

Interactive comment on “A qualitative description of shallow groundwater effect on surface soil temperature” by F. Alkhaier et al.

Anonymous Referee #1

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This paper presents an interesting investigation on the relationship between land surface temperature (hereunder, referred as LST) and groundwater table, which is potentially useful in detecting shallow groundwater table from remote sensing. Generally speaking, the manuscript should be interesting to the readers of HESSD and has potential to be a good publication. But some parts of the paper have to be re-investigated and rewritten for the sake of more clarity. Listed below are the reviewer's comments.

Major comments: 1. The soil temperature were measured at 5-10 cm. However, the soil temperatures at these depths are quite different from the skin temperature, which can be measured using thermal remote sensing. Should be noticed is that, in the arid region, the thermal gradient in soil column is very large, therefore, the soil temperatures measured at 5cm (e.g., figure 2-a) and 10cm (e.g., figure 2-b) might have poor

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representativeness of LST. The reviewer is wondering why the LST was not used in the analysis? No observation? Or the relationship is poor? Since the objective of the paper is to relate the ground water table with LST, which is measureable from remote sensing (not soil temperature at 5cm!), it is strongly suggested to use LST in the analysis. 2. The results show good relationships between LST and groundwater table (Figure 2 & 3), however, the vegetation, soil moisture, and other factors also have strong effects on LST. The study just carried out an ideal experiment at a homogeneous area. However, if other factors were taken into account, the relationship would not be so simple. In addition, the thermal conductivity and volumetric heat capacity in a true word will change with soil moisture, this was not considered in the paper as well. All these issues need to be discussed in the paper. 3. Is the results showed in Figure 4 meaningful? What the physics behind it? It is suggested to omit Figure 4 and related discussion. 4. What's the purpose of Figure 5 and corresponding discussion?

Minor comments: Page 2133, line 4. “Famous surface energy balance equation”. Omit the word “famous”. Page 2133, Line 10. “where K_{in} and K_{out} are, respectively, the short incoming and outgoing radiation” change to “where K_{in} and K_{out} are, respectively, the incoming and outgoing shortwave radiation”. Page 2133, Line 10-11. “and L_{in} and L_{out} are the long incoming and outgoing radiation, respectively” change to “and L_{in} and L_{out} are the incoming and outgoing longwave radiation, respectively.” Page 2134, line 20-21. “saturated soils naturally have high values of both.”. Is this true? Saturated soil has low thermal conductivity but larger volumetric heat capacity. Most of the “relation” in the paper should be “relationship”. Page 2135, line 8. “Semi arid conditions”. Should this be arid conditions because the annual rainfall is less than 200 mm. Page 2137, line 4. “Data and results” change to “results”. Page 2137, line 4. “field measurements” change to “result from field measurements”. Page 2141, line 2-4. I do not think the results can be used in land surface energy balance studies. Page 2141, line 10-14. The final comment is very good! The authors conclude that shallow groundwater affects skin temperature on yearly basis. Using the annual mean LST derived from remote sensing may be feasible to detect groundwater table. Page 2144.

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The units of thermal conductivity and volumetric heat capacity need to be indicated in Table 2. Page 2145, Figure 1. "1 square=1 km2." Where is the square?

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