but local greenhouses were demolished and the stones beat through the broken lights, wreaking havoc among the plants and flowers within. Automobiles that were unfortunate enough to be caught in the storm as a rule received some mark signifying that fact. The large stones tore through their tops, one motorist reported twenty-one holes in his top. Wind shields were broken and wherever the hail hit the cars, the paint was knocked off and the body dented. Several people received minor injuries and bruises by being struck, but no reports were received of any serious injury.

TROPICAL STORM OF JUNE 22, 1921.

By B. BUNNEMEYER, Meteorologist.

[Weather Bureau, Houston, Tex., July 1, 1921.]

The storm was of comparatively short duration and of the milder type of hurricane. The sky was overcast throughout the day with nimbus or stratus and scud moving with the surface wind; upper clouds could not be observed.

The barometer fell until 5:40 p. m. and rose thereafter. The fall was slow with strong fluctuations until 9 a. m., then rapid, and the subsequent rise was about as fast as the preceding fall. The following barometer readings (reduced to sea-level) were taken:

	Inches.
9:40 a. m.	29.73
11 a. m.	29.87
1 p. m.	29.59
2 p. m.	29.53
3 p. m.	29.51
5:40 p. m.	29.37
6:30 p. m.	29.42

Rain fell from 2 a. m. to 9:15 a. m.; 10:50 a. m. to 1:30 p. m. and from 4:03 to 6:37 p. m., being excessively heavy between 6 and 9 a. m. when 2.77 inches fell.

Lightning and thunder were not noticed; residents about 5 miles south of Houston report faint flashes of lightning about 6:30 a. m.

The winds came in characteristic gusts throughout the day increasing in force until 5 p. m. and diminishing thereafter. The direction and force of the wind and other meteorological data are given in the table next below.

The storm moved inland over Matagorda Bay, the center passing in a northerly direction over Palacios, Wharton and Wallis, each of which reported a distinct calm, with wind coming from northwest and west after the calm.

TABLE 1.—*Wind and precipitation data for June 22, 1921.*

	A. M.												P. M.											
	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Midnight.
Wind direction	NE.	NE.	NE.	NE.	NE.	NE.	NE.	NE.	NE.	E.	SE.	E.	SE.	SE.	SE.	SE.	SE.	SE.	SE.	S.	S.	S.	SW.	SW.
Wind movement	11	11	13	13	16	17	23	23	21	23	28	32	44	38	44	47	49	41	37	36	28	19	16	16
Maximum velocities							29	28	34	26	42	41	49	52	54	58	60	58	42	48	34			
and directions.							NE.	NE.	NE.	E.	NE.	E.	SE.	SE.	SE.	SE.	SE.	SE.	SE.	SE.	S.			
Precipitation		T.	0.06	0.15	T.	0.02	1.04	0.27	1.46	0.03	0.01	0.04	0.01	T.			0.01	0.03	T.					

METEOROLOGICAL ASPECTS OF THE NATIONAL BALLOON RACE, 1921.

551.5 : 629.132.1 (73)

C. G. ANDRUS, Observer.

[Weather Bureau, Due West, S. C., July 23, 1921.]

SYNOPSIS.

On May 21, 1921, the annual National Balloon Race started. Nine balloons were entered, and the start from Birmingham, Ala., was given the benefit of every sort of aerological advice. The several pilots were probably never before so well informed of the current and expected meteorological conditions. Acting as aide to Mr. Upson, in one of the balloons, the writer had an excellent opportunity to become intimately acquainted with the practical side of aerology in free ballooning. Air currents, true to forecasts, were light in speed throughout the race, and few opportunities for making important observations were afforded. By making utmost use of the winds of the lowest levels unaffected by surface friction, we gained advantage on the other balloons during the first night, and escaped a series of local storms of convectional origin, which forced most of the balloons to land early the 22d. The stagnation of air at all altitudes during the 22d prevented headway until after sunset, when we set out on a curved course which carried us through Kentucky, West Virginia, and to a landing place in southwest Virginia. Flying the second night was at moderate speed, low altitude above ground, and the landing was forced because no wind could be located that would increase our distance from Birmingham. While it is often the function of aerology to indicate where the highest or best directed winds prevail, in this race it was chiefly a matter of directing the escape from most unfavorable winds. Observations on the height and depth of the sea-level pressure gradient winds, their disruption by convection, and the average tendency of a free balloon to move toward decreasing pressure regions were noted. As all the other balloons were forced to land in central Tennessee by severe local thunderstorms, the victory was ours.

The importance of the meteorological factor in free-balloon races has been discussed in a previous paper,[1] in which the practical application and the correct interpretation of the aerological material now available was stressed. When Mr. R. H. Upson offered me the opportunity to go with him as his aide in the 1921 National Race, I saw there the chance to test the theory and to examine the practical needs of a free-balloon pilot by drawing directly from the original source. Successful forecasts and satisfactory weather "post-mortems" have not the direct contact with the many aerial problems that actual flying provides; in fact it seems almost necessary that aerological advisers get into direct contact with these problems by virtue of actual experience in them. In a racing balloon it is more desirable to win the race than to indulge in elaborate observations of weather and sky, except in so far as they offer an index to the changes in progress. To make a practical demonstration of the utility of a knowledge of meteorology rather than merely a set of observations which could be better made by means of kites and pilot balloons was the desire.

The race was scheduled to start Saturday, May 21, under rules similar to those of the 1920 International Race. As in that race, surface conditions and aerological observations were made available by the Weather Bureau from its own stations and from some aerological stations of the Army and the Navy; special forecasts for the race were issued from Washington on the 19th, 20th,

[1] Andrus, C. G.: Meteorological aspects of the International Balloon Race of 1920. MO. WEATHER REV., Jan., 1921, 49: 8-10.