Mapping multiple climate-related hazards in South Asia

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Introduction

Risk is understood as the probability that exposure to a climate-related hazard with a given vulnerability will lead to negative consequences. Disaster risk reduction includes systematic efforts to analyze and manage the causal factors of disasters through reduced exposure and vulnerability to hazards, and improved preparedness for disaster events. In South Asia, interest in multi-risk assessment has increased during the last decade. The main objectives of this study were to:

- map areas exposed to five climate-related hazards: floods, droughts, extreme rainfall, extreme temperature (heat wave) and sea-level rise;
- develop a method for estimating the population exposed to individual natural hazards and their impacts on agriculture; and
- assess the overall vulnerability and risk at the country level based on country-wide, urban and rural population exposure to these hazards.

Method and approach

Using the ranking procedure, we found that most of the divisions in Bangladesh, and some divisions in India, Sri Lanka, Pakistan and Nepal are extreme-risk areas. Some cities are highly affected by hazards such as floods and droughts, which indicate that the adaptive capacities of those cities are not sufficient due to high population densities and significant exposure to the hazards.

Data used

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Dataset</th>
<th>Period</th>
<th>Spatial resolution</th>
<th>Temporal resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>MODIS – MOD09A1</td>
<td>2001-2013</td>
<td>500 m</td>
<td>8-day</td>
</tr>
<tr>
<td>Drought</td>
<td>MODIS – MOD09A1</td>
<td>2001-2013</td>
<td>500 m</td>
<td>8-day</td>
</tr>
<tr>
<td>Extreme rainfall</td>
<td>APHRODITE and TRMM</td>
<td>1951-2013</td>
<td>11 km</td>
<td>Daily</td>
</tr>
<tr>
<td>Heat wave</td>
<td>MODIS – MOD11C2</td>
<td>2001-2013</td>
<td>5,000 m</td>
<td>8-day</td>
</tr>
<tr>
<td>Sea-level rise</td>
<td>Tidal gauge data</td>
<td>1930-2013</td>
<td>Points</td>
<td>Monthly</td>
</tr>
</tbody>
</table>

Results and discussion

Using the ranking procedure, we found that most of the divisions in Bangladesh, and some divisions in India, Sri Lanka, Pakistan and Nepal are extreme-risk areas. Some cities are highly affected by frequent disasters in spite of their high adaptive capacity, because the adaptive capacities of those cities are not sufficient due to high population densities and significant exposure to the hazards.

Conclusion

This assessment of exposure to climate hazards has implications for country-level adaptation to climate change. It could be used to help inform decisions about financial aid or how to allocate climate adaptation resources within a country. Additionally, the assessment allows for comparisons to be made between different countries’ exposure to a particular hazard. The model is designed to be flexible, allowing exposure assessment methods to be applied to a range of outcomes and adaptation measures, such as economic loss, etc. The approach can be promoted within the Sendai Framework for Disaster Risk Reduction 2015-2030 to member states for building long-term resilience.

Acknowledgements

This research study was funded by the CGIAR Research Program (CRP) on Climate Change, Agriculture and Food Security (CCAFS); CGIAR Research Program on Water, Land and Ecosystems (WLE); Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan; and the International Water Management Institute (IWMI). The contribution made by various government agencies in data sharing and providing valuable feedback is gratefully acknowledged.