Comment on gc-2021-22

Dylan Ward (Referee)

Referee comment on "GC Insights: Identifying conditions that sculpted bedforms – human insights to building an effective AI (artificial intelligence)" by John K. Hillier et al., Geosci. Commun. Discuss., https://doi.org/10.5194/gc-2021-22-RC2, 2021

Identifying conditions that sculpted bedforms – Human insights to build an effective AI
John K. Hillier et al.

The paper is a concisely written report of a survey of a mix of geoscientists and non-geoscientists to determine whether bedforms from different processes and environments could be classified based on shape alone. The results are interpreted in the context of building an artificial neural network model for the same task. The survey results indicate that non-geoscientists perform as well as specialists at this task, as it is primarily a shape matching exercise that does not require specialist knowledge. Unsurprisingly, identifying environment from an individual bedform was more difficult for respondents than when a series of bedforms were provided. The paper then applies an ANN model to the task with qualitatively similar results. The involvement of the non-geoscientists in the survey group is the "geoscience communication" aspect of the paper.

The shorter-than-short article format seems to have resulted in a few leaps being made that would benefit from further explanation. I will highlight these in my technical comments below. There are also a few scattered errata, but overall the text is clear.

Abstract, elsewhere throughout - the way the profiles are described is highly inconsistent. Here and elsewhere they are called distance-depth profiles, presumably referring to bathymetric depth, but they are plotted as height vs distance, ie, topographic profiles, and presented as such to the survey respondents. The text later switches to talking about the shear velocity experiment profiles as elevation time series, the explanation for which is not in the main text but buried in the figure caption. While the timeseries could be recast as spatial series related through the migration rate of the bedforms, this step seems to have been omitted, so they are really timeseries presented as topography to the survey respondents and lumped in with the other experiments in the paper abstract and introduction as topography.

Line 31 - "this has been attempted for experimental parameters" is vague, what experiments? What parameters? ML has been applied to lots and lots of things…

46 - "Scale readily distinguishes…" I get that the purpose was to see if there was scale-independent data in the shapes that would allow discrimination of these bedforms, but if the ultimate purpose is to build a model to do so, wouldn't scale be included as it's such

reliable indicator?

46 - Also, it appears that some sense of relative scale WAS in fact provided on the survey. The tick mark spacing on the frame of each profile seems to have been scaled along with the profiles when the extracted bedforms were rescaled. It is therefore easy to tell from the height of the bedform relative to the tick mark spacing that certain profiles came from a specific "training" profile. It would be hard to determine whether survey respondents registered this or not post hoc, and to me it calls the results into question. Why were the tick marks included on the "scale free" profiles at all?

57 - the parenthetical "(experiment number)" is initially confusing, replace perhaps with "(coded by experiment number) "or something like that.

58 - here is where the text starts talking about time series instead of topography with no explanation unless you happen to read the figure caption first.

63-65 - "For Q1… expected of guesswork" this sentence is a bit overloaded with info and convoluted to read.
65-67 - "For Q2…" this sentence is also convoluted.

81 - more explanation needed, as far as I know glacier bed topography and eolian ripples are most certainly NOT modeled by the same physical equations… unless you mean not "modeled" but "described empirically"… there are process and form similarities across many environments, but perhaps this statement is oversimplified?

90 - this is hard to follow. There is a leap between the previous mention of preprocessing to the description of the preprocessing method, which is embedded in a topic sentence.

83-95 - This section of the discussion justifies the preprocessing and introduces the ANN, is it really discussion? Seems more like methods. How the preprocessing method follows from the survey results needs more explanation. As for the potential pitfall of training the ANN on the raw data, was this attempted? With what result? It is merely asserted that it might be a problem. As for the fitting of flat topped-cones, there are different ways to fit things, which may depend on scale of interest etc…. More info about this step is needed. (Actually some detail is provided back in the methods section - but it's not clear that the SWT/frustum algorithm described there is the same as the "fitting flat topped cones" described here. Also, SWT is never defined as an acronym.)

95 - The aside here about taking the statistical moments of the signal seems to obviate the other preprocessing. It's also not clear whether it means that the ANN is more successful when any of these moments are used individually or if they are used together. The next sentence, the conclusion that insights from the participants led to a more successful model, does not seem to follow from this sentence about statistics.

99 - "in the future"

So, I'm not really sure what to make of this study. It seems like a good exercise overall, to understand whether expert knowledge might help build a better ANN classifier, but most of the insights could have been gleaned just from trying the ANN in the first place. Coupled with some of the issues of scale info on the survey, the unclear link between the survey results and how they informed building the ANN, and the condensed article format leading to omitted context, it's hard to recommend publication without substantial revision.

Respectfully,

Dylan Ward