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Recalculating climate change consensus: The question of position and rhetoric

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ABSTRACT

Quantifying the consensus on anthropogenic climate change and its communication have become a controversial research subject in recent years. This paper utilized a reference list from a climate skeptic report and a previously published quantitative method of consensus research to revisit the theoretical and methodological questions. Beyond rating the abstracts according to their position on anthropogenic global warming (AGW), this study classified the strategic in-text functions of the references. Results not only showed the biased character of the literature set, but also revealed a remarkable AGW endorsement level among journal articles that took a position concerning AGW. However, this paper does not argue for modified consensus numbers, but instead emphasizes the role of 'no position' abstracts and the role of rhetoric. Our quantitative results provided evidence that abstract rating is a suboptimal way to measure consensus. Rhetoric is far more important than it appears at first glance. It is important at the level of scientists, who prefer neutral language, and at the level of readers such as report editors, who encounter and re-interpret the texts. Hence, disagreement appears to stem from the disparate understanding and rhetorically supported interpretation of the research results. Neutral abstracts and papers seem to provide more room for interpretation.

1. Introduction

In the last twenty years, the concept of consensus has become a crucial element in climate change science and policy formation. As the main consensus-making institution within the climate change community, the Intergovernmental Panel on Climate Change (IPCC) has, perhaps, garnered the most attention (Beck and Mahony, 2018; Hulme and Mahony, 2010; Pearce et al., 2018). Peer review, another institutional level, was mostly discussed by science-policy commentators after 'Climategate' (Grundmann, 2012, 2013), while referencing and citation techniques alone have gained less attention in climate consensus building (Jankó et al., 2014) despite the well-known signposts in science studies (Gross, 2006; Hyland, 2002; Latour, 1987). Originating mainly from the physical sciences branch, climate change consensus quantification became a highlighted research field (e.g. Anderegg et al., 2010; Benestad et al., 2016; Bray, 2010; Doran and Zimmerman, 2009; Oreskes, 2004), especially after the publication of Cook et al. (2013, hereafter: C13). All of these papers concluded that demonstrating an

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overwhelming consensus could close the climate change engagement gap between experts and the misinformed public, settle the science, and end debates about climate science (see also Carlton et al., 2015; Cook, 2016; Cook et al., 2016). In contrast, Pearce et al. (2017) and Russill (2018) provided detailed criticism concerning the pitfalls of this kind of research as it could mislead climate change communication. Rather than generating an unrealistic post-controversial state of climate science, the aforementioned authors demonstrated that such research only contributes to further debates and has had limited success persuading the public and influencing politics.

Similar to Pearce et al. (2017), the C13 paper forms the starting point of this study. C13 categorized 11,944 peer-reviewed journal abstracts according to the position authors took regarding anthropogenic global warming (AGW). Among abstracts where the authors expressed a position on AGW (33.6% of the total), C13 found that 97.1% endorsed the scientific consensus, yet the remaining 66.4% of the abstracts fell into the 'no position' category.

The first aim of this study is to use the C13 method to recalculate and revisit the consensus using the journal references and their abstracts cited in a climate skeptic report and to shed more light on its legitimation base. It is important to emphasize that our focus is on the cited literature and not on the contrarian report itself. The papers referenced here are in a particular situation; they were used to legitimize the opposing knowledge claims challenging the mainstream views on climate change. We have to recognize that IPCC has far more room to maneuver during their activities than skeptics do. Skeptics do not comprise large scientific groups and lack multi-level review processes, which means skeptic claims could usually only be legitimized by the literature. On the other hand, skeptics concurrently compromise these references. Though these papers are from roughly the same journals, they barely overlap with those cited by the IPCC (2013) Physical Science Basis report (Jankó et al., 2014, 2017), thus forming a "dubious" counterpart to the IPCC literature body.

Based upon a cursory consideration of the differences and the results of C13, it could be presumed that most of the authors cited in such a skeptic report would take a position indicating either an implicit or an explicit rejection of the AGW theory. Conversely, we assumed the answers should be sought in the 'no position' abstracts. We also assumed a greater number of those papers would be found in the reference list of the climate change skeptic report.

This hypothesis led us to the second major aim; the genealogical analysis of the 'no position' abstracts, and the meaning of these abstracts in consensus quantification and beyond. In addition to the interesting question concerning the consensus endorsement level of such a particular set of literature, we elaborate on whether this analysis reveals anything concerning the consensus research controversy specifically or about the climate change controversy in general (cf. Björnberg et al., 2017). In this way, our results could provide new insights into the workings of climate science and the climate skeptic branch.

2. Debates on quantitative consensus research. Paradigms and pure scientists

Prior to clarifying the methods and discussing the results, we highlight some controversial aspects of the quantitative consensus research, especially the debates around the C13 study, which also provide some theoretical aspects for our study regarding the question of 'no position' papers.

Investigating the debate on blogs prompted by the C13 publication, one criticism we found focused on the conceptualization of consensus itself as being too wide and simple (e.g. Betts, 2013; Neil, 2013), but the effectiveness of consensus communication induced much more friction during the debates (e.g. Hulme, 2014; Pile, 2013; Nuccitelli, 2013). While numerous articles demonstrated that enlightening the uninformed public about the overwhelming consensus among climate scientists on AGW could increase the support of climate policy (Cook and Lewandowsky, 2016; Ding et al., 2011; Lewandowsky et al., 2013; McCright et al., 2013; van der Linden et al., 2014, 2015), the consensus message itself entered into a marketing campaign led by some of the authors cited under the umbrella of The Consensus Project (Kahan, 2015). Conversely, others questioned the validity and the workings of these results. They argued that such minimalist claims on human-induced climate change misunderstood the role of scientific knowledge in policy and policymaking, prompting the need for more sophisticated knowledge transfer methods and the use of science in society (Kahan, 2015, Pearce et al., 2017 see also Collingridge and Reeve, 1986; Kahan et al., 2011, 2012).

In addition, the blog debates circled around the reliability and understanding of the results (e.g. Hobbs, 2015; Maessen, 2013), but rarely discussed the question of abstracts with no position on AGW. Originally, C13 tried to eliminate this problem by organizing a self-rating test with the authors, driving the 'no position' papers down to 35.5%; however, this rating was based on the entire content of the papers, not on the abstracts alone ($N = 2142$), which is an important point to note here. Furthermore, drawing on Oreskes (2007), the argumentation C13 put forward regarding 'no position' papers and climate science consensus clearly echoes the Kuhnian imagination of an emerging paradigm (Kuhn, 1970), revealing that many scientists imagine consensus formation in this sense: 'no position' authors, these scientists argue, should support the consensus. Nevertheless, the question of neutral abstracts was not addressed afterward. The results, especially the simple message of the 97% consensus rate, gained wide publicity, but failed to mention or chose to ignore these neutral abstracts (e.g. Cook, 2016; Cook et al., 2016; Nuccitelli, 2013). It is clear that excluding 'no position' papers from the interpretations and from the communication campaign was intentional; otherwise, the problem of underestimating the consensus could not be overcome (see the forum posts of Curtis et al., 2012).

Nonetheless, Powell (2015) employed similar Kuhnian logic when criticizing C13 for ruling out the 'no position' papers from original consensus calculations. Additionally, Powell assumed these papers fully endorse the consensus. Replying to Powell (2015), Skuce et al. (2017) noted a higher level of disagreement had to exist due to the authors with numerous papers in the dataset that fell into either the 'no position' or the 'rejecting' categories. Furthermore, Skuce et al. pointed out that papers containing 'no position' abstracts can go on to reject the consensus in the main body of their texts. In his commentary, Tol (2016) demonstrated further analysis about the different results of consensus papers excluding or including the neutral abstracts or answers; however, he did not analyze the potential reasons behind the question.

Science and technology studies offer two explanations; both warrant consideration. The first could be derived using the Kuhnian explanation for the workings of science (Kuhn, 1970), which is still popular among science practitioners and commentators, though the paradigms idea is controversial (Devlin and Bokulich, 2015) and slightly outdated (Collins and Evans, 2002; Golinski, 2005) in science historian and sociologist circles. Otherwise, Imre Lakatos's idea on research programs or Bruno Latour's black box concept (Latour, 1987) could also be used to explain consensus formation (Shwed and Bearman, 2010; Marx et al., 2017). Indeed, from this perspective, mainstream climate change research seems to be a normal science because pro-consensus scientists concentrate on minor problems and share an inherent puzzle-solving approach. In addition, the reliability of the paradigm and human impact regarding climate change is rarely questioned, and there is no need to take a position in terms of AGW (Powell, 2015). As Hyland (2006) shows, this is more specific to the science disciplines than it is in the humanities or social sciences. In fact, climate science is far more controversial and complex, as the concept of post-normal science and its application on climate science demonstrates (Hulme, 2009, 2014; Goeminne, 2011).

This point leads us to apply Pielke (2007) pure scientist idea to provide the second theoretical explanation concerning the existence of ‘no position’ abstracts. Pure scientists concentrate maximally on their specified research question(s), method, and data; in addition, they summarize their results without advancing any kind of wider conclusion in relation to AGW. Whether pure scientists do this deliberately or not, is up for debate; however, they tend not to make any statement about human-induced climate change or greenhouse gases, nor do they elaborate about what their results may mean in relation to the big theory. This task is left for the reader. Pure scientists supply only the results (facts, data etc.) and do not venture into the territory of issue advocacy or decision-making. Nor do they use their findings to advocate any kind of issue or policy. Simply put, they remain rhetorically neutral.

Indeed, this approach is common among scientists. As Fahnestock (1986) demonstrated, the language pure scientists employ is primarily forensic rhetoric aimed at establishing a framework of careful wording through which results and certainties are validated.

3. Material and methods

We evaluated the references from Climate Change Reconsidered II. – published by the Heartland Institute, an influential American conservative think tank (Boussalis and Coan, 2016; Cann, 2015) under the umbrella of the Nongovernmental International Panel on Climate Change (NIPCC) (Idso et al., 2013). Despite the criticisms raised against the methodological practice of C13 (e.g. Tol, 2014, 2016; Powell, 2015 see also Cook et al., 2014a, 2014b; Skuce et al., 2017), we decided to follow their methodology (Table 2 of C13) to keep the possibility of data-comparison open to C13 and related research. C13 originally used seven categories: explicit endorsements of as well as rejection of AGW were divided into quantified and non-quantified groups; implicit endorsement or rejection; and ‘no position’ abstracts not addressing or mentioning climate change causes.

We employed the same approach used in C13 when we cleared the database for this study. We removed all the items published before 1991 (N = 228) and all papers not published in scientific journals (N = 351). We made corrections only within the framework of the original method; contrary to C13, we introduced an uncertainty category immediately from the start, and added a further category within the ‘no position’ category. While analyzing the supplementary material of C13 and checking ‘no position’ abstracts, we noticed abstracts containing specific rhetoric referring to expected climate change, climate projections, or simply global warming (a phrase implying the anthropogenic causes). Hence, we created a ‘no positon with axiomatic reference to AGW’ category to solve the assumed monotony of ‘no position’ papers (see related methodological questions at Curtis et al., 2012). For the purposes of this study, we consolidated the ratings into the same three groups employed in C13: implicit and explicit endorsements together, implicit and explicit rejections, and ‘no position’ abstracts.

Every coauthor of this study took part in the abstract rating; each received the same number of articles, which were rated by only one colleague. Before the actual work began, we conducted two test stages to adjust and harmonize each other’s work and make the method clear to all coauthors. A flow-chart was prepared (Fig. 1) to demonstrate the rating process and to reduce rating uncertainty, and the corresponding author served as a forum for discussing the problematic abstracts during the work.

We also developed a second database focusing on the papers behind these abstracts. This second database was constructed by evaluating how references were used in the report and what the strategic functions of the in-text citations were. Our two databases were then merged; hence, taking a given paper, we were able to compare abstract ratings and in-text functions. As Latour (1987, 29) noted, “The fate of what we say and make is in later users’ hands.” This could be applied to the citation mechanism in the scientific literature, and “the construction of facts and machines is a collective process.”

The in-text citations of the journal references could fall into the following categories: supporting the IPCC knowledge claims about climate change; not supporting or creating uncertainty around the knowledge claims; or simply neutral, referring to a method or secondary information. Each reference that was used in different contexts was classified into a dominant category according to the following: ‘not supporting’ (the strongest function), ‘supporting’, ‘uncertainty’, ‘neutral’ (the weakest) (examples can be found in Jankó et al., 2014).

After papers without abstracts (N = 86) or in-text citations (N = 37) were excluded from the databases, the two databases were matched together. A total of 3136 papers with abstract ratings and a total of 4968 in-text citations were analyzed in order to compare the endorsement ratios, the in-text functions as well as the time series with the C13 results.

4. Results and discussion

Table 1 displays the basic results of this study compared to the C13 numbers, which are added in parentheses. Considering this study’s specific reference list, it seems logical that the percentage of abstracts endorsing AGW is lower, while those rejecting AGW is higher. Nonetheless, the larger ratio of ‘no position’ abstracts is also remarkable when compared to C13, as was hypothesized earlier. It must be noted that 15.4% of the ‘no position’ abstracts fell into the category ‘no position with axiomatic reference to AGW’. Though seemingly logical, transferring these papers to the implicit endorsement category would have pushed the ‘no position’ ratio down to 67.5%. This action would have opposed the C13 method.

The comparison of these results to Oreskes (2004) is limited

Table 1
Distribution of consolidated abstract ratings (C13 data added in parentheses).

	No. of all abstracts	% of all abstracts	% among abstracts with AGW position
Endorse AGW	473	15.1 (32.6)	74.7 (97.1)
No AGW position	2502	79.8 (66.4)	–
Reject AGW	132	4.2 (0.7)	20.9 (1.9)
Uncertain on AGW	28	0.9 (0.3)	4.4 (1.0)

Table 2
Distribution of in-text functions of references (rows) according to the consolidated abstract categories (columns), %.

	Endorse AGW (N = 473)	No AGW position (N = 2502)	Reject AGW (N = 132)	Uncertain on AGW (N = 28)	With position on AGW (N = 605)	Endorse AGW (N = 400)	No AGW position (N = 2019)	Reject AGW (N = 120)	Uncertain on AGW (N = 26)	With position on AGW (N = 520)
	With neutral papers					Without neutral papers				
Not supporting	54.1	65.7	83.3	57.1	60.5	64.0	81.5	91.7	61.5	70.4
Supporting	14.8	4.2	3.0	7.1	12.2	17.5	5.2	3.3	7.7	14.2
Uncertainty	15.6	10.8	4.5	28.6	13.2	18.5	13.3	5.0	30.8	15.4
Neutral	15.4	19.3	9.1	7.1	14.0	–	–	–	–	–

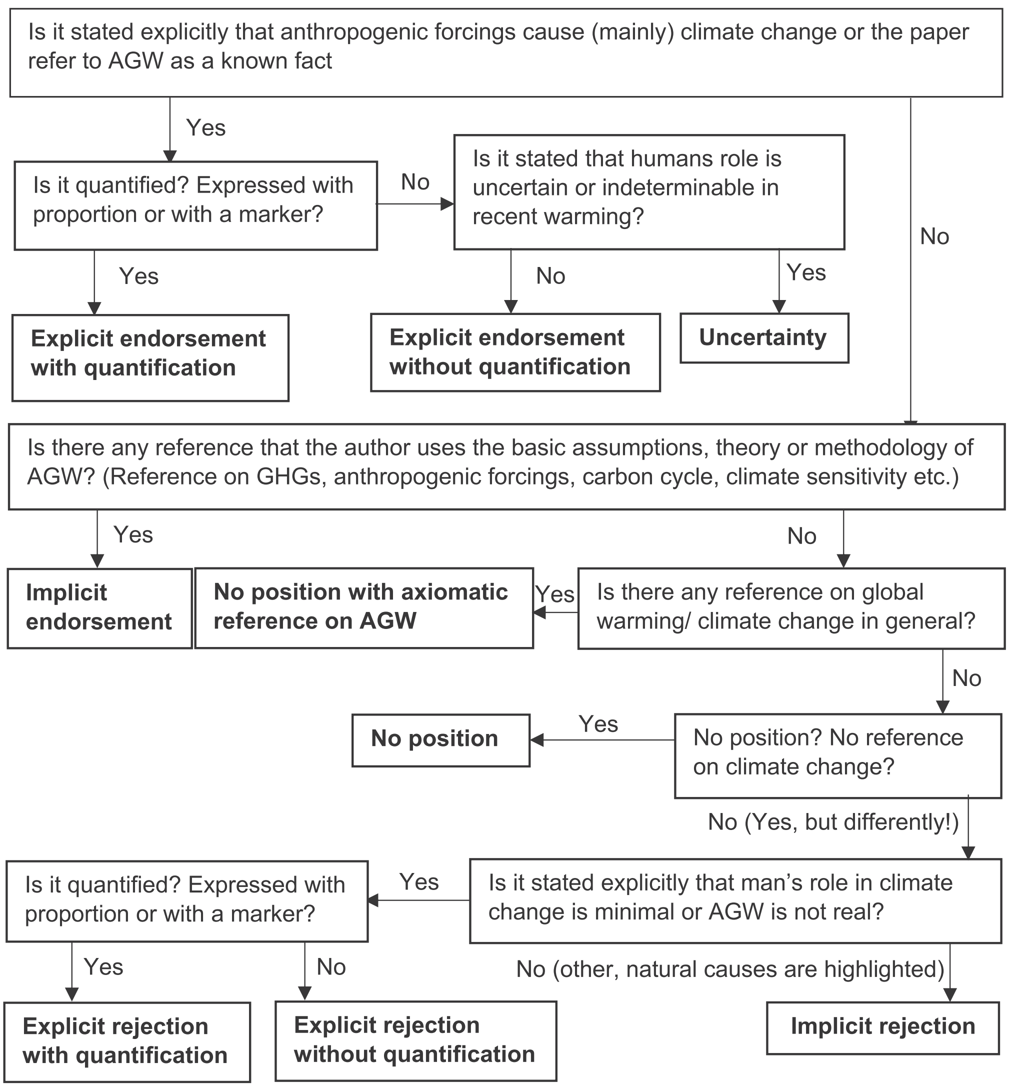

Fig. 1. Methodological flow-chart.

because the first three basic categories in this milestone study ('explicit endorsement', 'evaluation of impacts', 'mitigation proposals') were simply labelled as 'explicit or implicit endorsement' reaching 75% among all the abstracts, while 'methods' and 'paleoclimate analysis' were interpreted as 'no position' abstracts comprising only 25% of the papers. Beyond the problem of these ratings, the discrepancies could be explained by the method with which Oreskes (2004) and C13 created their databases, using the ISI Web of Science and the keywords 'climate change' (Oreskes) as well as 'global climate change' and 'global warming' (C13). In turn, many 'no position' papers written by pure scientists contained in this study's database do not feature these phrases at all, either in titles, or in abstracts or keywords (cf. Tol, 2014).

The functional investigation data of the in-text citations were no surprise (Table 2). In their dominant in-text citations, papers with any kind of abstract ratings mostly served the function of not supporting the IPCC picture of climate change. Adding the function of uncertainty to these numbers, it becomes apparent that papers rejecting the consensus were used against the IPCC the most (87.8%), while endorsing papers were used the least (69.7%). Consequently, papers with positions on AGW reach 73.7% on average. Additionally, 'no position' abstracts are in the middle with 76.5%; that means three-fourths of the papers in this rating category were used to support the climate skeptics' arguments. Though they are few in number, it is noteworthy that abstracts labelled with uncertainty ratings serve the most uncertainty function by in-text citations. Disregarding the papers used only for neutral purposes, more robust numbers emerge on the right-hand side of Table 2, which shows a clearer picture. Appendix 1 shows five examples where the abstracts were rated into different categories. All of these papers were used to oppose a given IPCC claim; consequently, we classified these as "not supporting".

These results may reveal that even papers in endorsing categories can be used to legitimize opposing arguments, especially when the inherent freedom of interpretation and rhetoric are taken into consideration. This topic could be further investigated beyond the framework of this study. On the other hand, the results may also indicate that research findings not fitting into the consensus or not reflecting the evidence provided by the majority in a given climate science domain still could or ought to be presented using the AGW rhetoric. On a related point, out of 90 papers with explicitly endorsing abstracts and not supporting in-text citations, we discovered only 9 endorsing AGW based on their results, while the other studies provided only rhetorical references to AGW thorough terms like 'human-induced climate change".

The entire completed data query revealed that the abstract ratings were primarily about rhetoric. As Appendix 1 illustrates, hedging and qualifying claims, retaining wordings adhering the observed results, and various formulas embedded in dry, technical jargon were all utilized in reference to AGW (Fahnestock, 1986; Hyland and Salager-Meyer, 2008). In the case of endorsing AGW, the clearest examples are ones in which authors draw conclusions from results indicating humans cause climate change; however, the rhetorical formula implying the consensual situation when an author only "refers to anthropogenic global warming/climate change as a known fact" (C13, Table 2), fell into the same category. The difference between this 'explicit endorsement' and the modified 'no position' category, where an author writes about global warming, for example, is also slight. This viewpoint simplifies the science process as well, suggesting science should concentrate only on the reliability of the AGW "paradigm".

It should be emphasized that the method has a narrow-focused approach. In this sense, abstracts referring to complex or controversial but detailed questions, like uncertainties with global circulation models, positive and negative feedbacks, sea temperatures in past periods, or trends in given proxy records, were all beyond the minimalist question on AGW and fell into the 'no position' category. A statement concerning AGW is merely the surface. Many more climate change statements exist below this, as demonstrated in the IPCC reports; from these, a larger and clearer "big picture" about present climate conditions and future of the Earth's climate emerges. It is likely that the abstract conclusions are connected mostly to these statements.

In the case of the 'no position' papers we have similarly two possible, diametrically opposed interpretations. First, in these papers, pro-consensus scientists fill in the gaps in the core area of a given climate change domain or in related subdomains, and their results are misinterpreted in the skeptic report using the technique of 'cherry picking' (Farmer and Cook, 2013). Second, conversely, there are pure scientists whose occasionally exceptional or unusual results are left up to the reader to consider and interpret. The balance between these two approaches depends on the correctness of the in-text citations in the skeptic report. Nonetheless, we lack the data with which to balance these two polarized perspectives.

Returning to the C13 data comparison, Figs. 2 and 3 show the time series of abstracts in the three main categories. The former shows roughly the same trends as Fig. 1. (a) of C13, but with a breaking dynamic and a slight, but significant, decreasing trend of 'no position' abstracts starting from the mid-2000s. No significant change among the curves occurred in the latter, i.e. Fig. 3, while Fig. 1 (b) of C13 showed this stagnant trend only from the beginning of the 2000s. The increasing number of neutral abstracts between 1995 and 2000 could indicate the evolution of the Kuhnian paradigmatic situation. During this period, authors were not required to accentuate their position on AGW. However, the ratio between the different ratings has barely changed (Fig. 3). Hence, this conclusion could be drawn more readily from the original C13 figures.

Similar trends are visible in Figs. 4 and 5 with the time series of the in-text functions. In the former, 'not supporting' papers trend similarly to the 'no position' abstracts; it is no coincidence that 81.2% of papers with not supporting in-text citation have a 'no position' rating. Fig. 5 indicates interesting changes in the reference list of the report. Papers containing a not supporting function plateaued in the 2000s, and only the significantly increasing trend of uncertainty papers provides improvement. Accordingly, the newest findings do not bear the brunt of support for the skeptic knowledge claims. For comparison, two-thirds of the references cited by the IPCC Fifth Assessment Report by Working Group I. were published after 2007; conversely, this ratio was only one-half in the case of

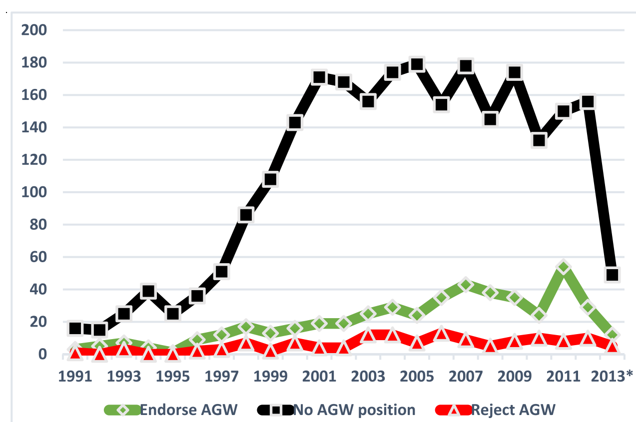

Fig. 2. Total numbers of abstracts classified into three main categories (uncertain abstracts are within 'no position' abstracts. *2013 is not a full year of reference.

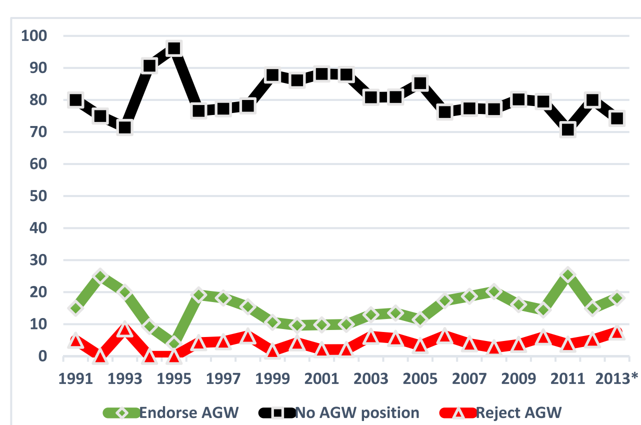

Fig. 3. Percentage of abstracts classified into three main categories (Uncertain abstracts are within 'no position' abstracts. *2013 is not a full year of reference.

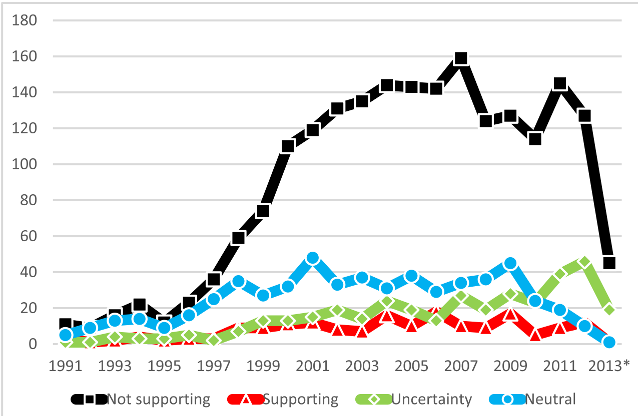

Fig. 4. Total number of abstracts classified into four categories of in-text functions. *2013 is not a full year of reference.

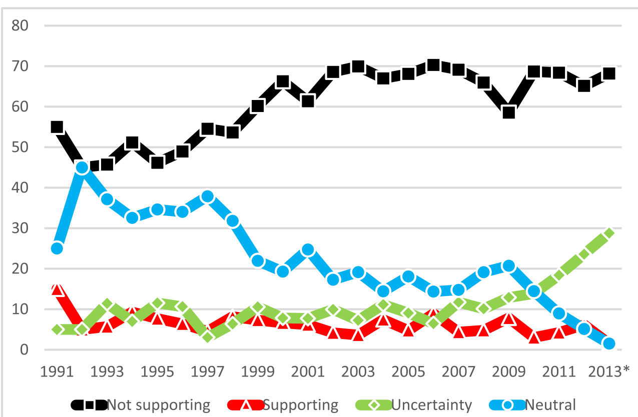

Fig. 5. Percentage of abstracts classified into four categories of in-text functions. *2013 is not a full year of reference.

the NIPCC-report (Jankó et al., 2017). The share of supporting papers is moderately, but significantly, decreasing, while the decreasing trend of neutral papers are much more visible. Older papers with research history serve some rhetorical functions, but have little to do with the controversy.

Our data indicates that the 'no position' papers, not the 'reject' papers that provide the sources for the opposing knowledge claims of the climate skeptic movement. However, the breaking dynamic in the curves of these 'no position' papers raises some questions about future NIPCC reports; due to depleting resources (i.e. journal articles), the rejuvenation of these reports is certainly not guaranteed.

The uncertainty of the research contained in this study should be emphasized utilizing the same points mentioned in C13, e.g. the ambiguous language of the abstracts, the rating of abstracts underestimating the ratio of papers with a position on AGW, and the subjectivity or varied backgrounds of the raters. This study sought to minimize these inherent uncertainties through tests; these tests demonstrated that some deviation among the ratings was possible. However, the similarities of the data and trends contained in this study to the data and trends contained in C13 or Jankó et al. (2017) provides a solid basis for the study conclusions.

5. Conclusion

This study aimed to revisit the consensus controversy using a quantitative approach and a literature set from a climate skeptic report. Superficially, the results of this study could easily be misinterpreted because they are very similar to C13, although our data demonstrated the analyzed literature set is clearly biased compared to C13 with relatively more abstracts rejecting the AGW. On the other hand, in the manner of the "Consensus Project", we could still proclaim that "75% of climate change papers cited in a climate change skeptic report, and stating a position on human-caused global warming agree that global warming is happening and we are the cause", so there is a 75% consensus rate in the climate skeptic report. However, this would be both astounding and ridiculous at the same time. Beyond the endorsement levels, we have shown that 'no position' abstracts/papers and their strategic in-text use provide the major source of climate skeptic knowledge claims; thus, we need 'no position' papers to grasp the whole picture regarding the climate skeptic report.

Based on these results, the following conclusions emerge. In terms of the consensus research controversy, our paper produced empirical evidence that abstract rating is a suboptimal way to measure consensus. The associated stats can be misleading or can cast doubt on the method rationale; thus, they relate more to the rhetorical state of the literature body in question than to anything else. Scientist surveys or careful literature investigations are other options for consensus calculations. The former could also be problematic (Anderegg et al., 2010; Verheggen et al., 2014), but the latter brings us right back to the starting point (Shwed and Bearman, 2010). Reviewer communities or advisory institutions like the IPCC can also assume a role in consensus formation. However, science representatives or advisory bodies addressing other controversial global issues such as genetically modified organisms (Carolan, 2008), anti-microbial resistance (Pearce et al., 2018), or microplastic pollution (Völker et al., 2019) are also limited when it comes to influencing policy decisions. Past a certain point, it appears science can do little to aid political consensus formation.

This leads us to our second conclusion. The role of scientific rhetoric is far more important than appears at first glance. The dominant neutral rhetoric reveals that many researchers do not refer to the AGW paradigm in their abstracts. Nonetheless, scientists likely have different motives for doing so, but for most, this non-referral in abstracts is usually not a primary aim. At the reader level, peers and report editors encounter and re-interpret the texts by forming conclusions based on results presented in articles. Consequently, the source of disagreement is the disparate understanding and rhetorically supported interpretation of the research results. Compared to rhetorically explicit abstracts, it is possible that 'no position' abstracts (and the related articles) left more room for rhetorical maneuvering. The interpretation histories of papers and abstracts reveal much concerning the workings of science and the climate skeptic community. This topic would benefit from further research studies in the future.

Credit author statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix. Papers with different abstract ratings and the context of their citation not supporting the IPCC's position.

Bibliographic data	Abstract quotation	Category of endorsement	In-text citation as not supporting the IPCC claims
Ring, M.J., Lindner, D., Cross, E.F., Schlesinger, M.E. 2012. Causes of the global warming observed since the 19th century. Atmospheric and Climate Sciences 2 (4), 401–415. doi: 10.4236/acs.2012.24035.	Measurements show that the Earth's global-average near-surface temperature has increased by about 0.8 °C since the 19th century. It is critically important to determine whether this global warming is due to natural causes, as contended by climate contrarians, or by human activities, as argued by the Intergovernmental Panel on Climate Change. This study updates our earlier calculations which showed that the observed global warming was predominantly human-caused. Two independent methods are used to analyze the temperature measurements: Singular Spectrum Analysis and Climate Model Simulation. The concurrence of the results of the two methods, each using 13 additional years of temperature measurements from 1998 through 2010, shows that it is humanity, not nature, that has increased the Earth's global temperature since the 19th century. Humanity is also responsible for the most recent period of warming from 1976 to 2010. Internal climate variability is primarily responsible for the early 20th century warming from 1904 to 1944 and the subsequent cooling from 1944 to 1976. It is also found that the equilibrium climate sensitivity is on the low side of the range given in the IPCC Fourth Assessment Report.	Explicitly endorsing AGW with quantification	Ring et al. (2012) did not calculate a sensitivity range, but rather estimated equilibrium warming with a spectral decomposition model of the four main global temperature data sets, fit to long-lived greenhouse gases, compensating aerosols, changes in tropospheric ozone and land use, solar irradiance, and volcanic activity in a model estimating land and ocean temperatures, with a 40-layer oceanic model to allow for latitudinal advection of heat. Their equilibrium temperature change ranged from 1.5 to 2.0 °C, and they noted …. These are on the low end of the estimates in the IPCC's Fourth Assessment Report.[1] So, while we find that most of the observed warming is due to human emissions of [long-lived greenhouse gases], future warming based on these estimations will grow more slowly than that under the IPCC's "likely" range of climate sensitivity, from 2.0 °C to 4.5°.
McDermott, F., Mattey, D.P., and Hawkesworth, C. 2001. Centennial-scale Holocene climate variability revealed by a high-resolution speleothem δ18O record from SW Ireland. Science 294, 1328–1331.	Evaluating the significance of Holocene submillennial δ18O variability in the Greenland ice cores is crucial for understanding how natural climate oscillations may modulate future anthropogenic warming. A high-resolution oxygen isotope record from a speleothem in southwestern Ireland provides evidence for centennial-scale δ18O variations that correlate with subtle δ18O changes in the Greenland ice cores, indicating regionally coherent variability in the early Holocene. Evidence for previously undetected early Holocene cooling events is presented, but mid- to late-Holocene ice rafting in the North Atlantic appears to have had little impact on δ18O at this ocean margin site.	Explicitly endorsing AGW without quantification	McDermott et al. (2001) derived a δ18O record from a stalagmite discovered in Crag Cave in southwestern Ireland. They compared this record with the δ18O records from the GRIP and GISP2 ice cores from Greenland. They found "centennial-scale δ 18O variations that correlate with subtle δ18O changes in the Greenland ice cores, indicating regionally coherent variability in the early Holocene." They also report the Crag Cave data "exhibit variations that are broadly consistent with a Medieval Warm Period at ~1000 ± 200 years ago and a two-stage Little Ice Age, as reconstructed by inverse modeling of temperature profiles in the Greenland Ice Sheet." Also evident in the Crag Cave data were the δ18O signatures of the earlier Roman Warm Period and Dark Ages Cold Period. The three researchers note the coherent δ18O variations in the records from both sides of the North Atlantic "indicate that many of the subtle multicentury δ18O variations in the Greenland ice cores reflect regional North Atlantic margin climate signals rather than local effects." Their data confirm the reality of the Medieval Warm Period/Little Ice Age cycle and the prior and

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Bibliographic data	Abstract quotation	Category of endorsement	In-text citation as not supporting the IPCC claims
			even-more-strongly expressed Roman Warm Period/Dark Ages Cold Period cycle.
Cameron-Smith, P., Elliott, S., Maltrud, M., Erickson, D., and Wingenter, O. 2011. Changes in dimethyl sulfide oceanic distribution due to climate change. Geophysical Research Letters 38, 10.1029/2011GL047069.	Dimethyl sulfide (DMS) is one of the major precursors for aerosols and cloud condensation nuclei in the marine boundary layer over much of the remote ocean. Here we report on coupled climate simulations with a state-of-the-art global ocean biogeochemical model for DMS distribution and fluxes using present-day and future atmospheric CO2 concentrations. We find changes in zonal averaged DMS flux to the atmosphere of over 150% in the Southern Ocean. This is due to concurrent sea ice changes and ocean ecosystem composition shifts caused by changes in temperature, mixing, nutrient, and light regimes. The largest changes occur in a region already sensitive to climate change, so any resultant local CLAW/Gaia feedback of DMS on clouds, and thus radiative forcing, will be particularly important. A comparison of these results to prior studies shows that increasing model complexity is associated with reduced DMS emissions at the equator and increased emissions at high latitudes.	Implicitly endorsing AGW	Noting “models for the distribution of marine DMS have lately been increasing in number and complexity, such that a regional portrait of their evolving climate response is constructible,” Cameron-Smith et al. (2011) employed the most recent version of the Community Climate System Model (CCSM), described by Collins et al. (2006), to produce the first marine sulfur simulations performed with what they refer to as “the most sophisticated ocean sulfur cycle model yet reported.” […]Cameron-Smith and colleagues conclude, “in global estimates involving constant upward or downward DMS flux changes, average planetary surface temperatures separate by three or more degrees Celsius,” citing the work of Charlson et al. (1987) and Gunson et al. (2006). This strong biological response to a CO2-induced impetus for warming can result in a greatly strengthened negative regional feedback that results in more incoming solar radiation being reflected back to space with enhanced regional cooling. The resulting DMS-enhanced “thermal insulating” of Antarctica from the rest of the world by this mechanism could significantly reduce the propensity for that continent’s ice sheets to lose mass and contribute to sea level rise, even in a world that is experiencing a net warming.
Hormes, A., Müller, B.U., and Schlüchter, C. 2001. The Alps with little ice: evidence for eight Holocene phases of reduced glacier extent in the Central Swiss Alps. The Holocene 11: 255–265.	Glacially deformed pieces of wood, organic lake sediments and clasts of reworked peat have been collected in front of Alpine glaciers since AD 1990. The palaeoglaciological interpretation of these organic materials is related to earlier phases of glacier recession surpassing that of today’s shrunken glaciers and to tree growth and peat accumulation in the valleys now occupied by the glaciers. Glacial transport of the material is indicated by wood anatomy, incorporated silt, sand and gravel particles, missing bark and deformed treerings. A total of 65 samples have been radiocarbon dated so far, and clusters of dates provide evidence of eight phases of glacier recession: 9910–9550, 9010–7980, 7250–6500, 6170–5950, 5290–3870, 3640–3360, 2740–2620 and 1530-1170 calibrated years BP. Allowing for the timelag between climatic fluctuations, glacier response and vegetation colonization, these recession phases may lag behind climatic changes by 100–200 years.	No position	Other European glaciers show a different pattern and have not experienced consistent, progressive loss of mass. For example, glaciers in the Central Swiss Alps experienced two periods of advance, around 1920 and 1980 (Hormes et al., 2001).
Yamano, H., Kayanne, H., Yamaguchi, T., Kuwahara, Y., Yokoki, H., Shimazaki, H., and Chikamori, M. 2007. Atoll island vulnerability to flooding and inundation revealed by historical reconstruction: Fongafale Islet, Funafuti Atoll, Tuvalu: Global and Planetary Change 57: 407–416.	The reef islands formed on coral atolls are generally small, low, and flat, with elevations of only a few meters. These islands are thus highly vulnerable to elevated sea levels caused by extreme events and global warming. Such vulnerability was recently evidenced at Fongafale Islet, the capital of Tuvalu, when it flooded during accelerated spring high tides possibly related to sea level rise caused by global warming. Many factors, not only environmental but also economic and social, determine the vulnerability of an island to sea level rise. In this study, we used data spanning 108 yrs to reconstruct changes in topography, land use/cover, population, and the distribution of buildings at Fongafale Islet. The results indicate that the vulnerability of Fongafale Islet relates to its original landform characteristics: the central part of the island was formerly dominated by swampland that flooded at high tides. Fongafale Islet experienced greater	No position with axiomatic reference on AGW	Connell (2003) found no evidence for the oft-repeated island doomsday claims about Tuvalu. Yamano et al. (2007) assessed 108 years of data for Fongafale Islet, Tuvalu, and found the problems attributed to sea-level rise in fact were due to population pressures resulting in the occupation of swamp land subject to periodic flooding throughout the historical record, thus demonstrating the great importance of real-world data—as opposed to climate model simulations—when it comes to considering the current and future status of Earth’s many low-lying islands. As Yamano et al. (2007) state, “examinations of global environmental issues should focus on characteristics specific to the region of interest. These characteristics should be specified using historical reconstruction to understand and address the vulnerability of an area to global environmental changes.”

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Bibliographic data	Abstract quotation	Category of endorsement	In-text citation as not supporting the IPCC claims
	population in-migration and centralization beginning in the 1970s following the independence of Tuvalu and Kiribati. Migrants were also responding to declines in overseas mining operations and limited options for paid employment. As the population increased, construction took place in vulnerable swampland areas. Our results clearly demonstrate that examinations of global environmental issues should focus on characteristics specific to the region of interest. These characteristics should be specified using historical reconstruction to understand and address the vulnerability of an area to global environmental changes.		

References

Anderegg, W.R.L., Prall, J.W., Harold, J., Schneider, S.H., 2010. Expert credibility in climate change. Proc. Natl. Acad. Sci. 107, 12107–12109. www.pnas.org/cgi/doi/10.1073/pnas.1003187107.

Beck, S., Mahony, M., 2018. The IPCC and the new map of science and politics. Wiley Interdiscip. Rev. Clim. Change 9 (6). https://doi.org/10.1002/wcc.547.

Benestad, R.E., Nuccitelli, D., Lewandowsky, S., et al., 2016. Learning from mistakes in climate research. Theor. Appl. Climatol. 126 (3), 699–703. https://doi.org/10.1007/s00704-015-1597-5.

Betts, R., 2013, May 16. So Who's Not in the 97%? Retrieved from. http://bishophill.squarespace.com/discussion/post/2125495. (Accessed 25 January 2019).

Björnberg, K.E., Karlsson, M., Gilek, M., Hansson, S.O., 2017. J. Clean. Prod. 167, 229e241. https://doi.org/10.1016/j.jclepro.2017.08.066.

Boussalis, C., Coan, T.G., 2016. Text-mining the signals of climate change doubt. Clim. Change 36, 89–100. https://doi.org/10.1016/j.gloenvcha.2015.12.001.

Bray, D., 2010. The scientific consensus of climate change revisited. Environ. Sci. Policy 13, 340–350. https://doi.org/10.1016/j.envsci.2010.04.001.

Cann, H.W., 2015. Climate change, still challenged: conservative think tanks and skeptic frames. In: Presented at the Annual Meeting of the Western Political Science Association Las Vegas, April 2-4, 2015. Retrieved from. https://wpsa.research.pdx.edu/papers/docs/wpsa15%20-%20cann.pdf. (Accessed 25 January 2019).

Carlton, J.S., Perry-Hill, R., Huber, M., Prokopy, L.S., 2015. The climate change consensus extends beyond climate scientists. Environ. Res. Lett. 10 (9), 094025 https://doi.org/10.1088/1748-9326/10/9/094025.

Carolan, M.S., 2008. The multidimensionality of environmental problems: the GMO controversy and the limits of scientific materialism. Environ. Values 17 (1), 67–82. https://doi.org/10.3197/096327108X271950.

Collingridge, D., Reeve, C., 1986. Science Speaks to Power: the Role of Experts in Policy Making. St. Martin's Press, New York, NY.

Collins, H.M., Evans, R., 2002. The third wave of science studies: studies of expertise and experience. Soc. Stud. Sci. 32 (2), 235–296. https://doi.org/10.1177/0306312702032002003.

Cook, J., 2016. Countering Climate Science Denial and Communicating Scientific Consensus. Oxford University Press, Oxford Encyclopedia of Climate Change Communication, London.

Cook, J., Lewandowsky, S., 2016. Rational irrationality: modeling climate change belief polarization using bayesian networks. Top. Cogn. Sci. 8 (1), 160–179. https://doi.org/10.1111/tops.12186.

Cook, J., Nuccitelli, D., Green, S.A., Richardson, M., Winkler, B., Painting, R., et al., 2013. Quantifying the consensus on anthropogenic global warming in the scientific literature. Environ. Res. Lett. 8 (2), 024024 https://doi.org/10.1088/1748-9326/8/2/024024.

Cook, J., Nuccitelli, D., Skuce, A., Way, R., Jacobs, P., Painting, R., Lewandowsky, S., Coulter, A., 2014a. 24 critical errors in Tol (2014): reaffirming the 97% consensus on anthropogenic global warming. Retrieved from. http://www.skepticalscience.com/docs/24_errors.pdf. (Accessed 25 January 2019).

Cook, J., Nuccitelli, D., Skuce, A., Way, R., Jacobs, P., Painting, R., Honeycutt, R., Green, S.A., 2014b. Reply to Comment on 'Quantifying the consensus on anthropogenic global warming in the scientific literature: a Reanalysis. Energy Policy 73, 706–708. https://doi.org/10.1016/j.enpol.2014.06.002.

Cook, J., Oreskes, N., Doran, P.T., Anderegg, W.R.L., Verheggen, B., Maibach, E.W., Carlton, J.S., Lewandowsky, S., Skuce, A.G., Green, S.A., Nuccitelli, D., Jacobs, P., Richardson, M., Winkler, B., Painting, R., Rice, K., 2016. Consensus on consensus: a synthesis of consensus estimates on human-caused global warming. Environ. Res. Lett. 11, 048002 https://doi.org/10.1088/1748-9326/11/4/048002.

Curtis, T., et al., 2012, February 22. Sorry john. Skeptical science forum. Retrieved from. http://www.hi-izuru.org/forum/The%20Consensus%20Project/2012-02-22-Sorry%20John.html. (Accessed 25 January 2019).

Devlin, W.J., Bokulich, A., 2015. Introduction. In: Devlin, W.J., Bokulich, A. (Eds.), Kuhn's Structure of Scientific Revolutions—50 Years on. Springer, pp. 1–10.

Ding, D., Maibach, E.W., Zhao, X., Roser-Renouf, C., Leiserowitz, A., 2011. Support for climate policy and societal action are linked to perceptions about scientific agreement. Nat. Clim. Chang. 1 (9), 462. https://doi.org/10.1038/nclimate1295.

Doran, P., Zimmerman, M., 2009. Examining the scientific consensus on climate change. Eos, Trans. Am. Geophys. Union 90, 21–22. https://doi.org/10.1029/2009EO030002.

Fahnestock, J., 1986. Accomodating science: the rhetorical life of scientific facts. Writ. Commun. 3 (3), 275–296. https://doi.org/10.1177/0741088386003003001.

Farmer, G.T., Cook, J., 2013. Understanding climate change denial. In: Climate Change Science: A Modern Synthesis. Springer, Dordrecht, pp. 445–466.

Goeminne, G., 2011. Has science ever been normal? On the need and impossibility of a sustainability science. Futures 43, 627–636.

Golinski, J., 2005. Making Natural Knowledge. Constructivism and the History of Science. The University of Chicago Press.

Gross, A.G., 2006. Starring the Text. The Place of Rhetoric in Science Studies. Southern Illinois University Press, Carbondale.

Grundmann, R., 2012. The legacy of climategate: revitalizing or undermining climate science and policy? Wiley Interdiscip. Rev. Clim. Change 3 (3), 281–288. https://doi.org/10.1002/wcc.166.

Grundmann, R., 2013. "Climategate" and the scientific ethos. Sci. Technol. Hum. Values 38 (1), 67–93. https://doi.org/10.1177/0162243911432318.

Hobbs, F.. What is there a 97% consensus about? Climate Etc. Retrived from. https://judithcurry.com/2015/12/20/what-is-there-a-97-consensus-about/. (Accessed 20 December 2015).

Hulme, M., 2009. Why We Disagree about Climate Change. Understanding Controversy, Inaction and Opportunity. Cambridge University Press, New York.

Hulme, M., February 4, 2014. Science can't settle what should be done about climate change. Retrieved from. https://theconversation.com/science-cant-settle-what-should-be-done-about-climate-change-22727.

Hulme, M., Mahony, M., 2010. Climate change: what do we know about the IPCC? Prog. Phys. Geogr. 34 (5), 705–718. https://doi.org/10.1177/0309133310373719.

Hyland, K., 2002. In: Flowerdew, J. (Ed.), Activity and Evaluation: Reporting Practices in Academic Writing, Academic Discourse. Longman, London, pp. 115–130.

Hyland, K., 2006. Disciplinary differences: language variation in academic discourses. In: Hyland, K., Bondi, M. (Eds.), Academic Discourse across Disciplines. Frankfort: Peter Lang, pp. 17–45.

Hyland, K., Salager-Meyer, F., 2008. Science writing. Annu. Rev. Inf. Sci. Technol. 42, 297–338. https://doi.org/10.1002/aris.2008.1440420114.

Idso, C.D., Carter, R.M., Singer, S.F. (Eds.), 2013. Climate Change Reconsidered II: Physical Science. The Heartland Institute, Chicago, IL, p. 993.

IPCC, 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge and New York, NY.

Jankó, F., Móricz, N., Papp-Vancsó, J., 2014. Reviewing the climate change reviewers: exploring controversy through report references and citations. Geoforum 56, 17–34. https://doi.org/10.1016/j.geoforum.2014.06.004.

Jankó, F., Papp-Vancsó, J., Móricz, N., 2017. Is climate change controversy good for science? IPCC and contrarian reports in the light of bibliometrics. Scientometrics. https://doi.org/10.1007/s11192-017-2440-9.

Kahan, D.M., 2015. Climate-science communication and the measurement problem. Adv. Political Psychol. 36, 1–43. https://doi.org/10.1111/pops.12244.

Kahan, D.M., Jenkins-Smith, H., Braman, D., 2011. Cultural cognition of scientific consensus. J. Risk Res. 14, 147–174. https://doi.org/10.1080/13669877.2010.511246.

Kahan, D.M., Peters, E., Wittlin, M., Slovic, P., Ouellette, L.L., Braman, D., Mandel, G., 2012. The polarizing impact of science literacy and numeracy on perceived climate change risks. Nat. Clim. Chang. 2, 732–735. https://doi.org/10.1038/nclimate1547.

Kuhn, T.S., 1970. The Structure of Scientific Revolutions, second ed. University of Chicago Press, Chicago.
Latour, B., 1987. Science in Action. How to Follow Scientists and Engineers through Society. Harvard University Press, Cambridge, Massachusetts, p. 274.
Lewandowsky, S., Gignac, G.E., Vaughan, S., 2013. The pivotal role of perceived scientific consensus in acceptance of science. Nat. Clim. Chang. 3 (4), 399–404. https://doi.org/10.1038/nclimate1720.
Maessen, C., 2013, September 16. 97% Climate consensus 'denial': the debunkers again not debunked. Retrieved from. https://www.realskeptic.com/2013/09/16/97-climate-consensus-denial-the-debunkers-again-not-debunked/. (Accessed 25 January 2019).
Marx, W., Haunschild, R., French, B., Bornmann, L., 2017. Slow reception and undercitedness in climate change research: a case study of Charles David Keeling, discoverer of the risk of global warming. Scientometrics 112 (2), 1079–1092. https://doi.org/10.1007/s1119.
McCright, A.M., Dunlap, R.E., Xiao, C., 2013. Perceived scientific agreement and support for government action on climate change in the USA. Clim. Change 119 (2), 511–518. https://doi.org/10.1007/s10584-013-0704-9.
Neil, A., 2013, July 22. Andrew Neil on Ed Davey climate change interview critics. Retrived from. https://www.bbc.com/news/uk-politics-23405202. (Accessed 25 January 2019).
Nuccitelli, D., 2013, July 29. An accurately informed public is necessary for climate policy. Making Science Public. Retrieved from. http://blogs.nottingham.ac.uk/makingsciencepublic/2013/07/29/an-accurately-informed-public-isnecessary-for-climate-policy/. (Accessed 25 January 2019).
Oreskes, N., 2004. Beyond the ivory tower: the scientific consensus on climate change. Science 306. https://doi.org/10.1126/science.1103618, 1686–1686.
Oreskes, N., 2007. The Scientific Consensus on Climate Change: How Do We Know We're Not Wrong? Climate Change: what it Means for Us, Our Children, and Our Grandchildren. MIT Press, Cambridge, MA. www.lpl.arizona.edu/sites/default/files/resources/globalwarming/oreskes-chapter-4.pdf. (Accessed 25 January 2019).
Pearce, W., Grundmann, R., Hulme, M., Raman, S., Kershaw, E.H., Tsouvalis, J., 2017. Beyond counting climate consensus. Environ. Commun. https://doi.org/10.1080/17524032.2017.1333965.
Pearce, W., Mahony, M., Raman, S., 2018. Science advice for global challenges: learning from trade-offs in the IPCC. Environ. Sci. Policy 80, 125–131. https://doi.org/10.1016/j.envsci.2017.11.017.
Pielke Jr., R.A., 2007. The Honest Broker. Cambridge University Press, Cambridge.
Pile, B., 2013, July 23. . What's behind the Battle of Received Wisdoms? Making Science Public. Retrieved from. http://blogs.nottingham.ac.uk/makingsciencepublic/2013/07/23/whats-behind-the-battle-of-received-wisdoms/. (Accessed 25 January 2019).
Powell, J.L., 2015. Climate scientists virtually unanimous: anthropogenic global warming is true. Bull. Sci. Technol. Soc. 35 (5–6), 121–124. https://doi.org/10.1177/0270467616634958.
Russill, C., 2018. The "danger" of consensus messaging: or, why to shift from skeptic-first to migration-first approaches. Front. Commun. 3 (37) https://doi.org/10.3389/fcomm.2018.00037.
Shwed, U., Bearman, P.S., 2010. The temporal structure of scientific consensus formation. Am. Sociol. Rev. 75 (6), 817–840. https://doi.org/10.1177/0003122410388488.
Skuce, A.G., Cook, J., Richardson, M., Winkler, B., Rice, K., Green, S.A., Jacobs, P., Nuccitelli, B., 2017. Does it matter if the consensus on anthropogenic global warming is 97% or 99.99%? Bull. Sci. Technol. Soc. 36, 150–156. https://doi.org/10.1177/0270467617702781.
Tol, R.S.J., 2014. Quantifying the consensus on anthropogenic global warming in the literature: a re-analysis. Energy Policy 73, 701–705. https://doi.org/10.1016/j.enpol.2014.04.045.
Tol, R.S.J., 2016. Comment on "quantifying the consensus on anthropogenic global warming in the scientific literature". Environ. Res. Lett. 11, 048001 https://doi.org/10.1088/1748-9326/11/4/048001.
van der Linden, S., Leiserowitz, A.A., Feinberg, G.D., Maibach, E.W., 2014. How to communicate the scientific consensus on climate change: plain facts, pie charts or metaphors? Clim. Change 126, 255–262. https://doi.org/10.1007/s10584-014-1190-4.
van der Linden, S., Leiserowitz, A.A., Feinberg, G.D., Maibach, E.W., 2015. The scientific consensus on climate change as a gateway belief: experimental evidence. PLoS One 10 (2), e0118489. https://doi.org/10.1371/journal.pone.0118489.
Verheggen, B., Strengers, B., Cook, J., van Dorland, R., Vringer, K., Peters, J., Visser, H., Meyer, L., 2014. Scientists' views about attribution of global warming. Environ. Sci. Technol. https://doi.org/10.1021/es501998e.
Völker, C., Kramm, J., Wagner, M., 2019. On the creation of risk: framing of microplastics risks in science and media. Glob. Chall. https://doi.org/10.1002/gch2.201900010.