

Interactive comment on “Expansion of global drylands under a warming climate” by S. Feng and Q. Fu

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Response to the comments on manuscript acpd-13-14637-2013

We would like to thank both reviewers for their comments and suggestions on our paper entitled "Expansion of Global Drylands under a Warming Climate", which are very helpful to improve the presentation of our paper. We have addressed the issues that both reviewers raised, and considered their valuable suggestions and comments in the revisions. The following are our point-by-point responses.

Reviewer #1

General:

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Global drylands encompassing hyper-arid, arid, semiarid, and dry subhumid areas cover about 41% of the earth's terrestrial surface and are home to more than a third of the world's population. This study found that global drylands have expanded in last sixty years and will continue to expand in the 21st century. By the end of this century, the world's drylands under a high greenhouse gas emission scenario are projected to be 5.8×10^6 km² (or 10 %) larger than in the 1961–1990 climatology. The global dryland expansions will increase the population affected by water scarcity and land degradations.

In general, I found the paper very well written and appropriate for ACP audience. I recommend accepted this paper for publication in ACP with addressing those comments listed below:

1. Page 14640, line 3 to 5: It will be much better if authors can provide more detail explanation about meaning of the sentence: " This algorithm is physically based and is superior to other PET formulations (Donohue et al., 2010; Dai, 2011; Sheffield et al., 2012)."

Response: The Penman-Monteith (PM) algorithm is derived based on physical principles and considers the effects of temperature, humidity, solar radiation and wind on the PET. It is therefore superior to other PET algorithms that are empirically-based and only consider the effect of temperature. The PM algorithm was recommended by FAO as the standard method to compute the PET (Allen et al., 1998). This sentence was revised accordingly.

2. Page 14640, Line 6: Author should give the reason why they use two dataset and adjust UD as the CPC data?

Response: We used two datasets to make sure that the temporal variations of drylands are robust and do not depend on the datasets used. The climatology from the two datasets is slightly different because of different number of observations and different spatial interpolation methods were used (New et al., 2000). We adjusted the datasets

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with the same climatology in order to focus on the temporal variations and long-term trends. We adjusted the UD dataset simply because CPC is updated in near real time while the UD doesn't. Several sentences were added to clarify these points.

3. Page 14647 line 4 to Page 14649 line 3: Authors need to provide some discussions about Asia dryland, especially Asia semi-arid regions.

Response: The projected changes in Asian drylands are weak comparing to other regions (Fig.5). The PET and precipitation are both projected to increase in this region, leading to weak changes in P/PET (Fig.7). We added a few sentences to discuss the changes in Asian drylands in the revision.

4. Page 14649, line 24: I suggest that authors change section 4 to "Summary and Discussions".

Response: The title of section 4 was changed to "Discussions and Summary".

5. Page 14649, line 4-24: I suggest that authors move those sentences to section 4: Summary and Discussions.

Response: Good suggestions. The manuscript was revised accordingly.

6. ACP published a paper about the dust effect on Asia semi-arid climate (Huang, J., P. Minnis, Yan, H., Yi, Y., Chen, B., Zhang, L., and J. K. Ayers, 2010: Dust aerosol effect on semi-arid climate over Northwest China detected from A-Train satellite measurements, *Atmos. Chem. Phys.*, 10, 6863-6872.). Please reference this paper to increase reader understanding of the Asia aridity.

Response: Thanks for bringing this article to our attention. The dust effect on the climate in Asia and other continents will likely become more evident in the future when drylands are expanding. We cited this article and briefly discussed the possible interactions between expanding drylands and dust effect in the revision.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 13, 14637, 2013.

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