Quite often before rains I noticed clouds over the sea. These clouds were not the fairly common cloud banks which one can observe off many coasts. They were low lying, though not touching the horizon—flat bottomed and almost stationary, very like the common flat-bottomed clouds of the trade-wind areas.

Prevailing winds here are from the south. A north wind was frequently the forerunner of rain, although this was not always the case.

When I arrived here last November small briny pools were still to be found inland. This year there are some, but I very much doubt whether they will be left five months from now.

Parinas, a dry stream under normal conditions, has been flowing now since the rains in 1925. Mr. Oscar Haught tells me, however, that it does not seem to be flowing as much water as it did this time last year.

Last year the country hereabouts blossomed forth with large numbers of plants. In December, 1925, the desert was bare and brown, but after the rains started grass and many legumes came up and grew both fast and rank. One of the legumes has a yellow flower and a long seed pod with almost cylindrical seeds. It often grows so high that you can not see over it from the seat of a Ford car.

These same rains also made pools on the Tablazo which attracted many wild ducks, affording our hunters much sport. The pools also bred mosquitoes, which are absent here under normal circumstances.

Discussion.—The almost complete absence of meteorological observations from Peru, save only from Lima, makes it difficult to visualize the meteorological changes that were associated with the extraordinary rains of February–April, 1925. The southward extension of the El Niño current in that year, seems to have taken place as early as the middle of January or a few days later. In 1926 the water temperatures as measured at the end of the steel pier at Negritos, Peru, first reached a height of 80° on January 27; the temperature then sank slightly below that figure and remained below about two weeks, again reaching 80° on February 11 and continuing close to that figure until the end of the month.

March opened with ocean water temperature at 82° and fell to 79° on but a single day until the 20th. A water temperature on the 21st is missing but on the 22d a temperature of 74° was registered—a drop of 9° from the 20th; on the 23d it had returned to 79° and continued about that figure until the end of the month.

On April 9 it registered 83° for a single day and then sank to 78° on the 10th.

These figures seem to indicate that the retreat of the warmer water proceeds irregularly and that fragmentary incursions of warm water may be experienced some days after the cessation of the warm current.

The meteorological statistics with the exception of the land and sea temperatures throw no light upon the cause of the extraordinary rains over the normally desert areas of northwestern coastal Peru.

The outstanding features of these statistics are the high ocean temperatures of March and the heavy rains of that month and the cessation of the rains so soon as the ocean temperature fell to approximately normal values in April and May. The high ocean temperature would increase the air temperature locally both by conduction and convection, and the contact of these local masses of warm air with the adjacent Peruvian highlands would doubtless cause the rains as observed. The drift of overlying ocean air landward must occur with some regularity, especially during the night hours, and there must have been a countercurrent seaward during the daytime hours; wherefore it is inferred that the disturbed air conditions were local rather than general and due to the unusual extension of El Niño current to the southward.—*A. J. H.*

In connection with Mr. Berry's paper and the above discussion, the following reprint from the Bulletin of the National Research Council, Volume II, part 2, No. 56, November, 1926, is of interest:

INVESTIGATIONS OF THE AMERICAN MUSEUM OF NATURAL HISTORY IN THE HUMBOLDT CURRENT REGION

From December, 1924, until March, 1925, the writer, accompanied by Mr. Van Campen Heilner, conducted marine zoological investigations for the American Museum on the coasts of Peru and Ecuador. A report on the oceanographic phases has since been published (Oceanic and Climatic Phenomena along the West Coast of South American during 1925, Geographical Review, vol. 16, pp. 26–54, 1926). This paper is supplemented, moreover, by another of more popular nature (Equatorial Vignettes, Natural History, vol. 25, pp. 431–449, 1925).

The problem on the arid west coast of South America is highly complex. In their incipience, the factors which produce the periodical changes are doubtless purely meteorological, while the end stages, because of the peculiar topography of the western watershed of the Andes, involve profound geographic effects. The intervening phenomena in the grand sequence are, however, distinctly oceanographic. The notably stable physical characteristics of the littoral ocean of this coast, and the consequently undue disturbances which occur during the rare cycles in which such characteristics are altered, are alike unequaled elsewhere. In no other part of the world does a simple reversal in direction of the coastwise oceanic circulation lead to such spectacular climatic, biological, and economic results.

The writer worked entirely from launches and other small craft, and his equipment was limited to surface apparatus. His data, therefore, do not lead to an understanding of the extent in breadth or depth of the warm countercurrent which for many weeks during the winter and spring of 1925 replaced the Humboldt Current, at least at the surface, bringing about the cessation of cool upwelling and preparing the way for perhaps unprecedented rainfall along the desert coast. Even as regards simple surface temperatures, all the tables thus far obtained from the pertinent section of the Pacific, record conditions only along coastwise tracks, within a few miles of shore. The data urgently needed are routine observations made at right angles to the trend of the coast, and extending for a thousand miles or more along any parallel between the equator and latitude 30° S. Such data, especially if accompanied by subsurface records, might reveal whether the counter-current known as El Niño was in the nature of a restricted coastal tongue or whether the phenomenon represented a surface movement of colossal extent in the wake of retreating high-pressure areas. A search for figures which may throw light upon this question is now being made, with the aid of Doctor Littlehales, of the U. S. Hydrographic

Office, and of several cooperating friends in South America.

The precipitation on the coast of Peru during 1925 has been recorded as certainly the heaviest since 1891; but there are reasons for believing that the conditions have not been paralleled during the course of at least six centuries. Prior to March, 1925, for example, the mud walls of the prehistoric fortress of Chan Chan, near Trujillo, still bore clearly the ancient reliefs and hieroglyphics of their builders, but the rainfall of a few subsequent weeks entirely obliterated them. The destruction of life in the sea, through a process which the writer has elsewhere described, was also unprecedented within human memory. Under date of January 30, 1926, Mr. Francisco Ballén, director of the Peruvian National Guano Administration, writes that probably two-thirds of the sea-bird population of the Peruvian coast, as existing in December, 1924, perished during the following months of unfavorable oceanic conditions.

Fortunately the serious economic effects of the countercurrent and its sequelae have simplified the study of meteorological and oceanographic problems by encouraging the recording of precise data. Through the interest of the American ambassador in Lima, of Maj. Otto Holstein, of Trujillo, and of other friends and correspondents in the service of numerous Peruvian industrial organizations, tabulated records of the climatic and oceanic régime are now being received regularly. These are deposited in the files of the American Geographical Society of New York, and their subsequent interpretation can not fail to go far toward illuminating our faint understanding of one of the most remarkable geographic phenomena of our time.—*Robert C. Murphy.*

NOTES AND ABSTRACTS

E. W. BLISS ON BRITISH WINTERS IN RELATION TO WORLD WEATHER

The author in continuance of his previous work on correlation of world weather correlates the mean winter temperatures of Greenwich with elements of the weather in various parts of the world.

The correlation coefficients with pressure, temperature, and rainfall in various quarters of the earth are shown in the exhibit below.

Number of coefficients 0.4 or greater

	Preceding quarter	Contemporary quarter	Succeeding quarters
Pressure	1	4	0
Temperature	8	6	3
Rainfall, etc.	1	1	1

Ten of these coefficients are with the two preceding quarters, eleven with the one contemporary quarter and four with the two subsequent quarters. The large coefficients are therefore mainly with previous and contemporary quarters. The author concludes as follows:

> Out of 310 correlation coefficients with Greenwich temperature of December to February as representing winter in Northwest Europe the largest appear to indicate the following relationships—
> (1) With pressure of the previous summer at Cairo.
> (2) With temperature of the previous June to August at Madras, Samoa, Batavia, and Perth.
> (3) With the previous Nile flood, the relationship here being inverse.
> The results indicate that conditions in the Southern Hemisphere play a part comparable with that of the North Atlantic oscillation in controlling subsequent winter weather in the British Isles.—*A. J. H.*

AEROLOGICAL WORK IN JAPAN[1]

This is the first published report of the Japanese Aerological Observatory at Tateno, where there is maintained a most complete meteorological equipment, including facilities for making aerological observations by means of pilot balloons, kites, sounding balloons, and captive balloons. This report contains data procured by double-theodolite pilot balloon observations only. The records cover two years (March, 1923–February, 1925) and total 1,030 observations. The balloons used weighed from 10 to 120 grams and the rates of ascent varied between 100 and 350 meters per minute.

There are included in the report a very complete history and description of the station, equipment, etc. Tables showing the wind velocity and direction at the various altitudes for successive minutes are given for each pilot balloon observation. Graphs are included, showing the:

Mean wind velocity (0–10 km.) for each season and for the year.

Mean annual wind velocity (0–2 km.) for 6 a. m., 10 a. m., and 2 p. m.

Mean wind direction (0–10 km.) for each season.

Mean wind direction (0–2 km.) for 6 a. m., 10 a. m., and 2 p. m. for each season.

Frequency of wind directions (0–10 km.) for each season.

Frequency of wind directions (0–2 km.) for 6 a. m., 10 a. m., and 2 p. m. for each season.

The report closes with a discussion of the agreement between the observed ascensional rates of pilot balloons and those determined by formula. A change in the formula was made in order to obtain a closer agreement with the average observed rates. Closer agreement was found to obtain between the observed rates and those computed from the formula used by the U. S. Weather Bureau than those indicated by the Dines's formula.

Among the conclusions cited are the following:

1. The observed rates were found to be generally greater than those computed from formula. (U. S. Signal Corps and Dines).

2. For the rate of 100 m/m the values almost coincide but the actual rate becomes 20% greater for rates of 200 m/m.

3. The following new formula was devised to obtain closer agreement with the observed data.

$$V=74.6\left\{\frac{A}{(A+B)^{2/3}}\right\}^{\frac{1}{1.53}}$$

This fits closely for the stratum 1 to 3 km. but to reduce the values computed from the above formula to the mean observed values from 1 to 10 km. they must be multiplied by the factor $\frac{1000}{1071}=0.934$.

4. The rate of ascent is greatest at 2 p. m. and least at 6 a. m. It is greater in winter than in summer.

5. The rate is greatest near the ground and decreases more and more upward but at 8 km. it increases again.

[1] Abstract of "Roporto de la Aerologia Observatorio de Tateno. Nol. By W. Oishi. (The report was translated by Mr. W. W. Reed from the original Esperanto.)