THE MARYLAND WEATHER SERVICE.

THE organization of State weather services to conduct observations over limited areas has been undertaken in recent years in many portions of the country. What the national service does for the entire United States, the local service does for each State. While the United States Signal Service affords information concerning the general climatic conditions prevailing over the whole country, the State service shows what those conditions are in the various districts and counties of the State. It at once becomes an important medium to the agriculturist, through which he learns the most favorable times to plant or reap, and how best to protect his crops. It aids the shipping interests along the coasts and in the bays and rivers, by indicating the character of the weather and the direction of the winds. It gives to all the valuable predictions of the national service, together with the conditions that locally prevail. The local service has been officially recognized by many of the States already as of the greatest commercial importance, and provision has been made for its maintenance. In others the chief expense has been borne by the United States Signal Service, and a sufficient number of men detailed to efficiently conduct the work.

The Maryland State weather service has been organized under the joint auspices of the Johns Hopkins University, the Maryland Agricultural College, and the United States Signal Service. The officers are: William B. Clark, Johns Hopkins University, director; Milton Whitney, Maryland Agricultural College, secretary and treasurer; C. P. Cronk, United States Signal Service, meteorologist in charge. The United States Signal Service will furnish men to take charge of the details of the work, will supply instruments to the observers in the various portions of the State, and will afford the means of sending out weather predictions and general summaries of temperature and rainfall. The ten stations in Maryland that now report directly to Washington will become incorporated in the State service, and the number of stations will be increased to forty or more, to meet the requirements of an efficient service.

It is proposed to print monthly a general report of meteorological conditions, and weekly to send throughout the State a brief statement as to the crop prospects. A scheme will be devised by which frost warnings may also be given. An important feature of the work will be the establishment of signal stations at such points on the Chesapeake Bay and its tributaries as can be readily communicated with, so that the captains of vessels can gain information as to the probable direction of the winds. As the efficiency of the State service will depend largely upon the closeness of co-operation with the United States Signal Service, it has been considered advisable to move the Baltimore office of the latter to the university, and it will after May 20 have quarters in the physical laboratory, upon the roof of which building the observations will be taken. An office will be retained in the centre of the business portion of the city so as to be in close communication with the public as heretofore. It is anticipated that the work outlined above will be fully inaugurated during the present summer.

COAL IN THE SHAN STATES.

A REPORT from Dr. Noetling, the geological expert who has been dispatched from India to investigate the coal measures of the region between the Irrawaddy and the Salween, has recently been issued in Burmah, and an abstract of it has oppeared in the London *Times*. The result of the analyses of twelve samples of coal show a remarkable uniformity of composition. The highest percentage of fixed carbon is 38 58, and the lowest 31.69. If the average of eleven analyses is taken, it is found that Shan coal has the following composition: Volatile matter (including moisture), 55.40; fixed carbon, 34.94; ash, 9.67. The coal is, therefore, of poor quality, and can hardly be termed "coal." "Lignite," or "brown coal," would better express its composition. Shan coal, when fresh, would make good fuel, and, being rather hard, it will stand long transport Those seams from which, owing to its friability, the coal could not be well transported, should make an excellent material for patent fuel. It is much poorer than the coal of the southern Shan States. In the latter the percentage of fixed carbon is from 64 to 70. So far, however, as is known, coal is not very plentiful in the southern Shan States, while the seams in the northern States are more favorably deposited, and, being found in workable quantities, they could be depended on for the supply of fuel to any railway through the Shan States. The fields examined by Dr. Noetling in the northern Shan States were seven in number, the two chief ones being Laisho and Namma Manze. He does not think they will be of any value so long as there is no communication by which the coal can be easily brought down to the Irrawaddy. The coal-fields are about one hundred and seventy miles away from the nearest centre of traffic. The present road leading to them is only suited for carts for about fifty miles, after which pack animals must be employed. It is absolutely essential that a railway should be constructed if the coal fields of the northern Shan States are to be of any economical value. But the construction of a railway line to this part of the country would be a costly undertaking if the fuel necessary to work it had to be transported from Rangoon. Moreover, the alluvial deposits in both the principal coal-fields would form a serious obstacle to mining operations. The thick layer of clay in the Laisho field and the conglomerate in the Namma field would make the sinking of a shaft difficult, as it would have to be constructed very substantially in order to resist the lateral pressure which it would have to stand in the alluvial deposits. Owing to the peculiar way in which the coal-bearing strata are found, a large quantity of water must be expected in both coal-fields, and this would require strong pumping machinery. Finally, the climate of these valleys is feverish, and the health of the miners would therefore be severely tried. It thus appears that coal-mining in the northern Shan States is in the distant future; every thing seems to be unfavorable to its development, — no transport, difficulties of working, quantities of water, unhealthy districts, doubtful seams, and bad coal.

SCIENTIFIC EXPEDITION TO SOUTH MARYLAND.

A REPORT of the recent scientific expedition into southern Maryland appears in the Johns Hopkins University circular for June. The need of a more complete knowledge of the material resources of the southern portion of the State of Maryland led to the organization of this expedition to further its investigation. The expedition, under the joint auspices of the Johns Hopkins University, the Maryland Agricultural College, and the United States Geological Survey, had in view the study, from different standpoints, of the varied capabilities of this section. The importance for this work of co-operation between the State and national scientific institutions was recognized from the start, and it is determined that the plan for joint investigation, thus inaugurated by a preliminary and general survey, shall in the near future embrace, under similar auspices, a detailed examination of the geology, agriculture, and archæology of all of southern Maryland. A wrong impression would, however, be conveyed, if the idea should be gained that nothing has been accomplished hitherto in this direction. Several of the members of the expedition have been actively employed in the past in making investigations in various portions of the region, among whom Mr. Darton deserves especial mention, while Mr. Clark has conducted thither three annual geological excursions, so that the knowledge gained in previous years has afforded a basis for work at the present time. The expedition received from the start the cordial support of all those interested in the material progress of southern Maryland. The necessary means of transportation were furnished by the State upon the authorization of the Board of Public Works and of Gen. Joseph B. Seth, commander of the Oyster Police Navy. The steamer "Gov. P. F. Thomas." Capt. Howard, and the schooners "Daisy Archer" and "Folly" were placed at the disposal of the expedition, and their officers and crews rendered most efficient service. The heads of the several institutions interested appointed the following representatives, who organized as a Board of Control: William B. Clark, Johns Hopkins University, chairman; Milton Whitney, Maryland Agricultural College, secretary and treasurer; W. J. McGee, United States Geological Survey. The other members of the expedition included Professor George H.

Williams, Messrs. A. E. Bibbins, F. P. King, E. P. Kohler, P. R. Moale, R. M. Parks, Jun., D. H. Roberts, M. J. Vea, and D. B. Pope, of the Johns Hopkins University; President Henry E. Alvord of the Maryland Agricultural College; Messrs. W. H. Holmes, N. H. Darton, C. D. White, and G. D. Harris, of the United States Geological Survey; Dr. E. Lewis Sturtevant, late director of the New Yerk Agricultural Experiment Station; Professor Frank D. Adams of McGill College, Montreal; and Mr. G. L. Collie of Harvard University; while President D. C. Gilman and Dr. H. M. Hurd, as guests of the expedition, accompanied the party the first day as far as Annapolis The expedition started from Baltimore at noon of April 23, and reached Washington, where the party was disbanded, at noon of April 30. Four lines of investigation were proposed, namely: (1) study of the oyster; (2) study of the geological formations; (3) study of the soils; (4) study of the Indian remains. By reason of the illness of Mr. A. E. Bibbins, which necessitated his return to Baltimore, work upon the oyster, of which he had charge, had unfortunately to be abandoned, although indications of good results were shown during the day or two he was with the party. The geological work, under the direction of Mr. Clark, assisted by Mr. N. H. Darton, was participated in by the larger number present; the agricultural investigations were conducted by Professor Milton Whitney; and Professor W. H. Holmes of the Smithsonian Institution examined the area for evidence of Indian occupation.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Eddies in the Atmosphere.

DURING last December there was published a paper by Professor Bezold "On the Theory of Cyclones" (*Sitzungsberichte der königlich preussischen Academy der Wissenschaften zu Berlin*). This exhaustive setting forth of theories by the director of the German meteorological bureau is of the highest interest, and demands notice from this side of the ocean. Professor Bezold says: "If one has attentively followed meteorologic literature for late years, so can he not fail to note that in the fundamental principles of air motions, little by little, a powerful revolution has taken place." Our author then gives a summary of the views that have arisen from time to time, especially regarding the relations between the general atmospheric circulation between the equator and poles, and the occurrence of storms or eddies in this circulation. He then gives a theoretic discussion of a particular cyclonic circulation, stationary, and having the wind directions parallel to the isobars. In this he finds that the whirl which occurs at the earth's surface extends only a short distance vertically, though he does not intimate whether this height should be 2,000, 10,000, or 20,000 feet. He also finds that if this whirl is exceedingly rapid, as one approaches the axis, a centrifugal effect is induced, and there results an "air-thinning" at the centre; moreover, there would be no tendency for air to rush to the centre, and hence there would be no uprush of air there. This is certainly a most startling conclusion, and agrees almost word for word with the view already advanced in this country ("The Tornado," pp. 57, 58, and others). Our author would account for the condensation and precipitation at the centre from the partial vacuum produced there by centrifugal action.

The origin of the tornado funnel is sought in the upper air current because there there is less friction, but no idea is given of even the approximate height of this formation. If the velocity of the gyration becomes sufficiently great, and other conditions favor, the funnel may reach the earth. This conclusion is also drawn: "In wide extended cyclones is it somewhat different; here is it very well thinkable, that, through the origin, or especially through the stronger unfolding of the same, in the middle atmospheric layers, which arise as well through the general circulation, as also in consequence of local drawing-in of the air, even as well is the air sucked into this whirl or eddy in the middle atmosphere, from above as from below." This is a most extraordinary result of this study. It is a little to be regretted that no idea whatever is given of the approximate height of this middle region, whether 5,000 or 10,000 feet. Our author finally concludes that there may be a reconciliation between the anomalous results of temperature conditions in storms and high areas, as found by Dr. Hann, and his own studies here given, as well as between the older convection theory and the eddy theory of M. Faye, more recently adopted by Siemens and Hann.

Professor Bezold's whole paper, of twenty-three royal-octavo pages, is very interesting reading, and should be perused by every one interested in the subject. It seems as though, in his attempts to reconcile two theories which are diametrically opposed to each other in almost every particular, he has indulged in some remarkable flights of imagination, but that question I leave for discussion to the advocates of each theory. Faye's view, that our storms are eddies in the upper atmosphere, seems to be gaining ground, and has already been accepted by Siemens and Hann. In *Science* for March 13, p. 151, I have suggested that "these views are entirely at variance with the facts observed in this country, and cannot possibly be accepted as an explanation of the phenomena in question." I desire to advance a few facts which show how untenable such an hypothesis as this eddy theory is.

1. The direction of the upper current does not coincide with that of the storm, but is very often at right angles to it.

2. The velocity of each stratum increases as we rise in the atmosphere to about 15,000 feet or a little less, and then diminishes; and in only a very limited stratum, perhaps at about 5,000 feet or less, is it the same as that of the storm. It is easy to see that no eddy could possibly be maintained more than a few minutes under such conditions.

3. The existence of the high area is practically ignored in this theory, though it must be very evident to every student of meteorology in this country that the high area is almost as important as the storm, and is built up under somewhat similar conditions, though with an opposite sign. To be sure M. Faye regards the high area as a static phenomenon, being led thereto by the stationary character exhibited by it in Europe, but in this country it is almost as much a dynamic phenomenon as the storm itself.

4. There are no obstructions, or counter currents at the same level, which can be invoked in calling such eddies into existence.

5. Even if it be granted that such an eddy can originate in the upper atmosphere, it is plain that its gyrations could not be transmitted to the earth through a frictionless medium. It has been computed that about twenty years would be needed for the communication of such conditions, through friction, in an air thickness of only three hundred feet.

6. If such an eddy should begin in the upper atmosphere, it is perfectly certain that absolutely no precipitation could result from it, for its downward propulsion, if it could occur, would serve to thoroughly dry the air.

7. High-level observations in this country show that a good share of the variation in pressure in our high areas and storms is far above the highest mountains, and very far from where any appreciable eddy could be formed.

8. There is absolutely no whirl in the air above 4,000 feet or less. This is fatal to this eddy hypothesis.

In *Science* for June 5 is an abstract or short statement of a paper, by Rev. W. H. Dines, read before the Royal Meteorological Society, in which were discussed these theories of storms: (1) The convection theory, or Espy's; (2) the eddy theory, or Faye's. To these I wish to add two more: (3) the wave theory, first proposed by Archibald, so far as I know, in these words: "Many facts, such as the observed direction of the upper clouds over and surrounding a cyclone, the velocities at the surface in different quadrants, the retardation of the barometric minima at mountain stations, and the frequently small elevation reached by the entire disturbance (not more than 6,500 feet, according to Loomis), tally more with a species of wave-motion by which the conditions are continually reproduced in a certain direction, than with the drift theory, and in any case require other and additional causes for their complete elucidation" (*Nature*, June 14, 1888, p. 151). This same theory has been independently advanced by Mr. John Eliot of India (*Science*, May 29, 1891). This theory is undoubtedly a great advance on the others, but is not entirely satisfactory. It