THE COUNTER-CURRENT OFF THE SOUTH AND SOUTH-EAST AFRICAN COAST

by

E. RÖMER, HAMBURG.

(Reproduced from *Der Seewart,* Hamburg, Heft 6, 1939, pages 175-179)

The set and origin of the Agulhas Current have been known in their essential features since Major J. Rennell's representation thereof some 160 odd years ago. Early Sailing Directions and dissertations (1), among which is the particularly prominent investigations by Captain H. Toynbee (2), were based on that concept, and even recent scientific works have strengthened J. Rennell's views and confirm the fact that his explorations have yielded most important contributions towards our knowledge of the region South of Africa (3). A brief description of the Agulhas Current, together with its cartographic representation, is found in the "Handbuch der Ost-und Südküste Africas 1931."

The presence of a counter-current in the above mentioned coastal area, i.e. practically in the effective area of the Agulhas Current, has also been the subject of early references. In the "Africa Pilot III" of 1878, is first given the description of an Agulhas Counter-Current (a "backdrift"), which curves to the right off the southern edge of the Agulhas Bank and sets northwards approximately between Cape Agulhas and Cape St Francis. Futhermore, mention is made of a counter-current close by land (inshore Counter-Current). When describing the different coastal stretches from Cape Agulhas to Delagoa Bay, the casual occurrence of such kind of eastward-setting weak counter-current is mentioned in the above cited English Sailing Directions, and attention is directed to the *danger* it offers to navigation. Closer, and more detailed data, and above all information based on accurate ship's observations are, however, lacking. Reference to the possible *nautical exploitation* of the counter-current is nowhere to be found.

Early reports from German vessels occasionally recall the encountering of a *cold coastal current,* verified by regular temperature measurements. S.M.S. *Vineta,* coming from Singapore, in April 1877, found "that on crossing the warm Agulhas Current towards the cold coastal current, the water temperature dropped within 6 hours (on 23rd. April, 7 a.m. till noon), from 23° to 18,5° C., although in this lapse of time 3 to 4 miles true N.W., at the utmost, had been covered. On the further course along the South Coast of Africa, the water temperature in the cold coastal current remained continually at 15° to 17° C." (4) These observations were substantiated three years later (September 1880) by S.M.S. *Luise* (5). The limits of the warm Agulhas Current and of the cold coastal current were met in about the same region (approx. 34,5° S. Lat., 26.5° E. Long.).

Easterly current-sets on approaching the S.E. African coast were observed by S.M.S. *Leipzig* in July 1879. This easterly counter-current was the stronger

(1) "Africa Pilot III, South and East Coast". Third and seventh Edition, London, 1878, and 1905 : "Segelhanbuch für den Indischen Ozean", Hamburg 1892 ; O. Krümmel, "Handbuch der Ozeanographie", Vol. 2. Stuttgart, 1911.

(2) "Die physische Ozeanographie und Meteorologie usw." *Ann. d. Hydr.,* 1883, pp. 1-5, 63-69.

(3) G. Dietrich, "Aufbau und Dynamik des südlichen Agulhasstromgebietes", Berlin 1935, p. 8.

(4) *Ann. d. Hydr.* 1877; pp. 352-353.

(5) *Ann. d. Hydr.* 1880, pp. 564-565.

the closer the ship approached land. Between Kowie River and Bird Island, a 2-mile easterly current was found (6). S.M.S. *Hertha* experienced in July 1882, in 34°27' S. Lat., 23°31' Long., an error in D.R. of N. 68° E. 1.1 miles (7).

So much for the historical observed facts. In more recent scientific investigations, no special attention is given to the water displacement under consideration. In G. Michaelis's chart (8), eddies "are little, if not at all, apparent," whereas H. Paech leaves open the question as to whether eddies actually occur in the shelf area of the African continent (9). G. Dietrich points out, however, that the inshore water is always cooler than the neighbouring offshore water masses. (Loc. cit., p. 37).

In current charts for navigation, northerly and northeasterly currents for the coastal stretch here involved, are indicated between Capetown and Lourenço Marques, though in very small percentages. Thus, for instance, in the current charts on pages 40-63 of the "Handbuch der Ost- und Südküste Afrikas", the current indications agree with those of the "Atlas der Stromversetzungen auf den wichtigsten Dampferwegen im Indischen Ozean und in den ostasiatischen Gewässern" (Atlas of the current-sets on the most important steamer tracks in the Indian Ocean and the East-Asiatic waters) (10). In the explanatory remarks of the last-mentioned cartographic work it is said, with regard to the sets between Delagoa Bay and Port Elizabeth, that northerly or easterly current-sets occur but seldom, or only to a very slight extent. The new 1937 "Dampferhandbuch für den Indischen Ozean" (Sailing Directions for the Indian Ocean), published by the Deutsche Seewarte, on the contrary, points emphatically to the fact that close inshore, from Kowie River to Cape Agulhas, and farther on to Hangklip, counter-currents and eddies frequently occur which must be taken into consideration in navigation (p. 155) (11).

As a matter of fact, the comparatively frequent occurrence of easterly inshore currents is not only known to ships which ply regularly in that area, but use is even made of those currents in a West and East direction, on the voyages around the Continent. To those ships which only occasionally make the coastal stretch in question, the prevailing conditions are, on the contrary, less well-known, and they then, sometimes, suffer no inconsiderable loss in distance made good. Thus, for instance, in the meteorologic-hydrographical log book of a ship on the way round the Cap of Good Hope, is to be found:

"From Great Fish Pt. all steamers on the northerly course kept barely 2 miles off shore. These are ships which ply constantly along this stretch and therefore know the local conditions. At first we kept at a distance of from 5 to 10 miles offshore, and could notice distinctly the advantage other ships derived against the Agulhas Current by navigating close inshore. As we followed this example, and in clear places went right up to 1 mile offshore, we were able to ascertain that the counter-current here was at least weaker by one mile."

By this "counter-current" is no doubt meant the Agulhas Current, which nearer inshore possesses an appreciably smaller velocity than in the vicinity of its main axis, just outside the shelf (the 200 m. edge). It is for this reason also that South-bound ships keep best outside the coastal bank. Only, when on

---

(6) *Ann. d. Hydr.* 1879, p. 572.

(7) *Ann. d. Hydr.* 1882, p. 622.

(8) "Die Wasserbewegung an der Oberfläche des Indischen Ozeans im Januar und July". Institut für Meereskunde, Berlin.

(9) "Die Oberflächenströmung um Madagaskar", Berlin, 1926, p. 17.

(10) Edited by the Deutsche Seewarte, 1905.

(11) The monthly charts for the Indian Ocean (Seewarte, Hamburg, 1915), show, for the months of February and April to September, easterly currents between Cape Agulhas and Cape Recife, but here only. Along the south coast, no kind of data re easterly counter-currents are to be found. The same holds for the Pilot Charts of the Indian Ocean (Washington), where, for the months of April to June, as well as September, easterly currents are shown. Such data refer thus solely to the Agulhas Counter-Current, i.e. to the "backdrift" *South* of the African mainland.

north-bound courses, is it advisable to keep close inshore, where not only a lesser antagonistic current is encountered, but where, as already stated, the current not infrequently runs *with you,* and this is precisely the *coastal counter-current,* i.e. the close inshore counter-current mentioned at the beginning.

That these water movements in this and similar current charts, did not until now show up with corresponding clearness may be attributed no doubt to the fact that the current data contained therein were based, to a large extent, on the evaluation of those errors in D.R. resulting from the noon position, i.e. the day's set. In doing thus, naturally, and above all inshore, on short runs between two bearings, the one or other current effect is eliminated. That is why, having cognizance of this state of affairs, the Seewarte appealed some ten years ago to its voluntary collaborators at sea with a request for observations of errors in *D.R. made at short time intervals.* This request was also answered readily by navigators engaged in East African shipping, and it is exclusively on such "short-run observations" that the material used in the present work is based.

The *material comprised,* therefore, the date obtained from the forms labelled "Current-sets" handed by the Seewarte to its voluntary collaborators and returned by them filled in. In a preliminary note, the observer is reminded that inshore current-sets are the most desirable, and only those sets "the computation of which is based on reliable fixes and observed within the shortest possible time intervals" should be taken into consideration. The different columns of the forms contain: date and time taken to run the distance between two bearings; location, from latitude and longitude, or distance, from bearings of landmarks (a = place of departure, b = place of arrival from log, c = true position from observation); current-set (direction and hourly velocity); wind, seaway and swell; water temperature.

From a *geographical* point of view, the observational material achieved the purpose intended, in so far as, in accordance with routine, it was subdivided by most of the observers into *four sections,* to wit, Capetown-Port Elisabeth, Port Elisabeth-East London, East London-Durban, and Durban-Lourenço Marques. (See chartlet on page 179). As a "critique" of the material, it should be said that the accuracy is as great as could be expected, because, as already stated, short-stretch observations are involved, which, besides, are based entirely on coastal fixes. And these in turn, on account of the nearness of the utilised land-marks yield a high degree of accuracy. (Most of the fixes were situated at distances ranging from 1-3 miles offshore.)

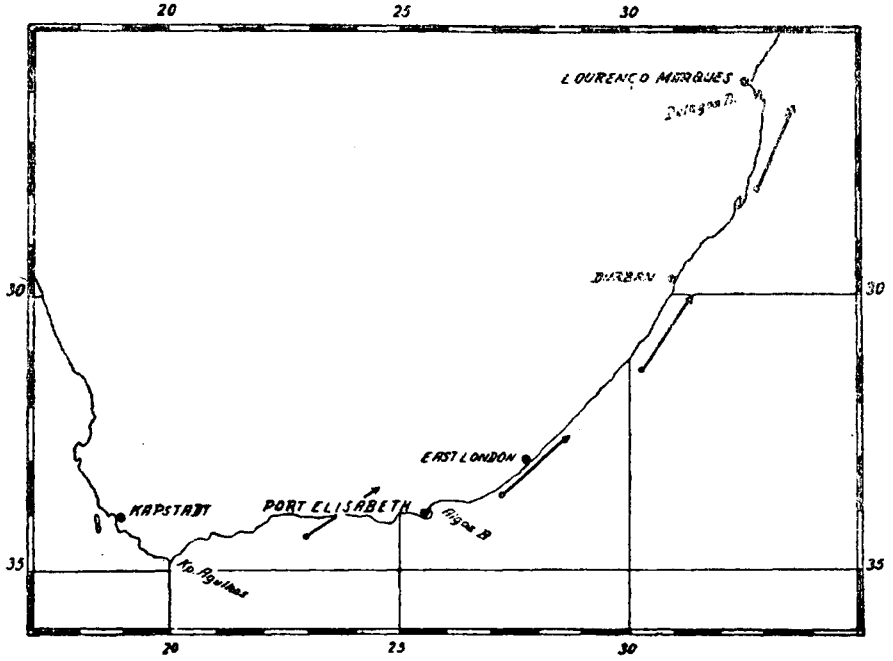
The *evaluation* of the material was simple. The four above mentioned sections (in *both* directions) included altogether 713 current-set observations. Oh these, 158 were *easterly* sets (22 per cent). For each individual section, the easterly current-sets were extracted, and from these the average direction and force of current were calculated. A division according to months had to be dropped, because the observations were not distributed regularly enough amongst the different months. Thus, for instance, March included only 25 observations, and September only 3. Finally, the mean water temperatures are taken into account.

The *result* is shown in the following tabulation and chartlet :

Section (in both directions)	Mean Current	Greatest current velocity	Current frequency	Mean water temperature
1	2	2a	3	4
1. Capetown-Port Elisabeth.....	57°0.8 m.	2.0 m.	26.5 %	17.4°
2. Port Elisabeth-East London..	49°1.0	2.0	23.5	17.1
3. East London-Durban.....	35°1.2	2.7	15.5	21.5
4. Durban-Lourenço Marques....	24°1.1	3.2	16.0	23.0

The current on the 1st section, in conformity with our introductory remarks, meets our expectations: it is the inflection of the Agulhas Current on the bank of the same name. And its stability is the greatest, *viz.* almost 27 per cent.

The currents of the three following sections conform remarkably well with the contours of the coast. The observed *individual sets,* from which the mean current referred to here was calculated, lay close inshore in each case and within the shelf. Hence it cannot be doubted that it is the direction of the coast which gives the north-easterly counter-current its trend. The fact that the Agulhas Current, which also follows the configuration of the coast also acts as a secondary factor, is obvious. Now the currents of these three coastal reaches should be indentical to the coastal counter-current indicated in the early Sailing Directions. But, while until now, only the "occasional" occurrence of a weak counter-current was reported, the tabulation shows, on the other hand, a not unimportant current persistence, together with a current stregth of about 1 m.h.



The fact that in all three sections, the current intensities are approximately the same, seems remarkable. May be this corresponds to the behaviour of the Agulhas Current, whose velocity exhibits no great seasonal differences.

The mean water temperatures in the tabulation permit of no further conclusions, as they refer to the whole year. Consequently, it cannot be inferred thereform that our counter-current carries colder water.

On the other hand, the question as to whether the actual counter-current should be regarded as a *whirpool of the Agulhas Current* might be investigated. I find no fact to contradict such an hypothesis. The whole current-image possesses, however, a northerly counter-part in the Florida Current off the East coast of Florida. If there, the geographic assumptions are actually somewhat different, in so far as the coastal trend farther North, shows a strong embayment to estward, the cold water transporting counter-current bound South over the inlet of the Florida coast, is unquestionably conditioned by the north-bound Florida Current.

And in both cases, these eddies, whether off the Florida coast or off the S.E. African coast, play an important role in navigation. The fact that proof for the last mentioned coastal area could also be unequivocally demonstrated, must be attributed to the zeal of the voluntary nautical collaborators.

❖ ❖ ❖