peculiarities is lacking. In framing forecasts at the observatory, Mr. Hunt explains, a wording is used sufficiently comprehensive to appiy as nearly as possible to the whole of the state, and until detailed topographical charts are available, it would be useless issuing other than general forecasts.

INFLUENCES ON AUSTRALIAN WEATHER.

Briefly describing the origin of Australian weather, Mr. Hunt recently explained that in the latitude of Australia the general movement of the air is from west to east; in fact, there is a great atmospheric stream always traveling eastward. This stream varies in velocity relatively from a few miles at the earth's surface, where friction retards motion, to a very much greater velocity in the higher levels. This easterly drift is by no means uniform in motion, but is divided up into a number of irregularities, known as anticyclones and cyclones or barometric highs and lows, respectively. To the anticyclone must be given first place as the great control system, determining the air movement which gives us our weather in the Southern Hemisphere.

"Although our rainfall is more immediately due to ascending convectional motion within the cyclone, it must be remembered that the energy of the latter is largely derived from, and its position governed by, the former, to which it acts the part of a secondary. These anticyclones or controls travel eastward with a normal daily velocity of 400 miles, but there are wide departures from this normal and sometimes the easterly translation for a single day may be as much as 1000 miles, and there may be within the lower levels, so far as the position of Australia is concerned, no forward movement of the atmospheric stream, when the anticyclone remains stationary for days over our mainland, as often occurs during the winter months, or there may be an actual retrogression, but any backward movement rarely lasts. All our weather phenomena may be said to be due to the varying intensity, and to the altered position day by day of these high and low pressure areas."

THE CHART EXPLAINED.—INTERVIEW WITH THE ACTING METEOROLOGIST.

The acting meteorologist (Mr. H. A. Hunt) furnishes the following details respecting the publication of a daily isobaric chart:

"The curves on the above chart represent lines of equal barometric pressure, known as isobars, and are drawn through simultaneous barometer readings received daily from 90 or 100 stations throughout Australia. These are carefully plotted on blank maps, after corrections for varying temperature and altitudes have been applied, together with those for index and gravity. If these charts are carefully studied from day to day, it will be noticed that a general translation takes place to the eastward with varying rates, occasionally halting, and in remote instances showing a retrogression. It will also be observed that at times the whole of the systems, anticyclonic, and cyclonic, are occasionally impelled to and from the equator.

"The pressures (high and low) which for the moment are lying over Australia, constitute a link in a vast atmospheric stream or belt surrounding the earth, which is fed by return currents from the equator and the poles. A like belt exists in the Northern Hemisphere in a similar zone. The mean latitude in which these belts travel varies with the seasons, and they are drawn to and from the equator as the sun goes north and south. Mr. Russell, in his paper on 'Moving Anticyclones in the Southern Hemisphere,' determined the mean easterly rate of progress at 400 miles per day, any variation in which rate brings about a break in the normal weather sequence, as also does a variation of path from the normal latitude for each period of the year.

"Were the rate and latitude of this belt constant, weather anticipations would be a very simple matter, but these occasional deviations render them very complex.

"The normal cyclonic systems of the Southern Hemisphere take the form of depressions, in shape not unlike an inverted capital letter V, the apex of which forms a wedge between the links or anticyclones in the anticyclonic belt. The isobars of these low pressures undergo a straightening in high latitudes, until they become parallel, and control the westerly trade winds, familiarly known as the 'Roaring Forties.'

"Similar isobaric formation exists in the equatorial zones, the monsoonal Vs or wedges extending southward between the anticyclones from the tropical low-pressure belt, more especially during the summer months.

"Occasionally these V-shaped depressions extend so far northward or southward by reason of occasional variations in the movements of the anticyclones—a neutral or dormant area intervening—that with an acceleration in the rear high-pressure system a portion of the V-pressure system is apparently imprisoned between the two anticyclones, and a violent cyclone is the result, such as caused the recent Nemesis storm. This is one of the principal causes giving rise to cyclones in the Southern Hemisphere, another being what is known as a backing or retrogressive movement, which is brought about in the following manner: An anticyclone, moving eastward, collides with a V-shaped depression that for some as yet unexplained reason has remained stationary, or a depression backs on to the easterly isobars of an advancing anticyclone. Both actions give rise to a steepening of gradients, with violent wind results. One memorable instance of this type is that known as the Ballarat storm in 1892, when a V-shaped depression over the Tasman Sea backed on to a high pressure to the west of Tasmania. Other instances with like eventuations occur when incipient depressions visit the coast of New South Wales from the northeast tropics, resulting in violent cyclones such as caused the Maitland gale."—*C. A.*

HAWAIIAN CLIMATE AND CROP SERVICE.

We learn from Mr. A. McC. Ashley, Section Director of the Weather Bureau at Honolulu, that he is now receiving reports from 116 stations in the Hawaiian Islands, distributed as follows: Hawaii, 42; Maui, 18; Oahu, 25; Kauai, 28; Molakai, 1; Lanai, 1; Kahoolawe, 1.

Only 23 of these, including the last three on the list, are equipped with thermometers, but this number will be materially increased. Many of these stations reported to the former Territorial Service, but the exposure of the rain gages and the preparation of reports has been to some extent lacking in uniformity, and Mr. Ashley will endeavor to reduce the whole to a homogeneous system. It is hoped that the publication of regular monthly reports may begin early in 1905.—*F. O. S.*

ANTARCTIC METEOROLOGY.

At the recent International Geographic Congress, whose meetings where held in Washington, New York, St. Louis, and elsewhere, the antarctic explorer, Mr. Henry Arctowski, who had charge of the recent Belgian Antarctic Expedition, delivered an interesting address, from which we make the following extracts:

Only a few years ago we knew nothing, or nearly nothing, of the antarctic climates, as the first wintering in the south polar regions was that of the *Belgica*, which only dates from 1898.

The publication of the results of our meteorological observations is at last nearly completed, and the five reports already published on the hourly meteorological observations—on the clouds, on snow and frost, on optical phenomena of the atmosphere, and on the aurora australis—make it possible to judge of the contribution to antarctic meteorology brought back by the Belgian Antarctic Expedition.

The study of the results which we have obtained convinces me that all this work is only the wedge started into the unknown, and from this critical point it is fortunate that the expedition of the *Belgica* was followed so closely by those others which have in such a short time enriched our knowledge by great geographical discoveries and a mass of scientific material, the publication and discussion of which shall, unfortunately, take many years. But, notwithstanding all the importance of the results obtained by the *Belgica*, *Southern Cross*, *Gauss*, *Discovery*, *Antarctic*, and the *Scotia*, I consider the whole of these new acquisitions to science as being only a work of orientation—provisory work.

If all the expeditions, in whose happy return we rejoice, had wintered simultaneously, and if they had been seconded by stations, which could have been easily installed on the subantarctic islands, the discussion of the whole of those observations would probably have revealed not only the exact position of the isotherms and the isobars all around the south polar ice cap, but also the course of the tempests, and, perhaps, even the laws of the general circulation of the atmosphere in the Antarctic; whereas, on the contrary, because of the conditions in which the several winterings were made, we shall only have climatological data and a series of questions simply touched upon but not resolved in everything concerning the dynamique of the atmosphere.

The thing is to have as great a number of stations as possible working, all simultaneously, not only in view of accumulating the figures resulting from the ordinary hourly meteorological observations, but, first of all, in view of enriching our knowledge of the meteorological conditions of the upper regions of the atmosphere by experiments with self-registering instruments mounted on kites and by continuous study of the clouds, especially of their height and the direction and speed of their displacement.

The stations must be sufficiently near one another to permit, after the return of the expeditions, the drawing of daily synoptic maps, or even hourly, for the most interesting cases, and it is only under such conditions that we shall succeed in learning the usual tracks of the cyclones which are observed in the subantarctic regions all around the polar ice cap, and about the displacement of which we do even know whether they converge toward the pole, following a spiral track, or if, on the contrary, the depressions are formed on the borders of the ice (there where the isotherms are very close together) and go, leaving the polar circle, in a northwestern direction. The clouds, as well, must be studied very carefully, so that the distribution of the systems of clouds in the barometric depressions may be established exactly, and in this respect the Antarctic regions may give us very precious information.

From the detailed study of the clouds that Dobrowolski undertook and carried out on board the *Belgica*, we can deduct that those cloud

masses which he has called "system clouds" form huge layers, generally discontinuous (at least at their borders), where the undulations may be distinctly observed.

The clouds show us the long waves which must necessarily be formed between two layers of air sliding one over the other and between which clouds are interposed.

However, Dobrowolski's work should be continued, and the only way to bring it to a satisfactory end and to resolve the fine problems of atmospheric dynamics which are still awaiting a definite solution is to have good observers distributed at a series of stations sufficiently close together so that the same system of clouds might be studied simultaneously through its whole extent. If we look forward into the question of the scientific exploration of the Antarctic regions the idea of an international cooperation, of the concentration of all efforts toward one and the same end, this idea must necessarily pursue us.

The Cape Horn region and the lands situated farther south seem to me very favorable for the establishment of a polygon of stations, the chosen places being Falkland Islands, Staten Island, one of the islands of Diego Ramirez, and the lighthouse of Los Evangelistas; then the South Georgia, Sandwich, Orkney, and South Shetland islands; lastly, a station on the coast of Graham Land, another at the wintering station of Nordenskjöld, for example, and two floating stations—one in the region of the drift of the *Belgica* and the other in the Weddell Sea. We would have in this way a polygon of posts of observation sufficiently large, and composed at the same time of points sufficiently near together.

The expenses of such an undertaking might be counted as follows:

A ship wintering in the ice in the region of the drift of the *Belgica*, $100,000.

A second ship in Weddell Sea, $100,000; a third, exploring the edge of the pack and studying the variations of the distributions of the ice and making oceanographic researches during the whole year, $100,000.

The first and second may install each a station on the Antarctic lands, and the third, in two cruises, the four stations on Sandwich, Georgia, Falkland, and Shetland islands—let us count six stations at $30,000 each.

And, lastly, as for the region of Cape Horn, there is already a good meteorological station on the Island Año Nuevo, near Staten Island, while that one of the lighthouse of Los Evangelistas would probably need a special staff and instruments, and so let us simply count Diego Ramirez, $20,000, and a mountain station, for example, on the summit of the mountain called Bonnet de la République, near Llopotaia, the installation and all the working expenses of which would not exceed $30,000.

The entire expenses of such an undertaking, then, would not, as you see, exceed $530,000.

If you will bear in mind that this expense would be divided between the different nations taking part in this expedition, and that, aside from the meteorological work, other researches, oceanographic, etc., would certainly be undertaken, you will see that the proposition which I submit could be easily realized, and that our knowledge of the physical conditions of the globe would be enriched by an enormous amount of new scientific data, for the acquisition of which it is worth while to sacrifice the money and necessary efforts.

DEFLECTION OF THUNDERSTORMS WITH THE TIDES.

CAPE MAY COURT HOUSE, N. J., *November 9, 1904.*

Prof. WILLIS L. MOORE,

Chief of U. S. Weather Bureau, Washington, D. C.

SIR: In the August issue of the MONTHLY WEATHER REVIEW, I note, with interest, an article from Mr. George L. Lovett, of Cape May, N. J., regarding the deflection of thunderstorms by the tides as they pass up and down the Delaware Bay.

I wish to concur with him as to the facts as stated, from several years' observation.

It is a common occurence, during the summer months, to witness heavy cumulo-stratus clouds passing up the bay with the rising tide, and down the bay with the falling tide, but more frequently do they pass up. At Cape May Court House, N. J., which is twelve miles from Cape May and about three miles west of the ocean, it is seldom we have a thunderstorm simultaneously with a falling tide, but usually with the beginning or on top of the flood tide. If, as occasionally occurs, a storm comes on the ebb tide, it is generally heavy and accompanied with dangerous lightning and heavy winds. It is the invariable practise of our baymen, on observing a "squall rising" as they term it, during the ebb tide, to seek shelter before the flood tide makes, when they look for the storm to break forth.

Another phenomenon is, that thunderstorms more frequently either follow the Delaware Bay or cross the cape in close proximity to the Tuckahoe River basin.

Cape May Court House is nearly midway between Cape May on the south and the Tuckahoe River on the north. Now, on the ebb tide, when storms are passing down the Delaware, they are liable to either cross the cape in the vicinity of Woodbine and pass down the Tuckahoe River basin, with the tide to the ocean, and on the flood tide from the ocean across the cape to the bay, or pass down the Delaware past Cape May, thus avoiding a belt across Cape May County, with Cape May Court House as the center.

This is evident by the following normal annual precipitation as given in the annual report of the New Jersey Weather Service: Ocean City, 1900, 43.94 inches; Atlantic City, 1903, 43.71 inches; Woodbine, 1903, 43.68 inches; Cape May, 1903, 43.88 inches, and Cape May Court House, 1903, 41.13 inches.[1]

From these figures it will be observed that Ocean City, situated near the mouth of the Tuckahoe River, receives a larger rainfall than either Atlantic City at the north or Woodbine or Cape May Court House at the south; that Woodbine, being situated farther from the river, receives less rainfall; that Cape May situated at the cape receives a large rainfall, and that Cape May Court House, being in the center of the belt, receives the least rainfall. On investigation of the reports it will be found the difference is noted during the summer months, or during the thunderstorm period, thus showing that the thunderstorms follow the rivers with the tides.

Yours, very respectfully,

L. T. GARRETSON,
Voluntary Observer.

WEATHER BUREAU RECORDS.

By virtue of Instructions No. 210, dated December 16, 1904, a number of changes will be made in the forms and records, which must be carefully considered by those of our colleagues throughout the world who are studying Weather Bureau data. Perhaps the most troublesome change is that depending on the adoption of local standard hour meridians instead of the uniform seventy-fifth meridian time that has been so convenient for meteorological, magnetic, and seismic work. We make the following extracts from the report of the board on the revision of forms, which report goes into effect January 1, 1905:

1. The adoption of a form to be known as the Daily Local Record. * * * This form provides for the entry of the hourly temperature readings; the hourly amounts of precipitation, with the time of beginnings and endings; the hourly sunshine; the hourly wind direction and velocity, and the hourly maximum wind velocities when above a certain limit, which limit will vary for the different stations. It also provides for entering the character of the day, the total sunshine in hours, prevailing wind direction, and other data; and a diagram is provided on which the daily temperature and pressure curves may be platted, if desired. Space is also provided for the entry of abnormal conditions, severe storms, and other matter not expressed by the instrumental readings. An extra horizontal column, without heading, has been provided for the entry of data of excessive precipitation, now recorded on the back of Form 1017-Met'l, or other data, a record of which may be of sufficient importance to retain at the station. In short, it has been the aim to embody in the Daily Local Record form a complete history of the weather of the day. * * *

2. In the matter of compiling the hourly readings of the various instruments the board is of the opinion that sufficient compilations of the hourly barograph readings have been made, and it therefore recommends that Form 1026-Met'l, Barograph, be discontinued on December 31, 1904, at all stations now rendering said form. In regard to temperature the board is of the opinion that this element, aside from its purely climatic value, has sufficient public interest to warrant the tabulation of hourly values, as at present, but after tabulations are made and means found for a period of twenty years no further sums and means of the daily and hourly values need be made.

The hourly records of wind direction and movement are important, especially to Lake and sea-coast stations, and at some points in the interior. Since frequent changes in the exposure of wind instruments have been made in the past, and since it is probable that such changes will continue to be made in the future, the matter of determining monthly and seasonal normals becomes exceedingly difficult. Each exposure of the anemometer forms, in itself, a separate and distinct record, and should be treated as such. Unless a series of comparative readings are made between the old and new exposures a combination of the two series in a general mean is not satisfactory. Therefore, when a removal is to be made, a series of comparative readings, extending over at least a year, should be made whenever practicable. It is believed that these data should continue to be tabulated as at present. At those stations where an undisturbed and continuous exposure has been had for a period of ten or fifteen years, it is quite probable that fairly accurate normals could be obtained, and those stations might be authorized to cease computing sums and means.

3. Form 1001-Met'l. The board recommends the adoption of a new Form 1001-Met'l. * * * The new form retains pages 2, 3, 6, and 8 of

[1] These normals are based on the following length of record: Ocean City, eleven years; Atlantic City, twenty-seven years; Woodbine, eleven years; Cape May Court House, fifteen years. The normals are therefore not comparable with one another.—*F. O. S.*