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Hydrology and Earth System Sciences Discussions

Interactive comment on "Land classification based on hydrological landscape units" *by* S. Gharari et al.

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The proposed study addresses a problem of cardinal importance in hydrology which is the assessment of landscape units that exhibit similar hydrological functioning. More specifically the focus is to derive landscape units with similar flow/runoff generation behavior using the signatures slope)S), distance to the next drainage (D) and height above the next drainage (H) derived from a high resolution DEM. Study area is the Wark catchment that is exhibits clearly different geomorphology in the western and eastern part where the authors collected more 5000 data points to train and validate different classification schemes that distinguish wetland (sloped, flat), hillslope and plateau. The authors argue that typical flow generation processes (percolation and ET, capacity con-

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trolled subsurface storm flow, saturated overland flow) generically dominate at these landscape units. The proposed results are based on a thorough analysis, which addresses the effect on the smoothing window size and selection of the trainings subset on the robustness and uncertainty of the landscape classification scheme, underpin the high potential of the proposed study. Nevertheless, the study suffers from several short comings that should be addressed within major/moderate revisions. Important points - In the present form the study mixes to my feeling probabilities and fuzzy membership functions. Equation 2 and 3 introduce to my perception not a probability of a pixel to have a high value of D, S or H (which would by the way imply that the authors have to test their assumption of normality) because mu and sigma are calibration parameters and cannot be derived from the sample of grid points or by a frequency analysis. Eq. defines fuzzy membership functions for a pixel to belong to the category high D (this makes sense). Along this lines equation 4 is a fuzzy rule describing the membership function of a pixel to belong to the category hillslope, the fuzzy rule is in linguistic terms "Pixels with high H and high S belong to hillslopes". I advise you to revise the terminology and avoid statistical terms when they are not adequate, as I am not whether all these “probabilities” sum up to one.

- The presented classification scheme performs well according to your ground "truth data". These data have been classified into the four categories based on expert knowledge. This expert knowledge can and should be formalized at least in form of linguistic principles. When making these expert classification did you take S, D, H into account, if so how? Did you use other indicators for instance functional vegetation types or soil types to for instance identify wetlands (which has typical vegetation and depending whether it is at a slope or close to the river typical soils)? I think it is crucial to validate, train your scheme with landscape units that have been classified according to different indicators, otherwise this is a bit a logical circle.

- The paper suffers from making statements a) too general and b) being often imprecise. For instance not all hillslopes are dominated by capacity controlled subsurface

HESSD

8, C2498–C2501, 2011

Interactive Comment

runoff, pipe systems might be intensity controlled (Wienhoefer et al. 2009, van Schaik et al.) some hillslopes are dominated by Hortonian overland flow (the Weiherbach in Germany). Your scheme of associating typical morphological units with the proposed dominant processes is certainly a valuable concept. However these dominant processes might change when moving to other landscapes. This should be discussed An example for being imprecise: what is exactly meant if you claim that ecology, hydrology and geomorphology co-evolve, not the science fields I guess.

- I miss a proper referencing to approaches to assess functional units in the landscape, I am no expert but I know work from Pelletier and Rasmussen, Behrens et al. James and Roulet, Schmocker-Fackel et al. Boogart et al.

Technical points - You sampled your points along transects, , obviously for good reasons , but you should comment and justify this design

- What is meant with essential hillslope functions (drainage and storage) essential for what? Or do you mean generic?

- preferential flow paths can also origin from a biotic processes, cracking

- maybe I missed it but which at within which ranges did you sample mue and sigma

- Eq. 14 by normalizing the sum of P with the sample size, you give equal weights to the three classes. This might be problematic when sample sizes are very different and confidence levels are different?

- The might be something to learn by analyzing the patterns of wrong classifications, in space and with respect to systematic errors?

- I would assign equal scales to panels c and d in Figure 11 and add the sample size at least to the figure caption

Best regards,

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8, C2498–C2501, 2011

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