although the coefficients −0.15 and −0.24 were too small to be considered as significant.

The most striking point in connection with *temperature* was the fact that both maximum and minimum temperatures from November to March, inclusive, had practically no influence on wheat yields the following season. But temperatures below normal in both October and April were followed by large yields the following summer. The remakably high yield of 1926, which was 21 bushels to the acre, followed an October in which 24 days had both maxima and minima below their normals for the month. On the other hand, a correspondingly high yield in 1928 followed an October which experienced maximum temperatures slightly above normal, although the minima were practically normal. Minimum temperatures below normal in June seemed to favor higher yields, the correlation being −0.60. Correlation of the number of days in a month in which temperatures were above or below certain temperatures which seemed to be critical, revealed practically no relationship except in October, April, and possibly November. Large yields seemed to be favored by a large number of frost days in both October and April; but temperatures below 20° in November seemed to be slightly unfavorable. An interesting point was the fact that the correlation between wheat yields and the number of 0° days in January was exactly zero. The only other relationship revealed was the fact that temperatures in excess of 85° in May were slightly unfavorable, the correlation being −0.35.

Thornthwaite's formula,[1] $\frac{P}{E}=11.5\left[\frac{P}{T-10}\right]\frac{10}{9}$, in which $\frac{P}{E}$ is the precipitation-evaporation ratio, P the precipitation in inches, and T the temperature in degrees Fahrenheit, was used to compute ratios for each month for the entire period, and these ratios were correlated with wheat yields. This was done in order to show the relation between wheat yields and two variables, temperature and precipitation. The results revealed nothing more than did either temperature or pecipitation alone. That is, high precipitation-evaporation ratios in April were followed by low wheat yields, and this was also true to a slight degree for August and December; while large precipitation-evaporation ratios in September favored high wheat yields the next summer.

The most conclusive of all correlations were those with wind velocities. The only significantly positive correlation was in December with a coefficient of 0.44, indicating the desirability of strong winds in that month. This seems absurd, and doubtless the yields of wheat in summer are good in spite of high winds in December. Wind velocities in October, February, April, and July revealed nothing worth considering. But strong winds in September and March clearly affected wheat yields, the correlations being −0.77 and −0.74, respectively. This was only slightly less true in May and June. Strong winds in November and January also seemed to indicate an adverse effect on wheat.

The general conclusion is that a cool October with rather dry air, but frequent small showers, and a cool April with a small amount of precipitation, few rainy days, but relatively moist air and not too much wind in early fall, late winter and spring, are favorable conditions for good yields of wheat the following season.

[1] C. W. Thornthwaite: The Climates of North America According to a New Classification, *Geographical Review*, vol. 21, 1931, p. 639.

CENTRAL OFFICE OF UNITED STATES WEATHER BUREAU STRUCK BY LIGHTNING

By ALBERT K. SHOWALTER

[Weather Bureau, Washington, April 1934]

At about 3:50 p.m., April 24, 1934, I was using the extreme northwest corner of the main building of the Weather Bureau, Washington, D.C., as a sighting point, from a west window of the annex, to check the movements of the clouds in a vigorous thunderstorm that was approaching from the west-northwest. While looking at this corner it suddenly became a terminus for a lightning discharge which occurred between the building and a northwest cloud. The discharge had the appearance of an ordinary streak of lightning which flashes from clouds to earth. However, at the same instant there appeared adjacent to the corner struck an exceptionally brilliant blaze of reddish light, which was somewhat round but not a perfect sphere, and pieces of brick and stone were thrown in all directions, except upward.

The thunder was not very loud. I had been quite close to lightning strokes before and each time I heard a deafening crash which left a ringing sensation in my ears for some minutes afterward. On this occasion however, I heard only a small crack at almost the instant of the flash.

I have discussed this lightning flash with several other persons who were in the room with me, or in adjoining rooms at the time of its occurrence. Their impressions were in general in harmony with my own. Mr. J. H. Gallenne observed the streak of lightning in the northwest but did not see it strike. Mrs. I. J. Brinks saw the flare adjacent to the corner struck and said it had a very reddish tint and although it was somewhat round it did not have the exact appearance of a ball. Mrs. R. R. Kass saw it also and said that to her it seemed to be a distinct ball.

NOTE.—No one was hurt and the material damage was inconsequential.—EDITOR.

THE "SINKING" OF LAKE AND RIVER ICE

By W. J. HUMPHREYS

In the spring, as Tennyson puts it, some of us are prone to obsessions. One of these obsessions is that of the boatman, fisherman, and lots of others, who swear that at this season surface ice becomes rotten, or honeycombed, and sinks. They know it sinks because in the evening the lake, for instance, may be covered with a sheet of old ice from end to end and shore to shore, and by the next morning no trace of the ice left, save little patches here and there along the water's edge. "Of course it sank", they say, "how else could it have disappeared so rapidly?" And river men tell us not to worry about the ice coming downstream from a broken jam above, for before getting very far it will go to the bottom like a rock. Evidently it can be sunk, and sometimes is, just as a boat may be, by overloading with a substance denser than water, such as sand, gravel, or mud, but as this requires 1 pound of sand, for example, to every 7 pounds of ice, a proportion hundreds of times greater than that of the suspended matter to the water in even a muddy river, it is obvious that such sinking cannot occur on lakes, except rarely at the mouths of flooded streams, nor at all commonly anywhere else.

This sinking by overloading every one admits. The argument, and need for explanation, comes when it is insisted that honeycombed ice, wherever it may be, sinks like water-logged wood, and perhaps for the same reason.

This is too much for the physicist to take "lying down", for he refuses to believe that anything 10 percent lighter than water, as ice is, actually does or can sink in that water, whatever it may seem to do in the eyes of no matter how many witnesses. However, the ice does disappear. If it doesn't sink it must melt, but then how can it all melt in a few hours in the same water in which it had remained for weeks without melting?

To simplify the problem consider the behaviour of ice on a lake of moderate size in a region where the water remains frozen over through the winter. The matters of importance are:

1. When winter approaches the surface water cools, becomes denser and sinks until from bottom to top the water has the temperature appropriate to its maximum density, that is, 39° F., very nearly.

2. As the surface water is further cooled it becomes lighter and remains at the top where, presently, it freezes to ice, and in so doing expands by about one-tenth its original volume, and thus becomes approximately 10 percent lighter in the solid form than it was while in the liquid state. Hence it floats.

3. In the process of freezing the dissolved substances in the water (in lake and stream water there always are such substances) are at first expelled by the forming ice and later entrapped, in part, in the water between the crystal faces or in crevices of whatever kind.

4. With a little further cooling this interfacial and cavity concentrate, which always has a more or less lower freezing point than pure water, also is frozen and the sheet of ice thus rendered continuous and solid throughout, save for such air bubbles as may be present.

5. Under the influence of moderating weather and increasing sunshine as the spring days lengthen, the ice slowly warms up until its least pure portions, that is, those in the crystal cavities and over the crystal faces, melt—melt at a small fraction of a degree, often as little as one-thousandth of a degree, perhaps, below the freezing point of the purer ice. When this happens the bricks (crystals) still are solid, but the mortar that bound them together is fluid, and the whole structure weak. The ice has become rotten, as generally expressed, and soon more or less cracked, honeycombed, and water-logged. This last condition is partly, at least, caused by top-surface melting, and rain, perhaps.

6. Even yet there has been very little melting at the undersurface of the ice because there the water, being in contact with ice, is at the freezing (or melting) temperature 32° F. And because, owing to protection from winds by the sheet of ice, there is no wave action to bring up the denser, *warmer* water from below.

7. Comes a storm. The weak ice starts to break and soon is extensively broken. Then the churning action of the waves brings up an abundance of water of several degrees higher temperature than the melting point, and in the course of a few hours, or a day, at most, much of the ice, if not all of it, has melted away—gone so rapidly as to force the belief on most of us that it just must have sunk.

And this is how the ice sinks, "sinks" by melting quickly, on lake and on river, and the only possible way reasonably clean ice can sink. In short, while ice can be sunk by an overload of sand, or other dense material, all moderately clean ice, such as that on lakes, that has "sunk" hasn't sunk at all; it has just melted in a hurry. Even anchor ice didn't sink—it formed in place.

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C. Fitzhugh Talman, *in charge of Library*

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