which we could then neither escape nor improve. The barometric situation appeared to be that of a deepened LOW (perhaps the rehabilitated northwest LOW) passing out to sea, with high pressure following eastward behind it, and such a situation promised no improvement in the wind direction for several hours, so that a struggle for time seemed impractical. The actual weather map does not quite agree with the hypothetical one, but the wind reports show that we could have gained nothing by remaining aloft and might have lost some distance. We had been aloft over 34 hours and were the only team to go through the second night.

The balloon voyage itself provides two important observations. One is the height of the ceiling of the wind produced by sea-level isobars. Each night we flew near this ceiling, and we may conclude that when stagnation occurs aloft the wind will tend to increase with altitude up to this ceiling where friction is at a minimum and thence upward will decrease as pressure gradients diminish. It is gratifying to note that the sea-level gradient wind, agrees closely with the actual wind observed at the expected altitude above ground (about 500 to 700 meters), both in direction and speed. Another observation is the tendency, which I have found exhibited in other balloon flights, for a balloon to land at a point where pressure is slightly lower than at the start of the balloon (with correction for altitude). On our voyage, the average rate at which we crossed isobars of decreasing pressure was 0.005 inch per hour.

It is appropriate to add that the position of meteorological observer in a racing balloon is exacting and constantly fraught with perplexities over weather and wind, yet the exhilaration and serenity of quiet air travel is so delightful and the unfolding of meteorological processes is so interesting that the net result is a keen joy in the game. Upon landing, one is overwhelmed with three fierce desires: to learn where the other balloons landed, to see a weather map and hold a "post-mortem" on your own flight, and to sleep.

While good luck, complete and reliable equipment, and plenty of courageous endurance are always necessary ingredients in a recipe for winning balloon races, it will be one of the most satisfying results of the race if it's outcome has proved that in addition to these ingredients, meteorology, providing reliable data of current conditions and future prospects, correct assumptions as a basis for operating tactics, and capable interpretations of weather processes as they unfold, has taken a higher place on the list of the necessities of the balloonist.

A study of the stormy conditions reported by the other balloonists indicates that the disturbances into which they were drawn were confined to a small area, and were of the class of local convectional showers, which may exhibit over a small area all the violence of the fiercest storms. No showers were reported in the southeast on Sunday, except in Florida and in the vicinity of Nashville, Tenn., where the balloons were forced to descend. It may be possible that the surface relief was in some measure responsible for the formation of thunderstorms in the more level land around the river valleys than in the hilly regions of the eastern part of the State, although it was our experience even there that cumuli seemed to assume huge proportions. Unfortunately there was no strong alternate wind at high altitude to which escape might have been had, but there seems to have been a slow current in those upper regions which, if attainable in ample time, should have carried the balloons to a safe distance from the storm even if toward Birmingham, and from this place the voyage might have been resumed and continued into the second night. The logs of the other balloons show unmistakeably that a hard fight was made to outride the storm; and we may again conclude that well-defined local disturbances and thunderstorms must be respected by all travelers in the air.

EFFECT OF CHANGE IN THE POSITION OF THE THERMOMETER SHELTER AT ESCONDIDO, CALIFORNIA, UPON THE MINIMUM TEMPERATURE.

551.524: 551.568 (794) By HENRY F. ALCIATORE, Meteorologist.

[Weather Bureau, San Diego, Calif., Apr. 17, 1921.]

SYNOPSIS.

An analysis of minimum temperature readings taken at Escondido, Calif., both before and after the instrument was moved to higher ground showed that an increase of elevation of 20 feet raised the minimum temperatures considerably in respect to mild mornings during November and February, and on all mornings during December and January. Also that the effect was more pronounced for temperatures ranging from 33° to 38° than for the limits between 30° and 33°.

In October, 1919, the instrument shelter of the special meteorological station at Escondido, Calif., was moved from the old site at the end of the Hubbard lemon orchard to another point in the same orchard about 408 feet north and 72 feet west of the old site, and 20 feet higher, at the suggestion of the chamber of commerce with a view to obtaining temperature records representative of a larger portion of the citrus belt centered about Escondido.

Now, did the change affect the minimum temperatures recorded after October, 1919? If "yes," to what extent and in what way? Is the science of climatology likely to be benefited by such a practice? Tentative answers to these questions will be found in what follows.

The data used were the daily minimum temperatures at Escondido, and El Cajon, for three seasons before the change and the two seasons next following. The elevations of the stations named are, 742 and 482 feet, respectively, above sea level, and separated from each other by a distance of about 15 miles in an air line.

As a basis of comparisons we chose the El Cajon temperature record. All the minima recorded at that place (below 40°) were tabulated in groups differing from each other by 1°, and the corresponding, simultaneous minima of the other station were entered oppositely thereto. The mean variations from the base-station temperatures were computed for each degree of temperature (39, 38, 37, etc.), and tabulated by months as indicated in Table 2. (The Bonita and San Diego records were used as checks on the work.) The values in Table 2 were then plotted in the manner shown in the graphs (not reproduced).

A glance at the Escondido graph shows that the coldness or mildness of the mornings at the base station is a function of the variations of the Escondido minima; also, that while some were plus and some minus before the shelter was moved, all the variations after the change were of one order, i. e., plus. On the other hand, the curves in the Bonita and San Diego graphs, do not show any marked positive or negative departures from the base-station minima, as might have been anticipated inasmuch as the shelter at Escondido was the only one of the four whose position was altered.

The tabulation of the net changes in temperature due solely to the moving of the shelter at Escondido (Table 1) shows very large changes on *mild* mornings (minima of 38 to 33), but very small ones on *cold* mornings (minima of 32 or lower) during November and February. The changes were *large*, however, on both types of mornings during December and January.

Passing from frost temperatures to milder ones, a statement of monthly mean minimum temperatures was prepared (Table 2) which shows a general agreement as to signs. Escondido after the change being uniformly higher then El Cajon. Considering the total number of minimum temperatures recorded the net effect of the change in the position of the thermometer shelter at Escondido appears to be an increase in the minimum temperature at that station of 2.5° F. on the average.

Summarizing results we found that the principal effect of changing the position of the Escondido shelter has been to raise the minimum temperatures, on mild mornings, 3.6° in November, 3.7° in December, 4.2° in January, 4.1° in February; on cold mornings, 0.7° in November, 4.5° in December, 3.8° in January, 0.3° in February.

Table 1.—*Apparent net changes in minimum temperatures at Escondido due to moving the instrument shelter to higher ground.*

Month.	Temperature limits.	Net changes.
	°F.	°F.
November	38-33	+3.6
	32-30	+0.7
February	38-33	+4.1
	32-28	+0.3
December	38-33	+3.7
	32-28	+4.5
January	38-33	+4.2
	32-26	+3.8

Table 2.—*Comparative monthly mean minimum temperature, El Cajon and Escondido, Calif.*

Before.				After.			
Year.	Month.	El Cajon.	Escondido.	Year.	Month.	El Cajon.	Escondido.
		°F.	°F.			°F.	°F.
1916	November	37	38	1919	November	41	42
1917	do	42	43	1920	do	40	42
1918	do	43	42				
1916	December	35	34	1919	December	38	40
1917	do	36	36	1920	do	36	38
1918	do	37	36				
1916	January	42	40	1919	January	40	42
1917	do	38	35	1920	do	37	39
1918	do	36	36				
1916	February	44	42	1919	February	44	43
1917	do	39	37	1920	do	37	39
1918	do	41	40				
Mean		39.2	38.2			39.1	40.6
Difference			−1.0				+1.5

CONVECTION-DOME HYPOTHESIS OF ORIGIN OF CYCLONES.

551.515 (048)

By Griffith Taylor.

[Excerpts reprinted from "Australian Meteorology, a textbook including sections on aviation and climatology" (Clarendon Press, Oxford, England, 1920), chapter 18, "The origin of the tropical lows in Australia," pp. 172-188, figs. 133-152.]

"The 'convection dome' hypothesis, as I may term it, assumes that a fluid flowing around an obstacle (the convection dome) is built up in our troposphere, and that most of the tropical eddies in Australia originate there. The clear skies often associated with the dome show that it is not constituted quite like temperate lows. The isobars and isohyets strongly support this hypothesis.

[This hypothesis of the origin of cyclones might be called convecto-dynamic since it is intermediate between the convectional and dynamic theories. The old convectional theory is that cyclones originate because of the low-pressure area caused by warmer air in it than that in an anticyclone. Hann definitely overthrew this convectional theory so far as European conditions are concerned by proving that above 1 or 2 kilometers the air in cyclones is colder than in anticyclones.[1] While this proved that European cyclones were not *maintained* by the low pressure owing to the lighter air, it did not prove that cyclones did not *originate* from low pressure produced by convection over a warm area. Once an eddy is established there is no reason why it should maintain all of its original characteristics. Its temperature at any part of its course would be determined by that of the air entering the whirl (and modified by changes of pressure or the physical condition of the water content); and so long as the eddy is driven or maintained, say, by differences in temperature at the same level, its degree of internal temperature is prescribed by the cooling due to the forced ascent of the air, and thus its temperatures in intermediate and upper levels are lower than those at corresponding levels in anticyclones.

Dr. Taylor shows that 80 per cent of the summer tropical lows of Australia are formed by budding off from the two semipermanent areas of heat low pressure.—*C. F. B.*]

"*Mechanism of the lows.*—In figure 152, I show in a generalized fashion what I believe to be the mechanism of many of our tropical LOWS in summer. The sun is heating northern Australia and a convection dome is built up, reaching into the westerly and northwesterly drift as shown. This causes the formation of eddies from time to time in the upper air which sail away to the southeast. They do not always extend down to the surface, possibly being at times obstructed by the trade-wind belt.

If the conditions are favorable they may supply rain with loop isobars at the surface (see fig. 150). They may increase in intensity and form a definite cyclonic low as in figure 151.

"*Summary.*—The distribution of permanent winds, of cyclones, anticyclones, and calms is always in a state of flux. Nature makes a compromise from day to day between the various dynamic and thermal controls. The writer believes that the regions of greatest convection (the convection domes) are logically more likely to control the supply of LOWS and of rainfall and storms than the so-called "centers of action" (permanent HIGHS). The latter are the stagnant portions of the atmosphere—the Sargasso Seas of the ocean of air. Here are those regions where convection is least operative and which nature accordingly uses as her "sinks." They, too, may, however, act as more or less stable obstacles in the belts of high pressure.

"It is easy to trace the "budding off" of HIGHS from the center of action in the north Atlantic. Every few days an independent anticyclone appears to split away and travel across to France or Spain. It can apparently be traced around the world, merging in the other centers of action as it arrives in their domain, and then traveling on again.

"To sum up, I feel sure than until the semipermanent HIGHS and LOWS are explored at least as fully as has been the case with the traveling eddies of temperate climes, it will be unwise to neglect convection as a very vital factor in our world circulation."

[1] See pp. 103-128 in vol. 2, of "*Les bases de la Météorologie historique—état de nos connaissances*," by H. H. Hildebrandsson and L. Teisserenc de Bort, Paris, 1900.