Exploring Carbon Dioxide Dynamics and Anthropogenic Influences in the Ganga River: Implications for Riverine Management

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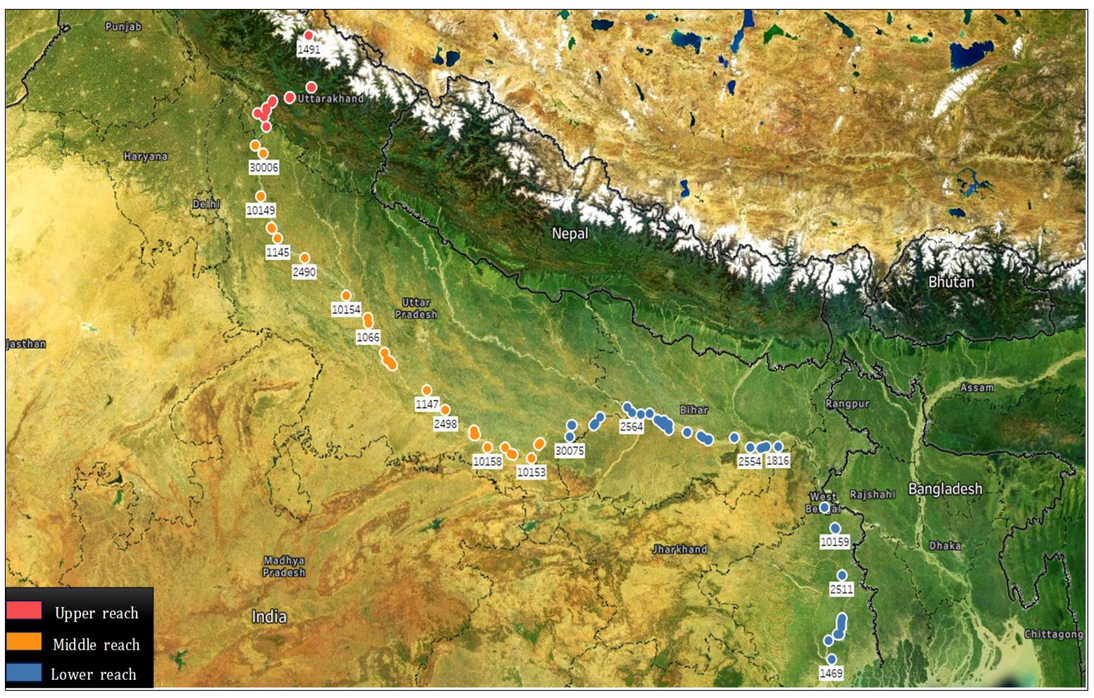
Abstract: Anthropogenic activities significantly modify the hydrochemical properties and material flow in riverine ecosystems across Asia, potentially accounting for 40-50% of global carbon emissions. Despite the prevalent impact on Asian rivers, there is a paucity of studies investigating their correlation with greenhouse gas (GHG) emissions. In this study, we computed the partial pressure of CO_2 (pCO_2) using the carbonate equilibria-based model (pCO_2SYS) and examined its correlation with hydrochemical parameters from historical records at 91 stations spanning 2013-2021 in the Ganga River. Our findings underscore the significance of incorporating South Asian rivers in the evaluation of the global carbon budget.

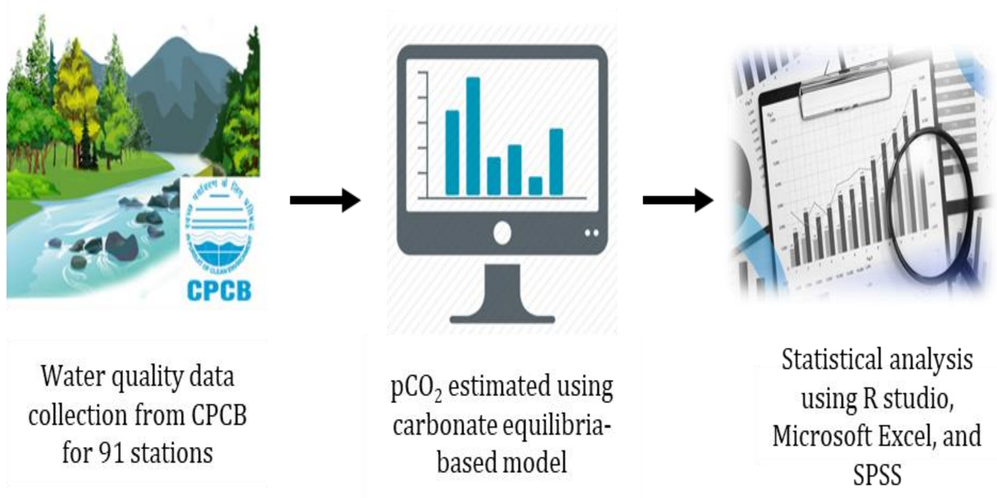
Keywords: *Ganga River, CO_2 partial pressure (pCO_2), carbon dynamics, statistical analysis*

Objectives

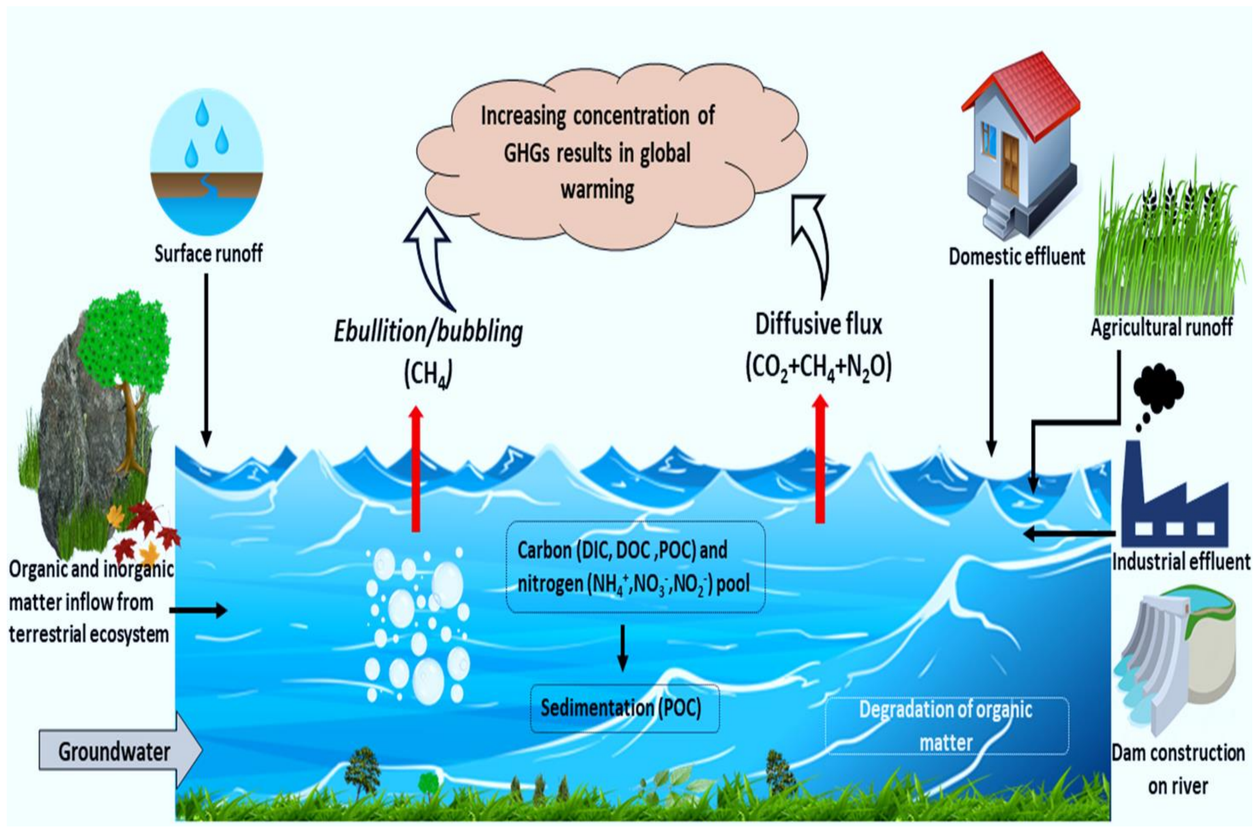
- To assess the pCO_2 values across the Ganga River using pCO_2 SYS.
- To investigate the spatial variability in riverine pCO_2 and water quality.
- To identify the predominant regulators of CO_2 variation in the river Ganga.

Study area & methodology

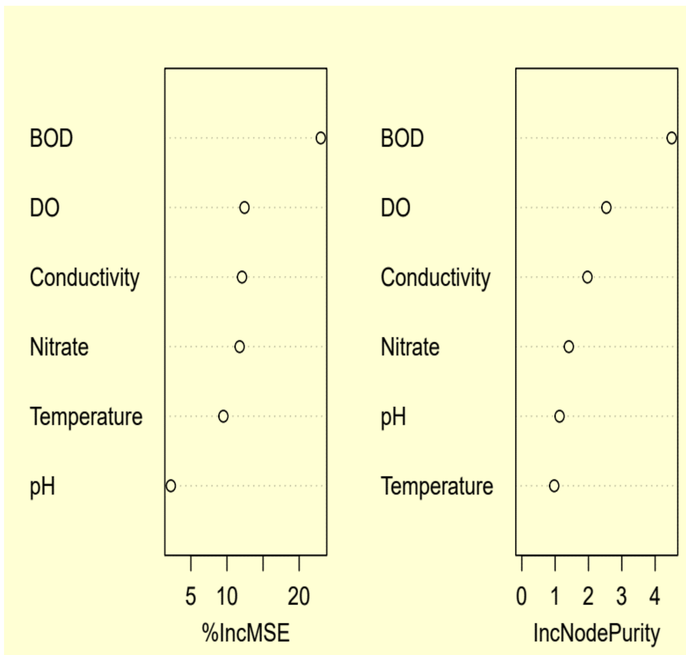


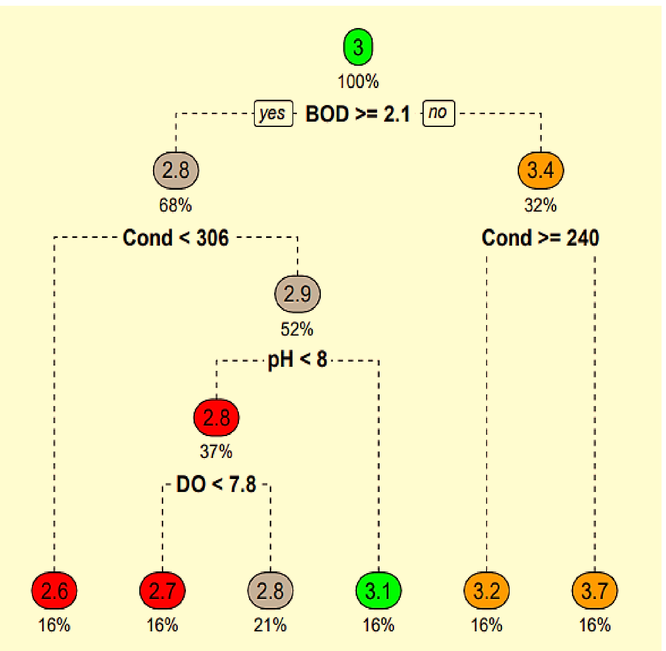


Result and discussion



Ganga River	Multiple regression	R^2	p value
Upper stretch	$pCO_2 = 242.51NO_3^- + 1244.29$	0.35	p<0.05
Middle stretch	$pCO_2 = -44.42\ BOD + 1269.86$	0.26	p<0.05
Lower stretch	$pCO_2 = 66.78\ DO + 660$	0.36	p<0.001
Whole stretch	$pCO_2 = -34.64\ BOD + 39.69\ DO + 950.40$	0.46	p<0.001





Conclusion

- pCO_2 concentration is higher in the upstream region than the downstream region of the Ganges.
- Nitrate predicts pCO_2 well in the upstream region.
- BOD and DO are the best predictors of pCO_2 in downstream regions.
- BOD emerged as a crucial influencing factor for pCO_2 across the Ganga River.

References

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