

# Research Highlights

## Flood Hazard Assessment in Astore River Basin, Pakistan

Muhammad Sohaib Baig

Kyoto University, Japan

[Email: [aquarius\\_baig@yahoo.com](mailto:aquarius_baig@yahoo.com)]

**Abstract:** Astore River Basin is prone to large flood events endangering lives and property in the area. This paper discusses the natural physical conditions of the basin that predisposes it to floods, especially during the monsoons. Imminent intensification of extreme climate events as a result of climate change may put the area under increasing risk from floods. Given this future climate phenomena, improvements towards the assessment and management of floods in the area becomes more important. Immediate and critical needs, and recommendations towards improving the assessment and management of flood hazards are made at the end of this paper.

**Keywords:** Flood hazard assessment, flood forecasting, Hindu-Kush region.

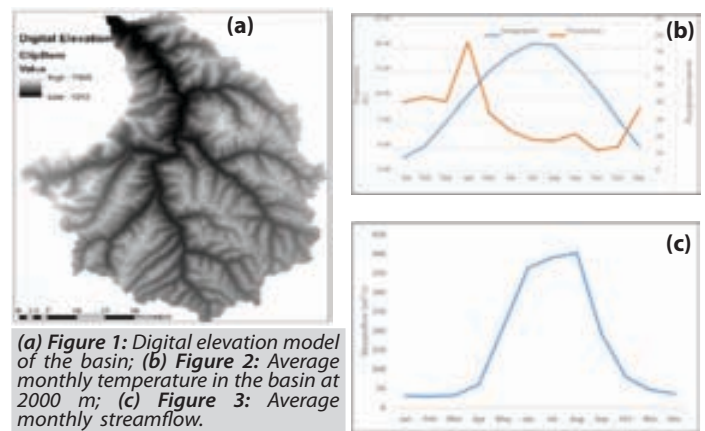
### INTRODUCTION

Devastating floods in the Astore River Basin in the last decade (2003, 2005, 2010 and 2011) resulted in a high number of human casualties as well as an enormous loss of property, causing immeasurable suffering to the people. Monsoonal rains, steep topography, and degraded catchments contribute to high flood peaks in the basin. A large drainage area and inadequate surface-storage capacity result in high stream flows. Encroachment and poorly planned development along the streams and in the floodplains also cause serious flood damage. The Basin lacks an appropriate flood policy, comprehensive laws, and adequate flood-control infrastructure. To date, no approved national water and flood policy exists, and too many institutions are involved when disasters occur. Considering the large basin area and scale of flooding, rescue and relief operations have been inadequate. During the 2010 floods, there were also problems in operational decision-making at the field level.

Frequency of natural disasters is on the rise due to extreme weather conditions and global climate change. The Intergovernmental Panel on Climate Change (IPCC) predicts that the average global surface temperatures will increase by 1.4°C-5.8°C between 1990 and 2100 (IPCC 2007). Climate change anywhere in the world will be accompanied by changes in the nature and frequency of extreme weather events. The increase in rainfall intensity and changes in rainfall patterns may further increase the frequency and/or intensity of floods in the Himalayan-Hindu Kush region, which the Astore Basin is a part of. This study will use a flood forecasting model with satellite imagery. The inaccessibility of disaster affected areas further adds to the complexity of relief and response work. In such a scenario, satellite imagery is a valuable tool to generate and establish a quick footprint of a disaster. It provides crucial input for the planning of relief supplies by assessing damage to transport networks, finding escape routes and potential shelter sites for displaced people.

### APPROACH

The Astore River Basin is located in the Himalayan mountain ranges in Pakistan (Figure 1). Its area is 4000km<sup>2</sup> and elevation range is 1242-7595m. The land use suggests mixed forests, grass or shrub lands and glaciers. The elevation of the basin ranges between 2000-4000m about 85% of the area appears to consist of steep slopes. This paper highlights the climate and hydrological conditions as well as challenges in the Astore River Basin, which is part of the Hindu-Kush region drawing on a previous study. The climate of the region is generally cold with the temperatures remaining below freezing from December to February at the elevation of 2000m (Farhan et al. 2014). Temperature decreases with elevation and at 4000m, it remains below 0°C from October-May. The precipitation falls in the form of snow and rain with snow in large proportions. Snow falls from December to March whereas from April to October the precipitation is less in comparison (Figure 2). The flow regime is snowmelt dominated. From October to April, the flow is relatively stable at 32m<sup>3</sup>/s. The snow starts to melt in April and continues to contribute in streamflow till September. The monthly average streamflows are shown in Figure 3.



### DISCUSSION AND CONCLUSION

There are several challenges facing the the Astore River Basin. There is an immediate need to assess technological, institutional and policy options with respect to flood events. There is also a need to develop a flood policy, adopt an intergrated water resources management (IWRM) framework and basin-wide floodplan following integrated river-basin approaches. In addition, organizational roles and institutional reform as well as the development and enforcement of a land-use policy have to be considered. The engagement of all stakeholders in these processes is critical to ensure effective outcomes. The increase of revenue for the maintenance and management of flood protection infrastructure is also a challenge that has to be addressed. Recommendations for improvement include the following:-

- Carrying out a vulnerability and flood-risk hazard study focusing on critical areas;
- Improving databases and information-sharing mechanisms, expand the coverage of the flood forecasting and early-warning system to major streams and hill torrents;
- Developing retention basins and wetlands, as well as flood-diversion and flood-bypassing arrangements;
- Repairing the critical hotspots of catchments, as part of an overall effort to support livelihoods of communities and environmental protection;
- Developing disaster management plans, including dam-break and dam-burst scenarios.

### REFERENCES

- Farhan SB, Zhang Y, Ma Y, Guo Y, & Ma N (2014) Hydrological regimes under the conjunction of westerly and monsoon climates: a case investigation in the Astore Basin, Northwestern Himalaya. *Climate Dynamics*, 44(11-12), 3015–3032. doi:10.1007/s00382-014-2409-9
- IPCC (2007) Climate change 2007: an assessment of the Intergovernmental Panel on Climate Change. *Assess Rep 446* (November): 12–17