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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Estimation of evapotranspiration through an improved daily global solar radiation in SEBAL model: a case study of the middle Heihe River Basin" *by* Jingqiu Yin et al.

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ET is an important part of water and energy balance. The water and the latent heat of hydrological processes exchange mutually or exchange in itself, regulating the global water and energy distribution. SEBAL model is widely used in this field. SEBAL model is a research based on interdisciplinary knowledge, but it is not a theoretical improvement of a certain sub model, there will be actual good results, which need to be verified repeatedly. It is in this spirit that the improved GSR model is introduced and good results are achieved. So we write an article to share with your journal, let this good

method can be popularized.

1) The reason why SEBAL was chosen to perform the actual ET calculation is unclear. Daily GSR calculation has implications all types of ET calculation. Why not use a simpler method such as Priestley & Taylor, or Penman? That will make discussion of the effect daily GSR on the ET less disturbed by the potential to actual evapotranspiration . âŚă According to the principle of heat balance and turbulent diffusion and Bowen's ratio, penman (1948) proposed the estimation of possible evaporation in the horizontal transportation of anhydrous steam. âŚąPriestley & Taylor (1972) based on the relationship between sensible heat flux and latent heat flux of wetted surface and the idea of equilibrium evapotranspiration, gave the potential evapotranspiration of wetted surface without advection (minimum advection). âŚć Priestley & Taylor, or Penman calculation results are potential evapotranspiration, which are converted into the actual ET, will produce great error. And SEBAL results are actual ET. âŚč Priestley & Taylor, or Penman model don't fully consider the underlying surface factors. For the Heihe River Basin, the underlying surface is very important (please look at introduction). But SEBAL considers these, and makes full use of remote sensing data to extract surface factors.

2) The SEBAL algorithm is applied to a very limited number of days in 2009. If you are promoting an improved to the daily GSR calculation, I would like to see its effect on the ET calculation over a long time period, e.g. at least two years. âŚă The Heihe River originates from the Qilian Mountains, is the largest inland river in Gansu. The water come from the mountains is the main water resources of agricultural production, living and ecological throughout the basin system. âŚą Water resources are mainly consumed during the growing season. Because the agricultural activities exhausted a large amount of water resource, hydrological recycle and ecology environment were influenced seriously in middle and lower reaches of Heihe River. Many researchs are done in the growing season, almost no observations in other seasons. âŚć SEBALïijĹ-Surface Energy Balance Algorithm for LandïijĽ' model is currently a very important

method for estimating water and heat fluxes. Using remote sensing data and meteorology knowledge, the calculation of daily scale water and heat fluxes is feasible and widely applied (Bastiaanssen et al., 2000; Teixeira et al., 2009; Liu, 2008; Yin, 2014; Li et al., 2010; Ahmad et al., 2014; Usman et al., 2015). And The SEBAL model is based on a single-day ET calculation. âŚč The improved daily GSR over rugged terrains is done enough to estimate the daily GSR of any day of the year (Shi et al.,2018; Shi et al.,2013; Yin,2014;Shi,2013;Deng 2012). The simulation results accuracy improved and spatial distribution more reasonable. This is the latest research result of our research team, the methods and simulation results are being compiled into articles and published. âŚď The SEBAL model can only estimate ET on sunny days, requiring no cloud and not damaged image.TM image cycle is 16 days, with high spatial resolution, MODIS image cycle is one day, but the spatial resolution is less than TM image. We collected many TM image and MODIS image in the growing season, only find this four days remote sensing data can usable. âŚě surface albedo and NDVI etc. are changing every day in growing season. The improved daily GSR model and SEBAL model are stable, parameterization methods are mature, and the simulation results are reliable. So we select those four days data.

3) The application of the SEBAL algorithm is insufficiently describe. SEBAL requires the selection of a 'wet' and 'dry' pixel. The authors should be describe how they did this. I have described in the manuscript.Where, the NDVI 0.72 in oasis is selected as wet point, and where, bare ground in desert is selected as dry point.

4) Equations for the error metrics (MABE and MARBE) need to be given in the manuscript. I have given in the manuscript.

5) The employed in-situ measurement need to be describe in a more transparent manner, e.g. for each measured quantity provide to instrument and the expected accuracy of that instrument. With respect to the ET measurements also the energy closure gap need to be reported. You are right, the research on energy closure gap is done by other researchers in digital Heihe. for example Wang et al.,(2015) This study focuses

on the results of improving daily GSR model, and the impact of the improvement on the estimation of ET.

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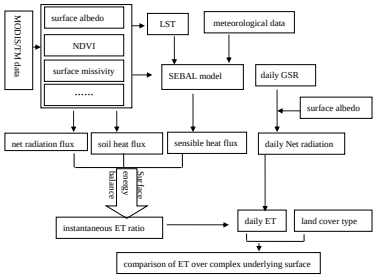

Fig.1. Flow chart of this study

Fig. 1.

Table 2
ET of three combination schemes on 24 June, 2009(Unit: mm)

Classification	farmland			wetland		
	measured ET	original scheme	improved scheme	measured ET	original scheme	improved scheme
TM strategy	4.8	6.3	5.0	2.2	4.7	3.5
MODIS strategy	4.8	6.3	4.2	2.2	4	2.6
TM/MODIS Hybrid strategy	4.8	7.0	4.8	2.2	4.7	3.1

Fig. 2.

Table 3
Errors of ETs of three combination strategies on 24 June, 2009(Unit: mm)

simulation strategy	simulation scheme	farmland		wetland	
		MABE	MABRE (%)	MABE	MABRE (%)
TM strategy	original scheme	1.5	31	2.5	114
	improved scheme	0.2	4	1.3	59
MODIS strategy	original scheme	1.5	31	1.8	82
	improved scheme	0.6	13	0.4	18
TM/MODIS strategy	original scheme	2.2	46	2.5	114
	improved scheme	0	0	0.9	41

Fig. 3.

Table 4
a. Daily ET of middle Heihe River Basin on June 21–24, 2009 (farmland) (Unit: mm)

Date	Measure	simulated ET		MABE		MARBE（%）	
	ET	improved	original	improved	original	improved	original
6.21	4.9	3.8	6.6	1.1	1.7	22	35
6.22	5.1	3.9	6.5	1.2	1.4	24	27
6.23	4.5	4.4	6.6	0.1	2.1	2	47
6.24	4.8	4.8	7	0	2.2	0	46
Mean	4.8	4.2	6.7	0.6	1.85	12	39

b. Daily ET of middle Heihe River Basin on June 21–24, 2009 (wetland) (Unit: mm)

Date	Measure	simulated ET		MABE		MARBE（%）	
	ET	improved	original	improved	original	improved	original
6.21	2.1	2.4	4.1	0.3	2	14	95
6.22	1.9	1.2	2.2	0.7	0.3	37	16
6.23	2.1	1.7	2.7	0.4	0.6	19	29
6.24	2.2	3.1	4.7	0.9	2.5	41	114
Mean	2.1	2.1	3.4	0.6	1.4	28	64

Fig. 4.