

Interactive comment on “On the meaning of independence in climate science” by J. Annan and J. Hargreaves

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This is an interesting manuscript which highlights the lack of an agreed-on definition of “independence” in climate science. As stated by the authors, independence has a statistical definition which is encouraged to be used more often. Two examples are given where this statistical framework is applied. I have a few comments and suggestions.

Section 2.1: I was expecting to read something about the Replicate Earth paradigm that C. Bishop and G. Abramowitz were working on (Climate Dynamics, 2013 and Journal of Climate, 2015). I think their idea of ensemble interpretation would only add to the summary of literature on model independence. It assigns weights to models and transforms the whole ensemble to be more “Replicate Earth”-like, and thus independent.

P8, L27-28: The authors use climatological fields of CMIP3 model runs. How many

C1

years were used for that? Depending on the length it might be that the RMSE values (as shown in Figure 1) are influenced by internal variability.

P10, L12-14: The author’s interpretation of independence is entirely unrelated to model performance. Does that mean that it is not relevant to know where the models lie with respect to the observation(s) in some kind of projected model space? Most publications I have seen on this topic are only able to tell if a specific model is independent if their relative “position” to other models and the observation are known.

P11, L23: I’d suggest to introduce the abbreviation LGM here as this abbreviation is then later used on P12, L3.

Figure 2: There seems to be a mistake in the caption. The authors wrote that 2c) is the “dependent” whereas 2d) is the “independent” case. Shouldn’t it be the other way around? The main text also suggests that those two words should be swapped.

Section 3.3: Couldn’t the correlation between two climate variables come from shared model biases (“model dependence”) rather than physical laws? I guess this is the danger of diagnosing dependence from model outputs directly. The expectation to find an error correlation of 0.5 for perfectly independent models might help gauge the degree to which two climate variables are physically correlated.

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C2