

Relative elevations of meteorological facilities at South Pole Station

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The near-surface climate of the antarctic plateau is characterized in winter by a strong temperature inversion. Temperature-dependent processes can, therefore, vary over vertical distances of only a few meters, for example, the formation of diamond-dust ice crystals and the atmospheric emission of infrared radiation. At South Pole Station in the winter of 1992, the air at 21 meters (m) height was usually 3–4°C warmer than at 2 m height and, on occasion, was as much as 19 degrees warmer.

Detailed information about the temperature profile near the surface is needed to interpret the measured infrared radiation spectra and to evaluate the turbulent heat fluxes. At South Pole Station this profile can be obtained from radiosonde launches, together with temperature measurements at the snow surface, at the standard reporting height 2 m above the surface, and near the top of the 23-m meteorological tower. The height of the radiosonde-launching deck has changed since its installation in the summer of 1974–1975, relative to the 2-m thermometers that are raised

every year as the surface snow accumulates and rises against the meteorological towers.

The heights of instruments of the Weather Office (radiosonde launching deck, 2-m thermometers, and barometer) were surveyed by Michael Starbuck and Stephen Warren on 5–8 October 1992, relative to benchmarks established by the U.S. Geological Survey (USGS). The heights of the laser ceilometer on the Clean Air Facility and thermometers on the 23-m meteorological walk-up tower were surveyed by Carl Groeneveld and Stephen Warren on 22 November 1992. The locations of these instruments are indicated in the figure. The surveys employed a standard leveling technique and obtained relative elevations to within 2 centimeters (cm), which are shown in the table.

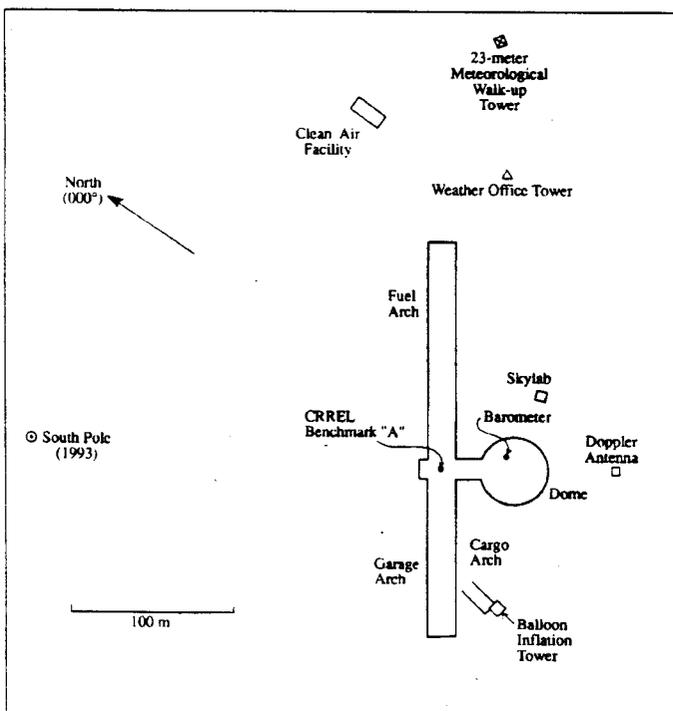
In a personal communication, Jerry Mullins of USGS told us that

the 1991 elevation at South Pole Doppler Benchmark "Ken Murphy" is 2833.51 m. This is an estimated value based on the

OSU89A Geoid Model used to correct the satellite-observed ellipsoid height (average of all 1991 solutions) to elevation above sea level. The uncertainty of this correction is ± 2 m. Global positioning system data connecting this elevation to the surface level of the polar plateau (for example, at the geographic pole marker) have not been completely resolved. However, optical surveys have provided a transfer of this elevation to two points that may be useful for determining the elevation of various science platforms. One is on the Skylab roof, at USGS Benchmark "SKYLAB II 1988-89," a brass screw in a plywood base, elevation 2845.42 meters. The other mark is CRREL Benchmark "A," a 4x4-inch wooden post set in the snow in front of the dome, roughly over the intersection of the entrance and storage arches. The elevation at the top of this post is 2835.36 meters. The relative heights of the three marks are known to the centimeter level.

The South Pole Doppler Benchmark is in a plywood shelter and is now below the snow surface.

In routine meteorological operations, the radiosonde is set on the deck of the balloon inflation tower (BIT), or more usually on a table inside the BIT, for initialization. It is assigned a height of 2,835 m at that location, and its pressure sensor is initialized to the value given by the barometer in the Weather Office. The BIT table, however, is 5.0 m above the barometer (see the table), that is, at about 0.5 millibars lower pressure. This difference has probably been unchanged since the summer of 1974-1975. The elevation of the barometer has remained fixed within the station for 18 years and has, therefore, probably dropped in absolute elevation a few meters (relative to sea level), due to the flow of the ice sheet. The temperature of a 2-m thermometer upwind of the station is entered as the first temperature in the radiosonde data stream (at 2,835 meters); in 1992, this thermometer was about 1 m higher than the BIT table.



Approximate locations of the meteorological facilities at South Pole Station.

Elevations of benchmarks and meteorological facilities at South Pole Station in October and November 1992. The absolute elevations (above sea level) are accurate to within 2 meters. The relative elevations are accurate to within 2 centimeters. The thermometers are raised annually by the amount of the annual snow accumulation.

Location	Elevation above sea level (meters)	Elevation relative to snow surface under Weather Office tower (meters)
South Pole Doppler Benchmark (below Doppler antenna)	2,833.51	-1.56
CRREL Benchmark "A"	2,835.36	+0.29
USGS Benchmark "SKYLAB II 1989-89" (on Skylab)	2,845.42	+10.35
Snow surface under Weather Office thermometers on tower northeast of Skylab	2,835.07	0.00
Two aspirated thermometers on Weather Office tower (bottoms of vertical tubes)	2,836.82 2,836.72	+1.75 +1.65
Deck of balloon inflation tower (BIT)	2,835.00	-0.07
Table in BIT	2,835.91	+0.84
Barometer in Weather Office	2,830.91	-4.16
Snow surface under meteorological walk-up tower	2,834.62	-0.45
NOAA's thermometer Ta on walk-up tower	2,836.45	+1.38
NOAA's thermometer Tb on walk-up tower	2,855.61	+20.54
Wooden porch by front door of Clean Air Facility (CAF)	2,838.02	+2.95
CAF roof	2,840.90	+5.83
Ceiliometer emitter head above CAF roof	2,842.42	+7.35

To enhance the utility of the meteorological observations, we recommend that the heights of these instruments be resurveyed every 5 years.

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(University of Washington) for requesting that we publish it.

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Reference

Mullins, J. 1992. Personal communication.
