H. THORADE examines in turn the influence of the wind and of friction, the effect of turbulence, the deflecting force of the earth's rotation, and the different kinds of currents, classified according to their causes — impulse currents, gradient currents, currents at various depths and the influence of the bottom — besides the use of temperature and salinity measurements for obtaining fields of force and fields of pressure; from which recent theories allow the direction and strength of the current at each point to be deduced. These temperature and salinity measurements, much easier to make than direct current measurements, have in certain cases (Newfoundland Banks) produced very interesting results which have been largely confirmed by experience. The author concludes, however, that numerous observations are still necessary definitely to confirm these theories.

Our only criticism of this excellent book is that it is a pity that the absence of an index makes reference somewhat difficult.

P. V.

THE DEVELOPMENT OF OUR CONCEPTION OF THE GULF STREAM SYSTEM.

Mr. C. O'D. ISELIN, of the WOODS HOLE OCEANOGRPHC INSTITUTION, Massachusetts, U.S.A., has written a paper entitled *The Development of our Conception of the Gulf Stream System*, which appears in the *Transactions of the American Geophysical Union, Fourteenth Annual Meeting*, April 27, 28, 29, 1933, Washington, D.C., (page 226). In this article he discusses the nature of the problem of the Gulf Stream in physical oceanography. Mr. ISELIN begins by pointing out that the question of terminology is of some importance, for the expression "Gulf Stream" is never quite clearly defined by the various authors who use it, and who apply it indiscriminately to the different parts of the sectors over which this vast current extends. Observing that the historical name should be retained to designate this vast river of warm water which flows out of the Gulf of Mexico, along the Eastern coast of the United States, towards the tail of the Grand Banks and thence to Europe and the Arctic, the author proposes to use the expression "Gulf Stream System" to denote the whole of the current including the branches.

After an historical review of the different conceptions which have given birth to the terms "North Atlantic Drift " and "Atlantic Current", the author states that the atlases have a tendency to exaggerate the breadth of the part that can properly be considered to be a current from an oceanographic point of view. The charts, in fact, usually show the sum of the permanent currents and the prevailing drift. In conclusion the author states that, logically, it is justifiable to split the Gulf Stream System into three parts on the basis of the structure of the current when examined in cross-section, and that historically there is good precedent for calling these the Florida Current, the Gulf Stream and the Atlantic Current. The latter is branched and the courses of all its branches have not yet been worked out, as their flow is masked by the shallow North Atlantic Drift.

TIDES AND COASTAL CURRENTS DEVELOPED BY TROPICAL CYCLONES.

by

ISAAC MONROE CLINE

(WEATHER BUREAU OFFICE, NEW ORLEANS, LA., DEC. 1931).

(From an article in the *Monthly Weather Review*, Vol. 61, No. 2, Feb. 1933, pp. 36-38: U. S. Weather Bureau, Washington, D. C.).

The greatest damage caused by tropical cyclones is due to the tides developed by them: 45,000 persons were drowned at Calcutta on 5th October 1864 by a storm tide of 16 feet; 100,000 others were drowned in the Ganges delta on 31st October 1876 by a similar tide which brought the water from 10 to nearly 50 feet above normal. Great loss of life from such tides has occurred also in more recent years.

From 1849 to 1900, a diagram by Colonel REID, according to which the swell travelled outwards from the centre of the cyclone in all directions, was accepted as correct. In reality, things occur very differently.

The study carried out by Mr. CLINE shows that the winds in the right-hand rear quadrant of the cyclone have a direction which is mainly the same as that in which the cyclone is travelling and that they continue to blow thus during the life of the cyclone. These winds form an air stream which persists with wind velocities of 40 to 100 miles per hour, covering a distance of some 200 miles, and in some instances a tail of winds of 20 to 30 miles per hour extends over a further 100 miles.

These winds, which are constant in direction, develop waves and swells ranging from 20 to 50 feet in height, which are not developed to the same extent in other portions of the cyclone where the winds are constantly changing direction.

Once formed, these waves move forward in the same direction as the cyclone and parallel to its track. The speed of some of them is more than 40 miles per hour, while that of the cyclone may be only 12 to 15. They thus quickly overtake the latter and reach the coast far in advance of the arrival of the storm.

For example, on 26th September, 1915, at 8 p.m., a cyclone centred south of western Cuba was approaching the Yucatan Channel. At Galveston, Tex., and Burrwood, La., there was a storm tide of 0.8 feet.

At 8 a.m. on 27th September the storm tide was 1 foot from Galveston to Burrwood and had commenced rising at Fort Morgan, Ala.

The storm centre passed through the Yucatan Channel during the night of the 27th-28th, and at 8 a.m. of the 28th there was a storm tide of 1.5 feet from Galveston to Burrwood.

There was no further rise in the storm tide on the Texas coast, but at 8 p.m. of the 28th it had risen to 1.7 feet at Burrwood, La., and had extended to Fort Morgan, Ala.

From 8 p.m. of the 28th to 2 a.m. of the 29th the storm tide rose to 2.7 feet at Burrwood, and in the following 6 hours it reached 3.7 feet. The rise in the storm tide extended well eastward on the Florida Coast but there was no rise in the tide west of Isle Dernier, 25 miles to the left of the path followed by the centre of the cyclone. The greatest rise in the storm tide was about 40 miles to the right of the line followed by the storm centre.

In this case, the first warning of the passage of the cyclone was given three days in advance by the rise in the tide.

The progressive movement along the coast from the point where the rise in the tide is greatest gives valuable indications of the subsequent alterations in the path of the cyclone, as is clearly shown by the observations made between 2nd and 14th September, 1919. During that period the movements of the barometer were slight and sometimes contradictory. Also they became evident much later than those of the tide.

The swells sent out by the right-hand rear quadrant of a cyclone give rise to powerful currents running from right to left. These currents are capable of moving buoys rapidly, with their sinkers and mooring chains (the whole weighing more than 15 tons), for anything up to ten miles.

Naturally, these storm swells are capable of causing great destruction. An idea of this can be obtained from the mere fact that, at Sabin Bank Lighthouse, cast iron plates 5/8 of an inch thick, 27 feet above the surface of the water, were bent up and crushed in by the storm swells.

THE IMPORTANCE OF TIDE-OBSERVATIONS.

by

H. A. MARMER

(Extract from the *Transactions of the American Geophysical Union*, Fourteenth Annual Meeting, April 27, 28, 29, 1933, Washington, D.C., page 21).

In the first place, such tide-observations permit the accurate determination of basic datums from which both heights on land and depths in the sea may be measured. And, in the second place, such observations furnish quantitative data for determining coastal stability.