Urban Water Journal

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/nurw20

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URBAN WATER JOURNAL
2020, VOL. 17, NO. 5, 379–380
https://doi.org/10.1080/1573062X.2020.1777754

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EDITORIAL

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Floods are among the main 21st century challenges related to climate change. They are responsible of about two thirds of the total human casualties incurred by natural disasters in the past 40 years and account for about one third of their related economic damages (IRDR, 2015; IFI, 2016). Hence, flood risk management is nowadays part of most governmental and UN organizations strategies for disasters risk reduction. However, in many developing countries, particularly in arid and semi-arid regions, these strategies are not yet integrating flood risk issues. One such example is the Middle East and North Africa (MENA) region where countries represent different climatic, hydrological, land use, storms characteristics and observational capacities. Recently, extreme and frequent flash floods have occurred in most of the MENA arid zones, resulting in significant economic and property losses. Indeed, in most countries of MENA, the unlikelihood of flood prospects in such countries inhibited their preparedness for flood risk and its related research remained largely disregarded by drought management works and its impact on water resources. However, in the last two decades, the region has experienced a dramatic shift in its rainfall records patterns. Many Arab cities such as Cairo (2020), Kuwait (2018), Riyadh (2016), Casablanca (2016), Alexandria (2015), Doha (2015), Guelmim (2014), and Muscat (2007) have experienced flash floods despite their highly arid and semi-arid climate. These events have caused live losses and important damages to properties and other urban assets. In this region of the world, such causalities are usually due to the combination of many factors such as extreme precipitations, weak or insufficient urban stormwater infrastructure and drainage system, silting of sewers and inlets by sand storms, urban stream bursting their banks, uncontrolled urban sprawl, rising groundwater tables, tides generated backwater effects on drainage systems outlets in coastal cities, the steep morphology of upstream basins, etc.

These phenomena are still not well studied and research about specific aspects of floods in one of the driest regions of the world that is MENA is still at its first stages. Besides, mitigation and adaptation measures are very rare in such countries and region because of the prevailing arid or semi- arid climate and growing urbanization. Tackling these problems requires a good analysis of climate change and meteorological data, particularly precipitation, and good knowledge of watersheds and cities vulnerability and exposure to floods in such territories. One of the initials publications on these phenomena was edited by Nouh and Maksimovic (2001) within UNESCO series of Urban Drainage in Specific Climates.

Following the Fourth International Symposium on Flash Floods in Wadi Systems (4th ISFF) (https://isff2018.com/), submissions to the special issue were opened for symposium participants from MENA region. This special issue gathered articles reporting and studying this uncommon new phenomenon in MENA countries and the ongoing first steps research on different aspects of flood issues in this region. One of the most recurrent hurdles to advancing flood risk research in this region is the lack of monitoring and data archive for accurate rainfall-runoff modelling and the access to high resolution maps for morphology and land use catchment characterization. The unavailability and sometimes the unreliability of data, particularly for the calibration and validation of flood models is a serious challenge for flood risk assessment in MENA region. To overcome this obstacle, Benkirane et al. developed and examined two validation methods in the Zat watershed, a sub-basin of the Tensift catchment in the High Atlas mountain of Morocco. Firstly, a correlation between the initial soil moisture conditions and the Curve Number (CN) from the calibration parameters was established to validate the flood model. Secondly, the Nash – Sutcliffe efficiency criteria were used for validating the model using four flood events recorded during the period 2011–2014. The two validation methods proved a reasonable result to assess the accuracy for simulating rainfall – runoff processes, despite data scarcity. Such methods can be used for flood modelling in semi-arid basins.

Different rainfall modelling tool and method were presented by Hafnaoui et al. for assessing October 2011 flood risk in El Bayadh city, which is located in the semi-arid wadi Deffa watershed in Algeria. The lack of data was countered by the development of two flood hazard maps. In the first map, four return periods were chosen 20, 50, 100 and 1,000 years. The required flood mitigation measures based on the resulting flood map proved to be costly and hard to realize at both social and economic levels. Therefore, the authors developed a more realistic second flood hazard map in the case of weather warning of sudden rainfall issued by the Algerian National Meteorological Office. This map was developed based on four hypothetical daily rainfall depicting possible floodplain extents. The flood of 1st of October 2011 was found to be close to the 50 years – return period. The resulting flood map was the first attempt to flood risk mapping in this area of Algeria where high damaging floods have been recorded in the past twenty years.

Flash floods in arid or semi-arid regions are often generated by heavy rainfalls in mountainous areas, where huge water volumes are accumulated and rapidly transported through wadi systems affecting cities and infrastructure located downstream at the wadi deltas. The Red Sea region of Egypt is such an example and many of its cities are not yet protected by structural measures. To help in identifying the right mitigation measures and highlight the importance of considering infiltration processes to improve their efficiency, Tügel et al. presented a 2D shallow water model set-up for El Gouna, a touristic town at the Red Sea coast of Egypt. Infiltration processes for sandy clay loam were considered to assess their effect along with mitigation structures to enhance flood protection of a combined natural/urban catchment in this arid area. Twelve different scenarios regarding infiltration, mitigation measures, and accumulated rainfall were simulated. The article showed that the impact of water retention basins and drainage channels can be much beneficial and effective as flash flood mitigation measures. Combined mitigation strategies and infiltration capacities of the soil lead to a significant effect of infiltration in terms of reduced water depths and delayed flood peaks due to dry conditions and hydraulic conductivity of natural and often sandy soils. The measures can also be combined with direct usage or artificial recharge as they enhance infiltration at specified locations.

Rapid urbanization is also one of the main causes of flash floods in MENA region. A case study highlighting this issue was presented in Hadidi et al. The article described the case of the far western region of Muscat city and governorate, part of the sub-basin of wadi Majraf, a tributary of wadi Manumah reaching Oman sea coast. The fast changing in land use and urban landscape affected flood depths and its extents. Therefore, the article highlights the need to capture interactivity between urban planning and flood risk modelling. It presents a 3-D interactive hydrodynamic model that provided an updated flood map of the studied area, showing the effect of a recent urban development on flow and flood patterns and hot spot locations changes.

Flood is a threat but is also an opportunity that brings water. Therefore, flood management is part of water management and it should be particularly considered as so in arid and semi-arid countries where solutions for water scarcity are desperately needed. Hence, the impact of flood and rainfall extreme events requires more attention from scientific researchers over MENA region. The article by Saber et al. depicted the variability, on a wider scale, of rainfall along with other parameters such as Normalized Difference Vegetation Index (NDVI), evapotranspiration and water storage on the whole Arab region. They used GRACE satellites data and GLDAS data assimilation to analyze their spatio-temporal variability over the period 2002–2015. The idea is to assess the impact of changes in these parameters on water resources in this arid and semi-arid region. Their analysis showed that North African and Gulf countries are showing a declining trend of rainfall whereas the west Asian-Arab countries are exhibiting an increasing trend. The total water storage is consequently showing a considerable decrease except for Sudan and Somalia for the studied period. The authors showed that water scarcity in the Arab region is increasing over time with a significant high spatiotemporal variability.

Due to limited long record rainfall data in Jordan, the Intensity Duration Frequency (IDF) curves were not updated since mid-eighties. To overcome this hurdle, Abdulla Fayez used a stochastic approach to simulate the latest variability pattern of rainfall in Northern Jordan. The resulting IDF curves based on the stochastically generated storm sequences can improve the accuracy of hydrological modelling that are usually used for flood estimation in urban/rural watersheds in such particularly arid regions.

The articles presented in this issue show the wide range of flood risk research aspects and the need for deepening this research with regard to its good potential for finding solution to one on the most sensitive and strategic problem in the MENA region that is water scarcity.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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