Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-16-AC2, 2019

Hydrology and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "High-resolution palaeovalley classification from airborne electromagnetic imaging and deep neural network training using digital elevation model data" *by* Zhenjiao Jiang et al.

Zhenjiao Jiang et al.

jiangzhenjiao@hotmail.com

Received and published: 20 May 2019

Thanks a lot for your suggestions on this manuscript, which definitely helped us improve the article. We now modified the manuscript accordingly, and the detail responses are listed below.

Q1. The geolithological description is very synthetical. More details should be given and can you provide the image of a bore log for coherence with the described lithological classes?

Printer-friendly version

Discussion paper

Re: We now added in the article the history of palaeovalley formation in the arid zone of Australia and described the general lithology facies of sedimentary infills in the palaeovalley (now Line 71-85 in annotated manuscript in the supplements, and Fig. S1). Generally, the coarse sediments were deposited at the bottom of the palaeovalley in a fluvial environment, overlain by fine-grained sediments deposited in lacustrine environment. In the Quaternary, these palaeovalley sediments were partly covered by aeolian sediments with a maximum thickness 15 m. Although the borehole logs show a similar trend, those fine and coarse sediments often interbedded with each other, and it is also difficult to differentiate between the aeolian sands and fluvial sands without particle size analysis . We thus classify borehole logs according to the portion of coarse sediments (i.e. sands) and fine (i.e. silts and clays) sediments, and also the thickness. More detail principles for classification are now given in Line 89-94 in the annotated manuscript. We hope that these new explanations can make the interpretation of borehole logs more sound.

Q2: My main concern is about the scale effect of the AEM measurement to small resolution data, such as bore scale. Can you discuss more about the uncertainty in the bicubic algorithm for image scaling and the calibration/validation of the methodology with real data?

Re: In this study, the bicubic algorithm is employed on images of electrical conductivity, which are the input of the neural network. The binary palaeovalleys, as output, are then generated by the neural network. We could use other interpolation methods on the electrical conductivity image, e.g. kriging. However, as long as the interpolation method used in the training image generation is consistent with the prediction, the quality of the output binary palaeovalley is mainly determined by the structure of the trained neural network (e.g. filter size, crop size, depth and width), rather than by the interpolation method, as the neural network has learned to filter out the errors induced by the interpolation. The sensitivity of output binary palaeovalley to these parameters is discussed in Appendix A of the manuscript in Line 555-588 of annotated manuscript.

To make sure that the trained neural network works well, we first tested it based on synthetic examples. Regarding the scale effect, it is illustrated in section 4.3 (Line 320-355) that the methodology used in this study allows upscaling of the original electrical conductivity image to binary palaeovalleys by ten-times in resolution, without significant loss in accuracy. When the method is applied to the study area, we don't have many hard information to validate our results on, apart from the borehole logs. The AEM-derived electrical conductivity images were classified into binary palaeovalleys with a spatial resolution in horizontal plane of 40 m $\times$40 m. For validation, it is assumed that the control area of each borehole is also 40 m $\times$ 40 m. This is a reasonable assumption as the short-distance lateral stratigraphic heterogeneity is considered small over a few tens of meters.

Q3: Instead of summarizing the results, the conclusion should focus more on the novelty of the approach compared to other traditional methods. I would suggest to insert the part 'Future work' inside the conclusion to critically discuss the limit of the approach and the proposed future studies to improve it.

Re: We rewrote the conclusion and merged the limitations and future work in the conclusions section (now Line 456-482 in annotated manuscript).

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-16/hess-2019-16-AC2-supplement.pdf

---

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-16, 2019.

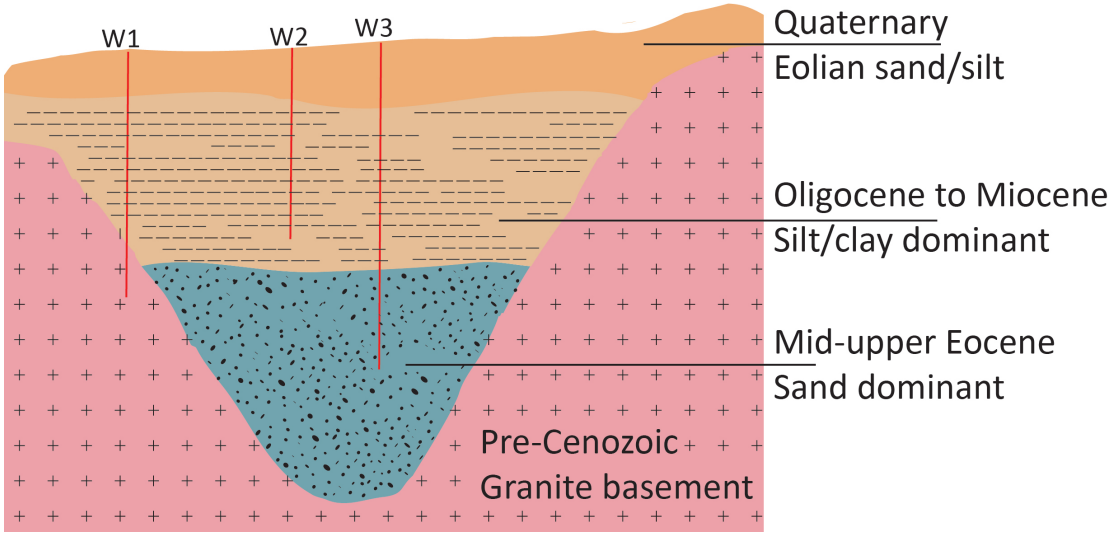

Fig. 1. Typical sedimentary facies in palaeovalley in arid zone of Australia (modified according to Magee 2009)

Printer-friendly version

Discussion paper