



Understanding the connection of extreme water levels to mortality in the megacity Dhaka

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To quantitatively assess the impact of extreme water levels on a local scale we study both low and high water levels and their connection to mortality in the megacity Dhaka. Dhaka is currently threatened by a range of natural hazards such as earth quakes, tropical cyclones and - on an almost annual basis - flooding . Flooding in the megacity is largely determined by the close proximity to the confluence of the Ganges and Brahmaputra rivers upstream as well as the conjunction with the Meghna river further downstream. The risk of flooding is aggravated through rapid urbanization and concurrent encroachment on retention areas, as well as increasing problems with both the natural and man-made drainage system. A growing population, continuing urbanization and climate change are all expected to worsen the situation in Dhaka.

This prompted us to study historical trends in extreme water levels using over 100 years of daily water level data with respect to trends in frequency, magnitude and duration, focusing on rare but particularly high-risk events using extreme-value theory. In a further step, the complex link between water levels and mortality are studied using a distributed lag non-linear model with mortality data available on a daily basis for a five-year period (2003-2007).

Our analysis suggests that water levels have indeed changed over the course of the past century. While the magnitude and duration of average flood events decreased, the frequency of extreme flood events has increased. Low water levels have also changed, with a significant decrease in the annual minimum water level when comparing the time periods 1909-1939 and 1979-2009.

Results further indicate that for the period of 2003-2007, which entails two major flood events in 2004 and 2007, high water levels do not lead to a significant increase in relative mortality, which indicates a good level of adaptation and capacity to cope with flooding. However, following low water levels, an increase in mortality could be found. This is particularly alarming as low water levels have continuously decreased over the past 100 years.

Thus, to ensure the population is capable of coping with future climate change, we stress the importance of not only continuing and improving the current adaptation measures for flooding, but to also prepare the population for drought events.