Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-564-RC2, 2020

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Climate change and snow cover trends in Iceland" *by* Darri Eythorsson et al.

Anonymous Referee #2

Received and published: 20 January 2020

This paper quantifies how two aspects of climate are (expected to be) changing in Iceland during period 1950-2100. The aspects climate aspects considered are (i) Köppen-Geiger class, and (ii) Snow Cover Frequency. Data and models underlying the reported changes are of + NASA10 NEX downscaled CMIP5 projections for RCP 4.5, and Snow Cover Frequency was derived from MODIS10A1 This article comes with several challenges that make it difficult for me to support publication:

1) Changes in Köppen classes have been quantified globally (e.g. Beck, H. E., Zimmermann, N. E., McVicar, T. R., Vergopolan, N., Berg, A., & Wood, E. F. (2018). Present and future Köppen-Geiger climate classification maps at 1-km resolution. Scientific data, 5, 180214.). The first problem seems that such studies are not acknowledged. A second problem seems that it remains unclear to me what the novel contribution is

of again quantifying similar changes (though with slightly different data and time windows).

2) What can we learn from reporting changes in Köppen classes? While Köppen serves as a standard climate reference in textbooks and research articles, it remains unclear (to me) what meaning we can derive from reported changes in these classes. These classes have been established based on a rather archaic system ("Modern textbooks continue to use the 100âĂŘyear old Köppen classification of climates (Köppen, 1936), which is based on de Candolle's vegetation groups, themselves based on the five climatic zones of the ancient Greeks" see Sanderson M. 1999. The classification of climates from Pythagoras to Koeppen. Bull. Am. Meteorol. Soc. 80(4): 669– 673.). If a climate shifts from one class to another, it only says some (rather arbitrarily set) threshold is passed (for example, take any rule in your "Appendix 1. Köppen-Geiger climate classification criteria"). I don't think it per se implies that actual greater changes occur compared to a place where the Köppen class does not change. One way to show the significance of Koppen classes is to show that distinct Köppen classes have very distinct ecosystems within Iceland. If a transition from one class to the next comes with a clear transition in ecosystem it (to some extent) supports the use of Köppen to characterize change. If it doesn't, I am unsure how to physically interpret all these results or how they really answer the main questions of the paper "Has the Icelandic climate been undergoing recent change, [. . .and. . .] what changes can be expected to these regimes in the future?"

3) The presented snow trends are relevant, but I am unsure it is of a scope/depth (both in terms of length of time series and depth of analysis) that HESS would be a suitable place for publishing this work. For example, can the analysis be enriched by discussing (or even better: showing) why these trends are seen?

4) Picking trend analyses such that the most significant p-value is identified seems like an unfair (or biased) statistical test ("Code was written in python that tests the hypothesis for all possible splits in the historical time series and returns the split with

the lowest p-value"). How is this choice justified?

5) I am unsure what the "verification" in section 3.2 really verifies. At present, it shows the results for three locations, but it does not quantitatively "verifies" anything that helps to support the overall analyses (it seems?).

6) Please check the paper for typos. For example "observeddecreasing" is part of the abstract. Please also check your figuring numbering; it seems a little illogical and inconsistent with what is expected for HESS.

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