Recent changes in temperature and rainfall trends and variability over Bangladesh

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1. Background

• Wide acceptance that Bangladesh is one of the most vulnerable countries of the world due to climate change: **Facts and dimensions of climate change parameters are needed in order to act.**
• Bangladesh Delta Plan 2100 Formulation Project is working on a longer term (50 to 100 year) time frame plan for the country. A climate change study has been done, collecting existing knowledge on trends and changes in climate parameters (Terwisscha van Scheltinga et al, 2015).
• This presentation shows the results of additional study
2. Objectives

Considering the need of incorporating the climate change knowledge in the processes of short, medium and long term planning and implementation BDP-2100 has undertaken study on ‘Baseline Climate Change of Bangladesh’. The presentation is an additional part of the BDP Climate change study.

- We present some results of trend analysis of minimum, maximum and mean temperature and rainfall.

DATA USED

- The daily and monthly Minimum, Maximum and Mean Temperature and rainfall for 32 meteorological stations belonging to Bangladesh Meteorological Department have been used.
3. Methodology

• Data preparation
  • Data quality checking.
    • Erroneous data are deleted
    • The gaps are filled using interpolation with neighboring stations
• Climatology has been analyzed
  • For trend analysis least square regression technique has been used
  • The results are presented in tables, figures, graphs and maps
4. Results & Discussions

4.1. General Climatic Condition of Bangladesh

- Av. Tmax: Peak in April (33.5 °C)
- Secondary peak in September (31.6 °C)
- Tmin: Lowest in January (12.5 °C)
- Annual rainfall: 2425 mm
- Monsoon: 1750 mm (72% of the annual)
- Pre-monsoon: 17%
- Post-monsoon: 9%
4.2 Climate change (Temperature)

Annual Trend of Minimum Temperature

\[ y = 0.014x - 7.249 \]
\[ R^2 = 0.524 \]

Temperature (°C)

Year

Annual 0.014 <0.001 0.008 <0.001 0.010 <0.001
Winter 0.021 <0.001 0.000 n.s. 0.013 <0.002
Pre- monsoon 0.014 <0.002 -0.004 n.s. -0.001 n.s.
Monsoon 0.008 <0.001 0.015 <0.001 0.011 <0.001
Post- monsoon 0.016 <0.001 0.024 0.528 0.016 <0.001

Annual Trend of Mean Temperature

\[ y = 0.0103x + 4.9261 \]
\[ R^2 = 0.3582 \]

Temperature (°C)

Year

Annual 0.0103 <0.001 0.008 <0.001 0.010 <0.001
4.3 Spatial distribution of Trends of Annual min and max temperature ($T_{\text{min}}$ and $T_{\text{max}}$)
4.3.1 Seasonal Trends of Minimum Temperature
4.3.2 Seasonal Trends of Maximum Temperature
4.4 Trends of annual and seasonal rainfall

Annual

\[ y = 3.96x - 5545. \]

\[ R^2 = 0.070 \]

(a) Winter

(b) Pre-monsoon

(c) Monsoon

(d) Post-monsoon
## 4.4.1 Annual and Seasonal Trends

<table>
<thead>
<tr>
<th>Season</th>
<th>Trend value (mm/year)</th>
<th>% increase of precipitation in 50 years</th>
<th>Probability ( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>0.2</td>
<td>29.2</td>
<td>n.s.</td>
</tr>
<tr>
<td>Pre- monsoon</td>
<td>1.3</td>
<td>12.2</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Monsoon</td>
<td>2.1</td>
<td>6.3</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Post-monsoon</td>
<td>0.5</td>
<td>11.4</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Annual</td>
<td>4.0</td>
<td>8.6</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
4.5 Map of Annual Rainfall Trend (mm/year)

The trend maps are useful for regional level and local level adaptation formulation and planning.
4.5.1 Maps of seasonal rainfall trends (mm/year)
4.6 The analysis of the number of rain days
for: Dry period (November-January), Wet Period (May-October)
The increasing trends of number of trends of rain days infers that the increasing of rainfall is mainly associated with the increase of the number of rain days.
4. CONCLUSIONS:
The study has the following conclusions:
• The temperature of Bangladesh has increasing trends. Minimum temperature of winter and Pre-monsoon seasons are increasing faster than maximum temperature. But in Monsoon and Post monsoon seasons the Maximum Temperature increases faster.
• The annual mean temperature has increased by around 0.64°C during the past 64 years (1948-2011).
• The annual and seasonal rainfall is found to increase. The increasing trends are significant for Pre-monsoon and Monsoon seasons and show 6% and 11% increase respectively over the last 50 years.
• The significant increasing trends of number of rain days depicts that the increase of rainfall is caused mainly by the increase of the number of rain days.
4. CONCLUSIONS (cont...😊)

• The spatial distribution of trends of temperature shows that the climate change is not uniform and causes of such variations are related to land-use change (urbanization, Land-use change and deforestation)
• The spatial distribution of trends of temperature and rainfall shows that the trends are not uniform neither for temperature nor for rainfall over the space or over the seasons.
• Thus, there no unique solution for adaptation for the whole country and the local level climate change and variability are needed to be considered. These maps would be very useful as they provide local level information of climate change.
THANKS