record of thunderstorms and auroras it is recommended that the following items be observed and that a special record be kept in accordance therewith.

Electrical phenomena should be recorded under some one of the following eight classes:

1. Thunderstorm at the station. 2. Thunderstorm passed near, *i. e.*, within 3 miles of station. 3. Distant thunder. 4. Distant lightning, such as it may be presumed belongs to a distant thunderstorm. 5. Lightning observed near at hand without thunder. 6. Fireballs. 7. Luminous clouds. 8. Auroras.

Hailstorms, high winds, tornadoes, waterspouts, and other interesting phenomena may accompany a thunderstorm, but these are not to enter into the classification, the main object of the thunderstorm observers being to distinguish between thunder and lightning as such and the other phenomena. Under classes 1 and 2 the items to be observed are as follows: The time of hearing the first thunder (*a*) and the last thunder (*b*); the azimuthal bearing of the thundercloud when first seen (*c*) and last seen (*d*); the temperature of the air before the storm (*e*), the maximum and minimum temperature during the storm (*f*) and after the storm is over (*g*); the direction of the wind (*h*) before, (*i*) during, and (*j*) after the storm; time of beginning (*k*) and ending (*l*) of rain or hail; the maximum force of the wind (*m*) and its direction (*n*); total amount of precipitation (*o*) and the approximate amounts, separately, of the rain (*p*) and the hail (*q*); the occurrence (*r*) of tornadoes, waterspouts, and other interesting phenomena.

Under class 3, distant thunder, note the time of the first thunder (*a*) and the last thunder (*b*) and the directions (*c* and *d*) from which these respectively appeared to come.

Under class 4 note the times (*a* and *b*) and the directions (*c* and *d*) in which the lightning without thunder was first and last seen.

Under class 5 give a description, as detailed as possible, of all the circumstances attending these rare and interesting cases.

In the monthly summary of thunderstorms keep these five classes separate. When several thunderstorms occur in the same day, adopt the rule that thunderstorms separated by a period of time or a region of clear sky such as separates one cloud from another, are to be counted as separate storms.

Under class 6, fireballs, St. Elmo's lights, globular lightning require such special description of the attending circumstances as the observer may think appropriate. No special instruction has as yet been suggested.

Under class 7, luminous clouds on dark nights, when it does not seem likely that their illumination is due to fires or lights on the earth's surface, are frequently observed, and every case of the kind should be carefully noted, as these probably often result from a feeble and gentle electric discharge going on within the clouds. In the winter season similar electric glows have been observed from snow-covered hills and mountain peaks.

Under class 8, auroras should be looked for carefully all over the sky at one or more specific times during every night, *e. g.*, 6, 7, 8, 9, or 10 p. m., and the record should show whether, at those moments, the sky is (*a*) clear and the aurora absent, or (*b*) clear and the aurora visible, (*c*) cloudy enough to obscure an aurora, or (*d*) illuminated by moonlight or twilight enough to obscure an aurora. The monthly summary would, therefore, read, *e. g.*: 8 p. m. daily observation; five cloudy nights; ten clear nights with aurora and ten clear nights without an aurora; five nights when moonlight and twilight interfered. If a description of the aurora is attempted, it should include the apparent angular altitude and azimuth of the ends and summits of arches and beams, and of the center of the corona.

FALL OF AN AEROLITE IN ARIZONA.

Although in the progress of science, aerolites, meteoric stones, and shooting stars have been shown to be foreign bodies circulating through space, and generally circulating about the sun, and are, therefore, now studied by the astronomer rather than by the meteorologist, yet, on many accounts, they are of interest to the latter and should always be recorded by meteorological observers. The atmospheric phenomena that are within the bounds of observation from any one station are, ordinarily, not more than 25 miles distant, or considerably less than one-half of a degree of a great circle, so that 100,000 stations scattered at a distance of 50 miles apart over the whole earth's surface would be needed if we were to attempt to keep watch on all that happens in the atmosphere. If a complete record of shooting stars be desired a number of observers must be placed at each station in order that each may confine his attention to a small and definite portion of the sky, since no one person can keep the whole of it under supervision continuously. It follows that if a single observer records all the meteors seen in a small portion of the sky, this number must be multiplied by several hundred thousands, if not millions, in order to obtain an idea of the total number that enters the earth's atmosphere. Even if we confine our attention only to the largest shooting stars that descend as aerolites to the earth's surface it is evident that there may be 100,000 of these for the whole earth every year, since those actually recorded by observers must be a very small proportion of the whole number. It is plausible that by the action of innumerable meteors the earth receives a minute but steady increase in its mass, a steady addition to its heat and a steady diminution of its atmosphere by the consumption of its oxygen; but these quantities are not appreciable in meteorology. The principal interest that science finds in an aerolite consists in its mineralogical structure, its geological history, and its astronomical path, since it comes to us, as it were, from other worlds than ours. It is very desirable that every aerolite be promptly secured and preserved from destruction by being placed in some public museum, and that a notice of this fact be published in some scientific journal, so that the experts in the study of meteors may become aware of its existence and location.

The following account of a meteor in Arizona is communicated through W. T. Blythe, Observer and Section Director for the Weather Bureau at Phœnix, Ariz.:

TOMBSTONE, ARIZ., *February* 27, 1897.—On Wednesday afternoon, February 24, at 3.45 local time, or 2.45 Pacific time, sitting in the house I heard a noise resembling thunder, but yet not like it, lasting 15 or 20 seconds. I felt no vibration or movement of any kind. On inquiry in this town I find that a meteor fell near by; many say that they saw it, and many concur in saying that windows and doors rattled, etc. I am told that a piece of the meteor has fallen at St. David about 12 miles away, and I have written to see if I can secure the stone for the public.—*Henry M. Gee, Voluntary Observer.*

From a newspaper slip inclosed by Mr. Gee, we learn that the meteoric stone which fell near the ranch of J. N. Curtis, a short distance below St. David, was secured by the latter. It weighed 27 pounds, and had buried itself in the ground after plowing up the earth for a considerable distance. At Tombstone the broad white lines which marked the flight of the meteor from southwest to northeast, were distinctly seen after it passed. At Benson this trail remained visible for fully five minutes. At Tombstone the interval between its visible passage and the subsequent explosive sound was about 50 seconds. The noise as of a great explosion was heard, but especially at Dragoon and Benson. Tombstone is in latitude 31° 40′ N., and longitude 110° 5′ W. Benson is about 25 miles northwest of Tombstone. Dragoon station is about 25 miles north of Tombstone. St. David is about 15 miles northwest of Tombstone.

A special report on this meteor received from Prof. S. M. Woodward, of Tucson, says:

The meteor was seen by enough people to have determined everything about its path if those who saw it had taken pains to accurately observe the directions and the times. The way people were deceived by it was amusing. One thought that it fell a few hundred yards away from our buildings on the Mesa, but it must have been distant at least 60 miles; he says it looked like an incandescent lamp bulb floating softly down. A woman ducked her head and thought it went over her no higher than the tops of the telegraph poles. Many people thought they saw where it fell and went to look for it, but afterwards could not remember the exact point where they were standing or the direction in which it disappeared. I have not been able to substantiate the report in regard to a piece falling from it near St. David. The following is a summary of such facts as I have been able to gather:

About 2.50 p. m., Pacific standard time, on February 24, a large meteor fell in Arizona. It was seen by a number of people in Tucson and vicinity as a brilliant light in the east although the sun was shining brightly at the time. The path was nearly perpendicular to the horizon, and was marked by a distinct ribbon-like band of white vapor which persisted for several minutes. The meteor was seen by a man about 25 miles west of Tucson, by a man in Sonora, Mexico, and by people in Benson, Tombstone, and Solomonville.

From Sonora it seemed to fall in the direction of Tombstone or Pearce, and from Benson in a direction somewhat north of east. At Benson the meteor was seen to explode when near the horizon, and the loud noise of the explosion was heard after an interval, estimated at from one to three or four minutes.

At Dragoon the noise was heard and described as terrific. From Wilcox and vicinity there are only rumors of the meteor having been observed. At all places as nearly as can be learned the path seemed to be nearly perpendicular to the horizon. If any pieces reached the earth, they probably fell near Dragoon. The few accounts from points to the eastward would be accounted for by the bright afternoon sun.

To those who are disposed to assist in determining the altitude, the velocity, and the direction of the path pursued by such a meteor, the Editor would say that the observations required for this purpose are of the simplest possible character, but owing to the suddenness of the apparition and its short duration, such observations can not be expected to be very accurate. In fact, the principal difficulty that is usually found results from the discrepancies of observers who are bewildered by the novelty of the phenomenon. The intelligent voluntary observer who desires to contribute to this subject in case an aerolite or bright meteor passes near the station, should simply collect from as many persons as possible, accurate and definite statements as to the apparent angular altitude and azimuth or bearing of the point where the meteor was first seen, and again of the point where it was last seen. These two items, or either one of them are probably all that any one is likely to observe or remember. If the meteor causes trees and buildings to cast a sharp shadow, then by remembering the location of the shadow one may afterwards determine the angular azimuth and altitude of some point in the path of the meteor. If the observer can count seconds carefully by his watch and thus determine the time that elapses after the passage of the meteor, before he hears the sound, that is also a desirable item. Of course a number of observers must contribute the results of their observations in order to make it possible for any one to compute the true altitude and path of the meteor.

CYCLES IN METEOROLOGY.

An esteemed correspondent, the well-known voluntary observer at North Lewisburg, Ohio, Mr. H. D. Gowey, calls our attention to the fact that according to the year book of the Department of Agriculture for 1895, page 161, the severe freezes in Florida occurred in the winters of 1747, 1766, 1774, 1799, 1828, 1835, 1850, 1857, 1880, 1884, 1886, 1894–95, and that furthermore a cycle of about seventeen years is indicated by these numbers, that is to say, any one of these dates is removed from some other date by some multiple of seventeen years. He also asks whether high waters and low waters do not recur in similar periods. Our reply must be, that all depends on which temperature or high water, or frosts we choose to select for our study and which we reject as unimportant. The above list of severe freezes in Florida (see MONTHLY WEATHER REVIEW, 1895, pp. 336–337) may be supplemented by many other years when the frosts were less severe or more local, and the cycles will depend upon the dates that we study.

As Mr. Gowey states that he is not much of a believer in cycles of weather we may, without giving offense, quote this 17-year cycle as another illustration of the ease with which artificial and empirical numerical relations can be discovered in the complex phenomena of meteorology. These relations are usually not very exact but they look mysterious to the wondering eye, and always suggest an inquiry as to whether there is anything in them, that is to say, whether they represent a natural law and can be utilized for weather predictions. So many such cycles have been worked out and they are, one and all, so useless for the purposes of weather prediction that we can not encourage any one in giving much attention to them; and yet as Kepler with his planetary laws and Schwabe with his 11-year sun spot cycle, and Chandler with his 423-day period in latitude, have each respectively discovered important natural cycles, so we suppose it not impossible that cycles of corresponding importance may be discovered in meteorology. On the other hand the ground has been worked over so well in the past three hundred years that there seems no probability of discovering any *simple* natural cycle; in fact, meteorological conditions are so complex that no simple cycle can possibly exist for any long time with any reasonable degree of accuracy. For instance, if we have a daily cycle of temperature in the temperate regions, it will repeat itself for two or three days only before some disturbance breaks it up; if we have a weekly cycle of rainy days and fair weather it may last four or five weeks at the most before being broken up, and it will be several weeks before it starts over again; if we have an annual cycle of cold and hot weather, or rainy weather and drought, or stormy weather and pleasant, it will continue for only two or three years before being so entirely changed as to be unrecognizable. Even the long cycles of eleven, seventeen, nineteen, thirty-five, and fifty-five years that have been "demonstrated" by their respective advocates, disappear after two or three repetitions, only to start up again by and by. These all remind one of the great ocean waves that advance across the Atlantic with perfect regularity but when they reach their limit die away, soon to be replaced by another set of similar waves, so that the whole ocean is covered with waves superposed upon each other, each having its own periodicity, and each set dying out as another replaces it. Within each group of waves there is the periodicity that the cyclist is seeking after, and yet there is also therein an element of dissolution that soon brings the cycle to naught. The cycle like the wave was evolved by a temporary combination of minor elements, and like it soon dissolves into other combinations.

As bearing upon this same subject, the Editor has just received a most instructive pamphlet, *Wetterperioden*, by Guido Lamprecht, published as a scientific appendix to the annual report for 1897 of the gymnasium or college at Bautzen. In this work Lamprecht gives the result of computations that have occupied his time for the past ten years, and he hopes that he has demonstrated that there are short periodicities in the weather. We must, however, distinguish between those periodicities that we have some reason for expecting, such as the lunar tidal periods and those that are purely empirical; we must also distinguish between apparent periodicities whose uncertainty, as shown by the disagreement with observations, is large, and those whose agreement is very close. Lamprecht derives his results from over 52,000 months of total rainfall, a number vastly greater than those used by any of his predecessors, and his stations are scattered throughout Germany,