**Hydrology and
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Interactive
Comment

Interactive comment on "Impacts of climate change on Blue Nile flows using bias-corrected GCM scenarios" *by* M. E. Elshamy et al.

M. E. Elshamy et al.

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The authors thank the referee for the constructive comments and for pointing out the need to compare the results to those of previous studies. We would like to draw the attention that our results are in agreement with previous studies which show general disagreement of GCM results over the area and we will address this when revising the paper although some hints were given about it in the introduction. Other specific comments are also appreciated and we will attempt to address them as possible.

The Blue Nile flow at Diem is slightly over 60% of the actual flow arriving at Dongola (average for the 61-90 is 73.76 BCM). This is meant to show the importance of the basin rather than giving an accurate figure. We conducted a monthly analysis and thus we cannot give a more accurate estimate of the time lag between flow and rainfall over the basin. We thought it will be rather lengthy to describe the formulation of the NFS

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hydrological model. However, we will try to elaborate it in the revised version especially with regards to calculation of actual evapotranspiration. Studies about groundwater in the Nile basin are limited.

We used GCM-derived PET and not actual ET from the GCMs directly after investigating the energy budget over the basin for the baseline and future periods and found some strange results showing little responsiveness of AET from GCMs to changes in the climate. In addition, the NFS is forced by rainfall and PET in order to calculate flow and thus we had to calculate PET to run the model. We could have calculated the runoff as the difference between rainfall and AET but only on an annual long-term basis. To get the monthly distribution, we needed run the hydrological model using rainfall and PET.

Regarding rainfall estimates, we do not think this paper aims to compare the different rainfall datasets over the region; this has been done by others (see Dinku et al., 2007; Dinku et al., 2008). A map of gauges used can be shown but gauges do not report data everyday. We did not want to swamp the reader with details about NFS and its validation (at the daily level) as the main aim is to show the impacts of climate change at the monthly scale. We actually think that the results shown are more or less independent of the hydrological model used as long as it is well calibrated (we tested that using HBV for a smaller sub-basin of the upper Blue Nile). The selection of the A1B is justified on the basis that the spread amongst GCMs is larger than that across the different emission scenarios; this will be elaborated in the revised version. I do not think we can fit in an analysis of land-atmosphere interactions over the basin in this paper; this is potentially a new research. However, we will try to elaborate on the rainfall-evaporation connection in view of the literature.

References

Dinku, T. et al., 2007. Validation of satellite rainfall products over East Africa's complex topography. International journal of remote sensing, 28(7): 1503.

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Dinku, T., Connor, S.J., Ceccato, P. and Ropelewski, C.F., 2008. Comparison of global gridded precipitation products over a mountainous region of Africa. International Journal of Climatology.

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