

The referee does not seem to object to the science in the paper nor to the claimed relevance of the precautionary principle in the abstract. His main issue seems to be the use of “honest and responsible” in the title. In response, I note the following. Line 12 of page 2 of the paper refers to this quote from IPCC’s AR5:[1]

The choice of time horizon has a strong effect on the GWP values—and thus also on the calculated contributions of CO₂ emissions by component, sector or nation. There is no scientific argument for selecting 100 years compared with other choicesThe choice of time horizon is a **value judgement** [emphasis added] because it depends on the relative weight assigned to effects at different times.

The same AR5 document also makes it clear that:[2]

The choice of metric and time horizon depends on the particular application and which aspects of climate change are considered relevant in a given context Metrics do not define policies or goals but facilitate evaluation and implementation of multi-component policies to meet particular goals. **All choices of metric contain implicit value-related judgements such as type of effect considered and weighting of effects over time** [emphasis added].

Ocko *et al.* in a paper in Science sum up the conundrum facing the scientific community as it confronts the widespread, misguided use of scientific tools, GWPs in particular:[3]

Policy-makers often treat a GWP as a value-neutral measure, but the time-scale choice is central to achieving specific objectives”

Indeed, the UNFCCC, and as a consequence the United States Environmental Protection Agency rely on use of the 100-year GWP, as does the United States Department of State, *e.g.*, in its 2014 Climate Action Report.[4] It is very likely that this use will add to “young people’s burden: requirement of negative CO₂ emissions.”[5] I mention this paper because Earth System Dynamics published it while its title, at least to my ears, has an unmistakable, normative ring.

As to the science, the referee writes:

Imagine two gases with the same instantaneous radiative forcing, but one decays in a year and the other remains in the atmosphere forever. Would it be wise to consider these two gases to be equivalent?

Of course not. On the contrary, the model that the paper uses in its thought experiment features two gasses, CO₂ and CH₄. The former is treated as stable; the second as decaying with a time constant τ , that appears in the equations used to produce Figs. 3, 4, 6, and 7. This is not the best conceivable model, nor is it presented as such, but it does much better job than using the GWP₁₀₀. The model shows (semi-)quantitatively that use of methane as a bridge fuel is irreconcilable with the alarming time scale of current developments of the cryosphere, a dominant time scale of the climate system.

One of the section headings of a paper in *The Lancet* reads: [6]

Climate change effects on health will exacerbate inequities between rich and poor

The use of the word “exacerbate” is clearly normative. Does the referee object to this? Does this use make the statement less empirically testable?

To sum up, both with respect to the relevant time and length scales, the use of the GWP₁₀₀ by the organizations mentioned above lacks scientific justification nor can it be reconciled with the precautionary principle. Indeed, as the referee mentions, “GWPs are flawed metrics for almost every purpose.” The paper provides scientific arguments why in these instances use of this metric is misguided; see, for example, the paragraph starting on line 6 of page 3. The referee’s objections seem mostly about adjectives—such as the use of “honest” instead of “useful”—rather than about scientific substance.

However that may be, certainly when a livable climate is at stake, it seems reasonable to have as one of the missions of Earth System Dynamics that it focus attention on misguided and irresponsible use of scientific tools, certainly when human behavior in the Anthropocene is an integral part of those dynamics.

[1] G. Myhre, D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura, and

H. Zhang, “Anthropogenic and natural radiative forcing,” in *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by T. F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. M. Midgley (Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2013) Book section 8, pp. 659–740page 711

- [2] See page 663 of Ref. [1](#).
- [3] I. B. Ocko, Steven P. Hamburg, Daniel J. Jacob, David W. Keith, Nathaniel O. Keohane, Michael Oppenheimer, Joseph D. Roy-Mayhew, Daniel P. Schrag, and Stephen W. Pacala, “Unmask temporal trade-offs in climate policy debates,” [Science](#) **356**, 492–493 (2017).
- [4] See for example the emission numbers contained in Table 3 on page 18 of [\[7\]](#).
- [5] J. Hansen, M. Sato, P. Kharecha, K. von Schuckmann, D. J. Beerling, J. Cao, S. Marcott, V. Masson-Delmotte, M. J. Prather, E. J. Rohling, J. Shakun, P. Smith, A. Lacis, G. Russell, and R. Ruedy, “Young people’s burden: requirement of negative CO₂ emissions,” [Earth System Dynamics](#) **8**, 577–616 (2017).
- [6] See page 1694 of “Managing the health effects of climate change,” [Lancet](#) **373**, 1693–1733 (2009).
- [7] “United States Climate Action Report 2014,” (2014).