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Hydrology and Earth System Sciences Discussions

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

Anonymous Referee #3

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The study used precipitation and potential evapotranspiration from 17 GCM of the 4th IPCC report. The downscaled data over the Upper Blue Nile for the period 2081 – 2098 were used to feed in a hydrological model which computes runoff at El Deim (Sudan/Ethiopia border). The results showed a reduced runoff by 15% because of increased PET. Precipitation showed variation between -15% to +14%.

Overall, the paper is a good contribution to climate change studies over the Upper Blue Nile. As the future Nile flows is vital information for water resources planning, the conclusion should be reported with utmost clarity, and with identification of uncertainty range. In its present form (at least in the Abstract) the prediction is given with high confidence, i.e., reduction of Blue Nile flow by 15%. The comparison with results from the literature is not reported clearly to show difficulty of runoff prediction in the Blue

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Nile.

The discussion on actual and potential evapotranspiration needs to be further clarified, to show how this may influence final results. The authors used actual evapotranspiration AET computed by another hydrological model (NFS), without explaining how it has been calculated in NFS. A review of the two way land surface – atmosphere feedbacks may lay ground for discussing sensitivity of PET and P.

The paper can be a useful contribution to the Blue Nile studies considering revision as discussed in details below:

- The reason of using GCM PET (potential evapotranspiration) and not GCM actual evapotranspiration is not clearly discussed. - P1408-8: Blue Nile contribution at El Deim is 60% of Nile flow? This is the % at Khartoum, i.e. including Dinder and Rahad tributaries which flow downstream El Deim. p1411-20, showed this as 54%, assuming total Nile flow of 84 Billion m3. - Abbreviations, e.g., NFS, IPCC TAR, GHG, CRU not explained in the right places. - P1411-1. Description of Nile Basin is a bit lengthy. It could have been better to use this space to describe Blue Nile, and further Upper Blue Nile, since it is the domain of the study. - P1411-19: flow lags rainfall by one month? This seems to be too long. If the analysis uses daily data (p1410-16), a more accurate lag time can be computed. This will further highlights sensitivity of P, PET and runoff. - P1411-21: Penman-Monteith PET. Explain further whether you mean reference crop evapotranspiration, or potential ET from natural vegetation over the Upper Blue Nile, i.e., stick to definition given in Allen et al., 1998. - P1411-24: needs to explain how NFS computes AET. - P1411-27. Justify ground water recharge, or even groundwater flow outside the basin (e.g., to Awash or neighboring basins) is negligible. - P1412-05: justify selection of period 2081-2098 - P1412-11. Needs to highlight accuracy of the NFS rainfall data in particular as used here as (observed) data. - P1413-5, downloaded from where? - P11413-7. Could be useful if describing locations of rain gauges used, etc, and accuracy obtained than the lengthy description of the inverse method. Here, it could have been more useful to compare rainfall for same locations from two different

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sources as the two datasets are available to authors: CRU, and WMO. A further insight to sensitivity of final conclusion. - P1415-26: since the analysis uses only the Upper Blue Nile part of the NFS model, it would have been more useful to describe in more details the NFS model hydrology for this part, and how is the validation, in particular for daily time steps. This is important to distinguish sources of uncertainty in the final results of the CC scenarios. - P1416-07: Justify and discuss selection of SRES A1B scenario. - P1417-15: what physical justification for modifying a deriver (PET), how this may influence final results, and what is the impact on uncertainty of the final results? Justification given in P1417-21 is not clear. This is further discussed in P1419-3, but still not clear enough. - P1435: The authors could discuss the land use atmosphere interaction in the Upper Blue Nile, and sources of atmospheric moisture in the region, to highlight whether there is any possible feedback, to support interpretation of PET results vs P (e.g., Fig. 7). Interpretation given in P1421-1 is too short, and with no support from literature, see e.g., Mohamed et al., 2005 (HESS, 9, 263–278) for feedback analysis over the Nile. - P1420-18: See De Boer study for similar results: http://www.iwmi.cgiar.org/africa/east/Workshop/iwmi_itc_ihe/bas_pres_addis_june4_climchange_nile.pdf - P1421-13: what additional information is provided here, since this is an outcome of a hydrological computation irrespective of the GCM? i.e., similar to sensitivity analysis given earlier.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 1407, 2008.

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