Geosci. Model Dev. Discuss.,
doi:10.5194/gmd-2016-203-RC2, 2016

Geoscientific Model Development Discussions

Interactive comment on "Half a degree Additional warming, Projections, Prognosis and Impacts (HAPPI): Background and Experimental Design" *by* Daniel Mitchell et al.

R. Knutti (Referee)

reto.knutti@env.ethz.ch

Received and published: 28 September 2016

Summary:

This paper describes the setup of a series of AMIP style fixed SST large ensemble simulations with different climate models, in order to inform in particular the changes in extreme weather events for today, for 1.5 and 2°C. The results are targeting the impacts community and should feed into the IPCC special report on the 1.5 and 2°C climate target.

Review:

I welcome the proposed effort to inform the upcoming IPCC special report with this

targeted experiment. This is both timely and relevant and will complement other efforts like ScenarioMIP within CMIP6 that will not happen before the deadlines imposed by the special report. The public availability of the data will ensure that other communities can benefit from that.

I have no major comments on this paper, since it's just a description of an experimental setup that is, in its core, not much different from earlier setups using fixed SSTs. The setup is likely to work fine, whether the results will provide a major step forward remains to be seen. The results might be unsurprising from a climate point of view in that most things appear to scale rather well with global temperature, but that may not apply to impacts or to specific regional questions. In any case it is worth doing this experiment, as it is straightforward yet interesting and valuable for both science any policy. The first reviewer has already made many important points which I support. I only have a few more comments below that the authors should discuss in a revised version.

The statement that the classic emission scenario approach is problematic to infer impacts for certain warming levels (line 51) is assuming that we look at the projections for a specific time period. But one can simply pick the 20yr period in which a particular model reaches 1.5°C or 2°C and aggregate that (as done for example in Fischer and Knutti 2015). That is assuming that the patterns in a transient 1.5°C world are similar to those in a near equilibrium 1.5°C world, but making that assumption is unlikely to introduce large biases, at least compared to the uncertainty of the warming pattern itself (e.g. Herger et al. 2014). This would on the other hand have the advantage of sampling results from the fully coupled model, including different patterns of SST and representations of coupled ocean atmosphere variability, which HAPPI cannot do. Of course it is more expensive in terms of computing and provides less model years, but given over a hundred CMIP5 ensembles it is still informative, and fundamentally I don't see why such an approach would be "very difficult" (line 51). In my view the two are complementary, and I think the current wording could be improved to be more balanced.

I'd like the authors to comment on using a decadal mean SST as a boundary condition vs. time varying fields. Is there a problem of say suppressing El Nino events by fixing the SST at a long term average, and could that have an effect on the frequency of extremes? What if the magnitude or timescale of ENSO changes as a result of warming, how would that affect changes in extremes in the regions that are affected by ENSO teleconnections, and would the proposed setup account for that? It seems like testing different SST patterns will sample some uncertainty but coupled variability would not be addressed by that.

Reto Knutti

–

References:

Fischer, E. M., and R. Knutti. 2015. "Anthropogenic Contribution to Global Occurrence of Heavy-Precipitation and High-Temperature Extremes." Nature Climate Change 5 (April): 1–6. doi:10.1038/nclimate2617.

Herger, Nadja, Benjamin M. Sanderson, and Reto Knutti. 2015. "Improved Pattern Scaling Approaches for the Use in Climate Impact Studies." Geophysical Research Letters 42 (9): 3486–94. doi:10.1002/2015GL063569.

Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2016-203, 2016.