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A COMPARISON BETWEEN TWO DEM PRODUCTS TO CALCULATE A VISIBILITY ANALYSIS FOR MILITARY OPERATIONS USING FOSSGIS

ABSTRACT: HENRICO I., HENRICO S. & COETZEE S., *A comparison between two DEM products to calculate a visibility analysis for military operations using fossgis.* (IT ISSN 0391-9838, 2020).

Visibility analysis, commonly known as viewshed, is a valuable function in any geographic information system (GIS) and is a critical tool used for many applications, including the military, for representing the overall visibility and surface characteristics of the terrain. The first step to perform a visibility analysis is selecting the digital elevation model (DEM). This study conducted a comparative viewshed analysis, utilising the TanDEM-X 90m and the SRTM 30m DEM products to determine if the lower resolution DEM is suitable to deliver accurate and reliable viewshed analysis results for military purposes. Strategically placed observer points were used to calculate the viewshed analysis and determine if specific target areas (military bases) are visible or not. It was interesting to note that all military bases were either visible or not visible from all observer point locations for both DEMs utilised, however it is unavoidable that the accuracy of a visibility analysis is influenced by the quality of the elevation data source.

KEY WORDS: DEM, Viewshed analysis, Geographic Information System.

INTRODUCTION

A viewshed analysis indicates areas that are visible to an observer in all directions. It is widely used in many applications such as the military, security, telecommunications, agricultural and landscaping to derive geomorphometric and/or morphometric parameters or to obtain general terrain information (Badura & Przybylski, 2005; Bolongaro-Crevenna & *alii*, 2005; Chaplot & *alii*, 2006; Knowles & *alii*, 2008; Pike & *alii*, 2009; Lagner & *alii*, 2018). This study only focuses on the military application of a viewshed analysis as a geospatial functionality that provides important information to the military commander about the theatre of operation, whether it is in support of humanitarian aid, peacekeeping and peach enforcement operations or even conventional warfare.

In literature, numerous viewshed analysis studies have been conducted that utilise DEMs to solve specific every-day problems, such as the placement of telecommunication towers to determine the best possible location for continuous coverage over a specific area (Dodd, 2001; Kim & *alii*, 2004; Benham, 2012; Edan & *alii*, 2013; Heyns & Van Vuuren, 2013; Johnson, 2015; Henrico & *alii*, 2016). Other studies utilise viewshed analysis for urban planning, landscape analysis and disaster management (Pyysalo & *alii*, 2009; Šiljeg & *alii*, 2017; Petrasova & *alii*, 2018; Hognogi & *alii*, 2020). Most studies when conducting viewshed analysis utilises global or near-global elevation data sources, such as Shuttle Radar Topography Mission [SRTM] (Rodriguez & *alii*, 2006), TanDEM-X (Fritz & *alii*, 2011; Rossi & *alii*, 2012; Zink & *alii*, 2014), Advanced Spaceborne Thermal Emission and Reflection Radiometer [ASTER], Global Digital Elevation Model [GDEM] (Abrams, 2000), Global Multi-resolution Terrain Elevation Data 2010 [GMTED2010] (Danielson & Gesch, 2011), and Advanced Land Observing Satellite (ALOS) World 3-Dimensional - 30m [AW3D30] (Stamatiou & *alii*, 2018) to conduct the research. Various techniques (airborne photogrammetry, airborne laser scanning, cartographic surveys, ground surveys, and stereo- or radar-based satellite imagery) are also used to generate digital elevation data sources (Hengl & *alii*, 2003; Malik & Kumar, 2018; Aleshin & *alii*, 2020). Conversely, most of these sources and techniques are expensive to acquire and apply, especially by Defence Forces of poor countries. In such instances, remotely sensed satellite images and freely available

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