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Modeling recent climate change induced extreme events in Bangladesh: A review



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ABSTRACT

Bangladesh is a resourceful and densely populated country that has been experiencing frequent disasters viz. cyclones, tidal surges, floods, salinity intrusions, droughts etc. which cause large damage to lives and properties every year. The frequency and intensity of the extreme events have increased significantly in recent decades due to climate change and global warming. This review paper synthesizes extreme climatic events in Bangladesh in the context of the climate modeling data. The modeling results of extreme events showed significant trends in Bangladesh due to climate change. The results of these climate models are significant to show the importance of climate modeling in Bangladesh and it will help to promote research on climate modeling in least developed countries like Bangladesh.

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1. Introduction

Bangladesh is a South Asian disaster-prone country. Almost every year, the country experiences disasters of one kind or another – such as tropical cyclones, storm surges, coastal erosion, floods, and droughts – causing heavy loss of life and property and jeopardizing the development activities. The rain fed agriculture of the country depends on seasonal rainfall and South Asian monsoon is the most important climatic phenomenon that is directly related to the intensity and frequency of rainfall and drought over the country. The country is already beset with many problems like high population density (total population 158,570,535 on July 2011 living in an area of 147,570 km²) (The World Factbook, 2011), shortage of land to accommodate the people, food security, human health, illiteracy, and so forth. The above mentioned types of disasters make the problems all the more complicated. In the foreseeable future, Bangladesh is likely to be one of the most vulnerable countries of the world in the event of climate change. The global warming due to the increase in greenhouse gas concentrations in the earth's atmosphere and the consequent sea level rise (SLR) are going to add fuel to the fire. Almost every socio-economic sector in Bangladesh is likely to be affected by climate change (Ramamasy and Baas, 2007).

Bangladesh ranked 5th in the Global Climate Risk Index, a ranking of 170 countries that are most vulnerable to climate change (Kreft and Eckstein, 2013). Fig. 1, describes areas of the

country affected by different types of climate-related disasters. The nation is particularly at risk because it is a vast delta plain with 230 rivers, many of which unstably swell during the monsoon rains. This geology, combined with river water from the melting Himalayan glaciers in the north and an encroaching Bay of Bengal in the south, makes the region prone to severe flooding. The situation is made worse by the prevalence of intense storms, a marker of climate stresses. Sidr, the Category 4 cyclone that ravaged southern Bangladesh in November 2007, killed some 3500 people, displaced 2 million, and wiped out paddy fields. Sidr was followed by two heavier-than-normal floods that killed some 1500 people and damaged about 2 million tons of food. The United Nations warns that a quarter of Bangladesh's coastline could be inundated if the sea level rises 3 feet in the next 50 years, displacing 30 million Bangladeshis from their homes and farms. If that happens, the capital, Dhaka, now at the center of the country, would have its own sea promenade (CCC, 2009).

Research on modeling climatic system is going on to understand the possible impacts of climate change, to make effective climate policy and to design various adaptive measures. Climate modeling occupies a special position in the Climate Change related research and development of adaptation strategies. According to the the IPCC (Intergovernmental Panel on Climate Change) Special Report on Emission Scenarios (SRES), a series of possibilities of earth's future surface temperature at the middle or at the end of 21st century are presented. Global surface temperature increase by the end of the 21st century is likely to exceed 1.5 °C relative to the 1850–1900 period for most scenarios, and is likely to exceed 2.0 °C for many scenarios (IPCC, 2013). Such studies show as to

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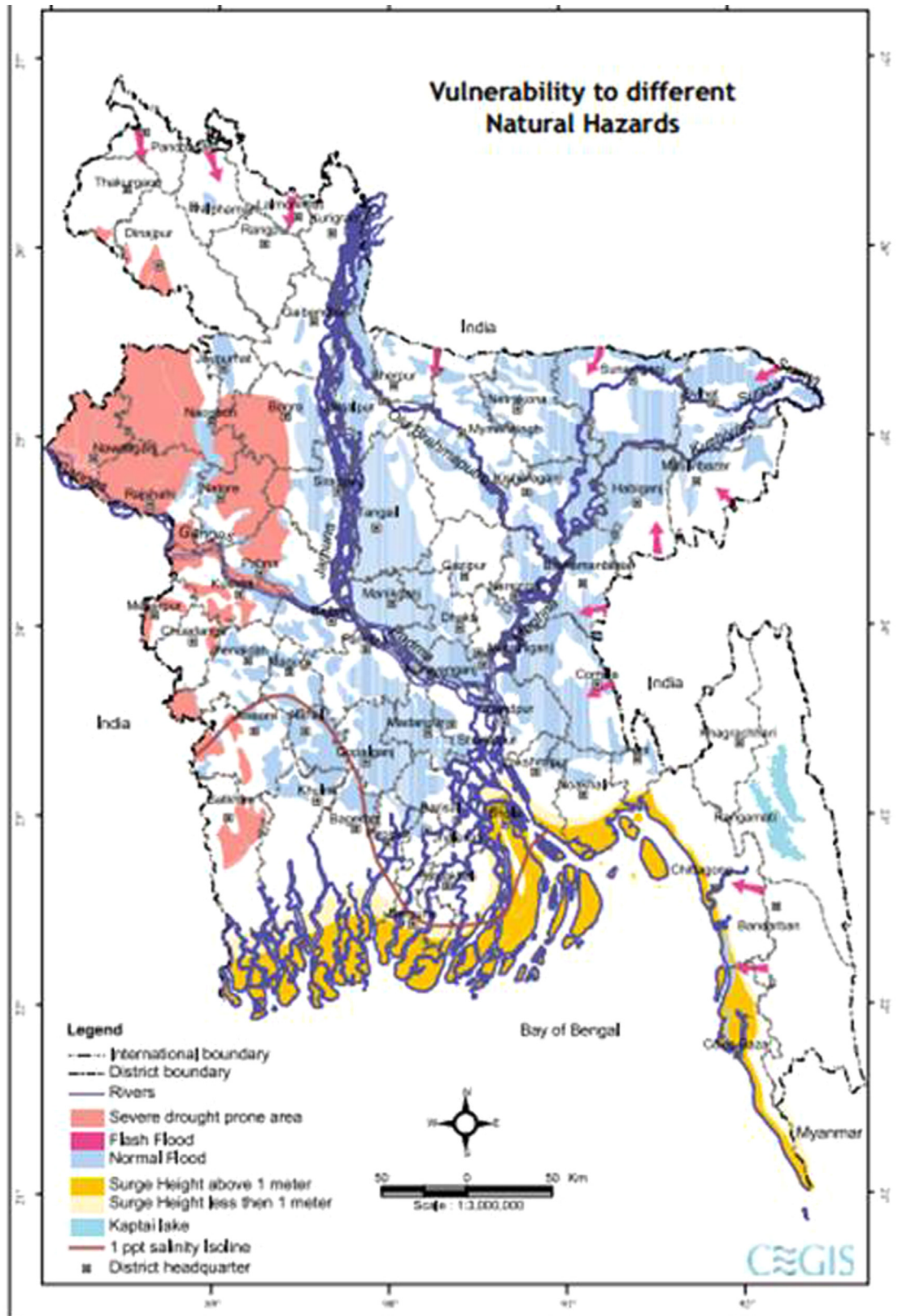


Fig. 1. Areas affected by different types of climate-related disaster of Bangladesh (MoEF, 2008).
Source: CEGIS, Dhaka.

why climate models are now part and parcel of climate science. Following are some of the reasons why climate models have assumed such importance: (a) Significant improvements in the speed of computers which facilitate the analysis of mathematical

models of weather and atmospheric heat and energy processes very quickly and accurately; (b) Climate models serve as an important demonstration tool for policy-makers to learn the possible outcomes and consequences of the increases in various

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