# Response to Short Comment from Scientific Community #1

*This manuscript revealed the differences of land-atmosphere interactions in four typical land cover types (Urban surface, Suburban surface, Grassland surface and Cropland surface). It is well organized and written. I suggest this manuscript for publication in Atmospheric Chemistry and Physics after some minor revisions and corrections.*

**Response:** We would like to thank the referee for providing the insightful comments, which indeed help us reconsider and further explore the underlying problems when we analyze the difference of land-atmosphere interaction at different surface types in the mid-to-lower Yangtze River valley. In the revised manuscript, we have added more clear descriptions on the physical characteristics of climate elements and surface parameter, as well as the discussion of mechanism.

*General comments:*

• *DX-Urban and XL-Suburb terms in the manuscript are suggested to replace corresponding DX and XL terms, and then land cover type will be distinguished more easily like LS-crop and LS-grass terms.*

**Response:** Accepted. These replacements help the readers more easily to understand.

• *Nighttime surface/air temperature differences are mainly emphasized in the manuscript, but day time surface/air temperature differences are rarely discussed. From Figure 3, we can see that daytime urban site surface/air temperature is lower than suburb site or grass site, it is just the opposite of the existing results based on remote sensing LST data and meteorological station data, extra explanations or discussions about the contrary daytime surface/air temperature results are needed in this paper. Following existing publications are recommended for reference:*

*Liu, S., Jiang, R., Wang C. Wang Y.: Observation analysis on spatial and temporal distribution characteristics of summer urban heat island in Nanjing (in Chinese), Trans Atmos Sci, 37(1): 19-27, 2014*

*Zeng, Y., Qiu, X. F., Gu, L. H., He, Y. J., Wang, K. F.: The urban heat island in Nanjing, Quaternary International, 208(1), 38-43, 2009.*

*Zhou, D., Zhao, S., Liu, S., Zhang, L., Zhu, C.: Surface urban heat island in China's*

*32 major cities: Spatial patterns and drivers, Remote Sensing of Environment, 152, 51-61, 2014.*

**Response:** Firstly, as the first paper mentioned, UHI is evident in the nighttime but not typical in the daytime. Secondly, when discussing the intensity of UHI, we must take the climate background into consideration. As shown in the figure below, summer in 2013 is an extremely drought period in southern China, the precipitation decreased by more than 78% of the average amount, breaking the historical record over the past 50 years (Yuan et al., 2016), especially in the mid-to-lower reaches of Yangtze River (Hou et al, 2014; Zhao et al., 2015). We therefore have an assumption to explain the "contradictory" phenomenon mentioned above. In the urban area and cropland, human watering and irrigation or other activities alleviate the natural drought effect in these areas. But in the grassland and suburb area, lacking water limited evaporation cooling to a large extent. So the extreme drought induced higher temperature in the natural vegetation cover in 2013 than before but didn't have large influence in the area with intense human activities, and therefore not only weakened UHI but also made daytime urban site surface/air temperature lower than suburb site or grass site.

Reference

Hou W, Chen Y, Li Y, et al. Climatic characteristics over China in 2013 [J]. *Meteorological Monthly*, 2014, 40(4):482-493 (in Chinese).

Yuan W, Cai W, Yang C, et al. Severe summer heatwave and drought strongly reduced carbon uptake in Southern China [J]. *Scientific Reports*, 2016, 6(25):87–90.

Zhao J, Yang J, Gong Z, et al. Analysis of and Discussion about Dynamic-Statistical Climate Prediction for Summer Rainfall of 2013 in China[J]. *Advances in Meteorological Science & Technology*, 2015 (in Chinese).

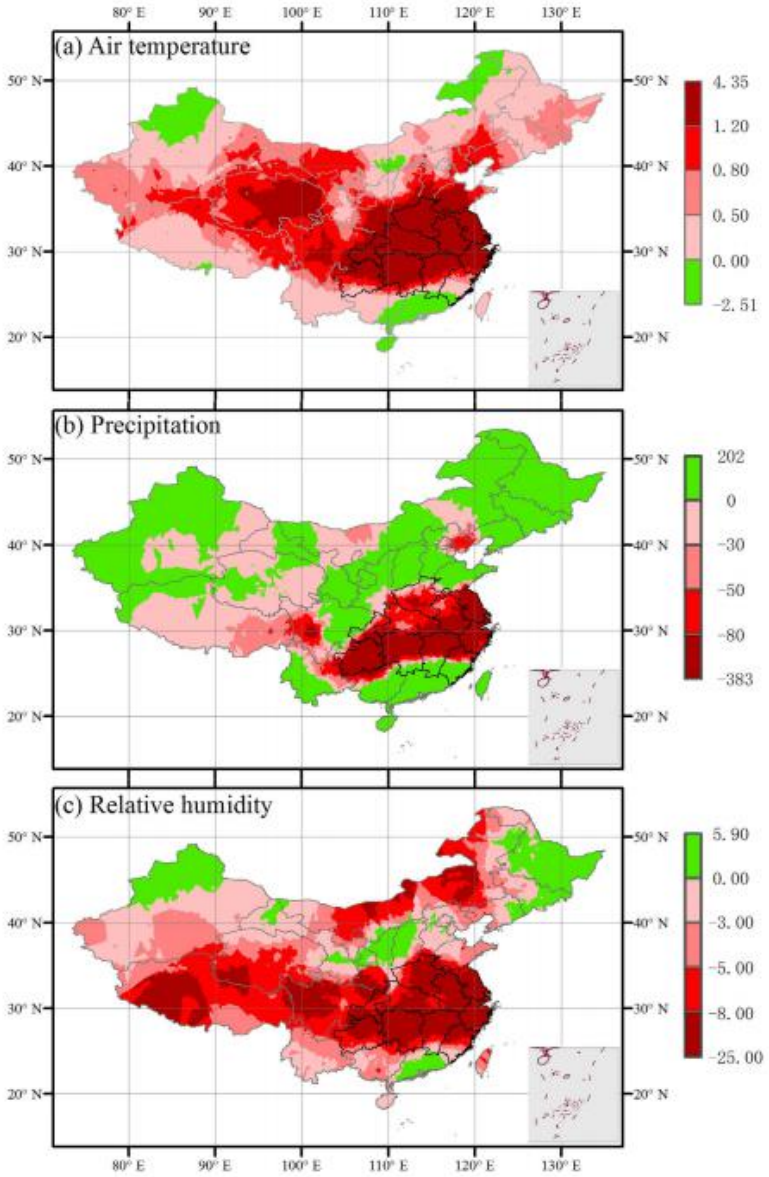


Figure 1. Regional anomalies of air temperature (°C) (a), precipitation (mm) (b) and relative humidity (%) (c) during July-August 2013. All data compare 2013 and the average of 1960 – 2012. The provinces with bold black boundary lines are the study area in this study. The right-bottom figures show the boundary of South China Sea. The maps were created by the ArcMap 9.3. (Yuan et al., 2016)

• *Similar descriptions or explanations such as "albedo decrease with the growing of vegetation" are mentioned in the manuscript many times, for example: Page15, line23, line9-10 and line12-14, etc. It is not appropriate for this paper in my opinion. Firstly, it can be seen that albedo increase with growing of the paddy rice from Figure 11, and this fact is mentioned in Page15, line5-7. Secondly, relations between albedo and vegetation fraction is not fixed, albedo may increase with the growing of*

*vegetation according to existed studies. Therefore, descriptions or explanations such as "albedo decrease with the growing of vegetation" should be used with caution in order to avoid misleading the readers. Please refer the following papers:*

*Gao, F.: MODIS bidirectional reflectance distribution function and albedo Climate ModelingGridproductsandthevariabilityofalbedoformajorglobalvegetationtypes. Journal of Geophysical Research, 110, D01104, 2005.*

*Rechid, D., Raddatz, T.J., Jacob, D.: Parameterization of snow-free land surface albedo as a function of vegetation phenology based on MODIS data and applied in climate modelling. Theoretical and Applied Climatology, 95, 245-255, 2009.*

*Wang, K., Liang, S., Schaaf, C. L., Strahler, A. H.: Evaluation of Moderate Resolution Imaging Spectroradiometer land surface visible and shortwave albedo products at FLUXNET sites. Journal of Geophysical Research, 115, D17107, 2010.*

**Response:** Thanks. The words *"albedo decrease with the growing of vegetation" and "albedo always decreases with the increase of vegetation cover fraction"* is easy to mislead the readers. We have rewritten it as " Fig. 12 shows that except for XL-suburb site, the albedo at the other three sites decrease from spring to summer. At the XL-suburb site with sparse and low grass, possibly because of insufficient precipitation after mid-July, the summer albedo increases and becomes slightly larger than that in the spring. But at grassland, the albedo decreases largely in the green-up phrase, which results in the lower albedo in summer. And the dramatic decrease of surface albedo in early June is associated with the biomass burning due to the cultivation system in this region, i.e., a rotation of wheat in winter and rice in summer." in part of 3.3.1.

*Specific comments:*

• *Page11, line19: USR should be DLR, USR is affected by albedo, not clouds and aerosols in the atmosphere.*

**Response:** It has been corrected in P11, line 26.

• *Page12, line15-18: It is hard to understand USR at the LS-crop site is smaller in the summer than in the spring as a result of albedo increase(line17-18), I think it is a mistake. The phenomenon that albedo at the LS-crop site in summer is smaller than that in spring can be seen clearly in Figure 12. The sentence "where surface albedo increases in the summer due to the decreased vegetation cover fraction" is also hard to understand, because vegetation cover fraction is supposed to increase with the paddy rice growing in summer, please explain this sentence more.*

**Response:** We corrected it in the part of 3.2.1. Yes, it is easy to misunderstand the sentence that "*the maximum daily average USR at the LS-crop site is smaller in the summer than in the spring by 16.98 Wm-2 , where surface albedo increases in the*

*summer due to the decreased vegetation cover fraction ”* . Consider the seasonal variation, the decrease of albedo (Figure 12a) result in the decrease of USR (Figure 6c) at crop site from spring to summer. When it comes to the daily variation, albedo increases from June to August in P12, line 20-26.

• *Page12, line18-19: The meaning of the sentence “As a result, the USR decreases by 90.35，84.79，59.49 W m-2 at the LS-crop, XL, and DX sites respectively. ” is apparently not corresponding to the Figure 6c, and LS-crop should be LS-grass because LS-crop is analyzed before. At LS-grass, XL and DX sites, USR all increases? Please confirm it.*

**Response:** Corrected. We have rewrote this sentence as “USR at XL-suburb, LS-grass and DX-urban grows to 90.35、84.79、59.49 W $m^{-2}$ respectively in the summer.” in P12, line 19-20 in our revised manuscript.

• *Page16, line19-22: roughness lengths are not right according to Figure 13 and Figure 14, please change “0.05m, 0.02m,and 0.17m ” to “0.02m, 0.05m,and 0.17m ”.*

**Response:** Accepted. It has been changed.