which we have selected those for December, January, and February. Thus, from 4th to the 13th of December, 1903, we find warm air near the ground, and cold air, namely, —10° C. to —16° C., at 4 or 5 kilometers. The latter sinks by gravity and is driven by centrifugal force southward over Berlin; colder air takes its place, and by the 18th of December the temperatures of —10° C. and —16° C. are at 3 kilometers above sea level, while on the 20th they are at 2 kilometers above. This rapid descent can not long be maintained. The lower, warmer air must be pushed aside, and that is a very slow process. A rather rapid descent becomes converted into a very much slower horizontal movement. But a rapid motion southward can go on for several days. The air is pushed out from within the areas of high pressure by the weight of the superincumbent mass. It is pushed southward by the excess of the centrifugal force of cold air over warm air. The warming due to the compression that attends the descent of air is now counteracted by the cooling due to radiation as the air flows southward and very slowly, so that there follows the great cold wave of December 23–31.

While the lower air, pressing against the ground, is forced to move horizontally during December 14–25, the upper air, coming down upon it, and unimpeded in its horizontal motion by the ground or mountains, experiences the warmth due to compression and gives rise to the high temperatures of December 18, 21–23, and 24, 25, at altitudes between 1000 and 2000 meters. The observer who ascends in the balloon records these as inversions of temperature, whereas the complex physical process that forms them consists in the cooling of the lower layer as it moves slowly and horizontally, but in the warming of the upper layer as it descends rapidly to the 1-kilometer level.

The diagrams for the months of September and October show that the air above Berlin is at that season liable to very remarkable changes of vertical gradient. Thus, the temperature of 0° C. was found at about 5500 meters on September 2, but at 1100 meters on September 12. This was undoubtedly due to the southward advance of a mass of cold air, which at first piled up the warm air of Europe in front of it to the maximum height shown by the observation of September 3, and then rapidly replaced this by the cold of December 12. But these great changes in the upper atmosphere seem to have had but slight influence on the temperature at sea level, which ranged from 26° on the 2d to 12° on the 11th and 12th.

We, at the bottom of the atmosphere, are as unconscious of the commotion above us as are the animals at the bottom of the ocean.—*C. A.*

AURORAS AND THUNDERSTORMS.

We have, on many occasions, called attention to the fact that auroral phenomena are often of a local character, as may be inferred from the fact that they are seen from but few stations, although in the neighborhood of many stations reporting thunderstorms, as though the electric discharge forming the aurora is in some way connected with the thunderstorm. On the other hand, we have many extensive auroras that have no apparent connection with local thunderstorms, although they may be associated with the numerous thunderstorms that prevail in the equatorial regions. We suppose that all auroras originate in disturbances of the earth's electric condition, and that such disturbances may be caused either by local atmospheric phenomena or by solar phenomena. In both cases we have earth currents and either lightning or aurora, or both. In both cases, also, we have magnetic disturbances, but these are very slight during the ordinary thunderstorms. It is barely possible that all these phenomena are essentially terrestrial and due to so-called tidal strains or elastic strains in the interior of the globe. Such strains are known to exist and must be as periodic as the tides. They must also have great irregularities due to the sudden relief of strain that takes place during the geologic process of faulting. It is also possible that influences emanate from the sun that may affect the distribution of electricity in the earth's atmosphere. Both solar and terrestrial causes may therefore produce both the local and the general auroras, and it is not at present possible to state which of these is most important, either in any special case or in general. The fact that there is a maximum frequency of auroras in the early evening of local time, between 8 and 10 p. m., over the whole globe shows that the local or terrestrial influences are quite appreciable. The other fact, that a sudden increase in auroras, earth currents, and thunderstorms occurs on the same day over a large region, such as Europe, the Atlantic, and North America, must be due to either one of two causes; either this represents an influence emanating from the sun and affecting a large part of the earth, or it represents a very important widespread terrestrial influence.

METEOROLOGY IN AUSTRIA.

The annual volume for 1901 of the Central Institution for Meteorology at Vienna is the forty-sixth of the annual series, and is the first published under the auspices of Prof. J. M. Pernter, as director of the institution. In this same year, 1901, the Central Anstalt celebrated the jubilee year of its existence by a festival, the publication of a jubilee volume, and an increase in its funds and work. By way of introduction, Professor Pernter gives a short historical sketch, from which we gather the following facts.

On the 23d of July, 1851, the Emperor Francis Joseph I authorized the establishment of a central institution for meteorology and magnetism, under the directorship of Prof. Karl Kreil, who had previously been director of the observatory at Prague. Carl Fritsch was associated with him as assistant director. The central institution was established at the instigation of the Imperial Academy of Sciences, the first movement thereto having been started May 13, 1848, when the president of the Academy, Baumgartner, stated that for a long time it had been his desire to see the telegraph stations of the railroad lines utilized as meteorological stations. The Academy appointed a meteorological commission to consider the subject, and requested Professor Kreil to prepare instructions for the establishment of a meteorological system of stations for Austria. This date, the 13th of May, 1848, precedes by some months the similar action taken by Prussia, which established a meteorological service under Dove, and also preceded Russia, with its service established in 1849, under Kupfer.[1]

For a number of years the central institution occupied small rented rooms or buildings. On December 21, 1862, occurred the death of the first director, and in 1863 Carl Jelinek succeeded him. In 1870 Jelinek secured authority for the erection of a building for the institution. This was located on the Hohe Warte, a hill on the outskirts of Vienna, and was occupied in April, 1872. Here was held the first international meteoroligical congress in 1873. Jelinek was also the founder of the Austrian system of daily weather telegrams. He began by receiving, in 1865, 14 daily dispatches; in 1869 he began to send out daily forecasts. In 1877 his daily weather report, with synoptic chart, began to be printed. His devotion to meteorology was especially shown by the founding, in 1868, of the Austrian Association for Meteorology, followed by the publication of a monthly journal supported by the society. This journal is now supported by the combined labors of the

[1] Americans will recall that Prof. Joseph Henry presented a similar project to the Board of Regents of the Smithsonian Institution, which was immediately adopted, and in the following year Professor Espy was assigned to duty under him. Meteorological observations had, however, been regularly taken and published since 1818 by the Surgeon General of the Army, and since 1817 by the observers of the General Land Office. For fuller details see Weather Bureau Bulletin 11, part 1.

Austrian and the German meteorological societies. Jelinek died at the age of 59, October 19, 1876; and on March 1, 1877, Prof. Julius Hann succeeded him. Under his administration the institution, the meteorological society, and its journal became the leading authorities in this branch of science. Hann paid special attention to the development of mountain stations. Fifty-two high stations, 6 of which are more than 12,000 feet above sea level, were established under his initiative. He also established 25 stations with self-recording instruments in Austria. He was the first director who at the same time personally and completely filled the rôle of professor in the university. He collected about himself a large number of scholars who devoted themselves wholly to meteorology, forming an Austrian school that has had a wide influence in meteorology. His own investigations in climatology and meteorology have given him the highest position in this department of science. He resigned the directorship on account of poor health, in 1897, but after three years absence at the University of Gratz, his alma mater, he returned to Vienna. The aim of his successor, Professor Pernter, is to maintain the great reputation of the establishment for activity in scientific research as well as practical usefulness. Ever since the war of 1859 the Central Anstalt has been greatly hampered by the want of funds, but Dr. Pernter has been able to secure the means for making kite and balloon ascensions and thus extending to southern Europe the exploration of the atmosphere that has been actively carried on in Russia, Germany, and France. Twelve such Austrian ascensions were made during the year 1901. The memorial volume of the Central Anstalt, and the Lehrbuch der Meteorologie, also published at the same time, are already recognized as classics in the literature of the science. The Central Anstalt includes in its personnel, beside the director, Pernter; the vice director, Kostlivy; the scientific assistants, Margules and Felix Exner, (son of Prof. Franz Exner); the chief of the observatory, Pircher; the chief in charge of stations and publications, Valentin; the chief in charge of weather telegraphy and forecasts, Kostlivy. There are 26 paid employees of all grades. In addition to these, an honorary position has been established known as "Corresponding Member of the Institution." This was especially appropriate to Prof. Julius Hann, who was the first incumbent, March 22, 1901. But since that date many others have been happily associated with him, and the list of correspondents embraces all in Austria-Hungary who have distinguished themselves by work in meteorology.—*C. A.*

WEATHER BUREAU MEN AS INSTRUCTORS.

Mr. Charles Stewart, Observer, Spokane, Wash., addressed the Spokane Science Club, June 14, on "Meteorological instruments and methods of the Weather Bureau."

Mr. J. Warren Smith, Section Director, Columbus, Ohio, on June 4, delivered a lecture on meteorology, at the local office of the Weather Bureau, to the class in geology of the Ohio State University.

On June 17 he addressed a meeting of the Ohio Workers in Agriculture, explaining how forecasts are made and outlining the forecast distribution by means of telephones.

The faculty of Norwich University, at Northfield, Vt., has adopted the following resolution:

Resolved, That the thanks of the Faculty of Norwich University be extended to Mr. William A. Shaw, of the United States Weather Bureau, who has, without remuneration, taught meteorology in this institution, in an efficient manner, for the past eight years.

Mr. J. B. Marbury, Local Forecaster, Atlanta, Ga., lectured on July 1 before the Georgia Educational Association on "The Weather Bureau, its Relation and Benefits to the Public." He explained how forecasts are made and distributed, showed the fallacy of the so-called long-range forecasts, spoke of the value of the Climate and Crop Service, and showed how useful to the public are the records of the Bureau, in addition to their value in forecasting.

METEOROLOGY IN THE COLLEGES AND UNIVERSITIES.

A letter from Mr. G. A. Loveland, Section Director, Lincoln, Nebr., dated June 23, says:

The University of Nebraska is now building a new physics building, with provision for this office and a department of instruction in meteorology. The professor of physics, D. B. Brace, is an investigator who has already encouraged students to work along meteorological lines. An article by one of his students has already been published in the REVIEW. I expect cooperation and help from Professor Brace and the students of his department, and hope for more rapid progress in developing meteorology as a department of instruction under these conditions.

A great aid to teachers and all users of the REVIEW would be cards (for a card catalogue) for each article in the REVIEW not relating to current weather conditions, or at least for the more important articles. I think all Weather Bureau stations furnished a file of the REVIEW should have such a card catalogue, and best of all the Weather Bureau stations constantly called upon for information should be furnished, if possible, with a card catalogue of the important articles in the whole file of Reviews, the reports of the Chief of Bureau, and bulletins of the Bureau. That is, all officials expecting to answer questions should have a card catalogue of the publications of the Bureau, that they may be able to consult authorities readily and answer questions promptly and efficiently. If the cards for each Review were printed at the same time the REVIEW was, a beginning in this direction would be made.

In 1903, the Secretary of Agriculture arranged for a course of instruction in meteorology in the department of agriculture of the North Carolina Agricultural and Mechanical College at West Raleigh at the request of the officials of that institution, and directed that the Weather Bureau send a competent man for that purpose. The college is a mile and a half west of Raleigh. Meteorological instruments for educational purposes were furnished by the Weather Bureau. Of course it was not intended to establish a regular observing station. Mr. C. F. von Herrmann, Section Director, was assigned to the duty of instruction and authorized to absent himself from the station as far as necessary in order to conduct the course. The original plan comprehended a full course for recitations of one hour, weekly, for thirty-six weeks, in the senior class, using Waldo's elementary meteorology as a text-book. In addition, a course of lectures to be given covering the following ten topics:

1. The atmosphere; composition, density, arrangement, physical properties, etc.
2. The temperature of the atmosphere.
3. The temperature of the atmosphere with reference to the climates of the earth.
4. The pressure of the air.
5. The moisture of the air, its condensation into frost, dew, fog, cloud, etc.
6. Precipitation.
7. Winds and the general circulation.
8. Weather; cyclones and anticyclones.
9. Local storms, thunderstorms, tornadoes, subtropical storms.
10. Climate.

Concerning this course of instruction, the professor of agriculture, Dr. Charles W. Burkett, under date of June 18, 1904, writes as follows:

The North Carolina Agricultural and Mechanical College now provides a course in meteorology that extends through the first two terms of the senior year. This course is required of all seniors in the agricultural course, and, personally, I think it is one of the most available courses, and one of the most important that we have in our agricultural course. The course in meteorology is now maintained through the kindness of the Honorable Secretary of Agriculture, who furnishes us the services of the director of the North Carolina section of the Weather Bureau. I am so convinced of the importance of meteorology that I look to see the