PRESSURE DROP IN A DUST DEVIL

ROY E. WYETT

Weather Bureau Regional Office, Salt Lake City, Utah

[Manuscript received January 8, 1954]

At about 1620 MST on August 12, 1953, the Airways Operations Specialist on duty at St. George, Utah, stepped out the door of the CAA Communications Station to begin the 1628 MST observation. Swirling directly toward him was a rising column of dust, sand, paper and other debris, rising to an estimated height of 50 feet—a dust devil, quite common to these semiarid valleys of the Intermountain Region during hot, dry days. This particular dust devil was unusual, however, in that it was about 200 yards south to south-southeast of the station's microbarograph (standard Weather Bureau equipment with a double dashpot), and was traveling directly toward that instrument. (See fig. 1.)

Proceeding with the observation, the observer had returned to the office when the dust devil passed over the building. Windows and doors on the east-southeast side of the building were all open, and as the cloud of dust and sand swirled into the office and as papers began scattering throughout the building, the observer's attention was drawn to the microbarograph, which had just begun to fall rapidly. Its downward traverse halted sharply, then reversed, leaving a vertical line the width of the pen-point, with an amplitude of 0.04 inch of mercury. The total time elapsed during this fall and rise was estimated to be 3 seconds.

The dust devil proceeded northward after passing over the station, as indicated in figure 1. From the estimated line of travel, it appears that the microbarograph was 8 to 10 feet to the left of center of the dust devil and could not have reacted to the lowest pressure within the storm. The diameter of the system was roughly estimated to be 50 to 60 feet.

The microbarogram showing the pressure drop with the passage of the dust devil is reproduced in figure 2. The following analysis of the barogram was made in the Scientific Services Division of the Central Office:

> "Examination of the 4-day microbarograph trace from St. George, Utah (CAA) for August 12, 1953 shows an apparently instantaneous drop and rise in pressure of 0.040 in. at approximately 1625 MST. This drop was preceded at 1610 MST by a slight drop of 0.005 in. in 5 minutes and a rise at 1615 MST of 0.010 in. in 10 minutes. The trace was unsteady from 1625 until about 1705 MST, showing amplitudes of the order of 0.005 in. although the trace was flat. At 1705 MST the trace rose 0.008 in. sharply and then leveled off again.
>
> "The drop occurred at the base of a trough after the pressure had been falling steadily for about 7 hours. The pressure, however, did not begin to recover generally until about 3 hours after the drop. A time check was not made at (or about) 1800 MST as was the pattern of the rest of the chart. The drop-off itself is rather indistinguishable from most of the time checks made on the trace."

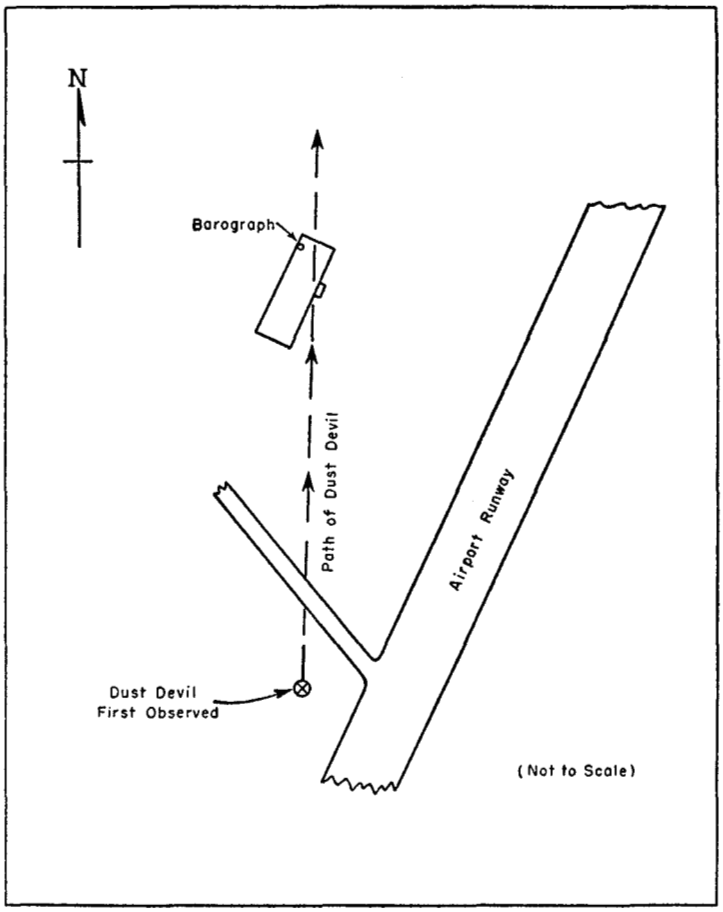

FIGURE 1.—Sketch of CAA station surroundings, St. George, Utah, showing path of dust devil, August 12, 1953.

The weather throughout the day had been partly cloudy to cloudy, with occasional thunderstorms in the area. At

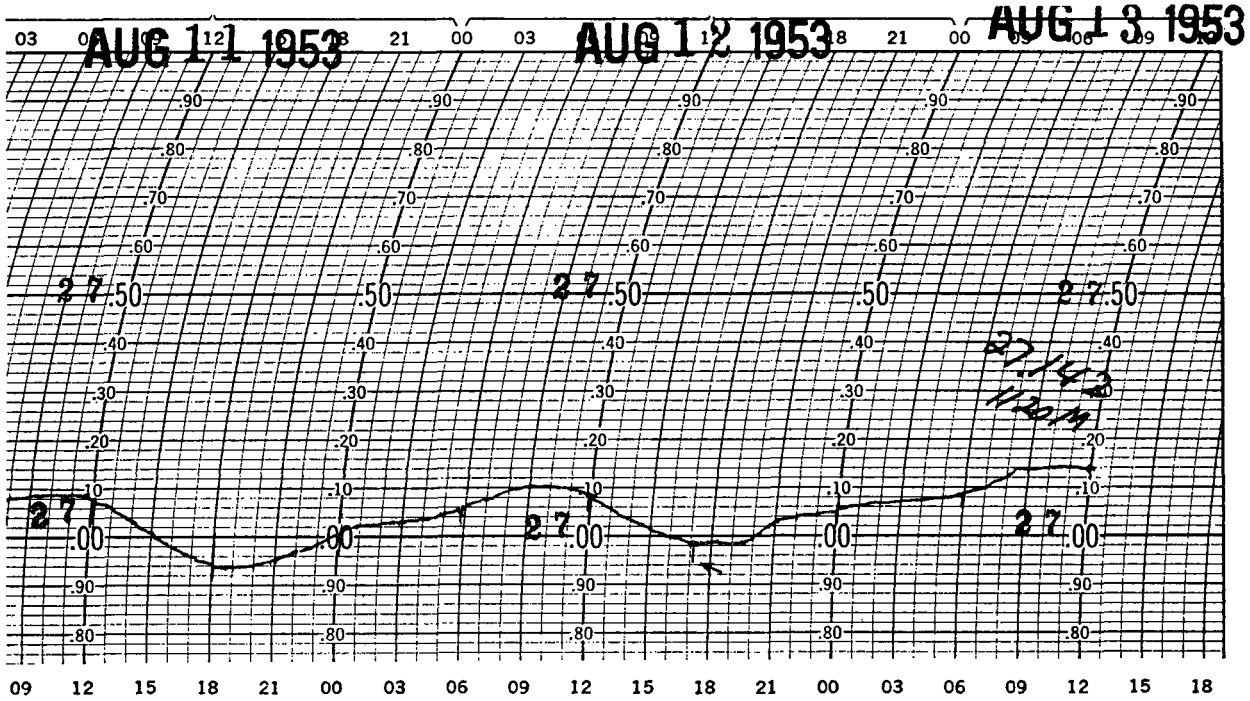

FIGURE 2.—Microbarogram, St. George, Utah, August 11–13, 1953. The arrow points to the pressure drop trace of the dust devil, August 12, 1953. Similar vertical marks at other points on the trace are time checks.

the time the phenomenon occurred, there was 0.9 sky cover consisting of scattered cumulus and cumulus-congestus clouds estimated at 8,000 feet and broken cirrostratus at 25,000 feet (on the borderline between opaque and transparent, though recorded as entirely opaque), through which the sun was shining part of the time. The temperature was 101° F. and the dew point 45° F. Wind was from the west to southwest at 10 to 14 m. p. h. prior to the passage, and shifted to south at 15 to 20 m. p. h. immediately after passage.

There are too many unknown and uncertain facts about the incident to draw indisputable conclusions as to the pressure field associated with the dust devil: The estimated time interval of 3 seconds to complete the drop and rise in pressure may be too small, or may or may not indicate that the microbarograph was on the fringe of the dust devil; except for the fact that the system had just crossed the airport runway, the height of 50 feet would seem to indicate a quite small dust devil—a great many in this area rise to several hundred feet; the damping effect of the double dashpot would almost certainly prohibit the instrument from recording the full amplitude of the trough in such a short time; and the 4-day clock revolves much too slowly to allow a really detailed microanalysis of the barogram.

Despite these indefinite items, it was interesting to note the amount of pressure drop actually recorded; it should prove even more interesting if a systematic dust-devil-observing project could be accomplished, utilizing undamped barographs with accelerated clocks stationed at intervals of perhaps 50 yards across (or around) areas known to produce frequent dust devils, and predetermined observing criteria for size and height of phenomena, direction and speed of movement, and possibly temperatures at one-foot intervals up to 15 or 20 feet above the ground.

ACKNOWLEDGMENTS

The author wishes to express his appreciation to Dr. Morris Tepper of the Scientific Services Division for his interest in the original Field Aide report, and for his suggestion that this note be written for publication: to Mr. W. A. Hass of the Scientific Services Division for his analysis of the barogram; and to Mr. Thomas F. Janik, Airways Operation Specialist and Weather Observer at St. George, Utah, for his clear, concise notes on Form WBAN-10 CAA and his later, more detailed description of the occurrence of the dust devil.