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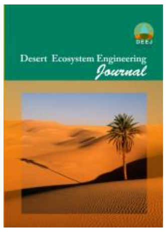

Using subpixel attractions model as a new model to extract shorelines

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Introduction

The attraction model algorithm spatially depends on the neighborhoods of the central pixels that are attracting surrounding sub-pixels. Another possibility is the hypothesis of subpixel interaction as introduced by Mertens et al. (2003) and Atkinson (2005). In order to reach a pixel state with the maximum number of sub-pixels of identical classes neighboring, there are several methods such as genetic algorithms (Mertens et al., 2003) and pixel swapping (Atkinson, 2005) that the techniques use the initial pixel fraction values as a constraint.

In this study, for the first time, an attraction subpixel model is applied on digital elevation models (DEM). The attraction model uses the surrounding pixels around the main pixel and tries to find the best matching value for each sub-pixel in the central pixel. There are two main methods in attraction model in order to select surrounding pixels for each sub-pixel in the central pixel. Each pixel can be divided into 2, 3, and 4 subpixels. To find the best model with a higher accuracy, an RMSE index is calculated and then using the best model rivers' shorelines are extracted. To validate the shorelines and lake border data using Landsat 8 images an NDVI index is extracted and then water area is extracted and the results are compared with attraction models output.

Materials and methods

In this study, a subpixel spatial attraction model is used to enhance the spatial resolution of DEM. The subpixel attraction model is based on neighboring values located around each subpixel inside a central pixel. In most studies, a set of methods are used to separate different neighboring methods. In this study, two quadrant and touching neighboring methods are used.

In the quadrant neighborhood, a neighbor pixel is the only pixel in the same quadrant while in touching neighborhood a neighbor pixel that is the pixel, which physically touches a subpixel. A sample of two neighborhood methods with different scale factors is shown in Fig. 2 (Mertens et al., 2006). For the quadrant neighborhood and S=3 and touching method, the darkest shaded subpixel inside the center pixel is attracted only by the right middle pixel and the gray subpixel is attracted by the left top, top middle, and left middle pixels. Shaded sub-pixels without corresponding pixels refer to sub-pixels that are not attracted by any of the pixels, as is the case for the center sub-pixels with

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S=3 for the touching and quadrant neighborhood. In the present work, two neighborhood methods with S=2, 3, and 4 are examined.
It must be noted that both neighboring methods are the same when S=2. The neighborhoods previously defined can now be formulated as Eq. 1 (Mertens et al., 2006):
N Touching neighborhood:

Keywords: Attraction model, Meander, sub-pixel.