Chapter 1
A GIS Multi-Criteria Analysis and Remote Sensing for Flood Risk Management of Bou Salem City, Tunisia

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ABSTRACT

In the context of global warming, it is very critical to delineate areas of high flood vulnerability and risk. Climate and hydrologic surveying using traditional methods is not always available and depends on external factors. So, the use of geographical information system and remote sensing is of high importance as a decision support system. This approach is of low cost and can cover a long period for surveying. This study aims to provide decision makers a framework of GIS based on multicriteria analysis for flood risk mapping. Classified remote sensing image layers are used to complete GIS-multicriteria results. Results show that the high to very high-risk levels affect the majority of the study area, particularly the south-west and north-east zones. The comparison between GIS and remote sensing approaches shows the same areas of risk and reveals that it is a reliable methodology that greatly enhances decision making.
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INTRODUCTION

Natural disasters like floods have greatly increased in the last few years and caused devastating consequences and serious effects on the economy, environment and people and number of events. Particularly, in Tunisia, Floods have caused a large amount of damage and this situation is crucial in watershed with dams. In fact, In Tunisia, the flooding phenomenon is old mainly in the Medjerda watershed. Indeed, this wadi is the only perennial watercourse in Tunisia. The best described and best-known flood events are those recorded since the beginning of the last century and especially after the 1950s. The floods of 1969, 1973, 2003, 2009, 2012 and 2015, which affected the Medjerda watershed, are all episodes that will mark the country's hydrological chronicles for a long time (Fehri, 2014).

Identifying the extension of flooded areas is the first step to cope the problem of flooding as well as to implement flood controlling plans.

Various methods and models have been developed for determining flooded such the frequency ratio (FR) (Lee et al., 2012; Rahman et al., 2012) 3D and remote sensing (Chen et al., 2017; Schroter et al., 2018; Liu et al., 2018). So, flood inundation mapping is extensively based on remotely sensed satellite images that provide quick and real time accurate temporal extents of flooded areas, compared to costly traditional ground survey methods (Kumar and Acharya, 2016).

In this context many studies have proven the efficiency of remote sensing in flood mapping and decision making in hazard risks such as (Cai et al., 2015; Ban et al., 2017; Twele et al., 2016; Bhatt et al., 2016; Giustarini et al., 2013; Mason et al., 2012; Brisco et al., 2011; Schumann et al., 2010; Martinis and Twele, 2010; Martinis et al., 2009; Matgen et al., 2007).

The combination of GIS and remote sensing show an efficient tool to protect area from rsik flooding and many studies are conducted by researchers especially in hazard analysis (Bates, 2004; Sanyal & Lu, 2004; Pradhan et al., 2009; White et al., 2010; Bates, 2012; Haq et al., 2012; Strobl et al., 2012; Patel & Srivastava, 2013; Jaafari et al., 2014; Tehrany et al., 2014; Wanders et al., 2014; Tehrany et al., 2015b; Rahmati et al., 2016; Das, 2019;Chowdhury et al 2009; Rosser et al., 2017; Saidi et al., 2018).

So, the main objective of this study is to demonstrate the efficiency of this approach in the identification of the highly vulnerable areas to flood and how exploit the combination of GIS-AHP and remote sensing to obtain a validated result. The use of AHP in the calculation of weights is an appropriate method for regional studies (Rozos et al., 2011; Subramanian & Ramanathan, 2012). It has been widely used in flood mapping (Kayastha et al., 2013; Vogel, 2016; Das, 2018; Lappas & Kallioras, 2019; Rahman et al., 2019).