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Change in Temperature and Rainfall Pattern at Coastal Region Adjoining Sundarbans, West Bengal

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Abstract

The Sundarbans is one of the major climate hotspots experiencing significant climatic and ecological challenges, mainly, temperature rise, erratic rainfall, occurrence of cyclones, intrusion of saline water and deforestation. In the present study, changes in temperature and rainfall pattern are assessed which are responsible for agricultural production as well as mangrove ecosystem of the region. The livelihood pattern of inhabitants is also influenced by the prevailing weather situation. Comprehensive study of weather pattern of the region will also be helpful to establish sustainable climate resilient models for the coastal zone of West Bengal. To fulfill the objective, climatological data on temperature and rainfall were collected for four locations adjoining Sunderban, namely, Diamond Harbour, Kakdwip, Manmathanagar and Baruipur. The analysis of data depicts shift in peak rainfall month from June to August for almost all study locations. More recently, the monthly rainfall pattern shows anomaly i.e., the variation of monthly total rainfall is very high. The temperature gradually increases from February to April and then decreases till September to October, thereafter decreasing sharply after post monsoon till January. The average monthly temperature for the period 1991-2011 has been compared with normal baseline temperature data of 1961-1990. For Diamond Harbour station, a significant rise in maximum and minimum temperatures (of 1991-2011) is noticed over baseline data for most of the months. The changing pattern of rainfall and temperature confirms the effect of global warming and climate change in the areas adjoining Sunderbans.

Keywords: *Sundarbans, climate change, rainfall pattern, temperature change*

Introduction

Meteorological factors such as temperature and rainfall are one of the key indicators of change in weather patterns, which has been associated with increase in global temperature and sea level rise that certainly pose a serious threat to the low lying areas of coastal region with special reference to Sundarban region with increased rate of vulnerability and disappearance of islands. IPCC predicted increase in global mean temperature between 1.4 and 5.8°C by 2100 (IPCC, 2001) and due to presence of low lying mangroves West Bengal tops the in the vulnerability list. The GMSL (Global Mean Sea Level) rise is projected to be 0.28-0.98 m by 2100 although with regional

variations and local factors the local sea level rise can be higher than the projected for the GMSL (IPCC, 2014).

Repeated submergence occurs during high tide due to low lying areas resulting to salt water intrusion and consequently top dying of *Sundari* tree population (Haq, 2010). Studies revealed the change in succession of Sundarbans where non woody shrubs have replaced woody trees leading to loss of productivity and wildlife increased risk of cyclones in recent years (Ali, 1999; Unnikrishnan, 2006; CSE, 2012). Increase in cyclonic storms leads to sea water intrusion and have subsequently affected the livelihood of the inhabitants leading to economic loss and the shift of monsoonal rainfall to post monsoon season affects the agricultural productivity and directly threats the livelihood and exacerbate food insecurity. Colette (2007) predicted sea level rise of 25cm and 45cm by the end of 21st century would result in loss or destruction of 40% and 75% of Sundarbans, respectively. The major threats to Sundarbans are mainly increased temperature, sea level rise, salinity rise, deforestation, and change in agricultural pattern.

Present study is conducted to assess the current weather pattern with reference to temperature and rainfall in Sundarban coastal belt that would help in developing climate resilient livelihood model for the region.

Materials and Methods

The study was conducted for Sundarban region and the meteorological data for maximum temperature, minimum temperature and rainfall pattern have been done on the basis of secondary data collection for few selected areas namely Diamond Harbour, Manmathanagar, Baruipur and Kakdwip. The data collected were analyzed over time using MS-Excel platform and concerned time series charts were prepared.

Results and Discussions

Rainfall pattern

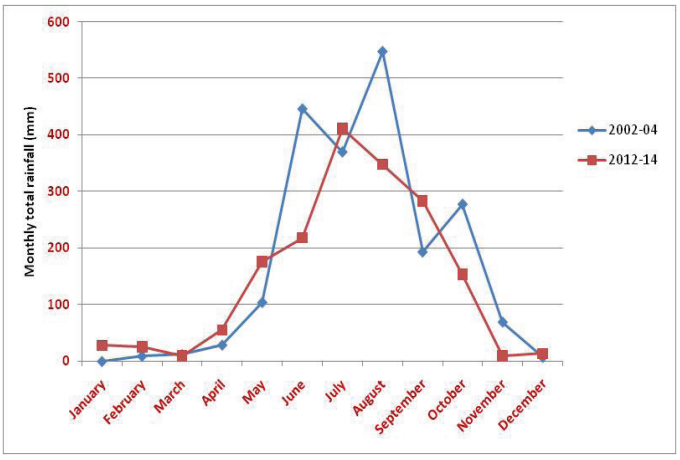

Figure 1: Change of monthly total rainfall pattern in Diamond Harbour over a decade

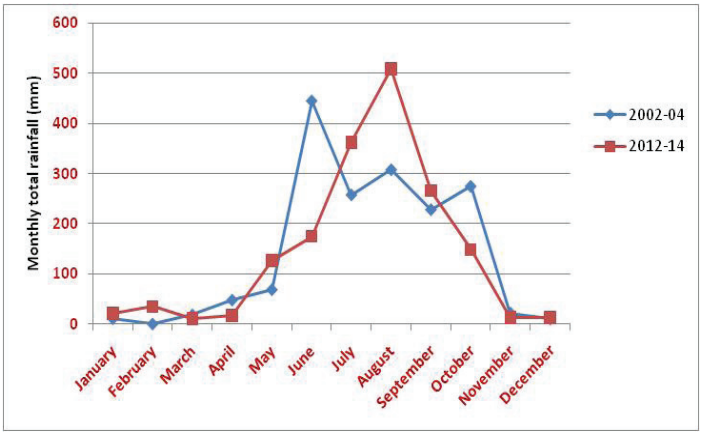

Figure 2: Change of monthly total rainfall pattern in Manmathanagar over a decade

In the present study, monthly total rainfall data were collected for over a decade in Diamond Harbour, Manmathanagar and Baruipur while the rainfall data in Kakdwip was collected over two decades. The average annual rainfall in the year 2002-04 at Diamond Harbour, Manmathanagar and Baruipur was found to be 1692.7 mm, 2059.8 mm and 1860.2 mm respectively while in the year 2012-14 it was 1700 mm, 1724.2 mm and 1728.8 mm respectively. Average annual rainfall at Kakdwip was recorded as 1719.5 mm, 1883.1 mm and 1700 mm in the years 1982-84, 2002-04 and 2012-14 respectively. The data recorded reveals decrease in rainfall in last decade for the region except for Diamond Harbour. Analysis reveals a general trend in shift of rainfall from June to August as well as erratic and anomalous pattern of rainfall is noticed for different areas. Data for monthly total rainfall shows highest rainfall (508.1 mm) in the month of August in the year 2012-14 while highest rainfall (444.87 mm) was recorded in the month of June in years 2002-04 at Diamond Harbour and sparse rainfall is observed in the month of February (2002-04) and March (2012-14) (Figure 1).

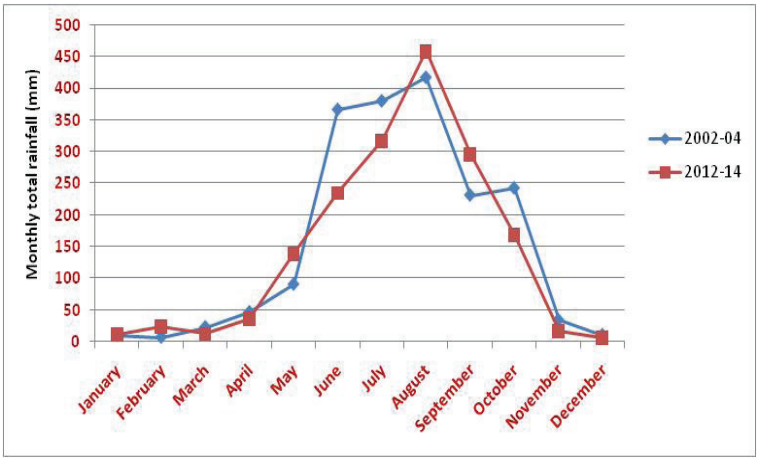

Figure 3: Change of monthly total rainfall pattern in Baruipur over a decade

However at Manmathanagar anomalous pattern is noticed with highest rainfall record in the month of August (547.7 mm followed by 446.2 mm in June with comparatively less rainfall in July 370.25 mm) for the year 2002-04 while in the years 2012-14 it was about 410.93 mm in July followed by August and September with no rainfall in January (2002-04) (Figure 2). Rainfall pattern over a decade in Baruipur shows highest rainfall in the month of August (417.367 mm) with very little rainfall in December, January and February (2002-04) (Figure 3).

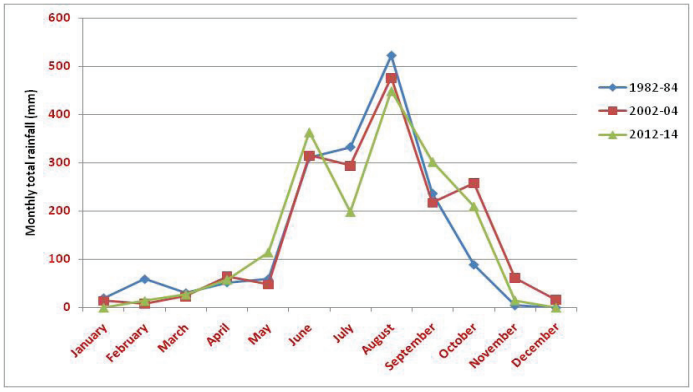

Figure 4: Change of monthly total rainfall pattern in Kakdwip over two decades

In Kakdwip highest rainfall is noticed in August (523.3 mm during 1982-84; 476.633 mm during 2002-04 and 449.4 mm during 2012-14) over two decades with consequently lowered amount of rainfall over the decades, but change in monthly rainfall pattern over two decades is significant. In the years 2012-14, rainfall in July was about 198.6 mm which is much lowered compared to the records from 1982-84 (333.4 mm) and 2002-04 (293.867 mm). Pronounced increase in rainfall in the month of October was found in the year 2002-04 (258 mm) and 2012-14 (210 mm) compared to 1982-84 records of about 89 mm (Figure 4). Considering peak rainfall months, the amount of rainfall is higher in recent years 2012-14 in Diamond Harbour and Baruipur while it has been found to be decreased in Manmathanagar and Kakdwip when compared to decades.

Temperature pattern

Monthly temperature data in Diamond Harbour has been collected over a decade comprising the years 1961-1990 and 1991-2011. Monthly maximum temperature data revealed, April was the hottest month (35.4 °C) followed by May (35.2 °C) in Diamond Harbour in the year 1991-2011 while in the year 1961-1990 it was 34.6 °C and 34.5 °C respectively. The result shows an increase in maximum temperature of 0.8 °C and 0.7 °C in 1991-2011 from preceding decade. The coolest month is December (maximum temperature 25.9 °C) in the decade of 1961-1990 and observed increase in maximum temperature in December (26.9°C) by 1°C in 1991-2011. However, coolest month in 1991-2011 was observed in month of January with maximum temperature of 25.6°C. The temperature has been gradually increasing from January, reaching to peak in April, then decreasing till October, thereafter decreasing sharply after post

monsoon till January in the year 1961-1990 (Figure 5). Similar trend is observed for the years 1961-1990 and 1991-2011 in Diamond Harbour. However a significant rise in temperature is noticed in each month over the decade (Figure 5 and 6). Minimum temperature was recorded in the month of December (13.8°C) in the year 1961-1990 while it is 15.4°C in the year 1991-2011.

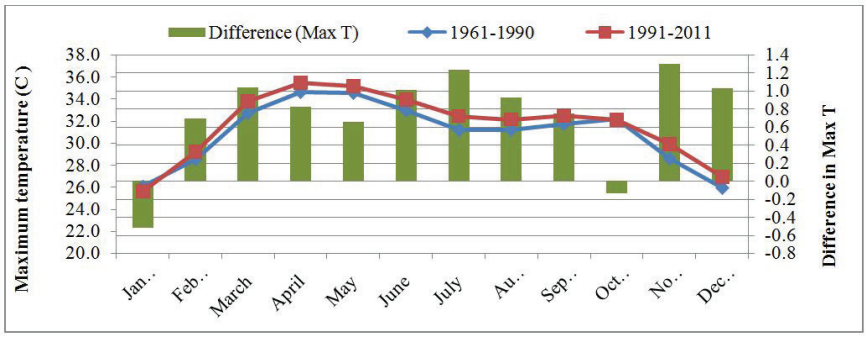

Figure 5: Changes in maximum temperature for Diamond Harbour station

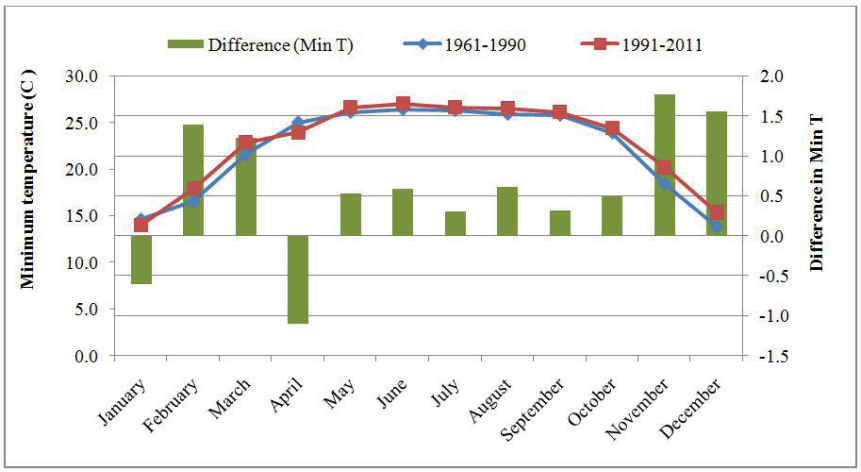

Figure 6: Changes in minimum temperature for Diamond Harbour station

Conclusions

A shift in peak rainfall months from June to August is noticed for all the study locations. In recent years, anomalous pattern in monthly rainfall is recorded with variation of monthly total rainfall which is very high. Gradual increase in temperature from February to April and decreasing trend till September to October is observed. A sharp decrease in temperature is also recorded after post monsoon till January. The average monthly temperature for the period of 1991-2011 at Diamond Harbour station, shows a significant rise in maximum and minimum temperatures over baseline data of 1961-1990 for most of the months. Impact of climate change and global warming is confirmed in the adjoining areas of Sundarbans with the changing pattern of rainfall and temperature.

References

1. Ali, A. (1999). Climate change impacts and adaptation assessment in Bangladesh. *Clim Res.,* 12: 109-116.
2. Centre for Science and Environment (2012). Living with changing climate. http://www/cseindia.org.
3. Colette, A. (2007). Case Studies of Climate Change and World Heritage. UNESCO Paris, pp. 82.
4. Haq, S. A. (2010). Impact of climate change on "Sundarbans", the largest mangrove forest: ways forward, paper presented at 18th Common Wealth Forestry Conference, Edinburgh International Conference Centre, Scotland, UK.
5. IPCC (2001). The Scientific Basis. Contribution of working Group I to the third assessment report of the Inter Governmental Panel on Climate Change. Edited by Houghton JT, Ding Y, Griggs DJ, Noguer M, Vandar Linden PJ, Dai X, Maskell K, Johnson CA (Cambridge University Press, Cambridge and New York, NY).
6. IPCC (2014). Intergovernmental Panel on Climate Change, Fifth Assessment Report. Final Draft, Working Group-II, Chapter 5.
7. Unnikrishnan, A. S., Rupak, U. K., Fernandes, S. E., Michael, G. S. and Patwardhan, S. K. (2006). Sea level changes along the Indian coast: Observations and Projections. *Current Science,* 90: 362-368.