calibrated units and set to approximately the standard 10 meter height. The UMQ-5 windbird was raised to standard height but not replaced or re-calibrated.

All three temperature sensors (one Rosemount and two Omega RTD's) were confirmed to be within the WMO standard height range of 1.25 to 2.00 meters.

4 April 1998
The Watcher web page was created, showing updated wind, temperature and pressure data every minute. This was displayed on a monitor in the galley and thus became known as the "galley scroll."

Also from Winter 1998

The A.I.R. software continued to stop recording data when the temperature dropped below -90C. Numerous problems with the A.I.R. system, including consistent errors in the coded messages, were detailed in a report appended to the turnover report.

The South Pole Daily Climatological Summary was created. This summary of each day's weather is emailed to a distribution list of interested parties.

16 November 1998

The RM Young wind monitors were replaced with calibrated units.

The digital barometer and Kollsman aneroids were calibrated.

4 December 1998

The Omega datalogger failed and could not be repaired. The Watcher system was out of service until late December when one of the Science Technicians completed a fix. This involved the installation of an analog-to-digital conversion board in the Watcher PC; the Met sensors were wired to this board and the Watcher program was modified to take data from it.

Within a few days after the datalogger failure, an Omega digital display was installed and connected to the primary Omega temperature sensor. This new display, model DP41-RTD had max/min capability and was used for the six-hourly max and min temperatures.

1998 – 1999 Summer

Over 140 weather balloons were recovered from Old Pole. These 1000g and 1200g rubber balloons were found to perform well during the summer months, resulting in a significant reduction in cost for the upper air program.

1999 Winter

The turnover report documents a number of major problems with the A.I.R. software. Several new versions were installed, often leading to new and different problems. An acceptable version of the upper air software was finally received and installed on Sept. 9th.

The department supported the first mid-winter airdrop in several years July 8-11 with two upper air soundings per day and additional METAR observations.

In February the A.I.R. company in Boulder, CO was acquired by Vaisala Corp. of Finland.

1999 – 2000 Summer

An attempt was made to implement a new database on a UNIX platform using re-written versions of the old VAX programs. However, the programs were found unsuitable for

current operations and there wasn't enough support available to make all the needed modifications. Instead, the Access database continued to be used for most tasks.

17 November 1999

ATS (Aviation Technical Services) personnel replaced the ancient UMQ-5 wind recording chart with an M-Tek model 2802 chart. The Qualimetrics digital wind display stopped working at this time and was replaced with an RM Young Wind Tracker model 06201. The Wind Tracker showed the 2-minute average wind and peak wind but not the 10-minute average (the chart was used for that). Both the new chart and digital display were connected to the RM Young wind monitor on Met tower #1, now the primary instrument.

Also installed at this time was the Handar 555 datalogger. This replaced the analog-to-digital board in the Watcher computer. The instruments that were logged by the Handar and then sent to the Watcher (and minute data files) were: the RM Young wind monitor on tower #1, a Setra 270 pressure sensor (built into the Handar), the primary Omega temperature sensor, and the RM Young wind monitor on tower #3.

22 November 1999

SPAWAR (Space and Naval Warfare Systems Center) personnel arrived to install a new upper air system. This was the MARWIN MW12 Portable Rawinsonde Set by Vaisala with GPS wind-finding. The installation was successful and test flights began in December. The A.I.R. system continued to be used for the routine collection of upper air data.

3 December 1999

Navy Calibration Lab personnel calibrated the digital barometer (primary instrument), the Kollsman aneroids, and the one remaining Omega barometer (although this barometer tended to drift off from calibration fairly quickly).

February 2000

The two Omega RTD temperature probes were raised to be within the standard WMO height range.

2000 Winter

Two test flights per week of the MARWIN upper air system were done through June. It was discovered early on that the system was calculating true wind directions instead of the needed grid wind directions. The A.I.R. system was used for all recorded and transmitted upper air data, with less difficulties than the previous winter.

Analysis of average temperature data since 1957 showed temperatures decreasing at a rate of 1.5°C per century.

2001 Winter

The first mid-winter medevac at South Pole happened on April 25th. The Met department supported this event with two soundings per day on the 18th – 25th and hourly METAR observations on the 24th and 25th.

Twice-weekly test flights of the MARWIN upper air system continued. These were done as dual launches with the A.I.R. system for the sake of data comparison. A lot of the new radiosondes were unable to obtain GPS synchronization, resulting in missing wind data. Correspondence continued with Vaisala on issues that needed to be resolved with the new system. The software was updated with several fixes, including one to convert true wind directions to the grid system.

1 August 2001

The switch was made from the A.I.R. system to the Vaisala MARWIN for upper air soundings. Vaisala RS80-15G radiosondes with GPS wind-finding were used.
The data files were processed with the A.I.R. software to produce coded messages and report files in the same formats as before.

9 November 2001

SPAWAR personnel installed an Automated Weather Station on the GOES/MARISAT berm for the purpose of testing and evaluating instruments that might be used in the planned Met system upgrade associated with the South Pole Station Modernization (SPSM). This Met department monitored these instruments and logged comparisons with the official observations until the system was removed on January 30th, 2002.

November 2001

While analyzing upper air data, the meteorologists determined that the grid wind calculations done by the MARWIN system were still not correct. The problem was described to Vaisala engineers who started working on another fix.

29 November 2001

Navy Calibration Lab personnel arrived on station and calibrated the digital barometer and the Kollsman aneroids.

December 2001

Three additional lines of visibility markers were installed at South Pole to improve prevailing and sector visibility measurements. The markers are 4x8 foot sheets of plywood painted black and placed 4 feet above the snow surface at various distances. The lines were surveyed from the geographic pole in grid directions of 350, 110, and 270 degrees, the latter replacing the existing line at approximately grid 280 degrees. This work was complete by December 20th.

9 January 2002
An upgrade from Vaisala was installed on the MARWIN computer, finally correcting the grid wind direction calculation. Two dual launches were later done with the A.I.R. system to confirm that the wind directions were correct.

20 January 2002
The RM Young wind monitor on Met tower #1 was swapped out with a calibrated unit.

February 2002
Both of the Omega temperature probes were swapped out with new, calibrated probes of the same model.

Summer 2001 – 2002
The meteorologists began using data from the NASA micropulse LIDAR to assist in determining cloud heights. The LIDAR, located in the ARO building, became an especially important tool for identifying cloud layers in the dark season. The meteorologists were given access to a screenshot of the latest data display from the LIDAR, updated every 15 minutes.

26 March 2002
The primary temperature reading (Omega Temp 1) started drifting up to 4ºC warmer than the other sensors. The signal cables on the Omega sensors were switched so that the official and Watcher temperature came from the secondary Omega probe.

9 July 2002
The troublesome Temp 1 probe was swapped out with a calibrated spare but the drifting problem did not cease. Official readings continued to be taken from the other Omega sensor.

15 July 2002
Kathie Hill was hired by RPSC as the Meteorology Coordinator, the first time the USAP contractor has had a full-time meteorologist.

August 2002
All the upper air files with incorrect wind directions (from the period 8/1/01 through 1/8/02) were corrected and archives were updated accordingly.

Also from Winter 2002
Three different models of Vaisala GPS radiosondes were used this season: RS80-15G, RS80-15GH, and RS90-AG. The radiosonde serial number is recorded in the header information of each data file. It was noted that the RS90's seemed to have a better, more responsive hygristor than the RS80's. With both models, missing wind data was a common problem for all or part of the flight, and missing humidity data was an occasional problem.

November 2002
A 12 ft. high observation platform was deployed to the grid west of the geographic pole, in a position where the observer could have a view of the entire skiway. This platform was used for evaluating the visibility whenever conditions were marginal during aircraft operations. The observing platform was used though the summer of 2004-2005; by the summer of 2005-2006 the Met office was in the new station and there were other options for obtaining and elevated view of the skiway.

All the one-mile visibility markers were enlarged from 4' x 8' to 8' x 8'. Later in the summer an additional line of markers was added adjacent to the skiway along grid 200 degrees. This has aided the evaluation of visibility on the approach end of the skiway, with markers at 1, 1 1/2, 2, 3, and 4 miles, measured from the observation platform.

10 January 2003
Both of the RM Young wind monitors were swapped out with calibrated instruments.

January 2003
A ceilometer was installed on the roof of the B.I.F. by ATS technicians but they were unable to get it to work. The meteorologists continued to rely on ceiling balloons (in summer), radiosonde humidity profiles, and the micropulse LIDAR at ARO for determining cloud heights.

September 2003
The Met department supported a medevac flight with additional (1200 UTC) upper air soundings the 12th – 21st and hourly METAR observations the 14th – 21st.

9 October 2003
The aspirator units for both Omega temperature sensors were replaced.

October 2003
All three of the temperature sensors were raised to approximately 2 meters above the snow surface.

The ancient Esterline Angus temperature recording chart stopped working; this was the only readout for the Rosemount RTD probe.

All the RS80 model radiosondes were used up during the winter. From this time on, the RS90-AG model was used.

17 November 2003
The digital barometer and the Kollsman aneroids were calibrated by personnel from the Navy Calibration Lab.

23 – 24 November 2003
An 88% eclipse of the sun began at the end of the 23rd (UTC) and did not complete its pass until the first hour of the 24th. The temperature dropped 5 degrees Fahrenheit during the period, resulting in minimum temperature records for both days.

3 January 2004
Both the primary and secondary RM Young wind monitors were swapped out with calibrated units.

19 January 2004
Installation of the SPSM surface observing system was completed. This is the AN/FMQ-19 Automatic Meteorological Station from Coastal Environmental Systems, also known as the OS-21 (Observing System for the 21st Century). See the supplemental document titled "2005 Met Transition" for information about the instrumentation with this system.

The two temperature/RH sensors, 3 barometers, secondary wind monitor, and solar radiometer are all located at the Clean Air met tower. The primary wind monitor and the seasonal visibility sensor and ceilometer are located at the skiway met tower.

This system was monitored through the year by the Met staff and hourly comparisons to the existing instrumentation suite were logged. The FMQ-19 was to become the official observation system in February 2005.

15 February 2004
Station closing: the season ended up with a record 329 LC-130 flights to South Pole thanks to favorable weather conditions throughout the summer.

10 March 2004
The visibility sensor, ceilometer, and radiometer from the FMQ-19 were brought in for the winter as temperatures dropped below their operating ranges. Data from the LIDAR located at ARO was the primary source of cloud height information during the winter.

20 May 2004
The Watcher program was updated to display wind chill temperature values from the newer formula that the National Weather Service had adopted in 2002.

24 August 2004
The network connection to the Clean Air tower of the FMQ-19 system went down and 8 hours' worth of data were lost. The FMQ-19 relies on network connections to pass the data from the towers to the processor in the Met office.

Also from Winter 2004
The MARWIN upper air system was used with Vaisala RS90-AG radiosondes. Very few radiosondes failed before flight, but missing wind data for part of the flight was a fairly

common problem. This occurred when the radiosonde was not able to communicate with enough GPS satellites to maintain the wind-finding capability.

An Iridium email account was established in Comms which enabled the meteorologists to email their observations to McMurdo outside the hours of the regular communications satellites. However, there were a lot of problems with the Iridium email through its first winter, and the observations sometimes had to be called in via Iridium phone.

29 October 2004

The optical sensors (visibility and ambient light meters and the ceilometer) were installed for the season at the skiway tower. The solar radiometer was installed at the Clean Air tower on the 25th.

November 2004

During the second week of the month, the blower was removed from the FMQ-19 ceilometer and insulation was installed around it in hopes that it would operate in colder temperatures.

13 November 2004

Installation of the Vaisala DigiCORA III MW21 upper air system was completed by an ATS technician. This system consists of a processor computer, known as the SPS220, and software that is run on a PC. The same GPS and UHF antennas that were installed with the MARWIN are used for the DigiCORA.

The first official upper air flight utilizing the DigiCORA system was for the 1200 UTC observation on the 13th, using an RS90-AG radiosonde.

15 November 2004

Personnel from the Navy Calibration Lab arrived on station and calibrated the digital barometer and Kollsman aneroids.

18 November 2004

A network problem prevented the DigiCORA SPS220 from communicating with the upper air PC. This problem took a while to troubleshoot and correct, therefore the MARWIN system was used for upper air flights from 1200 UTC on November 18th through 1200 UTC on November 24th.

24 November 2004

The network connection to the skiway Met tower was down for nearly 12 hours for scheduled SPSM work, resulting in a loss of data from the instruments that are located at that tower.

14 December 2004

The aspirator fan failed on the FMQ-19 secondary temperature sensor (AT/RH #2).

16 December 2004
ATS technicians replaced the entire AT/RH #2 unit on the Clean Air tower of the FMQ-19 system.

13 January 2005
A new UPS was hooked up to the FMQ-19 server (the TDAU), giving it 20 minutes of backup power.

10 February 2005
ATS technicians removed the optical sensors from the skiway tower and stored them for the winter. For the winter, cloud heights came from the micropulse LIDAR and from humidity profiles on the upper air soundings.

12 February 2005
The Met department moved from the Science Building in the dome to wing B2 of the new South Pole Station. The first official observation from the AN/FMQ-19 surface observing system was logged at 0150 UTC. Practices for manual evaluation of clouds, visibility and weather phenomena were not changed. See the supplemental document titled "2005 Met Transition" for information about the instrumentation with the FMQ-19.

The station elevation was updated to 9306 ft. This is the highpoint of the skiway. Previously the station elevation had been listed on observation forms as 9301 ft. (the elevation of the geographic pole), however the elevation of the barometer in the dome Met office was 9280 ft. See the supplemental document titled "FMQ-19 Elevation Settings" for more information about station, field and barometer elevations.

The wind recording chart and microbarograph were taken out of service at this time.

14 February 2005
The first RS92-SGP radiosonde was used along with the ground check unit (for the 1200 UTC flight). This was the radiosonde model for the rest of the year, and performance has been notably better than previous models, with much less missing wind data.

18 February 2005
The last Twin Otter flights departed for home and the meteorologists commenced the winter observing schedule of four METARs and Synoptics and one upper air flight per day.

3 March 2005
On this day it was first noticed that the skiway wind monitor was showing much lower wind speeds than the Clean Air monitor. The Clean Air instrument was made the primary one for the purpose of official observations while troubleshooting began.

10 – 18 March 2005
The skiway wind monitor was worked on several times. It was replaced with a calibrated RM Young windbird, however the manual winch that raises the mounting arm stopped working in the extreme cold and the wind monitor was left a couple of meters short of the proper height. Speeds continued to appear low, and wind observations were taken from the Clean Air tower for the rest of the winter.

4 April 2005
The first weekly dual radiosonde/ozonesonde launch of the winter was done with the NOAA personnel, using a 19k plastic balloon.

8 April 2005
Data for the Watcher page (galley scroll) on the South Pole internal web site started coming from the FMQ-19 system instead of the old Met system. The new Watcher program, written in Java, resided on a Macintosh Power Book laptop in the Met office.

1 May 2005
A change in practice was made regarding the entering of surface data for upper air soundings. Prior to this date, the surface relative humidity values were taken from NOAA's hygrothermometer. Starting on this date, the surface RH readings were instead taken from the FMQ-19 capacitive humidity sensor.

May 2005
The cryogenics technician started filling rubber weather balloons with excess gas from the liquid helium dewars, thus conserving the helium in the two half-racks.

1 June 2005
The Belfort microbarograph (with 7-day chart) was brought back online as a backup to the FMQ-19 barometers.

28 June 2005
The TDAU was set up to get its time from a GPS clock. Previously it was getting its time from Windows, which was drifting back a couple of minutes per month.

15 July 2005
The Macintosh computer that ran the Watcher program seized up. A temporary switch was made to the old Watcher computer to obtain data for the galley scroll. The Mac came back up the next day after it had been turned off for a while and the new Watcher program was restarted.

July 2005
Data analysis of wind readings from the Clean Air and skiway Met towers was done with help from Coastal Environmental. It was concluded that the differences between the two wind readings were real and were due to obstructions upwind of the skiway tower, i.e. the MARISAT berm and the elevated station. These obstructions cause greater directional

variability at the skiway tower, which due to vector averaging, reduces the magnitude of the wind speed.

1 August 2005
The old Watcher computer was turned off. One-minute data files now come from the FMQ-19.

16 September 2005
The FMQ-19 temperature/RH sensor heights were measured. AT/RH #1 was at 1.51m above the snow surface and AT/RH #2 was at 1.43m.

2 October 2005
The 1200 UTC upper air sounding was resumed for the summer season.

18 October 2005
The skiway wind monitor was raised back to the top of the tower at 0200 UTC after the alignment was adjusted. This was done manually since the winch was still not working. The skiway instrument was designated the primary wind reading again for official observations at 0300 UTC. Hourly METAR's to support Twin Otter flights commenced at 0600 UTC.

21 October 2005
The station opened for the summer season with the arrival of two LC-130 flights.

28 October 2005
The optical sensors (visibility and ambient light meters and the ceilometer) were installed for the season at the skiway tower.

18 November 2005
Steve Kolden from the Navy Calibration Lab arrived on station and calibrated two of the NovaLynx handheld barometers. The three FMQ-19 barometers were checked to a standard and determined to be within calibration limits. Steve brought the old Kollsman aneroid barometer back to the lab for testing; the Kollsman unit had been dropped during construction work in the new Met office in March of 2005.

28 December 2005
The RM Young wind monitor on the Clean Air tower was swapped out with a calibrated unit.

8 January 2006
The temp/RH #2 sensor unit at the Clean Air tower was swapped out with a calibrated unit.

16 January 2006
The temp/RH #1 sensor unit at the Clean Air tower was swapped out with a calibrated unit.

25 January 2006
The temp/RH units and the FDCU at the Clean Air tower were raised, after which the temperature sensor heights were measured to be 1.98m (#1) and 1.85m (#2) above the snow surface. A survey determined that the barometers elevations were at 9309.7 feet.

6 February 2006
The RM Young wind monitor on the skiway tower was swapped out with a calibrated unit.

10 February 2006
The transition to a new method of transmitting observations to the Global Telecommunication System was completed. Instead of passing messages to the AFTN via the McMurdo weather office, the new method disseminates the messages directly from the South Pole via email to the NOAA gateway to the GTS. The Iridium multi-channel email link allows the email messages to transmit at any time of day.

The ceilometer, visibility sensor, and ambient light sensor were removed from the skiway tower and stored for the winter.

21 February 2006
The station closed for the winter as the last LC-130 flight departed, marking a record-breaking flight season with 377 LC-130 missions to the South Pole. The meteorologists commenced the winter observing schedule of four METARs and Synoptics per day; the 1200 UTC upper air sounding was continued through the 28th to support modeling and forecasting efforts through the end of the McMurdo-Christchurch flight season.

February 2006
An equipment log was added to the department's Access database for the purpose of documenting preventative maintenance, calibrations, and repair work on Met equipment. Computer issues and data losses can also be recorded in the equipment log.

22 August 2006
Snow and frost accumulation caused the RM Young wind vanes at both towers to get stuck for several hours until Met personnel were able to service the instruments.

1 October 2006
The 1200 UTC upper air sounding was resumed for the summer as the flight season between Christchurch and McMurdo commenced.

Also from Winter 2006

Several power and network outages during the winter caused loss of data from the FMQ-19 surface observing system; most outages were an hour or less. The observing system is dependent on station power and the local area network to keep the data flowing into the TDAU (Terminal Data Acquisition Unit) server.

A project of correcting historical F-6 and LCD reports was completed using hourly data obtained from the National Climatic Data Center.

It was noted that the Balloon Inflation Facility was getting buried by blowing snow due to its relatively low location compared to other buildings and the general snow surface. Photos were sent to RPSC Denver headquarters along with an appeal for a solution.

Plastic balloon launches were done approximately twice per week; a few of these were dual launches using NOAA's 19k plastic balloons that can achieve heights above 10 millibars.

31 October 2006

The first LC-130 flight of the summer season arrived; station opening was ten days later than scheduled due to persistently low temperatures that led to a record cold October.

2 November 2006

The ceilometer, visibility sensor, and ambient light sensor were installed at the skiway tower and calibration checks were done.

4 November 2006

A new TDAU server for the FMQ-19 surface observing system was installed in the station's Network Operations Center (NOC). An upgraded version of the Airport Weather Advisor (AWA) display software was loaded on the new server. This version of the AWA included requested improvements such as displaying station pressure to the tenth of a millibar and reporting six-hourly peak winds.

Concurrent with the AWA upgrade, the FMQ-19 barometer elevations in the configuration were changed from 9309 to 9310 feet to reflect the previous summer's raising of the FDCU enclosure that houses the barometers.

21 November 2006

Personnel from the USAP Calibration Lab performed calibration checks on the FMQ-19 barometers and confirmed that all three instruments were reading very close to their standard. Wind and temperature instruments continue to be sent to Christchurch for calibration in the lab.

20 December 2006

Surface and upper air observations supported the South Pole's first C-17 airdrop, which was considered a great success.

25-26 December 2006
A major glycol leak in the station's power plant led to a 6 ½ hour power outage. Backup instruments and estimates were used to produce hourly surface observations, but no data was recorded from the FMQ-19 observing system during the outage.

4 January 2007
The RM Young wind monitor on the skiway tower was swapped out with a calibrated unit. The alignment of the wind vane was checked using grid north markers that the station surveyors installed and it was found that no adjustment was needed.

6 January 2007
The RM Young wind monitor on the Clean Air tower was swapped out with a calibrated unit.

The heights above snow surface of the FMQ-19 temperature sensors were checked: sensor #1 was at 1.85m and sensor #2 was at 1.74m. (Official hourly observations are taken from sensor #1.)

January 2007
A portable field weather station (PPMK) that runs on battery and solar power was obtained from SPAWAR in McMurdo. The station was set up between the station and the skiway and its data was evaluated for potential usefulness as backup during power outages. It was found that the wind and temperature readings were usually reasonably close to the FMQ-19 values, although the non-aspirated temperature sensor has a warm bias during light winds. The altimeter setting indicator on the PPMK was not accurate. The PPMK station was sent back to McMurdo at the end of the summer season; as temperatures approached -40C its display no longer worked.

18 February 2007
The station closed for the winter as the final LC-130 flight of the season departed, making for a total of 359 South Pole missions completed during the summer. The meteorologists commenced the six-hourly surface observation schedule for the winter. The daily 1200 UTC radiosonde flight was discontinued for the winter after the last C-17 flight left McMurdo for Christchurch on the 24th.

21 February 2007
The ceilometer and visibility sensor were removed from the skiway Met tower and stored for the winter.

8 March 2007
Changes were made to the report time settings in the AWA data display program so that the hourly reports at 50 minutes after the hour contain data from 50 after the hour. Previously the two-minute edit time setting was causing the data to come from 48 after the hour.

24 March 2007

It was discovered that the latest version of the AWA software would set the temperature sensors to "inoperative" when the temperature dropped below -62C. One-minute sensor data readings were still available but the system would not generate 5-minute average temperatures or 6-hour max and min temperatures when it was colder than -62C. The meteorologists used the one-minute data for hourly observations and identification of the 6-hourly extremes until a software fix was implemented.

March 2007

Wind speed discrepancies between the skiway and Clean Air towers were noted on numerous occasions. The difference is most pronounced during winds from grid northeast, when interference from station buildings causes the skiway wind monitor to read lower speeds than the Clean Air tower. A discussion was initiated to consider alternatives for reporting wind speeds in official observations during times of large differences between the two towers. At this time the skiway wind is used for METAR, Local, and Synoptic observations.

3 April 2007

Surface CLIMAT and upper air CLIMAT TEMP messages for March were generated and disseminated to the Global Telecommunication System (GTS), marking the beginning of the department's participation in this aspect of the Global Climate Observing System that is administered by the World Meteorological Organization. CLIMAT messages back through December 2006 were also generated and transmitted.

26 April 2007

The AWA data display software was upgraded from version 7.1 to version 7.2. The primary purpose of this upgrade was to fix the problem of the temperature sensors being set to "inoperative" whenever the readings dropped below -62C.

April 2007

Wind speed discrepancies between the two Met towers continued to be observed during grid northeast winds. The meteorologists decided to occasionally adjust the reported speed up to that of the Clean Air wind monitor when it was considered necessary to make the observation representative of conditions found outside the station.

18 May 2007

The SPAWAR Remote Weather Facility in Charleston, S.C. began issuing daily weather forecasts for the South Pole at the request of the NSF.

May 2007

It was discovered that the DigiCORA upper air program was not correctly calculating grid wind directions from the RS92 radiosondes. A ground test of the wind-finding function confirmed that the system was reporting true winds + 180 degrees. Vaisala determined that the error was related to a different wind-finding scheme associated with

the RS92 model that has been in use at the South Pole since 14 February, 2005. Researchers and modelers who use the upper air data were notified of the problem.

25 June 2007

The DigiCORA upper air program was upgraded from version 2.17 to version 3.12. The upgrade failed to fully correct the wind direction problem – winds at this point were reported in the grid coordinate system but were still flipped 180 degrees.

August 2007

The 1200 UTC sounding was resumed during the 18th-24th in support of McMurdo's Winfly. An additional 12Z sounding was done on the 27th in support of a medevac flight between McMurdo and Christchurch on the 28th.

30 September 2007

The 1200 UTC sounding was resumed for the summer in advance of McMurdo's Mainbody flights that started on October 2nd.

Also from Winter 2007

The project from 2006 of correcting historical LCD reports was brought up to date by completing monthly files for the 2003-2007 period. LCD files produced on a monthly basis during 2007 were done in two versions: one with the (max+min)/2 method of calculating daily temperature averages, and one with the "average of 24" method.

CLIMAT and CLIMAT TEMP messages were transmitted monthly starting in April, but there were often problems with the NOAA gateway to the GTS that prevented the messages from being disseminated. The Sr. Meteorologist corresponded with personnel at NOAA's Data Management Division, but as of October the system was not confirmed to be working for CLIMAT TEMP messages. The needed messages were emailed directly to the British Antarctic Survey, as they are interested in collecting all available Antarctic CLIMAT messages.

The Balloon Inflation Facility continued to get buried by blowing snow, sometimes leading to hours of shoveling after a strong storm.

Plastic balloon launches were done approximately every three days; many of these were dual launches using NOAA's 19k plastic balloons.