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Interactive comment on "Which spatial discretization for which distributed hydrological model?" *by* J. Dehotin and I. Braud

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1 General comments

We recognised that the title of the paper may have been misleading. Our aim was not to provide a conclusive answer to this very complex question, but to use the interactivity of the discussion offered by HESS to share our views, expressed in section 2.6 and 3. These views are based on a review of existing knowledge provided in the first part of the paper. It was probably not clear enough in the first version of the paper that the methodology proposed in section 3 was directed towards large scale catchments. For these catchments, explicit consideration of all the details of the landscape cannot be considered. Furthermore the section 3 is only one part of a more general line retained to get the final discretization that will be used in the hydrological modelling. The methodology proposed in this section must be viewed as a first pragmatic answer to

a complex questions. We are aware of some limitations of the technique, which are discussed more precisely in section 4.2.4. To better focus the aim of the paper, we modified the title as follows: “Which spatial discretization for which distributed hydrological model? Proposition of a methodology for medium to large scale catchments”.

The paper does not just propose a methodology for subdividing a catchment into homogenous units. We tried to share our views about the complex question of catchment discretization for hydrological modelling and to propose a first pragmatic methodology for larger catchments. This methodology addresses the necessity to keep in mind the hydrological processes that are considered and modelled within each unit. The present work forms part of researches related to the building of a modelling framework based on a spatial discretization consistent with process representation and with a better representation of landscape heterogeneity.

2 Specific comments

First paragraph The methodology we propose is not directed towards any particular hydrological model. The methods can be use for all models requiring the definition of homogeneous areas for the definition of homogenous units. Our goal was to propose a way to handle rationally input data from different sources and to retain the landscape features found important for the water cycle components retained by the modeller in the description.

We acknowledge that the use of raster-based format is a limitation of the approach. However, nothing prevents to further discretize the homogenous units using linear features such as river network, major roads, etc. if it is found suitable for the problem to be solved. Furthermore, as said below our methodology is more directed towards larger scale catchments, where any singularity such as ditch, small streams, etc. cannot be represented explicitly. At small scale, we agree that a vector-based format is certainly the most appropriate and modelling units can be defined directly using a very high resolution of the land surface. We can repeat here the comments to Referee #1

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If according to the study objectives (for instance pollution limitations), riparian zones are thought or known to be important, they should be represented. The representation can be explicit and in this case, the size of the objects the modeller wants to represent will condition the size of the modelling units and the resolution of the required data. Riparian zones can also be represented in a simplified manner. If this information is not available, the conclusion should be that the objective of the study couldn't be reached. The proposed methodology allows to think about the objects (and their size) which must be represented in the modelling before building or choosing the appropriate model.

The convexity problem is not related to the landscape discretization process. Algorithms are available to mesh (dividing polygons into convex units) the domain before fluxes computation (using for instance finite volumes algorithms). Some work is in progress in that direction for the 2D Boussinesq equation and will be reported in due time. The discretization of the hydro-landscape units into modelling units suitable for a given numerical solution is the third step in the catchment discretization we propose.

We do not agree with the claiming of Referee #2 than only 1D models can be used with this type of discretization. As said before the hydrological landscape discretization is only one step in the modelling process. The next step can be to subdivide the units to fulfil numerical requirements or to derive simplified representation to take the heterogeneity of the geometry into account in a lateral flux calculation.

Second and third paragraphs We agree with the comments of the reviewer about the handling of sub-grid scale variability using the tile or GRU approaches and we will complement the paper to mention this approach in the first part of the paper. However, we do not see any contradiction between what we have proposed and the handling of sub-grid scale variability using the tile approach. As well as the landscape units can be subdivided into smaller elements for numerical reasons, nothing prevents the use of the tile approach within the landscape units if it is considered suitable for the problem to be solved. Furthermore, the composition histograms readily provide a quantification

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of this sub-grid scale variability.

3 Recommendations

As mentioned above, our goal was not to focus on one hydrological model in particular, but to contribute with a pragmatic approach to the question of heterogeneity representation inside distributed models. A common practice in distributed hydrological modelling is to superimpose various factors to describe the landscape heterogeneity. Usually, there is not a clear view of the questions related to data resolution and the relevance with the modelled hydrological processes. We think that the method we propose allow to take these questions into account in a more rationale manner. Of course, there are some arbitrary hypotheses in the definition of the classes used for the factors description, of the shape and size of the neighbouring window, in the definition of the reference zones. We will try to better list them is the discussion section of the revised version. These choices can however be controlled and sensitivity tests can be performed to assess the impact on the classification on the description of heterogeneity and later, on the results of the hydrological model. Results using the proposed discretization will be reported in forthcoming papers, but, if required, we can tell more about the roadmap we plan to follow. Given that our objective was to give rise to discussions about this question, we do not thing that a full application with an hydrological model is required at this stage.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 777, 2007.