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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Why has catchment evaporation increased in the past 40 years? A data-based study in Austria" *by* Doris Duethmann and Günter Blöschl

Anonymous Referee #3

Received and published: 7 May 2018

General summary:

In this study, the authors leverage precipitation and streamflow observations to estimate trends in evapotranspiration at over 150 catchments in Austria from 1977 to 2014, and attempt to attribute the trends to numerous potential drivers including: radiation and evaporative demand, vegetation, and water availability. Due to the scarcity of evapotranspiration measurements, detecting and attributing trends in historical evapotranspiration has been difficult. Thus, I think this study is a significant contribution to the current literature, and appreciate the focus on observations. The results suggest that evapotranspiration is generally increasing, and these increases are due to increased

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atmospheric demand and radiation, increased vegetation activity, and increased water availability.

Comments:

[1] The authors clearly acknowledge that drivers of ETwb are tightly interlinked in the discussion. Does the attribution methodology adequately take this into account though? Have you explored the covariance among attributing variables? For example, if increases in P lead to increases in NDVI, are increases in P being overstated in the current attribution?

[2] Section 2.1.3. I am a little confused about the time scale of ETwb data being smoothed and plotted in Fig. 2. Are you estimating <annual ETwb> = <annual P> - <annual Q> and smoothing these annual estimates with the Gaussian filter? If so, could increases in precipitation add to storage and not necessarily ET? Also, are the trends in ETwb consistent with changes in ETwb inferred by actually dividing the time series into larger time intervals where changes in storage can assumed to be much smaller (e.g. <ETwb> estimated from average data 1977 to 1995, and <ETwb> estimated from average data 1996 to 2014)?

[3] Lastly, I agree with the three previous comments that the attribution would benefit from a more thorough discussion of the impacts of wind speed and water availability. I think these suggestions were well elaborated in the previous comments. With regards to wind speed though, it could be useful to perform a sensitivity analysis of ETo to possible wind speed trends (e.g. based on the magnitude of the trend inferred from ERA Interim data) rather than using uniform monthly wind speed.

Minor comments:

[1] Page 2 (L26): In addition to CO2, stomata also respond to changes in atmospheric demand, temperature, and soil moisture.

[2] Page 3 (L27): PET, “Potential evapotranspiration”.

[3] Page 5 (L14): It may be helpful to explain this in more detail: “wind data were regarded as not representative with respect to evaporation trends”, i.e. “not representative” is vague.

[4] Since the phrase “vegetation activity” is used frequently, it might be useful to add a sentence in the 2.3.2 explaining the potential physical mechanisms driving “vegetation activity” (as represented to NDVI), e.g. vegetation fraction, vegetation type, LAI, phenology, etc.

[5] Page 12 (L20): with higher values during the early 1990s, right?

[5] Clarify titles in Figures S7-S8.

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