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Correspondence/Rebuttal

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Reply to Comment on "Scientists' Views about Attribution of Global Warming"

We thank José Duarte for his interest in our paper. The criticisms in his comment are 3-fold: (1) he claimed we included an unknowable number of "non-climate scientists" in our survey; (2) the inclusion of impacts and mitigation researchers biases our results on the level of consensus upward; and (3) there is pressure to abide by the consensus, precluding any conclusions to be drawn from its existence. In response, we argue that the number of "non-climate scientists" in our survey is known to be small and their in- or exclusion does not change our conclusion that the level of consensus increases with increasing expertise. With respect to point 2, we reiterate that we intended to survey the wider scientific field that works on climate change issues. This has actually led to a slightly *lower* level of consensus than if we had only surveyed physical climate scientists. Finally, Duarte's characterization as if a scientific consensus is somehow enforced by nefarious means lacks substantiation.

Survey respondents were asked for the number of years that a respondent had been professionally involved with climate change issues (Q7a) and for the number of climate-related articles written in the peer-reviewed literature (Q7b). Researchers from a nonclimate related field, who were admitted to our survey because they wrote an article with the keyword "global climate change" or "global warming", would have answered zero to one or both questions, assuming they answered truthfully. The size of this group of "non-climate scientists" in our survey is 81 (~4% of the respondents). If they were excluded from our survey, the level of concensus based on Q1 of our total group of respondents who expressed an opinion—that is, excluding the undetermined responses—would remain the same: 84%.

Duarte argues that inclusion of scientists with self-reported expertise in climate impacts (WG2) or mitigation (WG3) cause an inflationary bias for the level of consensus found. However, we consciously included these professionals in our survey setup. In our article we describe how respondents were selected and that we surveyed "scientists studying various aspects of climate change, including physical climate, climate impacts, and mitigation." This setup of surveying the wider scientific field of climate-related researchers enabled us to investigate in detail how the various views on climate science depend on different metrics related to expertise.

Table S3 (SI) provides the consensus results for several subgroups, including those with self-declared WG1 expertise (physical climate scientists), WG2 and WG3. Those with WG1 expertise indeed reported a slightly lower consensus level than those with WG2 or WG3 expertise. However, the level of consensus of those with WG1 expertise is slightly *higher* than that of the total group of respondents, since the latter also includes respondents who did not report any of the IPCC WG1, WG2, or WG3 expertise fields, of whom 78% agrees with the IPCC attribution statement. Moreover, the 88 signatories of public statements critical of climate science—the"unconvinced"—exhibit a very low consensus level of 12%. So these latter two groups "bias" the consensus level in the opposite direction and probably contributed to us finding a lower level of consensus than several other studies did.

Our main conclusion, that the level of consensus increases with increasing expertise in climate science, as defined by the number of self-reported articles in the peer-reviewed literature on climate change, is not affected by having included impacts and mitigation researchers, or other tangentially related professionals.

Duarte bases his claim that dissent in climate science is oppressed on a few anecdotes and innuendo. He uses words such as "McCarthyite", "smearing", and "savaged", but only mentions anecdotes that support his case, seemingly unaware of the many anecdotes in which self-proclaimed skeptics engage in such behavior toward mainstream scientists. A scientist who is skeptical of the anthropogenic causation of climate change may be called a "denier"; a scientist who is convinced that climate change is predominantly human-induced may be called an "alarmist". Judged by the examples he draws upon, his opinion appears strongly influenced by the skeptical blogosphere, which is rife with unsupported accusations of wrongdoing.

These sorts of anecdotes exemplify the polarized nature of the public debate on climate change, which is to an extent due to the "wicked" nature of the problem and the moral aspects that it touches upon. Duarte's claim that dissent is oppressed has a conspiratorial tone to it. As such it cannot be disproven, but it can be pointed out that it lacks real-world evidence.

Duarte describes how psychological drivers—fear of ostracism—could lead scientists to pay lip-service to the consensus, even if they do not fully agree. However, making a Type I error (false positive or false alarm) is probably more damaging to a scientist's reputation and credibility than making a Type II error (false negative or missed opportunity).[1,2] This causes a tendency toward scientific reticence rather than exaggeration. This is exacerbated by widespread accusations of alarmism made against mainstream scientists. The opposite of what Duarte claims may be closer to the truth: scientists may express themselves in an increasingly reticent manner in order to avoid being labeled alarmist or activist.

There is another important incentive in the other direction than Duarte describes. You do not become a famous scientist by confirming or repeating what everyone already knows. Rather, as Anderegg et al.[3] wrote, "a scientist with a wealth of robust data from well-executed research would become famous by overturning a part of a consensus paradigm. Every young scientist dreams of being the next Darwin or Galileo."

Bart Verheggen[*,†,‡,#]
Bart Strengers[†]
Kees Vringer[†]
John Cook[§,∥]
Rob van Dorland[⊥]

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Jeroen Peters[†]
Hans Visser[†]
Leo Meyer[†]

[†]PBL Netherlands Environmental Assessment Agency, P.O. Box 303, 3720 AH Bilthoven, The Netherlands
[‡]Energy Research Centre of The Netherlands ECN, P.O. Box 1, 1755 ZG Petten, The Netherlands
[§]University of Queensland, Brisbane, QLD 4072, Australia
[∥]University of Western Australia, Crawley, Washington 6009, Australia
[⊥]Royal Netherlands Meteorological Institute (KNMI), P.O. Box 201, 3730 AE De Bilt, The Netherlands

AUTHOR INFORMATION

Corresponding Author

*Phone: +31 20 525 8271; e-mail: Verheggen.Bart@gmail.com.

Present Address

[#]Currently at Amsterdam University College AUC, PO Box 94160, 1090 GD Amsterdam, The Netherlands,

Notes

The authors declare no competing financial interest.

REFERENCES

(1) W. R. L. Anderegg, E. S. Callaway, M. T. Boykoff, Gary Yohe, Terry L. Root. Awareness of both type I and II errors in climate science and assessment. *Bull. Am. Meteor. Soc.* **2014**. doi: http://dx.doi.org/10.1175/BAMS-D-13-00115.1.

(2) Keynyn, B.; Oreskes, N.; O'Reilly, J.; Oppenheimer, M. *Climate Change Prediction: Erring on the Side of Least Drama? Global Environmental Change* **2012**, DOI: 10.1016/j.gloenvcha.2012.10.008.

(3) William R. L. Anderegg, James W. Prall, Jacob Harold Reply to Aarstad: Risk management versus "truth. *Proc. Nat. Acad. Sciences* **2010**. DOI: http://dx.doi.org/10.1073/pnas.1012742107.