GENERAL CHARACTERISTICS OF THE SOUTHERN BALTIC WATER LEVEL VARIATIONS

AND DAILY MEAN WATER LEVEL VALUES IN THE BAY OF GDANSK FOR THE 11-YEAR PERIOD 1955-1965

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Abstract

This paper is intended as a contribution to the knowledge of water level variations in the Baltic and gives in particular the mean water level values along the Polish coast for use by persons and institutions interested in such questions.

1. — Introduction

The author has been questioned many times about the lack of publications concerning sea level variations in Polish coastal waters. The present work is small in range but it is however hoped that it will fill this lack, at least in part.

Besides the tables of daily, monthly and annual mean sea levels in the Bay of Gdansk, this work contains the general characteristics of the water level changes in the Baltic Sea, with particular reference to the water level variations in the area of the Polish coast. The series of tables is preceded by a short description of sea level variations in the Bay of Gdansk and by some characteristic records of water level changes in this region.

On the basis of an almost 13-year observational period it can be said that the automatic sea level recorders of the Marine Station of the Polish Academy of Sciences at Sopot, together with the recording stations in Swinoujscie, Kolobrzeg and Wladyslawowo (under the control of PIHM (*)) characterise the water level variations of the southern part of the Baltic Sea in an accurate way.

The paper contains only the mean water level data for the Sopot region

(*) PIHM : Państwowy Instytut Hydrologiczno-Meteorologiczny, Gdynia (State Hydrological and Meteorological Institute, Gdynia).

of the Baltic for an 11-year period, but nevertheless these data may contribute to the complex study of the hydrological phenomenon in the Baltic.

To characterise the range of the sea level variations in the Baltic the author has based his descriptions principally on data taken from the literature, from his own observations and calculations, and from the archives of PIHM, Gdynia.

The mean sea level tables given in this article were elaborated by the author at the Marine Station in Sopot of the Department of Geophysics of the Polish Academy of Sciences, which since 31 May 1953 has carried out a permanent recording service for water level variations in the Bay of Gdansk.

The recordings are carried out by means of automatic sea level recorders (mareographs) which consist generally of a gauge well, a float and a recording mechanism.

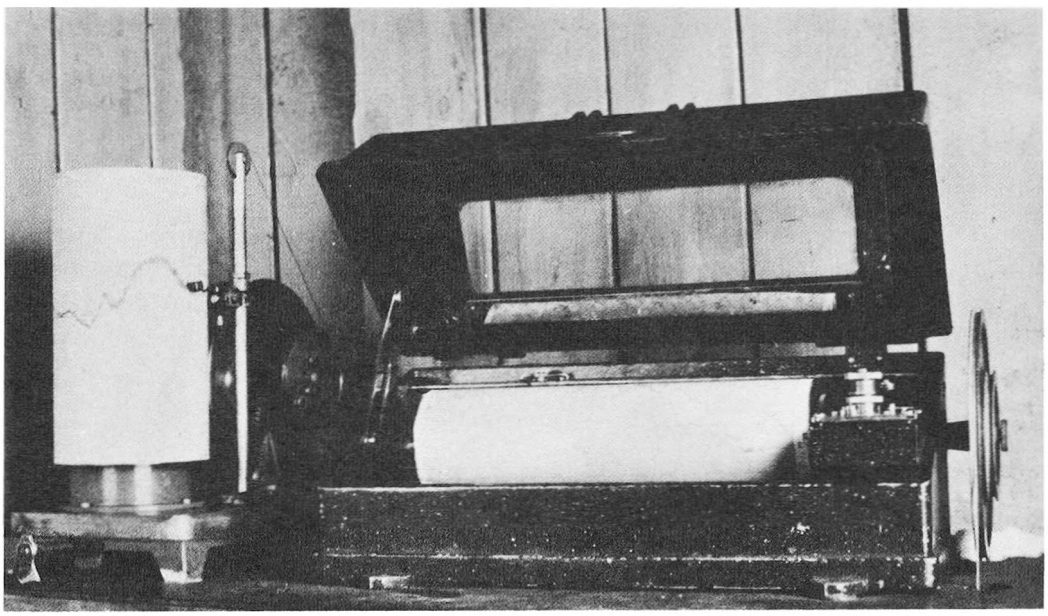

FIG. 1. — General view of the registration mechanism of the Marine Station " mareographs ".

The Marine Station has two automatic recorders : one with a daily (24-hour) and the other with a weekly recording paper, having a vertical drum (see fig. 1). A change in the actual water level of 2 cm gives a registration of 1 cm on the recording paper in the first mareograph (Valday, 1949, Russian type). The scale range in the second mareograph (Munro, 1956, English type) is around 10/1. The sea level recordings are linked to a visual water level gauge and referred to a stable bench mark.

The Sopot water level gauge station is one of the best situated along the Polish coast. It gives accurate recordings of even the smallest water level changes. The measuring point and all the instruments are situated far offshore in an open sea area. The automatic sea level recorders are installed at the end of Sopot pier, 500 m offshore.

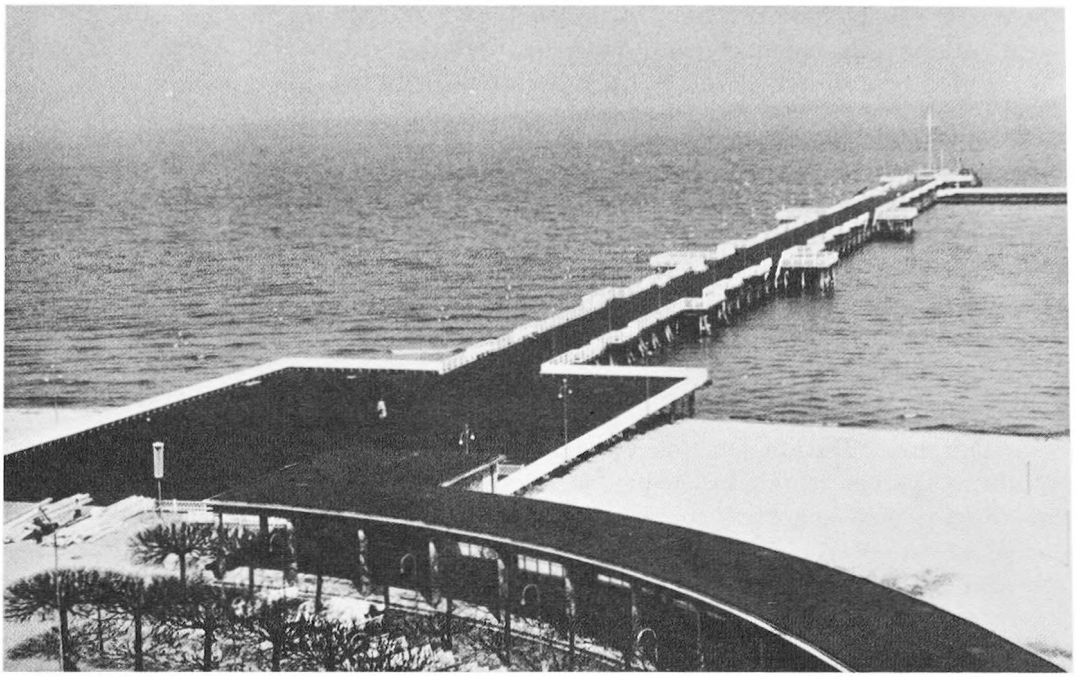

FIG. 2. — Sopot pier. Mast at the head of the pier shows the measuring place of the Marine Station.

The depth of Gdansk Bay here reaches 5.5 m. The geographical position of the observation point is : 54°26′52″ N and 18°34′45″ E. Such a positioning of the water level gauges affords a good possibility of observing the water level changes between two important Polish harbours, Gdansk and Gdynia (fig. 6).

2. — General characteristics of water level changes in the Baltic Sea

Water level changes in the Baltic sea are fairly insignificant, but the character of these variations is, however, compound and even sometimes difficult to define. The vertical movements of water masses differ depending on the causes which produce them.

By studying the literature and analysing water level records it can be clearly seen that there are two types of water level variation characteristic of the Baltic Sea, i.e. periodic and non-periodic variations.

For periodic variations, tides are of first consideration, and also the free oscillations of the water masses. The tides of the Baltic are very small, and to date, due to the small practical role they play in this basin, have never been completely elucidated. The shallow and narrow entrances through the Danish Sounds to the Baltic from the North Sea do not allow the tidal energy to penetrate the Baltic.

DEFANT [1] states that the tide wave in the Kattegat takes the form of a progressive wave travelling southwards with an amplitude of about 12-30 cm on the Jutland coast, and with a smaller amplitude of 4 cm on the

Swedish coast. These values decrease to 1-2 cm in the zone of the Polish coast. Generally speaking, one can say that the amplitude of the tide wave diminishes in range in the Southern Baltic from west to east.

One of the first, after WITTING in 1911, to investigate the problem of free oscillations in the Baltic was G. NEUMANN in 1941 [11].

Choosing representative sea level records from a great number of gauge stations, and by means of a statistical study of the water level variation between Ystad (Sweden) and Koivisto (Finland), he determined the free oscillation period of the Baltic waters. This period, later theoretically and practically verified by other investigators, amounts on the average to 27.6 hours. This is the period of the uni-nodal seiche in the Baltic and Gulf of Finland system.

Other oscillation periods were also found; e.g. in the Baltic — Gulf of Bothnia system which has a period of about 40 hours, and a great number of short-period sea surface pulsations characteristic of the different water areas of the Baltic such as the Gulf of Finland, the Gulf of Bothnia [7], the Bay of Gdansk [13], and others.

The water level changes most characteristic of the Baltic are the non-periodic variations. The forces which cause these movements are the anemobarometric effects; i.e. the wind and air pressure gradient changes.

High and low water levels in the Baltic depend quite distinctly on the different types of atmospheric situation. Making a good estimation of the influence of these climatological elements is the main problem in sea level analysis. Cyclonic and anti-cyclonic wind circulations, linked always with the various atmospheric pressure systems, are the determining factors in the sea level situation.

In the literature we may find two criterions which characterise the water level variations according to wind and air pressure changes, namely : the sea level increases — in stationary conditions — with the square of the wind value and with the decrease of air pressure, and decreases when this pressure augments. Thus a change of 1 mb in the atmospheric pressure corresponds to a water level change of 1 cm. These criterions, although completely true, correspond however to ideal conditions, mainly of static nature, e.g. in atmospheric pressure gradient changes, and they cannot always be applied without restriction to local conditions.

The Baltic is an open sea, connected by the Kattegat and the Sound with the North Sea. Due to this fact, the character of the water level variations depends mainly on the exchange of water between these two reservoirs. According to I. HELA [2] and K. WYRTKI [14], maximal changes of the Baltic mean water level caused by the inflow of North Sea waters amount to approximately 10 cm per day. Fresh river waters and precipitations in the Baltic Sea contribute to water level formation, but these waters do not have much influence on the water level variations.

The greatest influence on these variations is wind action [5]. The wind here decides not only the water exchange between the Baltic and the North Sea but it also very often participates in local surges.

Winds acting from south-west, west and north-west directions induce an uprise of the water level in the eastern part of the North Sea. The water masses accumulated in this region will penetrate into the Baltic across the Danish Sounds causing a distinct pile up in its western area. Water from that area may afterwards be shifted eastwards by the same winds. On the other hand, to these water upheavals can be added local uprises caused by local winds, giving in this case an additional surge effect.

This phenomenon explains in some way the fact that during offshore winds there can often be noted an uprise of the sea water level. Here we arrived at a simple conclusion. Examination of water level changes in a certain region on the basis of this area's coastal winds will not always be adequate since the cause which governs the piling up lies chiefly in the open sea beyond this coastal region and, as we have already said, it very often has to be sought in the North Sea. In any case we shall not be much mistaken in saying that strong and even moderate winds blowing on the Polish coast from the NW-N-NE sector lead to high water levels, and low water levels are caused by winds blowing from the SW-S-SE sector.

Maximum and minimum water level values along the Polish coast generally occur in the autumn and winter seasons, when the strongest barometric depressions occur and consequently strong on- or offshore winds appear.

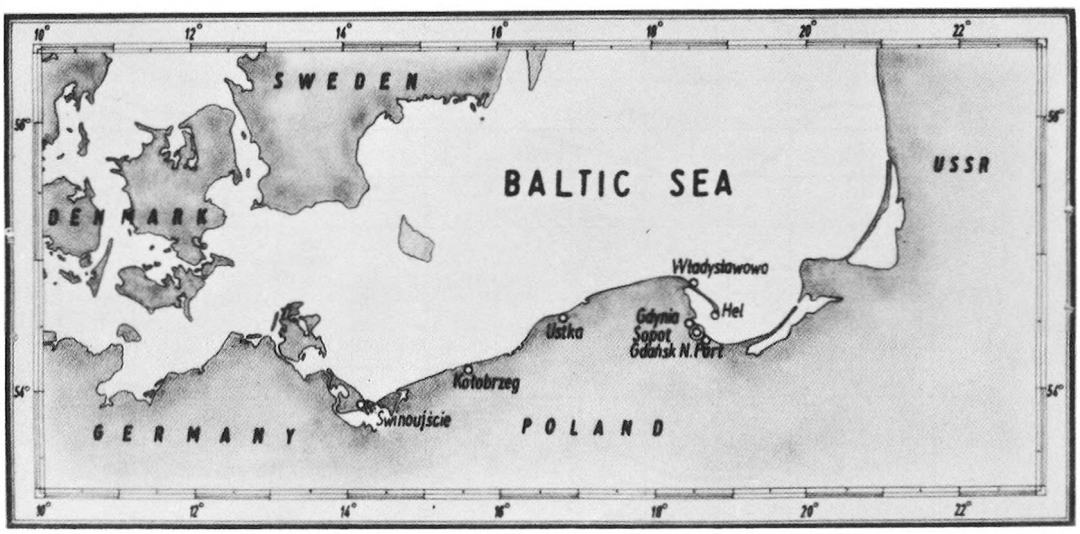

FIG. 3. — Southern Baltic.
Location of the main Polish sea level recorders.

A collection of water level records for any observation point for a one-year period, for instance, shows that the level of the Baltic Sea varies continuously during this time. These variations are entirely irregular; the periods of increasing or decreasing water level last from several up to many days.

I. HELA [2] states that in the Baltic during a year about 19 such periods may be distinguished. The period of water level increase lasts on an average 9 days. The periods of decreasing water level last about 10 days.

These cycles are closely connected with the weather phenomena; faster periods of water level increase occur in cyclonic situations, where the wind force is always stronger, and decreases will be found principally during anticyclones when the winds are weaker.

Analysing annual water level tables of the Polish coastal waters, we find that high water levels are noted mainly in the second part of the year, especially from July to October. Low water levels are noted in the first half of the year. March, April and May are the periods of the lowest water level on the Polish coast. August is the month when the highest water level occurs. January, February, June and November are the periods in which the mean water level does not deviate very much from the average sea level

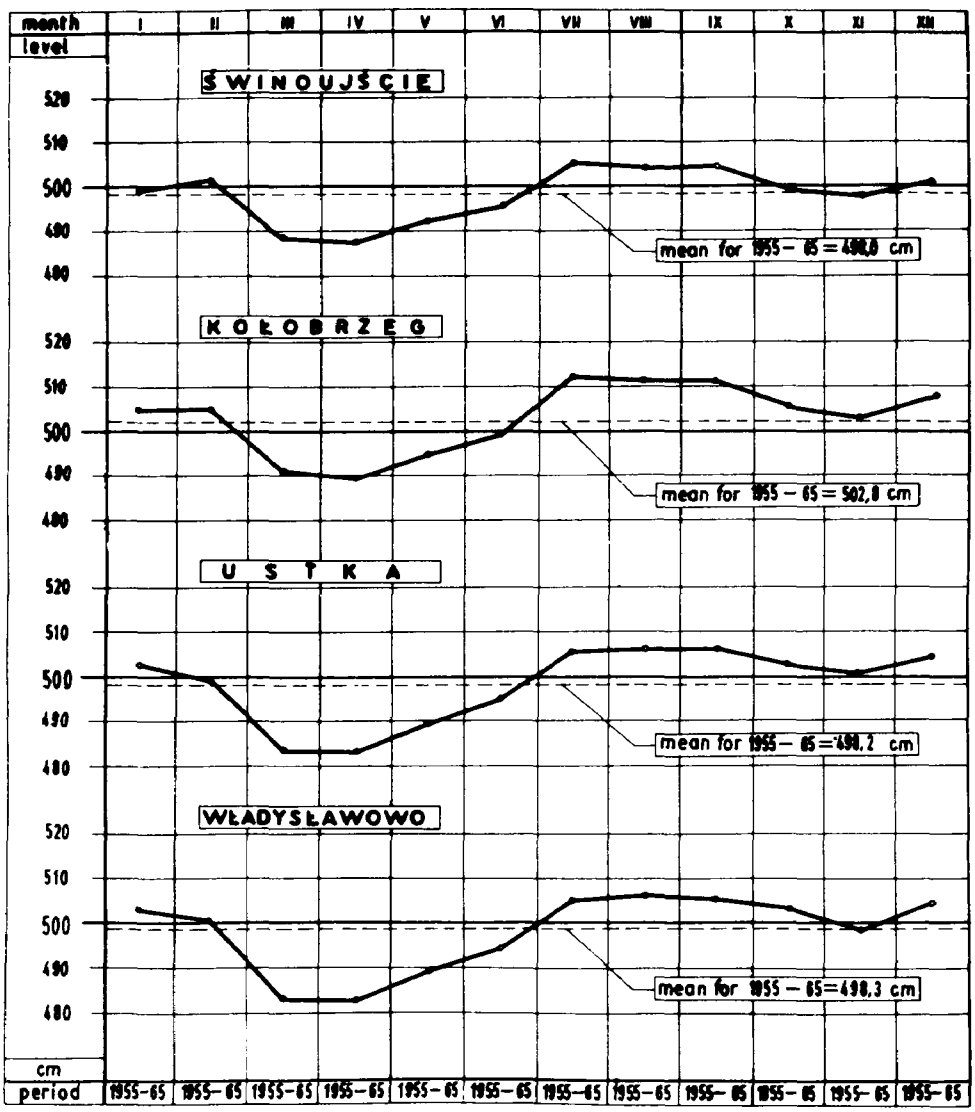

FIG. 4. — Seasonal mean water level values of the Baltic Sea on the Polish coast for the 11-year period.

of the Baltic; 500.0 cm has been chosen as the " Baltic zero " for Polish shores (*).

The above-mentioned facts are illustrated in figure 4 which shows the mean seasonal water levels for the four main automatic water level recorders situated in open sea.

The phenomena which influence the seasonal water level variations are principally : certain identical weather patterns occuring frequently at different seasons; the changes in sea water volume caused by temperature; water density differences in summer and winter seasons; the damping effect of the ice cover in winter periods.

Deviations of the annual mean water level values from the average sea level of the Baltic are fairly small, and according to I. HELA for the 10-year period 1926-1935 are + 4.7 cm and — 5.7 cm. The total amplitude of the Baltic Sea level changes in the period 1904-1942 for the Helsinki region amounts to 130 cm, resulting from the extreme water level values for this station in the above period (+ 70 cm recorded in December 1913 and — 60 cm in March 1923). The extreme monthly mean water levels for the same period are + 51 cm and — 42 cm.

Based on the calculated values shown in table 12, a diagram was established. It shows the annual mean water levels of the Baltic for certain automatic water level recording stations on the Polish coast during the 11-year period. It can be seen that the annual mean water levels for the period 1955-1965 do not here vary much either between themselves or from the average sea level of the Baltic.

Standard deviation σ, calculated by the known statistical formulae, demonstrates that the probable water level deviation from the average Baltic Sea level does not exceed $\pm$ 6.6 cm on the Polish coast. This figure agrees completely with HELA's values.

It is generally assumed that the long-term annual water level variations of the Baltic Sea remain below $\pm$ 10 cm.

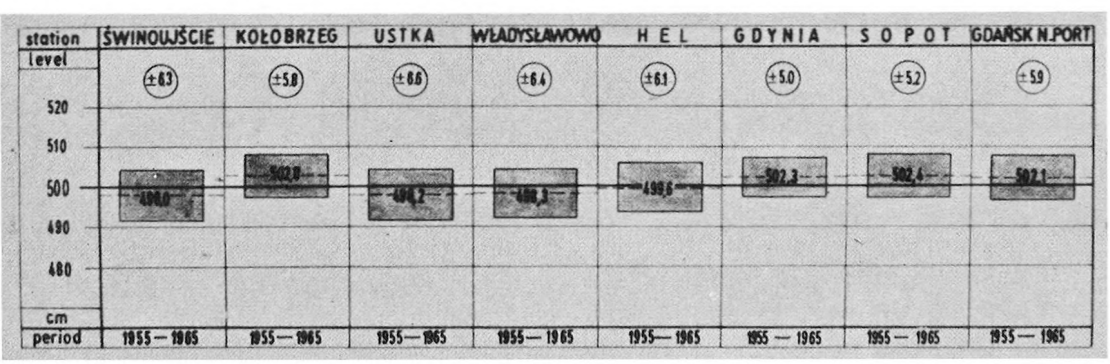

FIG. 5. — Yearly mean water level values of the Baltic Sea for the 11-year period for the main Polish automatic water level stations and standard deviation σ. The exact σ values are circled.

The characteristics of the water level variation discussed above are only representative of the " mild " vertical movements of the water surface

(*) 500.0 cm — for all Polish tide gauge stations (except Kolobrzeg, where 505.0 cm = 0.0 NN) — corresponds nominally to 0.00 NN (Amsterdam NAP — 1955).

which occur in individual months or seasons of a year and which compose the long-term changes of the annual water level of the Baltic Sea.

This description does not entirely resolve the whole problem of water level variations in this basin because one of the chief hydrological phenomena specific to the Baltic Sea was omitted, namely the storm surges, during which the level of the water surface rises by 40-60 cm per hour and the water level amplitudes approach 2-3 m and very often exceed 3 m (Swinoujscie station).

Under the term " storm surge " the author means a great piling up of the water level due to the action of wind and atmospheric pressure on the sea surface, associated usually with an existing storm. The dynamical action of winds from certain directions, linked also to a marked barometric depression may sometimes produce disastrous surges, especially in the shallow coastal waters of the Baltic. This question is distinct from the general description of water levels characteristic of the Baltic Sea. The author has already paid special attention to these phenomena in another paper [6], but some remarks will be made upon these phenomena under heading 3 below.

3. — Water level variations in the Bay of Gdansk, based on the 11-year water level recordings of the Marine Station

The problem of water level variation in the Bay of Gdansk may quite easily be solved due to the fact that the service for recording levels is well organised and was started for Hel in 1956, Gdynia in 1931, Sopot in 1953 and Gdansk in 1951 (*). The author does not, however, pretend to work out the problem completely, he has only attempted to give the general characteristics of the water level changes of the Baltic in this basin — mainly by his own observations and some elementary calculations — according to the aim of this paper which is to present the newest water level data from this region in order eventually to use them for more complex hydrographic problems.

The problem of the water level changes in the Bay of Gdansk has already been discussed by other authors, but their work was rather based on a short period of observation, and very often they only dealt with isolated high water phenomena.

To mention some of the latest publications on this subject : LOMNIEWSKI [9] gives a compound system of the hydrographic conditions in the Bay of Gdansk, as an example of a sea basin. At the same time he describes, on the basis of recent research work and publications, the hydrographic role of this reservoir.

MAJEWSKI [10] gives an approximate quantitative estimation of the conformity between anemobarometric conditions and water level changes, on the basis of a 3-year observation period (1952-1954), by describing anemobarometric conditions by means of air pressure differences between Swinoujscie and Hel.

(*) Gdansk pre-war recordings are lost.

Szymborski [13], using annual sea level records taken by the Marine Station in Sopot, distinguishes four groups of water level pulsations of different periods and amplitudes. He linked the whole analysis to the prevailing atmospheric situation.

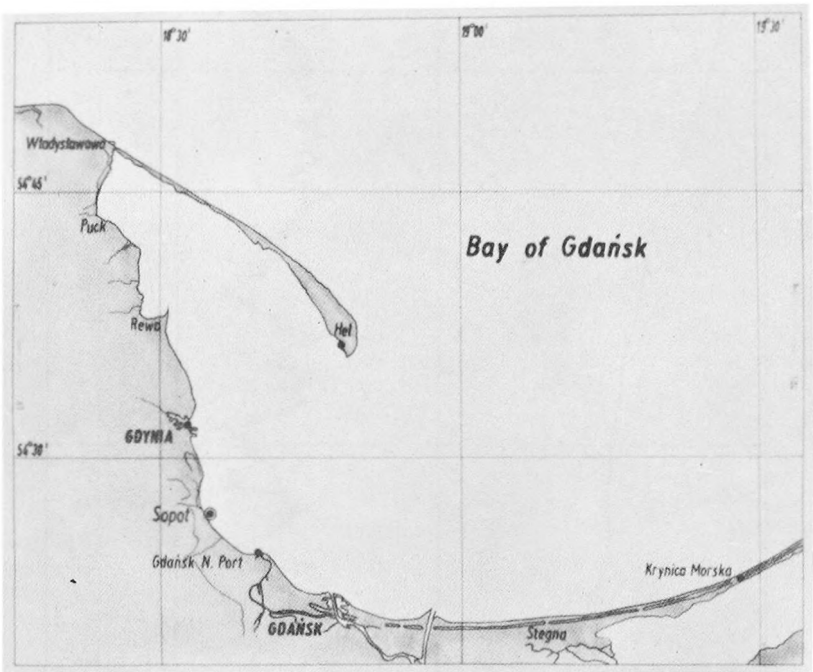

Fig. 6. — Bay of Gdansk.
Location of the main automatic sea level recording stations.

Figure 6 represents the principal Polish automatic sea level stations, situated in the region of the Bay of Gdansk. Daily, as well as weekly, recordings show that the water level in the Bay of Gdansk has a continuous vertical movement. The recorded curve illustrating this movement shows a distinct trend of rise and fall in the water level. The period of time for the increase and for the decrease varies, as does the amplitude of the water level changes. The short-period variations can be easily seen on the daily water level records. The long-period changes show up on the complex collection of daily recordings. Such an assemblage gives us the possibility of finding specific cycles of water level variations.

It can be seen that the water level variations in the Bay of Gdansk have a quite regular vertical movement. The recording makes it possible to distinguish certain types of water level oscillation which differ between themselves in both magnitude and duration.

For separating the basic periods of the sea level records the author used the method of auto-correlation taken from the theory of probability. With the library programme S2, a series of water level data were used for auto-correlation and were calculated by the electronic computer Elliott 803 B. As a result, some smoothed water level curves were obtained, giving approximately the following periods : 12.3 hours, 6.2, 3.5 hours and 50 mins.

Analysing individual kinds of water level changes we arrive at the

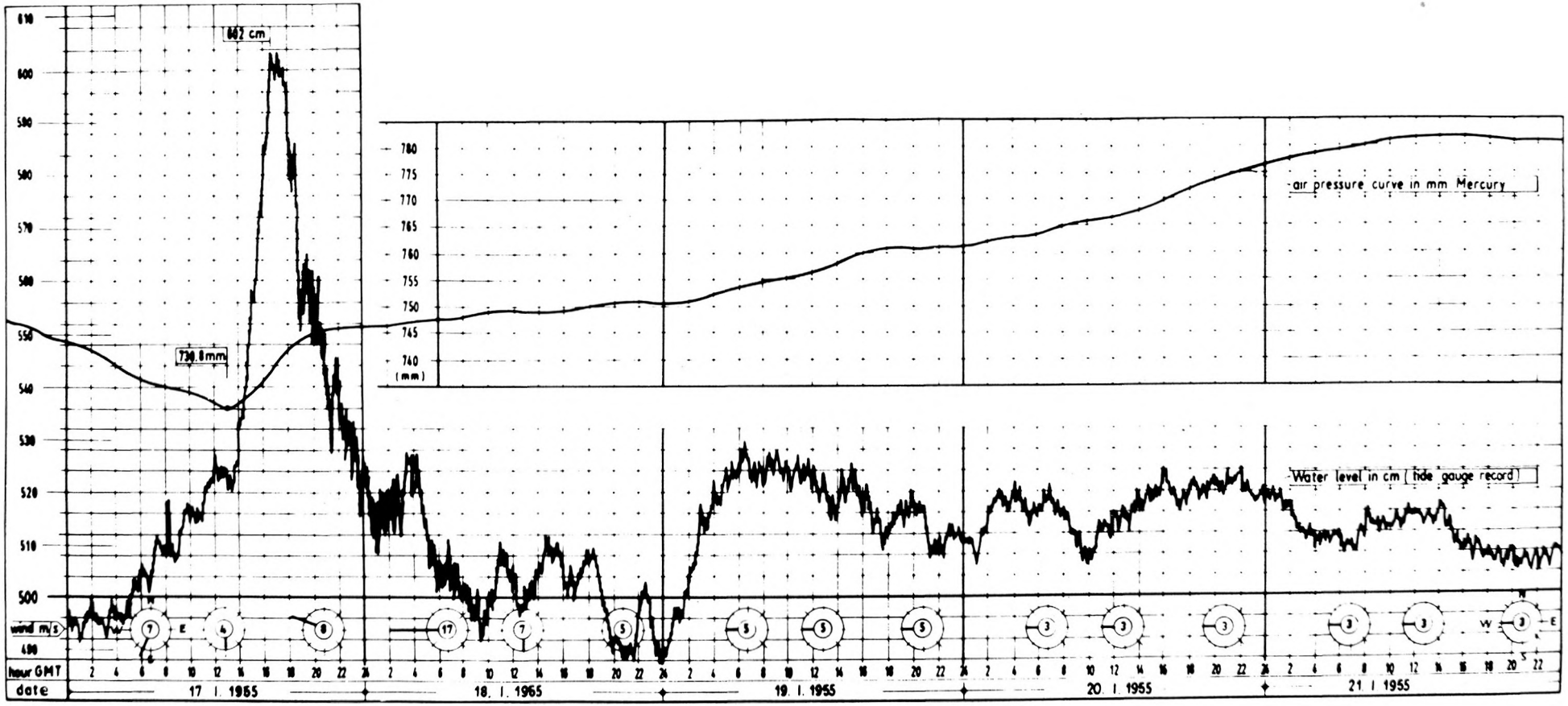

FIG. 7. — Water level variation of the Baltic Sea in the Bay of Gdansk during the 17 January 1955 surge.

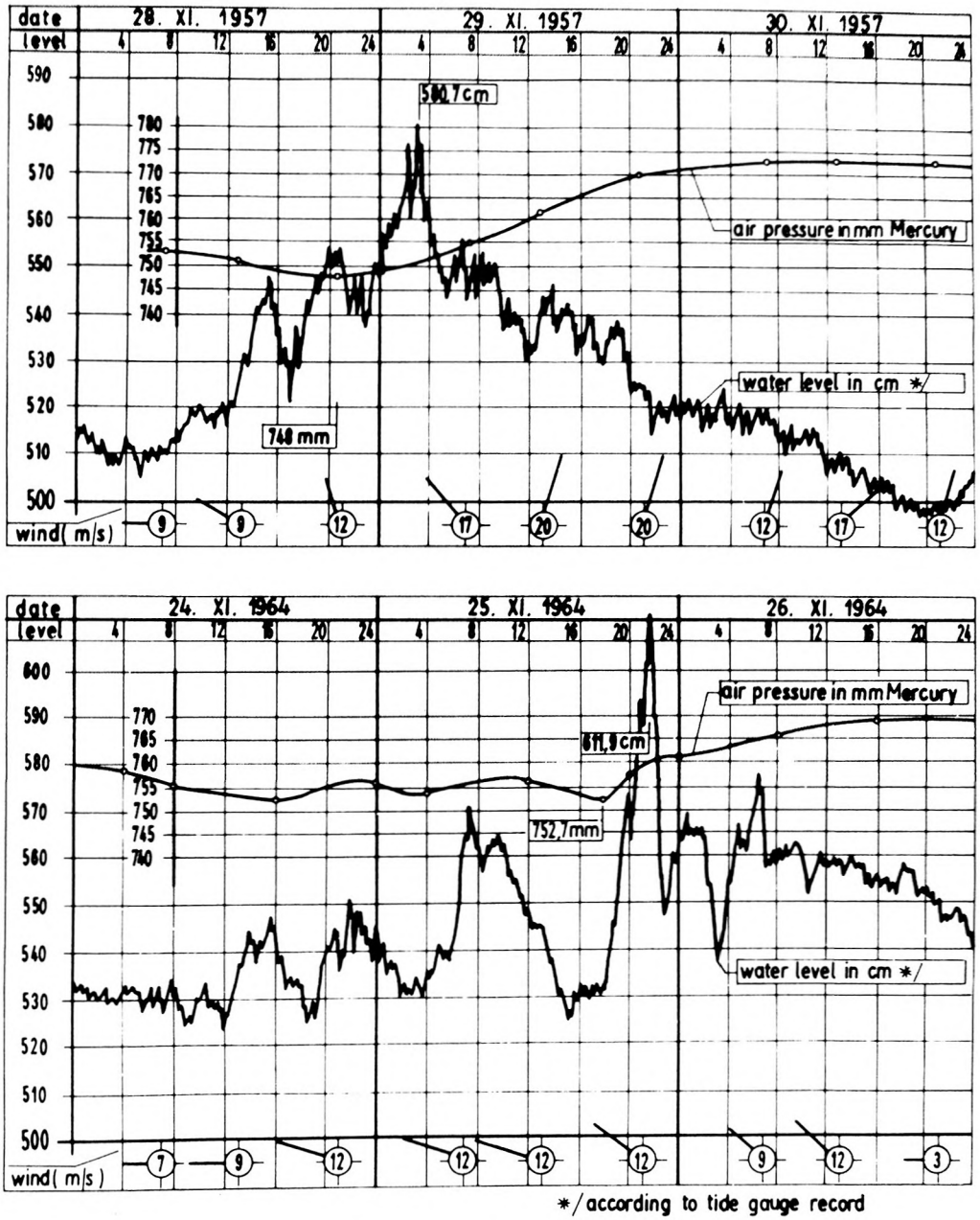

FIG. 8. — Water level in the Sopot region on 28/30 November 1957 and 24/26 November 1964, according to water level records.

conclusion that seiche phenomena occur in the Bay of Gdansk — which seems to be in some way a closed basin.

The problem posed by these phenomena is not yet completely resolved. A first approach to the matter has been given by S. SZYMBORSKI [13].

It can only be confirmed that seiches in the Bay of Gdansk develop in favourable circumstances in the form of " meridian " and " parallel of latitude " systems. It is difficult to say at present whether the seiches are uni-nodal or bi-nodal. Comparison of the Hel and Sopot water level records induces us to assume that the seiches in the meridian direction are bi-

nodal because a crest and a trough of the sea level occur at the same time. This question, however, requires more accurate and thorough study.

Barometric pressure has an important influence on the seiche formation in our regions. This is borne out by the Hel and Sopot records. The difference in the water level between these two stations during a relatively strong wind and a favourable fetch which piles up water masses in this region is rather small, but a great growth in water level has already been observed many times during a distinct lowering of the atmospheric pressure.

Some very interesting water level movement phenomena were observed in the Bay of Gdansk during the period under discussion; i.e. on 17/I/1955, 22/I and 22/VIII/1956, 28-29/XI/1957, 13-21/II/1962, 25/XI/1964 and 5-6/I/1965. During these days, as a consequence of strong winds and the decrease in atmospheric pressure, a rapid piling up of the water and a rise in water level took place. For instance, on 17 January 1955 when the air pressure amounted to 730.8 mm in Mercury and during a strong gust of wind, there followed an exceedingly high increase of water level from 520 cm to 602 cm. The same occurred, only on a smaller scale, on the other dates mentioned above.

Figure 7 and figure 8 show the atmospheric and water level situation recorded in the region of Sopot.

The above recorded phenomenon (figure 7) was dealt with by S. Szymborski in his publication " The phenomenon of seiche in the Gulf of Gdansk on 17 January 1955 ", where he concludes that such a suction of sea water can be produced by a barometric depression.

Storm surges in Polish coastal waters occur chiefly in the form of long frontal waves (e.g. the January 1962 surge, fig. 9) or long baric waves (e.g. the January 1955 surge, fig. 7) which do not have such a violent character as they would have in waters where the situation is worse on account of the existence of tides. However, due to the fact that they occur rather often, and especially because they entail material losses, careful and accurate attention has to be paid to this problem. The most dangerous in effect are surges which appear in shallow coastal waters, and such waters are typical throughout the Polish coastal area.

About 80 % of the southern Baltic coast is exposed to sea attack. Each year losses in beaches, damage to dunes, river revetments, shore protections and groynes, scouring along hydraulic constructions, silting in harbour entrances, destruction of breakwaters and harbour structures can be noted.

It can be seen that the water surges on the Polish coast occur mostly in autumn and winter. The most dangerous up to now are the surges which occur in January and February. Less severe, but still nevertheless frequent, surges are noted in October, November and December.

Sea abrasion and crushing wave effects in the storm surges are more dangerous when they appear during high water level in the locality, and when the duration of this high water level is long.

This can be proved by two examples; the surge of 17 January 1955, and that of 13-21 February 1962. In both cases the water level rose to

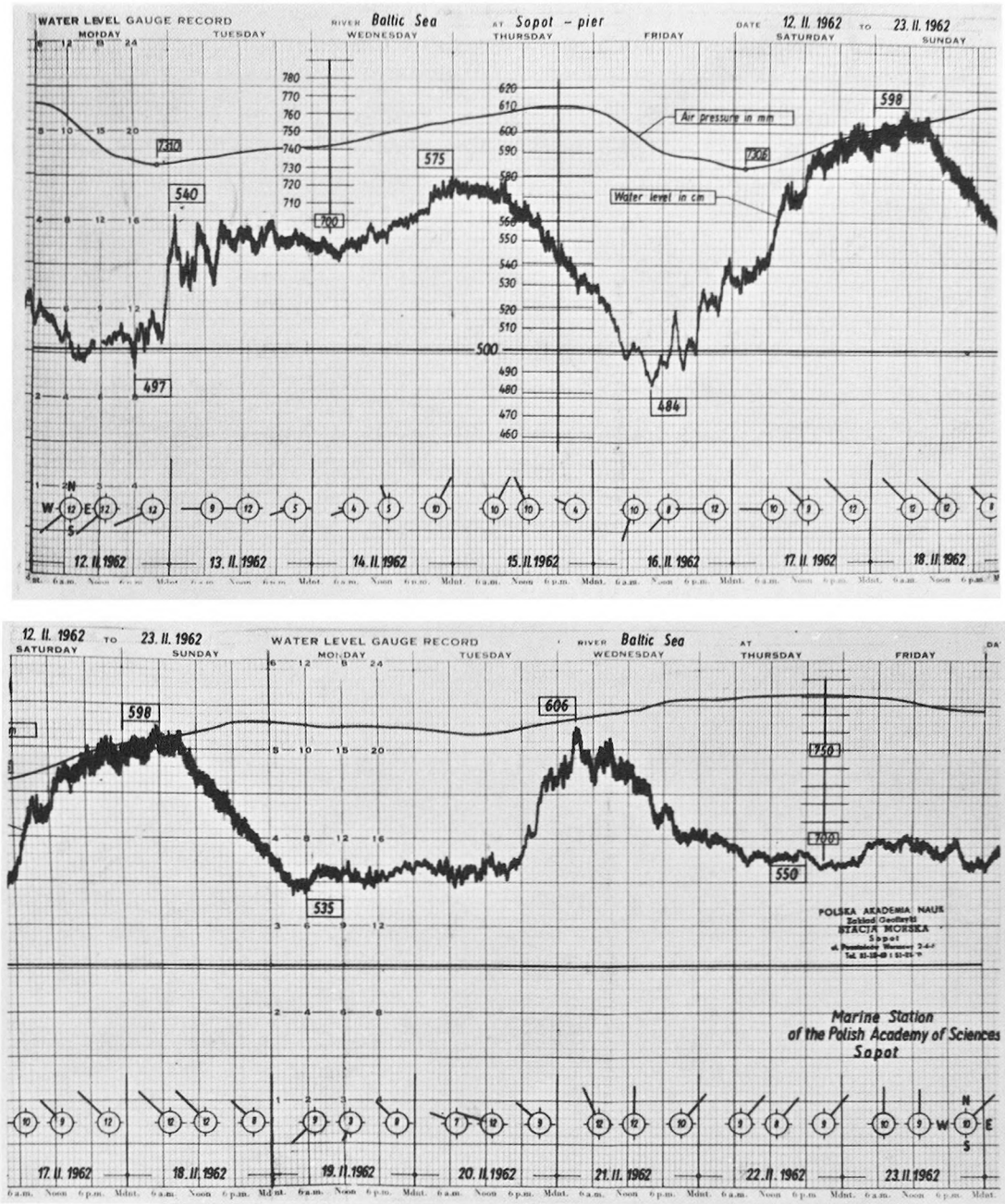

FIG. 9. — Water level in the Sopot region during the 13/21 February 1962 storm surge.

almost the same height, but the February surge was the more disastrous in effect, due to the time it lasted.

The high water level, of over 550 cm, lasted about 8 hours in Wladyslawowo during the January surge, and in the February surge about 5 days. Consequently the material losses were incomparably higher in the last case.

It should be stressed, in conclusion, that the basic effects influencing the degree of destruction during a storm surge are the following : the

duration of the surge, its structure and its locality, the duration of actual high water level, the dynamical parameters of the approaching waves, and the characteristics of the sea shore and structures attacked.

The general characteristics of water level variations in the Bay of Gdansk, in spite of the morphometric differences of this basin, do not differ very much from the Baltic sea level variations. Figure 10 demonstrates this well.

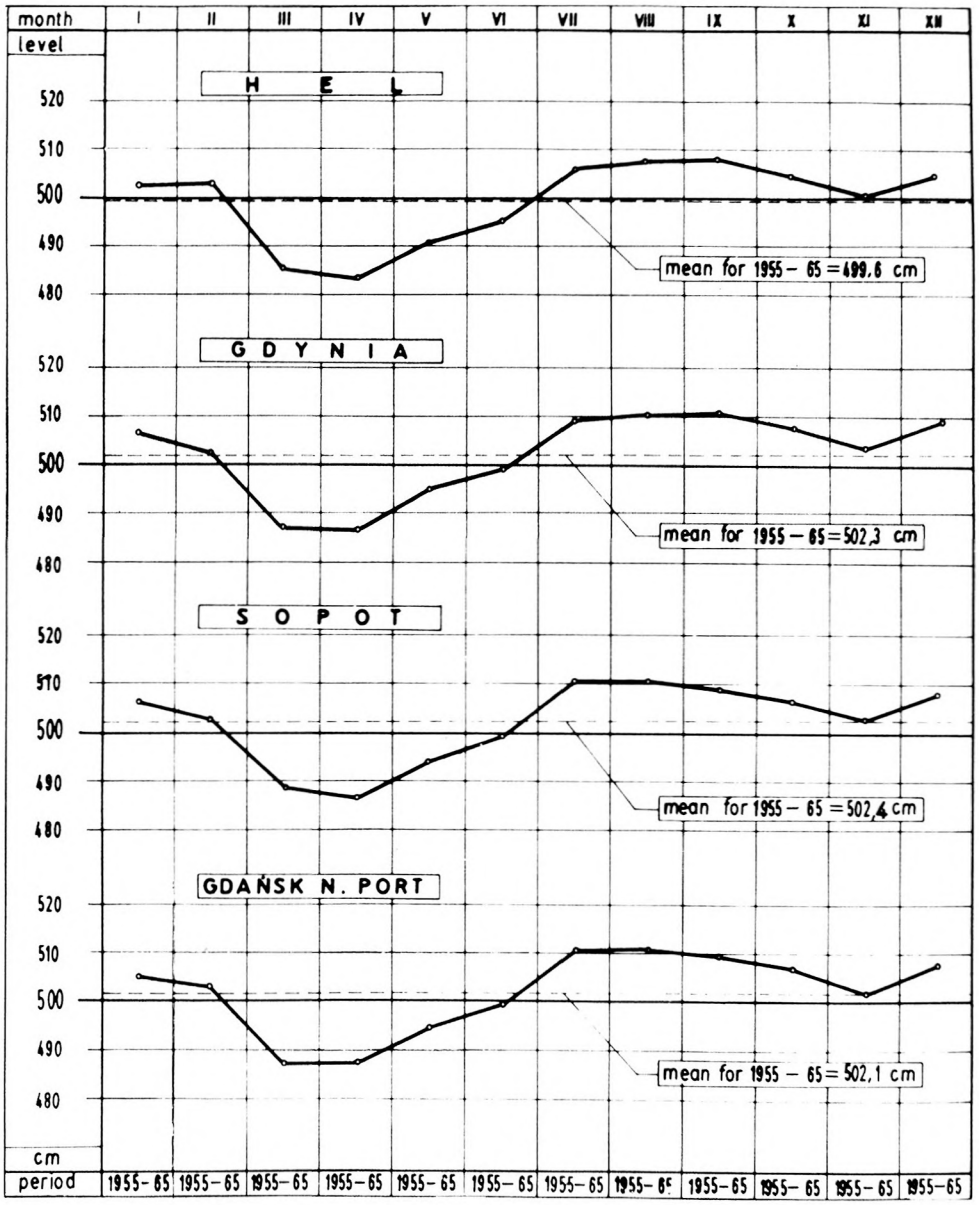

FIG. 10. — Seasonal mean water level values of the Baltic Sea in the Bay of Gdansk region.

Some anomalies of the water level changes in the Bay of Gdansk, which differentiate it from the rest of the Polish waters, can only be observed in isolated cases, usually during storm surges, when the highest

water level peaks for Sopot, Gdynia and eventually Gdansk, are much sharper and higher than those for Wladyslawowo, Ustka or Kolobrzeg.

A much quicker rising surge and higher water levels during such phenomena do not have very much influence on the long-term mean annual water variations in this reservoir. From the diagram (figure 5) it can be seen that the annual water level in the Bay of Gdansk for the 11-year period oscillates around the " zero level " of the Baltic and that the standard deviation σ has indeed a very small value in this region.

Although we have said that the correlation between high water level and the wind action is not certain, we may say that for the slowly generating changes of level in the Bay of Gdansk the winds are blowing from the N-NE sector and that a high water level is then observed, and that winds from the W-S sector push the water out of the Bay.

The diagram of the monthly mean water level curve in the Bay of Gdansk for the 11-year period was drawn up according to table 12 (Fig. 11).

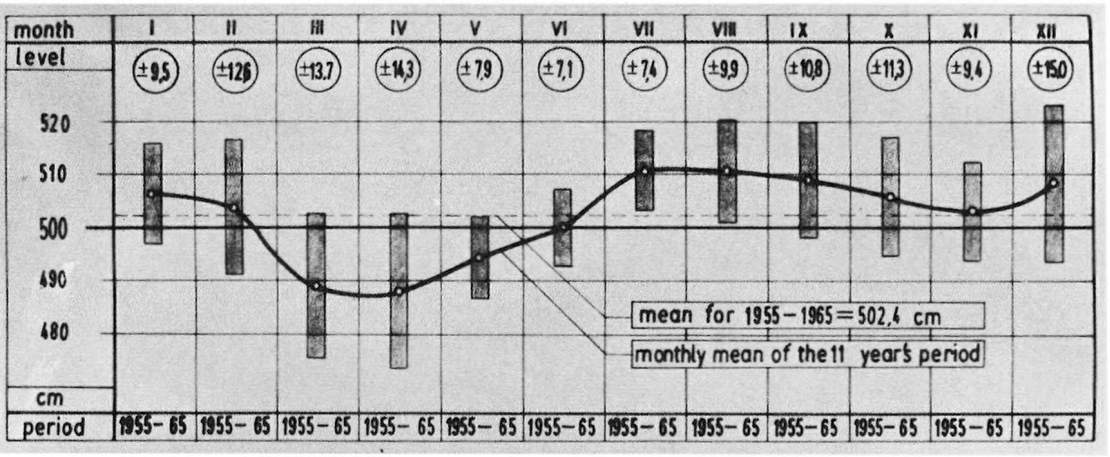

FIG. 11. — Mean water level curve for the 11-year period in the Sopot region. Vertical columns show the dispersion of the standard deviation σ. The exact σ values are circled.

The vertical columns show the dispersion of the standard deviation σ. The most probable and also the highest deviation from the " zero " point noted in the 11-year period amounts to $\pm$ 15.0 cm (December) and the smallest $\pm$ 7.1 cm (June).

Computation table 12 giving the monthly and annual mean water levels in the Bay of Gdansk for the Sopot region for the period 1955-1965 demonstrates that in spite of the great annual deviation : + 12.4 cm in 1961, and — 4.9 cm in 1960, the mean deviation from the zero level of the Baltic Sea for the same period amounts to only + 2.4 cm.

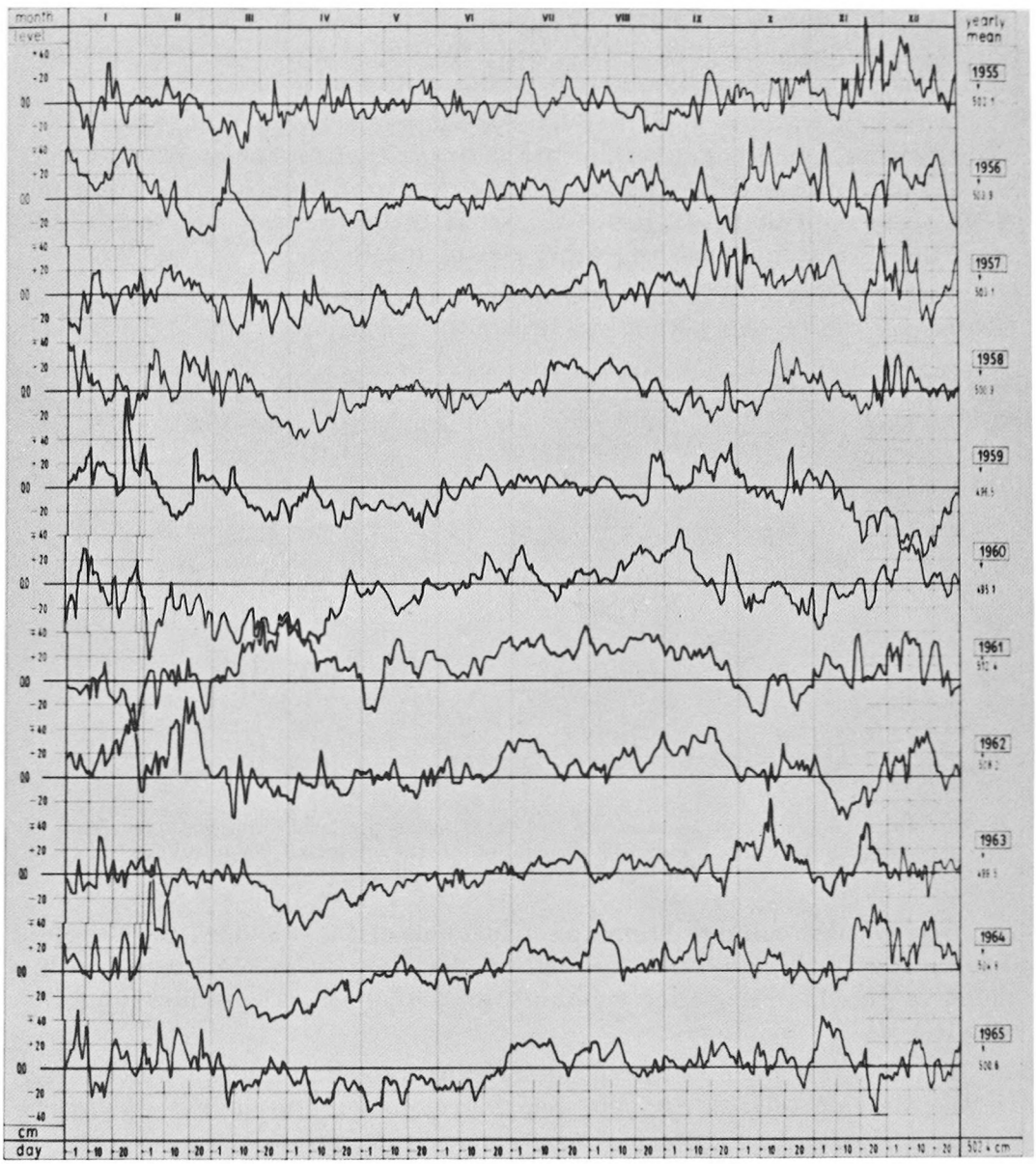

FIG. 12. — The annual course of daily mean sea level fluctuations at Sopot region in the years 1955-1965.

4. — Tables of Daily Mean Water Level Values in the Bay of Gdansk for the 11-year period: 1955-1965

Table 1
Daily mean sea levels for 1955

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	518.2	502.0	473.1	493.6	494.1	503.0	493.4	495.8	479.0	513.2	512.3	508.3
2	515.2	505.0	474.3	491.0	494.9	500.4	492.0	504.6	478.3	517.7	508.2	519.4
3	512.3	502.0	476.9	491.4	487.6	497.3	491.4	511.0	478.6	504.5	509.2	516.5
4	499.9	496.4	475.6	499.5	487.7	494.3	504.3	504.2	494.4	512.2	507.9	537.7
5	500.5	501.8	489.6	496.2	489.8	488.7	506.9	499.3	492.3	514.9	509.6	528.1
6	496.1	503.4	483.0	494.0	492.5	491.5	512.6	497.7	491.6	508.5	515.6	530.5
7	477.0	498.3	473.7	501.7	506.2	497.7	523.7	502.7	496.5	510.1	505.8	541.3
8	489.5	501.0	485.0	507.6	496.4	511.9	526.6	513.0	493.5	508.2	495.9	558.1
9	482.7	512.3	484.2	495.6	492.1	492.1	516.4	514.5	490.6	492.7	490.3	549.0
10	459.3	522.3	479.0	485.5	491.5	506.5	511.3	511.2	492.6	500.1	491.5	539.1
11	480.4	511.5	472.1	485.1	498.0	494.7	511.6	507.3	489.9	499.8	491.6	553.7
12	490.6	507.4	464.8	478.2	494.4	490.1	495.8	501.7	490.2	501.7	485.3	528.3
13	499.3	504.4	461.3	486.2	501.0	494.9	492.6	496.2	501.0	495.4	499.5	528.5
14	505.9	506.3	476.3	504.4	502.6	492.3	490.6	492.1	506.2	495.4	522.9	517.0
15	504.7	510.2	469.0	506.3	498.2	481.5	488.4	491.0	498.5	501.0	511.0	517.9
16	493.5	487.4	484.9	500.0	499.0	488.5	495.2	491.7	482.9	521.1	520.5	522.7
17	533.5	502.3	502.1	525.7	499.8	498.3	495.0	489.8	494.1	520.9	499.8	509.8
18	533.5	504.6	502.5	510.0	503.6	500.6	505.4	487.6	505.7	518.0	496.5	506.8
19	504.7	507.7	493.0	492.7	491.8	498.6	505.0	488.5	523.8	521.8	505.6	514.5
20	517.2	506.6	491.0	491.1	494.1	501.3	499.7	488.2	527.3	490.7	533.6	514.6
21	518.2	504.5	486.6	506.2	500.2	499.7	503.0	487.0	527.0	501.8	505.4	513.1
22	507.8	503.7	492.5	497.0	512.1	493.9	510.1	488.7	522.1	522.3	512.2	533.9
23	495.3	494.9	481.0	496.8	513.7	487.9	507.0	496.2	514.3	511.8	524.2	511.8
24	483.5	497.7	486.9	510.1	514.4	488.3	523.6	494.8	505.6	504.1	574.5	501.8
25	482.8	485.0	486.8	517.0	515.7	493.7	519.8	475.1	490.0	510.9	533.8	510.5
26	498.2	484.0	520.5	502.0	519.8	498.7	514.5	481.4	496.9	523.2	512.5	501.8
27	498.6	484.4	499.0	494.2	507.7	498.2	507.0	476.4	503.3	516.5	529.7	502.4
28	502.6	478.3	489.9	488.1	508.2	496.3	501.1	480.3	512.3	523.9	540.0	493.5
29	504.9		494.3	487.7	518.4	493.7	503.8	483.6	503.7	519.0	535.1	508.9
30	501.4		478.9	492.2	504.1	493.7	499.9	479.2	500.2	522.4	554.3	519.4
31	499.8		492.9		504.5		495.8	478.4		529.9		530.6
Mean	500.2	500.9	484.5	497.9	501.1	495.6	504.6	493.8	499.4	510.8	514.5	521.6

Mean for 1955 = 502.1 cm

Table 2
Daily mean sea levels for 1956

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	540.5	513.9	474.5	467.9	490.3	494.3	511.3	508.5	511.8	495.9	514.6	499.6
2	548.0	515.5	491.6	470.0	482.8	491.7	512.1	517.8	504.0	501.6	522.9	494.2
3	533.7	511.3	496.8	481.5	476.1	493.7	512.0	530.9	507.0	514.3	509.2	534.2
4	530.0	505.5	495.0	484.2	474.7	495.5	505.0	522.7	502.7	508.5	497.3	535.0
5	533.1	503.0	510.5	482.6	476.3	492.4	498.4	519.5	507.8	515.6	516.6	522.0
6	520.6	511.0	504.6	497.1	477.0	493.1	513.4	514.4	503.0	517.0	547.0	531.9
7	520.1	516.2	534.3	514.2	477.8	500.1	509.3	524.3	499.4	551.4	533.3	532.6
8	519.5	500.2	507.2	491.3	487.3	502.5	518.3	518.3	500.4	525.7	512.1	536.0
9	520.1	503.9	505.7	481.1	491.6	501.9	515.3	523.0	499.8	527.3	497.0	518.0
10	513.0	496.9	505.0	485.7	496.3	504.3	515.9	525.5	494.4	517.0	495.0	519.0
11	512.8	485.0	500.0	493.0	497.4	495.4	513.6	515.8	490.5	514.6	496.0	515.6
12	505.0	490.6	495.9	494.6	492.3	494.6	508.6	514.4	495.6	516.4	500.6	508.6
13	508.7	506.3	493.8	498.2	495.6	484.3	507.6	509.4	508.5	531.3	494.6	511.0
14	513.0	515.0	489.5	503.7	492.5	490.4	509.3	505.4	498.5	548.6	488.7	520.0
15	513.8	493.2	488.6	506.6	498.0	503.9	512.6	502.3	508.5	541.3	485.3	514.1
16	523.8	488.0	482.0	488.7	495.4	493.9	511.8	512.4	519.4	527.0	495.7	513.9
17	516.2	486.2	479.7	499.4	499.7	491.2	506.6	518.5	529.6	513.0	505.8	510.8
18	516.0	482.6	473.6	489.9	504.2	494.8	496.8	518.3	511.7	509.3	521.0	522.0
19	527.0	483.8	462.4	489.3	513.0	491.5	497.7	516.1	501.8	517.2	503.6	525.6
20	528.3	473.8	458.1	490.6	511.9	494.8	495.6	515.1	499.3	522.3	495.7	530.3
21	522.0	469.2	454.2	492.5	513.4	503.9	495.0	522.2	504.0	519.3	497.0	528.5
22	530.9	475.0	448.4	492.1	511.8	516.2	499.0	520.2	499.8	520.0	492.3	538.3
23	533.0	473.5	439.9	486.1	506.7	514.1	504.8	525.2	491.0	519.3	493.8	538.6
24	540.0	471.9	449.2	481.5	502.8	509.1	510.7	525.7	480.6	526.2	490.0	527.9
25	543.5	470.8	453.0	478.3	501.6	502.8	512.1	519.7	479.5	523.0	472.3	522.0
26	533.3	470.5	456.8	482.5	503.3	499.3	511.5	507.7	485.6	529.9	499.0	510.3
27	525.1	473.8	454.9	481.4	503.7	504.9	514.4	514.2	486.9	542.0	508.9	499.0
28	537.0	478.6	454.2	485.8	499.4	502.8	517.1	512.5	475.8	536.2	513.6	488.3
29	536.1	474.5	461.0	490.6	499.5	508.3	518.8	520.6	470.9	529.3	514.0	482.0
30	525.9		463.3	490.3	500.3	514.3	512.1	530.3	489.3	524.0	516.7	478.4
31	521.3		465.9		494.2		506.1	517.6		512.5		477.3
Mean	525.5	491.0	479.0	489.0	495.7	499.3	508.8	517.6	498.5	522.5	504.3	515.6

Mean for 1956 = 503.9

Table 3
Daily mean sea levels for 1957

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	479.4	490.3	493.3	480.6	481.1	482.7	504.9	518.3	517.2	530.1	520.7	514.1
2	473.2	496.0	490.3	480.7	473.9	488.6	500.5	527.5	511.2	510.3	512.9	512.3
3	477.1	505.7	477.6	477.8	477.3	487.1	500.2	526.3	519.2	504.3	526.3	519.3
4	472.6	499.8	489.3	474.3	484.5	492.7	503.3	524.1	517.3	548.8	513.7	502.4
5	467.1	496.8	500.1	472.6	494.3	495.5	502.5	513.5	511.4	524.7	514.0	529.4
6	490.0	506.3	494.4	486.9	501.0	493.9	504.6	506.1	507.6	533.5	516.6	509.2
7	503.1	508.2	483.7	503.6	508.0	492.4	502.1	511.2	510.1	534.9	524.7	495.4
8	486.9	517.8	478.3	495.0	502.7	499.3	500.1	511.6	506.4	526.6	527.8	514.8
9	484.4	522.3	474.0	494.0	500.7	504.3	498.4	497.4	514.5	526.3	531.4	546.2
10	508.3	520.5	470.2	492.9	504.0	501.8	499.0	495.9	506.3	521.6	533.2	540.6
11	519.9	524.5	467.0	516.3	495.3	506.9	506.3	487.4	501.6	514.7	524.9	520.9
12	517.4	515.8	475.0	501.2	490.7	500.6	506.4	489.3	500.8	518.2	515.1	518.8
13	521.4	513.9	473.3	494.1	489.8	508.0	501.7	490.9	496.7	505.9	509.0	520.6
14	510.9	518.1	482.8	494.2	485.5	509.9	499.2	497.8	506.4	518.7	509.4	531.8
15	499.3	520.0	498.1	488.5	483.5	497.5	498.6	499.9	521.0	522.1	502.7	493.1
16	501.5	515.9	513.0	486.5	487.5	499.5	501.3	496.1	521.5	508.1	501.8	477.6
17	500.6	508.3	479.0	491.5	483.4	490.4	503.3	498.2	532.5	505.3	496.6	483.5
18	499.0	511.4	500.3	487.0	483.8	496.0	503.2	505.0	553.7	511.9	496.0	491.5
19	496.6	514.5	493.6	485.3	491.1	494.3	501.3	503.9	536.8	511.3	490.6	484.8
20	483.0	504.6	495.0	487.2	490.8	492.7	500.9	493.2	533.6	517.9	482.8	473.4
21	486.8	511.7	486.8	489.3	493.7	487.5	501.6	500.9	518.1	506.8	478.8	480.1
22	496.8	509.9	496.3	488.0	502.6	494.4	501.6	510.3	512.1	512.8	478.2	493.2
23	505.5	510.3	494.0	486.7	505.6	491.2	501.0	509.2	519.4	515.7	500.6	495.1
24	507.5	502.6	478.3	486.9	505.0	486.5	504.2	502.4	533.0	518.6	504.0	499.4
25	507.1	501.3	466.6	486.5	494.5	492.3	503.1	489.6	545.0	526.1	513.9	500.4
26	496.8	496.4	478.9	485.3	487.0	491.8	506.2	501.4	528.4	514.9	509.0	508.6
27	500.3	495.7	481.8	478.0	485.7	495.3	511.4	505.2	516.9	514.1	509.3	506.3
28	509.7	500.4	490.5	474.0	479.5	498.1	511.3	511.0	531.8	510.1	521.1	505.7
29	502.9		502.0	473.3	481.9	504.8	508.8	517.2	531.0	515.3	548.9	517.7
30	518.1		494.0	474.5	477.0	505.9	516.8	518.4	538.0	521.7	520.7	529.4
31	509.8		488.0		477.8		516.3	514.5		525		532.8
Mean	501.1	508.5	486.6	487.1	490.3	496.1	503.9	505.7	520.0	518.6	511.2	508.0

Mean for 1957 = 503.1

Table 4
Daily mean sea levels for 1958

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	543.0	493.9	497.8	473.2	490.0	499.2	500.3	513.0	494.2	491.4	515.0	530.0
2	533.8	496.1	517.0	467.3	488.4	494.5	496.4	512.6	493.0	492.6	509.9	517.3
3	538.4	523.8	515.0	462.4	499.6	489.2	492.3	508.1	487.5	491.4	503.8	495.8
4	517.9	518.4	487.3	460.1	504.4	486.2	495.7	514.9	486.0	487.7	517.3	501.4
5	495.8	535.8	491.0	467.1	498.7	506.9	500.2	514.6	483.4	489.1	506.5	523.3
6	509.6	533.0	506.3	467.7	502.3	493.7	498.4	519.9	486.8	490.1	503.3	530.7
7	535.6	524.2	516.2	462.1	502.9	482.1	502.4	520.2	480.1	492.7	495.8	522.1
8	521.2	504.0	511.8	465.2	501.7	485.6	500.6	523.8	485.7	483.1	491.1	495.3
9	507.0	517.9	518.0	468.0	495.7	484.5	497.4	522.0	491.5	478.1	503.5	500.1
10	514.8	505.2	517.3	-x/	498.4	494.6	497.9	527.5	499.2	488.2	505.7	515.0
11	504.6	497.0	499.0	485.6	500.4	497.9	507.3	520.7	496.3	488.3	508.1	520.6
12	506.7	492.2	499.8	472.2	493.6	493.4	509.0	517.7	504.6	499.1	501.3	515.4
13	508.8	494.3	510.1	466.0	498.0	493.2	505.5	514.7	487.0	500.8	496.7	507.4
14	500.1	494.7	514.0	467.5	500.4	497.1	496.7	515.6	490.2	500.7	496.3	511.9
15	496.8	500.4	507.3	468.2	505.0	491.5	505.3	518.7	494.3	505.2	496.7	503.5
16	488.6	515.2	510.0	473.6	500.2	489.0	519.0	519.0	495.2	514.3	499.5	500.9
17	495.0	533.0	504.0	478.0	502.4	485.9	525.7	520.0	489.2	533.4	492.9	501.2
18	492.5	523.1	499.0	478.2	500.3	488.1	517.2	515.0	483.0	540.1	497.1	500.1
19	496.7	515.0	496.6	475.6	504.9	490.2	523.5	512.6	483.9	522.3	491.3	496.3
20	510.6	521.0	497.3	483.8	500.6	494.2	523.3	511.0	484.8	508.1	484.3	500.6
21	514.1	528.8	496.8	489.0	506.1	500.2	521.6	508.0	473.8	512.0	482.5	502.6
22	507.0	522.5	488.4	501.0	499.5	498.6	520.6	503.7	481.2	505.5	487.3	496.5
23	500.2	520.4	482.2	498.0	509.9	499.0	522.0	496.0	487.0	518.3	490.4	500.2
24	504.0	512.8	480.8	490.2	507.5	499.0	517.5	497.0	484.2	513.1	485.4	504.3
25	504.0	507.0	478.5	484.0	503.1	501.2	522.6	494.3	485.5	528.6	489.7	506.2
26	491.4	530.0	479.7	482.1	501.5	498.2	526.2	504.7	506.2	524.6	514.9	498.6
27	475.2	510.0	478.0	486.0	495.6	501.4	524.5	509.6	515.4	514.2	491.6	493.3
28	485.5	503.2	474.4	489.4	501.9	505.4	519.4	509.5	494.4	515.2	499.4	499.1
29	499.2		470.2	489.4	494.1	503.8	519.8	510.4	486.0	510.0	486.1	495.1
30	492.0		470.0	486.6	496.7	508.8	515.9	504.5	483.5	507.3	513.2	502.6
31	499.0		474.6		501.7		515.0	498.7		507.4		502.2
Mean	506.1	513.3	496.4	477.1	500.7	494.8	510.9	512.2	489.8	504.9	498.8	506.3

x/ watch repair

Mean for 1958 = 500.9

Table 5
Daily mean sea levels for 1959

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	502.1	536.8	510.3	468.4	482.8	483.8	506.6	498.4	511.0	516.2	507.3	483.6
2	505.8	514.5	505.1	483.8	485.4	490.8	499.6	495.4	508.8	509.4	509.6	480.0
3	511.0	513.5	502.0	486.6	485.9	508.1	508.4	496.7	510.3	512.1	505.0	476.7
4	506.1	502.7	498.9	484.4	481.5	500.5	511.5	502.0	504.0	500.4	499.0	477.1
5	517.9	506.6	498.8	493.0	481.2	494.5	508.8	506.9	499.9	495.2	507.6	474.3
6	513.8	499.1	494.9	489.6	480.3	491.8	505.9	508.8	501.0	498.0	514.1	462.1
7	515.0	492.8	497.1	496.8	483.7	490.1	510.9	508.2	495.0	500.4	512.0	449.6
8	525.9	491.1	515.0	491.0	488.0	490.0	507.7	507.7	501.6	501.8	510.6	449.0
9	526.4	487.8	517.4	500.6	488.9	491.6	503.0	506.1	498.2	492.2	505.3	450.4
10	532.0	488.3	502.7	510.4	486.9	499.1	508.6	505.6	499.5	495.6	490.0	447.9
11	502.6	484.2	498.9	495.6	483.5	505.8	509.4	500.6	501.6	500.2	497.2	454.7
12	516.4	476.8	496.2	508.8	483.3	508.0	504.8	497.1	503.4	498.4	499.1	463.7
13	521.3	478.1	492.5	499.8	483.7	504.5	500.9	494.6	518.1	490.1	492.8	463.7
14	518.6	473.8	490.4	494.0	481.5	500.5	495.3	490.9	516.7	496.6	482.9	465.1
15	521.0	480.1	484.6	495.5	480.8	499.0	508.6	490.2	512.9	497.2	482.5	456.4
16	515.8	477.0	484.9	501.1	482.8	508.2	511.1	492.3	527.3	488.8	481.4	442.0
17	512.1	480.6	485.4	503.9	486.5	508.4	509.0	492.1	527.8	487.2	488.8	444.2
18	510.3	486.7	480.0	515.6	487.0	507.3	507.5	491.4	515.1	490.4	471.7	448.9
19	510.4	487.3	484.3	543.6	481.0	513.0	503.9	492.8	511.8	480.1	472.6	459.1
20	508.0	486.7	482.4	522.8	477.8	519.9	501.5	492.9	514.4	490.2	471.0	452.1
21	493.5	527.2	478.2	492.9	483.0	517.6	500.0	492.6	504.6	498.0	455.1	451.6
22	497.3	532.9	477.2	495.6	472.9	516.7	501.5	487.6	518.2	522.2	458.1	469.4
23	498.0	506.6	477.1	493.3	471.5	513.7	505.6	485.9	524.1	533.2	470.5	466.1
24	527.8	510.6	480.6	486.7	480.0	508.1	503.9	486.3	528.2	495.4	477.0	475.3
25	575.1	510.0	474.7	480.0	466.0	503.5	501.5	489.9	525.4	506.4	477.7	484.7
26	543.5	506.5	475.8	476.2	479.3	497.9	503.5	512.2	520.7	500.9	478.2	478.5
27	525.5	507.9	474.0	476.2	490.2	494.6	502.7	528.6	530.3	492.4	462.6	478.8
28	514.6	509.4	489.3	477.4	485.0	497.4	493.6	527.2	538.2	504.2	470.7	488.9
29	514.8		490.9	480.2	480.9	500.7	493.0	522.6	520.5	510.4	479.9	493.9
30	510.1		488.3	482.7	477.1	503.2	499.6	530.1	510.9	516.8	483.2	495.5
31	529.9		484.3		476.2		497.9	520.5		511.7		492.2
Mean	516.9	498.4	490.7	494.2	481.8	502.3	504.1	501.7	513.3	501.0	487.1	467.0

Mean for 1959 = 496.5

Table 6

Daily mean sea levels for 1960

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	460.6	490.3	458.4	459.6	491.0	496.3	511.5	508.4	522.4	501.4	476.2	504.0
2	482.2	488.8	452.9	460.8	492.6	497.4	516.8	508.0	527.6	494.0	466.4	503.4
3	492.0	467.4	462.1	465.9	497.2	497.3	524.8	512.1	527.9	484.3	462.2	497.7
4	487.7	436.4	471.9	471.8	493.9	498.6	526.1	508.6	530.1	479.6	465.6	512.2
5	470.3	447.2	476.7	462.9	494.7	500.2	532.0	500.6	530.5	490.0	475.1	511.6
6	508.0	458.4	472.1	451.8	500.5	499.7	524.7	502.8	537.6	487.6	474.8	524.2
7	512.6	468.1	465.1	448.7	503.2	497.7	517.7	504.2	545.0	491.6	494.0	536.8
8	530.6	471.3	460.0	451.3	499.4	490.5	512.5	505.1	544.5	487.3	501.2	534.9
9	529.2	466.1	457.9	460.0	498.6	495.5	517.2	504.6	530.6	484.6	498.0	541.2
10	501.0	475.9	454.4	458.5	496.8	497.0	509.9	502.6	529.8	486.4	492.3	540.2
11	524.8	488.3	450.9	457.3	492.0	502.4	507.7	500.4	527.4	484.6	489.6	534.8
12	507.7	489.6	454.1	457.2	488.1	497.8	501.6	506.6	517.8	492.3	490.7	532.3
13	510.5	501.1	463.0	450.2	482.0	498.2	500.6	517.0	512.6	497.0	492.4	524.3
14	509.6	481.2	468.8	458.0	479.2	508.0	498.2	519.3	510.2	497.3	489.4	529.0
15	493.6	478.7	476.3	458.1	475.2	508.4	498.4	510.0	507.6	501.5	490.3	521.9
16	498.4	480.3	479.7	472.2	476.7	508.5	499.7	513.2	506.2	499.8	494.2	505.8
17	492.0	490.1	480.8	470.1	480.0	504.0	493.3	515.0	502.6	501.0	492.2	497.0
18	482.0	492.9	477.3	480.2	480.0	503.3	492.4	519.0	497.0	501.2	498.0	497.0
19	483.0	474.8	473.2	476.8	483.0	512.3	485.4	526.8	502.0	498.0	503.4	503.0
20	498.3	475.4	465.2	472.8	484.2	526.3	490.9	524.8	505.3	496.8	504.6	507.0
21	507.0	475.1	457.8	474.4	485.0	524.4	498.0	528.8	502.0	492.0	501.2	509.0
22	483.3	482.2	455.5	479.3	490.6	521.0	498.7	531.4	497.8	492.2	489.0	506.0
23	472.1	488.3	471.9	484.2	486.9	517.2	497.8	525.0	489.2	484.2	479.1	510.0
24	483.6	491.8	460.5	491.9	484.2	512.8	504.2	528.6	484.4	484.0	478.3	504.2
25	485.2	485.7	459.7	501.3	488.8	510.0	500.3	527.8	486.4	481.6	481.0	495.0
26	494.3	476.3	458.9	512.6	502.2	513.3	502.7	525.2	509.5	474.4	496.3	489.8
27	505.2	465.9	463.0	504.2	500.2	510.9	511.2	522.3	524.0	488.0	505.0	492.0
28	503.4	477.9	467.1	500.8	505.1	500.8	511.6	519.3	523.8	478.2	510.2	504.0
29	512.4	476.4	465.5	494.3	499.3	500.4	512.8	519.2	518.0	476.9	514.4	509.4
30	519.8		468.5	490.0	490.5	511.8	508.6	517.3	508.2	487.0	516.3	506.6
31	503.6		471.2		498.8		508.0	525.3		497.9		499.6
Mean	498.2	477.3	465.2	472.6	491.0	505.4	506.9	515.5	515.4	490.1	490.7	512.4

Mean for 1960 = 495.0

Table 7

Daily mean sea levels for 1961

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	497	491	501	550	498	516	529	538	522	497	508	521
2	495	499	502	543	477	516	528	530	524	493	504	531
3	494	508	506	544	477	516	525	530	528	491	503	514
4	494	509	499	542	476	515	528	520	526	488	507	522
5	493	508	505	539	479	509	531	525	517	483	523	529
6	488	476	502	533	475	505	530	527	518	478	520	505
7	492	484	511	534	481	504	536	530	518	474	519	532
8	494	506	510	533	487	504	527	529	528	475	513	540
9	496	510	506	534	502	501	530	526	527	472	511	536
10	484	507	503	524	520	504	527	522	523	470	510	530
11	503	502	506	524	520	507	533	522	518	473	513	534
12	501	509	520	509	513	505	535	524	517	483	512	535
13	485	509	531	515	516	502	538	525	525	499	506	528
14	503	496	524	516	528	510	529	523	520	503	499	531
15	505	514	531	516	535	519	527	523	526	505	495	510
16	516	510	531	517	533	518	523	528	519	501	494	497
17	499	510	523	518	525	510	521	533	522	496	514	496
18	488	510	533	515	517	504	523	536	522	503	536	504
19	486	520	550	520	515	514	520	534	528	504	539	514
20	484	503	528	516	515	520	520	535	523	505	506	526
21	483	506	550	508	516	519	520	533	516	499	498	532
22	486	506	527	508	506	518	523	534	513	492	503	530
23	494	502	524	509	506	519	523	533	514	481	504	514
24	490	495	533	511	502	518	526	538	509	478	502	495
25	479	482	534	507	508	522	523	538	509	474	500	502
26	478	473	524	510	516	526	519	537	516	489	505	509
27	465	477	543	512	523	532	521	532	512	489	514	498
28	460	500	555	515	524	532	526	533	504	491	514	487
29	458		550	502	524	532	533	538	494	494	506	493
30	466		554	506	525	536	541	531	493	495	504	494
31	486		557		518		545	529		494		496
Mean	488.5	500.8	524.9	521.0	508.3	515.1	527.7	530.2	517.7	489.3	509.4	515.6

Mean for 1961 = 512.4

Table 8

Daily mean sea levels for 1962

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	514	489	500	481	505	504	525	506	528	501	517	508
2	521	511	500	482	503	509	520	510	523	496	511	496
3	512	504	501	479	505	504	529	512	521	497	503	509
4	509	502	503	494	507	514	532	506	518	506	499	517
5	506	514	508	503	498	517	531	507	518	507	496	511
6	520	522	510	499	494	505	530	502	519	505	492	512
7	510	501	494	495	501	495	531	511	526	504	490	519
8	509	516	494	495	499	496	528	493	526	503	483	495
9	503	517	468	493	498	496	528	503	526	500	483	500
10	506	508	466	495	502	494	532	508	517	502	477	524
11	501	518	496	491	504	500	527	514	527	506	469	520
12	507	542	518	492	498	512	520	516	534	501	476	521
13	513	540	512	504	508	511	523	514	534	488	472	533
14	520	548	491	522	516	500	522	518	530	512	463	524
15	528	544	478	505	506	498	517	524	529	499	467	533
16	509	502	498	500	493	501	515	518	529	496	478	528
17	512	542	509	491	492	503	511	517	528	500	478	538
18	515	568	500	493	489	501	511	519	537	507	479	530
19	524	543	496	498	494	502	506	526	541	528	479	524
20	528	552	493	491	488	496	501	519	540	515	484	508
21	532	564	492	490	488	498	501	509	540	511	492	504
22	519	543	495	485	489	500	498	504	529	509	490	503
23	529	546	499	485	483	502	500	507	530	507	476	503
24	536	537	491	486	486	505	509	510	520	508	482	494
25	544	518	490	484	498	505	510	512	517	514	490	488
26	536	509	484	488	506	511	511	513	515	505	488	494
27	554	510	486	494	496	520	515	519	514	515	492	500
28	563	503	493	507	492	522	512	523	512	505	504	502
29	533		485	506	508	530	504	534	508	511	511	510
30	511		485	503	493	529	501	529	502	501	520	507
31	488		485		498		500	537		510		497
Mean	519.7	525.5	494.5	494.4	498.0	506.0	516.1	514.2	524.6	505.5	488.0	511.4

Mean for 1962 = 508.2

Table 9

Daily mean sea levels for 1963

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	498	514	497	466	479	495	507	502	509	522	492	501
2	495	502	501	458	484	488	499	499	507	524	497	494
3	484	503	504	463	486	485	500	495	502	516	497	497
4	484	498	500	470	492	497	497	493	501	525	497	503
5	485	500	495	470	494	492	497	499	505	525	487	497
6	513	515	495	462	487	495	495	495	502	522	484	493
7	494	514	509	458	490	488	502	497	503	527	483	521
8	486	501	504	455	491	501	506	501	500	515	482	514
9	491	492	491	456	492	504	509	496	501	510	489	499
10	494	489	499	463	487	491	506	497	504	518	496	496
11	493	479	492	464	486	503	510	501	503	528	499	509
12	490	488	498	470	482	490	514	505	500	542	505	509
13	488	497	514	469	482	488	508	512	498	532	488	496
14	532	497	508	467	488	488	508	514	491	562	498	504
15	530	494	498	464	493	492	506	516	503	541	500	493
16	520	498	494	472	494	495	508	511	505	520	499	507
17	503	506	492	478	491	489	508	512	508	529	498	502
18	491	503	493	480	489	492	509	515	515	524	507	479
19	505	496	493	480	495	493	508	502	516	519	511	492
20	516	494	492	482	496	496	512	504	502	511	532	508
21	497	494	490	482	495	503	512	506	496	511	528	509
22	493	494	488	485	494	503	511	511	496	524	541	508
23	498	488	488	488	497	502	511	509	495	521	540	510
24	504	499	486	484	500	503	508	505	493	508	520	504
25	488	504	486	478	500	506	508	509	497	512	522	502
26	505	494	486	475	500	504	512	505	480	508	518	507
27	512	495	474	472	500	500	519	506	500	512	513	511
28	507	494	472	476	495	510	517	509	512	506	505	508
29	504		470	474	497	507	515	515	511	513	509	501
30	506		472	482	499	499	514	516	527	502	507	502
31	513		475		502		508	513		495		507
Mean	500.6	497.9	492.1	471.4	492.2	496.6	507.9	505.5	502.7	520.1	504.8	502.7

Mean for 1963 = 499.5

Table 10

Daily mean sea levels for 1964

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	526	511	486	463	488	495	518	513	523	529	489	539
2	521	533	485	466	490	501	519	522	515	517	489	532
3	507	513	490	468	493	506	517	534	510	529	490	506
4	510	527	491	475	492	498	520	531	509	514	496	518
5	516	566	490	478	490	493	524	543	506	509	501	535
6	511	589	477	472	499	489	526	538	506	505	493	531
7	507	534	470	465	498	494	527	532	511	499	507	506
8	503	536	464	466	497	495	518	525	508	494	505	510
9	498	535	469	468	497	494	515	524	515	505	493	501
10	501	532	480	465	499	492	517	525	515	506	483	513
11	497	552	483	474	496	493	516	524	518	505	491	520
12	494	559	485	471	496	494	514	523	526	506	492	522
13	514	534	480	478	496	480	517	519	531	517	494	504
14	531	532	474	482	501	496	518	510	510	513	491	519
15	517	527	467	484	507	495	515	491	504	511	500	533
16	500	520	470	484	509	498	509	501	510	513	499	540
17	498	531	471	482	513	498	510	503	509	508	531	532
18	496	528	472	480	508	501	511	498	510	515	542	533
19	494	515	470	482	496	498	508	502	523	506	543	544
20	496	507	461	486	500	505	509	500	527	496	532	532
21	500	509	463	485	505	511	506	504	527	497	536	525
22	513	501	465	489	502	504	509	505	535	502	535	520
23	494	495	466	493	498	500	511	506	524	489	526	518
24	515	497	464	484	495	494	508	499	520	493	537	509
25	528	491	459	494	493	501	506	501	519	497	553	511
26	533	482	460	473	490	503	505	509	519	507	554	521
27	524	478	461	477	492	499	506	503	520	503	537	519
28	493	480	462	577	488	505	507	509	516	501	549	513
29	500	489	463	476	490	507	501	510	511	497	541	515
30	498		464	480	488	516	516	499	529	493	542	504
31	507		461		484		512	513		490		499
Mean	507.8	520.8	471.7	477.2	496.5	498.5	513.4	513.4	516.9	505.4	515.7	520.1

Mean for 1964 = 504.8

Table 11

Daily mean sea levels for 1965

Date	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	497	507	499	497	485	482	518	513	509	514	513	491
2	506	522	495	496	480	483	516	520	509	508	514	492
3	515	503	506	489	473	481	520	520	505	499	527	488
4	516	509	513	485	463	485	520	521	506	500	542	496
5	526	496	503	489	465	482	518	517	502	504	539	494
6	548	499	500	487	470	483	519	506	500	496	533	502
7	519	503	485	494	470	487	520	505	499	495	537	507
8	508	540	468	502	472	480	521	506	498	513	530	502
9	535	519	482	489	469	483	523	510	496	520	524	494
10	523	515	489	482	492	482	522	513	502	508	531	491
11	498	515	485	476	493	482	520	516	507	514	530	513
12	475	501	488	470	490	487	517	521	502	506	528	524
13	489	491	490	472	485	490	518	524	501	493	522	518
14	487	518	481	476	490	490	520	520	504	501	509	523
15	481	533	482	472	488	480	519	513	517	498	511	514
16	488	531	486	470	482	471	524	504	505	503	507	515
17	475	527	485	475	470	475	520	502	499	514	500	502
18	492	519	485	470	470	480	516	497	505	516	494	488
19	504	513	490	475	482	485	510	496	505	515	500	483
20	517	507	486	484	485	490	505	495	522	510	504	498
21	525	501	490	488	495	493	504	492	509	503	501	503
22	515	510	499	492	495	490	503	493	510	505	516	505
23	508	509	495	490	492	493	500	498	515	508	493	497
24	508	498	497	490	490	494	493	497	518	507	474	488
25	509	533	50[illegible]	483	493	497	499	493	520	503	475	489
26	515	508	506	480	492	498	504	497	517	491	462	495
27	503	513	501	485	486	494	510	496	512	488	462	491
28	497	509	497	490	487	499	510	507	508	482	493	502
29	495		496	485	491	510	513	496	509	493	493	513
30	494		506	482	490	513	514	497	502	501	490	511
31	497		503		483		516	498		503		519
Mean	505.3	512.5	493.5	484.0	482.8	487.9	513.9	505.9	507.1	503.6	508.5	501.6

Mean for 1965 = 500.6 cm

Table 12

Marine station Sopot-Molo
Monthly and annual mean sea levels of the Baltic Sea in the Bay of Gdansk
for the 11-year period 1955-1965

Year / Month	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	Monthly mean
I	500.2	525.5	501.1	506.1	516.9	498.2	488.5	519.7	500.6	507.8	505.3	506.4
II	500.9	491.0	508.5	513.3	498.4	477.3	500.8	525.5	497.9	520.8	512.5	504.2
III	484.5	479.0	486.6	496.4	490.7	465.2	524.9	494.5	492.1	471.7	493.5	489.0
IV	497.9	489.0	487.1	477.1	494.2	472.6	521.0	494.4	471.4	477.2	484.0	487.8
V	501.1	495.7	490.3	500.7	481.8	491.0	508.3	498.0	492.2	496.5	482.8	494.3
VI	495.6	499.3	496.1	494.8	502.3	505.4	515.1	506.0	496.6	498.5	487.9	499.8
VII	504.6	508.8	503.9	510.9	504.1	506.9	527.7	516.1	507.9	513.4	513.9	510.7
VIII	493.8	517.6	505.7	512.2	501.7	515.5	530.2	514.2	505.5	513.4	505.9	510.5
IX	499.4	498.5	520.0	489.8	513.3	515.4	517.7	524.6	502.7	516.9	507.1	509.6
X	510.8	522.5	518.6	504.9	501.0	490.1	489.3	505.5	520.1	505.4	503.6	506.5
XI	514.5	504.3	511.2	498.8	487.1	490.7	509.4	488.0	504.8	515.7	508.5	503.0
XII	521.6	515.6	508.0	506.3	467.0	512.4	515.6	511.4	502.7	520.1	501.6	507.5
Annual mean	502.1	503.9	503.1	500.9	496.5	495.1	512.4	508.2	499.5	504.8	500.6	502.4

Mean sea level for the 11-year période 1955-1965 = 502.4

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