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Discussions

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Interactive comment

Interactive comment on "Peak river flows in cold regions – Drivers and modelling using GRACE satellite observations and temperature data" *by* S. Wang et al.

Anonymous Referee #1

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This manuscript presents a modeling approach to determine the date of the peak river flow in Arctic regions. This method was applied in the McKenzie and was previously applied to the Red River (Canada). I do not know that is the meaning of determining this parameter at basin in such a large drainage basin (1.8 million km^2). Please find below my detailed comments:

About the introduction

Among the different technique that were used to estimate Snow Water Equivalent (SWE), you can mention that an inverse method was developed to separate SWE from Terrestrial Water Storage (TWS) estimated by the GRACE mission (Frappart et al., 2006; 2011), around line 75. Due to the principle of the GRACE mission (e.g., Schmidt

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Discussion paper

et al., 2008), there is no footprint associated to the GRACE data. It is better to mention the resolution of the mission. Replace in all the manuscript.

About the study area and datasets

Clearly separate the different aspects: 3.1 Study area, 3.2 Datasets, 3.3 Hydroclimatology This three sub-parts seem disconnected. Smooth the text. GRACE data: Add the spatial resolution of the GRACE data (∼330 km at degree 60), line 137. What is the impact of leakage error on your estimates? How are defined the scaling factors? To what I understand, applying these factors, you make the assumption that a hydrological model that may not take into account all hydrological reservoirs can be used to scale the GRACE estimates. Does this operation seem realistic in the McKenzie drainage basin in terms of hydrology (does the model simulates surface, snow and groundwater storages . . .)?

About the methods

About the model: References are missing. Are these common equations for modeling the baseflow? McKenzie drainage basin is a quite large basin. Are these relationships valid at such spatial scale. Is the breakup time occurring the same day on the whole basin ranging from 54°N to 66°N? Can this study be refined at smaller scales? At least at major sub-basins scale? About the results Break-up date are given with a great accuracy (a specific day). But GRACE-based TWS have a monthly temporal resolution. What is the impact of this temporal resolution on your estimates? Some studies derived TWS on a daily basis (e.g., Kurtenbach et al., 2012). Would it be relevant to consider these datasets if available? It would be also interesting to compare your results to the ones from global hydrological models such as WGHM, rather doing the comparison with the same approach in another basin. The presence of extensive floodplains (lines 307-310) has for consequence to delay the water in its path. How is this accounted for in your approach? If surface runoff is minimal in winter (line 310), is it because the river is frozen? In my opinion, there is no forecasting (line 405) as your approach does not predict the peak flow. To do so, it is necessary to have access to the GRACE data one or two months before this event. I do not think this is the case. What is the amplitude of the GRACE error? (lines 406-415).

About the tables Tables 1,2,3 could be merged.

About the Figures Figure 1 should present a map of Canada, locating the McKenzie Basin.

References

Frappart F., Ramillien G., Biancamaria S., Mognard N.M., Cazenave A. (2006). Evolution of highlatitude snow mass derived from the GRACE gravimetry mission (2002 -2004), Geophysical Research Letters, 33(2), L02501, doi:10.1029/2005GL024778.

Frappart F., Ramillien G., Famiglietti J.S. (2011). Water balance of the Arctic drainage system using GRACE gravimetry products, International Journal of Remote Sensing, 32(2), 431-453, doi: 10.1080/01431160903474954.

Kurtenbach E., A. Eicker, T. Mayer-Gürr, M. Holschneider, M. Hayn, M. Fuhrmann, J. Kusche (2012), Improved daily GRACE gravity field solutions using a Kalman smoother, 59–60, 39–48.

Schmidt, R., Flechtner, F., Meyer, U., Neumayer, K. H., Dahle, C., König, R., & Kusche, J. (2008). Hydrological signals observed by the GRACE satellites. Surveys in Geophysics, 29(4-5), 319-334.

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