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DISCREPANCIES OF THE SEAWATER TEMPERATURE BETWEEN BALTIC SEA PHYSICAL REANALYSIS DATA AND IN-SITU MEASUREMENTS OFF THE SHORE OF THE CURONIAN SPIT

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This study provides new estimates of the discrepancies between the Baltic Sea Physical Reanalysis data and in-situ measurements of seawater temperature in the coastal zone of the Baltic Sea off the Curonian Spit (Kaliningrad region, Russia). The relevance of this assessments driven by the need for reconstruction and analysis of previously occurred extreme events in the coastal zone of the Baltic Sea. Additionally, predictive assessments are required to evaluate the possible impact of extreme weather conditions on the intensification of lithodynamic processes in the coastal zone of the sea using numerical modeling. Quantitative assessments of water temperature discrepancies were obtained by comparing BALTICSEA_REANALYSISPHY_03_011 computational data with instrumental measurements. The latter were obtained by a thermistor chain sensor installed on the D6 platform, which is located approximately 20 km from the shore. The analysis revealed significant discrepancies (up to 6 °C) between the calculated and measured temperatures in the near-surface (5 m), intermediate (13 m), and deep (20 m) layers of coastal waters in 2018. The water density mismatch in October and May 2018 ranged from −0.2 to −0.13 kg/m³ and from 0.025 to 0.25 kg/m³, respectively, with corresponding temperature discrepancies. This can affect the calculated water dynamics. This circumstance is significant in numerical simulation under extreme weather conditions. Therefore, it is difficult to correct the existing Baltic Sea Reanalysis dataset for use in numerical simulations of coastal water dynamics near the Curonian Spit shores.

Keywords: in-situ measurements, thermistor chain, seawater temperature, reanalysis data, temperature discrepancy, coastal waters, Baltic Sea

1. Introduction

Reanalysis datasets of various models, both global and regional, are widely used in modern research practices. These datasets are used to study oceanological processes and to set the initial state and boundary conditions in numerical models of marine regions (Fedorov, 1981; Leppäranta, Myrberg, 2009; Dutheil et al., 2023). A sufficient number of successful applications of reanalysis data have been demonstrated in various studies (Zhurbas et al., 2006; Lavrova et al., 2011; Kapustina, Zimin, 2023; Zakharchuk et al., 2023; Diouf et al., 2025; Wattimena, Salamena, 2025). For example, Copernicus Marine Environment Monitoring Service (CMEMS) Baltic Sea Physical Reanalysis dataset (Liu et al., 2019) enabled the estimation of the frequency of upwelling events along the southeastern Baltic Sea coast (Kapustina, Zimin, 2023). Satellite data alongside data from two different reanalysis datasets – ERA5 and the Baltic Sea Physics Reanalysis (using the NEMO v3.6 model, or Nucleus for European Modeling of the Ocean) – were successfully used to investigate the peculiarities of the interannual seasonal fluctuations in the Baltic Sea level (Zakharchuk et al., 2023). In another study (Zakharchuk et al., 2024), the variability of oceanographic processes in the Baltic Sea during the spread of the Major Baltic Inflow was investigated using reanalysis data and measurements of sea level, temperature and salinity. Discrepancies between data from in-situ measurement (ice chart-based data, expedition data), satellite data, and reanalysis have been noted in various studies of the Baltic Sea (Liibusk et al., 2020; Singh et al., 2024; Stepanova, Mizyuk, 2022). It is possible to assume that the discrepancy depends on the specific water area.

The principles of reanalysis array construction are well-known (Liu et al., 2019). The physical system uses the NEMO model (https://nemo-ocean.eu), and ERGOM model (Ecological Regional Ocean Model, https://ergom.net), and WAM wave model. The system assimilates data from various sources, including satellite sea surface temperatures and in-situ temperature and salinity profiles. The system is forced by ERA5 atmospheric dataset. The reanalysis provides daily, monthly and yearly mean fields at points within the model domain for which there are no measurements. At the same time, it is clear that the "bad" physiographic features of a certain sea area, such as an indented coastline at different linear scales, significant bottom relief heterogeneity, regional hydro-meteorological specificity, strong water stratification and the absence of stationary observation points for the TS structure and water dynamics, can complicate data calculation conditions and worsen their quality.

The Baltic Sea can be classified as a water body of the World Ocean with a "bad" set of physiographic parameters for calculations (Hydrometeorological conditions of the shelf…, 1994; Leppäranta, Myrberg, 2009; Amantov et al., 2010). Additionally, the rugged coastline of shallow southern and rocky northern shores as well as the two-layer thermohaline structure of waters, impose strict requirements on the organization of model calculations and the accuracy of parameterization of subgrid processes. At the same time, long-term and detailed in-situ measurements in the Baltic Sea present challenges when addressing fundamental and applied problems. The demand for more precise measurements has led to the use of publicly available results from reanalysis models for examining the variability of the thermohaline structure of the sea and its numerical simulation.

The necessary components of any numerical model are procedures for constructing the model domain, initializing state all field states, and setting the boundary conditions. The model domain had previously been constructed using a digital elevation model with a spatial resolution of 30×30 m (Kileso et al., 2020). The procedures for the initial state and boundary conditions should be performed using the Baltic Sea Physical Reanalysis data. The reliability of the results of model calculations depends on the accuracy of these procedures. The reanalysis data in the coastal zone, i.e. at the boundaries of the model domain (based on NEMO-Nordic), may have reduced accuracy compared to data in the open part of the sea. Thus, improving the quality of reanalysis data is especially important in the highly dynamic coastal sea zone, where coastal abrasion, sediment and pollution transport and redeposition, and coastal fisheries and recreational activities occur (Leppäranta, Myrberg, 2009; The Baltic Sea in the Present…, 2016).

The novelty of our research lies in the new estimates of discrepancies between seawater temperatures in the Baltic Sea Physical Reanalysis model and the measurements by the thermistor chain sensors on the D6 oil platform (Lukoil-KMN). These estimates are new for the selected study area. The objective of the research is to evaluate the discrepancy between the calculated seawater temperatures from the Baltic Sea Physical Reanalysis and the long-term instrumental measurements of temperatures in the Baltic Sea's coastal zone (platform D6, Kaliningrad oblast', Russia). This evaluation is conducted within the potential application for the reconstruction and analysis of extreme events off the shore of the region.

2. Materials and methods

The study area of our research is located in the south-eastern Baltic Sea off the shores of the Curonian Spit (see black square in Figure 1). The CMEMS Baltic Sea Physical Reanalysis product (Liu et al., 2019) was used to perform the study. This product contains daily water temperatures from the surface to the bottom on a regular rectangular grid with a cell size of 2×2 km. This array was generated using the NEMO-Nordic model, which incorporates the Local Singular Evolutive Interpolated Kalman (LSEIK) data assimilation routine. For our research, we used 2018 data from the grid cell centered approximately at 55.275°N, 20.652°E (see the sub-plot in Figure 1), which is closest to the point of the in-situ temperature measurements (the sub-plot in Figure 1, blue circle).

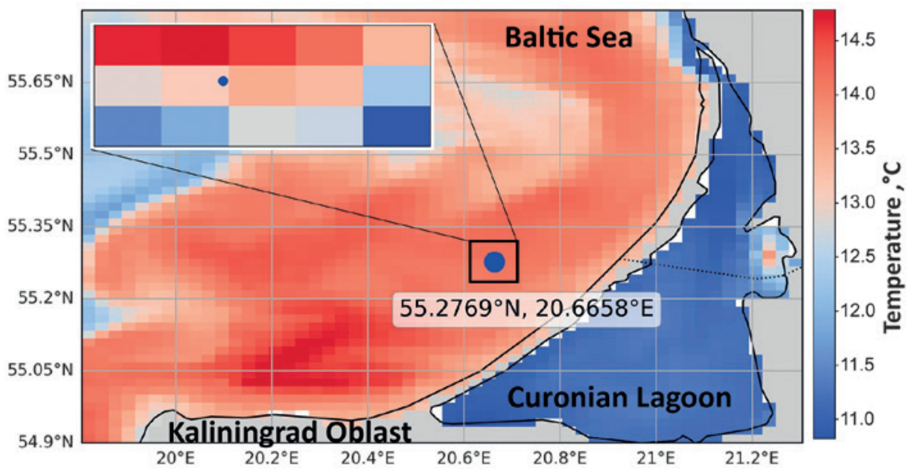

Fig. 1 – Daily sea surface temperature in the study area on 01.10.2018 (from E.U. Copernicus Marine Service Information (Liu et al., 2019)). The solid blue circle indicates the point where thermistor chain measurements were taken. The sub-plot in the upper left corner of the chart shows a magnified temperature field around the measurement location

To analyze the agreement between the reanalysis data and the instrumental measurements, we used water temperature measurements from a thermistor chain installed on the D6 ice-resistant oil production platform. The platform is located approximately 20 km from the base of the Curonian Spit (see blue circle, Figure 1), at a depth of 29 m (Myslenkov et al., 2017a). The time step for temperature measurements is one minute. Thermistor sensors, which have an accuracy of ±0.025 °C, are located at depths from −1 to 28 meters. Full maintenance of the thermistor sensors was carried out once a year. Data were collected quarterly, accompanied by partial maintenance of the thermistor chain. A detailed description of the measurement system can be found in (Myslenkov et al., 2017b).

The choice of 2018 as the observation year was based on previous studies (Kupriyanova et al., 2023; Korobchenkova et al., 2025), which showed it to be a representative year of the seasonal variability of coastal water temperature over the observation period from 2016 to 2020. The seawater cooling process occurred gradually at an average rate of –0.11 °C per day. By the end of autumn in 2018, the water temperature had reached 5 °C. A similar pattern of temperature variability was appeared from 2017 to 2020. This pattern of temperature variability was referred to as typical mode (Kupriyanova et al., 2023). The present study assumes that the local analysis of seawater variability in 2018 can be applied to the entire observation period from 2017 to 2020.

To analyze the discrepancy between the reanalysis data and daily averaged in-situ measurements, the depth of the reanalysis data closest to the depth of the thermistor chain were selected (respectively, 4.63 and 5 m, 12.27 and 13 m, 19.7 and 20 m). Figure 2 shows temperature measurements at a depth of 5 m from thermistor sensors and reanalysis data at depth of 4.63 m over seven days in October 2018.

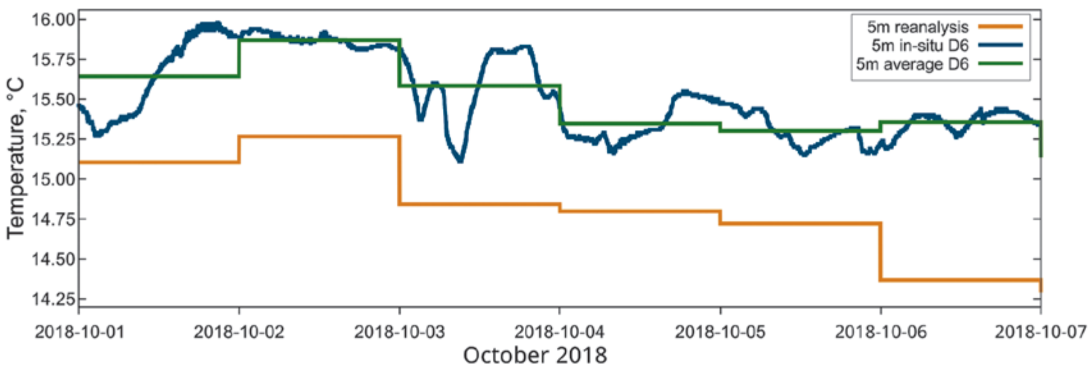

Fig. 2 – The in-situ measurements (blue line) and calculated reanalysis data (orange step function) of the seawater temperature at a depth of 5 m for seven days in October 2018. The green step function indicates daily averaged temperatures of the thermistor chain

Note that water temperature curves at a depth of 5 meters, as shown in Figure 2, indicate a discrepancy between the calculated and measured temperatures ranging from 0.5 to 1 °C for the selected time interval. A similar discrepancy between the measured and calculated temperatures is observed at other depths throughout the entire fall cooling period of coastal waters. Consequently, assessment of the agreement between the datasets is required, which is presented in this work.

2.1. Statistical analysis of the used data

Figure 3 shows the distribution functions of temperatures (abscissa) and seawater density difference for (a) daily averaged instrumental measurements and (b) reanalysis data at depths of 5 and 4.63 m, respectively.

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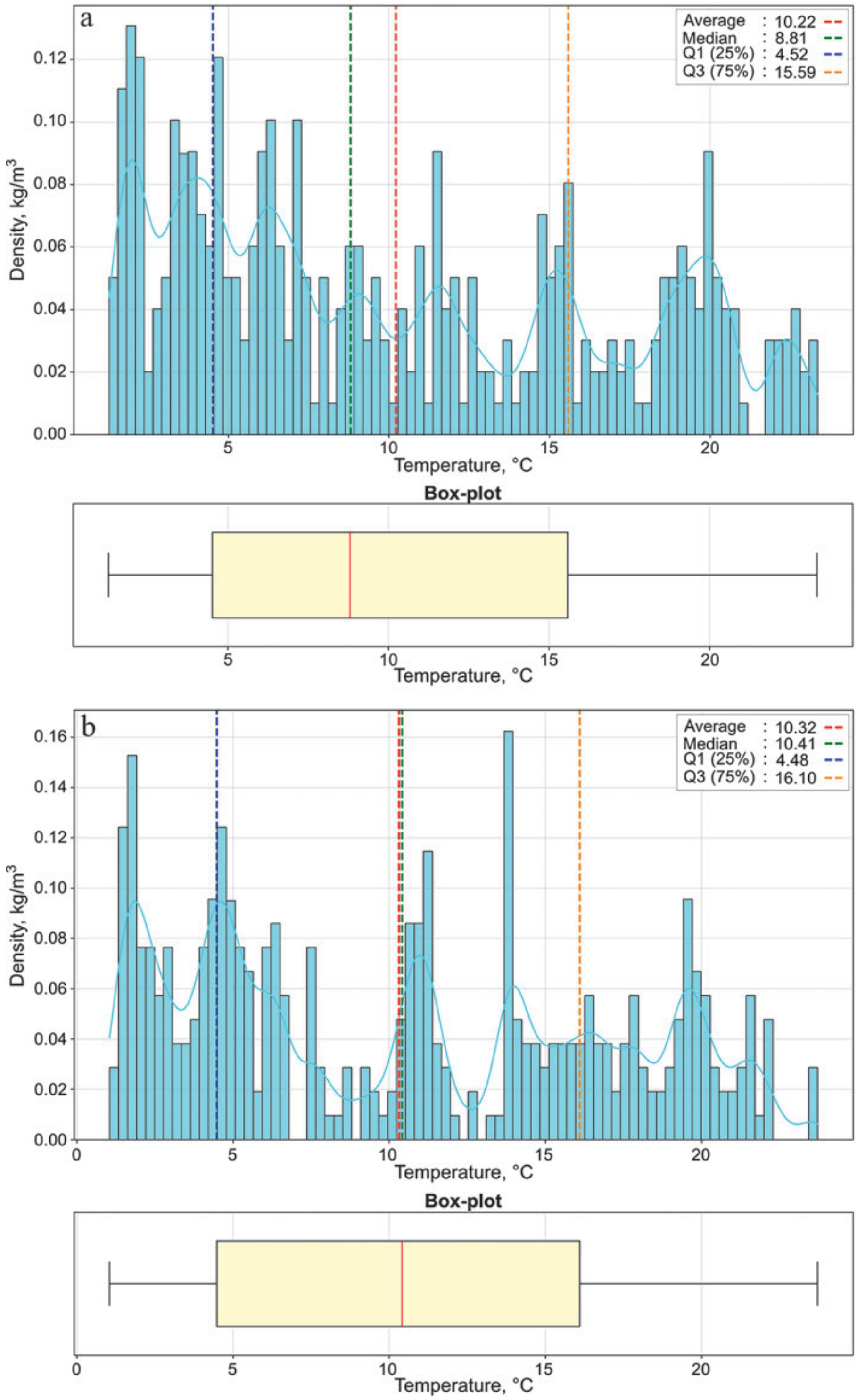

Fig. 3 – The data distribution function of daily average measurements (**a**) and reanalysis data (**b**) in 2018. The box-plot presents temperature from measurements and reanalysis arrays grouped by all depths. The right and left ends of the whiskers correspond to the maximum and minimum temperatures within the three-sigma criterion range. The red dashed line indicates average water temperature. The green dashed line denotes median water temperature. The blue and yellow dashed lines show Q1 and Q3 quartiles, respectively

Water density was calculated using the equation of state of seawater (TEOS–10, (IOC, SCOR and IAPSO…, 2010)). The water temperature distribution from both reanalysis and in-situ data was within the same temperature range (approximately from 2 to 24 °C), as shown in the box-plot in Figure 3 (a, b). The Q1 and Q3 quartiles for the instrumental measurements and the reanalysis data are quite similar (Figure 3 (a, b)). However, the water temperature distribution according to the thermistor chain data within the range of Q1 and Q3 is shifted to the right relative to the median temperature. This shift does not correspond to the temperature distribution according to the reanalysis data. The left and right temperature ranges are nearly equal relative to their median, for the calculated temperatures (Figure 3 (b)).

The average water temperature according to the reanalysis data quite coincides with the median temperature (10.32 and 10.41 °C, respectively), as shown in Figure 3 (b). In contrast, the corresponding parameters according to the thermistor chain data (Figure 3 (a)) do not show an agreement (average – 10.22 °C, median – 8.81 °C). The agreement between the median and average temperatures in the reanalysis data is likely due to the smoothness of the in-situ data used in the reanalysis model and the coarse spatial scale (2×2 km). According to the thermistor chain and reanalysis data, the average water temperatures are almost equal, 10.22 and 10.32 °C, respectively.

The differences in water density (the in-situ density minus 1000 kg/m^3) are not distributed equally, as shown in the upper plot of Figure 3 (a) and 3 (b). The maximum water density difference according to the reanalysis data reaches greater values (up to 0.16 kg/m^3) than that calculated according to the instrumental measurements (up to 0.13 kg/m^3). It is not possible to clearly identify the reasons for the observed differences in water density due to a lack of data required for analysis. Possible reasons for the differences in water density are discussed later. The analysis of the distributions of the seawater temperature and density revealed statistical variability in the data and confirmed the need to improve the accuracy of the data used as initial and boundary conditions for the numerical modeling of the coastal water dynamics in the Baltic Sea off the Curonian Spit.

3. Agreement analysis of the reanalysis and thermistor chain D6 data

The results of a comparison between the daily averaged measurements of seawater temperature taken by thermistor chain and the calculated reanalysis data ($\Delta T = T^k_{insitu} - T^k_{reanalysis}$, where k is the day) in 2018 at similar depths are described below. Now we describe in detail the features of the variation of the difference of daily averaged in-situ measurements and reanalysis data of temperature at depths of 5, 13, and 20 m for the water cooling period in October 2018 (Figure 4). Previous studies showed (Kupriyanova et al., 2023) that significant water temperature changes were observed in October 2018, which could complicate the conditions of model calculations. Thus, this month was chosen to analyze the discrepancy of the temperature of the coastal waters.

An analysis of the differences of the water temperature at the depths of 5, 13, and 20 m in October 2018 showed an average discrepancy of 0.76 °C across all depths (Figure 4).

The maximum difference between the calculated and measured data was approximately 1.25 °C during a period of rapid water cooling at the selected comparison depths on October 26 and 29. Some consistency was observed between the thermistor chain and reanalysis data at the 20-meter depth on October 11 and 30, with a difference of approximately 0.28 °C. From October 12 to 16, the temperature discrepancy between the data at all depths changed insignificantly and averaged 0.87 °C.

The calculated data accurately describe the trend of the slow seawater cooling in October 2018, including the period of rapid temperature change mentioned in previous paper (see Kupriyanova et al., 2023, Figure 1). At the same time, the highest discrepancies (Figure 4) corresponded to days with high water temperature gradients. Consequently, significant intraday temperature variations might cause discrepancies between the calculated reanalysis data and the measurement data from thermistor chain sensors at the selected comparison depths. A synchrony is also observed in water temperature variations in October 2018 at all depths. However, the calculated reanalysis data do not reflect every peculiarity in the behavior of the water temperature (see October 26, 28–29, 2018 in Figure 4).

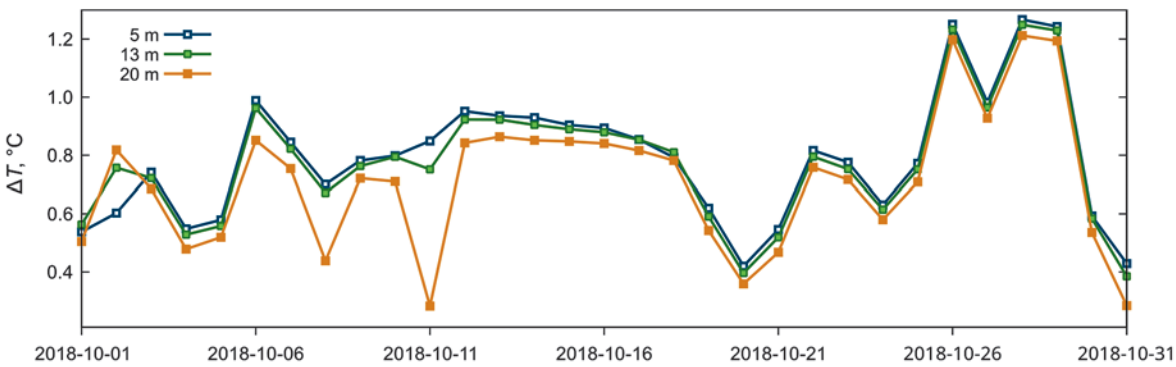

Fig. 4 – Time series of discrepancy variations (Δ*T*, °C) between daily averaged measurements (according to the thermistor chain data) and the reanalysis data of water temperature in October 2018. The depths are as follows: blue line – 5 m, orange line – 13 m, and green line – 20 m

The above plots characterize the features of the discrepancies between the calculated and measured water temperatures in October 2018. Notably, the reanalysis seawater temperature turned out to be lower than temperatures from thermistor sensors data. However, the calculated data generally reflect water cooling well when this difference is excluded.

During the spring of 2018, the agreement between the calculated and measured water temperatures was notably different (see Figure 5). The difference in the physical nature of the processes of water heating and cooling (Fedorov, Ginzbirg, 1992) was determined by the volumetric character of water heating in spring and surface cooling in autumn. This leads to discrepancies between the measured and calculated data of water temperature variations. Figure 5 shows the discrepancies in the seawater temperatures in May based on calculated and in-situ data at 5 and 20 m depths. Overall, differences were negative, which was significantly different from the autumn period. The average temperature discrepancy was −1.8 °C.

Initially, the discrepancy reached −0.4 °C, then increased to −5 °C at a depth of 5 m. Over the next three days, the difference in water temperatures rose sharply into the positive range and decreased again to −2 °C. The discrepancies for the upper 5 m in spring are understandable: significant daytime warming and nighttime cooling can generate temperature jumps registered during measurements, which are not well described by the reanalysis model.

During the first eighteen days of May, discrepancies were small at 20 m depth (up to 0.5 °C; see Figure 5), indicates better agreement between the reanalysis array and the thermistor chain measurements. This is also indirectly confirmed by the presence of the small temperature gradients for these days. In other words, the onset of spring volumetric heating is, by its nature, quasi-linear (with pulsations at 5 m), as reflected in the calculated temperatures. Over the following days, the difference in water temperature between the reanalysis data and the in-situ data gradually increased from virtually zero difference to −4 °C (see Figure 5, orange line).

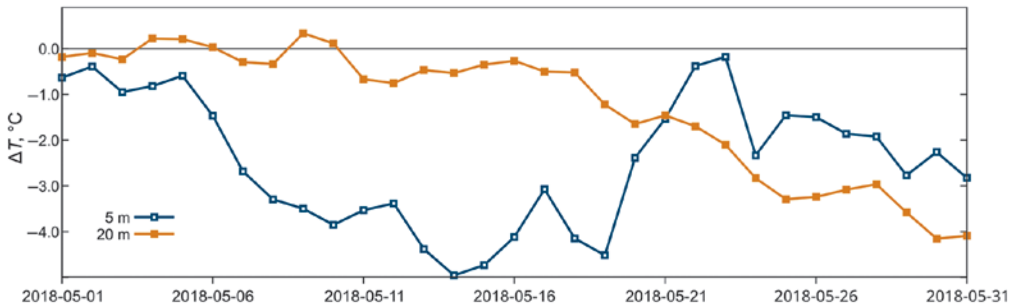

Fig. 5 – Time series of discrepancies between daily averaged measurements (according to the thermistor chain data) and the reanalysis data of water temperature in May 2018. Depths are: blue line – 5 m, orange line – 20 m

The discrepancies of water temperature between calculated and measured data suggest that the NEMO-Nordic numerical model, used to construct the Baltic Sea Physical Reanalysis data, differently describes water heating and cooling processes. On average, the reanalysis data accurately reflect the seasonal increase in water temperature at the beginning of spring. Therefore, the reanalysis model reconstructs seawater temperature variations quite well under conditions of slow changes in the cooling or heating process.

Now we present estimates of the discrepancy between reanalysis data and measured temperatures for the winter and summer of 2018. Water stratification is practically absent in winter, while the thermal structure of seawater changes in summer and high thermocline mobility is observed (Leppäranta, Myrberg, 2009). The discrepancies in water temperature in February 2018 were completely analogous to those in October 2018 (Figure 6) at a depth of 5 m, i.e., the reanalysis data were lower than the in-situ temperatures. The maximum difference reached 1.65 °C at the 5-m depth on February 22 and 23 (see Figure 6, blue line), when the difference was ≈ 1.0 °C in the last five days of October. The average temperature discrepancy was 0.63 °C.

A unique agreement between the calculated and measured temperatures at the 20-m depth (from 0.5 to −0.7 °C; Figure 5, orange line) is observed throughout the month. The temperature difference between the data was on average 0.36 °C at all depths.

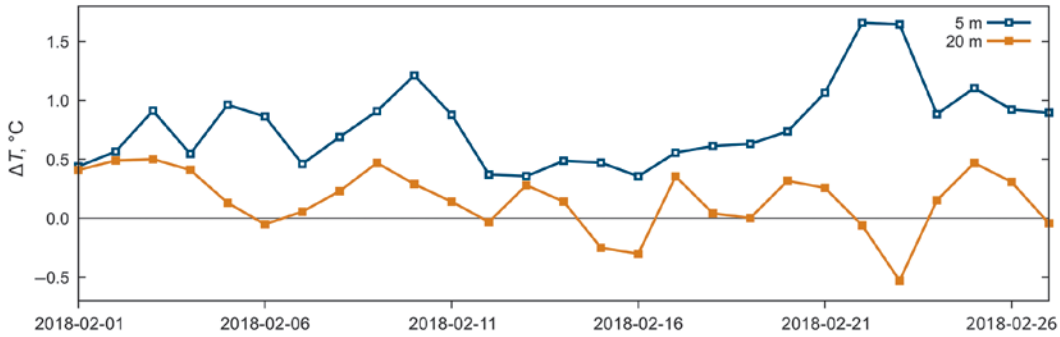

Fig. 6 – Time series of discrepancies between daily averaged measurements (according to the thermistor chain data) and the reanalysis data of water temperature in February 2018. See the caption for Figure 4 for a description of lines

Figure 7 shows the discrepancy between the calculated and in-situ water temperatures at 5 m (blue line) and 20 m (orange line) in July 2018. Similar agreements were observed between the calculated data and the daily averaged in-situ temperatures at depths of 20 m in February (Figure 6) and 5 m in July (Figure 7). Temperature discrepancies ranged from −1.0 to 0.8 °C at a depth of 5 m from July 10 to 31.

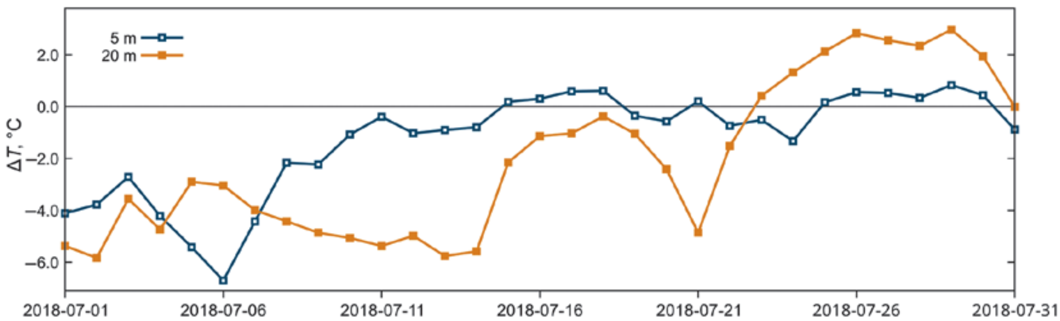

Fig. 7 – Time series of discrepancies between daily averaged measurements (according to the thermistor chain data) and the reanalysis data of water temperature in July 2018. See the caption for Figure 4 for a description of lines

During the first half of the month, the discrepancies were negative at the observed depths because the calculated data were larger than the in-situ measurements. The differences in the water temperature reached their maximum during this period (−6.7 °C at 5 m, −5.8 °C at 20 m). The average temperature discrepancy was −1.7 °C at all depths, which is similar to the discrepancy in May 2018. However, the change in the temperature discrepancy was different in July. In the second half of the month, the sign of the temperature reversed, as this was in October and February 2018. Moreover, the maximum discrepancy between depths differed by approximately a factor of 3 (0.8 °C at a depth of 5 m; 2.9 °C at a depth of 20 m). Due to volumetric water heating, the calculations of the reanalysis model do not robustly reproduce the measured water temperature at all depths, as shown in Figure 7. Additionally, the calculations respond to an increase in temperature with some delay. From July 19 to 22, a significant temperature discrepancy occurred near the bottom layer, apparently resulting from incomplete upwelling (Zhurbas et al., 2006; Kapustina, Zimin, 2023).

Thus, the analysis of intra-month temperature discrepancies shows variability for each period of the year. No uniform pattern of discrepancy between calculated and daily averaged temperatures was observed in 2018.

4. Discussion

The temperature discrepancies between calculated and measured data were significant from May to July 2018 at depths of 5, 13, and 20 meters (Figure 8). This is evident in the significant scatter of the box-whiskers and dispersion ranges of discrepancies, which had medians ranging from −1.5 to 0.1 °C at 5 m, from −4.5 to 0.7 °C at 13 m, and −3.5 to 0.5 °C at 20 m (compared to other months).

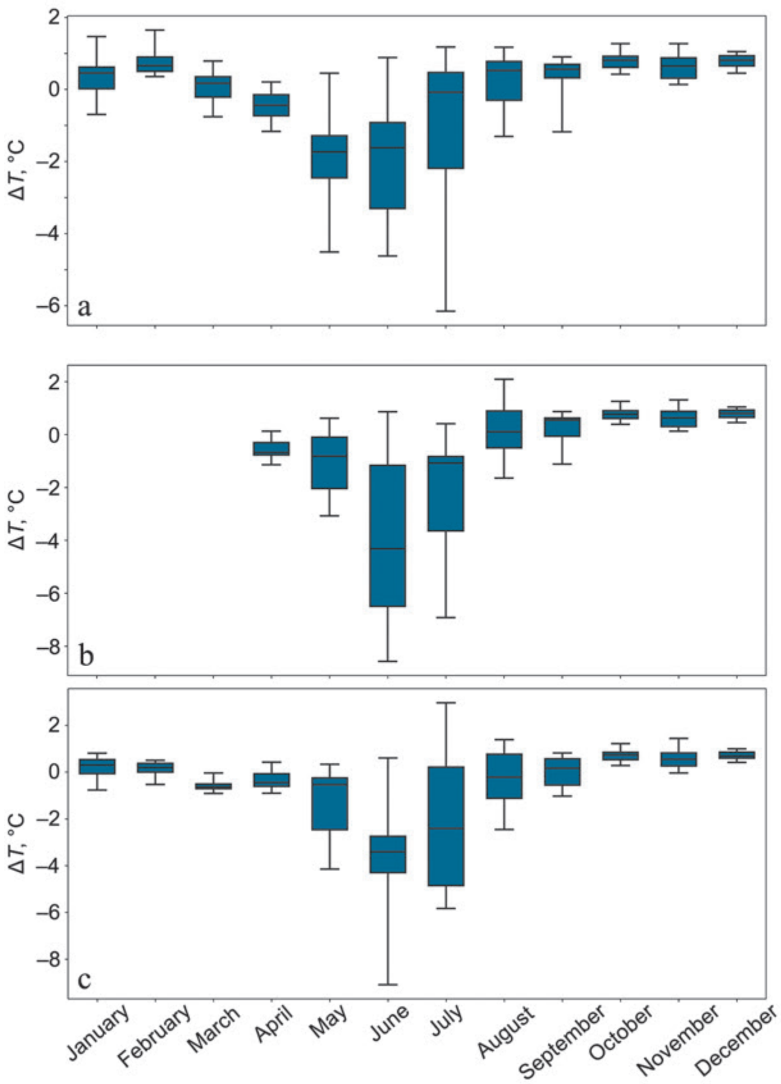

Fig. 8 – Quartile analysis of temperature discrepancies from the reanalysis array and measurements taken during 2018. The data were grouped by depths of 5 (**a**), 13 (**b**), and 20 (**c**) meters. The upper and lower ends of the whiskers correspond to the maximum and minimum values within the three-sigma criterion range. The median values are denoted inside the box

The maximum range of the whiskers was 7.5 °C in July at a depth of 5 m, 9 °C in June at a depth of 13 m, and 10 °C in June at a depth of 20 m. One possible reason for the this effect is the formation and rapid migration of the daily and seasonal thermoclines during these months (May–July). The significant temperature difference most likely arises from substantial water dynamics resulting from mesoscale eddies moving along the shore (Ginzburg et al., 2017).

From October to December 2018, when temperature stratification is practically absent, the range of water temperature discrepancy was approximately 1.0 °C, with medians almost equal at about 0.8 °C. This means that the calculated data were consistently lower than the in-situ measurements during this period at all observation depths. From January to April, the range of discrepancy increases slightly (up to 1.5 °C), but did not reach the maximum ranges from May to July.

Figure 9 (a–c) shows a histogram of the distribution of temperature discrepancy (ΔT, °C) and the number of days on which each discrepancy was observed. As shown in Figure 9, the most common temperature discrepancies are in the range of 0.5 to 0.8 °C at all three depths (5, 13, and 20 meters). The largest negative differences (about −8.5 °C) were observed at the 13 and 20-meter depths. The frequency of these events was low (up to three days). Thus, the discrepancy between temperatures of the thermistor chain and the reanalysis can be attributed to the seasonal temperature variation, the anomaly of the waters in the vicinity of the density maximum, and the predominant type of heat exchange: surface cooling in autumn and volumetric heating in spring.

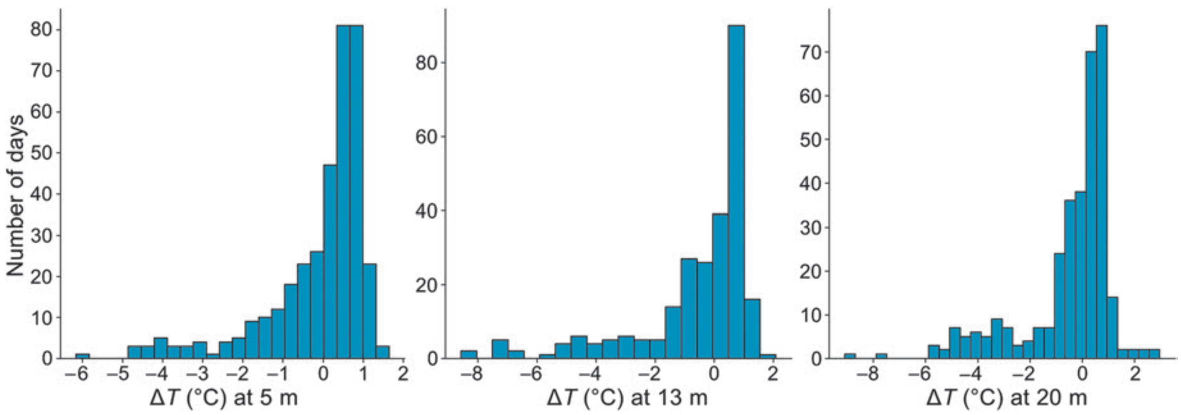

Fig. 9 – Histogram of the number of days in which the corresponding temperature difference was observed at depths of 5, 13, and 20 m in 2018

Monthly and annual comparisons revealed significant differences between the reanalysis data and the thermistor chain measurements at all depths (near-surface: 5 m; intermediate: 13 m; deep: 20 m). Note that specified difference in calculated and measured temperatures lead to corresponding increases or decreases in calculated water density (calculated using the the GSW module (TEOS–10, (IOC, SCOR and IAPSO…, 2010)). For example, at maximum temperature discrepancies, the density difference between the thermistor chain and reanalysis data was −0.2, −0.14, and −0.13 kg/m³ in October 2018, and 0.25, 0.15, and 0.025 kg/m³ in May 2018 at observation depths of 5, 13, and 20 m, respectively.

Clearly, the density change affects the results of water dynamics calculations in the Baltic Sea's coastal zone by increasing or decreasing the contribution of inertial terms in the model equations. Therefore, using reanalysis data directly to calculate regional dynamics and the thermal structure of coastal waters may result in an inaccurate representation of the observed situation.

5. Conclusions

A comparison of seawater temperature reanalysis data and daily averaged measurements from the thermistor chain in the southeastern Baltic Sea off the shore of the Curonian Spit (Kaliningrad oblast', Russia) was performed for the first time. Our study revealed significant discrepancies (from 1.26 to 6.7 °C) between the calculated water temperatures according to the BALTICSEA REANALYSIS data and the in-situ measurements, approximately 20 km from the Curonian Spit base.

The completeness of reanalysis data in time and space makes it the most convenient source for the initial and boundary conditions in coastal ocean models. It is therefore essential to evaluate the discrepancies in the temperature field between reanalysis and the instrumental measurements. The results indicate that the temperature discrepancies within each month of 2018 reached their local maxima during periods of significant changes in seawater temperature and the mobility of the diurnal or seasonal thermocline position. The largest differences between data sets of different origins were found in May and early July of 2018. The temperature differences ranged from 0.5 to 6.7 °C at all comparison depths (5, 13 and 20 m; Figure 8). The best data matches were found in the second half of July (5 m; Figure 7), throughout February (20 m; Figure 6), and the first decade of May (20 m; Figure 5), with small discrepancies of up to 1 °C. Due to the decrease in coastal water temperature in October 2018, there was a decreasing of calculated temperatures compared to the daily averaged measurements (by an average of 0.76 °C at all comparison depths). The mismatch in water density ranged from −0.2 to −0.13 kg/m³ in October and from 0.025 to 0.25 kg/m³ in May 2018, due to corresponding discrepancies between the reanalysis data and the instrumental measurements of water temperature near the Curonian Spit.

Using reanalysis data directly in models of water dynamics in the coastal sea zone near the Curonian Spit – for setting the initial water temperature state and boundary conditions – can lead to distorted results. This is especially important when modeling water dynamics under extreme weather conditions, which have been occurring more frequently in recent years. However, attention must still be paid to the known discrepancies in temperature between the Baltic Sea Reanalysis and in-situ datasets when using them in numerical models of coastal water dynamics near shores.

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НЕСООТВЕТСТВИЕ МЕЖДУ ДАННЫМИ BALTIC SEA PHYSICAL REANALYSIS И КОНТАКТНЫМИ ИЗМЕРЕНИЯМИ ТЕМПЕРАТУРЫ МОРСКОЙ ВОДЫ У БЕРЕГОВ КУРШСКОЙ КОСЫ

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В данной работе получены новые оценки несовпадения между данными Baltic Sea Physical Reanalysis и результатами натурных измерений температуры морской воды в прибрежной зоне Балтийского моря у Куршской косы (Калининградская область, Россия). Актуальность оценки несовпадения определяется необходимостью реконструкции и диагностического анализа ранее произошедших экстремальных событий в прибрежной зоне Балтийского моря. Кроме того, необходимы прогностические оценки для анализа возможного влияния экстремальных погодных условий на интенсификацию литодинамических процессов в прибрежной зоне моря с использованием численного моделирования. Количественные оценки несовпадения температуры воды были получены путем сравнения расчетных данных BALTICSEA_REANALYSISPHY_03_011 с инструментальными измерениями, которые были получены с помощью датчиков термокосы на платформе D6, расположенной примерно в 20 км от берега. Анализ выявил значительные расхождения (до 6 °C) между расчетными и измеренными значениями температуры в поверхностном (5 м), промежуточном (13 м) и глубинном (20 м) слоях прибрежных вод в 2018 году. Перепад плотности воды в октябре и мае 2018 года составил от −0,2 до −0,13 кг/м³ и от 0,025 до 0,25 кг/м³ соответственно, при соответствующих несовпадениях значений температуры. Это может привести к искажению расчетной динамики вод. Данное обстоятельство особенно значимо при численном моделировании в экстремальных погодных условиях. Полученные в работе результаты позволяют предполагать, что прямое использование данных BALTICSEA REANALYSIS при численном моделировании динамики прибрежных вод у берегов Куршской косы может привести к некорректным результатам.

Ключевые слова: in-situ измерения, термокоса, температуры морской воды, данные реанализа, несовпадение температуры, прибрежные воды, Балтийское море

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波罗的海物理再分析数据与库尔斯沙嘴沿岸海水温度原位测量数据间的偏差

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本研究对波罗的海物理再分析数据与库尔斯沙嘴（俄罗斯加里宁格勒州）沿岸波罗的海海域海水温度原位测量数据之间的偏差进行了最新评估。评估的必要性在于需重建和诊断分析波罗的海沿岸区域既往发生的极端事件，并需利用数值模拟方法对极端天气条件可能加剧沿岸带岩石动力过程的潜在影响进行预测性分析。

通过将BALTICSEA_REANALYSISPHY_03_011计算数据与仪器测量数据进行对比，获得了水温偏差的定量评估结果。仪器测量数据由安装在距岸约20公里的D6平台上的热敏链式传感器获得。分析发现，2018年近岸水域表层（5米）、中层（13米）和深层（20米）的计算温度与实测温度存在显著偏差（最高达6°C）。2018年10月和5月的水体密度偏差分别为-0.2至-0.13 kg/m³和0.025至0.25 kg/m³，并伴有相应的温度偏差。这可能影响水体动力学计算的准确性，在极端天气条件下的数值模拟中尤为显著。本研究结果表明，在数值模拟库尔斯沙嘴沿岸水域动力过程时，直接使用BALTICSEA REANALYSIS数据可能导致结果不准确。

关键词： 原位测量，热敏链，海水温度，再分析数据，温度偏差，沿岸水域，波罗的海

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