Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
https://doi.org/10.5194/hess-2020-599-RC2, 2021

Comment on hess-2020-599

Anonymous Referee #2

Referee comment on "Spatially distributed impacts of climate change and groundwater demand on the water resources in a wadi system" by Nariman Mahmoodi et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-599-RC2, 2021

Review to HESS-2020-599

General comments

General comments - Reviewer

The topic covered fully corresponds to the aims and scope of the Hydrology and Earth System Sciences. Moreover, it covers aspects of hydrology and management. Though, the manuscript, in its present form, has a few weaknesses. Appropriate revisions to the following points should be undertaken to improve the readability and increase the interest for a general audience.

The title should better describe the study. Sustainable water use is not the subject of this study. I would rather say potential future climate impacts on water resources. At the end of the introduction provide a statement on the novelty of the study. At the moment it is not clear enough. Two sections of the manuscript need improvements. More specifically *2.2 Hydrological model* and *2.3 Future climate change simulation sections.* These two sections are parts of previously published work and they are confusing in relation to this research effort. Authors should better justify the selection of the G-RCM. I strongly recommend a flow chart of the methodology followed. Please provide as supplementary table the IHA Non-Parametric RVA Scorecard. Methodology limitations should be mentioned. Discussion section should be extended, as this is the main contribution to future researchers. Explain and discuss why the streamflow time series was generated for the period from 1993 to 2009 and 1979-2009. The presented results are influenced by this choice and it should be motivated. Moreover, at least a minimal discussion should be provided on expected differences (if any) when using different reference periods. Please contrast your own findings with those of previous literature about hydrological studies and climate change in the area (e.g. https://doi.org/10.1029/2008WR007615;

https://doi.org/10.1186/s40068-019-0135-3; https://doi.org/10.1007/s10666-019-09665-x). Uncertainty of the model outputs should be also in discussion.

Specific Comments

Comment 1

Page 1, Line 11-13*"A hydrologic model is used to assess streamflow and groundwater recharge of the Halilrood Basin on a daily time step under different scenarios over a model setup period (1979-2009) and for two future scenario periods (near future: 2030–2059 and far future: 2070-2099)."*

Please specify the number of the different scenarios.

Comment 2

Page 3, Line 92-94

"Based on representative climatic conditions, an eight-year period was used for model calibration (1995-2003) and a six-year period for validation (2004–2009)."

Please specify which are the representative climatic conditions. Are these observations? If yes please provide the reference and the source of the data.

Comment 3

Page 3, Line 88-89:

"The Soil and Water Assessment Tool (SWAT, Arnold et al., 1998; Arnold et al., 2012) was used to simulate the streamflow of Halilrood River between 1993 and 2009 on a daily time step."

Perhaps, authors mean that the outputs of the SWAT model were used in this study. This description is poor and confusing. Most of the work presented in this section, has been carried out in Mahmoodi et al. (2020a). Please consider to rewrite this section by clarifying the work you did for this research effort. Moreover, please specify if SWAT parametrization using the representative climatic conditions is sufficient when using the CSIRO-SMHI. In Mahmoodi et al. (2020b) it is mentioned that "Further details on model parameterization and performance are available in **Mahmoodi et al. (2020)**". I couldn't find this study on the internet.

Mahmoodi N., Kiesel J., Wagner D. P. & Fohrer N. 2020 Water use systems and soil and water conservation methods in a hydrological model of an Iranian Wadi system. J. Arid Land. 12 (4), 1–16

Comment 4

Page 4, Line 110-112:

"The calibrated and validated SWAT model was run with this climate model output to simulate groundwater recharge and streamflow for the model setup period (1979-2009) and two future periods (near future: 2030-2059 and far future: 2070-2099)".

SWAT model was run in previous work (Mahmoodi et al., 2020b). Please, provide more information about the model outputs. Perhaps a table with descriptive statistical analysis of the observational streamflow data, together with the model outputs (e.g. streamflow for the three different periods) would help readers to follow the logic of the paper.

Comment 5

Page 4, Line 104-107"*For the present impact study, following the argumentation that errors level out and a projection can be better represented through averaging, i.e., taking the mean, median, or weighting (Tebaldi and Knutti 2007, Thober and Samaniego, 2014), from the RCP8.5 and distribution mapping-adjusted ensemble, one global-regional climate model was selected."*

This sentence is a too long and it is confusing. Could you please explain further? Please also specify why you didn't use climate change projections from RCP 4.5.

Comment 6

Page 4, Lines 107-108:

"This selection was conducted according to the model democracy approach, which treats all climate models equally and the median model of the model ensemble is selected (IPCC, 2013)."

What is the model democracy approach? In the IPCC 2013 there is no mention about it. Moreover, please fix the references according to the journal's requirements and in respect to the report's recommendations (see below).

IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

Comment 7

Page 4, Lines 108-110: *"The G-RCM CSIRO-SMHI was chosen since it represented the median model of the major hydrological components (Mahmoodi et al., 2020b)."*

A model and its collection of runs is referred to as an ensemble. Please specify what do you mean as median model. If this ensemble selection influences the hydrological components in a major way, authors should add additional discussion in case of a different selection.

Comment 8

Page 4, Lines 117-119: *"The population growth rate suggested by presidency of I.R.I, Plan and Budget Organization (2019) was applied on the 2017 population data to estimate the population of the basin for the years 2045 and 2085, representative for the near and far future periods respectively (Table 1)."*

If your analysis was made based on 2017 population data, why data relative to 2011 population are presented in tables (table 1 etc.)? If you didn't use these data please remove them.

Comment 9

Page 4, Lines 123-124: *"(i): To meet the future domestic, agricultural and industrial water demand, increases in the number of wells and qanats are linearly extrapolated with the estimated increases in the population of Halilrood Basin as follows:"*

Linear extrapolation should be discussed in the discussion and conclusion sections. Why authors decided to use this method?

Comment 10

Page 7, Lines 186-187:

"The direction of change is shown by positive RVA, where the indicator becomes more stable within the RVA targets and negative RVA, where the indicator is moving towards an upper or lower alternative state."

Please explain what do you mean *"the indicator becomes more stable"*.

Comment 11

Page 1, Line 42-42; Page 7, Line 203-204; Page 8, Line 225-226; Page 11, Line 287-288:

- *"In Iran, the scarcity of rainfall, combined with climate change and population growth over the last decades, has resulted in higher groundwater extraction rates (Izady et al., 2015; Rafiei Emam et al., 2015; Mahmoudpour et al., 2016)."*
- *"As shown in Figure 2c and e, the GWW/GWR ratio is higher in the near and far future if the two stressors climate change and population growth are considered simultaneously (Projected-WUS)."*
- *"This might be due to the higher reduction in projected winter precipitation (Mahmoodi et al., 2020b).*
- *"This could lead to a higher groundwater withdrawal in summer season when the surface water does not meet the rising demand."*

Higher than what?

Comment 12

Page 5, Lines 135-136 *"To disentangle the impacts of climate change and population growth and its combined effects on future aquifer condition and hydrologic regime, five scenarios were developed (Table 4)"*

I only see 4 scenarios in table 4. Please fix the table and also explain the symbol *.

Comment 13

Page 9, Lines 236-237

"Although annual extreme flows mainly experience a lower degree of change in the near and far future (Figure 3 and 4),.."

Should there be figure 4?

Comment 14

Table 8.

Please write the relative years under each of the two future periods.

Comment 15

Figure 3.

Please improve coloring. It is very hard to distinguish as is.