frontiers | Frontiers in Earth Science

TYPE Editorial
PUBLISHED 18 November 2022
DOI 10.3389/feart.2022.1065133

Check for updates

OPEN ACCESS

EDITED AND REVIEWED BY
Eliot Atekwana,
University of California, Davis,
United States

*CORRESPONDENCE
Shafi M. Tareq,
smtareq@juniv.edu

SPECIALTY SECTION
This article was submitted to
Hydrosphere,
a section of the journal
Frontiers in Earth Science

RECEIVED 09 October 2022
ACCEPTED 11 November 2022
PUBLISHED 18 November 2022

CITATION
Tareq SM, Lu XX, Shammi M and
Maruo M (2022), Editorial:
Hydrobiogeochemistry of major
Asian rivers.
Front. Earth Sci. 10:1065133.
doi: 10.3389/feart.2022.1065133

COPYRIGHT
© 2022 Tareq, Lu, Shammi and Maruo.
This is an open-access article
distributed under the terms of the
Creative Commons Attribution License
(CC BY). The use, distribution or
reproduction in other forums is
permitted, provided the original
author(s) and the copyright owner(s) are
credited and that the original
publication in this journal is cited, in
accordance with accepted academic
practice. No use, distribution or
reproduction is permitted which does
not comply with these terms.

Editorial: Hydrobiogeochemistry of major Asian rivers

Shafi M. Tareq[1]*, Xi Xi Lu[2], Mashura Shammi[1] and Masahiro Maruo[3]

[1]Hydrobiogeochemistry and Pollution Control Laboratory, Department of Environmental Sciences, Jahangirnagar University, Dhaka, Bangladesh, [2]Department of Geography, National University of Singapore, Singapore, Singapore, [3]Department of Ecosystem Studies, School of Environmental Science, The University of Shiga Prefecture, Hikone, Shiga, Japan

KEYWORDS

water pollution, carbon cyle, dissolved organic matter, greenhouse gas emission, anthropogenic activities, ecological risk

Editorial on the Research Topic
Hydrobiogeochemistry of major Asian rivers

The Asian continent is home to many large rivers, such as the Ganges, Brahmaputra, Mekong, and Yellow, which provide abundant freshwater resources. Many rivers in the Asian continent are transboundary in nature, and their tributaries and distributaries flow in different countries or regions. These rivers support millions of people and their livelihoods through diverse landscapes. The hydrobiogeochemistry of these rivers plays a crucial role in water quality, nutrient dynamics, carbon cycle, and aquatic ecology. The hydrobiogeochemistry of these Asian rivers is highly sensitive to natural disturbances and human perturbations because of rapid socioeconomic and environmental changes. Diverse hydrobiogeochemical research from various parts of the Asian continent and their status are gathered in this particular issue to support policy decisions on global carbon dynamics, nutrient and pollution dynamics, and greenhouse gas emissions. We have received eight unique articles for this Research Topic.

One common problem related to hydrobiogeochemistry of rivers in the Asian continent is water pollution (Begum et al., 2021; Nayna et al.). In this Research Topic, we have four articles from South Asia. South Asia has the largest Ganges-Brahmaputra-Meghna (GBM) Delta situated in Bangladesh and part of India. The comparative study on Ganges-Brahmaputra by Niloy et al. described the concentrations, origins, availability, and seasonal variation of dissolved organic matter (DOM) in Bangladesh's major river systems. It was critical to understand biogeochemical cycles, destiny, and ecological and environmental factors before discharging into the Bay of Bengal. This study also showed that sewage discharge was the second highest contributor to DOM in river water after natural sources, indicating unsustainable anthropogenic activities in the river systems.

We have two articles that deal with the estuarine systems and distributaries of the lower Ganges. The Ganges River distributaries feed their discharges to the most extensive mangrove forests in the world-the Sundarbans. The Sundarbans mangrove ecosystem is a hotspot for biogeochemical studies in the tropical estuarine environment due to its high productivity and extensive organic matter cycling. Spatial and temporal dynamics of the biogenic gases (CO_2, CH_4, and N_2O), also known as radiatively active gases, were measured in mangrove-dominated estuaries (Acharya et al.). The Acharya et al. study showed that CH_4 and N_2O fluxes were positively associated (p 0. 05), with organic matter decomposition. Furthermore, water-air CO_2, CH_4, and N_2O fluxes demonstrate that estuaries are a minor source of CH_4 but oscillate between sources and sinks for CO_2 and N_2O gases. In addition, CO_2 fluxes were ~10 times higher in the monsoon season than in both the pre-monsoon and the post-monsoon seasons.

Another article relevant to the Ganges is "*Pollution level of trace metals (As, Pb, Cr, and Cd) in the sediment of Rupsha River, Bangladesh: assessment of ecological and human health risks*" (Kubra et al.). The Rupsha River is a distributary of the Ganges and an important River in South-west Bangladesh. Trace metal concentrations of As, Pb, Cd, and Cr, along with biological effects and potential ecological and human health hazards for adults and children, were identified from sediment samples. The metals in the sediments were attributed to natural sources and anthropogenic industrial activities.

The fourth article is on "*Intersectoral competition for water between users and uses in Tamil Nadu-India*" (Suresh). Water demands for household potable water, agricultural food production, aquaculture, and industry rise as the population increases. Furthermore, urbanization will demand a large share of common water resources for household purposes, thereby increasing intersectional conflicts. Conflict resolution needs investment in the water sector and state-of-the-art technological measures, and diplomacy for water reuse, recycling, and treatment.

Given the growing interest in evaluating the contribution of riverine CO_2 emissions to the global C budget, field measurements of pCO_2 have increased (Haque et al., 2022). We have two articles from East Asia on the measurements of pCO_2. Direct field measurements of pCO_2 using manual headspace equilibration or sensor-based instrumental measurements will provide increasingly more reliable field-based data (Nayna et al.). The first article on the method study of this Research Topic is "*Improving carbonate equilibria-based estimation of pCO_2 in anthropogenically impacted river systems*" (Nayna et al.). Across the five Asian rivers (Ganges, Mekong, Yangtze, Yellow, and Han rivers), calculated and measured pCO_2 values exhibited more significant discrepancies during the monsoon season, particularly in the low pH range. The authors urged using carbonate equilibria-based models to complement the corrective measures for calculating pCO_2.

The second East Asian article is on "*Rapid loss of dissolved CO_2 from a subtropical steep headwater stream*" (Chan et al.). The study was conducted in the Pokf ulam catchment (area: 1.7 km^2) in subtropical Hong Kong. CO_2 emissions have been largely overlooked in the steep headwater streams due to their limited water surface areas and the difficulty in measuring them due to narrow channel widths and severe turbulence. This study suggests that high-gradient headwater streams are hotspots of CO_2 emissions. The omission of these systems may introduce significant biases in estimating catchment scale and regional CO_2 flux from aquatic ecosystems, The third paper from East Asia is on the heterotrophic bacteria in rivers that depend on dissolved organic nitrogen (DON) as an essential energy source and/or organic nutrients. Takaki et al. identified factors controlling the spatial distribution of DOM with changes in the C/N ratio from the upper to lower reaches of the Ishikari River, Japan (Takaki et al.). Although several variables influence the quantity and quality of DOM in rivers, DON was less explored than dissolved organic carbon (DOC). The C/N ratio of bulk DOM decreased continuously from the upper reaches to lower reaches due to *in situ* microbiological degradation.

The last article on this Research Topic is from Northeastern Siberia-the Asian Taiga. The article is about "*Stable water isotope assessment of tundra wetland hydrology as a potential source of Arctic Riverine dissolved organic carbon in the Indigirka River Lowland, Northeastern Siberia*" (Takano et al.). The wetlands exhibited higher $\delta^{18}O$ and greater DOC concentrations than the Indigirka River's tributaries and main channel. There was a link between the two parameters in the wetlands, tributaries, and mainstream, indicating that the wetlands can be a source of DOC for the mainstream *via* the tributaries.

What's next? The hydrobiogeochemistry of rivers and the causes of river water deterioration can only be demonstrated and recognized by systematic monitoring and assessment of water interchange processes between rivers and catchments. This understanding is critical for protecting and managing significant water resources and obtaining ecological services from rivers. As a result, river hydrobiogeochemistry research is essential to ensuring enough excellent quality water supplies for future generations and sustainable development. The special Research Topic is broadly related to hydrochemistry, carbon transport mechanisms, and analytical methods of hydrobiogeochemical analysis in Asian rivers. The future stresses focusing the hydrobiogeochemistry of the rivers on maintaining a healthy water ecosystem while simultaneously strengthening the focus on minimizing anthropogenic and climate stressors.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

10.3389/feart.2022.1065133

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Begum, M. S., Bogard, M. J., Butman, D. E., Chea, E., Kumar, S., Lu, X., et al. (2021). Localized pollution impacts on greenhouse gas dynamics in three anthropogenically modified Asian river systems. *J. Geophys. Res. Biogeosci.* 126, e2020JG006124. doi:10.1029/2020JG006124

Haque, M. M., Begum, M. S., Nayna, O. K., Tareq, S. M., and Park, J-H. (2022). Seasonal shifts in diurnal variations of pCO_2 and O_2 in the lower Ganges River. *Limnol. Oceanogr. Lett.* 7, 191–201. doi:10.1002/lol2.10246