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Interactive comment on "A Budyko framework for estimating how spatial heterogeneity and lateral moisture redistribution affect average evapotranspiration rates as seen from the atmosphere" *by* Elham Rouholahnejad and James W. Kirchner

Anonymous Referee #3

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This is a great little paper where the Budyko framework is used together with a second-order Taylor analysis to show that average surface parameters (P and PET) will yield to an overestimation of true evaporation. Next, a simple connected column model is used to show that lateral redistribution of water can either increase or decrease average evaporation. What is really interesting is that the maximum evaporation reached by lateral redistribution is exactly equal to the (positively biased) evaporation. In hindsight this is logical if one realizes that if all the available water P and energy PET is

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redistributed over an area we arrive at the evaporation belonging to average P and PET.

The paper is really well written and can deserves publication almost in its present form. There is however one issue that the authors could discuss and one point of partial disagreement.

First, I am not convinced that it safe to assume that redistribution would mean that all the water that is laterally moved to other areas is in available for evaporation. Apart from the fact that the lateral movement is constraint by P-ET (which could I think be build in their approach), the lateral movement of water will almost always happens as either surface flow or saturated (shallow) subsurface flow. This means that this additional water is most likely captured by a stream and lost from the system and thus not all available for lower places. This would mean that the receiving location would move a bit less in the direction of the energy limited domain then in the current model and areal evaporation would end up a bit lower in case of redistribution.

Second, The point of partial disagreement that I have is that a Taylor approach could also be used for temporal averaging. Yes, this could be done, but only if the time scale is such that storage changes can be ignored.

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