Hydrology and Earth System Sciences Discussions

Interactive comment on "Köppen versus the computer: an objective comparison between the Köppen-Geiger climate classification and a multivariate regression tree" *by* A. J. Cannon

Anonymous Referee #2

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The author applies multivariate regression tree (MRT) analysis to the Köppen-Geiger climate classification variables to automatically delineate an alternate climate classification. The resultant classification is compared against Köppen-Geiger and stated to perform better than Köppen-Geiger. Generally the manuscript is well written, but requires major revision relating to the comparison with Köppen-Geiger, explanation of the analysis methodology and the overall conclusions prior to publication.

My key concern is that the aims of the two classification systems (MRT and Köppen) are different and therefore comparisons between the two are not always meaningful.

Wilcock (1968) discusses the aims of Köppen in producing his climate classification, which, roughly paraphrased, are to provide a simple/brief arrangement of climatic information to aid understanding of climate and its impact on nature (including vegetation distribution) and humanity. To this end Köppen did not optimise a metric to achieve his classification. Furthermore, he sometimes adopted rules based on natural thresholds (eg: relationships between vegetation transitions and temperature) within his classification. Thus the aims of Köppen are not translatable into numeric form to be optimised. Whereas the MRT analysis presented here is fundamentally different in aim and methodology. MRT requires a metric to optimise, in this case the difference between observed and classified mean monthly precipitation and temperature (EV, equation 4) is adopted. This choice of metric defines the aim of the MRT classification and is critical to the output of the MRT process. In MRT the optimisation process determines the classification rules, whereas in Köppen the rules, often based on nature, defined the classification.

Thus the aims of Köppen and the MRT analysis presented here are fundamentally different, which needs to be kept in mind when comparisons between the two classifications are made and discussed. The assessment of the two classifications presented in Section 5, and conclusions based on that section, rely on metrics pertaining to the MRT analysis (eg: EV). Not surprisingly MRT performs better than Köppen using these criteria. Does this mean the MRT classification outperforms Köppen? In terms of EV, which measures the difference between observed and classified mean monthly precipitation and temperature, MRT outperforms Köppen, but Köppen was not designed solely to maximise this metric (as MRT is). From my reading of the results I could argue that in terms of EV, Köppen performs remarkable well considering it was not designed to maximise EV. In the revised version of the manuscript the author needs to clearly state that the aims and methodologies of the MRT analysis and Köppen are different and keep these differences in mind when revising the discussion and conclusions of any comparisons between the two methods.

The differences in aim and methodology discussed above also raises questions about the appropriateness of the manuscript title. I recommend the title be changed to emphasise the contribution of a climate classification for mean monthly precipitation and temperature using a multivariate regression tree. "Köppen versus the computer", although appealing, is not meaningful and should be removed. Likewise the term "objective" is inappropriate in the title.

An alternative MRT analysis the author might consider is whether a set of predictors other than those used by Köppen can produce a better performing classification than the MRT classification presented here.

Another concern is the explanation of the MRT data preparation process in Section 4. It is not clear why the Köppen-Geiger variables need to be rounded for simplicity or consistency. Also the process of preparing the predictands for analysis is not well explained. Why do the grid values need to be area corrected when they are in units of millimetres and Celsius (no volumes, so area is irrelevant)? Is the predictand rescaling to mean = 0 and standard deviation = 1 applied to each grid cell or across the entire globe? Not all readers are familiar with MRT, so more detail needs to be given regarding how and why data are prepared prior to analysis.

Specific Comments

Page 2348, line 26: "MRT algorithm; (ii) to" should be "MRT algorithm; and (ii) to"

Not at all clear how the 95% confidence intervals in Figures 7 & 8 are calculated.

Not at all clear how the predicted centroids for Köppen or MRT in Figure 9 are calculated.

References

Wilcock AA (1968) Köppen after fifty years. Ann. Assoc. Am. Geog., 58(1), 12-28.