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Hydrology and Earth System Sciences Discussions

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.

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Reply to interactive comment on 'Potential climate change impacts on the water balance of regional unconfined aquifer systems in South-Western Australia' by Ali et al. Response to general comments: Yes we agree it is a comprehensive case study. Thanks for the comments.

Yes we agree with the comment that coupling the outputs of a recharge model that takes account of variations in both climate conditions and land surface conditions with the groundwater flow models to quantify aquifer storage and discharge changes is an

important step in this field of study.

Response to specific comments Increase in groundwater storage under the historical and recent climates. The increase in groundwater storage projected under the historical, recent and other future climates was an average value over the whole model domain. While watertables were projected to decline in many areas within a model domain, there were also areas in the north of Perth (Central Perth Basin) where these were projected to rise substantially. These areas have been recently cleared for agriculture, have sandy soils and low groundwater development. Due to this reason mean annual storage change was positive although over two third of the Central Perth Basin was projected to have declining watertables. The areas with declining watertables also contain most of the natural and engineered drainage network where discharge to drains and ocean is projected to reduce due to lower watertables. This has been clarified in the discussion section. In the Southern Perth Basin due to rising watertables in the Scott Coastal Plain (sandy cleared coastal area) and in areas of water ponding in winter the overall storage change is positive although the watertables are projected to decline under most of the Blackwood Plateau which is a major portion of the Southern Perth Basin. In areas where watertables are projected to decline the discharge to drains is projected to reduce. The groundwater storage is likely to remain unchanged in the Peel-Harvey Area under the historical climate due to relatively stable watertables projected in this area. A storage loss is likely to occur under a wet, median and dry future climate due to declining watertables which in turn reduce discharge to drains. This area is relatively flat with relatively flatter hydraulic gradients towards the ocean. A small decline in watertables increases the risk of seawater intrusion which is projected to occur under a dry future climate. This has been included in the discussion section of the paper.

Specific comments: Page 6376 Line 5-10. Third condition was a repeat of the second condition and has been deleted. Page 6378, lines 1-15. Two models (PRAMS and SWAMS) were coupled with VFM before their calibration. The third model (PHRAMS)

was not coupled with the VFM. This has been clarified in the text.

Page 6378, line 18-26. The remaining 10 years of climate data were added to extend the historical climate data to 2040 for simulation only. The groundwater conditions were reported in 2030. The sequence approach was used because the observed climate data (1975-2007) of 33 years duration were larger than the required 23 years to extend it to 2030 for reporting. Elimination of 11 years of data from the front or back end of this period (1975-2007) without recharge assessment and recharge ranking could have selected a relatively wetter or drier historical climate data. Recharge estimation and ranking of average recharge rates from 11 sequences and the selection of 50th percentile recharge avoided such selection. The scenario (i) paragraph has been modified and the rationale of the approach used for creating the historical climate scenario has been clarified. Page 6369 Line 1. New references have been added.

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