**Hydrology and
Earth System
Sciences
Discussions**

Interactive comment on "Derivation of RCM-driven potential evapotranspiration for hydrological climate change impact analysis in Great Britain: a comparison of methods and associated uncertainty in future projections" *by* C. Prudhomme and J. Williamson

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This is a clear and concise paper that evaluates the suitability of a range of PET methods for use in hydrological impact assessment in the UK. The authors use PET estimated by the MORECS method as their reference series - the method currently employed to derive observed estimates of PET in the UK. The paper looks at a range of methods categorised as either temperature based, radiation based or combined

methods. Methods and results are clearly described and details on the derivation of variables and parameters are provided in supplement document. This comparison of methodologies (a sensitivity study of sorts) is valuable to practitioners in the hydrological community, as it provides a clear comparison of skill by commonly used PET estimation methods in the hydrological field. Bar one comment I have little to add that would improve the submitted manuscript (see very minor comments below). My only 'concern', with the manuscript is the quite brief description of how the future time series were created. As far as I understand, the HadRM3-Q0 is used as the baseline time series and time series representative of a future climate are generated using change factors derived from the probabilistic climate projections provided by the UKCP09. I wonder if some more detail could be provided here as many readers won't be familiar with the output format of UKCP09. For example, the manuscript states that a probabilistic ensemble of monthly CF are used (and the probabilistic ensemble is based on 10 000 members), how is this uncertainty represented in the future projections of PET – or was the ensemble mean/median chosen to represent the future time slice? Further, whilst it would be optimal to use the combined method, it will only work well if the input variables are well simulated by the models used to generate the UKCP09 ensemble – was this assessed? Admittedly, using the CF method probably smoothens some of the potential model biases that could occur compared to if 'raw' RCM runs had been used. Nevertheless, I think it would be beneficial for the manuscript if the authors said something about the characteristics of the downscaling method (i.e. the CF method as applied here) in terms of what aspects of climate change that is likely to be captured (e.g. probably changes to the mean rather than changes to the variability) and also something about how well the variables used to estimate PET are simulated (although this may be outside the scope of this paper) – as a background note: in "Ekstrom et al 2007. Regional climate model data used …... estimation of PET. HESS (11)3, 1069-1083" the HadRM3H was used to estimate PET for a European domain. Whilst the authors initially set out to use the FAO PET, a couple of different empirical methods were later employed as the FAO gave poor results due to an enhanced hydro-

logical cycle in the HadRM3H. Presumably some of the problems with the HadRM3H were improved in later versions and it is likely that bias correction of temp could have improved the results ... anyway, just a note as the authors are using outputs from the same model albeit a younger generation (and I guess, in a different format).

Minor observations:

1. Last sentence of Abstract and in last sentence of Discussions and conclusions. Whilst PET is a challenge for the hydrological community, perhaps the largest challenge yet lies in generating locally realistic rainfall (particularly for water limited catchments, very few regions (if any) has resources such as UKCP09 to draw upon).

2. Page 606, line 14. Insert space between SRES and A1B

3. Page 611, sentence starting on line 14. This reads a little bit funny. I assume the methods that give extreme results are less trustworthy because of the understanding of how these extremes were generated, rather than them giving extremes per se.

4. Figures – all. These are tiny. Can't read labels or make out results (probably isn't helped by the 'print friendly version' of the doc printing two figures on one portrait sized doc.

5. In the supplementary doc. A track change is left in the last row on the last page (net radiation term).