Hydrol. Earth Syst. Sci. Discuss., 11, C6099–C6103, 2015
www.hydrol-earth-syst-sci-discuss.net/11/C6099/2015/

Hydrology and Earth System Sciences
Open Access
Discussions

Interactive comment on "Global patterns of annual actual evapotranspiration with land-cover type: knowledge gained from a new observation-based database" *by* S. M. Ambrose and S. M. Sterling

Anonymous Referee #2

Received and published: 15 January 2015

This manuscript aims to analyze the variability of annual mean evapotranspiration ET with respect to land cover (LC) types on a global scale. The authors use a ET dataset which comprises estimates from different methods. This incoherent dataset is then extrapolated with a statistical model using global average meteorological data at a spatial scale of 1° and land cover type data at a smaller resolution of 5 min. Although the authors report max, range, mean and sd of model and observations for each LC, however, no model performance evaluation is shown (model performance such as explained variance, model error, etc) and more important, no cross validation analysis is presented. The model performance is also not compared to other global ET studies

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

such as Jung et al. (2010) or Mueller et al. (2013). Further the model is not compared against the physical constraints of ET: precipitation and evaporative demand (net radiation or potential evaporation).

Nevertheless the authors extrapolate the empirical model for each LC type to the global land. These extrapolations are then being used to qualitatively discuss the sensitivity of ET to land cover change. This is done by simply comparing the extrapolations for the different LC. Here I would wish that the author would be more careful with the conclusions of different sensitivity of ET along different latitudes given the lack of sufficient data for their zonal evaluation and the uncertainties of their model in these regions. So in particular I am wondering why the zonal averages e.g. for grass and grazing LC are so different in the tropics. Reported coefficients seem to be quite similar.

My greatest concern with the approach taken in the manuscript is that spatial scales of observations (ecosystem to watershed), model (5 min) and explanatory variables (1°) are inconsistent. The variability of climate can be large within 1 geographical degree and also land cover can be quite heterogeneous. This problem is especially true for anthropogenic LC. Hence the large variability found for these types may be due to the inappropriate choice of spatial scales.

So given these inconsistencies I am not sure what we can learn from the global extrapolations. I would rather recommend to study the important LC effect at the scale where the observations have been done. Here an evaluation of LC effects on ET (see Williams et al. (2012) for a good example using FLUXNET data) using sophisticated statistical models may be more informative than the attempt to upscale to global ET fields.

Detailed comments

- P12107L22: What is the source of the LC rasters?

HESSD

11, C6099–C6103, 2015

- P12108L2: NCC is not defined
- P12109L20: how is spatial correlation represented in the model?
- P12110L6: which statistical model assumptions have been tested?
- P12110L24: 58% of unaligned LC types of observations and LC raster. How does this influence your results? Please discuss this in the discussion.
- first two paragraphs of section 3.1 are a data set description rather than results. Whereas the last paragraphs does not link to the section heading.
- section on global means for LC: here ET of land cover types are compared without taking climate effects into account. As climate shapes ET in the first place, a comparison of ET between land cover types should be conditional on the respective climate. One way to do that is by binning the data with the aridity index.
- P12112L26 wrong reference to table
- P12113L24-26: comparison to Jung et al. (2010) at Amazon is unclear to me. I can not see this from Fig 5.
- P12114L3-4: I do not fully understand how Fig 5a is being computed. How is natural vegetation defined and what do you mean be overlying with wetlands?
- P12115L17 “more jagged curves” is not a quantitative assessment of variability
- P12117L20-25: unclear
- P12118L5: “powerful” / also in the abstract “robust” global ET patterns. The robustness of these extrapolated patterns has not been assessed. Hence this should not be claimed.
- P12122: reference of Jung et al. (2010) missing

HESSD
11, C6099–C6103, 2015

- P12127: Table 3, here deviations of the estimated coefficients should be reported.
- P12129: Fig.1 increase the scale for SW
- P12131: Fig.3 unit is missing. Why do we see circle shapes? Maps should have a coordinate system plotted.
- P12133: Fig.5 I can not really see much in this figure due to the low resolution of the color scale. Also the subpanels in Fig. 5b do not reveal much information.
- P12134: Fig 6. could you plot the data points as well?
- P12135: Fig.7: unit is missing. Color scale does not reveal much information for must of the globe.

References

Jung, M., Reichstein, M., Ciais, P., Seneviratne, S. I., Sheffield, J., Goulden, M. L., Bonan, G., Cescatti, A., Chen, J., de Jeu, R., Dolman, A. J., Eugster, W., Gerten, D., Gianelle, D., Gobron, N., Heinke, J., Kimball, J., Law, B. E., Montagnani, L., Mu, Q., Mueller, B., Oleson, K., Papale, D., Richardson, A. D., Roupsard, O., Running, S., Tomelleri, E., Viovy, N., Weber, U., Williams, C., Wood, E., Zaehle, S., and Zhang, K.: Recent decline in the global land evapotranspiration trend due to limited moisture supply, Nature, 467, 951–954, doi:10.1038/nature09396, 2010.

Mueller, B., Hirschi, M., Jimenez, C., Ciais, P., Dirmeyer, P. A., Dolman, A. J., Fisher, J. B., Jung, M., Ludwig, F., Maignan, F., Miralles, D., McCabe, M. F., Reichstein, M., Sheffield, J., Wang, K. C., Wood, E. F., Zhang, Y., and Seneviratne, S. I.: Benchmark products for land evapotranspiration: LandFlux-EVAL multi-dataset synthesis, Hydrology and Earth System Sciences Discussions, 10, 769–805, doi:10.5194/hessd-10-769-2013, 2013.

HESSD

11, C6099–C6103, 2015

Williams, C. A., Reichstein, M., Buchmann, N., Baldocchi, D., Beer, C., Schwalm, C., Wohlfahrt, G., Hasler, N., Bernhofer, C., Foken, T., Papale, D., Schymanski, S., and Schaefer, K.: Climate and vegetation controls on the surface water balance: Synthesis of evapotranspiration measured across a global network of flux towers, Water Resources Research, 48, n/a–n/a, doi:10.1029/2011WR011586, 2012.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 12103, 2014.