## Peer Review Report

# Review Report on Morphological model for erosion prediction of India's largest braided river using MIKE 21C model

Original Research, Earth Sci. Syst. Soc.

Reviewer: Ketan Nandi
Submitted on: 02 Aug 2023
Article DOI: 10.3389/esss.2024.10075

## EVALUATION

**Q 1** **Please summarize the main findings of the study.**

The presented study focuses on the highly braided Brahmaputra River and its morphological dynamics due to monsoon-induced high upstream discharges and large sediment loads. The main objective of the research is to develop a two-dimensional morphological model using the MIKE-21C program to predict erosion and morphological changes in the short-term and medium-term. The specific study area is the Palasbari-Gumi reach of the Brahmaputra River. The authors successfully utilized the morphological model to predict erosion and plan protection works in the study area. They conducted model runs with various hydrological scenarios to forecast design variables along the river reach. The results indicated that the model's predictions were in excellent agreement with ADCP velocities, design flood levels, and yearly sediment load. The model's performance was particularly noteworthy, as the peak velocities from the model were found to be lower than 10% different from the ADCP measurements at most of the compared river sections. Regarding sediment load predictions, the model estimated a mean annual sediment load of 257 Mt/year for the 2021 hydrological year and a bank full discharge of 314 Mt/year. These values were compared to the historically recorded sediment load in the Brahmaputra, which was 400 Mt/year. The model's ability to predict flood levels for the bank full discharge condition was also impressive, showing an accuracy of nearly 98% at the Gumi site. The study's findings are of significant importance as they demonstrate how the developed morphological model can enhance the planning and execution of river training works in highly braided rivers like the Brahmaputra. The model's ability to predict morphological changes over a 2-3 year period can aid in decision-making for protection works and river management.

**Q 2** **Please highlight the limitations and strengths.**

Strengths of the Study:

The study addresses an important issue by focusing on the highly braided Brahmaputra River and its morphological dynamics, providing valuable insights for river management in this challenging environment. The development of a two-dimensional morphological model using the MIKE-21C program is commendable, and its successful comparison with real-world data adds credibility to the study's findings. The model's ability to accurately predict erosion, flood levels, and sediment load is a significant strength, as it can aid in planning river training works and protection measures effectively.

Limitations of the Study:

The study only considers a specific reach of the Brahmaputra River (Palasbari-Gumi), which may limit the generalizability of the findings to other river reaches or different river systems. The temporal scale of 2-3 years may not be sufficient to capture longer-term morphological changes, and it might be essential to discuss potential long-term implications of the model predictions. The study should provide a comprehensive analysis of the model's uncertainties and limitations, including sensitivity analysis and potential sources of error in data inputs and model assumptions. The accuracy of the model predictions may vary under extreme hydrological events or during non-monsoon seasons, which should be acknowledged and discussed. The study could benefit from a comparison of the model's performance against other established morphological models to assess its relative strengths and weaknesses. While the model's agreement with real-world data is

noted, a more detailed discussion on the reasons for any discrepancies and how they impact practical applications should be included.

Addressing these limitations and providing further insights into the model's applicability and reliability will significantly enhance the impact and contribution of the study to the field of river geomorphology and management.

---

**Q 3** **Please comment on the methods, results and data interpretation. If there are any objective errors, or if the conclusions are not supported, you should detail your concerns.**

Methods:
The study employs a two-dimensional morphological model using the MIKE-21C program to predict erosion, flood levels, and sediment load in the Palasbari-Gumi reach of the Brahmaputra River. The choice of using a numerical modeling approach is appropriate for studying the complex dynamics of braided rivers. However, the methods section lacks sufficient detail regarding the specific setup of the model, boundary conditions, and calibration procedures. Including more comprehensive information would help readers better understand the model's setup and ensure reproducibility. Additionally, a sensitivity analysis of key model parameters would enhance the understanding of the model's robustness.

Results and Data Interpretation:
The study's results indicate that the model predictions show excellent similarity with real-world data, including ADCP velocities, design flood levels, and sediment loads. While this agreement is promising, a detailed statistical analysis to quantify the accuracy and reliability of the model predictions is missing. Providing statistical measures would strengthen the data interpretation and lend credibility to the model's performance.

Objective Errors and Conclusions:
As a reviewer, I did not identify any significant objective errors in the study. However, the conclusions drawn from the study should be cautiously interpreted. The model's ability to predict morphological changes over a 2-3 year period is impressive, but it might not be sufficient to draw long-term conclusions or make precise decisions for river management. The study acknowledges the historically recorded sediment load in the Brahmaputra, but it is essential to contextualize the model's predictions in light of potential changes in sediment sources and transport processes over time.

Overall, the study provides valuable insights into the morphological behavior of the Brahmaputra River and its potential implications for river training works. However, it would greatly benefit from providing more in-depth details about the methods, conducting a thorough statistical analysis, and considering the limitations of short-term predictions for long-term management decisions. Addressing these points will improve the quality and impact of the study.

---

**Q 4** **Check List**

Is the English language of sufficient quality?
Yes.

Is the quality of the figures and tables satisfactory?
Yes.

Does the reference list cover the relevant literature adequately and in an unbiased manner?
No.

Are the statistical methods valid and correctly applied? (e.g. sample size, choice of test)
No.

If relevant, are the methods sufficiently documented to allow replication studies?
No.

Are the data underlying the study available in either the article, supplement, or deposited in a repository? (Sequence/expression data, protein/molecule characterizations, annotations, and taxonomy data are required to be deposited in public repositories prior to publication)

Yes.

Does the study adhere to ethical standards including ethics committee approval and consent procedure?

Not Applicable.

If relevant, have standard biosecurity and institutional safety procedures been adhered to?

Not Applicable.

---

**Q 5** **Please provide your detailed review report to the editor and authors (including any comments on the Q4 Check List):**

*Introduction: I recommend that the introduction would be strengthened by conducting a critical review of the most recent and relevant literature. As the river is highly morphologically active, some of the recent study on the morphological behavior of the Brahmaputra river needs to be reviewed. This review should focus on identifying gaps in the current understanding of the topic and providing a clear justification for the chosen approach. Therefore, the authors should update their literature to include some recent papers that could be relevant to their study area. Deeply considering the scientific question at hand will further enhance the introduction's clarity and relevance to the field.

*Methodology: The methods section lacks sufficient detail regarding the specific setup of the model, boundary conditions, and calibration procedures. Including more comprehensive information would help readers better understand the model's setup and ensure reproducibility. Additionally, a sensitivity analysis of key model parameters would enhance the understanding of the model's robustness.

*Result and Discussion: Results and Discussion were mixed together. Strongly suggest that these two parts are divided into two independent sections. Discussion needs to be strengthen in the article.

L 334: The field photograph presented in figure 5 is interesting. To enhance its relevance and context, it would be beneficial to include specific location details and the date of capture in the caption or figure description. This additional information will provide readers with a better understanding of the photograph's significance.

L 361 – 366: Authors has mentioned use of inflow and water level data collected from Pandu gauging station. Please mention the source of the data.

L 389: Inline to my previous comment, author mention that the data used in the study is collected from literature. Mention which literature.

L 396: The formula presented in the article be written in a proper format. I suggest including such formulae, along with their appropriate formats, in the methodology section (check throughout the article). Additionally, the result section should focus solely on presenting relevant results without delving into the modeling procedure. The modeling procedure can be appropriately detailed in the methodology section, keeping the result section concise and focused on the obtained outcomes. This will enhance the clarity and organization of the article.

L 411: The author mentions "ADCP measurements," but it would be more informative if they provide additional details about the ADCP transect in the satellite image collected on the date of ADCP observation.

L 444 – 447: The design variables considered in the study lack clarity. It is essential to explain why both the bank full discharge condition and peak flow discharge condition were included in the analysis, considering their different roles in a large braided river like the Brahmaputra River. Providing a detailed explanation for the

choice of these design variables will help readers better understand their significance and relevance in the context of the study.

L 515: The color bar for the figure should be provided.

L 499 – 539: It is not clear how the results fully support the schematic in Figure 11, 12. In general, Figures 11 and 12 could be better explained in greater depth given that why these type of behavior was observed.

L 536: What is the need of this figure 13. Explain this figure with clarity. It will be better to keep only the bank line migration for all the years within a single figure so that it will be easy to observe the mentioned changes of bank erosion.

*Conclusion: I recommend restructuring the conclusion section to enhance its clarity for readers. One effective way to achieve this is by presenting the main conclusions in bullet points. This format will allow readers to grasp the key findings more easily and improve the overall readability of the conclusion section.

## QUALITY ASSESSMENT

| | | |
|---|---|---|
| Q 6 | Originality | ■■■■□ |
| Q 7 | Rigor | ■■■□□ |
| Q 8 | Significance to the field | ■■■■■ |
| Q 9 | Interest to a general audience | ■■■□□ |
| Q 10 | Quality of the writing | ■■■■□ |
| Q 11 | Overall quality of the study | ■■■□□ |