levels. The anticyclone has a system of outward components from top to bottom, and the cyclone a system of inward components from bottom to top, but in neither case can there be any true inversion in the type of the system. The temperatures show that the wave motion is intensified on approaching the surface, as the strong eastward drift is gradually diminished in the lower levels. The pressure, on descending from one level to the other, in the same way gradually takes on the well-known features of the high and low pressure areas, the high areas standing with the "saddle" toward the south, and the low areas with the "saddle" toward the north. The *closed* isobars decrease in density from the surface upward, and disappear at two or three miles above the ground, being depleted at the top by penetration into the eastward drift. Whenever closed isobars occur there is a vertical component of the circulation, downward in anticyclones, upward in cyclones. There is evidently very little vertical movement in the upper levels of the atmosphere, where the isobars are mere wavy lines, unless some unobserved closed isobars occur, as is probably the case in the development of hurricanes in the Tropics.

In fig. 10 the disturbing components are given for the velocity, temperature, and pressure. In the velocity of the anticyclone there is a gradual transition of the known outflowing structure at the surface into a simple loop in the upper levels, the orientation being changed only a little; in the cyclone the inflowing components are better preserved from the surface to the higher levels, but there is a distinct rotation of the structure through about one quadrant. The temperatures show the maximum disturbances on the boundary of the high and low areas, with a distinct rotation of both the cold and warm areas through one quadrant. The pressure disturbances consist of closed isobars gradually diminishing into loops in the higher levels and rotating through one quadrant, especially in the cyclone. In one aspect the analytical solution of this dynamic structure is simpler than that demanded in Ferrel's or in Guldberg and Mohn's adopted types of vortices, but it is certainly different from either of them. It is evidently necessary to distinguish carefully between the cyclonic system proper and the resultant system formed by its combination with the general eastward drift, so that the mathematical analysis shall not deal with the components and resultants indiscriminantly. It is not proper to appeal to observed resultant motions in the atmosphere in verification of a theory applying solely to the components, namely, the cyclonic and anticyclonic gyrations as examples of a special form of vortex. Having thus found at least an approximate system of correlated velocities, temperatures, and pressures in the atmosphere, it will be possible to approach the mathematical analysis of the structure with some prospect of a satisfactory solution.

VERTICAL AIR CURRENTS.

By FRANK W. PROCTOR. Dated Fairhaven, Mass., January 28, 1906.

In the MONTHLY WEATHER REVIEW for September, 1905,[1] Mr. Clayton mentions two instances of vertical air currents having considerable lifting power. Both occurred on mountains, and Mr. Clayton expresses the opinion that "it is probable that near the ground over a level country the air can have no great vertical motion, except in whirlwinds, so that phenomena of this kind are not observed."

The writer has observed one case of a descending vertical air current in a valley, which seems to be a precise counterpart of the current that lifted Mr. Eddy's kite vertically about 1000 feet above Blue Hill, as described by Mr. Clayton. It was in summer, and the writer was flying a Hargrave kite of the Weather Bureau pattern, standard size, without any load, at Andover, N. H., in the valley lying between Ragged and Kearsarge mountains. These mountains rise 1400 and 2400 feet, respectively, above the level of the valley floor, which is narrow at this point.

Upward of 2000 feet of wire were out when the line apparently broke, and the kite fell rapidly and disappeared. The line of flight was across a river, and in order to prevent if possible the wire from sagging into the river and getting wet, the line was reeled in as rapidly as possible. With no tension on the wire, and a reel that took in approximately five feet at every turn, the line came in pretty fast. After about 500 feet had been reeled in, the kite was seen to rise, and it was then discovered that the line was not broken, and that the fall of the kite was due to a descending air current.[2]

At another time on a summer day at the same place, this kite, while flying at an ordinary angle, rose and passed the zenith at a height of about 1000 feet, being lifted by a vertical current. There was no cloud overhead.

The writer has several times had toy kites lifted by vertical currents during summer anticyclonic weather, while flying at levels from 100 to 300 feet, over the south shore of Massachusetts, where the ground is tolerably level. From the fact that in the nonenergetic summer areas of high barometer falling currents are rarely seen, while rising currents are not rare, it seems to be a fair inference that at this time of year the slow descent of large masses of air is offset by the more rapid ascent of small masses. These small rising masses are probably too irregular in horizontal section and too evanescent to generate whirls.

SNOW FORMED BY MIXTURE OF WARM AND COLD AIR.

By RICHARD W. GRAY, Assistant Observer, Weather Bureau. Dated Atlantic City, N. J., February 7, 1906.

At Atlantic City, N. J., on February 6, snow, in the form of minute flakes, fell continuously from 10:45 a. m. to 3:30 p. m., the sky during this period being perfectly clear. At intervals, and for periods of from one to two minutes, the flurries were quite heavy, and, except for the size of the snowflakes, had every appearance of an ordinary snowstorm. Condensation seemed to take place at a low altitude (probably not more than 75 or 100 feet above the ground), and had practically ceased at the elevation of ordinary buildings.

The unusual condensation was evidently caused by the mixing of relatively warm and moist air from the ocean with the colder air over the land. The wind, during the occurrence of the phenomenon, was from the northeast; the temperature ranged from 15° to 22°, and the relative humidity averaged about 70 per cent. Strato-cumulus clouds began to form about 3:30 p. m., at which time the snow ceased.

It is generally taught that rain and snow are formed principally by the cooling due to the expansion of rising moist air; still it is also recognized that small amounts of rain or snow can be formed by the cooling due to the radiation of heat during the nighttime, but the quantities formed are small, the process is slow, and the radiation is itself checked by the haze or fog or thin cloud that accumulates, so that the radiation can only take place from the upper surface of a cloud.

Precipitation can also take place by the intimate mixture of warm and cold moist air, and, if the masses and temperatures are properly adjusted, light snow may be formed in this case. It frequently occurs in the winter months that a mass of clear, cold air, moving southward from Canada, encounters a corresponding mass of warm, moist air in the United States, and the pressures and densities are so well adjusted that we have a well-defined band trending east and west, showing gentle southerly winds on the south side, and gentle northerly winds on the north, with a belt of cloudy air separating them, over which light rain or snow occasionally falls. Eventually, some-

[1] Pages 390–91.

[2] Would not a simple failure of the wind have produced the same drop of the kite and wire?—*C. A.*