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1 Water hazards in the Indo-Tibetan Brahmaputra basin: A regional climate change impact perspective

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Location of river like the Brahmaputra is so significant that impact of global climate change would appear earlier in such places of most sensitive nature – a geo-environmentally vulnerable watershed that is located at the transitional zones between different climatic regions and different distinct geomorphologies, such as that of the cold dry climate of the Tibetan plateau and the warm tropical humid climate of the Assam-Bangladesh plains, where temperature contrast would occur earlier than other regions. The thermal and dynamic influence of the Tibetan Plateau not only plays a significant role in the evolution and formation of the Asian monsoon circulation; it affects climatic modulation of different water-induced hazards like the annual flooding of the Brahmaputra and also impact the relationship between spatial distribution of water and intensity of such disasters. As a result, basic characteristics of water hazards, especially those related to water movement and land-water-atmosphere interactions are severely affected. While the flood damage is on the rise in the Brahmaputra, the colossal water (1.6 X 10^{12} m^3/y) and sediment (1.4 X 10^9 tons, one of the highest in the world) loads injected to Bay of Bengal during the monsoon is a phenomenon of serious consequence. The open sea connection to this high water and sediment flux is of particular importance as time-series studies revealed sediment load fluctuations of an order of magnitude over two decades, indicating one of the highest variability in the world. Distribution of C-N-P and DO in the deep Indian Ocean suggests that the sediment flux serves as a major nutrient source and oxygen sink. Thus, the current uncertainty about the future climate change effect on the hydrological, ecological and

biogeochemical processes of the watershed is increasing, having potential implications for a range of ecosystems from the highlands (5300 m) of the Himalayas to the coastal zone of Bay of Bengal. Though due to scarcity of historical data, whether all of these recent changes cannot be attributed to climatic variability, but phenomenon like the recent three decade high floods in Assam and Bangladesh plains may not be unforeseen after all, as the magnitude and direction of climate change impacts could be significant both in relative and absolute terms. Vast floodplains and areas including coastal regions could experience diverse impacts due to modified hydrological and biogeochemical cycles leading to changes in vegetative cover and constrained ecosystems. The role of such modified flux in the evolution of the fluvial ecosystems of this globally critical region could be vital with several irreversible changes. In the backdrop of intensified human impacts that can exacerbate natural impacts, the current observations, though limited in scale for such an understudied and hence less understood river, point towards meticulous monitoring needs for evolving mitigation and adaptation strategies.