Manuscript: hessd-10-5739-2013: A worldwide analysis of trends in water-balance evapotranspiration

Major remarks

The authors present an interesting approach to estimate trends in evapotranspiration (ET). The paper is a valuable contribution to the topic of on-going changes in the hydrological cycle. Especially for ET such changes are rather difficult to quantify as ET itself is difficult to evaluate on the large scale. The paper is well structured and written concisely. But there is currently one problem in the methodical approach of defining energy- and water-limited basins, which are designated as wet and dry basins, respectively. These are classified according to their value of basin-averaged the potential evapotranspiration divided by precipitation.

On one hand, precipitation data are used that are not corrected for precipitation undercatch. This is especially important in mountainous areas and areas with snowfall such as the high latitudes. Consequently, this leads to more dry basins than there actually are. This is probably the case for the erroneous classification, e.g., of several high latitude catchments (Mackenzie, Kolyma….) which are located in areas that are usually classified as energy limited (see, e.g., Fig. 1, Teuling et al. 2009). The authors claim (see, e.g., Sect. 2.2) that they use two independent precipitation datasets (both uncorrected). This statement is wrong as they are both derived from gauge measurements that overlap in many areas. Here, it would make much more sense to use one uncorrected dataset and one corrected dataset, such as GPCP data (Adler et al., 2003) or the WATCH forcing data (Weedon et al. 2011).

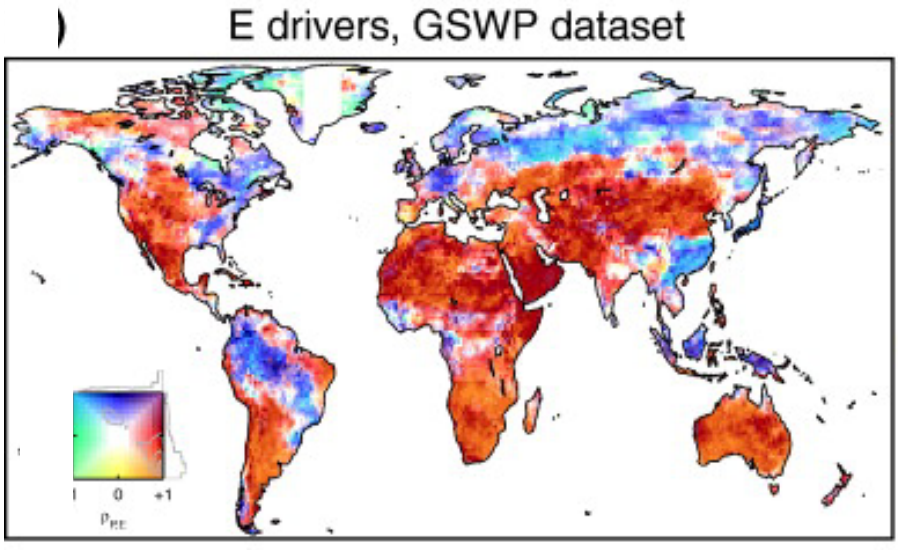

Fig. 1: Driver of evapotranspiration E (**moisture** and **radiation**) from Teuling et al. (2009). Estimation based on land surface model simulations showing yearly correlations of E with global **radiation** and **precipitation**.

Teuling, A. J., et al. (2009), A regional perspective on trends in continental evaporation, Geophys. Res. Lett., 36, L02404, doi:10.1029/2008GL036584.

Adler, R.F., G.J. Huffman, A. Chang, R. Ferraro, P.-P. Xie, J. Janowiak, B. Rudolf, U. Schneider, S. Curtis, D. Bolvin, A. Gruber, J. Susskind, P. Arkin and E. Nelkin (2003) The Version-2 Global Precipitation Climatology Project (GPCP) monthly precipitation analysis (1979-present). *J. Hydrometeorol.* **4**, 1147–1167.

On the other hand, an estimate of potential evapotranspiration is used that only depends on temperature and cloud cover. The choice of this approach should be thoroughly discussed, and it should be justified why the authors don't use a more sophisticated approach such as the Penman-Monteith formula that is often used. Necessary data can be taken from reanalysis or Weedon et al. (2011).

In summary, I suggest accepting the paper for publication after some revisions have been made.

Minor Comments

p. 5748 – line 18
The Mezen river is a rather small catchment and relatively unknown catchment. Please choose either a larger and more known catchment as an example, or indicate the Mezen basin in a map, e.g. in Fig. 1. I suggest indicating all basins specifically considered in the paper (in Fig. 3) in this map.

p. 5748 – line 20-21
These uncertainties could be better dealt with if also corrected precipitation data are used. See major remarks.

p. 5750 – line 2-3, Fig. 4
Are these trends significant? In line 7 you mention that only part of the trends are significant. In my opinion you should only show those trends that are significant. And you should state which measure of statistical significance you are using!

p. 5752 – line 8+
Please discuss also the results of Mercado et al. (2009) in the context of your study. Even though plant photosynthesis tends to increase with irradiance, Mercado et al. (2009) pointed out that recent theoretical and observational studies have demonstrated that photosynthesis is also more efficient under diffuse light conditions. They estimated that variations in diffuse fraction, associated largely with the 'global dimming' period, enhanced the land carbon sink by approximately one-quarter between 1960 and 1999.

Mercado LM, Bellouin N, Sitch S, Boucher O, Huntingford C, Wild M, Cox PM.:
Impact of changes in diffuse radiation on the global land carbon sink. Nature. 2009 Apr 23;458(7241):1014-7. doi: 10.1038/nature07949.

p. 5763/65 - Fig. 2/4
The panel legends are much too small. For Fig. 4, also the panels are too small. Please improve!