

As this is one of the most important and most difficult problems in observational meteorology it must continue to demand special attention by manufacturers, inventors, theoretical and experimental physicists, since numerous questions must be considered, and it will be a long time before highly accurate results can be obtained. As the authors say, the measurements of atmospheric pressure in sounding balloons make demands upon the aneroid barometer such as have never before been considered. The aneroid box must be free from errors over a range of more than 700 mm. in pressure and 80° C. in temperature, it must also be equally accurate for the most rapid and for the slowest changes. The present investigation considers only the influence of the temperature on the Bourdon pressure tube, with regard to which the authors state that no such tube has yet attained an absolute compensation, they also show that the ordinary method of compensation which was supposed to hold good for a pressure of 760 mm. is the worst possible for the barograph of a sounding balloon, as it introduces the largest errors at great altitudes. The special Bourdon tube, prepared by the authors' method for aerial research and especially adapted to balloon work, seems to reduce the error of compensation to a minimum. The authors also give a method of determining the correction to such a tube for any given pressure and temperature. Many of the tubes investigated by them showed during the first few months after manufacture very large changes in their indications, so that none should be used that have not had time to show their invariability.

(10) *K. Wegener*.—"A Study of the Simultaneous Kite Ascensions in Berlin, Germany, and Hald, Jutland, from the Summer of 1902 to the Spring of 1903." The station Hald is 530 kilometers northwest of Berlin and near Viborg. The observations at that place were made by a Franco-Scandinavian expedition conducted by Teisserenc de Bort, and the results of it are published in full by him. At the same time the Aeronautic Observatory of the Royal Prussian Institute began regular daily work at Berlin. This present study of the work at Berlin and Hald presents many features analogous to the study by Assmann of the observations at Berlin and Hamburg above summarized. Wegener finds a maximum number of inversions in the winter time, and for east winds, and for calms. The inversion layer was generally higher above Berlin than above Hald, and higher at both places in summer than in winter. The intensity of the inversion was greater above Berlin than Viborg, and greater in winter than in summer. The largest inversions occurred with southeast winds above Berlin, and with east winds above Hald. The statistical material seems to show a great horizontal extension of the inversion layer. In general, the velocity of the wind at every altitude was greater above Hald than above Berlin, or in other words, the retardation of the lowest stratum of air was greater at Berlin than at Hald. The greatest increase in velocity of the wind occurred between sea level and 500 meters; above this elevation at Hald there was a diminution of velocity, so that the average increase of wind velocity with altitude was less at Hald than at Berlin. The variation of wind direction with altitude was greatest in the lowest stratum and greater over Hald than above Berlin, but in the stratum between 500 and 1000 meters above Hald the change of the wind was in the opposite direction. Cases of great dryness of the air were more frequent over Berlin than over Hald. The average monthly changes of temperature were more uniform at 1000 meters above Hald, and the monthly range was less. The nearly circular area of low pressure of October 16, 1902, which belonged to those specially studied by von Bezold as so-called "centriert" depressions, or those from which air must be flowing outward at some special level above the ground was specially studied by Wegener, who found that the critical altitude in this case was 1100 meters,

and that above this limit the air must be flowing outward, against the barometric pressure gradient.

(11) *H. Hergesell*.—"New Observations on the Meteorological Conditions of the Upper Warm Stratum of Air." This paper discusses especially the balloon ascension from Strassburg on the 9th of February, 1905, when an altitude of 15,080 meters was attained. The remarkably warm layer of air previously described by Assmann and Teisserenc de Bort as a result of their numerous voyages, as existing at and above eleven kilometers, but for the existence of which no satisfactory reason has yet been given, was again certainly met with on this occasion at an altitude of 11,400 meters, or about 30 minutes after the balloon had left the ground. Up to that point the ascending balloon had recorded a nearly regular adiabatic diminution of temperature which, however, now suddenly changed to an increase, although the rate of increase diminished with farther ascent. The same phenomena were observed in reverse order as the balloon fell, and it attained the lower limit of the warm stratum at 11,300 meters; the difference between the ascending and descending determinations is, therefore, only 100 meters and may have been largely due to the sluggishness of the thermograph. As soon as the rising balloon entered the warm layer it suddenly changed the direction and increased the velocity of its motion, so that the layer of warm air represented an entirely different current, whose azimuthal direction was 130° different from that of the lower one.

This summary of the first eleven articles in the *Beiträge* will suffice to show the nature of the problems presented by the new meteorology, and the solid physical basis on which the investigations are to be conducted; the periodical itself is bound to become a leading publication in physical meteorology.

HAILSTORM IN THE BAHAMAS.

A newspaper clipping from Miami, Fla., states that about April 18 the island of Spanish Wells, in the Bahamas 50 miles west of Nassau, was visited by a deluge of rain changing to hail. The hailstones ranged from one-fourth to one inch in diameter. This continued for several minutes until the ice was banked for several inches on the ground. Of course great damage was done to the crops. The residents of the Bahamas state that hailstorms were unknown but this present phenomenal fall is confirmed by several witnesses, indeed some state that the roofs of houses were covered six inches deep. A driving wind occurred during the hail.

We have held back this item until receiving confirmation from the cable operator at Nassau. The fall must have been very local as no hail was reported from any other island.

NO CHANGE OF CLIMATE.

The daily press is the great educator of the country and the *MONTHLY WEATHER REVIEW* hopes in a modest way to emulate its example. When we find popular errors that have permeated the human mind for centuries repeated and taught as it were *ex cathedra* by numerous newspaper correspondents we can but hope that these same papers will give to the public the best results of recent careful study, as in the following case:

In a syndicate letter of July 5, a special correspondent, Mr. William E. Curtis, shows that the western limit of the Kansas wheat belt has been pushed westward from the one hundredth meridian to the one hundred and second meridian, or about 100 miles without special irrigation and without any change in climate. He states that the extreme limits of cultivation have been as follows: in 1860, Emporia, 110 miles west of the Missouri State line; in 1870, Manhattan; in 1880, Salina, 286 miles west of the State line of Missouri; about 1890 there were "seven lean years" and many farms were abandoned, but

in 1896 there was plenty of rain and sunshine and the westward march was resumed; in 1900 Ellis County was the limit, but now the plowman has crossed the boundary of Colorado.

Mr. Curtis adds that there are many theories in regard to the increase of rainfall in Kansas. The popular impression is that the plowing of the ground increases the evaporation and therefore increases the precipitation, but as he very properly states there is nothing to prove that there has really been any increase of rainfall. The records cover too short a period and are neither accurate nor complete. The comparison of the records shows great variations but no increase, the greatest precipitation is in Greenwood County and the least at Dodge City in Ford County. In the extreme northwestern corner of the State, in Wallace County, the records for the past twelve years show some good rainy seasons and some dry years. We quite agree with the author when he says that:

"It is useless for anyone to assert that the cultivation of the soil has increased the rainfall."

On the other hand, there have been some remarkable changes; 25 years ago nothing would grow at Dodge City, where the soldiers at the military post tried in vain to make a garden. But the experiments were repeated from year to year, each time with better success, until now very fair crops are harvested. In 1867 old Fort Hays was the center of the Great American Desert, and to have imported a plow or a sickle would have been a matter of public ridicule. Now it is within the richest part of the grain belt. At Winona, within 40 miles of the border of Colorado, it was supposed that nothing but buffalo grass would grow, but within five or ten years dry farms have been cultivated and profitable crops harvested, and now several train loads of wheat are shipped annually. In fact, there is very little land left in Kansas that has not been taken up by farmers.

There can be no doubt but that the successful settlement and agriculture of Kansas are due primarily to the natural necessity that is imposed upon intelligent man of learning how to overcome the difficulties of his situation. It is not the increase of rainfall or the change in climate that has made Kansas habitable any more than it is the diminution of rainfall that has made Syria a desert. In the one case intelligent man has conquered the desert, in the other case ignorant men and oppressive rulers have allowed the desert climate to conquer them. As a rule, even without artificial irrigation, a good crop plant, such as wheat or maize, suitable to desert conditions can be evolved by a proper system of selection; when irrigation comes in to help, the sunny desert becomes a more profitable garden field than the moist climate of the seashore or the Tropics. As a rule, grain crops require plenty of sunshine, a soil of the right physical properties, and a very careful, systematic application of water. Formerly, the ideal wheat fields were in Egypt, with abundance of sunshine, a fine soil for retaining the water, and a periodic inundation and irrigation, regulated by the river Nile. Almost the same conditions prevail throughout the basins of the Mississippi, Missouri, Saskatchewan, and Mackenzie. The fertility of this great region is a matter that depends wholly on human industry, and not on any change of climate.

EXPLORATIONS OF THE UPPER ATMOSPHERE BY THE BLUE HILL OBSERVATORY.

Referring to the MONTHLY WEATHER REVIEW for November, 1904, page 521, and May, 1905, page 209, we find some additional interesting information in Science for July 14, 1905, from which we quote the following:

During the months of January, February, and March, 1905, nine more ascents were made at St. Louis; every balloon but one was found and, with the attached instrument, was returned to Blue Hill in accordance with the instructions on each. Like the previous balloons all of

these fell within the eastern half of a circle having its center at St. Louis and a radius of 285 miles.

On January 25, when a high barometric pressure prevailed at the ground, a temperature of -111° F. (-80° C.) was recorded at a height of 48,700 feet, this being one of the lowest natural temperatures ever observed. The experiments last winter were conducted by Mr. Clayton, under the direction of Mr. Rotch, and their success induced Professor Langley, Secretary of the Smithsonian Institution, to grant Mr. Rotch \$1000 from the Hodgkins Fund, in order to continue the experiments this summer at St. Louis. These, like the first, will be conducted by Mr. Fergusson, of the Blue Hill Observatory staff. Soundings of the atmosphere made at different seasons should reveal the annual variation of temperature at great heights above the American Continent, which is at present unknown.

The above-mentioned low temperature is lower than any that has hitherto been recorded in the highest balloon ascensions in Europe up to altitudes far greater than were attained in America, and emphasizes the fact that when balloon work is carried on as extensively as it ought to be by American meteorologists the conditions over our interior valley will be found to be extreme in the highest degree.

The lesson to be learned from this observation is the fact that in an area of high pressure with very cold air at the surface of the ground we also have very cold air at great altitudes and yet that same upper air at the altitude of 48,700 feet when brought down to the surface of the ground ought by compression to attain a temperature of considerably above 100° F. The difference between this high temperature and the one actually observed at the surface of the ground on January 25 (which, according to the daily weather map, was 20° F. as a minimum on January 25, and 12° F. as a minimum on January 26) must be accounted for almost wholly by the radiation of heat from the air in course of its slow descent from a height of 48,700 feet to the ground. This slow descent of air, giving time for the cooling effect, cooperates with a slow horizontal movement of the still colder air from the north. The air within our areas of high pressure must have a general slow descending motion from the north southward correlated with an ascent of warm, moist air from the surface as has so often been explained in the MONTHLY WEATHER REVIEW.

The inversion of temperature which is a widespread and almost normal phenomenon somewhere between the altitudes of 5000 and 30,000 feet must, we think, be attributed to the fact that some layer of cloud having dropped its rain and having also intercepted the sunlight has for both these reasons acquired an extra quantity of heat that can only be slowly lost by radiation.

AN OLD REFERENCE TO THE KITE IN METEOROLOGY.

Speaking of the winds Louis Cotte¹ says:

Even the children have made the wind contribute to their amusement, since it is by means of the mechanism similar to that of the sails of a wind-mill that they have found out how to force it to raise up a species of frame work covered with paper which they call *Cervolans*. The cord with which they hold this framework is always attached to it in such a way that the plane of the framework presents itself obliquely to the direction of the wind, and thus the impulse of the air tends continually to make it rise by describing the arc of a circle which has for its radius the twine which they hold in their hands.²

WINDS AND WAVES.

A wave progressing over deep water does not travel alone; waves always occur in groups. The center of the group is the largest or principal wave. It is preceded and followed by a series of gradually diminishing waves. The smaller waves advance more slowly than do the larger ones. The central, biggest wave is continually overtaking and swallowing up smaller waves in front of it while at the same time starting

¹ L. Cotte, *Traite de la Meteorologie*, Paris, 1774. Page 304.

² *Essais de Physique de Musschenbroek*, tome II, page 912.

Lecons de Physique de M. L'Abbé Nollet, tome III, page 500.