winds impede it. A play of such wind conditions over the North Sea at large, as would be expected to pool up the Southern Bight (and north-westerly wind conditions are well known to do this), can most effectively hold up and reverse the current.

The results of the last three years are of especial interest, for, instead of the residual current heading boldly into the North Sea (as it most frequently had done in the previous three years) it has displayed less and less easting with the passage of time. During 1933, the current headed about half a point west of north.

Such long-enduring modifications of the current are held to be analogous in a way to the short-lived modifications produced by wind influence. The inferred cause, in their case, however, is an oceanic pulse — an accession of strength on the part of the parent supply stream which flows in from the ocean round the north of Scotland. This causes an extra strong southward urge of waters through the North Sea — with the results observed in 1933 particularly.

The Dover Straits current attains its strongest and weakest rates of flow a half year later than does the current entering the North Sea round the north of Scotland, but a quarter year later than the current in the Cromer Knoll region.

These facts are interpreted to indicate that the Dover Straits current waxes and wanes through the year in a sort of buffer relationship with the current from the north — that there exists a sort of seesaw conflict between the two. The vagaries of the Dover Straits currents are, on the strength of the findings mentioned, held to serve as pointers to major modifications of the currents in the northern and middle reaches of the North Sea half a year earlier.

ÜBER STROMUNRUHE.

(ON THE IRREGULARITIES OF CURRENTS).

From observations made in the Kattegat in August 1931.

by

H. THORADE.

An account was given in *The Hydrographic Review*, Vol. XI, No. 2, November 1934, page 179, of Messrs. A. DEFANT and O. v. SCHUBERT'S book on the current measurements carried out in August 1931 in the Kattegat by an oceanographical expedition in which four nations took part. Issue IX of 15th September 1934 of the *Annalen der Hydrographie* contains, on pages 365 to 377, an important article by H. THORADE on the same observations from a different point of view, which is of interest in the case of all current observations made on board an anchored ship.

The writer has worked out with the utmost care the observations made by the *Poseidon* with Dr. H. RAUSCHELBACH'S current-meter (1).

This apparatus, which was exhibited at Monaco in connection with the Supplementary International Hydrographic Conference 1929 and a brief description of which was given in *The Hydrographic Review*, Vol. VII, No. 1, May 1930, pages 115 to 123, by its twin-cable suspension continuously refers the direction of the current to the ship's head and records it every 10 seconds; the speed of the current is measured by recording every ten revolutions of the current-meter's screw.

From a very careful analysis of the observations H. THORADE comes to the following conclusions :—

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(1) See H. RAUSCHELBACH. — *Beschreibung eines bifilar aufgehängten, an Bord elektrisch registrierenden Strommessers* — Supplement to the *Annalen der Hydrographie*, 1929.

(1) These accurate records taken in quick succession have brought to light a considerable dispersion in the results and have shown that it is not sufficient to make a few observations at long intervals. The only thing of real value is a mean derived from a large number of isolated observations.

(2) Two current-meters set 19 metres apart have nearly always indicated different currents. A scrutiny of these differences enables the influence of the ship's movements to be eliminated. Those which remain after this correction have been resolved into two parts, one due to a slow oscillation (*langsame Schwankung*), the other to an instantaneous irregularity (*schnelle Unruhe*).

(3) The instantaneous irregularity arises from the rolling of the ship and increases with the roughness of the sea.

(4) The slow oscillation, expressed in hundredths of the current's velocity, may be resolved into a systematic deviation caused by the ship's hull and a pure dispersion (*reine Streuung*).

(5) The pure dispersion depends to a slight extent on the ship's position with respect to the current, to a greater extent on the velocity of the current, and to an inappreciable extent on the differences of the current at various depths.

Hence, in practice, currents (as well as temperature and salinity) should not be observed even at 10 metres depth from the side which is to leeward of the current.

(6) The pure dispersion, in the same way as the slow oscillation, depends in particular to a great extent on the mixing processes and may actually serve to measure their intensity.

P. V.

AGGREGATION OF STATIONARY CURRENT OVERFALLS IN THE WATERS OF NORTHWEST AFRICA.

by

ERNST RÖMER, DEUTSCHE SEEWARTE, HAMBURG.

(Extract from the *Annalen der Hydrographie und Maritimen Meteorologie*, Berlin, 15th January 1935, page 10.)

Dr. Ernst RÖMER of the Deutsche Seewarte has published in the *Annalen der Hydrographie und Maritimen Meteorologie* of 15th January 1935 a documentary article on the presence of overfalls in West African waters.

The conclusions of this interesting study are reproduced hereunder.

* * *

We have taken the continental shelf to be the principal cause of the current overfalls which occur during every month, firstly because the places where they occur lie in its immediate vicinity, and secondly because the general orientation of the overfalls mainly follows its outline.

The nature of the independent movements of the water which, combined with the influence of the shelf, give rise to this phenomenon, could not be determined. The question whether (and to what extent) the edge of the shelf, considered as a mechanical obstacle, is capable of causing the surface currents to follow to some extent the shape of its outline, must be left undecided.

It would appear, however, that the part taken by the configuration of the bottom is clearly shown by the 20-metre line, for, where this approaches closest to the 200-metre edge and runs parallel to it — between 11° 40' and 10° 35' N. — the greatest number of overfalls is found.