Reply to 'Quantifying the consensus on anthropogenic global warming in the scientific literature: a Re-analysis'

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Highlights

- T14's consensus value is based on a math error that manufactures ~300 nonexistent rejection papers.
- T14 infers data drift using an inappropriate statistic that poorly correlates with consensus.
- Analysis of appropriate consensus statistics reveals no significant data drift.
- T14 wrongly conflates abstract ratings and author self-ratings; differences are detailed in C13.
- Reanalysis without T14's errors confirms 97 ± 1% consensus on AGW.

Abstract

Cook et al., 2013 (C13) found that 97% of relevant climate papers endorse anthropogenic global warming (AGW), consistent with previous independent studies. Tol, 2014 (T14) agrees that the scientific literature "overwhelmingly supports" AGW, but disputes C13's methods. We show that T14's claims of a slightly lower consensus result from a basic calculation error that manufactures approximately 300 nonexistent rejection papers. T14's claimed impact on consensus due to the reconciliation process is of the wrong sign, with reconciliation resulting in a slight increase (<0.2%) in the consensus percentage. Allegations of data inconsistency are based on statistics unrelated to consensus. Running the same tests using appropriate consensus statistics shows no evidence of inconsistency. We confirm that the consensus is robust at 97 ± 1%.

Keywords
scientific consensus, global climate change, anthropogenic global warming

> *"There is no doubt in my mind that the literature on climate change overwhelmingly supports the hypothesis that climate change is caused by humans. I have very little reason to doubt that the consensus is indeed correct."*
> – Richard Tol (T14)

C13 classified abstracts of climate science papers based on the level of endorsement that most of the recent global warming is man-made (anthropogenic global warming or AGW, Categories 1–3), rejection or minimisation of AGW (Categories 5–7), or 'no position' on AGW (Category 4). Among abstracts that express a position on AGW (i.e., those outside Category 4), 97.1% endorsed AGW. Each abstract was categorised by multiple raters, and a reconciliation process resolved disagreements. C13's finding of ~97% expert agreement on AGW is consistent with previous studies. These include surveys of the personal views (Doran and Zimmerman, 2009) and citation and publication data of relevant experts (Anderegg et al., 2010), as well as Oreskes' (2004) meta-analysis of the peer-reviewed scientific literature, which found near unanimous agreement on AGW.

T14 agrees that there is an overwhelming consensus on AGW, but disputes the methods used by C13. However, the methodology of T14 contains a number of significant flaws which falsify its main conclusions. T14 incorrectly claims that reconciliation moved scores 'towards greater rejection.' While reconciliation reduced the number of endorsements (6.7% or 281 abstracts), it reduced rejections by a proportionally greater amount (29% or 32 abstracts). As a result, reconciliation actually increased the consensus from 96.6% to 97.1%; the opposite sign to that claimed by T14.

T14 also erroneously assumes disagreements are randomly distributed between endorsement levels, applying a uniform adjustment distribution (T14, Figure S20) across all categories. In doing so, T14 spuriously manufactures ~300 nonexistent rejection abstracts, nearly quadrupling the total number of rejections observed by raters at any stage of the abstract rating process. The uniform adjustment applied by T14 does not consider the observed distribution of disagreements, nor the probabilities of between-class disagreements. Disagreement was almost four times as likely in 'endorsement' and 'rejection' categories as in the 'no position' category, and just 1.8% of disagreements over 'no position' abstracts resulted in the paper being classified as 'rejection.' T14 wrongly assigns 55% of 'residual

incorrectly rated ‘no position’ papers to ‘rejection’ by assuming approximately uniform reconciliation distributions for each category.

Thus, T14’s stated consensus of 91% is the result of a basic mathematical error. Re-application of the T14 error rate (6.7%) accounting for the observed distribution of disagreement shows that the consensus remains within <0.2% of 97.1% (Figure 1).

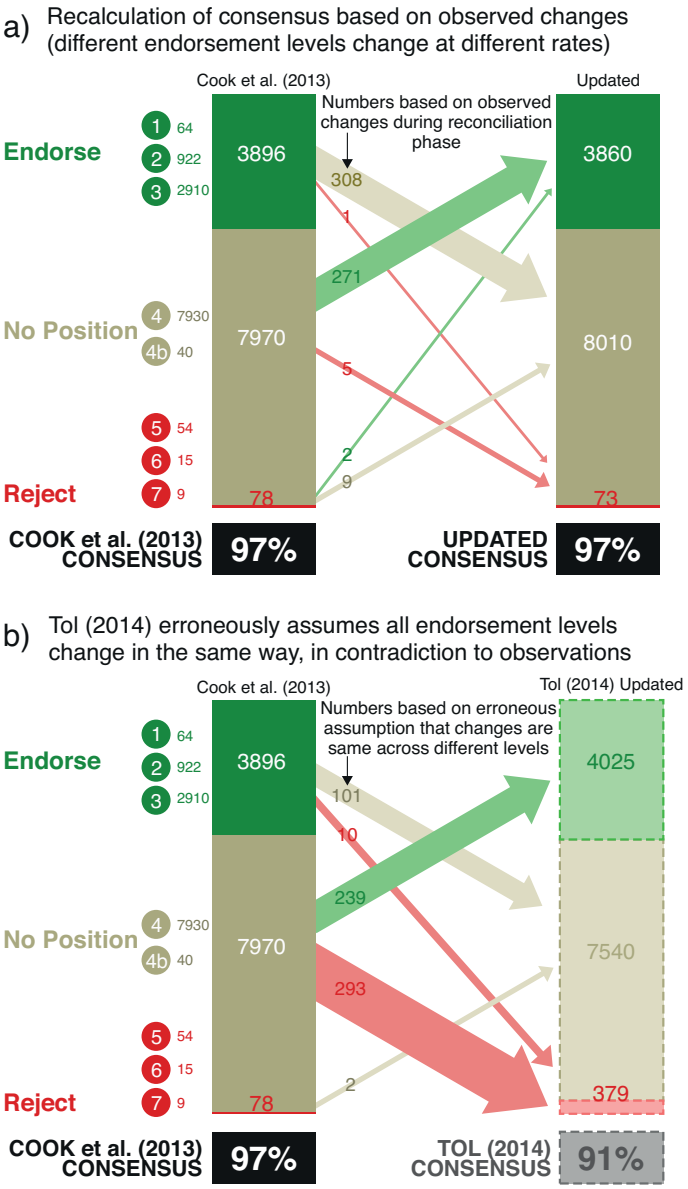

Figure 1. Changes in initial to final abstract ratings assuming a 6.7% uncertainty. a) Recalculated consensus value based on actual proportional endorsement changes during the resolution process. b) Tol’s method of recalculating consensus, based on the erroneous assumption that all endorsement levels change at the same rate. This assumption changes 293 “No Position” abstracts to “Rejection” abstracts.

Compounding the aforementioned errors, T14 also uses an invalid method to infer drift in consensus, by examining variations in the ordinal endorsement label (1 to 7), which has no numerical significance

(Healey, 2011). The mean endorsement score shows little correlation with consensus (percentage of relevant papers endorsing AGW); for 500-abstract running means, r^2 = 0.03 pre-reconciliation, r^2 = 0.00007 after. We replicate T14's analysis using the appropriate consensus value (i.e., omitting category 4 as per C13) for 50-, 100- and 500-abstract windows and find no evidence of the purported data drift. Consensus falls outside the 95% confidence interval 2.8%, 3.2% and 1.7% of the time for 50-, 100- and 500-abstract windows respectively (Figure 2).

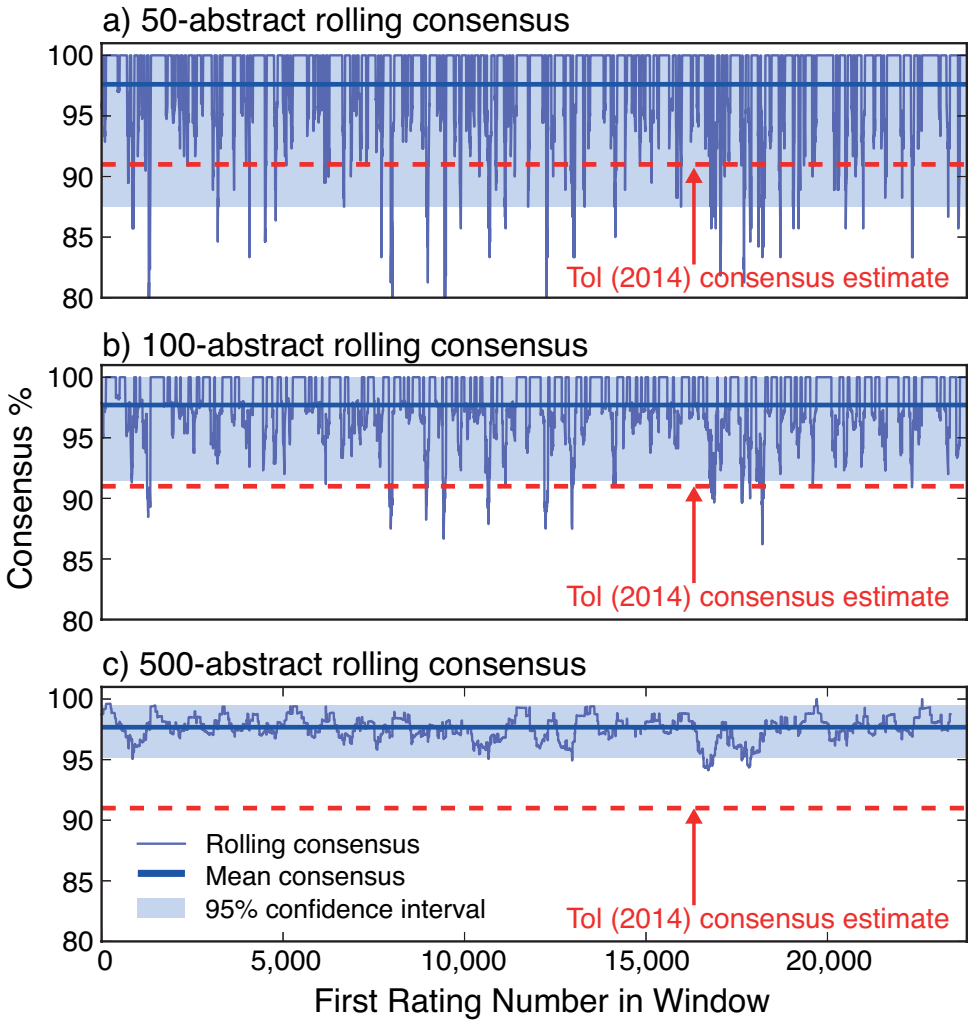

Figure 2. Calculated consensus (number of endorsements divided by total number that take a position) in rolling windows of 50- (upper), 100- (middle) and 500-abstract rolling windows (lower) for the first 2 ratings of each paper prior to reconciliation. Shaded area indicates 95% confidence interval. Blue thick line indicates mean consensus. Red dashed line indicates T14's recalculated 91% consensus.

Variations in the mean endorsement score examined by T14 are explained almost entirely by variations in the fraction of papers rated as 'no position' (r^2 = 0.90 for 500-abstract windows). 'No position' papers have a small effect on calculated consensus percentage, so this variation affects the number of papers taking a position on AGW, but not the primary consensus conclusion.

T14 also examines differences between abstract- and authors' self-ratings, but does not quantify the impact on consensus. The issue of differences between abstract and self-ratings was discussed explicitly in C13, as abstract ratings consider only the abstract text, in contrast to the authors' self-ratings of their full-papers. Only 1.4% of papers with an 'endorsement' abstract rating received a 'rejection' self-rating, whereas 55% of papers with a 'no position' abstract rating received an 'endorsement' self-rating. Thus if the authors' own ratings are representative of the full set of papers, a larger number of papers take a position on the cause of recent global warming (N=7603 inferred, versus N=4014 for the abstracts), and the inferred self-rating consensus is 96.7%. Once again, when correctly evaluating the impact of issues raised by T14, the 97% consensus documented by C13 is found to be robust to within <1%.

To summarize, we outline a selection of the methodological flaws in T14 which falsify its main conclusions. For example, T14's consensus estimate of 91% is based on the erroneous adjustment of approximately 300 'no position' abstracts to rejection. Likewise, T14's key arguments are based on statistics that show little correlation with consensus and are inappropriate to make inferences about the consensus percentage. Performing the same statistical tests using appropriate consensus values reveals no evidence of data drift. Correctly accounting for the issues raised by T14, we conclude that there is a 97 ± 1% consensus on AGW in relevant climate papers.

For conciseness, this comment discusses only the most substantial technical flaws in T14. T14 also includes a number of other unsupported assertions about bias in C13 but provides no quantitative evidence or analyses to demonstrate they have any impact on its results. Further discussion of numerous other critical errors in T14 can be found at http://sks.to/TolReply

We emphasise that the technical flaws identified in this response were evaluated using publicly available data, and that the release of additional information would compromise the anonymity of participants in C13, which is protected by University of Queensland ethical guidelines.

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