

Reply to Referee #2

We appreciate the constructive comments and suggestions from Referee #2. We have addressed all the comments in our revised manuscript. The point-by-point responses to the review comments are provided below.

General Comments

1: It would be nice to discuss the interpolation technique in more detail, as this is a crucial part of your study. Looking at Fig. 1, there seems to be some inconsistency as some individual stations show positive trends, whereas all neighbouring stations show strong negative trends (especially in the NW regions and along the border between HUI and CJ). Does the interpolation technique account for altitude differences between the stations (which is of great importance, especially for wind speed)?

Reply: Thanks for the insightful comments. We interpolated wind speed using the Synographic Mapping System (SYMAP) method (Shepard 1984) as implemented by Maurer et al. (2002). The interpolation technique does not account for altitude differences between the stations. The method is not an ideal method for wind speed interpolation (see Luo et al. 2008). There are only a few stations at high altitude. The method we used would likely underestimate larger wind speed values in upland areas. We believe geostatistical techniques such as cokriging would improve the performance of the interpolation, but these are beyond the scope of the present paper. We have added a brief discussion on the wind speed interpolation and its potential influence to our results in the revision.

We have noticed the possible inconsistency shown in Figure 1. The odd pattern actually matches the previous studies (e.g. Xu et al. 2006 and Guo et al. 2011) which showed also some stations with distinct trend to all neighboring stations. The possible reason is that the wind speed change reflects local changes, for example, forestation or urbanization around the station. It is difficult to clarify and remove these local effects without detailed knowledge of the surrounding environment at the stations. Also, the number of the suspected stations is small and it looks those stations have only minor effect on the pattern of wind speed change. Thus we decide to use the observations at all the stations, including those with suspicion. We have noted the possible local effects and added a brief discussion in the revision.

Guo, H., Xu, M. and Hu, Q.: Changes in near-surface wind speed in China: 1969–2005, *Int. J. Climatol.*, 31, 349–358, 2011.

Luo, W., Taylor, M. C., and Parker, S. R.: A comparison of spatial interpolation methods to estimate continuous wind speed surfaces using irregularly distributed data from England and Wales, *Int. J. Climatol.*, 28, 947–959, 10.1002/joc.1583, 2008.

Maurer, E. P., Wood, A. W., Adam, J. C., Lettenmaier, D. P., and Nijssen, B.: A Long-Term Hydrologically Based Dataset of Land Surface Fluxes and States for the Conterminous United States, *J. Climate*, 15, 3237–3251, 10.1175/1520-0442(2002)015<3237:ALHBD>2.0.CO;2, 2002.

Shepard, D.S. Computer mapping: the SYMAP interpolation algorithm. In: *Spatial Statistics and Models*, Gaile, G.L. and Willmott, C.J., eds. Dordrecht, Netherlands: D. Reidel Publishing Company, 1984, pp. 133–145.

Xu, M., Chang, C.-P., Fu, C., Qi, Y., Robock, A., Robinson, D., and Zhang, H.-m.: Steady decline of east Asian monsoon winds, 1969–2000: Evidence from direct ground measurements of wind speed, *J. Geophys. Res.*, 111,

D24111, 2006.

2: Related to point 1, there are some references missing in the references list, in particular those of the interpolation algorithm (Shepard et al., 1984 and Maurer et al., 2006). Please double-check all the references.

Reply: Thanks for the suggestion. We have checked the references carefully and corrected the errors. Maurer et al. (2006) should be Maurer et al. (2002).

Maurer, E. P., Wood, A. W., Adam, J. C., Lettenmaier, D. P., and Nijssen, B.: A Long-Term Hydrologically Based Dataset of Land Surface Fluxes and States for the Conterminous United States, *J. Climate*, 15, 3237-3251, 10.1175/1520-0442(2002)015<3237:ALTHBD>2.0.CO;2, 2002.

Shepard, D.S. Computer mapping: the SYMAP interpolation algorithm. In: *Spatial Statistics and Models*, Gaile, G.L. and Willmott, C.J., eds. Dordrecht, Netherlands: D. Reidel Publishing Company, 1984, pp. 133-145.

3: The topic of atmospheric stilling has gained a lot of attention in recent years. Maybe you could add a more comprehensive introduction to this topic, including also other studies and not just those dealing with impacts on pan-evaporation.

Reply: Thanks for the suggestion. McVicar et al. (2012) has provided a nice review on the implications of wind speed for evaporation including pan-evaporation. We have further included other studies on the impacts to actual evaporation, soil moisture and runoff. The references below have been added.

McVicar, T. R., Roderick, M. L., Donohue, R. J., Li, L. T., Van Niel, T. G., Thomas, A., Grieser, J., Jhajharia, D., Himri, Y., Mahowald, N. M., Mescherskaya, A. V., Kruger, A. C., Rehman, S., and Dinpashoh, Y.: Global review and synthesis of trends in observed terrestrial near-surface wind speeds: Implications for evaporation, *J. Hydrol.*, 416–417, 182-205, 2012.

McVicar, T. R., Roderick, M. L., Donohue, R. J., and Van Niel, T. G.: Less bluster ahead? Ecohydrological implications of global trends of terrestrial near-surface wind speeds, *Ecohydrology*, 5, 381-388, 10.1002/eco.1298, 2012.

Tang, Y., Tang, Q., Tian, F., Zhang, Z., and Liu, G.: Responses of natural runoff to recent climatic variations in the Yellow River basin, China, *Hydrol. Earth Syst. Sci.*, 17, 4471-4480, doi:10.5194/hess-17-4471-2013, 2013.

Yang, H., and Yang, D.: Derivation of climate elasticity of runoff to assess the effects of climate change on annual runoff, *Water Resour. Res.*, 47, W07526, 10.1029/2010WR009287, 2011.

Yang, K., Wu, H., Qin, J., Lin, C., Tang, W., and Chen, Y.: Recent climate changes over the Tibetan Plateau and their impacts on energy and water cycle: A review, *Global Planet. Change*, 112, 79-91, <http://dx.doi.org/10.1016/j.gloplacha.2013.12.001>, 2014.

4: Considering the fact, that you just need temperature, precipitation and wind speed as forcing data, potential evaporation and in consequence also evapotranspiration are possibly estimated via crude parameterizations. Please add some information on this.

Reply: We have provided a brief description of the parameterization of evaporation in VIC with citations to the VIC references (Liang et al. 1994; Gao et al. 2010; Tang et al. 2012).

Liang, X., Lettenmaier, D. P., Wood, E. F., and Burges, S. J.: A simple hydrologically based model of land surface water and energy fluxes for general circulation models, *J. Geophys. Res.*, 99, 14415-14428, 10.1029/94jd00483, 1994.

Gao, H., Tang, Q., Shi, X., Zhu, C., Bohn, T. J., Su, F., Sheffield, J., Pan, M., Lettenmaier, D. P., and Wood, E. F.: Water

budget record from Variable Infiltration Capacity (VIC) model, available at: http://www.hydro.washington.edu/SurfaceWaterGroup/Publications/Water_Cycle_MEaSURES_ATBD_VICmodel_submit.doc (last access: 28 August 2013), in: Algorithm Theoretical Basis Document for Terrestrial Water Cycle Data Records, 2010

Tang, Q., Vivoni, E. R., Muñoz-Arriola, F., and Lettenmaier, D. P.: Predictability of Evapotranspiration Patterns Using Remotely Sensed Vegetation Dynamics during the North American Monsoon, *J. Hydrometeorol.*, 13, 103-121, 10.1175/jhm-d-11-032.1, 2012.

5: In general, the paper is well written. Nevertheless, there are some phrasing issues. Maybe, it would be beneficial to get some input from an English native speaker.

Reply: Thanks for the suggestion. We have polished the English writing in the revision.

Specific Comments

P.11294, l.14: 'wind speed decline' instead of 'Wind speed decline'

Reply: Thanks. It has been corrected.

P.11294, l.19: 'except' instead of 'expect'

Reply: Thanks. It has been corrected.

P.11294, l.20-21: You could provide more updated references here, like e.g. 'Sheffield J, Wood E and Roderick M 2012 Little change in global drought over the past 60 years *Nature* 491 435–8'

Reply: Thanks for the suggestion. The references have been updated.

P.11294, l.21-22: What do you mean by 'soil moisture based on land surface models'? Do you mean soil moisture estimates derived from land surface models or something else?

Reply: Thanks for the suggestion. We intended to say 'soil moisture estimates derived from land surface models'. It has been clarified in the revised manuscript.

P11296, l. 9: Confusing phrasing of the sentence: 'Total 756 stations data are used,...'

Reply: Thanks for the comments. The sentence has been revised.

P11306, Fig. 1: Actually, you do not need the box on the lower right. As there are anyway no values for all these small southern Chinese islands, there is no added value in displaying them separately. (Same for Fig. 4). Further, there seem to be some offshore stations (along the coast of PR and HUI, possibly at small islands). Are these stations also considered in the interpolation procedure and how?

Reply: Thanks for the comments and suggestions. We agree that it would not add much value. But if we do not show that part, we can not say it is a complete map of China and we may need to change "in China" to "in a part of China" in the figure caption, paper title and main text. In order to be consistent with the title, we would like to show the complete map. The offshore stations are not considered. We have removed the offshore stations from the map.

P11308, Fig. 3: I don't quite understand, why there is a general increase of variability with time. The time series are almost perfectly linear in the 60s and 70s and highly variable afterwards.

Reply: Thanks for the comments. The wind difference between EXP1 and EXP2 increases with time. It would likely cause the general increase of variability due to the nonlinear hydrological response to wind speed change. The variation in Fig. 3 generally responds to the variation in wind speed (see Fig.2) and the corresponding relationship is mostly obvious after the 70s when the wind difference between EXP1 and EXP2 is large. We have added a brief discussion on this in the revision.

P11308, caption of Fig. 3: I guess there is something missing in front of 'is relative change magnitude.'

Reply: Thanks for the comments. The Δ symbol is missing. It has been corrected in the revision.

P11308, Fig. 3: Maybe you could add a little space between each panel like in Fig. 2. Right now, its rather difficult to distinguish between individual panel plots and their corresponding labels.

Reply: Thanks for the suggestion. We have redrawn the figure.