

LETTERS TO THE EDITOR

ACCURACY OF RADIOSONDE DATA

22 June 1945

Dear Sir:

In conjunction with the paper, "Temperature Changes during Formation and Dissipation of West Coast Stratus" by Morris Neiburger, as printed in the September, 1944 issue of the *Journal of Meteorology*, it is pertinent to consider a certain inherent limitation of the Diamond-Hinman type radiosonde.

It is well known that the radiosonde presently in use by the meteorological services of the United States do not transmit a continuous measurement of either temperature or humidity during their rise through the atmosphere. Instead, temperature and humidity are transmitted alternately except during transmission of reference frequencies, in which case neither element is recorded. It is, perhaps, not so well known that this characteristic may contribute an error of several hundred feet in measuring the height of inversions of the temperature curve.

In the lower layers of the atmosphere, temperature is transmitted continuously while the radiosonde rises through a layer of air approximately 20 millibars in thickness. After this space is traversed, the switching device in the radiosonde causes the temperature transmission to cease and the humidity or a reference frequency, as the case may be, to be transmitted for an interval of approximately 20 millibars, after which the transmission of temperature will be resumed. Now if the radiosonde should pass through a temperature inversion while it is not transmitting temperature, it is the standard practice to determine the height of the inversion by extrapolating to an intersection the recorded curves obtained above and below the inversion, thereby determining the height inductively. The process is more or less subjective since the curves on either side of the inversion are often slightly irregular. In addition there is no guarantee that the temperature variation consists of strictly straight line functions in the area of extrapolation. Thus, there is a space of 20 millibars, or approximately 500 feet, thickness within which the height of the inversion is uncertain. While this uncertainty may be unimportant in some phases of meteorological work, it is certainly of prime importance to stratus investigations where this degree of uncertainty often is of the same order of magnitude as the height of the inversion base.

There is little doubt that this state of affairs was carefully considered in the thorough investigation

carried on at the University of California at Los Angeles; however, in the literature I have not seen any reference to it. If the uncertainty were to be neglected, that is to say, if the investigator proceeded from coded data rather than referring to the original record sheets, the resulting distortion of the curves showing variation of inversion base is, I think, quite apparent.

The matter seems of sufficient importance to warrant the attention of the general reader as well as those who contemplate further research on the stratus inversion. It should also be of vital interest to those forecasters who, receiving their soundings over the teletype networks and not having access to the original data, cannot know whether a given inversion height was actually measured or determined inductively.

CARL A. MOORE JR.
Major, Air Corps

San Francisco, California

July 17, 1945

Dear Sir:

The limitation of the Diamond-Hinman type radiosonde which Major Carl A. Moore Jr. discusses is unquestionably real, but by no means as serious as he represents it. In the instruments used in the stratus investigation, which were of the standard mass-production type used by the various U. S. weather services, each contact represented a pressure interval of about 14 millibars, which was divided between the transmission of temperature and humidity or reference frequencies. The humidity was transmitted for three-tenths of a pressure contact, and the reference frequencies for four-tenths. Thus the maximum interval through which no temperature signal was recorded was about 5.6 millibars, or about 150 feet. This is the *maximum* error to which the location of the inversion base would be subject due to this factor.

In the 1943 investigation, the results of which were published in the *Journal* article to which Major Moore refers, the inversion base was located by interpolation whenever temperature was not being recorded. Some of these heights of inversion base may thus be off by as much as 150 feet. Since the variation of the inversion base was much greater than this in the second and third cases discussed in the article, it is seen that the results are not affected.

In the 1944 stratus investigation (1) the humidity record was used as an indication of the inversion

position when that element was being transmitted. Observations by aircraft showed that almost invariably the relative humidity decrease was coincident with the temperature increase. Thus only in the cases where the inversion occurred during a reference contact was interpolation necessary. This method was not used for the 1943 observations because the instruments used then had hair humidity elements, whose lag introduced as great an uncertainty as interpolation.

While the above discussion shows that it is possible to use the Diamond-Hinman radiosonde for stratus study and forecasting, the instrument is not ideal for the purpose. The development of a cheap and accurate sounding device capable of making frequent accurate soundings of the lowest 5000 feet is extremely desirable.

MORRIS NEIBURGER

Los Angeles, California

REFERENCE

(1) Morris Neiburger, Charles G. P. Beer, and Luna B. Leopold. The California Stratus Investigation of 1944. U. S. Department of Commerce, Weather Bureau, Washington, D. C. April, 1945.

MEASUREMENT OF DIVERGENCE

May, 1945

Dear Sir:

In the article "On the Theory of Cyclones" by J. Bjerknes and J. Holmboe in Vol. 1, Nos. 1 and 2 of the *Journal*, the distribution of horizontal divergence in waves in a baroclinic westerly current was discussed. The same problem was treated earlier from a similar viewpoint in Professor V. P. Starr's book *Basic Principles of Weather Forecasting*. By an unfortunate omission no reference was made to Starr's work in our article, although our thinking was strongly influenced both by the book and by personal discussions with Professor Starr at the time when the article was written.

JORGEN HOLMBOE

Los Angeles, California

[The methods employed by the authors of the above mentioned article in order to compute the distribution of divergence in a cyclone wave are essentially different from the procedures outlined in my book. The inclusion of this reference would not have contributed materially to the discussion—Ed.]