

Assessing Flash Floods Prone Regions at Wadi basins in Aswan, Egypt

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Wadi flash floods are become more frequent and very devastating in terms of environmental and economic importance. Delineation of the prone regions for flash floods and design of control facilities are subjects of continued and increasing importance along the Nile River, Aswan City, Egypt. Identification and management of flood hazards on such regions have become important issues for the decision makers and especially for Aswan governorate. The management of flash floods and determination of prone regions are critically important due to two reasons: 1) residential development on hill slopes and outlets of wadies in Aswan city has expanded recently and continues to grow rapidly, 2) lacking of previous studies addressing flood hazard assessment due to the infrequent occurrence of rainfall and absence of well-defined watercourses.

The increase of flash floods and their destructive results worldwide require an ongoing enhancement on identification and mapping of flood hazard (Kundzewicz and Kaczmare 2000; Ebert et al. 2009). **The main purpose** of this study is to assess and investigate the prone urbanized regions for the flash floods threats along the river Nile, at Wadi Abu-Shieh, and Wadi Abu-Subiera, in Egypt (**Fig. 1**) using an integrated approach including field investigation, remote sensing, GIS, and rainfall runoff hydrological models and topographical analysis.

An integrated approach is used to explore and identify the prone regions for flash floods in these arid regions throughout 1) Field survey to investigate the real situation for the regions susceptible to the flash floods impacts, 2) Topographical analysis for the

DEM using GIS, and 3) Rainfall runoff modeling for flash floods.

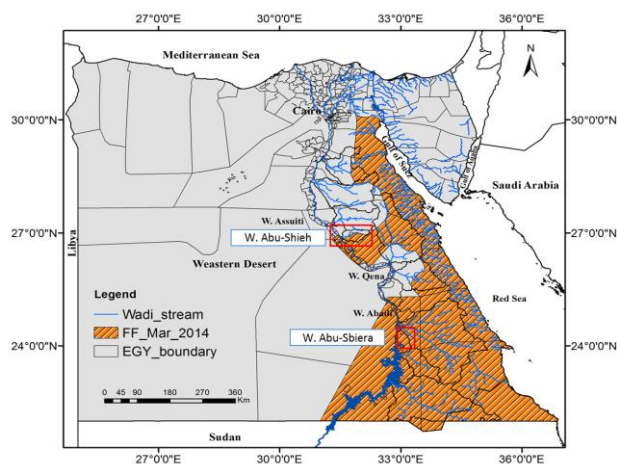


Fig. 1 Location map of the study area showing the spatial coverage impacts of flash flood event of March 2014.

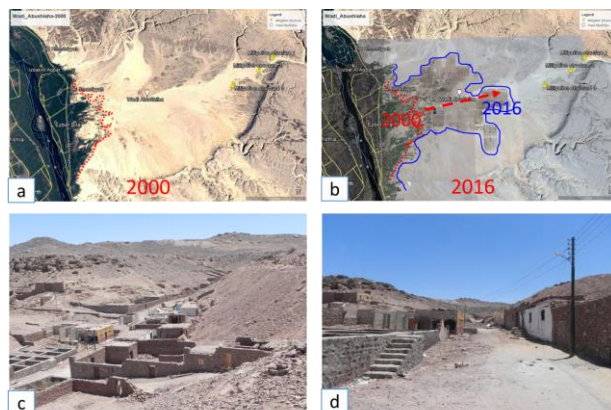


Fig. 2 Increasing agricultural and urbanization activities at wadi abu shieh, Egypt (a & b), Expansion of urbanized lands at wadi outlets at Aswan city, Egypt (c & d).

The main problems are represented in expansion of the agriculture activities and urbanization due to development and increasing population. As we observed at Wadi abu-Shieh that the agricultural lands expanded from 2000 to 2016 about 100% (Fig. 2 a, b). We found also that many urbanized areas are

directly located at the outlet of wadi systems which means they are subjected for the flash floods impacts in case of the lack of mitigations measures (Fig. 2c, d).

In order to explore the prone regions for the flash floods along the River Nile, field survey was conducted starting from Aswan city until Assiut City, and we have investigated several locations at different wadi outlets along the River Nile (**Fig. 2 c, d**). Additionally, based on public survey, we found that most of the urbanized regions in Aswan cities are constructed without any pre-planning from the governmental, thus, their houses were not well constructed which resulting in increasing the possibility of failure and damage with any extreme flash floods. We used 2D Rainfall-Runoff-Inundation (RRI) model (Sayama, 2012), to simulate flash floods discharge and inundation at the target basins.

Flash flood event (Mar 2014) is simulated to estimate water depth & discharge (**Fig. 3 a, c**) and to develop an inundation map (**Fig. 3 b, d**) at wadi Abu-Shieh, and wadi Abu-Subiera, Egypt, respectively.

In the present study, investigation and exploring the prone urbanized regions and agriculture lands for flash floods threat at some wadi basins in Egypt were conducted based on the field survey and rainfall-runoff modelling. Inundation maps showing the affected regions (urbanized and agricultural) due to flash floods were developed. Consequently, appropriate mitigation strategies should be considered in such critical regions based on the research results to re-manage or re-allocate the urbanized regions to be far from the flash flood threat. Additional application at other regions would be more effective to validate this study outcomes.

References

- Kundzewicz, Z.W., Kaczmarek, Z. (2000), Coping with hydrological extremes. *Water International*, 25(1), 66-75.
- Sayama, T., Ozawa, G., Kawakami, T., Nabesaka, S. and Fukami, K. : Rainfall-runoff-inundation analysis of the 2010 Pakistan flood in the Kabul River basin, *Hydrological Sciences Journal*, Vol. 57, No. 2, pp. 298-312, 2012.

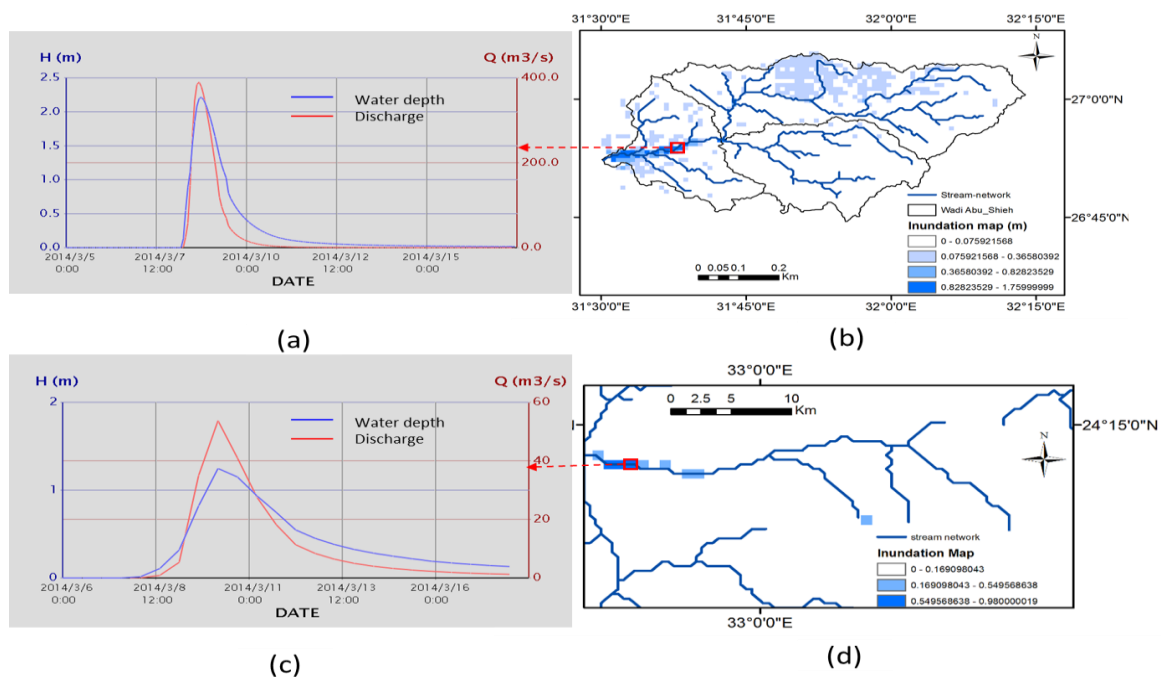


Fig. 3 RRI Flash floods simulation (Mar 2014 event) showing water depth & discharge (a, c) and inundation map (b, d) at wadi Abu-Shieh, and wadi Abu-Subiera, Egypt, respectively.