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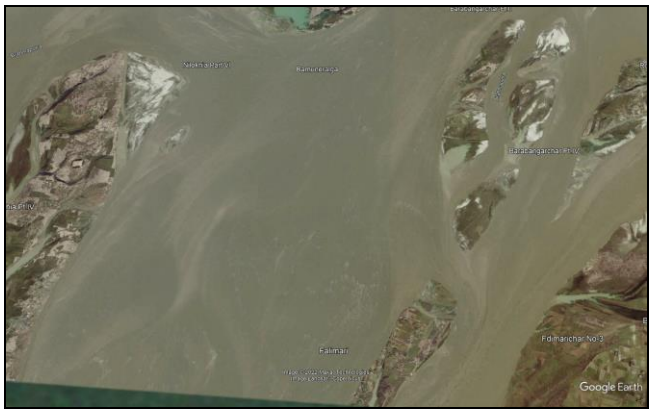
Lifecycles of volatile landscapes: islands in the Brahmaputra River

1. Background

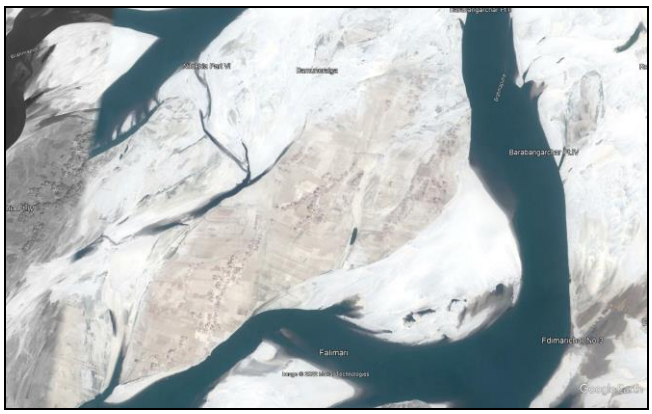
The Brahmaputra River flows out of the Himalaya and into the Bay of Bengal (Figure 1), through the territory of India and Bangladesh. It is one of the world's largest rivers, and contains numerous islands known as chars, which originate as bars within the braided river. Some of these islands are inhabited, despite their extreme instability which is caused by the high discharge and erosive power of the river. Islands can appear, become inhabited, and be wiped out by shifts in the river, all within the timespan of a few years. Between 2005 and 2010 alone, 880 villages and almost 37,000 houses were completely eroded[1]. It is therefore a critical societal question whether there is more that could be done to predict the behaviour of the river, and to mitigate flood and erosion risks. There are linked scientific questions on the behaviour of large, braided, rivers in general: is the migration of channels within the floodplain essentially random, or are there patterns that provide elements of predictability? What are the implications of the records of Brahmaputra island and channel evolution for models of braided rivers?

Figure 1. Location of the Brahmaputra River.

The images in Figure 2 show the same region within the river, in 2003, 2014 and 2016. In this time interval an island has appeared, become inhabited, and been erased. This example is not an exception; inspection of public domain satellite imagery reveals numerous similar cases.



September 2003



April 2014

November 2016

Figure 2. Satellite imagery for the Brahmaputra River on a decadal timescale. Images are centred on ~25.81° N 89.88° E; field of view: ~4.85 km.

2. Aims

The aim of this project is to analyse satellite imagery for the Brahmaputra River, to quantify and understand:

- The processes that form and destroy islands within the river.
- The implications for inhabitants of these islands. Are there predictable aspects of river behaviour, that might help the mitigation of flood and erosion risk?

3. Scientific approach

There is limited research on the evolution of the Brahmaputra River and its islands, that utilises the data contained in public domain satellite imagery. Most previous research has relied on snapshots of the appearance of the river at a particular time, and not focussed on the changes. The available satellite imagery contains high resolution records of the river and its bedforms, with the crucial element that there are multiple images, taken over decades, for all areas. It will therefore be possible to map changes in the river at decadal, annual and sub-annual timescales, to find patterns and hence likely controls in river behaviour.

ArcGIS and Global Mapper will be used to record and quantify changes in the shape of channels and islands, to improve on existing models of braid bar evolution for the Brahmaputra. There is the opportunity to apply machine learning techniques.

The project will be in collaboration with researchers from the Presidency University, Kolkata, India, led by Dr Mery Biswas. There is a clear alignment between the project and United Nations Sustainable Development Goal #15 – Life on Land.

4. Training

As a masters student in the Durham Earth Sciences Department you will become part of a vibrant research culture in which ~70 postgraduate students work on a wide range of Earth Science research projects. In particular, you will closely collaborate with the academic staff, postdoctoral researchers and fellows, and postgraduate students in your research group. Training will be provided in the range of techniques being applied including data analysis techniques and GIS. The aim of this training is to broaden your understanding of the applications of geoscience and provide you with additional skills valued by future employers.

5. Further reading & information

1 https://www.bbc.com/future/article/20180516-the-sapori-people-living-on-indias-brahmaputra-islands

Ashworth, P.J., Best, J.L., Roden, J.E., Bristow, C.S. and Klaassen, G.J., 2000. Morphological evolution and dynamics of a large, sand braid-bar, Jamuna River, Bangladesh. Sedimentology, 47(3), pp.533-555.

Best, J.L., Ashworth, P.J., Mosselman, E., Sarker, M.H. and Roden, J.E., 2022. The Jamuna–Brahmaputra River, Bangladesh. Large Rivers: Geomorphology and Management, Second Edition, pp.579-640.

Gogoi, P.R., Chetia, M., Borgohain, S., Bora, M., Kumar, A. and Lahiri, S.K., 2022. Morphotectonic forcing and anthropogenic impact behind a recently emerged relict island of the Brahmaputra River. Earth Surface Processes and Landforms, 47(13), pp.3062-3082.

Jotheri, J., Allen, M.B. and Wilkinson, T.J., 2016. Holocene avulsions of the Euphrates River in the Najaf area of Western Mesopotamia: impacts on human settlement patterns. Geoarchaeology, 31(3), pp.175-193.

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