**Hydrology and
Earth System
Sciences
Discussions**

Interactive comment on "Surface soil moisture estimates from AMSR-E observations over an arid area, Northwest China" *by* L. Wang et al.

Anonymous Referee #2

Received and published: 14 April 2009

General comments

Access to soil moisture, particularly over a semi-arid area, is a crucial issue. Soil moisture influence on surface-atmosphere exchanges is important. However, providing soil moisture information, both in term of temporal variation as well as in term of absolute values, is still an issue. This study contributes to advance of research in remote sensing of soil moisture. However, the methodology needs to be rewritten and clarified. I recommend this paper to be published after major revisions indicated below are taken into account.

The methodology chosen to retrieve soil moisture is based on radiative transfer theory,

which requires knowledge of several parameters. Because of the difficulty to access some information, some assumptions are made, as in most similar studies. Influence of atmospheric moisture and multiple scattering in the vegetation are neglected, together with vegetation and soil temperature, which are considered as equal.
Surface roughness is commonly neglected and considered zero or constant due to the large scale of remote sensing observations. This study shows an important attempt to define the parameters of surface roughness. However, section 3, which introduces theoretical background and methodology, is relatively confused and needs to be rewritten (cf. comments about section 3).

To validate results, the authors are confronted to the classic problem of comparing remote sensing and ground data, which are registered at different spatial scale and depth. However, these differences do not explain the over-estimation of estimated soil moisture.
The authors conclude than the strong agreement between soil moisture variations with rainy events and ground soil moisture clearly demonstrates performance of the model. However, it has already been shown that the brightness temperature from AMSR-E contains this information on rainy event, particularly over area without vegetation.
Results about absolutes values of retreived soil moisture need to be more investigated. The low amplitude of variation of soil moisture from model and its over-estimation of low ground soil moisture values are characteristics of some soil moisture products currently available.

Specific comments

Section 3 Theoretical background and methodology
- Adding subsections in the 6 pages of this section could facilitate understanding.
- p.1063-l.7: k is the wave number, while in the Fig.2.a, k is the soil dielectric constant.

Please use consistent terms through the manuscript.

- p.1063-l.18: "In this study, we use a numerical solution for the vegetation optical depth rather than use ancillary data or other surrogates (e.g. NDVI, LAI, and MPDI).". I think MPDI must be removed from this list because it is an element of a (eq. 8).

- p.1064-l.16: The equation of MPDI is defined here. The MPDI is cited some times before in the manuscript. Elimination of temperature effects is already addressed in the section 1.3 (p.1058).

- Eq 12 (p.1064-l.19) allows the authors to define $t+2h$. A good knowledge of t is essential. A specific subsection would bring all relevant points together and it would clarify the manuscript.

- p.1062-l.13: t is introduced for the first time with the most widely-used equation and then used with a different equation. Please make it clear. Consider merging the literature review and your own solution.

- p.1066-l.22: The methodology to distinguish between vegetation and bare soil is based on Wang et al. 2006, in Chinese language. Information about this methodology and validation should be given, and a land cover map should be shown.

- The methodology to distinguish between t and $2h$ is not well explained.

- p.1067-l.15: The empirical value of $h = 0.6$ over mountain area must be explained, particularly because it is not the maximal value observed over the study area.

Section 4 Algorithm implementation, results and validation

Section 4.1 Implementation
This section contains information, which must to be introduced before:

- p.1068-l.8: "...the dielectric mixing model developed by Hallikainen et al. (1985) was used..." should be in the last paragraph of section 2 (p.1061-l.13).

- p.1068-l.8: "The soil texture classification of the surface soil on a 1-km grid for this study area was used here (Webb et al., 1991)." should be in the data description

section. Furthermore, this paragraph is more associated to methodology than results.

Section 4.2 Results

Section 4.2.1 Mean annual soil moisture patterns
- p.1068-l.16: "These patterns are similar to each to other.". I think the mean annual soil moisture obtained is variable from one year to another. The year on top right is particularly different with an over-estimation of soil moisture in desert area. The last three years (bottom) do not show particularly high values over the transition zones. Can you add a comment about this specific aspects ?

Section 4.2.2 Annual maximum soil moisture pattern
- p.1069-l.5: How do you explain the very low soil moisture values between the Taklimakan Desert and Kunlun Mountain ? It is very strange to see here some "dry" pixels while both sides are really wet. I think this area is particularly rugged, and empirical value of 0.6 for h parameter may not be right.

Section 4.3 Validation
- p.1070-l.4: The two soil moisture stations used for validation are described as "reprehensive". Can you add a short comment about stations choice ? Furthermore, I think that must be introduced in section 2.

Section 4.3.1 Temporal variability of estimated soil moisture
- p.1070-l.11: The meteorological stations network is introduced in section 2. I think it is more appropriate to move the six representative stations used for the validation in the data description section. Criteria used to select stations must be explained. Furthermore, I am not sure geographical coordinates are right for Tazhong station.

Section 5 Conclusion and discussions

- p.1072-l.24: "One was vegetation optical depth which was calibrated using an excellent numerical solution which made it possible to separate the effects of surface roughness and vegetation, especially over bare soil regions." I think this sentence needs to be rewritten (Fortunately, vegetation effect can be separated from roughness effect over bare soil).

Figures

Fig. 1

On the first figure, study area, network of meteorological stations are drawn. Could you highlight the selected meteorological stations and add soil moisture stations on the map ?

Fig. 5

Could you add the year over each figure or specify the order in caption ?

Fig. 8

This figure is not referenced inside the manuscript.

References

- Reference "Owe, M., de Jeu, R., and Holmes, T.: Multi-Sensor Historical Climatology of Satellite-Derived Global Land Surface Moisture, J. Geophys. Res., 113, F01002, doi:10.1029/2007JF000769,2008." is cited as "Owe et al., 2007".

Spelling errors

Although not a native english speaker, I suspect there are several spelling and grammar problems. For instance, I am not sure the following terms are correctly used or spelled:
- p.1056-l.17: "reprehensive" ?
- p.1060-l.29: "metrological"
- p.1061-l.6: "AMSE"
- p.1061-l. 8: "m, The"
- p.1063-l.9: ", /."
- p.1065-l.2: "temperature" ?
- p.1070-l. 4: "reprehensive" ?
- p.1070-l. 27: "soli"
- p.1072-l. 15: "responsed"
- p.1084-Fig.7: "responsed"