Study of Water Quality Changes in Chang Canal Over Four Years

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Abstract

This study aims to evaluate and compare the water quality of Khlong Chang (Chang Canal) over a four-year period between 2023 and 2026. The investigation involved monitoring physical and chemical parameters, including water temperature, surface water temperature, pH, turbidity, dissolved oxygen (DO), electrical conductivity (EC), and salinity. The results indicate that the water temperature ranged from 29–32 °C, while the surface temperature varied between 29–35 °C, showing slight seasonal fluctuations. The pH values were recorded between 6.98 and 8.26, characterizing the water as neutral to slightly alkaline, which remains close to standard criteria. Turbidity levels ranged from 22.25 to 28.89 NTU, with a slight upward trend observed in certain years, potentially due to suspended solids or activities within the surrounding area. Dissolved oxygen (DO) remained within a normal and suitable range of 4.52–5.73 mg/L. Notably, electrical conductivity increased from approximately 163.12 µS/cm in 2023 to 250.2 µS/cm in 2026, reflecting an increase in minerals or dissolved substances in the water. Salinity remained between 100 and 115.65 ppm, classified within freshwater levels. In summary, the study found that the water quality of Khlong Chang over the four-year period was in good to moderate condition. However, the rising trends in electrical conductivity and turbidity may be associated with human activities and nearby industrial factories. Therefore, continuous monitoring and surveillance are recommended to prevent long-term environmental impacts.

Keyword: Water quality assessment**,** Khlong Chang

Introduction

Rivers and freshwater resources are fundamental natural ecosystems essential to human existence, serving as primary sources for domestic consumption, agriculture, and food production. Furthermore, these ecosystems play a vital role in ecological processes, including nutrient cycling, energy transfer, and the maintenance of environmental equilibrium. However, global freshwater resources are currently facing severe environmental crises driven by anthropogenic pollution, changes in land use, and the impacts of climate change, all of which contribute to the continuous degradation of water quality.

Khlong Chang, located in Trang Province, is a significant waterway that sustains the livelihoods of local communities by supporting agricultural areas and providing water for daily use. Beyond its socioeconomic utility, Khlong Chang is a critical natural resource that helps maintain the ecological balance of the surrounding region. Nevertheless, local observations and preliminary surveys indicate environmental changes within the canal, such as increased turbidity and alterations in watercolor and odor. These observations reflect fluctuations in water quality that may adversely affect the long-term utilization of this water resource.

Consequently, the research team recognized the importance of studying the changes in the water quality of Khlong Chang. This study involves the measurement of key physical and chemical parameters, including water temperature, surface temperature, dissolved oxygen (DO), pH, electrical conductivity, salinity, and turbidity. By focusing on the comparison of water quality data over time, this research aims to analyze trends and variations in water quality. The findings of this study will provide a comprehensive understanding of the environmental status of Khlong Chang and serve as foundational data for the sustainable planning, conservation, and management of freshwater resources in the future.

Research question

1. How do the changes in water quality over the four-year period reflect environmental trends and influencing factors?
2. To what extent do the physical and chemical water quality parameters differ, and what are the implications of these variations?

Hypothesis

1. The temporal changes in water quality over the four-year period reflect significant shifts in the environmental factors within the study area.
2. There are distinct differences in the physical and chemical water quality parameters across the various sampling sites within the water source.

Material and Methods

1. Material and Equipment

1. Water sampling bottles
2. pH meter
3. Dissolved oxygen meter
4. Thermometer
5. Turbidity Tube
6. Conductivity meter
7. Laser Themometer
8. Salinity Tester

2. Method

2.1. Study sites

This research was conducted at Khlong Chang, Trang Province, Thailand. The study was carried out at five sampling sites. Site 1 was located at the water gate, at latitude 7.55225° and longitude 99.5585°. Site 2 was located at the sand dune area, at latitude 7.5551° and longitude 99. 5578°. Site 3 was located at the fishing spot, at latitude 7.5551° and longitude 99.557°. Site 4 was located near the bridge, latitude 7.5551° and longitude 99.5581°. Site 5 was located at the pier area, at latitude 7.5539° and longitude 99.5572°.

Figure 1: Study area at Khlong Chang, Trang Province, Thailand

2.2. Procedures and Data Collection

1. Water Data Collection

Water quality measurements were conducted following the methods of the GLOBE Program. The measured water quality parameters included salinity, surface water temperature, water temperature, pH, water turbidity, electrical conductivity, and dissolved oxygen. The details of the procedures are as follows.

1.Do the GLOBE Land Cover by using GLOBE Observer Application.

2.Study the quality of water according to various indices, including salinity, by using a salinity meter. Measure the surface temperature and the water temperature by using a thermometer and Laser meter. Measure conductivity by using a conductivity meter. Measure pH with a pH meter, measure transparency with a turbidity tube, and measure dissolved oxygen in water by using a DO meter.

3.Collect 3 data repeatedly and calculate the water quality average. Then send the data to GLOBE Data Entry.

2. Data Collection

Data collection in this study was conducted as a long-term continuous investigation during the period 2023–2026 to examine long-term changes in water quality. The study area was Khlong Chang, Trang Province, Thailand. The collected data consisted of water quality measurements, which were carried out regularly and continuously to ensure data reliability and to enable appropriate analysis of trends in water quality changes over time.

3. Data Analysis

1. Water quality was analyzed using descriptive statistics, including the mean and standard deviation.

2. Water quality was compared using a one-sample t-test.

3. Salinity, surface water temperature, water temperature, pH, water turbidity, electrical conductivity, and dissolved oxygen were compared with data from previous years (2023–2026).

Results

1. Analysis of Average Water Temperature value

The graph illustrates changes in water temperature from 2023 to 2026 in comparison with the standard value, reflecting water conditions during different sampling periods. Overall, water temperature shows slight fluctuations but remains generally close to the standard range, indicating no extreme variation throughout the study period. On a yearly basis, the average temperature in 2023 was slightly lower than the standard (≈29.4 °C), while 2024 recorded the highest value (≈32 °C). In contrast, 2025 and 2026 exhibited temperatures closest to the standard, at approximately 30.82 °C and 30.12 °C, respectively. In summary, 2024 showed the highest water temperature, whereas 2025–2026 represented more stable conditions and were most consistent with the standard value.

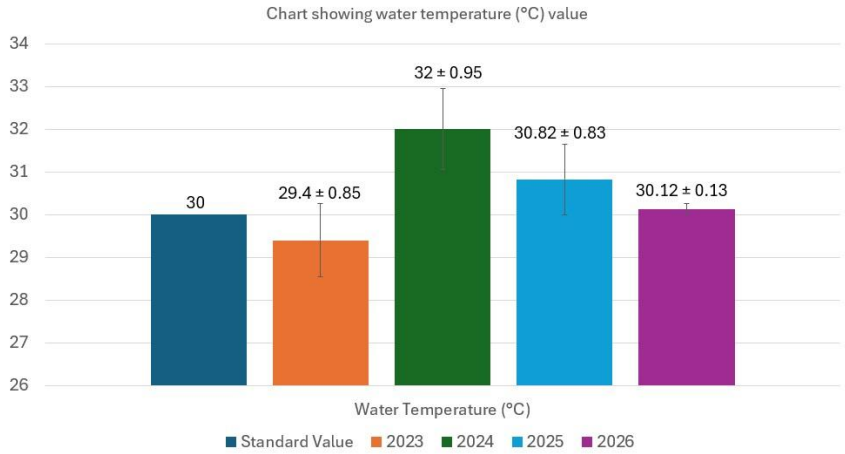

Figure 2: Show a bar chart of water temperature value

2. Analysis of Average Water Surface Temperature value

The graph illustrates changes in water surface temperature from 2023 to 2026 in comparison with the standard value, reflecting surface water conditions during different sampling periods.Overall, water surface temperature shows greater fluctuation than general water temperature, with some periods clearly exceeding the standard. This pattern indicates the influence of climatic conditions and heat accumulation at the water surface.On a yearly basis, 2023 recorded a value close to the standard (≈30.24 °C), while 2024 showed a slight decrease (≈29.14 °C). In contrast, 2025 exhibited the highest temperature (≈35.28 °C), indicating an unusually warm period. In 2026, the temperature decreased again and returned to a level close to the standard (≈29.4 °C).In summary, 2025 represented the year with the highest surface water temperature, whereas 2023 and 2026 showed values closest to the standard, highlighting temporal variations in surface water temperature influenced by environmental conditions.

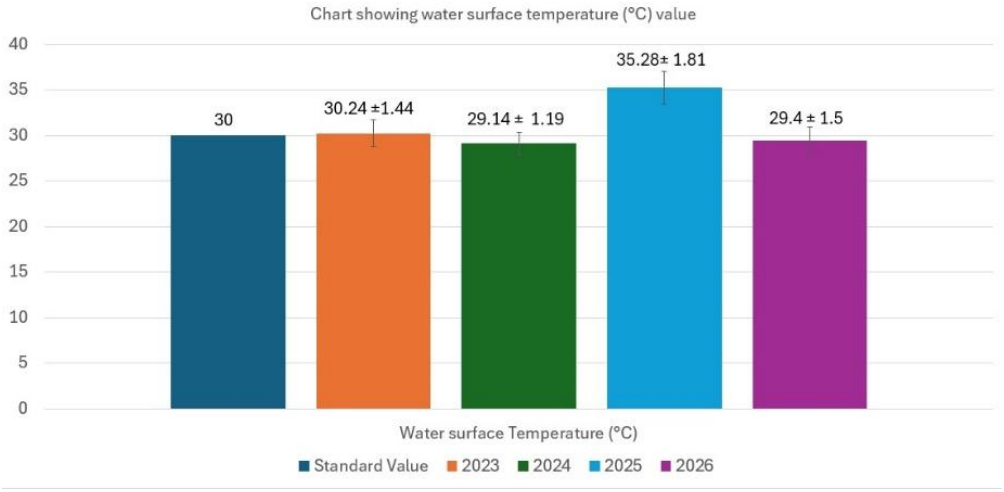

Figure 3: Show a bar chart of water surface value

3. Analysis of Average pH value

The graph illustrates changes in pH values from 2023 to 2026 compared with the standard value. Overall, pH levels remained close to neutral, with slight fluctuations across the study period. In 2023, the pH was slightly higher than the standard at approximately 7.38, while in 2024 it decreased to around 7.00. In 2025, the pH remained stable at about 6.98. The highest value was recorded in 2026 at approximately 8.26, indicating slightly more alkaline conditions. Overall, pH values remained within an acceptable range, with 2026 showing the highest deviation from the standard.

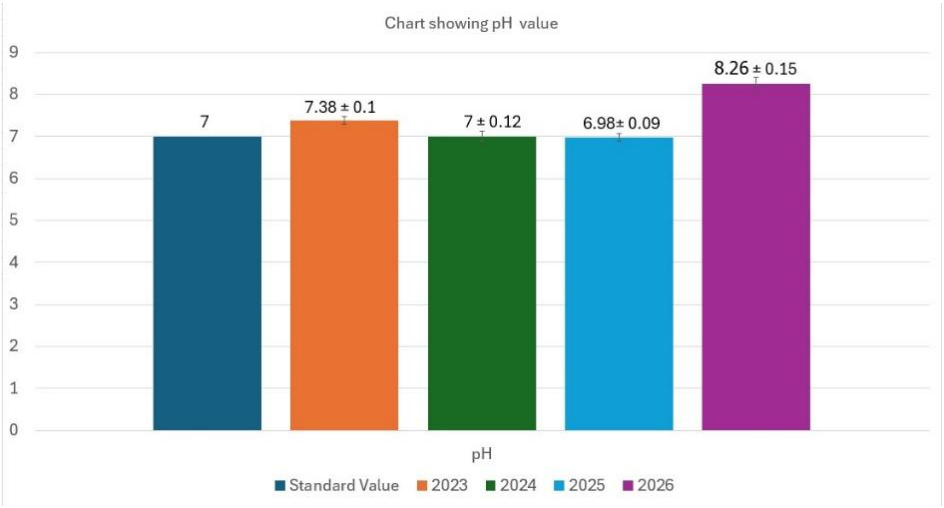

Figure 4: Show a bar chart of pH value

4. Analysis of Average Turbidity value

The graph illustrates changes in turbidity from 2023 to 2026 compared with the standard value. Overall, turbidity levels in all years were lower than the standard, indicating relatively clear water conditions throughout the study period. In 2023, turbidity was the lowest at approximately 22.25 cm, followed by an increase in 2024 to about 27.7 cm. In 2025, the value slightly decreased to 25.5 cm, while in 2026 it increased again to 28.89 cm, the highest among the study years. Overall, turbidity showed moderate fluctuations but remained consistently below the standard value, suggesting stable water clarity over time.

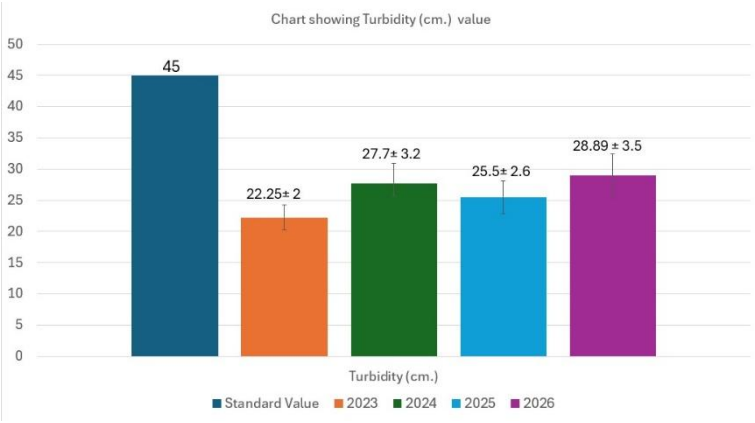

Figure 5: Show a bar chart of Turbidity value

5. Analysis of Average Dissolved Oxygen value

The graph shows changes in dissolved oxygen (DO) levels from 2023 to 2026 compared with the standard value. Overall, DO levels gradually decreased over the study period and were slightly lower than the standard in all years. In 2023, the DO value was about 5.73 mg/L, followed by a decrease to 5.3 mg/L in 2024. The lowest values were observed in 2025 and 2026, at approximately 4.96 mg/L and 4.52 mg/L, respectively. Overall, the declining trend indicates a gradual reduction in dissolved oxygen, which may reflect changes in water quality and environmental conditions over time.

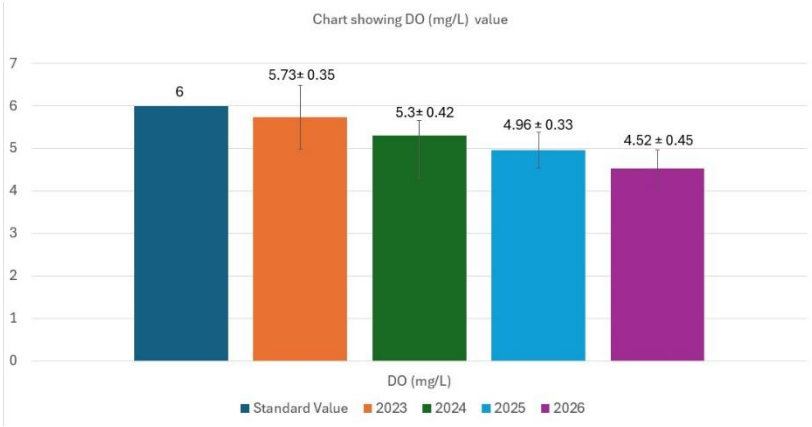

Figure 6: Show a bar chart of Dissolved Oxygen value

6. Analysis of Average Salinity value

The graph shows changes in salinity from 2023 to 2026 compared with the standard value. Overall, salinity showed a slight increasing trend over time and was mostly higher than the standard. In 2023, salinity was about 108.44 ppm, while in 2024 it was close to the standard at 100 ppm. The highest value was observed in 2025 at approximately 115.65 ppm, before slightly decreasing in 2026 to about 111.82 ppm. Overall, the results indicate a gradual increase in salinity, which may be influenced by environmental factors such as evaporation and seawater intrusion.

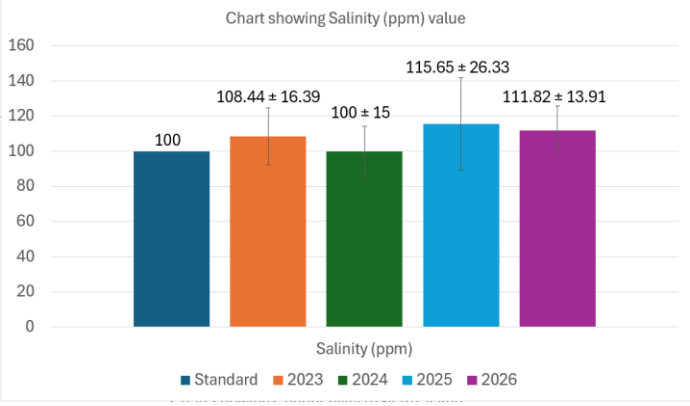

Figure 7: Show a bar chart of Salinity value

7. Analysis of Average Conductivity value

The graph shows changes in electrical conductivity from 2023 to 2026 compared with the standard value. Overall, conductivity increased gradually over the study period but remained lower than the standard. In 2023, the conductivity was about 163.12 µS/cm, then increased to 200 µS/cm in 2024 and 202.66 µS/cm in 2025. The highest value was recorded in 2026 at approximately 250.2 µS/cm. Overall, the increasing trend suggests a gradual rise in dissolved ions in the water, although the values were still within an acceptable range.

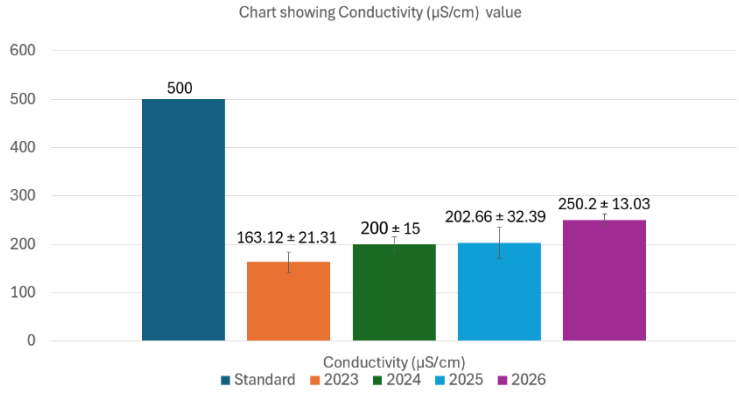

Figure 8: Show a bar chart of Conductivity value

Conclusion and Discussion

Based on a retrospective survey and analysis of water quality data collected from Khlong Chang, Trang Province, during the period 2023–2026, the results indicated a declining trend in water quality. Increases in turbidity, electrical conductivity, and salinity were observed, while dissolved oxygen levels decreased. These changes were associated with the influences of climatic conditions, monsoon winds, and human activities in the study area.

If this situation continues without appropriate management measures, further deterioration of water quality in Khlong Chang may occur, potentially causing long-term impacts on the freshwater ecosystem. Field observations revealed clear signs of changes in water quality, leading to recommendations for continuous water quality monitoring, alongside the control of pollution sources and the promotion of community awareness. These measures are essential to support the conservation and sustainable use of water resources.

The results of the water quality study conducted at Khlong Chang, Trang Province, from 2023 to 2026, revealed continuous fluctuations in both physical and chemical parameters. Notably, turbidity, electrical conductivity (EC), and salinity exhibited upward trends, whereas **dissolved oxygen (DO) levels** showed a progressive decline. These shifts indicate a gradual deterioration in water quality, which may adversely impact the equilibrium of the freshwater ecosystem within the study area.

Khlong Chang is a surface water body influenced by both natural phenomena and anthropogenic activities, particularly surface runoff and sediment transport. Previous research has established that water turbidity is directly correlated with the concentration of sediment and suspended solids, which typically surge during periods of heavy rainfall and monsoon-driven winds (ThaiEnvi, 2023; SUPMEA, 2024). This aligns with the findings of the present study, which recorded a consistent increase in turbidity values.

The rise in electrical conductivity and salinity suggests an accumulation of ions and dissolved substances. This may be attributed to saltwater intrusion during the dry season, increased evaporation rates driven by rising temperatures, and the discharge of wastewater from local communities and land-use activities. These observations are consistent with existing literature on Thai watershed areas, which reports seasonal spikes in EC and salinity in coastal regions (Royal Irrigation Department, 2013; Thammasat University, 2023).

Furthermore, the upward trend in water temperature has reduced the water's oxygen-carrying capacity. When coupled with elevated turbidity and organic matter, these conditions accelerate the decline of dissolved oxygen. This is supported by studies indicating that high temperatures, combined with organic loading, stimulate microbial decomposition and increase oxygen consumption in aquatic environments (Tandfonline, 2017; Thai Meteorological Department, 2021).

In conclusion, the water quality trends in Khlong Chang reflect the synergistic influences of climatic conditions, monsoonal patterns, and human activities. Without appropriate management interventions, these persistent conditions may threaten water resource utilization and the long-term sustainability of the aquatic ecosystem. Therefore, continuous monitoring and robust water quality management strategies are essential to mitigate these impacts and ensure the sustainable use of this vital resource.

Acknowledgements

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Citations

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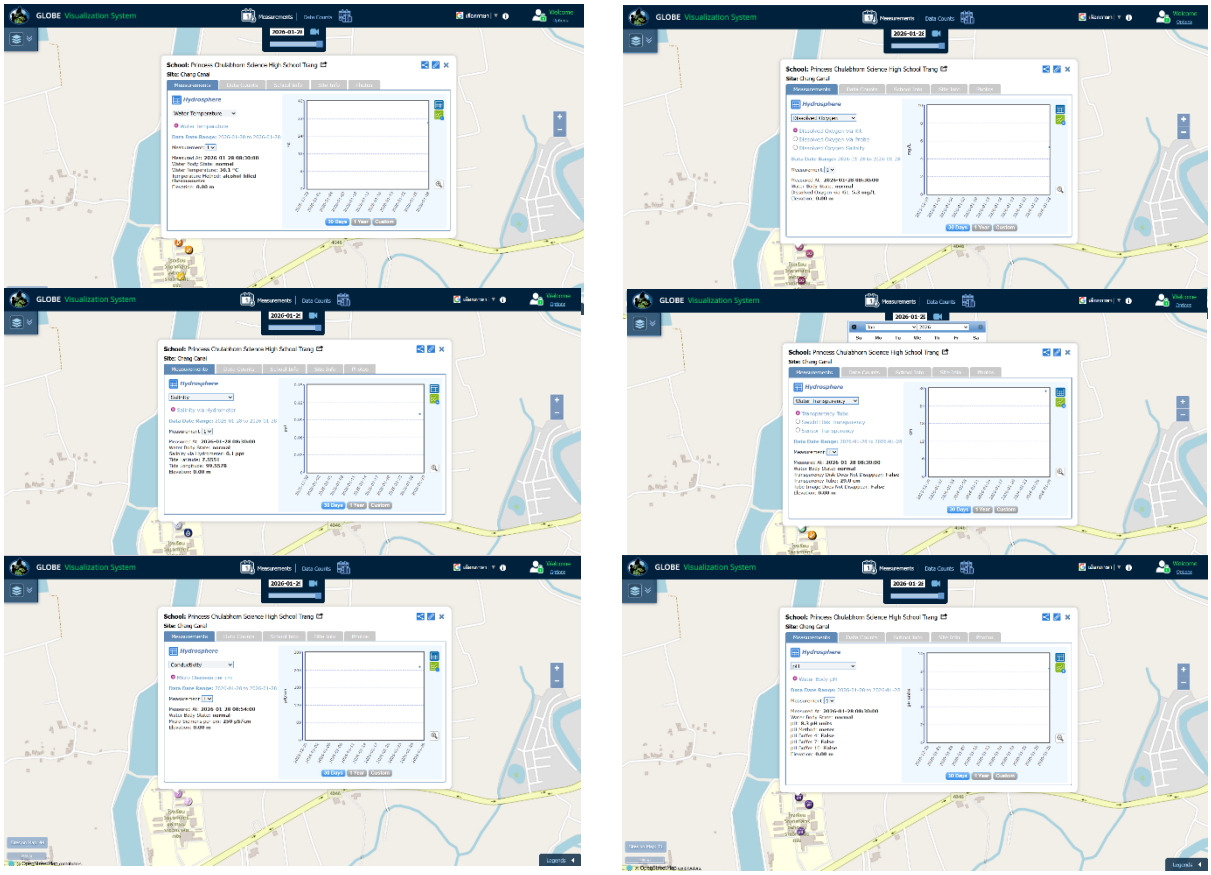
GLOBE's databases



Optional Badges

1. **I am a Collaborator**

Reasoning: The research was conducted through systematic teamwork, supported by academic advisors and institutional partnerships.

Description: The success of this research project stems from a highly structured collaborative process among team members, with clearly defined roles ranging from field survey planning and data collection to statistical analysis. Beyond internal teamwork, the researchers engaged in significant academic collaboration with faculty advisors, who provided technical expertise and specialized instrumentation. Furthermore, the partnership with Princess Chulabhorn Science High School Trang provided the necessary institutional infrastructure and environmental context for the study. This multi-level collaboration enhanced the precision of data analysis and ensured that the interpretations met rigorous academic standards.

2. I am a Problem Solver

Reasoning: Beyond data collection, the study provides strategic recommendations for sustainable water resource management to mitigate long-term environmental degradation.

Description: This research utilizes empirical data to identify and analyze the degradation of water quality in Chang Canal. By evaluating the upward trends in turbidity and electrical conductivity, the researchers have established a scientific baseline to propose systematic monitoring and management strategies. These recommendations encompass point-source pollution control and the promotion of environmental literacy within the local community. Such initiatives demonstrate the application of the scientific method to address localized environmental challenges, aiming to preserve ecological equilibrium and the well-being of communities that depend on this water source for domestic consumption and agriculture.

3. I am an Earth System Scientist

Reasoning: The research analyzes the correlations between physical and chemical water parameters, interlinking natural processes and anthropogenic activities within the Earth system.

Description: This research integrates Earth System Science (ESS) principles to evaluate the environmental dynamics of Chang Canal. By adhering to GLOBE Protocols, the study monitors diverse parameters, including water temperature, pH levels, electrical conductivity (EC), and dissolved oxygen (DO). The findings illustrate the intricate interconnectedness between the Hydrosphere and the Atmosphere, specifically analyzing how climatic variations and monsoonal patterns influence water quality fluctuations. Furthermore, the study examines the impact of the Anthrosphere, identifying how local socio-economic activities and communal land use contribute to the significant accumulation of suspended solids and dissolved substances in the aquatic ecosystem.