

Interactive comment on “Land classification based on hydrological landscape units” by S. Gharari et al.

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Reply to Comment by I. Nalbantis

The authors would like to thank you for your interesting and detailed comments on our paper. The hint to model complexity and parameters which was mentioned in the reviewer's paper (Nalbantis et al., 2011) truly mentions an important fact in hydrological modeling, parameters identifiability vs. model complexity. It seems a related publication to our work and we will discuss this important reference in our paper.

We accepted the suggestions made by the author of the comment. To clarify the rest
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of the comment the answers to comments are presented below.

General comments:

5-The paper is in general well structured. Yet, the large number of tests appearing in sections 3 and 4 makes it difficult to read. To improve readability it is suggested to exhaustively describe all tests within section 3 in the order that these appear in section 4, and leave results in section 4 without repeating any features of the experiments. In my view, rigorous one-to-one correspondence of the test description details and the results will help readers.

We agree that one by one correspondence would help the reader to follow the paper. We will also add another sub-section to section 4 as a general discussion about the methods and other previous works.

Specific comments:

2 - Page 4382, line 10: The term "sample size" is confusing. What is a "sample"? Is it the dominant hydrological regime at certain points in space (field observations), or the spacing used in the digital elevation model?

The sample size represents the number of points which were collected in the field observation. Different sample sizes mean different point's numbers which were used for the calibration.

4 - Page 4383, line 3: By "infer dominant runoff process" do the authors mean "infer the dominant runoff process", or "infer dominant runoff processes"? Please consider clarifying this.

The word process should be change into its plural form.

7 - Page 4384, lines 11-12: The phrase "a catchment model ... flow generation processes." raises the question of the utility of hydrological units in hydrological modeling; please add a brief comment on this.

We will add a brief comment on how we approach the hydrological modeling part. We will clarify what we mean by a catchment model, it is not a simple hydrological model but it contains different hydrological units in its structure for different response units.

8 - Page 4383, line 17: The phrase "their relation to various catchments" is confusing; please rephrase to clarify.

By various catchments we mean different catchments with different hydrological features, however we will rephrase this sentences by eliminating the various catchment which seems to be confusing.

11 - Page 4385, line 1: Since the paper is centred on the concept of "hydrological landscape units" I would not avoid commenting on the difference from the work of other researchers who used the same term based on another definition or philosophy (e.g., Park and van de Giesen, 2004; Lin and Zhou, 2008)

This will be added as another section in discussion part, we will compare the difference of our work with previous works including Park and van de Giesen (2004) and Lin and Zhou (2008) and other related works.

12 - Page 4385, line 4: The wide hydrological audience may not know what "effective smoothing window sizes" mean; please provide an explanation or reference.

The smoothing window size was explained in detailed later, however for clarity we will explain it where the term is introduced.

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15 - Page 4385, line 24: The phrase "...distinguishes three hydrologically, ecologically and morphologically different landscape units" fails to accurately reflect the aim and scope of paper. First, the main classification criterion is hydrological, which allows for ignoring ecological and morphological criteria, at least at a first level.

Of course the main aim is to distinguish between hydrologically different landscape units. However, since there is co-evolution in landscape formation, the hydrological unit will also reflect a specific ecological, morphological and even land-use unit, although the correspondence may not be complete. It may be clear that for the purpose of this paper the hydrological characteristic is the most important, but the fact that there will be a correlation with ecological, morphological and land-use units will help identifying these units in the field.

17 - Page 4387, line 2: A brief comment is required to stress that saturation overland flow is expected also in climatic zones where extremely high rainfall intensities may lead to saturation from above.

We will explain these concepts more thoroughly or refer to them where possible.

19 - Page 4387, line 8: Information is required regarding the method and raw data used for producing the DEM together with an indication on the uncertainty in the horizontal and vertical direction.

We will ask the Lippmann institute who provide us with this 5 meter resolution DEM about the details. We shall add this information in our final paper.

20 - P 4387, line 26: A few words are needed with regard to the general plan of the campaign (e.g., full coverage of the basin or selection of representative areas, or personnel requirements).

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We will clarify this part by explaining the where we selected the points and how we walked in the Wark Catchment and why we selected the point across transects.

22 - Page 4388, line 12: In the phrase "These reflect" the word "These" is ambiguous; to what does this refer?

These refer to the transition from one landscape to another landscape. It will be more clarify in the paper.

23 - Page 4388, line 18, Eq. 1: Avoiding using classical symbols for the cumulative distribution function such as $F(x)$ inevitably induces some difficulty to readers.

If we understood the reviewer correctly he meant the function $CGDF(x|m,s)$ should be written as just F with a simple letter. We will change it in the final paper.

24 - Page 4389: Using X or Y to denote probability is likely to lead to confusing probability with random variables; it is suggested to change these symbols.

We apologize for the confusion and we will change these symbols. It seem mroe appropriate to use P and Q instead.

25 - Page 4388, line 24: To help readers I would tend to suggest: (1) defining two generalised topographical variables (e.g., X subscript (1) and X subscript (2)); (2) using these variables in classification rules; and (3) substantiating the generalized variables later, when presenting the actual topographical variables that are used in models.

We try to consider this suggestion however we think using H ($HAND$) and S (slope) and explaining the classification rules based on them can be more informative for

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readers.

27 - Page 4390, line 11, Eq. 11: What does the new variable HD^* mean? Is it an indicator of the "total flow path length"? Naming this would greatly help readers.

HD^* is the power transformed of multiplication of $HAND$ and distance to nearest drain. It is the same combination of $HAND$ and distance to nearest drainage.

28 - Page 4391, line 13: What is "functionality" here?

We will clarify this part; by functionality we mean the dominant runoff process.

29 - Page 4391, lines 14-16: The phrase "The objective matrix is designed in a way that the number of sample points in each class does not affect the calibration process" is ambiguous; please be more specific.

We will explain what we mean by this sentence. This sentence wants to express the fact that the objective function is not affected by any bias from the percentage of collected points for each landscape units.

32 - Page 4392, line 18: The example "i.e. $2 \times 3 \sigma$," is confusing; what do the indicated numbers represent? Please consider explaining or removing the example.

The intention is to show the influence length of the effective area for the smoothing windows, which are truncated at 3σ (i.e. 99.7 % in a normal distribution) from each side which ends in $2 \times 3 \sigma$ as the total influence length. So instead we also can say a circle with radius of $3 \times \sigma$. We will change this in the entire paper; the size of the smoothing window will be reported simply as σ .

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35 - Page 4394, line 11: Adding a sub-section numbered 3.8 and titled "Other sensitivity tests" (or similar) is necessary, which will describe all tests that are related to results (section 4) but are introduced in section 4 for the first time. For example, this may encompass material from sub-section 4.6.

This is true and we will add a section explaining the topographical wetness index and we discuss the result in section 4. Another subsection will be added to section 4 for general discussion.

36 - Page 4394, line 20: I think that by "S = 0.129" the authors denote the value of parameter " μ_S ". The same holds for H. For other models the same inconsistency is observed. Please explain.

The author of comment sharply mention the fact that the reported values are the μ_S and so on, this was for the fact that the authors assumed mean value as the threshold value but as it was reported earlier and in equation with μ , it should be changed and elaborated more. We thank the reviewer for spotting this mistake.

37 - Page 4398, lines 5-6: What is "head water convergences"

By convergence we mean the decrease in slope from steep headwater areas to the place where channels initiate. However we agree that this term should be clarified. We prefer to eliminate the "convergences" to avoid ambiguity.

39 - Page 4398, lines 13-15: The phrase "This phenomenon ... separation" fails to fully clarify how the authors treated cells with multiple observed classes.

This sentence will be rephrased; we will express the "This phenomenon" more clearly. The phenomenon refer to the fact that in DEM with lower resolution (e.g. 100 m), a cell may contains different points which were classified differently.

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40 - Page 4399, line 20: The statement "For very robust models only small deviations would be expected." is not informative since reducing the size of the calibration data set naturally leads to loosing model capacity for generalization. So, it is the rate of such loss that is of interest here and not the model behaviour in general. Although this becomes clear later I would suggest stressing it in this phrase also.

We will explain what we mean by this sentence in line 20, page 4399. We would explain later what we meant by a robust model. However to clarify this sentence we will rephrase it.

42 - Page 4400, line 21: The verb "constrain" induces ambiguity; what was effectively done?

This sentence seems to be clearer without the word "constrain". This word will be eliminated in the paper.

45 - Page 4401, lines 8-9 and 10-11: The authors are invited to verify qualifiers in "the northern and eastern parts" and "like southern and eastern parts", since readers would normally expect to find the word "western" in place of one of the two instances of "eastern".

Indeed the second "eastern" word in line 11 should be changed into "western".

47 - Page 4403, line 23: What do the authors mean by "classified map with aerial picture"? Is this a map with the same four classes (plateau, hillslope, flat wetland, sloped wetland) but obtained through using other sources of information such as photogrammetric products?

It is actually a merely visual comparison for the reader to see the relation of wetness index, classified landscapes and real landscape features from areal pictures. We will

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rephrase the sentence to make it clearer.

51 - Page 4425, line 3 of caption of Fig. 13: The phrase "The location of identical points are indicated by a star, triangle and square." is incomprehensible; what do the authors mean by "identical points"

The aim of these symbols is to help readers to localize three matching points in each of three pictures for orientation purposes. The sentence will be rephrased for clarity and the symbols will be shown more prominently.

Once again we would like to kindly thank the reviewer for his constructive comments on our work.

References

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