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Interactive comment on "HESS Opinions "Topography driven conceptual modelling (FLEX-Topo)"" *by* H. H. G. Savenije

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I would like to thank Prof. Bardossy for his valuable observations and his general support of the proposed methodology. First of all he underlines the importance of topography for hydrology both at short and long time scales. Subsequently he states that land use, which is also linked to topography, of course, varies with climate, policy and economic development. This is very true and I think that in the use of the proposed topography-driven conceptual modelling this should be taken into account. It should be clear from the start that the proposed methodology is an approach rather than a prescriptive procedure. It is not a straightjacket; on the contrary. It is a framework to develop appropriate model structures for the problem at hand, taking topographcal

knowledge as a starting point. Subsequently land-use information, specific properties of the hydro-ecological zone, and geological information should be used. For instance, if we want to apply the approach in the Blue Nile in Ethiopia, we have to realise that many of the hillslopes are cultivated, which lead to Hortonian overland flow on hillslopes. This is indeed happening and it is the reason of the heavy erosion that takes place in this region. Cultivated hillslopes and forested or pastured hillslopes hence need to be treated separately. But these things are part of the "Art of modelling" (see Savenije 2009). What I present here is nothing more than an example of how I would approach it in temperate Western Europe, but the model set-up is likely to be different elsewhere. I am sure Prof. Bardossy and I agree on this.

Another issue raised is that wetlands and riparian zones can also support trees. He is right. In fact the whole of the Netherlands was once forested, also the swampy peat lands. But the trees that can grow on very shallow groundwater tables, and which can sustain some periods of submersion, are generally very shallow rooting trees such as willows and ash, which are not very attractive economically. Hence we only see these trees along streams or along roads, but not in extended areas, where pasture or agriculture are a much more attractive land use. So in fact the wetlands without trees are part of the cultivated landscape. The hillslopes are different. Deep rooting trees can survive on hillslopes because they have 'co-organised' their own sub-surface drainage, as a result of an evolutionary process. How long it takes before this sub-surface system becomes effective, after forest cleaning and replanting, I don't know, but I suspect it is a matter of several years to decades, where in the first years there is still erosion due to insufficient sub-surface drainage and where gradually the subsurface drainage system develops.

Prof. Bardossy rightly observes that my remark that forested hillslopes are mainly responsible for the runoff production is only valid for the specific temperate European condition. In other climatic zones and other land use and geology conditions this is likely to be different. But that is exactly the point I wanted to make. Obviously in

Karstic areas a completely different conceptualisation is necessary. The model structure presented in the paper is just an illustrative example tuned to temperate European conditions. This model structure still needs to be tested, improved and confronted with data.

I agree that the purpose of the model should guide its development and that it should be based on a solid understanding of the dominant hydrological processes. I agree with the "anarchistic view" that we need to develop specific models for specific problems and conditions. I think that the flexible framework that I am proposing is an important instrument to do that.

Reference:

Savenije, H. H. G.: HESS Opinions “The art of hydrology”, Hydrol. Earth Syst. Sci., 13, 157–161, doi:10.5194/hess-13-157-2009, 2009.

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