

## Comment on 'Quantifying the consensus on anthropogenic global warming in the scientific literature'

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## Environmental Research Letters



## COMMENT

## Comment on ‘Quantifying the consensus on anthropogenic global warming in the scientific literature’

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**Keywords:** climate change, survey methods, consensus**Abstract**

Cook *et al*'s highly influential consensus study (2013 *Environ. Res. Lett.* **8** 024024) finds different results than previous studies in the consensus literature. It omits tests for systematic differences between raters. Many abstracts are unaccounted for. The paper does not discuss the procedures used to ensure independence between the raters, to ensure that raters did not use additional information, and to ensure that later ratings were not influenced by earlier results. Clarifying these issues would further strengthen the paper, and establish it as our best estimate of the consensus.

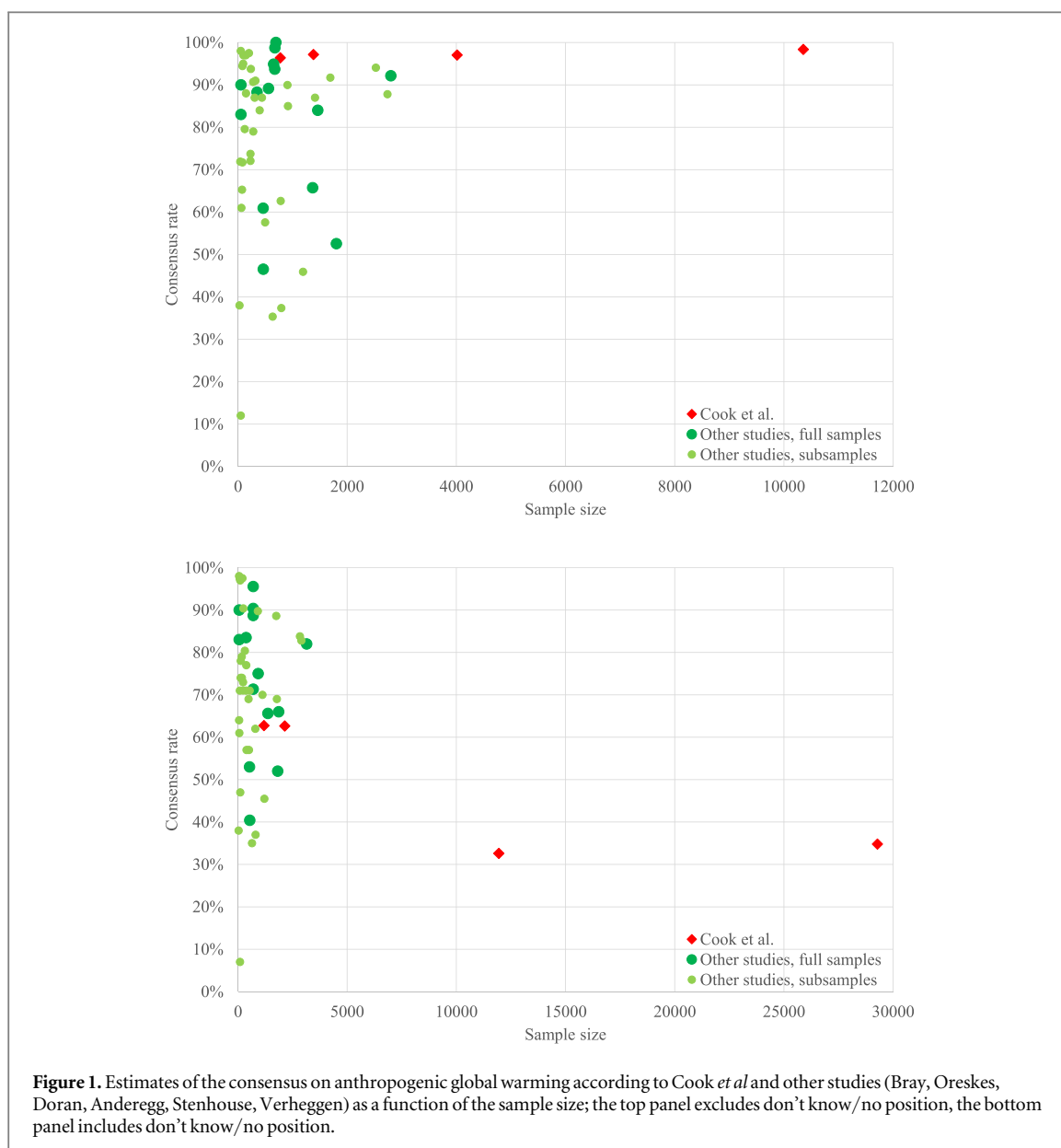
The consensus paper by Cook *et al* (2013) generated a lot of interest. Consensus is not proof, but occasional stock takes of the state of scientific knowledge are useful for identifying fruitful new research avenues and potential paradigm shifts. Agreement, or perceived agreement, about the extent and causes of climate change has no bearing on rational choices about greenhouse gas emission reduction—those are driven by the trade-offs between the impacts of climate change and the impacts of climate policy—but it does affect the public perception of and the political debate on climate policy, as does the integrity of climate research.

Cook *et al* (2013) estimate the fraction of published papers that argue, explicitly or implicitly, that most of the recent global warming is human-made. They find a consensus rate of 96%–98%. Other studies<sup>6</sup> find different numbers, ranging from 47% in Bray and von Storch (2007) to 100% in Oreskes (2004)—if papers or experts that do not take a position are excluded, as in Cook *et al*. If included, Cook *et al* find a consensus rate of 33%–63%. Other studies

range from 40% in Bray and von Storch (2007) to 96% in (Carlton *et al* 2015). Cook *et al* use the whole sample. Other studies find substantial variation between subsamples. Doran and Zimmerman (2009), for instance, find 82% for the whole sample, while the consensus in subsamples ranges from 47% to 97%. Verheggen *et al* (2014) find 66% for the whole sample, with subsample consensus ranging from 7% to 79%. Figure 1 shows these estimates; see also table A1 in the appendix.

Measuring ‘consensus’ is, of course, not easy—the human brain always reinterprets information presented. Different studies may have different objects of consensus. This is illustrated by Carlton *et al* (2015) who ask four different questions—about the impact on climate change of human activities, greenhouse gases, carbon dioxide, and the Sun—and find four different results for the consensus rate (90%, 96%, 89%, and 71%, respectively). Other survey studies ask slightly different questions again. Oreskes (2004) and Cook *et al* (2013) rate abstracts, but where Oreskes finds 75% agreement and 25% no position, Cook has 33% agreement, 66% no position and 1% disagreement. Cook’s raters often disagree with each other about the message of a

<sup>6</sup> Later studies were found from the forward references to Cook *et al* using Scopus. Earlier studies were found from Cook’s backward references, and backward references in backward references.



paper (Cook and Cowtan 2015) and they disagree with the authors too (Tol 2014a).

These differences notwithstanding, the results by Cook *et al* (2013) seem to be at the high end in the consensus literature when 'no position' is excluded, and at the low end when included. As Cook *et al* have a sample that is so much larger than in other studies, you would expect its results to lie towards the centre of earlier results. Figure 1 highlights that this is not the case.

It may be that there is a trend in consensus findings, and that study by Cook *et al* stands out because it is recent. Cook *et al* (2013) argue that there is an upward trend in consensus but Tol (2014a) shows that this is a trend in composition rather than agreement. There appears to be no trend in the consensus rate across studies. There is no statistically significant trend in the

results that include all. There is a statistically significant trend in the results that exclude 'no position', but this trend disappears if the 1996 Bray and von Storch estimate is omitted. See figure A1 in the appendix.

The problem may lie in the methodology of Cook *et al* (2013)—although earlier papers are not above criticism either (Peiser 2005, Duarte 2014). Reusswig (2013) praises Cook *et al* but Legates *et al* (2015) and Tol (2014a) question its data and methodology (Bedford and Cook 2013, Cook *et al* 2014a, Tol 2014b). Dean (2015) notes that the paper omits inter-rater reliability tests. Cook and Cowtan (2015) add these. These methodological exchanges omit the following five points:

1. Cook *et al* (2013) do not show tests for systematic differences between raters. Abstract rater IDs may or may not be confidential (Queensland 2012, 2014),

but the authors could have reported test results without revealing identities.

- The paper argues that the raters were independent. Yet, the raters were drawn from the same group. Cook *et al* (2013) are unfortunately silent on the procedures that were put in place to prevent communication between raters.
- The paper states that ‘information such as author names and affiliations, journal and publishing date were hidden’ from the abstract raters. Yet, such information can easily be looked up. Unfortunately, Cook *et al* (2013) omit the steps taken to prevent raters from gathering additional information, and for disqualifying ratings based on such information.
- Cook *et al* (2013) state that 12 465 abstracts were downloaded from the Web of Science, yet their supporting data show that there were 12 876 abstracts. A later query returned 13 458, only 27 of which were added after Cook ran his query (Tol 2014a). The paper is silent on these discrepancies.
- The date stamps, which may or may not have been collected (Cook 2013, Cook *et al* 2014b), reveal that the abstracts were originally rated in two disjoint periods (mid-February to mid-April; second half of May). There was a third period of data collection, in which neutral abstracts were reclassified.

Unfortunately, Cook *et al* (2013) do not make clear what steps were taken to ensure that those who rated abstracts in the second and third periods did not have access to the results of the first and second periods.

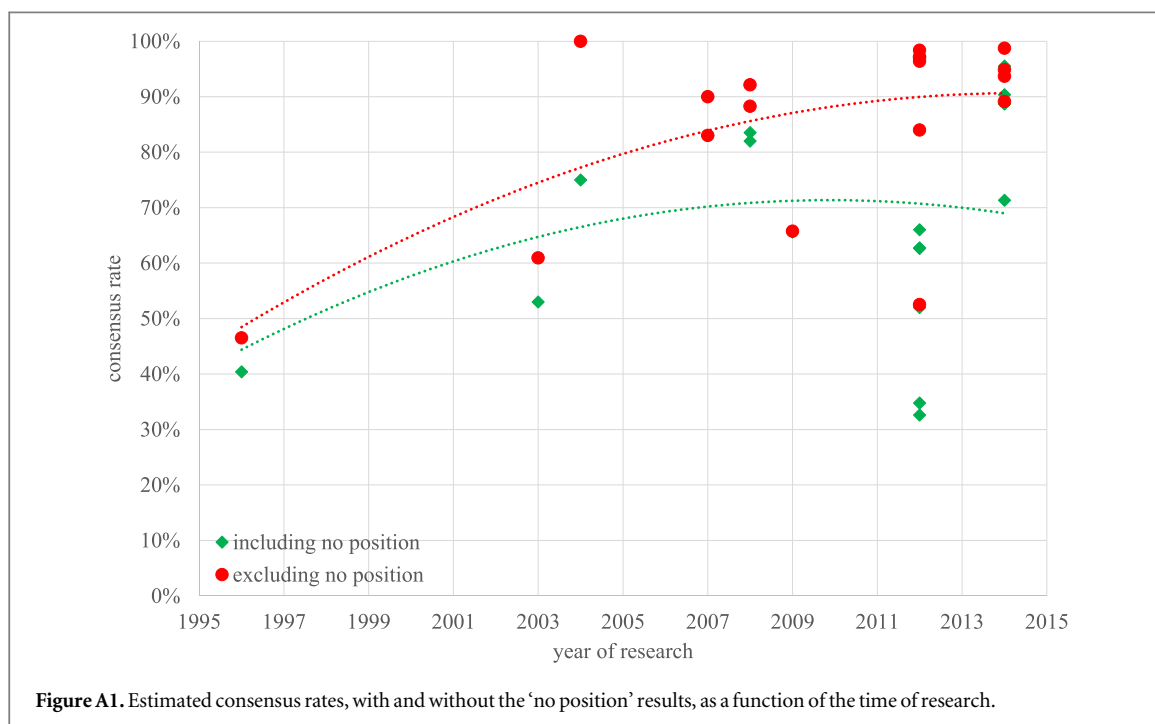
It would be of considerable benefit to readers if these issues would be clarified, if at all possible. That would help to convince people that the results of Cook *et al* are not just different but better than those in other studies.

Cook *et al* (2013) renewed interest in the question how to communicate (climate) science. While several studies show that people respond to cues about the scientific consensus (Guy *et al* 2014, Myers *et al* 2015, Van der Linden 2015, van der Linden *et al* 2014, 2015), other studies show that this effect is dominated in the long run by other factors (Bliuc *et al* 2015, Campbell and Kay 2014, Kahan 2015).

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Oliver Bothe, Collin Maessen, Ken Rice, Bart Verheggen and two anonymous referees had excellent comments on a previous version of the paper.

## Appendix A.



**Table A1.** Details of consensus estimates: lead author, year of publication, year of research, sample size, method, estimated consensus rate, object of study.

Study	Year	Excl. don't knows		Incl. don't knows		method	object
		N	rate	N	rate		
(Bray and von Storch 2007)	1996	539	40.4%	464	46.5%	survey	climate scientists
	2003	530	53.0%	461	60.9%	survey	climate scientists
(Oreskes 2004)	2004	928	75.0%	696	100.0%	other-rated abstracts	number of papers
(Milloy 2007)	2007	54	83.0%	54	83.0%	survey	IPCC scientists; more CO <sub>2</sub> implies warming
	2007	54	90.0%	54	90.0%	survey	IPCC scientists; less CO <sub>2</sub> implies cooling
(Bray and von Storch 2010)	2008	370	83.5%	350	88.3%	survey	climate scientists
(Doran and Zimmerman 2009)	2008	3146	82.0%	2800	92.1%	survey	earth scientists
	2008	2833	83.8%	2524	94.1%	survey	USA
	2008	313	80.4%	277	90.7%	survey	international
	2008	244	90.4%	235	93.8%	survey	active
	2008	2902	82.8%	2737	87.8%	survey	non-active
	2008	1749	88.6%	1690	91.7%	survey	publishing
	2008	103	47.0%	74	65.3%	survey	economic geologists
	2008	77	97.4%	79	94.5%	survey	climate scientists
	2008	47	64.0%	42	71.9%	survey	meteorologists
	(Anderegg et al 2010)	2009	1372	65.6%	1369	65.7%	public statements
2009		908	89.8%	906	90.0%	public statements	20+ climate papers
2009		200	97.5%	200	97.5%	public statements	most publications
2009		100	97.0%	100	97.0%	public statements	most publications
2009		50	98.0%	50	98.0%	public statements	most publications
(Cook et al 2013)	2012	11 944	32.6%	4014	97.1%	other-rated abstracts	number of papers
	2012	29 286	34.8%	10 356	98.4%	other-rated abstracts	number of authors
	2012	2142	62.7%	1381	97.2%	self-rated papers	number of papers
	2012	1189	62.7%	774	96.4%	self-rated papers	number of authors
(Stenhouse et al 2013)	2012	124	78.0%	122	79.6%	survey	climate scientists, climate focus
	2012	82	71.0%	81	71.7%	survey	climate scientists, other focus
	2012	26	38.0%	26	38.0%	survey	climate scientists, not publishing
	2012	232	71.0%	229	72.1%	survey	climate scientists
	2012	61	61.0%	61	61.0%	survey	meteorologists, climate focus
	2012	501	57.0%	496	57.6%	survey	meteorologists, other focus
	2012	641	35.0%	635	35.4%	survey	meteorologists, not publishing
	2012	1203	45.5%	1192	45.9%	survey	meteorologists
	2012	231	73.0%	229	73.7%	survey	climate focus
	2012	790	62.0%	782	62.6%	survey	other focus

**Table A1.** (Continued.)

Study	Year	Excl. don't knows		Incl. don't knows		method	object
		N	rate	N	rate		
(Verheggen <i>et al</i> 2014)	2012	800	37.0%	792	37.4%	survey	not publishing
	2012	1821	52.0%	1803	52.5%	survey	all
	2012	1868	66.0%	1461	84.0%	survey	all
	2012	388	57.0%	278	79.0%	survey	3- climate papers
	2012	480	69.0%	396	84.0%	survey	4–10 climate papers
	2012	373	71.0%	304	87.0%	survey	11–30 climate papers
	2012	379	77.0%	319	91.0%	survey	32–300 climate papers
	2012	174	79.0%	142	97.0%	survey	IPCC AR4 WG1 authors
	2012	1118	70.0%	914	85.0%	survey	IPCC WG1
	2012	534	71.0%	438	87.0%	survey	IPCC WG2
	2012	120	74.0%	94	95.0%	survey	IPCC WG3
	2012	175	74.0%	146	88.0%	survey	focus on attribution, aerosols, clouds
	2012	88	7.0%	50	12.0%	survey	unconvinced of anthropogenic climate change
(Carlton <i>et al</i> 2015)	2012	1780	69.0%	1411	87.0%	survey	convinced of anthropogenic climate change
	2014	698	90.4%	673	93.7%	survey	biophysicists; human activity caused warming
	2014	698	95.5%	675	98.7%	survey	biophysicists; more CO <sub>2</sub> implies warming
	2014	698	88.7%	653	94.9%	survey	biophysicists; CO <sub>2</sub> affects climate
	2014	698	71.3%	558	89.2%	Survey	biophysicists; sun has not caused warming

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