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Hydrology and Earth System Sciences Discussions

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Interactive comment

Interactive comment on "Global re-analysis datasets to improve hydrological assessment and snow water equivalent estimation in a Sub-Arctic watershed" *by* David R. Casson et al.

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Thank you to the referee for their constructive review and comments. No major objections to comments and review. Manuscript will be updated with the following revisions.

Pg 1. Line 22. Will add sentence: Study results were unable to demonstrate statistically significant correlations ($p<0.05$) between measured, global hydrological model and GlobSnow-SWE to snowmelt runoff volume or peak discharge.

Pg 1. Line 26: Will update closing sentence to: This study demonstrates the operational and scientific utility of the global re-analysis datasets in the Sub-Arctic, although

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knowledge gaps remain in global satellite based datasets for snowpack representation, for example the relationship between passive microwave measured SWE to snowmelt runoff volume.

Pg 2. Line 19: Modify text to: Precipitation gauge measurements to quantify snowfall at high latitudes have high uncertainty due to the scarcity of meteorological stations, short duration of meteorological measurement records and systematic measurement error (Devine & Mekis, 2008; Mekis & Vincent, 2011; Sugiura et al., 2006).

Pg 3. Line 9: Modify text to: Research into the reliability of re-analysis products at high latitudes is, however, limited due to a lack of reliable precipitation and SWE data (Mudryk et al. 2015; Wong et al., 2016).

Pg 3. Line 10: The intent here is local (not locally as suggested) in contrast to global models. Will not modify.

Pg 3. Line 15: Correct! Thank you. Modify text from 'but' to 'and'

Pg 3. Line 19: Noted. Modify from 'real and practical' to 'practical'

Pg 3. Line 24: The intent here is local (not locally) as suggested in contrast to global models. Will not modify.

Pg 4. Line 18: Modify text to: Sublimation, the direct conversion of snow particles to vapour, is a major factor in removing snow from tundra areas (Marsh et al., 1995) and along with wind redistribution is a key driver of spatial variability and quantity of SWE.

Pg 4. Line 27: Modify text to: Current approaches for hydropower operations in the Snare Watershed use ground SWE measurements and matching with historical discharge records with similar flow characteristics to anticipate discharge.

Pg 5, Line 17: Modify text to: Historical discharge data was separated into calibration, validation and testing periods.

Pg 6, Line 8: No conflict, Pg 4. Line 27 has been modified

Pg 6, Line 11: Reference will be added added for Penman Monteith (Allen et al, 1998) Allen, R. G., Pereira, L. S., Raes, D., and Smith, M.: Crop evapotranspiration-Guidelines for computing crop water requirements-FAO Irrigation and drainage paper 56, FAO, Rome, 300, 6541, 1998.

Pg 7, Line 11: Good catch, is unclear. Modify text to: Secondary hydrograph peaks which occurred after the freshet peak and are driven by late-season rainfall events were removed in the snowmelt volume calculation. The separation of rainfall driven flow increases was performed using a simple exponential regression to estimate the regression curve from the spring melt hydrograph (Toebes et al., 1969) .

Pg 8, Line 14: Rank Correlation Analysis Data Summary containing all annual maximum SWE, snowmelt contribution to streamflow and peak discharge will be added to supplemental material. Due to consistent period of record, can clarify with addition of text as below. The period of record for all rank correlation analysis was 1985 to 2012.

Pg 8, Line 15: Add text 'or acceptable'

Pg 8, Line 15: Add text and references

Nash-Sutcliffe Efficiency (NSE) values has a range of all negative values to 1 where 1 indicates the ideal with no difference between simulated and observed values. (Nash & Sutcliffe, 1970). Percent Bias (PBIAS) gives a measure of the tendency of the simulated results to be larger or less than the observed values. Root Mean Squared Error (RMSE) standard deviation ratio (RSR) has the benefit the commonly used RMSE statistic with a normalization and scaling factor which facilities comparison (Moriasi et al., 2007). Evaluation using Kling-Gupta Efficiency is similar to NSE with an ideal optimized value of 1. (Gupta et al, 2009)

Gupta, H. V.,Kling, H., Koray, Y., & Martinez, G. (2009). Decomposition of the mean squared error and NSE performance criteria: Implications for improving hydrological modelling. Journal of Hydrology, 377, 80–91.

Nash, J. E., & Sutcliffe, J. V. (1970). River flow forecasting through conceptual models part I âĂŤA discussion of principles. Journal of Hydrology, 10(3), 282-290. doi: http://dx.doi.org/10.1016/0022-1694(70)90255-6

Pg 12, Line 4 Will move to recommendations. Text updated as below. Data products available in Near-Real Time such as MSWEP-NRT, which is a variant of the historic MSWEP dataset, can be similarly applied to as model forcing in remote regions. Using Delft-FEWS, scheduled model runs can be used to keep model states current and generate regularly scheduled hydrological forecasts.

Pg 12, Line 24 Remove 'real and'

Pg 12, Line 30 Remove Canadian

Pg 17, Figure 1 Noted, will increase contrast

Pg 18, Figure 4 Noted, will update figure according to recommendation

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2018-82/hess-2018-82-AC1-supplement.pdf

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