

Interactive comment on “A surface model for water and energy balance in cold regions accounting for vapor diffusion” by Enkhbayar Dandar et al.

Anonymous Referee #1

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This paper studies the role of vapor diffusion in the land energy and water balance cold and semi-arid regions. A new water and energy balance model has been developed that accounts for freezing and melting. In general, the topic is interesting for the land surface modelling community. However, there are several problems need to be addressed.

(1) Line 359: ‘In summary, results are qualitatively consistent with observations.’. However, I did not find the evaluation of the model simulations with observations. It is important to comprehensively evaluate the new model in representing water and energy cycles (e.g., river discharge, soil/surface temperature, sensible/latent/ground heat

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fluxes) over more than one site in different river basins.

(2) The equations are not precise enough. All of them should be re-checked. For example, in equation 16, R_{nl} should equal to $RL_{down} - RL_{up}$, but not $RL_{up} + RL_{down}$. Line 208, the description of λ is puzzled. It is better to express by an equation.

(3) Lines 74-76, the inputs and outputs are mixed here. I suggest to describe the inputs/outputs in a more clearly way, not only for water, but also for energy balance.

(4) I do not see the advantages of the new model. The authors may want to emphasize it more clearly.

(5) In Equation 1 and Lines 96-99, how the interception loss (by canopy) is treated in the model ?

(6) Instead of using ‘length’ to explain L_{ss} and L_{sf} , the ‘depth’ might be easier to understand. (e.g., Line 130 and other places)

(7) Equations 13-15, how the m_l , m_i and m_s are determined in model ?

(8) How is the model initialized ? At what time step is the model run ?

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