

# ARRCC Impact Story

Creating local sea-level projections to manage coastal climate risks



## Motivation

Coastal communities in Bangladesh and Pakistan are highly exposed to changes in sea-level. Yet coastal risk management and planning decisions have previously relied only on global sea-level change projections which are unable to capture the greater fluctuations of local changes in sea level. As part of ARRCC, we applied methods recently developed for the UK in South Asia, to improve estimations of local sea-level changes and better inform decision-making and investments in coastal protection.



Protection against rising sea-levels – Kutubdia, Cox's Bazaar District, Bangladesh.

## Our approach

To improve sea-level science in South Asia, we have:

1) Reviewed the latest sea-level science and information in Bangladesh and Pakistan with a review of scientific literature.



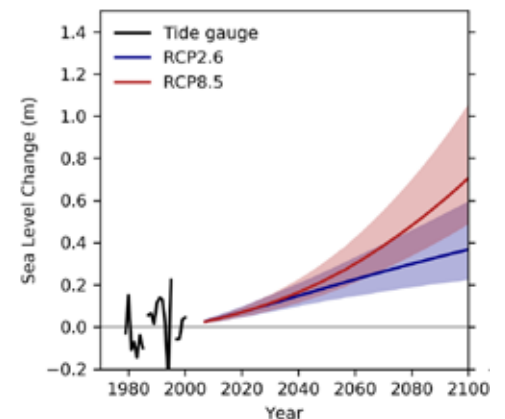
2) Generated new future projections of local sea-level change at locations on the coastlines of the Bay of Bengal, Arabian Sea, and the equatorial Indian Ocean Islands by applying methods used to produce the 2018 UK Climate Projections (UKCP18). These projections were generated for contrasting future climate scenarios representing both highly stringent and minimal greenhouse gas reductions (Figure 1).



3) Worked with the **Bangladesh University of Engineering and Technology (BUET)**, the **Institute for Water Modelling (IWM)**, and the **Pakistan Meteorological Department (PMD)** to identify how these new projections may be used.



Cox's Bazaar, Chittagong Bangladesh



**Figure 1.** Projected sea-level change at Cox's Bazaar, Bangladesh in the north-eastern Bay of Bengal under stringent (RCP2.6) and minimal (RCP8.5) mitigation measures.

4) Assessed regional variations in current sea-level trends using tide-gauge and satellite data.



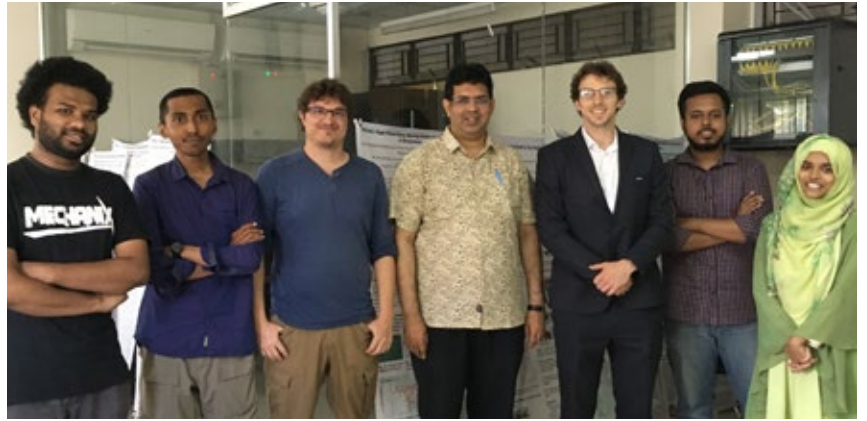
We find that sea-levels across South Asia are generally projected to rise more slowly than the global average rate of increase, whilst the highest local rates of SLR in the region occur in the north-eastern Bay of Bengal. We identified climatic factors as the greatest contributors to future sea-level rise but found that local deviations from global mean sea-level changes were mostly caused by changes in land-based water storage.\*

This work was conducted in the Climate Analysis for Risk Information and Services in South Asia (CARISSA) project of the ARRCC Met Office Partnership programme.



## Impacts

**Capacity Development:** Alongside BUET and PMD, we have run virtual sea-level workshops and webinars to train over 20 users from national meteorological and hydrological departments and other organisations in South Asia to access the new sea-level projections (Figure 2). This will allow them to develop and apply the projections to coastal risk assessments and coastal management decision making. In one workshop, 85% of participants rated their knowledge of all topics ‘good’-‘excellent’ after the course and requested further engagement.



**Figure 2.** Representatives at the Climate Modelling and Simulation Lab during a consultation visit to Dhaka, Bangladesh.

**Managing coastal climate risks:** Supported by the ARRCC programme, the Institute of Water Modelling (IWM) in Bangladesh are applying the new sea-level projections to update their previous work<sup>2</sup> (Figure 3) to assess the future effectiveness of polders (coastal defences) and inform the prioritisation of their maintenance and implementation. This will directly contribute to improving the resilience of Bangladesh to sea-level rise.



**Figure 3.** IWM study showing in red the 33 sea-facing and 26 interior-facing polders likely to be overtopped by 2050 based on global sea level projections.



**Integration into policy:** In collaboration with BUET, we hosted a webinar to discuss implementation of SLR information into policy. These local sea-level projections will now be used to inform the Bangladesh Delta Plan 2100 which aims to reduce climate risk to investable sectors such as housing, industry and flood control.

## What's next?

**Collaborative Development:** Feedback from the workshops has highlighted the need for the provision of further training on the technical methods of handling sea-level projection data.

**Future Research:** These local sea-level projections can be combined with past sea-level and storm surge data to calculate the magnitude and regional differences in required coastal defences to address coastal climate risk. The projections also provide an opportunity to research the seasonality of sea-level and storm surges to support coastal management strategy.

<sup>1</sup>Harrison, B., Daron, J.D., Palmer, M.D., Weeks, J.H. 2021, Future sea-level rise projections for tide gauge locations in South Asia, Environ. Res. Comms. Accepted.

<sup>2</sup>See more at: <https://iopscience.iop.org/article/10.1088/2515-7620/ac2e6e>  
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