where R is the range of temperature, n the land area, φ the latitude, a and b the constants. I have computed the constants from the same data as used by Mr. Tsutsui, and compared the calculated values of R with those observed. I find that there exists no considerable difference between Tsutsui's and mine; but for forty stations between latitude 22° and 45° north (Tsutsui's $a=3.61$, $b=0.67$; mine, $a=4.56$, $b=0.64$, in the case $n=\frac{2A+B}{3}$) the discrepancies between the calculated and observed values are in general ±0.5° and sometimes as great as 1°, while the discrepancies between my calculated and observed values are not greater than 0.7°, the average being ±0.4°.

A COMPARISON OF THE CHANGES IN THE TEMPERATURE OF THE WATERS OF THE NORTH ATLANTIC AND IN THE STRENGTH OF THE TRADE WINDS.

By Commander W. C. HEPWORTH, R. N.

Communicated by the author to the Monthly Weather Review as reprinted from the Report of the British Association for the Advancement of Science, Dublin meeting, 1908.

In order to confine that portion of the inquiry which relates to the trade winds within manageable limits, two representative areas were selected for examination. One of these lies well within the region of the northeast trade wind, and covers an area of 1,000,000 square miles; the other is in the heart of the southeast trade-wind, and covers an area of 1,380,000 square miles. For the former homogeneous averages for a period of five years only are available; but for the latter the results of four hourly observations, extending over a period of forty-five years, have been utilized for estimating normal conditions. Judged by the five years' averages, the northeast trade is strongest in April (13.5 statute miles per hour); relatively strong in February (13.0 miles; in March (12.6 miles); and in May (12.4 miles). It then rapidly declines in strength until August, when its velocity is only 8.2 miles per hour. It is lightest (7.4 miles) in September. From October its strength increases until February. According to the average results obtained for the forty-five years' period mentioned, the southeast trade is strongest, (15.5 miles per hour) in February; relatively strong (15.0 miles) in April and November; also in March and December (14.9 miles). It is at about its average strength for the year (14.7 miles) in January, August, and October. In May it is lightest (13.7 miles), and from that month gradually increases, and is again at its average strength for the year in August. It declines to 14.5 miles in September.

To represent the North Atlantic in a comparison of the changes taking place in the surface temperature of that ocean two zones were selected—the one lying between Florida Strait and Valencia, and the other between that strait and Cape Race. Average results, based on observations extending over a long series of years, show that the temperature of the surface water is lower in February, March, and April than during any other period of the year, and is lowest in March. It is relatively low, as compared with any other months than the above, in January, May, and December, and of these months January has the lowest mean surface temperature, and May the highest. The surface temperature is relatively high in June, October, and November; highest as regards those months in October, lowest in November. It is higher in July, August and September than during any other period of the year; highest of all in August, not quite so high in July as in September, in in the Florida Strait to Valencia zone; but in the Florida Strait to Cape Race zone the mean is found to be the same in these two months. A comparison between results of Atlantic trade-wind volocity in each of the years 1902–1907 and those of North Atlantic surface temperatures for the same period leads to the belief that a relation may be traced between departures from the mean in the velocities of the trades in any one year and deviations from normal in the average distribution of surface temperature in the North Atlantic in the year following. Further, there is some evidence to prove that departures from the average strength of the two trades during a series of months, and at times during even so short a period as one month, are roughly reflected in deviations from normal in the average distribution of surface temperature in the North Atlantic in the corresponding series of months, or month, as the case may be, of the succeeding year, notwithstanding the many causes affecting the temperature of the surface water, which must tend to mask the appearance of any such connection.

A large number of tables and diagrams accompanied this paper.

KASSNER'S METEOROLOGICAL GLOBES.

By Prof. R. DEC. WARD, Harvard University. Dated Cambridge, Mass., Sept. 28, 1908.

Professor Kassner, of the Prussian Meteorological Institute, has recently constructed two meteorological globes which can be highly recommended for use wherever meteorology and climatology are taught. The globes measure about 13½ inches in diameter and show the pressure, temperature, and winds for January and July, on the basis of the latest and most complete data available. The globes are mounted on a wooden base, and a simple and very useful device makes it possible to turn them over, so that when desired, the south polar region is at the top. The price of the globes is 50 marks, with 3 marks additional for packing. They may be purchased of Dietrich Reimer (Ernst Vohsen), in Berlin.

Kassner's globes will unquestionably facilitate and simplify any instruction in which there is need of presenting the broad facts which they so clearly set forth. Every teacher of meteorology has had frequent occasion to regret that the great facts of temperature, pressure, and winds have to be learned from charts which, especially if they are on the Mercator projection, as is so often the case, almost always give the students a distorted or at least an unreal picture of the actual meteorological conditions, as well as of the relative sizes of the zones. A scheme of coloring is used which emphasizes the distribution of pressure and temperature, and the isobars and isotherms are drawn so that important, or critical lines are duly emphasized. The lands are shaded, and the higher elevations are shown in darker shading.

It is to be hoped that Professor Kassner's excellent work on these globes will receive proper appreciation in the United States, and that the globes will find a place in the equipment of many geographical and meteorological laboratories.

LUMINOUS FOG.

George A. Turner, second officer of the steamer *Counsellor*, reports that on Friday, July 24, 1908, when in the Gulf of Siam, latitude 30° N., longitude 103° E., "the steamer past thru a small field of remarkable phosphorescent patches in the form of a kind of vapor lying above the surface of the water in lengths of 500 to 1,000 feet and breadths of 100 feet approximately, and about 15 to 20 feet in depth to the surface of the water. At distances of 1 to 2 miles these 'streaks' appeared like shining silver (no moon shining), and at first were taken to be shoals of fish, but on passing directly thru one it had all the effect of a slight luminous fog. No disturbance or presence of any fish appeared in the water, which is only about 25 to 30 fathoms in depth, and no unusual color appeared in the contents of a draw-bucket taken at the time."

BRILLIANT GULF WATERS.

The following extract was taken from the Tampa, Fla., Times, November, 1908:

A remarkable marine phenomenon was observed by the steamship *Dover*, Capt. Yon A. Carlson, as that vessel steamed to Tampa from Mobile. When at a point 35 miles from Mobile light, at 7 o'clock in the evening

of the 24th, the ship ran suddenly in a streak of light coming from the water which alternated blue and green, the colors being so brilliant that the vessel was lighted up as if she were covered with arc lights with colored globes.

A half mile streak of dark water, and a blackness that settled like a pall over the ship followed, and a second streak of the same brilliant-hued waters was encountered. The second streak was about as wide as the first one, and when the ship ran out of it the same black waters and a night of exceptional blackness were also encountered. * * *

"I have sailed the high seas for twenty years," declared Captain Carlson, "and have seen interesting phenomena, both meteorological and otherwise, in the waters of every known ocean, but I never saw anything that approached this blue and green light from the water phenomena. The night was dark, but clear, and we ran into the streaks without any seeming warning. I was in the pilot house when we struck it, and I ran on deck, thinking that something was on fire.

"The crew tumbled out to witness it also, and it was magnificent. It was so light that it was remarked by the chief engineer that it could be read by, and to make sure I grabbed a paper, and the finest print that I could find was easily discernible. We ran out of the streak into a streak of black water, and the darkness of the night seemed to increase as we did so. From the streak of blackness we ran into the second streak of lighted waters. Each of the streaks and the intermediate streak of black water was about half a mile wide. The wind at the time was a light northwest. The sea was smooth and we were bearing southeast by east half east, 35 miles from Mobile light."

NEW SYSTEM OF STORM SIGNALS FOR NORWAY.

Communicated by F. S. S. JOHNSON, American Consul, Bergen, Norway. Dated November 19, 1908.

I have the honor to report the placing of new storm signals in and around Bergen. Signal masts have been placed on the part of Frederiksberg under control of the fire brigade who are to attend to the signals. These will be:

DAY SIGNALS.

One cone with the point up, denotes storm from the northwest.

One cone with the point down, denotes storm from the southwest.

Two cones above each other with the points up, denotes storm from the northeast.

Two cones above each other with the points down, denotes storm from the southeast.

One ball denotes a storm without direction of wind.

NIGHT SIGNALS.

The night signals consist of white lanterns as follows:

One triangle with the point up, denotes storm from the northwest.

One triangle with the point down, denotes storm from the southwest.

One triangle with the point up and lantern over same, denotes storm from the southeast.

One triangle with the point down and a lantern under same, denotes storm from the southeast.

Eight lanterns in the form of the Roman cardinal numeral "I," denote storm without the direction of the wind.

There can also be used for a night signal a red light alone which will be stationed at Molon where formerly storm signals were seen.

The above system has been prepared by the Society for the Promotion of Norwegian Fisheries in cooperation with Prof. Dr. H. Mohn and the director of the meteorological station at Bergen, Mr. Foyn, and has been accepted at most places along the coast where storm signals are displayed. The system serves as a substitute for the previous heterogeneous signals which were used at the various stations.

RECENT PROGRESS IN CALIFORNIA.

In a recent interview with a representative of the San Francisco Chronicle Prof. Alexander G. McAdie said:

The Weather Bureau intends to put in a large number of snow gages in the mountains at elevations of over 4,000 feet.

This is one of the first steps resulting from the meeting of the governors of different States in Washington about six months ago, and the resulting discussion on the conservation of natural resources. Naturally water is one of the most important subjects, and one of the first things to be done in all the States west of the Rocky Mountains was to determine the depth of snow and the amount of water the snow would yield.

The Weather Bureau intends to go into that matter extensively, and California will probably lead all the States, partly because we make such direct use of the water for irrigating and for power purposes.

I went south to the Cuyamaca Mountains, back of San Diego, and then worked north to the Sierra Madre Range. One of the most interesting experiences was at Mount Wilson, where I spent a couple of nights. Dr. George E. Hale, director of the Yerkes Observatory, and head of the Solar Physics Observatory, was most kind to me, and showed me the results of the investigations going on, and the discoveries already made at that point by the staff of astronomers and astrophysicists. Some wonderful discoveries have been made, in one sense almost as great as Galileo's original discovery of the sun-spots themselves.

They are able at Mount Wilson to photograph not only the spots and the hydrogen masses sucked into the spots, but the calcium and hydrogen flocculi. The photographs made by Professor Hale with the spectroheliograph and the big Snow telescope show what is going on at the different levels of the sun's atmosphere. In fact, I told Professor Hale that he was discovering so much about the solar atmosphere that meteorologists envied him and wished we knew as much about the earth's atmosphere

These remarkable photographs, unequaled in any part of the world, and not likely to be duplicated for years, show very plainly solar vortices. It is impossible to do justice to the work in a few words, but I felt that I had seen the sun for the first time, although I had been studying it for years. To put it in popular language, it is as if these men at Mount Wilson were able at their pleasure to analyze and look thru all the layers of metallic clouds in the sun. There have been some marvelous discoveries also with regard to the magnetic effects produced by sunspots. In brief, the fruits of nearly twenty years' work at other observatories in the East are now coming forth.

California, I may say without the slightest brag and with all modesty, now leads the world in astrophysical work. With the Lick Observatory contributing its full share, as it has done since Doctor Campbell became director, and this young but powerful solar-physics observatory at Mount Wilson, backed by the Carnegie Fund, the Smithsonian, and Professor Hale's own large means, California is simply setting the pace for all other observatories.

SUGGESTED REFORM IN METEOROLOGICAL METHODS.

By Prof. A. G. MCADIE. Dated, San Francisco, Cal., September 29, 1908.
[Published by permis ion of the Chief of Bureau.]

In order to help the Weather Bureau maintain its present prestige, I venture to submit a plan for a gradual adoption of the metric system in our records and work. Many National Weather Services now use this system and it will be admitted without argument that the universal use of one system will by uniformity, facilitate exchange, economize time and labor, increase efficiency, and briefly, bring into harmonious whole, the now somewhat disjointed efforts of meteorologists.

I have suggested elsewhere that an easy way of beginning the use of the metric system was in the connection with the measurement of precipitation. The problem of measuring the snowfall and its equivalent water is now submitted to the Bureau by the Inter-Bureau Agreement, and it is all important in connection with the water resources of our country and the conservation and preservation of water yields, that scientific measurements of snowfall and rain should be available. Heretofore measurements have not been made in a manner or on a basis suitable for the new requirements. In a letter recently submitted, I urged that some method may be adopted whereby the water-content of snow would be given in decimal parts. The particular scheme suggested seemed to be an easy and entirely feasible one.

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For a time at least it will be necessary (as an educational and precautionary measure) to use some system giving values side by side. There is, however, no difficulty in doing this. Instruments with double scales are already on the market and

[1] This paper is published in order to invite discussion. Its appearance here does not imply the approval of the Chief or other officials of the Weather Bureau.—*C. A.*