

## ***Interactive comment on “Potential climate change impacts on the water balance of regional unconfined aquifer systems in South-Western Australia” by R. Ali et al.***

**R. Ali et al.**

riasat.ali@csiro.au

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Response to first paragraph: The reviewer made general comments about this paper without specifying any of the any of the shortcomings This paper is a case study. Text has been added in the paper to say that it is a case study. Many papers published in the international journals are case studies that focus on a particular region of the study.

In response to reviewer 1 comment about ‘no new methodological developments’ we believe that by dynamically linking a recharge model (unsaturated flow) model that takes account of variations in climate and land cover with groundwater models to quan-

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tify storage change and discharges was an important step forward in this field of study. Reviewer 2 also believes that this study is an important step forward in this field of study.

After this paper was written it was reviewed and edited by at least four internal reviewers. Parts of this paper were written by research scientists (English as first language). Co-authors made significant contributions in writing and analysis (most with English as first language). According to reviewer 2 it is mostly well written and comprehensive case study.

The reviewer 1 has concerns about the length of introduction. The introduction section has been modified in response to all the comments related to this section. Additional text has been added to further clarify what is new and different in this study. Some text has been re-arranged and deleted to improve clarity and flow.

The description of the study area consists of two small paragraphs and is supported by a figure to help understand the study area and its features. The addition of maps, cross sections and profiles in the hydrogeology section will increase the length of this paper without adding much value in our view. It is a large study area with a distance of over 340 km between Gingin and Augusta. Inclusion of a large number of maps and cross sections will be required to fully describe the study area which may be suitable for a report but not for a paper in our view. Also additional text will be required to explain surface/subsurface geology maps and cross sections of complex sedimentary aquifer systems of the Perth Basin. This section is only an overview of the hydrogeology of the study area. Further details about hydrogeology of the Perth Basin can be found in references provided in the text.

The section on historical groundwater use describes groundwater use in different regions of the study area which are shown in Figure 1. Reference to Figure 1 is now added in the description to identify areas mentioned in this section.

Response to comments from reviewer 1 about methodology: One paper which re-

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ports other aspects of the work has been published in HESS using the same methodology (Dawes et al. Modelling the effects of climate and land cover change on groundwater recharge in south-west Western Australia. HESS, doi:10.5194/hess-16-2709-2012). Another paper has been published (in press) in the Journal of Hydrology which uses the same methodology but reports different aspects of the work (<http://dx.doi.org/10.1016/j.jhydrol.2012.04.043>). This study was part of a large project. The methods used in this project were reviewed by the internal (CSIRO) and external reviewers (peers). This study is based on this methodology. A flowchart has been added as Figure 5 which helps explain important steps/methodologies used in this study. The methodology section has been revised slightly for a better clarity of the methods.

Response to comments from reviewer 1 about model calibrations. The models used in this study are well calibrated. Two of the three models have been refined over time with a much better calibration and this study used these improved models. In fact, PRAMS is one of the most well calibrated models in Australia. The reviewer 1 has raised doubts about model calibrations without any evidence or justification. The results from the same well calibrated models have been published in the Journal papers (doi are given in the next paragraph). We used three regional groundwater models for this study. A detailed description of three complex groundwater model calibrations will further increase the length of this paper without adding much value. Furthermore the reader can get extra information from the references provided.

Response to comments from reviewer 1 about modelling scenarios. A similar approach was used to derive the future climate data for modelling scenarios for surface water modelling and groundwater modelling. Using these modelling scenarios, results about groundwater levels and surface water runoff have been produced and published in the Journal of Hydrology <http://dx.doi.org/10.1016/j.jhydrol.2012.04.043>; <http://dx.doi.org/10.1016/j.jhydrol.2012.02.009>). Of course the use of GCMs for projecting future climate is based on assumptions and adds some uncertainty in projec-

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tions which is discussed in the discussion section. The objective is to capture the range of projections that might be expected. Again it is a concern without any justification. The description for the historical climate scenario has been modified to explain the rationale for using a sequence approach

Response to comments from reviewer 1 about results. The reviewer 1 did not identify which results quality as 'interesting results'. The reporting of the results is similar in style and content to most other papers on climate change, most of which have focused on particular study areas and assessed the impacts on groundwater systems or recharge or water levels, etc. The results can be compared and modelling and analysis methods used in this study can be transferred to other regions. The reviewer 1 did not mention what type of maps and diagrams are needed or missing from the results section. All necessary tables and figures have been included to better understand the results. The results section has been modified in response to general comments from reviewer 1

Response to comments reviewer 1 about discussion. The discussion section has been modified in response to comments from reviewer 1. The discussion section also includes a paragraph about uncertainty in model results and findings.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 6367, 2012.

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