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Hydrology and Earth System Sciences Discussions

Interactive comment on "Identification and mapping of soil erosion areas in the Blue Nile-Eastern Sudan using multispectral ASTER and MODIS satellite data and the SRTM elevation model" *by* M. El Haj El Tahir et al.

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Dear Prof. Guido D'Urso

Thank you for your comments and advice on our manuscript. We have carefully revised the paper with full consideration of your advices and suggestions, which will be uploaded to the webpage as soon as the open interactive discussion is closed, i.e. when we are given the opportunity by the Journal's editorial team to do so. The following is our point to point reply to your comments and suggestions.

1.Comment: some elaboration products are not used in the subsequent sections, i.e. the calculation of NDVI and EVI does not find any further application in the paper (or it is very hidden). The authors should clearly explain the usage of this information or remove it.

Reply: according to your suggestion we have added the following new paragraph to the revised text "These two MODIS vegetation indices (VI) are used as auxiliary data to discriminate between training classes; Gully and Flat_land. At first MODIS NDVI and EVI signatures are used to discriminate between two classes: Stable vegetation and Unstable vegetation. The unstable vegetation is seasonal vegetation that grows during the rainy season; this vegetation is flushed away with erosion, indicating that areas where there is unstable vegetation there are also erosion. The stable vegetation on the other hand is there throughout the year hence no erosion Where NDVI and EVI values are low, this is an indication of limited, unstable vegetation hence higher erosion risk. Higher values of NDVI and EVI indicate more stable vegetation. This information aids the classification at times when the differentiation between Gully and Flat_land becomes difficult based on DEM."

2.Comment: the core of the paper is then found in Section 4, where the application of a supervised classification is described, based on 9 ASTER spectral data and 4 morphological variables derived from SRTM DEM. There are elements which arise doubts about the classification procedure adopted

Reply: Thanks for the comment; we have rewritten the related part to explain it in more details in the revised text.

3.Comment: there are elements which arise doubts about and the attempts done for reducing the redundancy of input data. For example, the authors mention the lack of satisfactory separability between the two classes of main interest in this study (Gully and Flat_land).

Reply: We have revised this part to make clearer explanation. Please also refer to

the added paragraph on the use of NDVI and EVI to discriminate between Gully and Flat_land classes in reply to comment number 1.

4.Comment: field data have not been used for assessing the final classification accuracy. The absence of any field control on the output does not allow the authors to draw conclusions on the reliability of their classification results

Reply: in the revised text we have clarified that field data are used in the study in two ways a) ASTER: Field knowledge obtained during the field survey in 2006/2007 was used as the basis for visual interpretation of (ASTER) imagery. In this way large representative areas of trained classes were manually classified. b) MODIS: The use of a set of thirteen digital co-registered photos from different areas in the field taken at a time close to the acquisition time are used as ground truth data for validation of the classified MODIS products.

5.Comment: I expect that the classification results to be quite low.

Reply: The overall classification accuracies of ASTER (Table 3) are 82.21 and 75.20 respectively and those of MODIS (table 5) are 61.85 and 63.82 respectively

6.Comment: another important issue - which is not even mentioned in the paper - is related to the spatial scale of the studied process (gully erosion) and the geometrical resolution (both horizontal and vertical) of the used data. While ASTER spectral data in the visible ranges might be consistent with the average dimension of gullies (also shown in the picture of Fig.2), it might not be the case with infrared bands and especially with SRTM data.

Reply: in the revised text we tried to clarify that the spatial width of the seasonal gullies varies between 2m to 20m. Therefore a combination of ASTER's VNIR and SWIR channels of 15 m spatial resolution can capture this phenomena. ASTER TIR bands (B10-B14) whose spatial resolution is 90 m are therefore not used in this study. As for SRTM we have summed up the use of SRTM in this study as follows: a) To orthorectify

the ASTER images b) To create river network in ArcGIS (Congguo et al, 2008) that is further used to aid in the classification of gullies c) As a reference map for ASTER rectification. Its resolution of 90 m is reasonable for this purpose especially that updated topographic maps of the area are unavailable.

7.Comment: for the same reason, I'm convinced that the attempt in using MODIS is completely ill-posed, and it should be completely removed from the text.

Reply: This point is taken up in the revised text and as follows: ASTER and MODIS are complementary in resolution, offering a unique opportunity for scale-related studies. ASTER with its finer spatial resolution and better accuracy is used to identify erosion areas and to quantify the erosion for the small area, while MODIS is used to up scale ASTER results for sake of understanding erosion on a larger scale for the wider Blue Nile region in Eastern Sudan. The use of these two satellite products in similar studies is available from Vrieling et al (2006).

8.Comment: I believe that they need to deeply revise the text to address the issues mentioned earlier to make the paper a full convincing one.

Reply: following your suggestions we have deeply revised the text addressing all issues that you have mentioned earlier. We shall post the revised version as soon as we are given the opportunity by the Journal's editorial team to do so.

References: 1) Congguo Tang and Congqiang Liu, 2008, Surface water hydrologic simulation of Qingshuijiang Watershed based on SRTM DEM, Proc. The International Society for Optical Engineering SPIE, Vol. 7143, 71430W (2008); doi:10.1117/12.812556 2) Vrieling, A., Rodrigues, S. C., Bartholomeus, H., and Sterk, G.: Automatic identification of 25 erosion gullies with ASTER imagery in the Brazilian Cerrados, Int. J. Remote Sens., 28(12), 2723–2738, 2007.

Sincerely El Haj El Tahir et al

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 135, 2010.