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Hydrology and Earth System Sciences Discussions



# *Interactive comment on* "Uncertainty in water resources availability in the Okavango River Basin as a result of climate change" *by* D. A. Hughes et al.

**Anonymous Referee #2**

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General comments

This is a relevant study of a (potential) water resource with great value, and uncertain future. The results of the GCM simulations are in-conclusive, but that is related to the GCM model formulations. The main problem with the present study is the parameterization of the hydrological Pitman model. Regarding the data scarcity and uncertainty, the model is over-parameterized. The authors assumes that it is the model that is correct, and that the problems with the model performance is related to the poor quality of the precipitation data available.

The Okavango River is extremely oligotrophic and the function of the downstream Okavango Delta is more related to the quality of the inflow, and not the quantity. The inflow of sand (bedload) is also essential, as it builds up the Delta and causes the flood to change position on the alluvial fan underlying the Delta. The internal hydrological function and sustainability of the Okavango Delta is also dependent on specific bio-engineering species (including hippos, elephants and termites). Changes in the climate and inflow can also impact these internal functions. The hydrological impact of climate change might hence primarily impact the Delta through changes in vegetation and ecosystem structure and function. But probably the largest challenge lies in keeping the waters oligotrophic and the sand propagating along the river bed with expected increases in the human population. The study focuses purely on changes in volume and timing of inflow, and hence does not address the key aspects of the functioning of the Okavango River and its downstream Delta. This is not a critical issue for the study as such, neither a critique, but in the light of this and the uncertainty in the model performance, the results of the study will be difficult to use for practical policy and management decisions as suggested by the authors.

Specific comments

Given the crucial importance of the model parameterization and its physical correctness, more efforts would have been needed in determining the quality of the precipitation and historical climate data. This could for instance have been done comparing the rainfall/temperature data with vegetation growth as recorded from satellite images (NOAA-AVHRR derived vegetation indexes going back to 1981). From 1995 and onwards the rainfall estimates derived from Meteosat could have been used to verify the precipitation data. Given the uncertainty in the model parameterization the results and conclusions of the study are somewhat pre-mature.

Technical corrections

The article is well written, albeit short on some of the methodological parts. Some illus-



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trations would have benefitted from being published in colour, or with patterns easier to differentiate. In figure 8 it is nearly impossible to attribute which graph belongs to which GCM. Figure 3 is also difficult to interpret in black and white, and shows a very small (selected) sections of the Cuito and Cubango rivers (with different scales, almost impossible to discern). The positions of the details shown in figure 3 could also have been indicated in figure 1. And figure 1 could have been patterned or coloured to show the sub-catchments used in the study. Given the significant difference in rainfall-runoff response in the various sub-basins, and the importance of the regolith and the bedrock, this could have been illustrated. The final model parameterization in the sub-basins eludes me. I am not even sure if the same parameterization was used throughout the whole basin (line 239 to 244).

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 5737, 2010.