Replies to the comments by Axel Thomas

We would like to thank Axel Thomas for his interest and for his comments on our manuscript. His main comment addresses the potential effect of changes in wind speeds on evapotranspiration. Two further comments address a statement in the introduction that relates increases in evapotranspiration to global warming, and the use of the term evapotranspiration.

Potential effect of changes in wind speed

There is a vast body of evidence (see in particular the review paper of McVicar et al. (2012, cited) that both radiation and aerodynamic terms are determining potential evapotranspiration (Ep). Depending on region wind may account for the major part of Ep variance. Even though the authors argue with a lack of spatial homogeneity of wind speeds in their study area their averaged wind speeds (Supplement Figure S2b) show quite well the general decrease of wind speeds that has been observed world-wide. The large variability is to be expected in largely mountainous Austria and disregarding this variability does introduce a major error into the analysis. In this respect it is most unfortunate to see that both calculation AND attribution analysis of Penman-Monteith Ep are based on spatially and temporally averaged wind data. Even using averaged wind data as additional variable in the attribution analysis would already show that both radiative and aerodynamic forcing largely explain most of the variance. In the present form – without a realistic inclusion of wind data – the results are misleading. I would propose to recalculate Ep with wind speed data that contains as much spatial and temporal variance as possible. In addition attribution itself is variable both in spatial and temporal terms (Fan and Thomas, https://doi.org/10.1016/j.jhydrol.2018.02.080) so an extended analysis taking into account attribution variability would offer the reader a considerably improved analysis of Ep dynamics.

Response: We have now analyzed the effect of changes in wind speed. In order to estimate the potential effect of changes in wind speed we derived spatially smoothed patterns of average monthly trends in wind speed from station observations. These were applied to spatial patterns of wind speeds derived from high-resolution downscaled reanalysis data. Initial results show that wind speeds have indeed decreased in Austria (by about 2% per decade) but the effect on trends in reference evapotranspiration is small. When allowing for decreasing wind speed, the average trend in reference evapotranspiration is 2.9% per decade, as compared to 3.1% when assuming no trends in wind speed. The low impact of the changes in wind speed on reference evapotranspiration can be explained by the generally humid climate in Austria, where wind speed has a much lower impact on reference evapotranspiration than in an arid climate (Irmak et al., 2006). We have added the analyses to the supplement and we refer to it in the main text.

Statement in the introduction

There are two smaller points I would also like to mention: the authors rightly point out in their paper that temperature is not an important driver of Ep but at the same time begin their introduction with the much-too–often-heard statement that global warming (hence temperature) has increased regional evapotranspiration. Even the IPCC still voices this scientifically incorrect statement. I would propose to rephrase this sentence to clarify that in the context of global CLIMATIC change Ep also has seen changes.

Response: We agree and this has been changed as suggested: “In the context of global climatic changes, regional *E* has increased in many parts of the world in the last decades (Huntington, 2006).”

Use of the term evapotranspiration

Another point to clarify is the sometimes misleading way 'evapotranspiration' is used in this paper. Evapotranspiration is an umbrella term that has many definitions and can be estimated in different ways. In the Introduction most of the papers cited deal with actual evapotranspiration as do the authors when they use the abbreviation 'E' in their data analysis and results. On p 2/l 15 however they appear to mean potential evapotranspiration (at least most of the cited papers deal with Penman-Monteith potential evapotranspiration). On p 3/l 27 it is PET (again perhaps potential evapotranspiration) while reference evapotranspiration (E0, p 6/l 22) is actually crop reference evapotranspiration as the method of Allen et al. 1998 is cited. 'potential evapotranspiration' is used twice in section headlines 2.3 and 2.3.2 but is not defined elsewhere; on p 7/l 23ff 'potential evapotranspiration' and 'reference evapotranspiration' are used almost synonymously. Perhaps the authors might consider adding a short section pointing out the differences between different measures and methods of evapotranspiration cited or used in their paper and then use the appropriate terms consistently throughout their paper.

Response: Thank you very much for pointing this out. Indeed, the different terms for evapotranspiration have not always been used carefully in the manuscript and we have changed this in the revised version. In detail, we have included the following changes:

P2/L15: Here we discuss potential drivers of changes in actual evapotranspiration, changes in available energy and atmospheric evaporative demand being one of them. Since this may be estimated by pan evaporation, the cited papers in this section deal with pan evaporation.

P3/L27: Reference evapotranspiration has been used for this analysis and this has been changed accordingly.

P6/L22: To our knowledge, both terms, reference evapotranspiration and reference crop evapotranspiration, may be used for the method of Allen et al. (1998).

Headlines 2.3 and 2.3.2: potential evaporation has been replaced by reference evapotranspiration.

P7/L23 ff: All uses of potential evaporation have been changed to reference evapotranspiration.

Reference:

Irmak, S., J.O. Payero, D.L. Martin, A. Irmak, and T.A. Howell (2006): Sensitivity analyses and sensitivity coefficients of standardized daily ASCE-Penman-Monteith equation, *Journal of Irrigation and Drainage Engineering*, *132*(6), 564-578.