

Interactive comment on “Supplemental irrigation potential and impact on downstream flow of Karkheh River Basin of Iran” by B. Hessari et al.

B. Hessari et al.

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Author comment to Reviewer #2

We would like to thank the reviewer for his/her thoughtful suggestions and comments, which helped us to improve our manuscript. Please find below the reviewer's comments (RC) with our responses (AC) and the corresponding changes we have made in the manuscript.

RC: 1) Methodology section could be improved with more information and justification (also giving appropriate references), in particular on the estimation of environmental flow requirements, and the methods used in downstream routing of flow (e.g. simple spreadsheet or hydrological model).

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AC: We agree with the reviewer that the introduction of our selected EFR is indeed rather brief. We have added background information on the Tenant (1976) methodology for EFR in the Introduction. We also added the selected application of the Tenant method in the Methods in Section 2.3 and added the explanation that all monthly flows used for the water resources allocations were based on observed 30-year average flows at the 53 subbasin outlets (no hydrologic model was used). In Section 2.5 (Water allocation) we have improved the explanation of the downstream-upstream computation of available water resources and the upstream-downstream allocation and routing of water resources. All computations were made with a Fortran code. The routing scheme identifies for each subbasin the number of upstream basins and the downstream basin.

Tenant, D.L.: Instream flow regimens for fish, wildlife, recreation and related environmental resources. Fisheries, 1(4), 6-10, 1976.

Tharme, R.E.: A global perspective on environmental flow assessment: emerging trends in the development and application of environmental flow methodologies for rivers. River Res. Applic., 19, 397-441, 2003.

RC: 2) Another main point is the downstream impacts are only compared at annual level. It is suggested to show the monthly impacts as well, in particular for the months when supplemental irrigation was applied (e.g. October, November, May, June). If a hydrological model is used than affect on couple of following months could also be shown.

AC: We agree. We have added the flow reductions for the 0-5% and 0-20% areas for the irrigation months for the different scenarios in the text.

RC: 3) On page 6 line 4, author used 15% of the mean annual runoff as environmental flow requirement. Would be good to add more on justifying this choice with references from the literature.

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AC: We agree. We have added the justifications for the environmental flow requirements in the Introduction and in Section 2.3 (see also comment 1).

RC: 4) On page 8, line 1, the sentence on comparison of findings with other study could be revised. The part saying, that the other study by Masih et al. (2011) did not specify the exact criteria used in their study could be deleted, as the authors do present how they delineated the potential rainfed areas using GIS based approach within the SWAT model environment.

AC: Yes. We changed this as follows: Masih et al. (2011) used the Soil Water Assessment Tool (SWAT) to allocate irrigation water from streams to rainfed wheat [..]

RC: 5) On page 9, line 20, the sentence on artificial groundwater recharge could be deleted or explained and supported through references.

AC: Yes. We have changed this as follows: Options for artificial recharge of groundwater with stream flows through check dams in the river bed or with off-stream basins could also be investigated (e.g., Khan et al., 2008).

Khan, S., Mushtaq, S., Hanjra, M.A., Schaeffer, J.: Estimating potential costs and gains from an aquifer storage and recovery program in Australia. *Agric. Water Manage.*, 95, 477-488, 2008.

RC: 6) On page 10, lines 9-11, the sentence on further refinement could also include the better representation of hydrological processes and estimation of downstream demands for environment and other sectors of water use (irrigation, hydropower).

AC: We agree. We have added the following: Economic studies could also consider additional scenarios such as hydropower and irrigation downstream of the dam. Furthermore, ecological studies could be done to base the environmental flow requirements on biological indicators, which could be integrated in hydrologic models that represent surface and groundwater processes.

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