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NEXT Black Sea Basin

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Current Advancements in the Real-Time Monitoring of the Black Sea Environment

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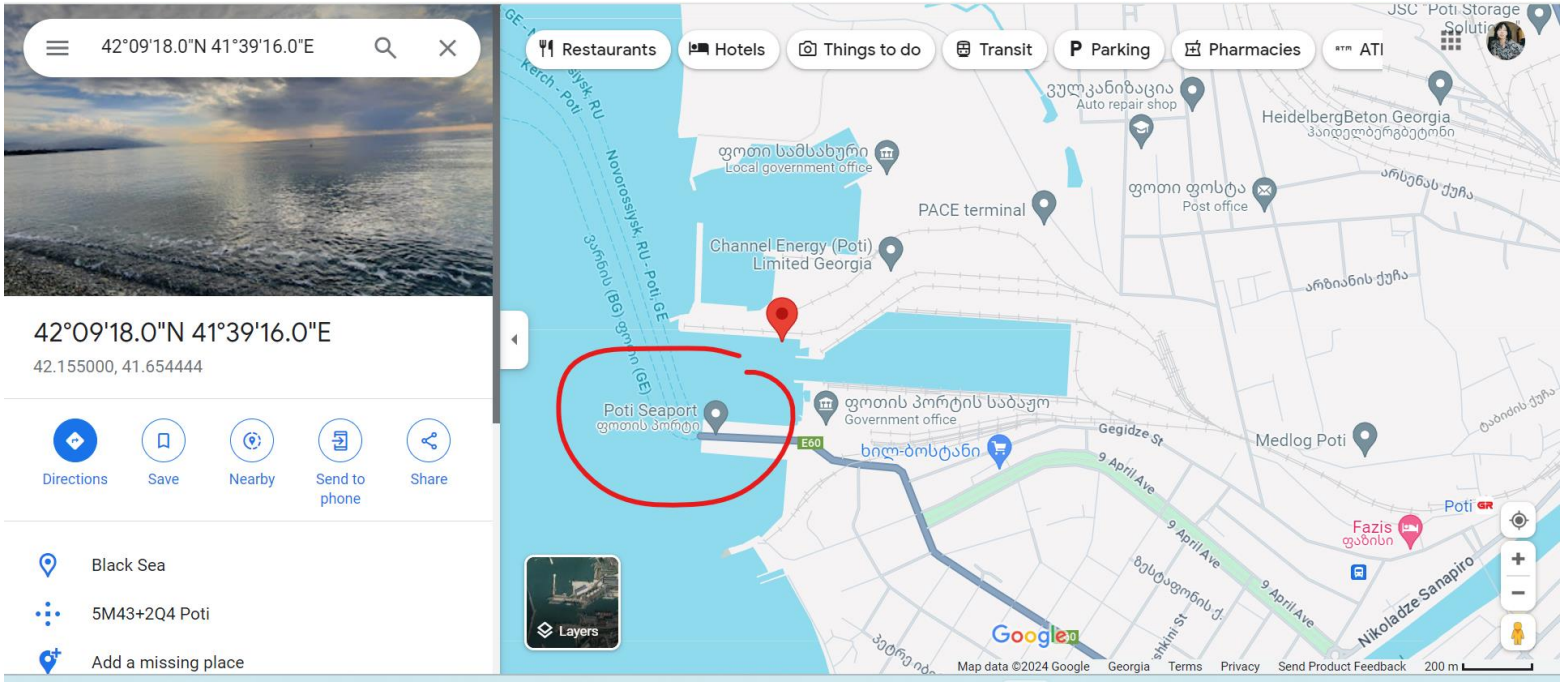
Identify an area of interest for the physico-chemical buoy installation

The **Poti Sea Port** is a major seaport and harbor off the eastern Black Sea coast at the mouth of the Rioni River in Poti. Location at 42°9′18″N 41°39′16″E

The Poti seaport is a cross point of the Trans-Caucasian Corridor, a multinational project which connects the Romanian port of Constanta and Bulgarian port Varna with the landlocked countries of the Caspian region and Central Asia.

Identify an area of interest for the physico-chemical buoy installation



Buoy deployment-29 April,2025

Buoy deployment

Temperature; conductivity electrode (0-500 mS/cm) (salinity) turbidity analyzer(no wiper)(0~10/100/1,000/4,000 NTU),
chlorophyll a analyzer(no wiper)(0~500 mg/L)

The sensors were cleaned

The composition of seawater

Element	Concentration / μg L^{-1} ± 95% confidence limit
Arsenic	1.65 ± 0.19
Cadmium	0.029 ± 0.004
Chromium	0.175 ± 0.010
Cobalt	0.004 ± 0.001
Copper	0.109 ± 0.011
Iron	0.224 ± 0.034
Lead	0.039 ± 0.006
Manganese	0.022 ± 0.007
Molybdenum[b]	11.5 ± 1.9
Nickel	0.257 ± 0.027
Selenium (IV)	0.024 ± 0.004
Uranium	3.00 ± 0.15
Zinc	0.178 ± 0.025

The composition of seawater

	Concentration / μg L^{-1}	
	Minimum	Maximum
Chloride	25	40 100
Nitrate	8.6	354
Sulphate	10.6	4020
Bromide	0.8	49.4
Phosphate	1.8	49
Fluoride	0.1	0.2
Sodium	15	17 050
Potassium	3.1	740
Magnesium	2.7	1450
Calcium	12.6	1010
Ammonium	2.4	46.5

Buoy deployment

Temperature; conductivity electrode (0-500 mS/cm) (salinity) **turbidity analyzer**(no wiper)(0~10/100/1,000/4,000 NTU),
chlorophyll a analyzer(no wiper)(0~500 mg/L)

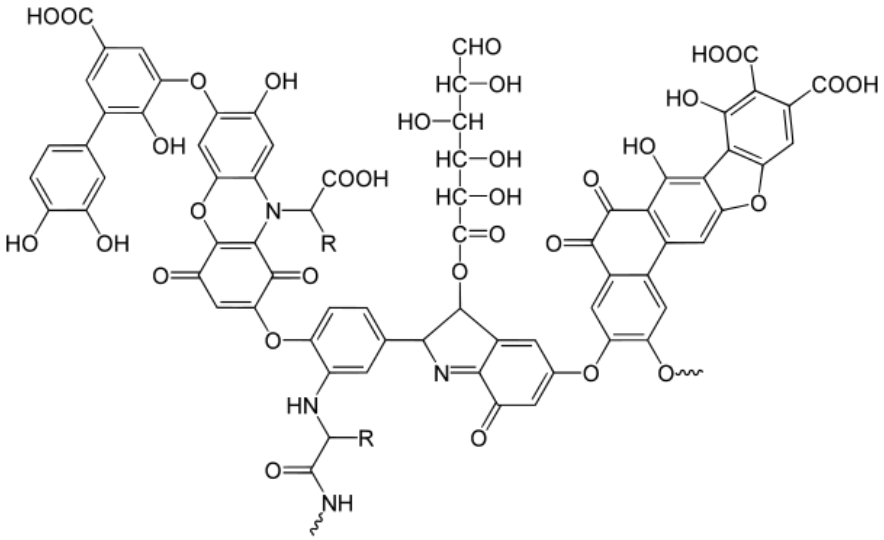
Turbid water are a quite frequent phenomenon in coastal waters, in particular in shallow soft bottom coasts and at the mouths of rivers and estuaries.

Turbidity is caused by small particles in the water, ranging from half a micron to several millimeters, some of mineral composition, such as clay minerals, and others of organic origin.

All these particles can be summarised under the term **Suspended Particulate Matter (SPM).**

Chlorophyll-One of the indicators of water pollution

Humic substances (HS) mainly **humic acids constitute the major fraction of natural organic matter in water supplies**. They play an important role in the formation of harmful disinfection by products.



The main component is of fulvic acid, dissolves well in sea water and is active throughout the pH range.

CH3Sn; CH3Hg; CH3Pb; CH3Cd-CH3Met;

On-site Researches

Temperature; **conductivity electrode** (0-500 mS/cm) (salinity) turbidity analyzer(no wiper)(0~10/100/1,000/4,000 NTU), chlorophyll a analyzer(no wiper)(0~500 mg/L)

- **Indicates salinity and dissolved solids** – Higher conductivity means more ions like sodium, chloride, calcium, etc. In seawater, conductivity is naturally high.
- **Water quality indicator** – Sudden changes can signal pollution (e.g., industrial discharge, wastewater, agricultural runoff).
- **Helps understand chemical composition** – It reflects the overall ionic content, which is crucial for analyzing water chemistry.
- **Affects aquatic life** – Organisms are adapted to certain conductivity ranges; large shifts can stress or harm them.
- **Useful for monitoring trends** – In your kind of dataset, conductivity helps track seasonal or environmental changes in water.

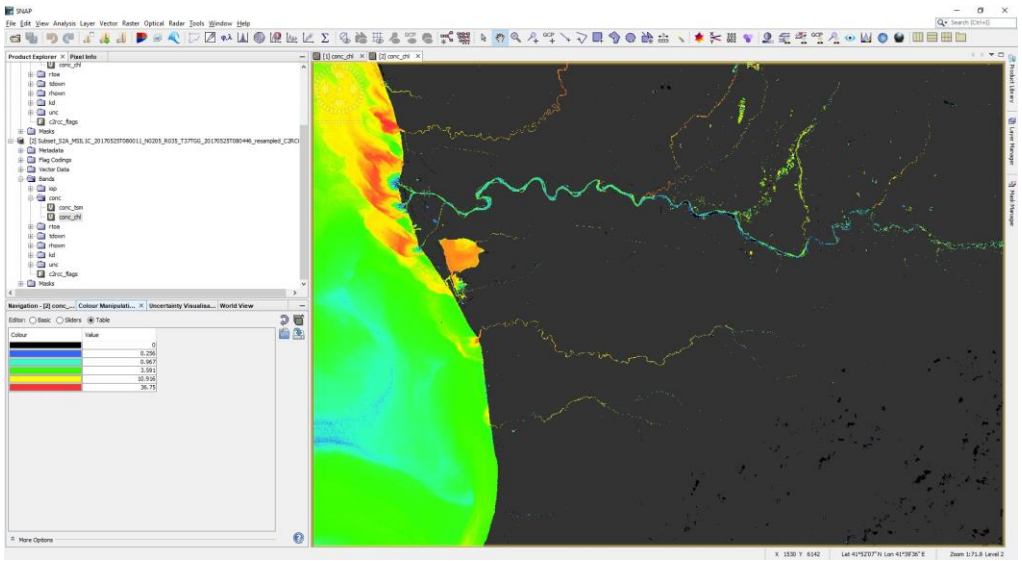
Chlorophyll Measurement with Satellite remote-sensing

Sentinel 2 (10m)

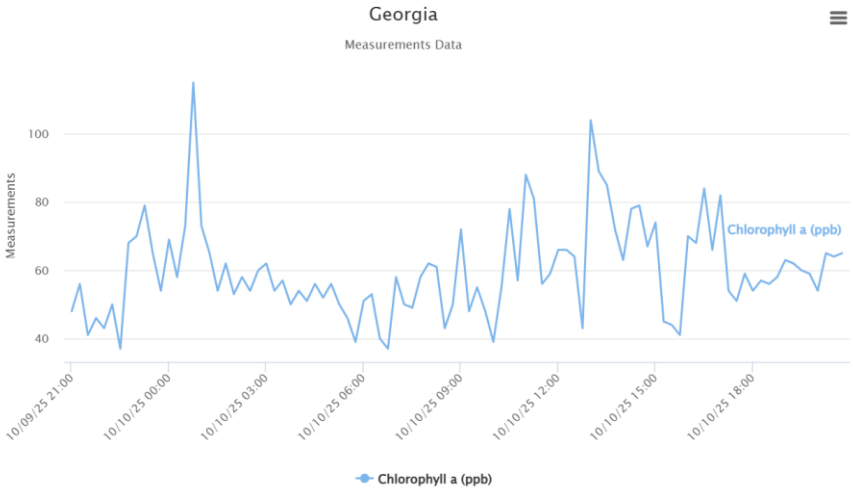
2015 - Today

Sentinel 3 (300m)

2016 - Today



Chlorophyll



Chlorophyll a (ppb)

08/01/25 23:00 - 10/08/25 23:45

Chlorophyll a (ppb)

Y Axis Values: 9 10684 **Submit**

Minimum value = **9** | Maximum value = **10684** | Average value = **76.74**

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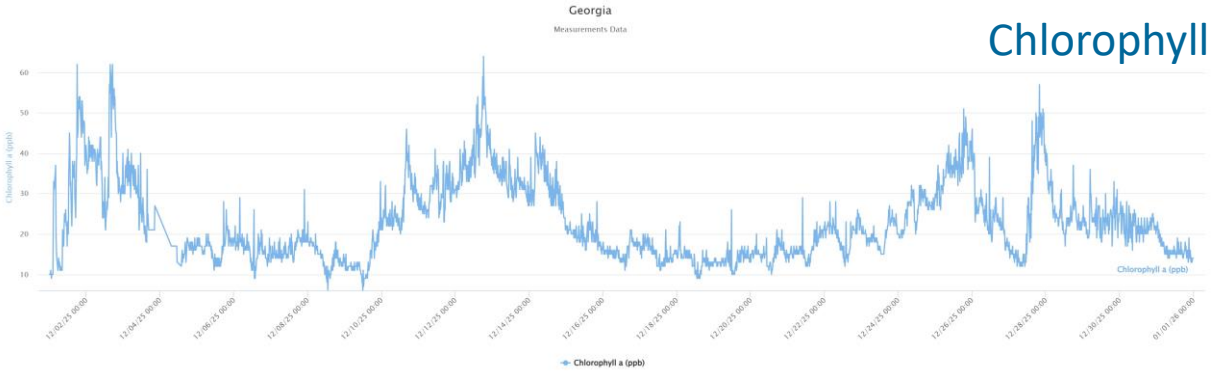
Chlorophyll



At the **beginning of the period**, chlorophyll concentrations are **highly variable**, with **sharp peaks reaching 50–60** . This indicates **intense phytoplankton blooms** or rapid growth events.

A **second major increase** occurs around **Dec 10–14**, where chlorophyll rises again to **40–60**, indicating another **bloom event**.
After this peak, there is a **gradual decline** toward **moderate levels (15–25)**, showing a post-bloom stabilization phase.

In the **last week of December**, chlorophyll again shows **increased variability**, with peaks up to **45–50** , followed by a final **decreasing trend** toward the end of the month.

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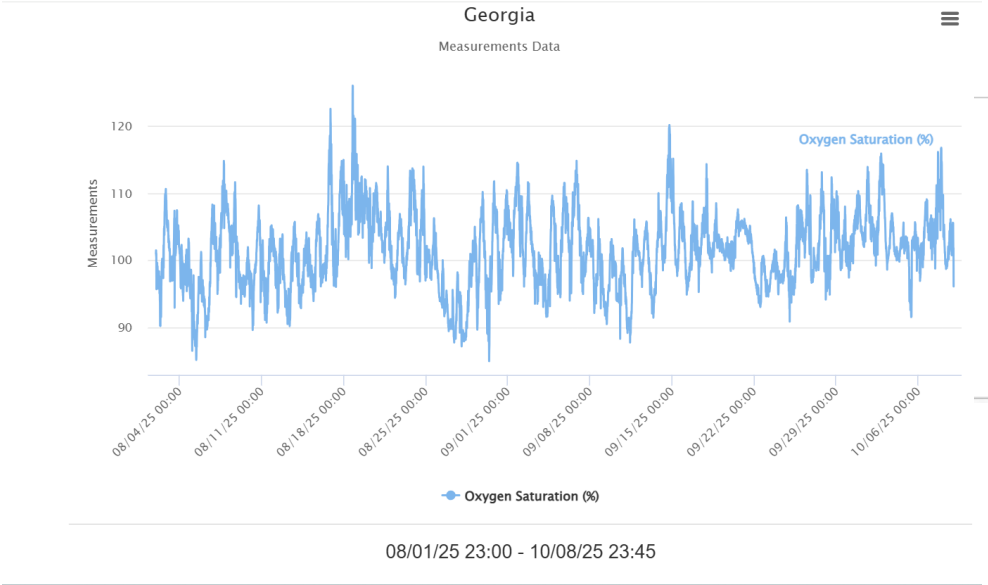
Oxygen Saturation



Oxygen Saturation (%)

08/01/25 23:00 - 10/08/25 23:45

Oxygen Saturation (%)

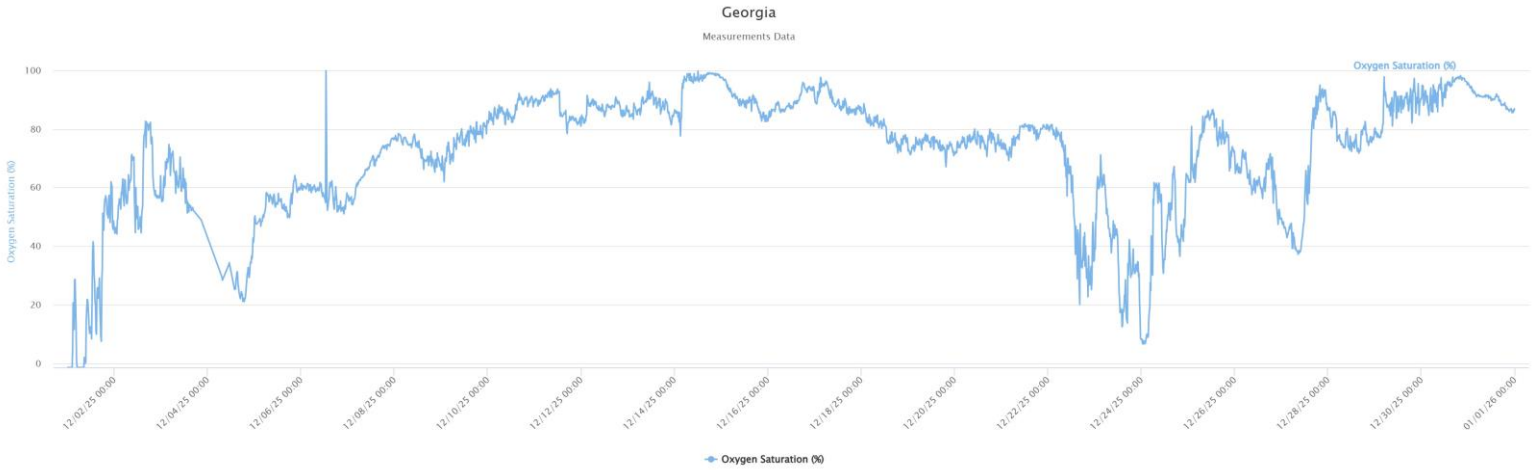
Y Axis Values: 84.94 126.04 Submit

Minimum value = **84.94** | Maximum value = **126.04** | Average value = **101.49**

Calculation after Winkler Titration

Average Value 98%

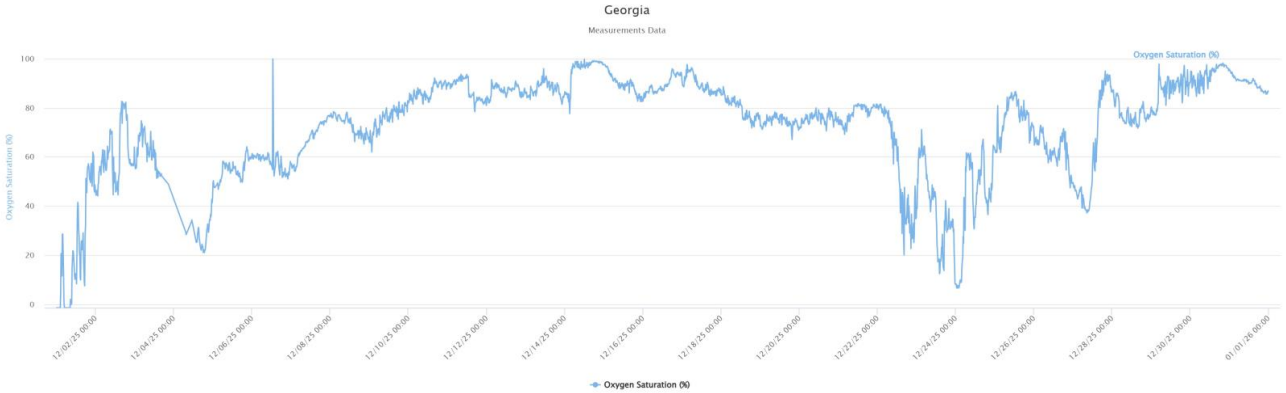
Oxygen Saturation-December



Oxygen saturation exhibits **high variability throughout the month**.

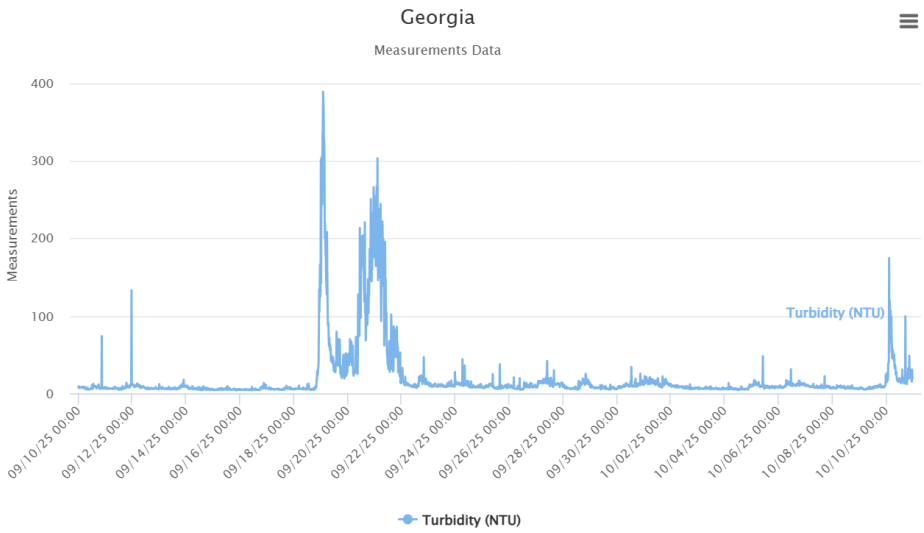
- Early December: **low and unstable values (~60%)**
- Mid-December: **increase to ~80–100% (more stable)**
- Late December: **sharp drops (down to ~10–30%)**, followed by recovery to ~90–100%

Oxygen Saturation-December



- The sharp drops (especially around Dec 23–25) indicate **oxygen depletion events**, possibly linked to:
- increased turbidity
- organic matter decomposition
- The increase in mid-December suggests **enhanced mixing and aeration**.

Turbidity



Turbidity (NTU)

08/01/25 23:00 - 10/08/25 23:45

Turbidity (NTU)

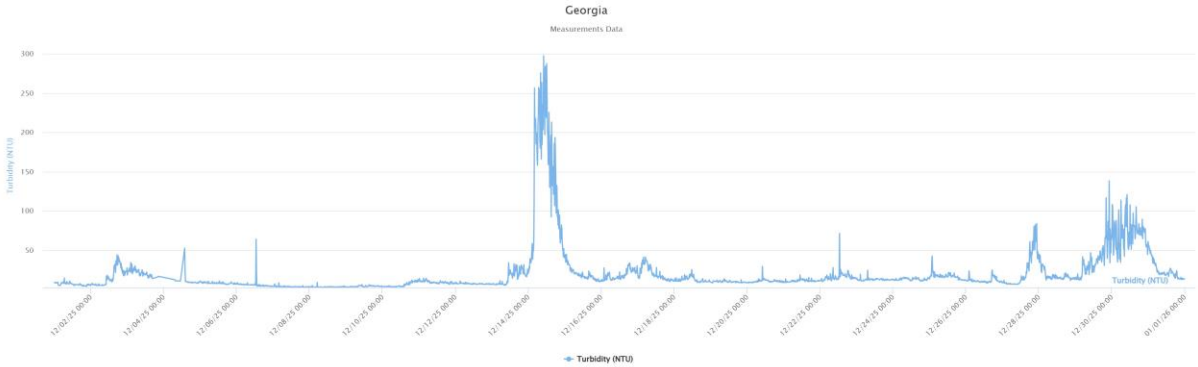
Y Axis Values: 3.16 5395.87 Submit

Minimum value = **3.16** | Maximum value = **5395.87** | Average value = **13.39**

Pasco Sensor

Average Value 14.15

Turbidity

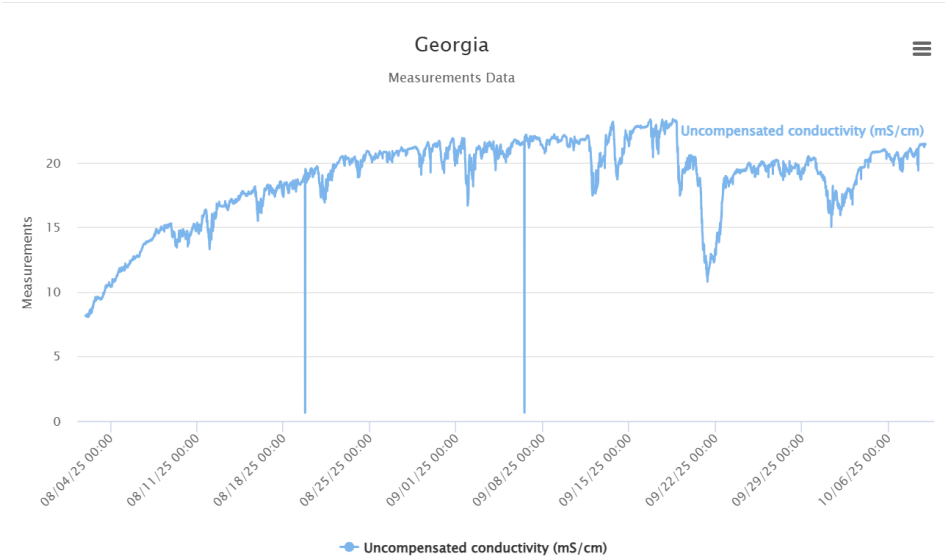


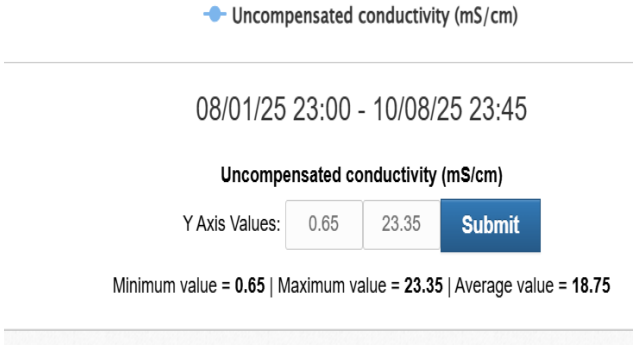
- Mid-December: **(~250–300 NTU around Dec 14–15)**
- Late December: **(50–140 NTU)**
- Early December: small fluctuations (mostly <50 NTU)

The **mid-December peak** is a major event, likely caused by:

- storm activity
- river inflow carrying sediments
- resuspension of bottom sediments

Conductivity

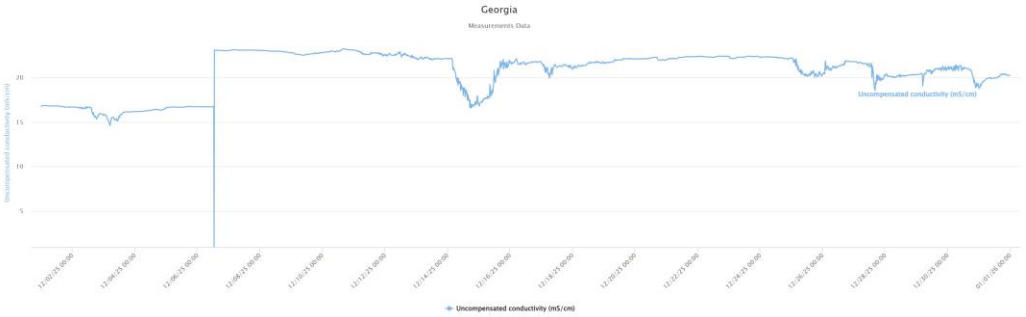




Pasco Sensor

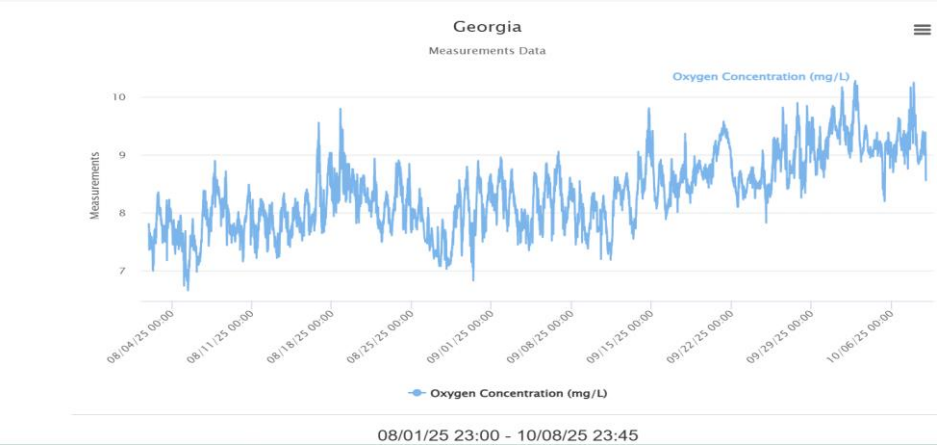
Average Value 16.44

Conductivity



Conductivity **increase in early December**, rising from ~16–17 mS/cm to ~22–23 mS/cm. After this, values remain relatively stable with **moderate short-term fluctuations**.
A **notable drop occurs around mid-December (≈ Dec 14–15)**, followed by a quick recovery. Smaller fluctuations are observed toward the end of the month.

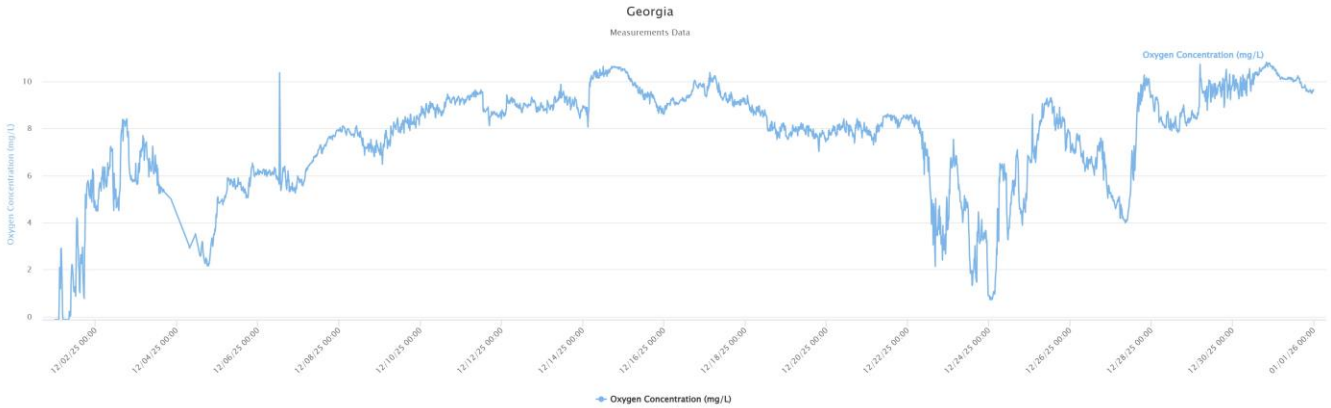
Oxygen Concentration



Winkler Titration

Average Value 8.10

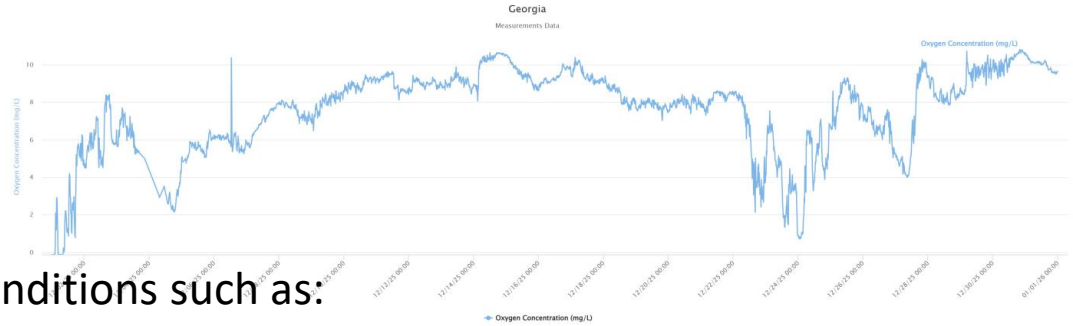
Oxygen Concentration



At the **beginning of the period**, oxygen levels are relatively low and unstable (close to 0–5 mg/L), followed by a **rapid increase** reaching approximately 7–8 mg/L. This suggests an initial disturbance or mixing event in the water.

From the **middle of the month (around Dec 10–18)**, oxygen concentration becomes **more stable and elevated**, generally ranging between **8–10 mg/L**, with peaks exceeding 10 mg/L.

Oxygen Concentration



This period likely reflects improved conditions such as:

- enhanced water mixing,
- lower biological oxygen demand,
- or increased photosynthetic activity.

around **Dec 23–25**, there is a **sharp decline**, with oxygen dropping again to very low values (~1–3 mg/L). This is a critical feature of the graph and may indicate:

- organic matter decomposition,
- stratification breakdown,
- or reduced photosynthesis.

Towards the **end of the month**, oxygen levels recover rapidly and stabilize again at **high concentrations (9–11 mg/L)**.

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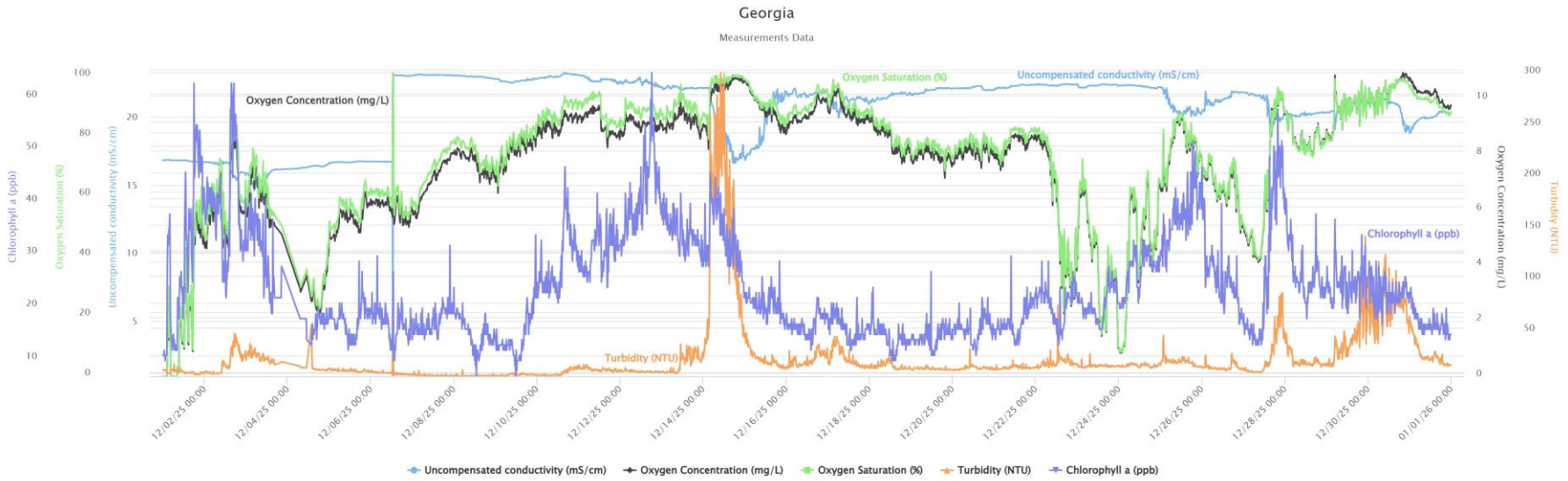
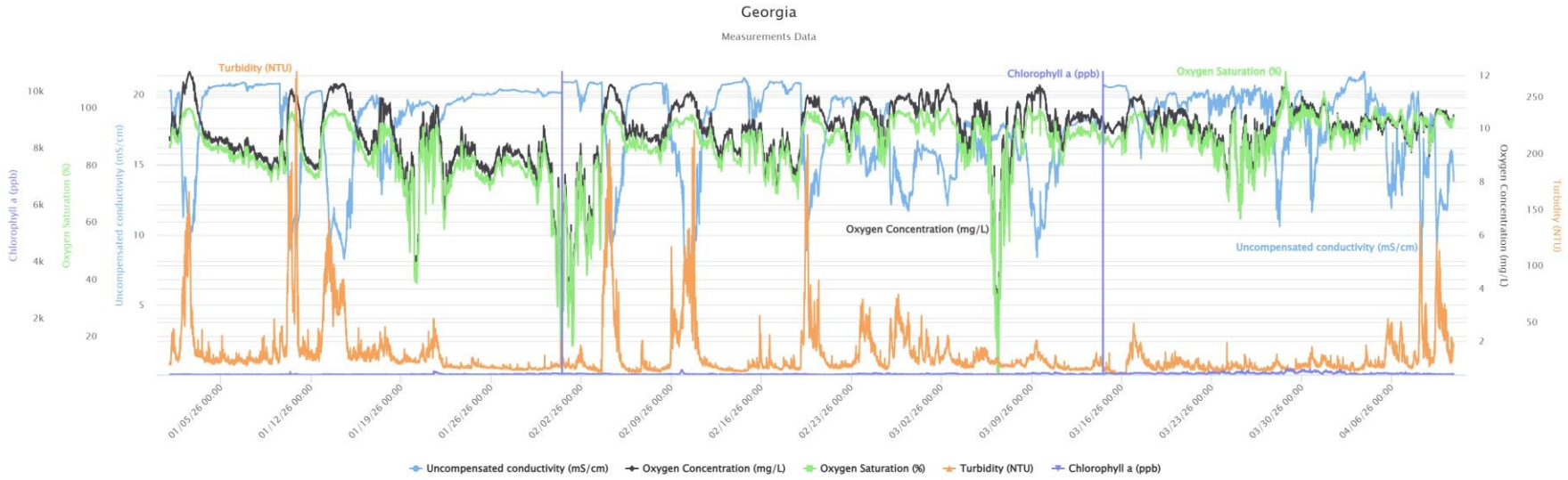
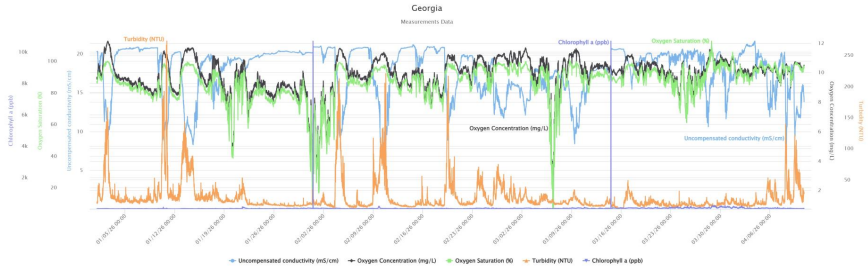
DECEMBER



The system is strongly driven by phytoplankton dynamics and short-term environmental disturbances. The interaction between biological activity (chlorophyll) and physical factors (turbidity, mixing, conductivity) directly influences oxygen variability, highlighting a complex and interconnected aquatic ecosystem.

January-10 April





This graph shows water quality trends from January to early April. Overall, the system is quite stable, especially during winter, with high oxygen levels. However, we can see short-term disturbances, mainly spikes in turbidity, which sometimes cause temporary drops in oxygen. Toward spring, there is a slight increase in chlorophyll, indicating the beginning of biological activity. So, the main pattern is a stable baseline with seasonal changes and occasional anomaly events

Thank You