Urban Flood Risk Management: systematical, risk-based approach and an innovative solution with microwave links

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BACKGROUND

Urban flooding has become the leading source for disaster in the world (WEF, 2014). It poses an increasing challenge particularly for countries and cities with rapid urbanization. Therefore, it leads to an urgent need for urban flood risk management in cities' spatial planning and infrastructure management. The challenge governments are facing often is not only a lack of financial resources, but also about understanding how to use most effectively the resources at hand (UN-DRR, 2013). Integrated urban flood risk management is a multi-disciplinary and cross-sector intervention under the responsibility of diverse government and non-government bodies (GFDRR, 2011).

Urban flooding is mainly caused by heavy rainfalls and is understood as the inundation in a built environment. In rapidly growing cities massive surface runoff leads to severe damage especially in densely populated areas. Limited capacities of drainage systems often increase the destructive impact of urban flooding.

WORKSHOP ON URBAN FLOOD RISK MANAGEMENT

In 2014 Ernst Basler + Partner (EBP) organised a two-day-workshop on urban flood risk management (UFRM). The 26 participants of the workshop consisted of representatives from the cities of Barranquilla (Colombia), Ba Ria (Vietnam) and Manila (Philippines), 17 technical experts from EBP, risk experts from Swiss insurance and reinsurance companies as well as Swiss government representatives.

The workshop addressed the following issues:
– What challenges the cities are confronted with?
– How do they tackle these challenging issues?

The main goal of the workshop was to offer a platform to discuss and elaborate ideas and concepts in order to support the city authorities of Barranquilla, Manila and Ba Ria. Therefore, three case studies were carried out by estimating the current risks, developing cost-effective measures and representing the future risks after implementation as a base for the future decision making.

Besides the risk based results of the case studies the following conclusions could be made based on the workshop.

CONCLUSIONS

Causes for urban floods:

There are three types of causes for urban floods:
- Hazard related: heavy rainfalls leading to overland flows are becoming more intensive due to climate change. Additionally, urban floods often have a short warning time.
- Damage potential related: These causes are mainly driven by spatial development in low-lying areas with increasing population density and the construction of underground facilities such as subways or shopping malls.
- Prevention infrastructure related: The capacities of disaster prevention infrastructures, such as drainage systems, often have deficits, e.g. due to fast spatial development.

Systematical and cross-sectoral approach:

Dealing with urban floods is a complex task. The different causes and interactions between damage drivers are one reason for that. Another one is the fact that several stakeholders and institutions are involved which requires more coordination. Despite different characteristics and challenges of the three cities the systematical and cross-sectoral approach was applied successfully in the workshop.

The applied approach:
- bases on an integrated risk assessment
- identifies the need for action (priority setting) in a participative way considering the practical experiences and knowledge of relevant stakeholders
- enables an effective use of resources

– promotes a risk dialogue with all relevant stakeholders and enables dealing with limited data.

FLOOD FORECASTING USING MICROWAVE LINKS

Urban floods have a short forecasting time. Therefore an accurate and reliable rainfall input is important for forecasting and the optimisation of urban drainage systems. However, the strong spatial and temporal variability of rainfall complicates a reliable observation with rain gauges or weather radars. More innovative and cost-effective approaches are needed. Commercial microwave links (MWL) in telecommunication networks can represent a complementary source of rainfall information. MWL are particularly dense in urban areas, operate at millimetre wavelengths and are therefore strongly attenuated by rain drops.
A research project of the Swiss Federal Institute of Aquatic Science and Technology (EAWAG) investigated how far rainfall estimates from MWL can improve urban runoff predictions. As the research showed, commercial MWL can provide reliable rainfall data with low cost and can contribute to more reliable urban runoff predictions.

REFERENCES

- WEF (2014). Global Risks 2014 - Ninth edition. Insight report published by the World Economic Forum.
- UN-DRR (2013). Making Cities Resilient: Summary for Policymakers. Report published by the United Nations Office for Disaster Risk Reduction.
- GFDRR (2011).Cities and Flooding. Guide to Integrated Urban Flood Risk Management published by the Global Facility for Disaster Reduction and Recovery.

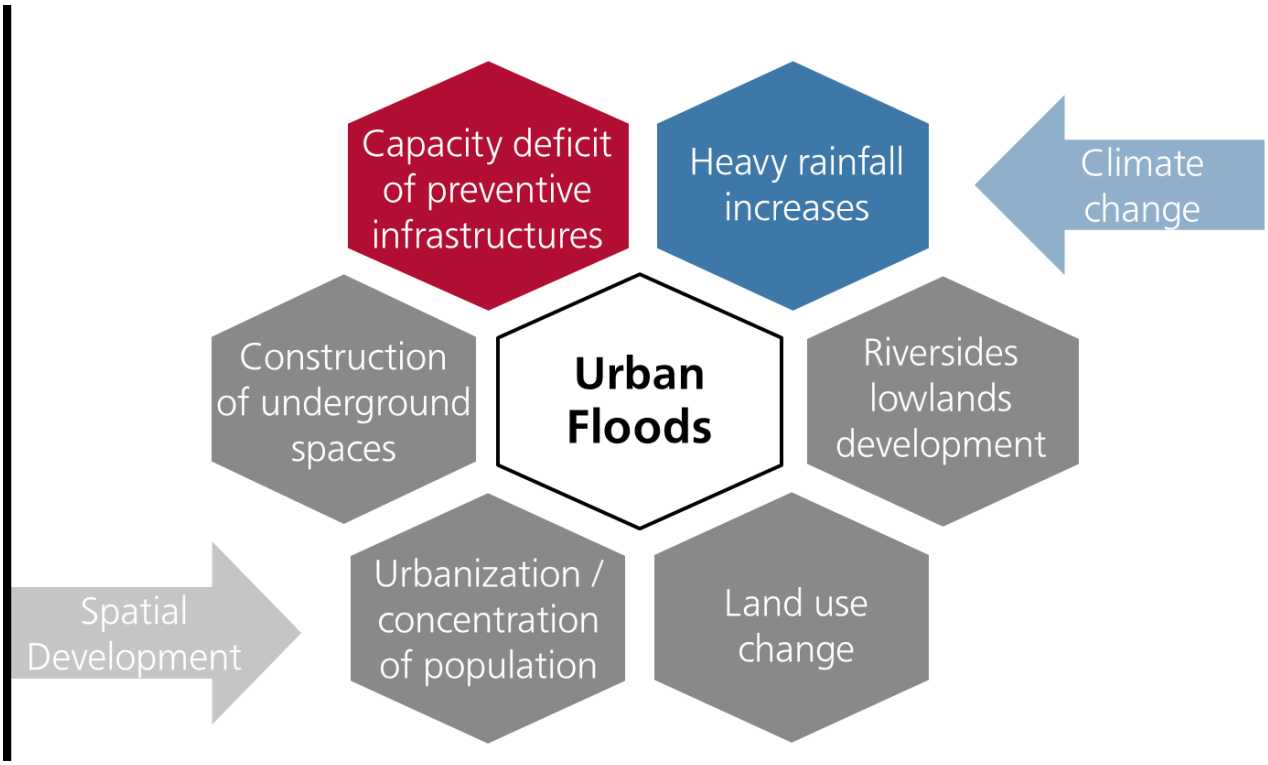

Figure 1. Urban Flooding is understood as the inndation of land in a built environment particularly in more densily populated areas mainly caused by heavy rainfalls.

KEYWORDS

Urban Flooding; Heavy Rainfall; Urban Flood Risk Management; Microwave Links; Participative Approach

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