

Interactive comment on “Critical Assessment of Geoengineering Strategies using Response Theory” by Tamás Bódai et al.

Anonymous Referee #2

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I think this paper contains the germ of a good idea. It would be interesting to plot an actual, rather than schematic version of Figure 1, for a large number of interesting observables (beyond global mean temperature and precipitation to include some integral measures of, for example, economic or ecosystem damage). However, the writing is so difficult to read, the emphasis on what turns out to be a not-very-useful linear inverse technique for estimating what solar forcing trajectory would be required to cancel out a given greenhouse gas forcing trajectory is so over-done, and the absence of any figure like figure 1 using actual data, that I don't think it is publishable in this form.

The key problem with the paper as presented is that finding the solar forcing trajectory that would cancel an exponential increase of CO₂ seems to be quite easy in the simplified climate model the authors use: just iterate the value of the solar constant to

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zero out the global mean temperature rise at a large value of CO₂, and then adjust the solar forcing linearly towards that solution over the ramp period. Since numerous perturbation experiments need to be performed to solve the inverse problem, it's not clear what benefit that more mathematically complicated procedure provides. Furthermore, the real problem with geoengineering is that you can't exactly cancel the CO₂-forced climate change at all points using a single means of controlling the solar cycle, and this paper provides no help in achieving that more thorough cancellation, nor in documenting the already well-known difficulty.

The first reviewer has covered many of the points I would have made (and several more that I didn't think of, not knowing the geoengineering literature as well), but I will add a few specific points: 1) the concept of system identification is used many times, but was never defined in a comprehensible way. 2) "primarily of a diplomatic nature" is a distracting comment, not clear what's intended and why its important in this context. 3) The section on response theory is especially murky. It's not clear enough (e.g. all symbols in equations are not defined as soon as they're introduced) to allow a reader unfamiliar with the math to actually learn it, and it seems to be based on already published material, so it would be better to just refer interested readers to more thorough descriptions published elsewhere. The phrase "of course" is used frequently through the paper when derivations are being skipped and the conclusions being described are not at all obvious. I would also suggest banning the word "obvious". 4) Page 13, L12, not clear what "aymptotic times" refers to.

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