

## ***Interactive comment on “Extension of the Representative Elementary Watershed approach for cold regions: constitutive relationships and an application” by L. Mou et al.***

### **Anonymous Referee #3**

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#### GENERAL COMMENTS

The authors summarize the development and testing of mass and energy balance equations applicable for cold regions hydrometeorological processes within the representative elementary watershed (REW) framework. They claim the success of these new closure equations because they were able to simulate one season of runoff from their modeled catchment, the Urumqi River in China. I have serious concerns about the robustness of the authors' methodology. This may be because of the presentation of the manuscript. It was needlessly convoluted and excessively cumbersome. Of

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more concern are the several flaws and mistakes that could imply basic problems with the proposed approach. These include contradictory explanation (or no explanation whatsoever) of variable and parameter units, balance equations that do not balance, and mistakes in logic. One year of well simulated runoff after calibrating for four does not constitute any proof that the approach is viable. Also, the authors spend much time deriving over convoluted and poorly described energy budget equations that are already well known and then spend even more time describing how they substitute field equations developed by others into these closure equations. There is little new information presented, besides a lot of mathematics. Furthermore, a true test of a cold regions hydrological model is not necessarily in simulating runoff, but the cold regions processes simulated by the additional algorithms. Comparing simulated and observed snow water equivalent, snow covered area or soil temperature would have been more telling. To my knowledge, no one to date has been able to correctly model more than one dependent variable during the same simulation period, even after calibration. For instance, either snow covered area or runoff is correct, but never both. I'm afraid I cannot consider the paper, as presented, worthy of publishing. I encourage the authors to focus on the goal of multivariable simulation for the future, as that would be an achievement.

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