



DIEL Variations of Physico-chemical factors at BARAM in Glacial fed Mountainous Goriganga River of Uttarakhand, India

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Abstract

Diel variations of physico-chemical factors were investigated at BARAM (900msl) in Glacial fed Mountainous Goriganga River of Pithoragarh district, Uttarakhand, where Gossi Garh joins Goriganga River. In the present study, ambient temperature, water temperature, Dissolved Oxygen, pH, and carbonate alkalinity were found to increase during day hours which decreased during night hours. Free carbon dioxide (CO₂) was completely absent throughout the study period i.e. for 24 hours. Water temperature showed a positive correlation with air temperature and pH, whereas dissolved oxygen showed positive relationship with carbonate, bicarbonate and total alkalinity during the day and night hours. Moreover, a complex interaction of various environmental factors also plays an important role to decide the fate of diel variation of abiotic factors.

Keywords: Diel, variations, Physico-chemicals, Baram, Glacial fed, Goriganga, Uttarakhand.

Introduction

Uttarakhand was formed on 9th of November 2000 as the 27th State of India, when it was carved out of northern Uttar Pradesh. Located at the foothills of the Himalayan mountain ranges, it is largely a hilly State, having international boundaries with China (Tibet) in the north and Nepal in the east. On its north-west lies Himachal Pradesh, while on the south is Uttar Pradesh. It is rich in natural resources especially water and forests with many glaciers, rivers, dense forests and snow-clad mountain peaks. Char-Dhams, the four most sacred and revered Hindu temples of Badrinath, Kedarnath, Gangotri and Yamunotri are nestled in the mighty mountains. It's truly God's Land (Dev Bhoomi). Dehradun is the Capital of Uttarakhand. Pithoragarh district is the easternmost Himalayan district in the state of Uttarakhand, India. It is naturally landscaped with high Himalayan Mountains, valleys, alpine meadows, forests, waterfalls, perennial rivers, glaciers, and springs. The flora and fauna of the area have rich ecological diversity. Pithoragarh district has many temples and ruined forts from the once flourishing reign of the Chand Kings.

Among many large rivers, the Goriganga River is lying in Munsyari Tehsil of the Pithoragarh District, part of Uttarakhand state in north India, falls between the latitudes 29° 45' to 36° 36' N and longitudes 79° 59' to 80° 45'. The Goriganga river originates from a dual source in a glacier near south of Untadhura ridge feeding the eastern branch and another glacier near Milam (3600 msl) just north east of Nanda Devi, feeding the western branch. The total catchment area of the river is about 2230 sq.km. Out of which 346 sq. km. is snow bound¹ and the whole stretch of river is 100 km. and the Goriganga River runs through the entire length of the valley. Baram

(80°21'23.725"E 29°51'00.079"N) is a Village in Didihat Tehsil in Pithoragarh District of Uttarakhand State, India. It is located 28 KM towards North from District head quarters Pithoragarh. 258 KM from State capital Dehradun Baram is surrounded by Kanalichina Tehsil towards South, Berinag Tehsil towards west, Pithoragarh Tehsil towards South, Gangolihat Tehsil towards west. Pithoragarh, Champawat, Almora, Nainital are the nearby Cities to Baram.

Considerable investigations have been made on the DIEL variations in physico-chemicals of various fresh water bodies, i.e. lakes, ponds, reservoirs and rivers²⁻¹³.

Material and Methods

After the preliminary survey of the Goriganga River, the spot was selected keeping in mind its accessible position at night for the study of DIEL Variations. The study was made at BARAM-900msl. In order to investigate the DIEL variations in physico-chemical factors of glacial fed Goriganga River at BARAM, the surface water samples were collected at 4 hour interval for a period of 24 hours from 6 a.m. on the 22nd of January-2008 to 2 a.m. on 23rd of January-2008, when the weather was clear during day and slightly cloudy during night. Most of the analyses were made on the spot. The physico-chemical parameters like ambient temperature, water temperature, dissolved oxygen, free carbon dioxide, pH, carbonate, bicarbonate and total alkalinity were estimated by using standard methods¹⁴⁻¹⁸.

Results and Discussion

DIEL variations in physico-chemical parameters at BARAM in

glacial fed mountainous Goriganga River recorded for 24 hours are tabulated in table 1. For the analysis of DIEL variations in physico-chemicals, water samples were collected at an interval of 4 hours starting from 6 a.m. of 22nd of January-2008 to 2 a.m. of 23rd of January-2008. Well marked DIEL variations have been recorded in most of the physico-chemical parameters.

Ambient and water temperature varied between 9.5^oC to 15.5^oC and 8.0^oC to 11.0^oC table-1. The maximum atmospheric temperature 15.5^oC was recorded during the day hours at 2p.m. and relatively minimum atmospheric temperature 9.5^oC was recorded during the night hours at 2a.m on 23rd of January-2008 figure1. Surface water temperature followed the similar trend. The maximum water temperature 11.0^oC was again recorded during the day hours at 2p.m. whereas minimum water temperature 8.0^oC was recorded during the night hours at 2a.m. figure 2. The dissolved oxygen fluctuated between 10.0 mg/l to 12.8 mg/l in the present study figure 3. Maximum value of dissolved oxygen 12.8 mg/l was recorded during the day hours at 10am when the water temperature was 10.5^oC and minimum dissolved oxygen 10.0 mg/l was recorded during the night hours at 2am when the water temperature was minimum 8.0^oC. It was observed that a positive relationship was observed between water temperature and dissolved oxygen during the night hours.

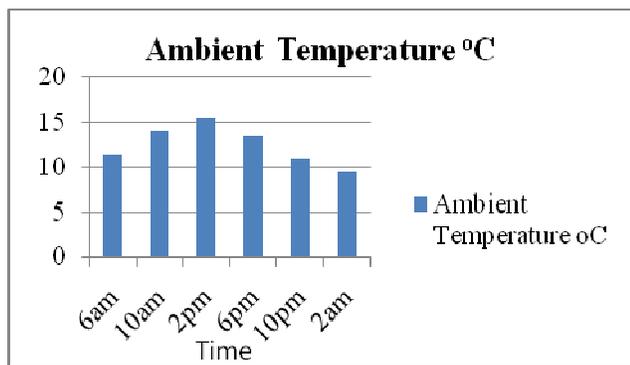


Figure – 1

Diel Variations in Ambient Temperature at BARAM in Glacialfed Mountainous Goriganga River

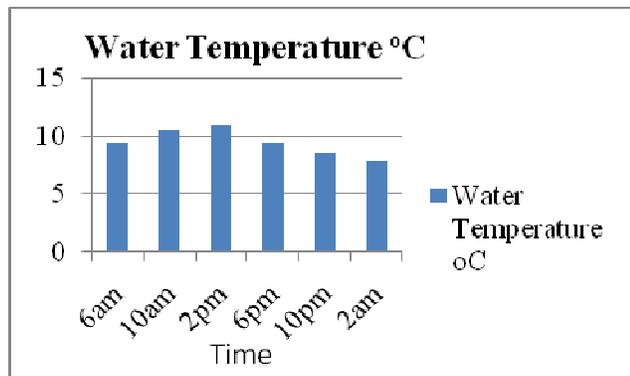


Figure – 2

Diel Variations in Water Temperature at BARAM in Glacialfed Mountainous Goriganga River

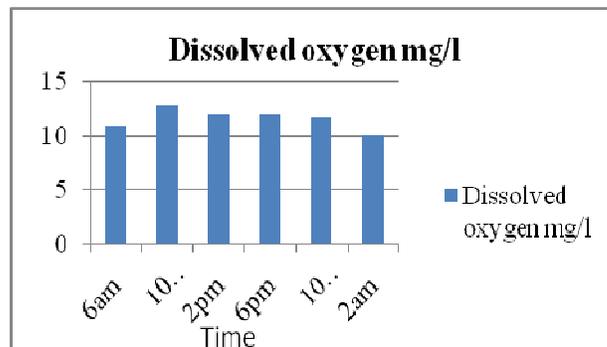


Figure-3

Diel Variations in Dissolved oxygen at BARAM in Glacialfed Mountainous Goriganga River

Dissolved oxygen is the most important factor that supports aquatic life and self purification capacity of water body in high altitude rivers. It is thus, considered as an index functioning of biological and physical processes. Hydrogen ion concentration expressed in terms of pH depends upon the amount of carbonate and free CO₂ tension in the water. It is an important indicator that shows the acidic or alkaline nature of water. It is therefore, considered as an index of acidic and alkaline and neutral nature of water. In the present study pH of water remained alkaline and fluctuated from 7.5 to 8.87 figure-4. However, there were no significant differences between the pH values recorded for 24 hours. Free CO₂ was completely absent throughout the study period i.e. for 24 hours table-1.

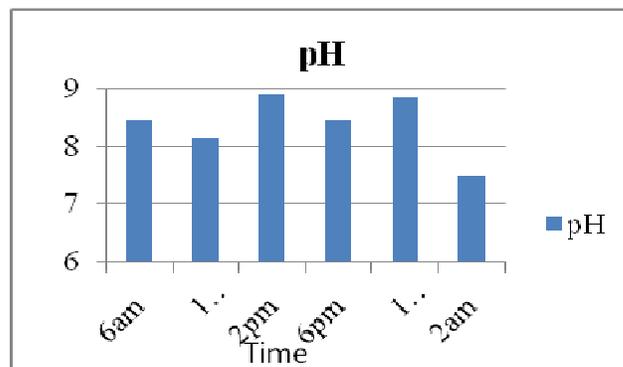


Figure-4

Diel Variations in pH at BARAM in Glacialfed Mountainous Goriganga River

Carbonates fluctuated between 3.0 mg/l to 5.0 mg/l figure-5. Maximum value of carbonate 5.0 mg/l was recorded during the day hour at 10.0am when dissolved oxygen value was maximum 12.8 mg/l and minimum value of carbonate 3.0 mg/l was recorded during the night hour at 2 am when dissolved oxygen value was minimum 10.0 mg/l, hence carbonate showed positive relationship with dissolved oxygen. The bicarbonate fluctuated between 140 mg/l to 180 mg/l figure 6. Maximum concentration of bicarbonate 180 mg/l was recorded at 10 am where a minimum value of bicarbonate 140 mg/l was recorded at 2am. The values of total alkalinity ranged from 143 mg/l to 185 mg/l

Figure 7. Moreover, it was also observed in the present study that the minimum values of all the physico-chemical factors under investigation were recorded during the night hour at 2 a.m.

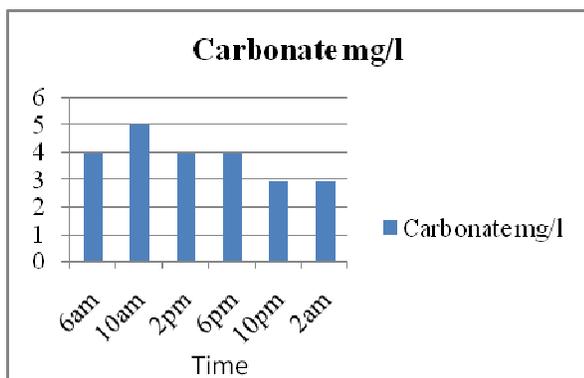


Figure-5

Diel Variations in Carbonate at BARAM in Glacialfed Mountainous Goriganga River

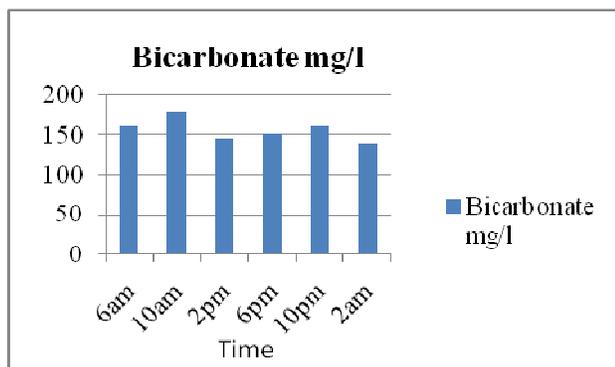


Figure-6

Diel Variations in Bicarbonate at BARAM in Glacialfed

Mountainous Goriganga River

Conclusion

From the results, it may be concluded that some physico-chemical factors of glacial fed mountainous Goriganga River at BARAM under investigation for DIEL variations exhibit DIEL pattern of fluctuation to some extent which are controlled by complex interaction of various environmental factors operating in the system e.g., light hours, photosynthetic activity, community respiration of aquatic biota present in the water.

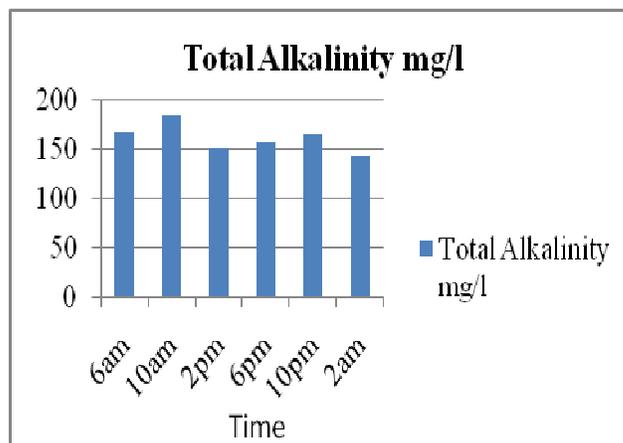


Figure-7

Diel Variations in Total Alkalinity at BARAM in Glacialfed Mountainous Goriganga River

Table-1

DIEL Variations in physico-chemicals at BARAM in glacial fed mountainous Goriganga river

Date	Time	Ambient Temperature °C	Water Temperature °C	Dissolved Oxygen (D.O)mg/l	Free Co ₂ mg/l	pH	Carbonate mg/l	Bicarbonate mg/l	Total alkalinity mg/l
22-01-2008	6 a.m.	11.5	9.5	10.8	nil	8.43	4.0	162	166
-do-	10 a.m.	14.0	10.5	12.8	nil	8.15	5.0	180	185
-do-	2 p.m.	15.5	11.0	12.0	nil	8.87	4.0	146	150
-do-	6 p.m.	13.5	9.5	12.0	nil	8.43	4.0	152	156
-do-	10p.m.	11.0	8.5	11.6	nil	8.82	3.0	162	165
23-01-2008	2 a.m.	9.5	8.0	10.0	nil	7.5	3.0	140	143

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