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Hydrology and Earth System Sciences Discussions

Interactive comment on "Improvement of surface albedo parameterization within a regional climate model (RegCM3)" *by* Y. Bao and S. Lü

Anonymous Referee #3

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General comments:

This paper investigated the effect of an improved albedo parameterization on the modeling of East Asian monsoon and NW China climate. This is a very interesting topic that links the terrestrial surface energy budget and the monsoon, and I believe it could be turned into a high-quality paper. However, there exist some severe uncertainties and subjective conclusions; and therefore, it needs major revisions before being accepted.

Major comments:

1. Table 1: the improvement of the cold bias in the mean air temperature is significant after implementation of the albedo scheme, but the diurnal range of air temperature (max. - min.) is much under-predicted. The maximum and minimum air temperatures

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are quite different between the modeling and the CRU data. I suggest checking the quality of CRU data, which is taken as "observations" in this study. Though some studies (Wen et al., 2006) used CRU data for climate change studies, its quality could be confirmed against CMA routine data for the specific simulated period (a simple evaluation would be OK). Moreover, the temperature must be corrected to account for elevation difference between CRU and model grids before the temperature comparison in Table 1 and relevant figures, if this has not been made.

2. Abstract: "The simulated diurnal cycle of ground temperature conforms fairly well to the observation in the nesting simulation in Northwest China". According to Figure 6, we cannot make this conclusion. The difference between observation and modeling can be as high as 10K. In reality, this is a major model deficiency for the dry region and should be pointed out. Also see comment No. 8.

3. Do not understand Ssw in equations (1) and (2). What is the range of Ssw/Zu in Equation (2)? Is it soil water content? The authors should make efforts to clarify the meaning of each symbol.

4. p1657: "Diffuse albedo is the integral of all SZAs with the weight of cos(theta)". Please explain by an equation.

5. P1657: "The exchange of land-atmosphere flux is a sub-grid scale process (Sun, 2006)". Sun (2006) is not found in the reference list.

6. Figure 3 shows the elevated Tibetan Plateau surface absorbs less solar radiation compared to its surroundings. This is unusual, as it is well known that the Plateau receives much higher solar radiation though its albedo is relatively high in the western Plateau. Please explain this. Longwave cooling radiation flux (upward minus downward) also needs a definition?

7. Figure 6a: there is a big difference in shortwave radiation between observations and simulation at 15Z. According to my experiences, the temporal average for the

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simulated radiation might be not consistent with that for the observed one, or, your modeling produces too few clouds. An explanation should be given.

8. Figure 6b: the error in Tg is as high as 10 K. This big error is also mentioned by another comment. The authors explained that the simulation RCM_SZA yields more absorbed shortwave radiation on the surface and thus higher Tg. Two points should be clarified here. First, the authors should compare the observed albedo and simulated albedo at the site (according to Figure 6a, the observed albedo is available), in order to avoid a possibility using an error caused by the albedo parameterization to compensate an error caused by a model deficiency. Second, the big error at noon found at this site is very similar to the results for dry sites presented in another paper of this special issue (Some practical notes on the land surface modeling in the Tibetan Plateau), which shows the very high daytime temperature is successfully simulated, after a new scheme for the thermal roughness length is introduced in the model. Similar explanation should be applicable to the results in Figure 6b.

9. P1665, L14: "Beyond our expects, no more precipitation occurs both in East Asia and in Northwest China although there are above 2Wm−2 extra latent heat fluxes in RCM SZA simulations". What is the authors' expection? "2Wmˆ−2" extra latent heat fluxes is equivalent 0.07 mm /day (25 mm/year) increase of evaporation, which is comparable to or even less than the difference in precipitation (0.13 mm/day or 45 mm/year) between RCM_ORI and RCM_SZA. Do the authors think this amount of precipitaton increase is too small?

10. I found several obvious errors that should be avoided, such as Figure 3 has a completely wrong caption, Figure 6d is missing, and too many language errors ("ground temperature e in summer" at P1654 L4; "stored in the surface and soil heating them" at P1665 L12). The authors must check the manuscript carefully and thoroughly.

Minor comments:

1. Too many acronyms in the abstract.

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2. Figure 1 is low-quality, the sub-domain needs a legend, and land use types have no explanation (e.g. what is type 1?).

3. Many references in the reference list are not put in order according to the HESS manuscript format.

4. Change “benchmark experiment” to “control experiment”.

5. P1662, L18: “While in the Northwest China, there are positive biases for the high evaluation in mountains. . .” What is the meaning of “high evaluation”?

6. P4 L4: replace high level by high-level

7. Many sentences are so complex that it’s tough for me to understand them, such as:

“Results indicate, RegCM with SZA method (RCM SZA) considerably improve the cold bias of original RegCM (RCM ORI) in air surface temperature in East Asia with 1.2 degree increased in summer due to the lower albedo produced by SZA method which makes more solar radiation absorbed by the surface and used for heating the atmosphere near to the surface.”

“It is a very important land surface parameter in physical climate system which controls directly the partition of radiation energy in surface, thus affects the surface temperature and evapo-transpiration, consequently, affects the modeled atmosphere condition, that, in turn, affects the basic land surface conditions and the large or meso-scale flux transportation between the atmosphere near to the surface and boundary layer.”

“Besides the general reasons that the excessive high level cloudiness produced by model and possibly the lack of urban heating in local areas (Giorgi et al., 1999), and the formulation of snow processes in 5 BATS which depends on snow albedo and fractional cover descriptions that may include significant factors of uncertainty maybe contributing to the variance of temperature in winter (Steiner et al., 2005), the simulated surface albedo bias from the coupled land surface model BATS is considered to be one of the other possible factor.”

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 1651, 2009.