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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Estimating long-term groundwater storage and its controlling factors in cold regions" *by* Soumendra N. Bhanja et al.

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The work by Bhanja et al. presents a study where GRACE observational products are compared with monitored and estimated groundwater storage changes in Alberta, Canada. The study shows that GRACE data can be used to understand groundwater storage changes and responses. As such, the results are important and the study of broad international interest. However, the manuscript is poorly organized and several sections are poorly written.

Main comments: The title promises too much. A more specific title with the focus on Alberta as case study would be more appropriate considering the content of the work. Also, is Alberta really a cold region or temperate region?

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Generally, the role of snow accumulation and melt is not well discussed or included in the work. Certainly, this must be a main reason for seasonal changes in water storage in regions with winter and snow (4 seasons). Improve e.g. section 3.1. on this issue. Also on line 29, page 8, the statement on precipitation is a bit odd for cold climate (correct to snow).

I find it surprising that the global scale hydrological modelling used to estimate recharge has not explained in the methods at all (only shortly in section 3.5). A sub-section is needed on this under section 2 including aspects of uncertainty. Revise section 3.6 to focus on results of the modelling.

Detailed comments:

Several sections are poorly organized such as: âĂć abstract: the 4 fist lines are too general. Provide 1 line as intro. âĂć introduction: delete the first 2 paragraphs which are really poor in content (lines 1-18), and split the 3nd paragraph into 2-4 sub section on lines e.g. 23, 28 âĂć the third objective is not presented as a number (bullet point) similar to the other sub-objectives. Why not?

In section 2, on lines 12-20, some information is provided about the aquifers. A map of the aquifers of Alberta could be useful. More importantly, how are the aquifers split into confined, semiconfined and unconfined?

In section 2.6, the equations 4-8 are general knowledge and should be deleted.

I feel that more information is needed on the comparison of GRACE MS and SH is needed in section 3.1.

Combine section 3.3-3.4. Also provide a meaningful title! RMSE etc. is not a good choice of title. Provide the result or outcome in the title.

The section 3.6. on assumptions is quite odd. Focus perhaps on uncertainty or delete the section, or put it into section 2.

The "conclusions" section 4 is well written.

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