

Flood Hazard Assessment and Mapping in Semi-arid Urban Areas: A Case Study in the Wadi Al-Sayelah, Sana'a, Yemen

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Flash floods are one of the major natural disasters that may hamper human development in arid areas; aspects of the process leading to their initiation remain uncertain and poorly understood. In the present study, wadi Al-Sayelah in the Sana'a Basin, one of the major basins in the Northern parts in Yemen that is frequently subjected to severe flash flood damage, is selected for investigation. A comprehensive hydrologic analysis of the Sana'a Basin was conducted using GIS, HEC-SSP for rainfall frequency analysis and HEC-HMS for hydrologic modelling. Surface Tool in ArcGIS-10 software, and ASTER (DEM) was used to create different thematic maps such as DEM, contour, slope aspect and hill shade maps. Flood plain maps as well as flood hazard and risk maps for the different flood return periods have been developed by integrating the models HEC-HMS and HEC-RAS with HEC-GeoHMS and HEC-GeoRAS as well as with GIS and remote sensing.

Technical and non-technical measures have been proposed for flash flood mitigation. A warning alert system proposed design for a flood alert system all over the entire Sana'a city has been proposed. For protecting the city from flooding, it has been proposed to build multi-purpose dams and recharge pits that can divert the exceeding flow in its natural and former course.

Results obtained from the present study revealed marginal increases in the runoff peak discharges and volumes within the catchment, the floodplains were effectively mapped along Sana'a major stormwater channel and the Sana'a flood hazard areas were identified for extreme storm events. This information is being used to support a natural disaster risk evaluation for Sana'a city.



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The Second International Symposium on Flash Floods in Wadi Systems

Disaster Risk Reduction and Water Harvesting in the Arab Region



International Symposium on Flash Floods in Wadi Systems ISFF

25 – 27 October 2016
Technische Universität Berlin, Campus El Gouna, Egypt





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UNESCO Japanese Fund-In-Trust (JFIT) Study titled "Urgent Capacity Development for Managing Natural Disaster Risks of Flash Floods in Egypt, Jordan, Sudan and Yemen"

Flash Flood Hazard and Risk map for Wadi Al-Sayelah in the City of Sana'a Yemen




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Objectives of the study report



- Flash Flood Disaster Risk Assessment in the Wadi Al-Sayelah,
- Preparation of the Integrated Storm Water Management Plan (ISWMP) in the Wadi Al-Sayelah.



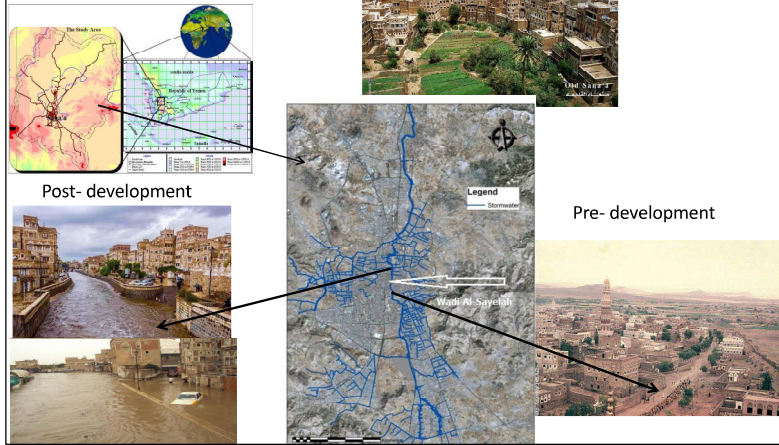
Methodology



- Apply the principals of probabilistic risk assessment in order to develop an analysis of flash flood risk for the city of Sana'a.
- Apply advanced hazard analysis and risk modeling techniques to identify flash flood risk.
- Conduct a comprehensive planning framework, taking into account the dual objective of flood protection and, to the extent feasible, aquifer recharge.
- Assessment of all the previous studies and drainage networks/channels constructed and proposed overall flood protection management system in the Wadi Al-sayelah



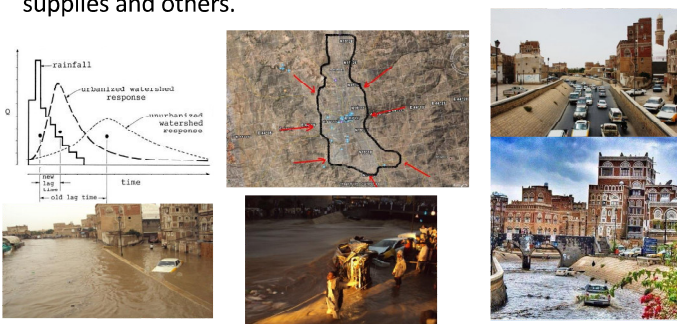
Location of the study area



Problem of the Flash flood in the Sana'a city



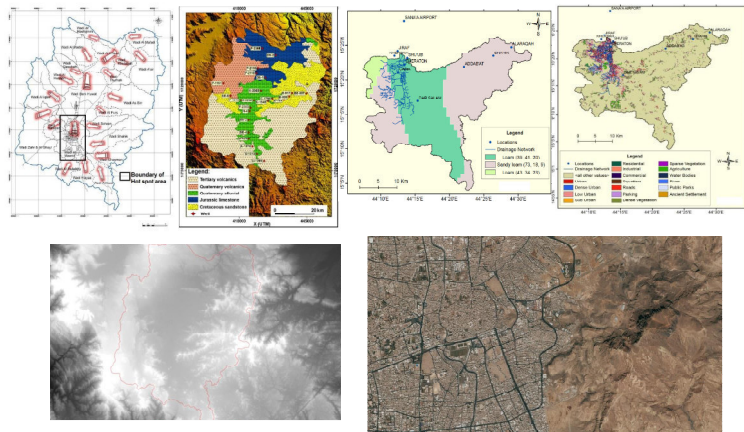
- in October 2008, May, 2010, and April, July, August 2016 a heavy Flash floods caused destruction and damage of public infrastructures such as roads, electricity network, water supplies and others.



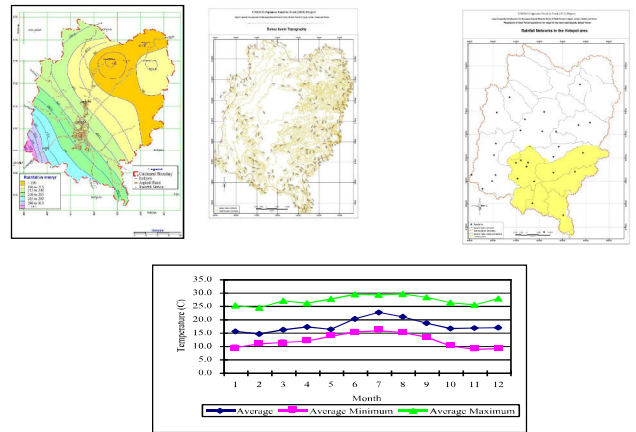
Data collection

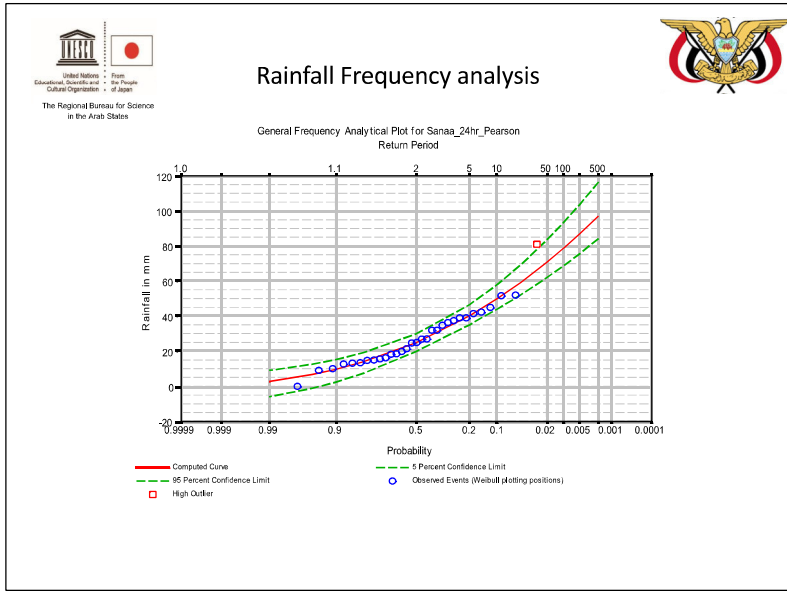
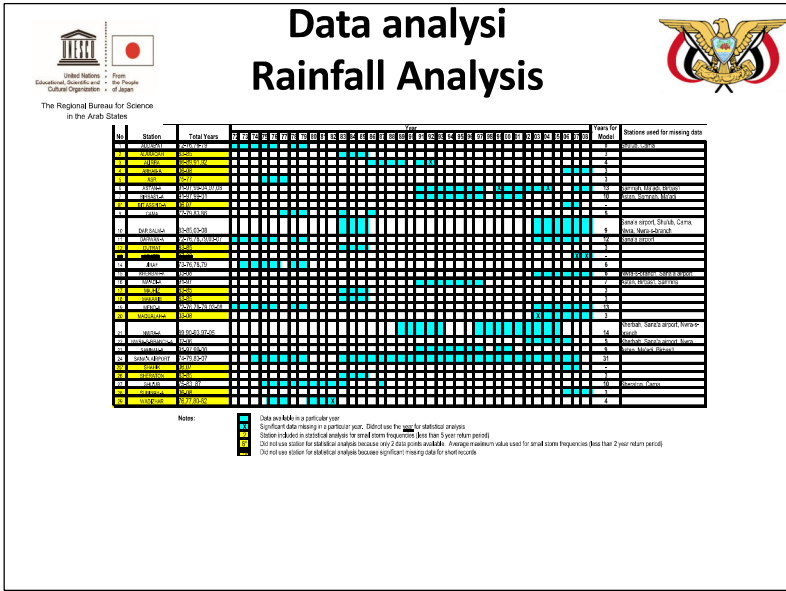


Physical settings of the study area

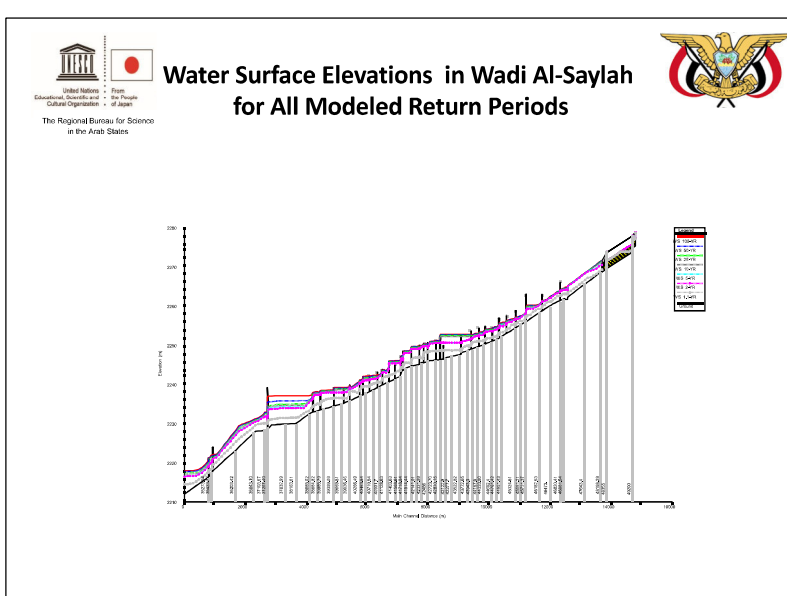
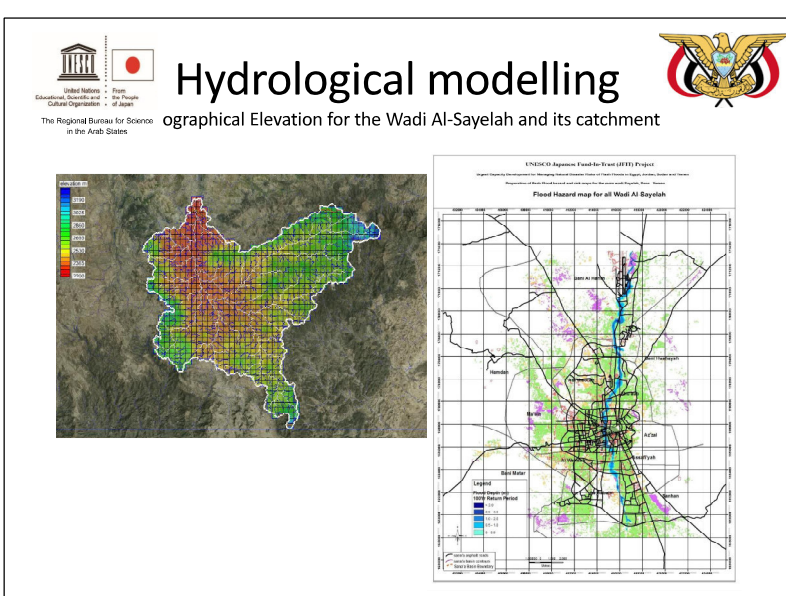
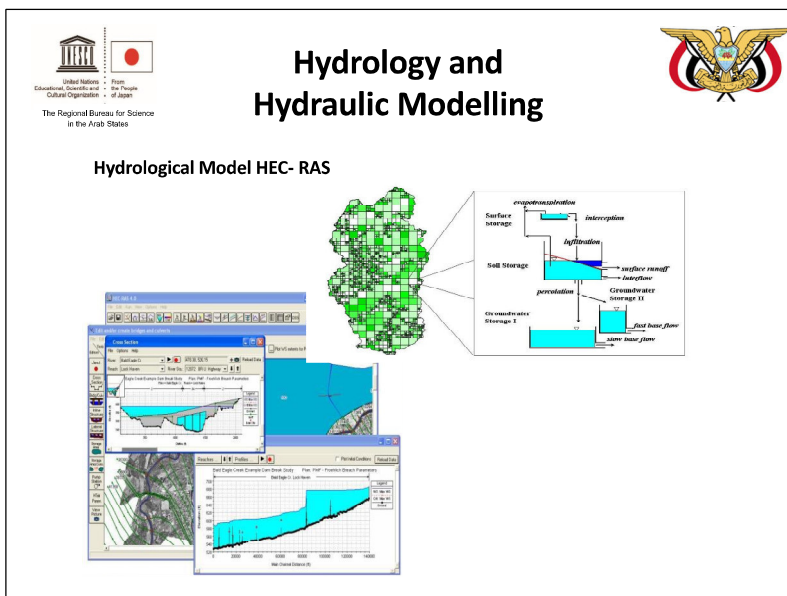


Climate Data

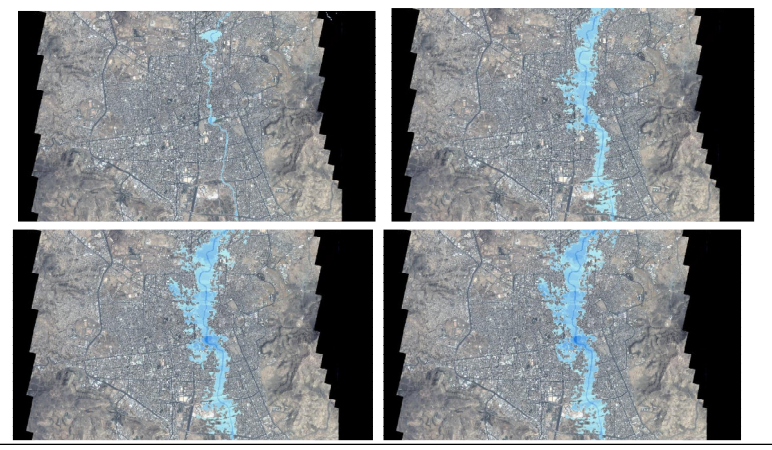




Modell Application and Results



Floodplain in the Wadi Al-Saylah for 10, 25, 50 and 100 Years Return Period

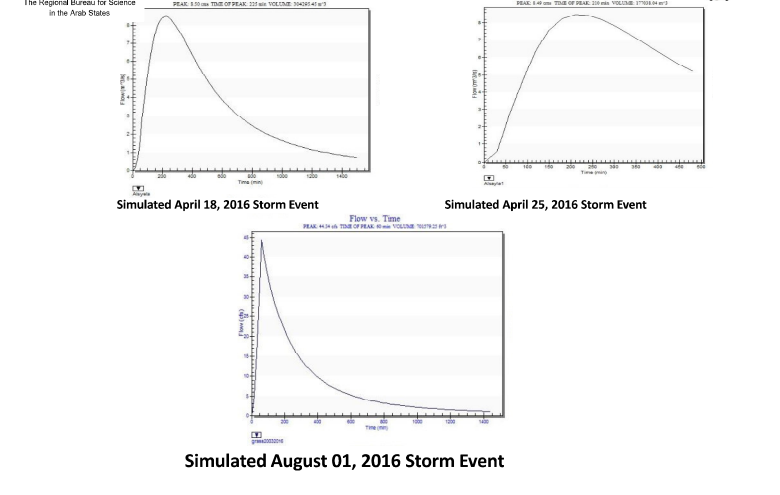


Calibration and Validation

Flood Calibration



Model Simulation

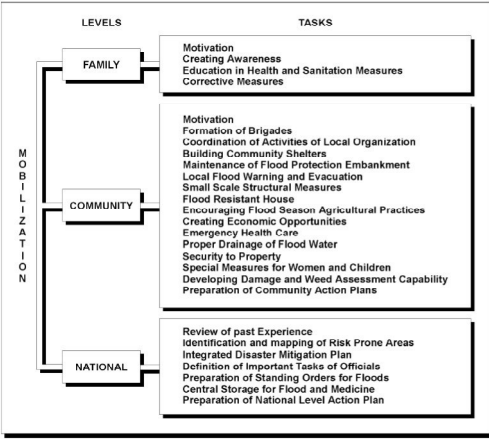


Summary of Calibration Results

Storm Event	April 18, 2016	April 25th, 2016	August 01, 2016
Source	Picture 2	Picture 3	Picture 4
Average Rainfall, mm	15.1	10.7	20.7
Max rainfall available, mm	24.5	21.7	41.1
Haight of measured Water, m	1.51 m	0.85 m	3.06
Q (m3/s) observed	8.72	8.45	44.7
Q (m3/s) modeled	9.61	7.70	43.8
% calibration error	+9.0%	-11.0%	-10.20%
Calibration Status	good	good	good

Integrated Flash Flood Management in the Wadi Al-Saylah

Community Mobilization



Mobilization tasks at different levels
(UNESCO, 1995)

Conclusions and Recommendation



- A detail flash flood study should be conducted to develop a best fit damage function for flood hazards to arrive at reliable estimates for risk prone areas
- Flow and stage data is the main dataset lacking for the Saylah.
- Training is a critical component of a FEWS that is people centered.
- For effective FEWA, it is important to increase a number of a rain gauges in the Wadi Al-Sayelah catchment with the ability to transmit data in real-time .



Thank you for your attention