**Hydrology and
Earth System
Sciences
Discussions**

Interactive comment on "Sediment transport modelling in a distributed physically based hydrological catchment model" *by* M. Konz et al.

M. Konz et al.

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Response to interactive comment of Prof. Kirkby

The valuable comments of Prof. Kirkby are highly acknowledged and we will comment on each of the points in the following. Our response is written in italic.

It is not clear to what extent the sediment transport reflects channel behaviour and to what extent it reflects the amount delivered from the catchment. The reconstructed sediment transport has a maximum of ca 3x104 m3. Over the catchment area of 90 km2, this represents the significant net lowering of 0.3 mm, so the catchment supply is presumably a significant contribution.

It is assumed that during the 60h event the entire sediment which is mobilized is eroded from the channel bed. Contributions from hillslopes are neglected. Stereoscopic aerial photos taken shortly after the event, field inspection, and pre- and post-LiDAR DEM analysis indicate that the sediment transported along the simulated reach was derived mainly from the following sources: (i) input from the upstream main channel, (ii) bed and bank erosion, (iii) concentrated sediment input from tributaries, mostly in the form of debris flows, depositing material on the fan and in the main channel. Diffuse hillslope sediment delivery is neglected, and there was no evidence of landslide sediment delivery to the main channel other than via tributaries (or bank failures). Both models consider sediment transport along the entire river network, thus implicitly accounting for all the in-channel processes leading to sediment mobilization and transport. The point of the paper is, however, about the development of a distributed sediment transport component for a distributed hydrological model (DHM), and its comparison with a "specialized" model, which is used as benchmark. The application to real data is not meant to be a proof of the ability of the model to reproduce the overall sediment balance during a storm event, but a demonstration of the ability of the DHM to mimic a state of the art model for channel erosion and sediment transport.

It would help to clarify what the model is doing if (i) The hillslope sediment delivery model was at least briefly described. Looking at the catchment it appears as though there are widely disparate sediment sources, from intact forest to very active steep slopes, so that sediment delivery to the streams is likely to show a similar wide range of values. (ii) The contribution of hillside and channel sediment can be logged, side by side, to show how much of the downstream fluctuation is due to hillslope and channel behaviour, and therefore how important the developments in channel modelling are to the simulated and observed behaviour.

In the current manuscript we exclusively focus on the sediment transport in the river channel. SETRAC does not take hillslope erosion into account. Therefore, this module has been switched off in the TOPKAPI simulations. Since it is not used for the sim-

ulations we do not explain details of the module. The coupling of both channel and hillslope erosion processes is not the scope of this paper. We acknowledge the importance of comment (ii), which is presently under investigation within the context of the same underlying research project. This, however, would require better data to validate the outcome of the hillslope and channel accounting DHM.

Can the authors also tell us how the transition between transport limited movement (of coarse debris) and supply limited movement of fines is managed and modelled?

The transition is managed by the amount of sediment available in the sediment storage of the respective cross-section. If enough sediment is available the transport limited condition is assumed to hold and correspondingly simulated, whereas if the storage is empty the full transport capacity cannot been utilized and then the supply limited transport is simulated. The transport of fine material in suspension is not modelled. Thus, in case of bank erosion, fine material likely to be transported in suspension is for the time being disregarded.

Finally, it is not sufficiently explicit how much of the (moderately?) good fit is achieved through the use of globally validated parameters, and how much is achieved through local optimisations?

The parameters of the two sediment models were not optimized. Only the parameter ïĄą is changed for runs M2 and M3 to consider the impacts of form roughness. This parameter is global and there is no option for local calibration. The geometrical data like river width, slope and initial sediment storage volume are input data to the model which have been derived from field observations.

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