entific work of the government along practical lines. The board will consist of the heads of ten scientific departments, "together with such other scientific authorities as may from time to time be invited by the government of India to serve upon it." The Secretary of Revenue and Agriculture, who is the official head of the departments represented, will be ex-officio president of the board. It is the function of this body to—

Annually receive and discuss the proposals of each departmental head in regard to the programme for investigation in his department. In cases where interdepartmental cooperation is necessary, it will rest with the board to advise as to the lines on which mutual assistance should be given and the department to which the inquiry should primarily appertain. Where the proposed investigation falls exclusively within the domain of a particular department, the function of the board will be confined to examining and criticising the proposals. It is not intended that the directing influence of the board should, in any way, weaken departmental executive control or responsibility, and the precise manner in which, and the agency by which, any required information is to be collected or investigation carried out must be left to the heads of the deparments concerned. The board will submit annually to the government a general programme of research which will embody the proposals of departmental heads in so far as its subjects are to be exclusively dealt with in one department, and its own proposals in cases where two or more departments are to cooperate.

This experiment should be observed with great interest in this country, where a duplication of work exists, not only between different departments, but, in some cases, between different bureaus of the same department. Cooperation or consolidation has at times been suggested. Perhaps the chief obstacle lies in the fact that works apparently identical may be prosecuted for such different purposes as to necessitate an essential difference in the details of their execution. Thus the departments of Agriculture, War, and Interior are all three engaged in measuring the heights of rivers, but for different purposes, and no one of the three could depend entirely for this work upon either of the others. Or again, the bureaus of statistics, soils, weather, crops, irrigation are all interested in rainfall, but the Weather Bureau alone is expected to gather and publish the precipitation data. However, as each bureau needs a record of observations prepared in the special manner best fitted for use in its own studies, it would seem wise to have a board representing these five bureaus devise some system of work that will harmonize the various requirements and save any unnecessary labor. Some years ago similar committees, representing several departments and bureaus, did good work in reference to seismology and magnetism, respectively. Why may not suitable departmental committees be more frequently appointed as occasion arises? The board of scientific advisers for India appointed by the governor and council includes 10 persons, representing every branch of government work in applied science.

AQUEOUS VAPOR LINES OF THE SOLAR SPECTRUM.

A general method of determining the total quantity of moisture in the whole atmosphere or any large portion of it has long been a desideratum in meteorology. It is probable that the colors of the sky are due to the action of the mixture of gases and vapors; a comparatively few molecules make a a particle that affects the transmitted waves, both as to their intensity, their wave length, and their planes of vibration. Larger groups of particles of moisture, such as form mist and fog, give rise to the colored rings known as glories and anthelia; larger groups form fog bows and halos and the still larger raindrops form rainbows. Our ordinary pyschrometric observations tell us of the tension and amount of atmospheric vapor, properly so called, but nothing of the condensed moisture; they tell us of the vapor that is near us, but nothing of that which is far away, and especially nothing of what is in the upper strata. Observations of sky color and of the polarization of the blue skylight tell us of the presence of the smallest particles, but not much as to their absolute size or quantity. Quantitative measurements of the general intensity of the light or heat received from any source may be made to tell us the sum total of the effects of absorption by gases and vapors and of reflection or dispersion by small particles of water or dust; but they do not separate the effect of absorption from that of reflection. Finally, quantitative measurements of the intensity of special wave lengths, when observed visually, may give us the effect of the absorption proper. Twenty years ago the observation of the dark band was thought sufficient, but we may also confine ourselves to the observation of specific moisture lines in the spectrum, and they may be observed either visually, bolometrically, or photographically. The visual method was quite thoroughly carried out by Mr. L. E. Jewell, of Johns Hopkins University, in 1892 and 1893, and the results were published in Weather Bureau Bulletin No. 16. The bolometric method has been developed by Professor Langley and has given excellent results; an equivalent thermoelectric method has been developed by Angström. The photographic method of recording the location and intensity of the atmospheric lines in the solar spectrum has recently been developed by Prof. E. C. Pickering, Director of the Harvard College Observatory. This depends upon the measurement of the widths (as being synonymous with the intensity) of the photographs of the dark lines in the spectrum, and is described in Circular No. 72 of that observatory; the results of the first year's work, are given in volume 48 (1903) of the Annals of the Observatory. To begin with, photographs of the spectra of the sun are taken when the latter is at various altitudes. Each line in the spectrum has its width measured; some of these are found to grow broader and darker in proportion as the sun stands nearer the horizon. These are the atmospheric lines, due to absorption in the earth's atmosphere. Others do not appreciably vary, and these are due to absorption in the sun's atmosphere. Some vary with the amount of moisture in the air and are due to absorption by it. By comparing the intensities or widths of an atmospheric line, as photographed when the sun is high and when it is low, with the corresponding computed thicknesses of the layer of air, it appears that there is an outstanding variation, due to the moisture in the air, namely, according as it is dry or moist. Professor Pickering collates the observations of the atmospheric moisture lines, namely, wave lengths 6267.8, 6273.7, 6276.6, 6282.1, 6293.2, 6305.5, all of which are near the alpha line. These were photographed on 16 different plates by Higgs at altitudes varying from 1° to 49°, for which the path of the beam of light varied between 18 and 0.3. The intensity of the six dark lines, and especially of the average of all, increased steadily with the decrease in the sun's altitude, except only for two cases where the atmosphere was unusually dry. The computation for low altitudes give very constant results from different photographs taken on different days, and Professor Pickering concludes:

It, therefore, appears that the total moisture in the atmosphere along the line of sight can be determined more accurately by this method than by any other as yet proposed.

This conclusion is fully confirmed by the laborious work of Mr. Jewell above referred to. Possibly the bolographic method may yet surpass both the visual and the photographic.

SEICHES IN LAKE GARDA.

Dr. J. Valentin has published in the Anzeiger or early notes of the memoirs presented to the Academy of Sciences in Vienna, a preliminary report on the periodic variations, commonly known as seiches, in the level of Lake Garda, as observed at Riva. The length of Lake Garda, from Riva at the north to Desenzano at the south, is about 52 kilometers; the maximum depth of the lake is 346 meters; the mean depth is 136.1 meters, and the altitude above sea level is 65 meters. From

these data, it results that the duration of one oscillation should be 47.45 minutes, as computed by the formula $T=\frac{2\,L}{\sqrt{gh}}$ where L is the length, h is the depth, and g the force of gravity, = 9.80596 meters. On the other hand, the arms at the southern end of the lake are not likely to take active part in the oscillation of the general mass, and Dr. Valentin thinks it more proper that we should omit their consideration, and adopt 165.6 meters as the mean depth of the remaining portion of the lake, whereby the computed period of oscillation becomes 43.01 minutes. Besides these simple or uninodal oscillations there are also observed binodal and even polynodal oscillations. The former are rather longer than one half of the principle oscillation, so that in general 19 binodal periods are synchronous with 10 uninodal, whence each one has a duration of 22.6 minutes. Oscillations of about 30 minutes and 15 minutes duration, that is to say two-thirds and one-third of the principle oscillation, sometimes occur in connection with the longer or single oscillation. At the north end of the lake, the 30-minute seiche combines with the 43-minute seiche after a short time, while at the south end of the lake the uninodal seiche is maintained pure and simple. The 15-minute seiche, as well as the 30-minute, undoubtedly originates in attempts at oscillations perpendicular to the axis of the lake. In general, the oscillations in the surface of Lake Garda show not only periods that are multiples of the principle seiche, but also the first and second octaves and the two-thirds and one-third of the fundamental period corresponding to the first and second quint or fifth above the fundamental note in music. The analogy between the oscillations of lakes and of the tones of musical instruments is thus quite complete, since the fifth and upper fifth occur most frequently next after the octaves.

A record by the limnograph maintained by Valentin at Riva must be compared with the record of the Italian observers in the southern part of the lake before we can completely elucidate all the peculiarities of its oscillations. The result of the first four months of registration at Riva was sufficient to show that the average duration of the uninodal oscillations was 42.99 minutes, and the amplitude was on the average 20 or 30 millimeters, but had twice attained to 60 or 70 millimeters.

Dr. Valentin gives no suggestion as to the origin of these seiches, but it has been generally recognized that although sometimes due to earthquakes they are most frequently initiated by sudden blasts of wind or changes in barometric pressure.

COPIES OF PROFESSOR VERY'S MEMOIR ON ATMOSPHERIC RADIATION.

A memoir under the above title was published by the Weather Bureau as Bulletin G, serial number W. B. No. 221, Washington, 1900. There has recently been a call for a few copies of this bulletin, and, as the edition is entirely exhausted, the Editor would be glad to hear from any one who is willing to dispose of his copy.

EXTREMES OF TEMPERATURE AND PRESSURE IN MONTANA.

On November 18, Mr. C. W. Ling, Assistant Observer, Havre, Mont., reported:

The weather that has prevailed so far this month has produced record breakers both in the temperature and the atmospheric pressure for the month of November. The first and second days of the month were the *warmest* November days on record at this station for a period of twenty-four years. The high atmospheric pressure that prevailed on the 17th instant made an actual barometric reading of 28.09 inches and a reduced reading of 31.03 inches at 12 noon, which is the *highest* November reading on record here.

The minimum temperature this morning, −29°, was, with but two exceptions, the *coldest* on record here for the second decade of November.

COMPUTATION OF THE ALTITUDE OF MOUNT WHITNEY.

(See page 524.)

Under date of January 11, 1904, Prof. Joseph N. LeConte, of the University of California, says:

The Lone Pine railroad station is on the main line of the Carson and Colorado Railroad, and is on the eastern side of Owens River, close to the base of the Inyo Range. The town of Lone Pine is on the western side of the valley and on the western side of the river also. The distance between the two points is about three miles, and the railroad station bears about north 60° east of the town. I visited the railroad station last September and spent some time with Mr. McGrath, the division superintendent. His memory of the altitude of the rail at the station, namely, 3658 feet, was afterward corroborated in a letter from him to me after consulting the records of the survey at Carson City, Nev. Mr. Henry Gannett gives the same number in his directory of altitudes, evidently obtained from the same source. This, however, is not the altitude of the point occupied by Professor Langley in his determination of the height of Mount Whitney. There has never, to my knowledge, been a line of levels run between the two places, and the only determination of the height of the town that I have ever found is the one given by Captain Wheeler, namely, 3810 feet; this, however, is barometric.

There is a "railroad tangent" at Lone Pine station over 20 miles long. It is absolutely straight and nearly level. It would be easy to measure off a base line four or five miles long, and arrive at a good measure of the elevation of the mountain; this might be still further improved by simultaneous angles observed from the mountain and the station. Such a measurement would depend on the elevation of the rail, of course, but this I think can be checked up. A survey has been run from this point to Mojave on the line of the Southern Pacific near Los Angeles. If the results of this latter survey could be obtained, we would know better how much reliance to put on the figures 3658. It has long been a desire of mine to make this triangulation, for the angle of elevation is over 6° and the distance 15 miles only. But I could not put very much faith on the levels over 550 miles of such rough country.

Under date of January 16, 1904, the Director of the United States Geological Survey, says:

Regarding the relative elevation of the railway station near Lone Pine, Cal., and the barometric station in that town occupied by Professor Langley, the only information that I have been able to get is to the effect that the difference in elevation is slight, probably not exceeding 10 feet, the site of the town being the higher.

More to the purpose, however, is the fact that this office has run a line of levels from the sea through the San Joaquin Valley, and up the south fork of the Kaweah River to Farewell Gap, thence connecting by vertical angles with the summit of Mount Whitney obtaining, as a result, 14,434 feet. I do not consider this result as conclusive, inasmuch as the last link in the chain consists of a single vertical angle at a distance of 34 miles.

METEOROLOGY IN THE UNIVERSITIES AND NORMAL SCHOOLS.

We are pleased to note that the State University of Iowa, in its calendar for May, 1903, announces, on page 171, a course of lectures on meteorology, twice a week through one semester, by Prof. A. A. Veblen, the professor and head of the department of physics. In addition to this course, which is open to both undergraduates and graduates in the department of physics, the university requires for admission the general knowledge of meteorology contained in works on physical geography mentioned on pages 80–81 of the calendar, many of which have already been noticed in the MONTHLY WEATHER REVIEW. This is one of the few universities in the world that recognizes meteorology as a part of physics rather than of geography. Corresponding with this classification we understand that the lectures at Iowa City cover the applications of thermodynamics, hydrodynamics, and physics in general to the problems of the atmosphere, thus laying a solid foundation for the future progress of this science.

Prof. R. D. Calkins, Superintendent of the Department of Geology in the Central State Normal School, Mount Pleasant, Mich., states that—

Our students are all preparing to teach in the schools of Michigan. Various phases of the subject of geography are presented to all my classes. In all courses I put a special emphasis upon the weather and