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Interactive comment on "Modelling water availability, sediment export and reservoir sedimentation in drylands with the WASA-SED Model" *by* E. N. Mueller et al.

E. N. Mueller et al.

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Final response on 'Modelling water availability, sediment export and reservoir sedimentation in drylands with the WASA-SED Model'

We are very grateful for the valuable comments for the improvement of our WASA-SED modelling paper from the two anonymous reviewers. From both reviews we got very detailed suggestions how to clarify certain aspects of the current paper in regard to process description, applicability and uncertainty of the meso-scale modelling framework, and we will address these issues in a revised version of the paper to be submitted to GMD asap. A major criticism of both reviewers aimed at the fact that the article currently contains only a model description and no means of model eval-

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uation or application to assess model performance. Previously we had thought that the inclusion of an application with a full description on a study area, availability of parameterisation and testing data for hydrological and sediment-transport and deposition for the hillslope and river scale and a reservoir, regionalisation of parameter sets to the meso-scale using the LUMP approach and a thorough error assessment would go far beyond the scope of the paper. However, we have to agree with the reviewer at this point that the paper will only be able to demonstrate the strength of our multi-scale modelling approach, if error measures and uncertainty ranges for all included erosion, transport and deposition processes are given. We therefore intend to extent the paper with a case study on sediment export for a meso-scale basin in the Pre-Pyrenees (ca. 440 km2) by adding model results and quantitative performance criteria for: a) event-based water and sediment-transport for headwater-catchments, b) seasonal and annual changes of sediment-storage in the corresponding dryland river and c) long-term bed-elevation changes and management scenarios for a large reservoir. The updated paper will also clarify the comments of the reviewers in regard to the novelty of our hierarchical modelling approach that allows the assessment of long-term reservoir sedimentation in dryland settings (which are frequently under threat of limited water availability for drinking water and irrigation and urgently require some reliable prognosis on sedimentation as a function of climate and land-use change) by integrating the effects of overland flow and resulting erosion events generated during high-intensity rainstorms. As we stated in an earlier reply, the strength and focus of the WASA-SED model lies in its integrated multi-scale approach. This refers to the linking of the hillslope to the catchment scale and the integration of the three components hillslope (including very detailed soil and vegetation parameter descriptions for the hierarchically-built spatial aggregation system of landscape units, terrain components and soil profiles), river and reservoir into a single model. Using its innovative scaling approach, WASA-SED enables an adequate upscaling of those processes that dominate water and sediment export of dryland catchments: runoff and sediment generation on the hillslope; water routing and temporary sediment storage in the river

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network; water and sediment retention in reservoir networks; aggradation and remobilisation patterns in large reservoirs. The employed upscaling approach preserves a high degree of process-relevant details (e.g. intra-hillslope profile and soil distribution) while maintaining a slim demand in computational power and storage. We acknowledge that we did not lay enough stress on the discussion of the applicability of process-based and empirical transport descriptions for the simulated erosion processes, as well as the uncertainties and limitations of the model and will do so in an updated version. Finally, as one of the reviewers suggested, we have made the source code of the WASA-SED model now fully available via a Subversion repository, licensed under a modified BSD licence (http://brandenburg.geoecology.uni-potsdam.de/projekte/sesam/svn_form.php). We would like to thank again both the reviewers and our editor for their help in improving the impact of our paper, and anticipate that a revised version will refine significant sections of our work.

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