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‘Global warming is not a crisis!’

Studying climate change skepticism on the Web

Sabine Niederer

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Introducing the skeptics, or ‘Global warming is not a crisis!’

This article makes a contribution to the study of the climate controversy by using Web data to research the status of skepticism within the climate debate. In March 2008 the Heartland Institute, a Chicago-based libertarian public policy think-tank, organised the first international conference for climate change skeptics with the theme ‘Can You Hear Us Now? Global Warming is Not a Crisis!’ The event format was that of a traditional scientific conference with three days of parallel sessions and keynote speakers as well as online proceedings. In his opening remarks Heartland’s president Joseph L. Bast stressed that the conference featured talks by over 200 scientists and other experts from leading universities and organisations from all over the world. Bast stated that

[t]hese scientists and economists have been published thousands of times in the world’s leading scientific journals and have written hundreds of books. If you call this the fringe, where’s the center?²

Other descriptions of climate change skeptics be it by watchdogs, journalists, or scientific analysts paint a less flattering picture. Scholars emphasise how skeptics effectively keep the climate controversy alive.³ Skeptics are often criticised for having strong ties to industry as described in books such as *Merchants of Doubt* and *Doubt is their Product*, as well as the report ‘Smoke, Mirrors and Hot Air: How ExxonMobil Uses Big Tobacco’s Tactics

to Manufacture Uncertainty on Climate Change' and various academic papers.⁴ These publications describe how industry-funded skeptics insist on the lack of consensus on anthropogenic (i.e. human-induced) global warming, similar to how tobacco industry-funded research insists on a lack of proof of the health risks of smoking.

Greenpeace's Exxonsecrets watchdog project shows key scientists, spokespeople, and organisations that have received Exxon-Mobil funding since 1998. Figure 1 shows a map of the affiliations of the prominent climate change skeptics Willie Soon and Sally Baliunas and depicts which of those organisations (have) receive(d) funding from ExxonMobil.⁵ On the left Soon is depicted as having six institutional affiliations (for instance with the George C. Marshall Institute and the Fraser Institute) – four of which have received funding from ExxonMobil and one of which is the American Petroleum Institute. On the right-hand side Baliunas is shown to hold 11 institutional relations, 10 of which have received ExxonMobil money and one of which is also the American Petroleum Institute.

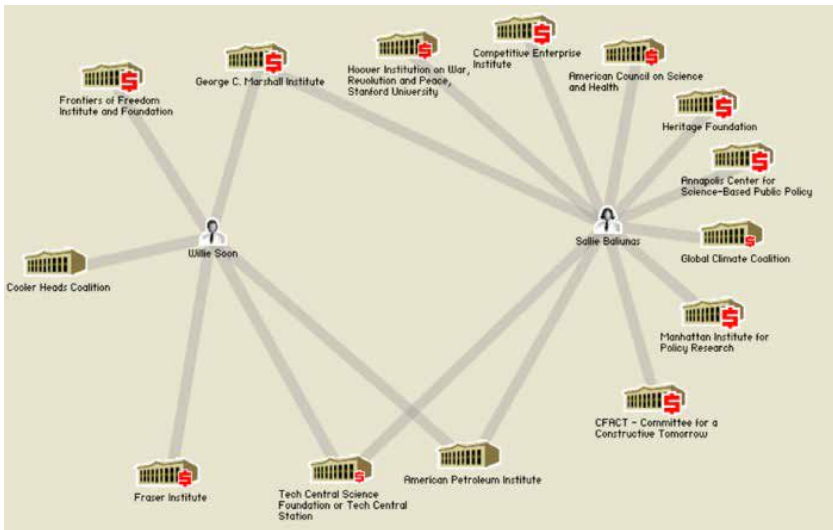


Fig. 1: Exxonsecrets map showing the institutional relationships of Willie Soon (left) and Sallie Baliunas (right) and their funding by Exxon-Mobil since 1998.

Rather than zooming in on the industrial ties of these researchers this study zooms out and looks at the place and status of climate change skepticism within the climate debate. The central question harkens back to the opening statement of the first international climate change skeptic conference and

turns it into a question, asking if climate change skeptics are indeed in the 'center' or mainstream of climate change debates. The main analysis relies on a combination of three methodological approaches: scientometric analysis, hyperlink analysis, and resonance analysis. Finally, I explore the issue commitment of the skeptics by looking at their (non-) scientific publications on topics other than climate change.

The first site of analysis is that of scientific publications as studied through citation analysis as part of scientometrics, an approach built on citing behavior and referencing as part of the norms and rules of scientific writing.⁶ This citing behavior as indexed by ISI Web of Science provides us with a data set of interlinked scientific publications. Here I study over 15,000 scientific articles on climate change that have been cited at least three times to find whether these skeptics are indeed part of a scientific mainstream.

I also consider hyperlinks. New media scholar Richard Rogers describes how links are both the indicator of reputation and the performance of a 'politics of association'.⁷ For example, not all organisations link to all organisations – they rather link to an organisation they want to be associated with. For the analysis of climate change skepticism I choose a national perspective where the starting points are sets of 'national' skeptics. As part of a larger comparative study of the climate change controversy in which skeptics of various countries are analysed and compared⁸ I examine both Dutch and French examples. I first compare the hyperlink networks of short-listed Dutch and French skeptics with those of the opposing climate scientists. Hyperlinks can be theorised as reputational markers and politics of association but also as traces of group formation. This analysis builds on the work of philosopher and anthropologist Bruno Latour who, in his influential book *Re-assembling the Social*, describes how there are no groups 'without a rather large retinue of group makers, group talkers, and group holders'.⁹

A third way of measuring the reputation of actors and their viewpoints within the issue can be described as 'resonance analysis'. Making use of Google results for the query 'climate change' I measure the presence (and absence) of climate change skeptics as well as other scientists in the top results. Do the skeptics make it into the top results? Which sources of the top 100 are most 'skeptical-friendly' – i.e. mention these short-listed skeptics most frequently? Last, I analyse whether the *skepticism* of climate change skeptics is confined to the topic of climate change alone. By looking at their academic and popular publications I collect their viewpoints beyond climate change and further complicate the characterisation of these influential actors in the climate change debate.

It is of importance, however briefly, to address the terminology used in this article. I use ‘climate change skeptic’ as an umbrella term for those skeptical of the anthropogenic (human) causes and the unprecedented nature of climate change (global warming as well as global cooling). I choose the term skeptic over ‘denialist’, a term often used by the opposition to these actors; the term ‘alarmist’ is used by climate change skeptics to describe their opposition. Both ‘deniers’ and ‘alarmists’ are labels used by others to describe these specific actors, not by the actors to describe themselves. In a Latourian tradition I choose to follow the actors’ language as much as possible and therefore also use ‘climate change’ and not the more limiting term ‘global warming’. All scientists are ‘skeptical’ to a certain extent, so when I use the term ‘non-skeptical climate scientists’ it refers to scientists who do not publish skeptical articles on the anthropogenic causes or unprecedented effects of climate change.

The hockey stick as controversy object

I previously mentioned the work by Latour which describes how groups exist merely at instances of formation. Actors within a controversy not only form groups during gatherings such as events but also in publications or in interlinked websites; actors also form groups by sharing specific topics or objects. These shared topics and objects, which I would like to refer to here as ‘controversy objects’, are often the focus of watchdogs and such websites as skepticalscience.com (run by John Cook, co-author of *The Scientific Guide to Global Warming Skepticism* and *Climate Change Denial: Heads in the Sand*). On this website Cook and colleagues collect skeptical articles and list their main arguments; a thermometer on the homepage shows the top 10 (Figure 2). There is also a Skeptical Science smartphone application with which you can report skeptical arguments that you have encountered to add to the repository. Once submitted the application serves a brief description of ‘what science says’ on that particular topic.¹⁰



Fig. 2: Thermometer on the *Skepticalscience.com* homepage, with '[m]ost used climate myths, and what the science really says...'

In February 2013 the top result was 'climate's changed before' – a statement that also resonates in the Heartland 08 slogan 'Global warming is not a crisis'. In the next section I will briefly address this talking point by discussing perhaps the most well-known controversy object of climate change: the hockey stick graph.

'Climate's changed before'

In 1999 Michael Mann et al. published an influential paper on temperature fluctuations over the millennium.¹¹ The researchers analyse data from temperature as well as tree ring and ice core measurements (and other 'proxies') and conclude that the late 20th century warmth was indeed anomalous. The accompanying graph shows a thick black line that indicated temperature variations over the past 1,000 years (Figure 3) where the gray area in the background represents the uncertainty limit. The thicker black line is later dubbed the 'hockey stick', powerfully demonstrating a sharp and unprecedented rise in global temperatures since the late 20th century. The hockey stick has been widely published, for instance in the IPCC report of 2001. In the film *An Inconvenient Truth* (Davis Guggenheim, 2006) Al Gore projected a graph showing rises in temperatures and CO₂ levels and used a lift to follow the line all the way up to the top of the screen.

In response Soon and Baliunas published a paper in 2003 in the peer-reviewed journal *Climate Research* criticising the research by Mann et al.¹² In their critique Soon and Baliunas referred to research from the 1960s that included findings of both an ‘early ice age’ and a ‘warm medieval period’ (as represented in Figure 4) and rejected the hockey stick graph as well as other research that had referred to these earlier periods as being ‘not global’.¹³

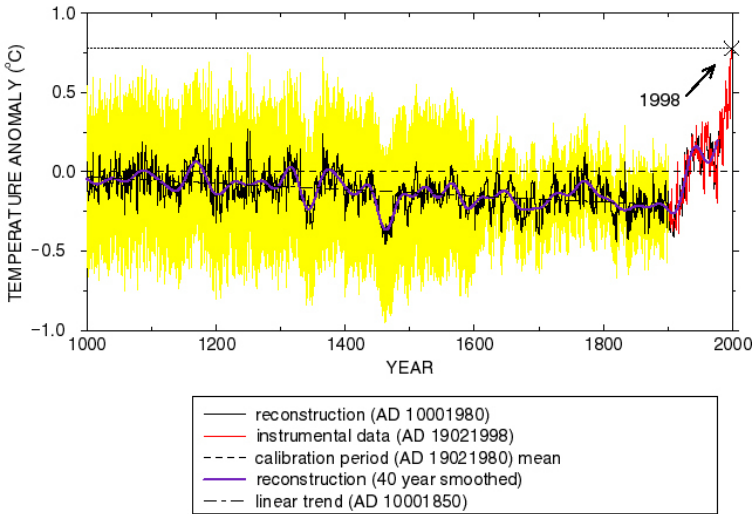


Fig. 3: The so-called ‘hockey stick graph’, Millennial Temperature Reconstruction by Mann et al. (1999).

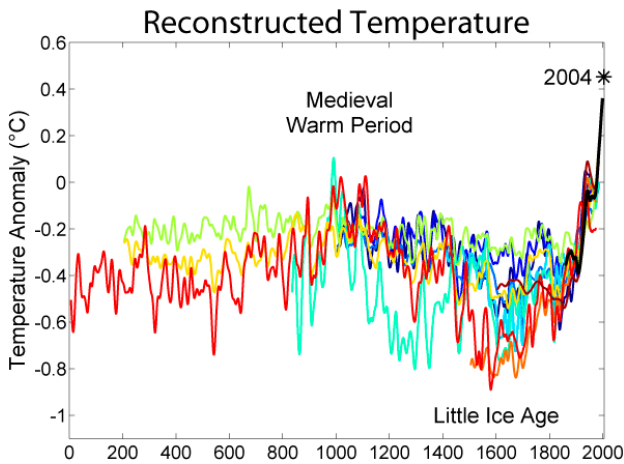


Fig. 4: Example of a graph including a medieval warm period as well as little ice age. The black line is the ‘hockey stick’ by Mann et al.

A longer version of this paper co-authored with skeptics Craig and Sherwood Idso and David Legates was published in the journal *Energy and Environment* two months later. Many of the scientists whose work was referenced in these papers objected to the representation of their data and misuse of their findings in this context and many co-authored a letter in the journal *Eos*.¹⁴ Eventually the criticism of the article and the peer-review process behind its publication led to the resignation of the editor-in-chief of *Climate Research* and part of its standing review panel. However, this did not close the case. With the 2009 Climategate scandal and the oft-cited ‘Mike’s Nature Trick’ (a sentence in one of the leaked emails referring to the making of the hockey stick graph) the discussion around the graph, the data, and methods used once again reached a high point.

Controversy objects are one means of identifying group formation. This article will classify other instances thereof in a contribution to the mapping of the climate change controversy and the place and status of climate change skeptics in that ‘issue space’. Before applying three methods of Web analysis of (the skeptics within) the climate change controversy (link analysis, Web resonance analysis, and actor-issue commitment analysis) I will start the mapping within science. Here I will make use of ISI Web of Science to chart the position of these skeptical scientists within climate science and then test how ‘fringe’ or ‘mainstream’ the skeptics are.

Climate change skeptics: Mainstream or fringe?

The first case study is a scientometric analysis of the skeptics’ position within climate science in which I compare the composition of disciplines and journals of climate change skeptics to those of the non-skeptical view. The first question in this analysis is whether climate change skepticism resembles climate science (that is, non-skeptical climate science). In other words should we consider skeptical climate science to be its own field in the sense of the particular distribution of disciplines or does the composition of skeptic climate science mirror that of the rest of climate science?

To answer these questions a list of prominent skeptics is compiled. There are a series of lists with climate change skeptics available including Wikipedia entries, compilations by the previously mentioned watchdogs, as well as outcomes from academic analysis. Triangulation of online lists with the line-up of keynote speakers at the Heartland conference of 2008 results in a short list of 15 prominent skeptics: Sallie Baliunas, Joseph Bast, Paul Driessen, William Gray, Sherwood Idso, Václav Klaus, Richard Lindzen,

Patrick Michaels, Steven Milloy, Frederick Seitz, S. Fred Singer, Willie Soon, Roy Spencer, John Stossel, and James M. Taylor.¹⁵

Subsequently I query ISI Web of Science for all articles on 'climate change'. On 9 July 2008 there were approximately 27,000 articles, 15,877 of which receive at least three citations which form the list of articles retained for the analysis. Using that data set of nearly 16,000 articles and the list of skeptics I compare the disciplines of the journals in which significant climate change articles appear to those of the skeptics and their co-authors. From this first analysis I find that seven out of the top 10 disciplines in the climate sciences are present in the skeptics' top 10: ecology, meteorology and atmospheric sciences, multidisciplinary sciences, environmental sciences, interdisciplinary geosciences, plant sciences, and agronomy. The climate change skeptics' scientific composition matches that of climate science in general besides having some signature disciplines of its own in the top 10, namely astronomy and astrophysics, biochemistry and molecular biology, and medicinal chemistry. Disciplines unique to the rest of climate science are multidisciplinary sciences, forestry, and environmental engineering. These results show that on the level of the disciplines engaged in the topic skeptical climate science is part of climate science and not positioned outside the field. Knowing the place of climate change skeptics within the climate science disciplines I now want to test how 'mainstream' or 'fringe' climate change skeptics' publications are. Do the skeptics and their co-authors publish articles in the same journals and are these significant in the field (i.e. receiving the most citations for climate change-related articles)?

Using the ISI result files and ReseauLu (the network analysis software) I compare which journals *do not* publish skeptics at all, which publish *only* skeptics, and which journals publish *both* skeptics as well as non-skeptical views. Here it is found that the skeptics publish in the top four climate journals (which are in the shared nodes in the center). This may be counterintuitive especially when thinking about the readings of the climate change skeptics' 'lobby' in which these actors are described as a relatively small but powerful group of scientists of which 'the most vocal skeptics were *not* qualified, were *not* working in the field'.¹⁶

Figure 5 shows the visualisation of the results. In the centre we see the shared nodes. These are the 30 publications that publish articles (cited at least three times) by skeptics as well as others. The shared journals include prominent academic publications such as: *Nature*, *Science*, *Journal of Climate*, *Geophysical Research Letters*, *Journal of Geophysical Research*, and *Climatic Change*. This is where climate change skepticism overlaps or resides within the rest of climate science. On the left are the journals that

do not publish work by our short-listed skeptics and their co-authors. On the right are the nodes that represent the journals that publish only the works of climate change skeptics.

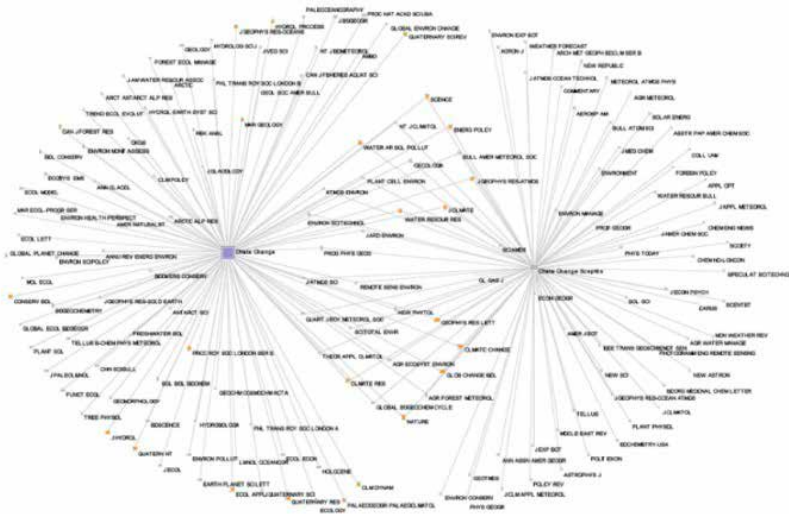


Fig. 5: ReseauLu Map showing journal publications for climate science and skeptics. The middle section holds the shared journals, including Science (at the very top of the middle section), and Nature (the bottom node in the middle section).

This comparative scientometric analysis (of articles cited at least three times) shows that the climate change skeptics are indeed part of the scientific mainstream of climate change research. Although the skeptics have their own specific outlets (which would be an interesting topic for further research, as would be an analysis of the journals not publishing any skeptical research) their main disciplines and journals are part of mainstream climate science. The climate change skeptics cannot be characterised as merely a fringe; important to mention here is research that two separate analyses of global warming-related article abstracts through ISI have found no ‘disagree[ment] with the consensus position’¹⁷ and that ‘an overwhelming percentage (97.2% based on self-ratings, 97.1% based on abstract ratings) endorses the scientific consensus on A[nthropogenic] G[lobal] W[arming]’.¹⁸

The analysis of the place and status of actors within climate science ISI and the large subset of cited academic papers is an entry point that filters out the less relevant outlets (un-cited papers). The Web and its search engines know a related logic that enables a means of analysis similar to

citation analysis. As described by Sergey Brin and Lawrence Page in 1998 when they presented their Google prototype, the search engine algorithm treats hyperlinks almost like a web of science would treat a citation. ‘Intuitively, pages that are well cited from many places around the web are worth looking at.’¹⁹ But not all citations are equal; those from well-cited pages ‘weigh more’. Note that Page and Brin use the term ‘citing’ when they refer to linking.

New media scholar Axel Bruns describes the IssueCrawler, the hyperlink analysis tool used in this article to conduct hyperlink analysis and visualise the hyperlink networks, as ‘predominantly designed for identifying “issue networks”, that is, networks of websites which form around the interlinkage and exchange of information pertaining to specific issues or topics’.²⁰ The use of hyperlink analysis in the mapping of the climate debate has been applied by Rogers and Marres in their study ‘Landscaping Climate Change’ in 2000. Here they describe the study of hyperlinking as a means to map the debate around an issue. Their paper describes linking as a way to recognise other participants in the debate and ‘[s]imilarly, non-linking is a sign of non-recognition, or, more radically, is an act of silencing through inaction. (Greenpeace does not link to Shell, but Shell links to Greenpeace.)’²¹ When thinking of a link as recognition or ‘politics of association’ the link can be regarded and repurposed as a relevant trace of group formation.²² As described in the introduction the following hyperlink analysis takes a national viewpoint and studies the online networks of climate skeptics in the Netherlands and France.

Climate networks on the Dutch Web

In October 2011 the Royal Dutch Academy of Sciences (KNAW) published a report titled ‘Climate Change: Science and Debate’. With the brochure written by a small committee of scientists from inside and outside the Academy the KNAW sets out to map the state of the art in climate science, listing what has reached scientific consensus and what still causes controversy and why. The report ends with a summary in which the topics of consensus are listed as seven statements.²³ Statement A reads:

[m]ankind changes the composition of the atmosphere quickly and drastically. The increased concentration of carbon dioxide and other greenhouse gases cannot be marginalized.²⁴

This first statement already is likely to turn the brochure into a controversy object, for it stresses the role of mankind in global warming and the effects of CO₂ on climate change. Unsurprisingly, soon after its publication Dutch skeptical blogs started posting about the report by the 'alarmist' KNAW.²⁵ One of the more prominent skeptical blogs of the Netherlands, *climategate.nl*, featured a blog posting in English stating that the brochure contained a 'tsunami of scientific errors'.²⁶

The brochure claims that these seven statements are hard science on which all scientists agree. Nothing is further from the truth: they are a rendering of the claims of the IPCC, in denial of all serious criticism that has been brought against it by the scientific community.²⁷

Besides blogging about the report in various Dutch climate blogs the skeptics chose two other formats for their criticism: a letter signed by over 20 scientists demanding retraction of the report and a 'climate seminar' organised at Nieuwspoor, the international press centre in The Hague.²⁸

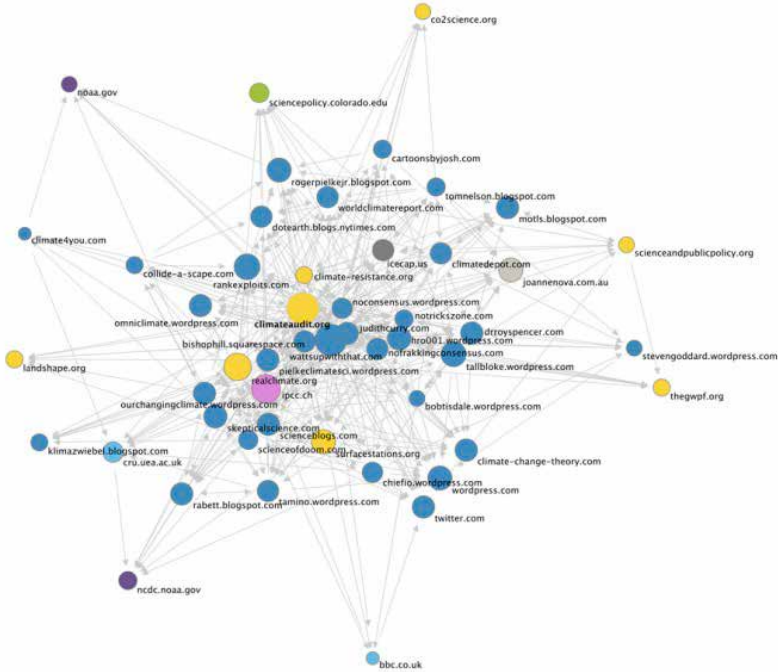
In the letter the scientists refute the seven statements and demand retraction of the publication.²⁹ The letter is signed by 22 scientists from various academic disciplines such as (bio-)chemistry, physics, geology, engineering, and climatology. The only non-academic who signed the letter is Ralf Dekker, blogger and chairman of the aforementioned *Groenerekenkamer.nl*. One of the scientists on the list is Pieter Ziegler, Swiss Geology Professor Emeritus at University of Basel and Emeritus Member of the Royal Academy (KNAW). The signed letter readily provides a short list of 22 climate change skeptics. The program of the climate seminar organised by *Groenerekenkamer.nl* and its list of speakers overlapped mostly with the short list. Only one new skeptic – journalist Marcel Crok – was added to the list.

The list includes the following 23 skeptics: Peter Bloemers, Marcel Crok, Ralf Dekker, Hans Erren, Bas van Geel, Kees de Groot, Albert Jacobs, Hub Jongen, Rob Kouffeld, Kees Kwantes, Hans Labohm, Kees Le Pair, Gerrit van der Lingen, Rob Meloen, Jan Mulderink, Henk Schalke, Hajo Smit, Dick Thoenes, Theo Wolters, Rypke Zeilmaker, Arthur Rorsch, Frans Sluiter, Henk Tennekes, and Peter Ziegler. For a comparison with other climate scientists the authors and editors of the KNAW report are short-listed for further analysis: Robbert Dijkgraaf, Henk Dijkstra, Louise Fresco, Henry Hooghiemstra, Hans van Maanen, Harro Meijer, Hans Opschoor, and Rudy Rabbinge. The next step in the analysis of the skeptic group formations is to study their networks. The question here is whether we see national skeptic

networks in which they link to sources from their own countries; or, do Anglo-American skeptics dominate climate change skepticism on the Web?

For this step a list of the skeptics' websites³⁰ is entered into the Issue-Crawler tool for hyperlink analysis. The IssueCrawler then performs co-link analysis, crawling the inputted (seed) 'URLs for links and retain[ing] the pages that receive at least two links from the seeds'.³¹ The map of Dutch skeptics shows that the hyperlink network is dominated by Anglo-American sources. One may expect a stronger national network as the Dutch skeptics have an active collective blogging culture in the Dutch language. However these sites link not to each other or to other Dutch sources but mainly to sources outside the Netherlands (Figure 6).

The remaining Dutch climate scientists show a more heterogeneous network with many Dutch sources (green on the map, Figure 7). There is a science and government cluster where the InterAcademy Council (which is based at KNAW in Amsterdam) is the link to an international cluster that includes the UN and the World Bank. There are also media clusters with the large Dutch daily newspapers and broadcasting companies who link to their international colleagues such as *The New York Times*, the *Financial Times*, and *Repubblica* (Italy).





Figs 6 and 7: IssueCrawler maps for the Dutch skeptical and other climate science networks.

The next step in this analysis is to measure the skeptics' and other scientists' web resonance. In this case study I first demarcate the space of climate change on the web and subsequently measure how much and where the various actors are resonating within this 'issue space'. I again make short lists of prominent actors as '[a]ctors occupying influential positions deserve special attention because, like it or not, they will have better chances to shape controversies'.³²

Dutch climate change corpus: 'klimaatverandering'

To demarcate the Dutch issue space of climate change on the web I query Google.nl for the search term *klimaatverandering* (Dutch for 'climate change'). The top 100 results contain only 25 unique hosts consisting mainly of news sources, governmental sources, and some environmental organisa-

tions and blogs. These 25 URLs were subsequently queried for each of the 24 skeptics on the short list. This can be done manually with such queries as ‘Hans Labohm’ site:knmi.nl and ‘Hans Labohm’ site:www.wnf.nl, et cetera. Here I used the Lippmannian device, a tool inspired by Walter Lippmann and developed to discover partisanship.³³ First one inputs a list of URLs and a list of queries and the tool does the sequencing automatically. Re-sizing the URLs according to their mentioning of the short-listed skeptics then shows which sources are most skeptic-friendly. Showing a source cloud per actor and leaving the search results in their original order (i.e. of the result list in Google) makes visible that some skeptics enter into the top results and others resonate only ‘under the fold’. The tool also offers an ‘issue cloud’ in which the actors’ names are clouded according to their resonance within the top sources, which shows who the most prominent actors on the short list are (Figure 8). The three most prominent Dutch skeptics are economist Hans Labohm, former Director of Research at the Royal Netherlands Meteorological Institute (KNMI) Henk Tennekes, and Bas van Geel, Associate Professor of Paleo-Ecology at the University of Amsterdam.



Fig. 8: Dutch Climate Change Skeptics Resonance Cloud. This cloud shows the prominence of skeptics within the Google.nl results for the query *klimaatverandering* (climate change). The larger the name, the more mentions in the results.

Hans Labohm is an economist formerly employed by the Dutch Institute of International Relations Clingendael and a former 'expert reviewer' at IPCC. He is also affiliated with the Heartland Institute. In 2004 Labohm published the book *Man-Made Global Warming: Unravelling a Dogma* (ref) which he co-authored with Dick Thoenes (who is less resonant in the online debate) and Simon Rozendaal (not on our short list). Focusing on Hans Labohm we can see which sources mention him most (Figure 9). He resonates most on atmospheric scientist Bart Verheggen's blog klimaatverandering.wordpress.com where he has his own tag and category and in NRC, the Dutch daily newspaper. The NRC archives then reveal that most of this attention stems from 2004 when his book was published and 2007 when NRC published a portrait of Labohm as a 'liberal climate skeptic'.³⁴ Labohm generally resonates well in the media (also in *Volkskrant* and *Trouw*) and makes it into the top results.



Fig. 9: *Climate Change Source Cloud for Hans Labohm. This cloud shows the resonance of Hans Labohm, the most prominent Dutch climate change skeptic, in the top results for climate change.*

The sources in which skeptics resonate most are KNMI, Klimaatverandering, and NRC. There are only five sources that do not mention any of the short-listed skeptics, the highest-ranked one of which is milieucentraal.nl.

Milieucentraal is a foundation dedicated to providing consumers unbiased information on energy and environment.

Of the analysed climate scientists the author and editor of the KNAW brochure Professor Louise Fresco of the University of Amsterdam (and KNAW member) is the most prominent (Figure 10). Fresco resonates in 16 of the top climate change sources (which is only one more than Hans Labohm). In half of these sources she is mentioned at least 100 times (the ceiling for this scrape was set at 100 and she hits that ceiling in eight of the sources). Second is Rudy Rabbinge, professor of Sustainable Development and Food Security at Wageningen University. The third most resonating scientist is Robbert Dijkgraaf, Director of the Institute for Advanced Study in Princeton (United States) who at the time of the publication of the report was president of the KNAW.

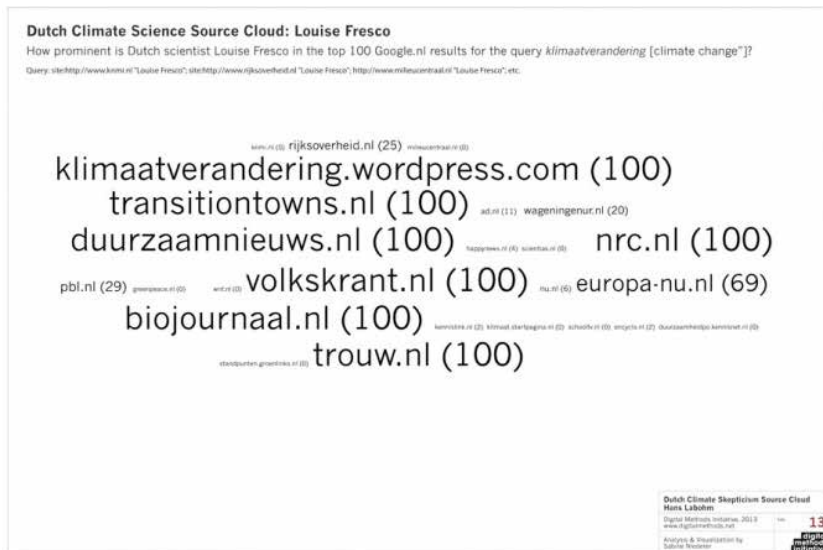


Fig. 10: Climate Change Source Cloud for Louise Fresco. This cloud shows the resonance of Louise Fresco in the top results for climate change.

Collectively the other scientists resonate in all but seven of the sources. They are not present in two sources that do list skeptics: scientias.nl and greenpeace.nl. There are no sources that mention only our small sample of other scientists without the short-listed skeptics. Skeptical and other scientists resonate broadly in the results, both at the top and bottom of the list.

Climate networks on the French Web

As Dutch climate change skeptic Hans Labohm puts it in a review of a French climate change skeptic book by Marcel Leroux, the relative absence of French skeptics in the international debate is a result of a Francophone language barrier.³⁵ Nevertheless the French climate debate makes it into the international press on occasion. In France the debate seems more closely linked to national politics where the most prominent climate change skeptic, Claude Allègre, is also the former Minister of Education and Research (1997-2000). Collective action is also directed towards the national government. In 2010 over 400 French scientists signed a petition and presented it to science minister Valérie Pécresse as well as various national scientific organisations.³⁶ With this unprecedented action in France the scientists demanded the minister to take a stand against the undermining of climate science as present in the book by Allègre titled *L'Imposture Climatique, ou la fausse écologie* (The Climate Fraud, or the Faulty Ecology). This book, an important French controversy object, heavily criticises climate science and refers to the IPCC as a 'mafia-like' and 'totalitarian' system.³⁷ The scientists' letter also points at similar work by climate change skeptic Vincent Courtillot and asks for the support of climate science and refutation of these non-reviewed publications.

French environmental journalist Denis Delbecq is an expert on the French climate debate and its prominent actors whom he portrayed extensively in a 'dossier' for the French environmental journal TerraEco in 2010.³⁸ For the comparative case study presented in this article Delbecq provides the short lists of prominent French skeptical and other scientists and scientific organisations in France. Rather than triangulating existing lists, as there are no such lists (besides the long list of 400+ scientists opposing climate change skepticism as presented by Allègre and Courtillot), we use his (expert) lists instead. The short-listed skeptics are: Claude Allègre, Vincent Courtillot, Luc Ferry, Serge Galam, Dominique Lecourt, Christian Gerondeau, Marcel Leroux, Jean Martin, Benoit Rittaud, Laurent Cabrol, Charles Muller, Jean-Michel Belouve and Vincent Bénard. The non-skeptics in the sample are: Jean Jouzel, Hervé le Treut, Claude Lorius, Edouard Bard, Sylvie Joussaume, Dominique Raynaud, Valérie Masson-Delmotte, Anny Cazenave, Nathalie de Noblet, and Gilles Delaygue. All of these scientists signed the aforementioned petition with the exception of Joussaume, director of the National Institute of Sciences of the Universe (INSU/CNRS), and Cazenave, Senior Scientist at the 'Laboratoire d'Etudes en Géophysique et Océanographie Spatiale' (LEGOS), Centre National d'Etudes Spatiales (CNES).

I conduct hyperlink analysis to find these scientists' 'politics of association' and group formation.³⁹ Figure 11 shows the network map with CNRS, the French National Science Foundation, as its central node. Other important actors are major French laboratories and research centres in the field of climate science (such as IPSL, LMD, etc.) all of which are French. This map clearly demonstrates that French climate science links to French sources. The majority of the nodes on the map are of French scientific organisations. Of the non-French nodes the IPCC is one of the largest, yet it remains in the periphery (node in upper left corner).



Fig. 11: French Climate Science IssueCrawler Map. Network visualisation of prominent climate scientists made through co-link analysis with the IssueCrawler.

Figure 12 shows the network of the French climate change skeptics in a strikingly different configuration. Delbecq is surprised to see the international focus of these skeptics, for he expected to find at least one dense French cluster. However, the French TLD nodes (.fr) are in the minority and in the margins of the network. An important characteristic of this network is that it is mainly blog-based, where the blogs tend to link to each other and the objects of their criticism: from IPCC and NASA to pages with corrections to the research by Michael Mann from 1999.⁴⁰ There is a cluster of dark green nodes that are French blogs on the blogging platform over-blog.com.

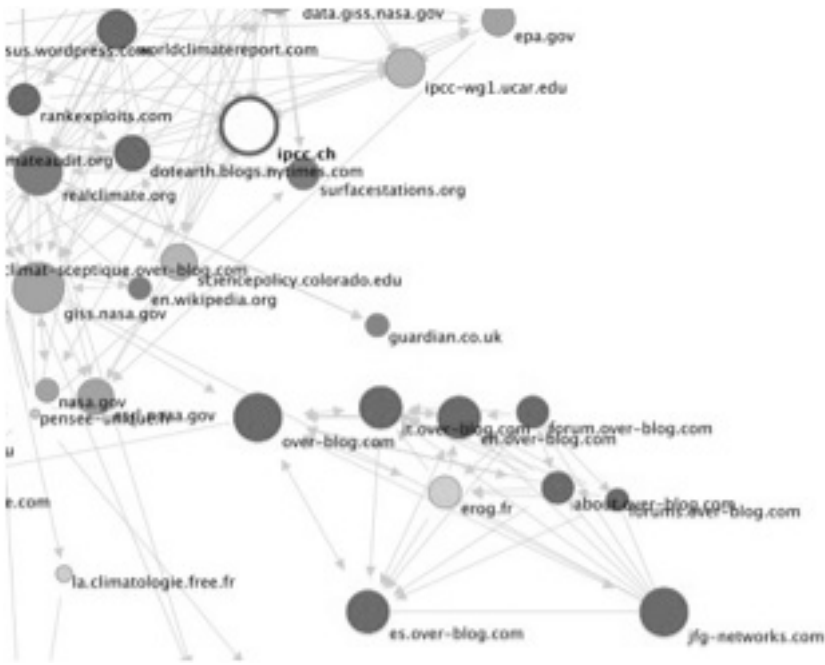


Fig. 12: French Climate Skeptics IssueCrawler Map. Network visualisation of prominent French climate change skeptics (detail) made through co-link analysis with the IssueCrawler.

The network analysis provides us with a means to analyse group formation through politics of association. As could be expected in their linking to objects of criticism the skeptics grant high authority to these same objects, positioning them right in the center of their network. The IPCC is therefore the main node in the skeptics' network. The scientists have a different and more traditional approach and grant network authority to the top established scientific figures (in the case of France) and also the government and media (in the Netherlands).

French climate change skeptics

To demarcate the issue space of climate change on the French Web I query Google.fr for 'changement climatique'. With the Lippmannian Device each of the websites in the top 100 results is queried for each of the skeptics' short-listed names (as provided by Delbecq). The results are again visualised

in an actor cloud where the names of the actors are re-sized according to frequency of mentions in the top 100 results (Figure 13, top).

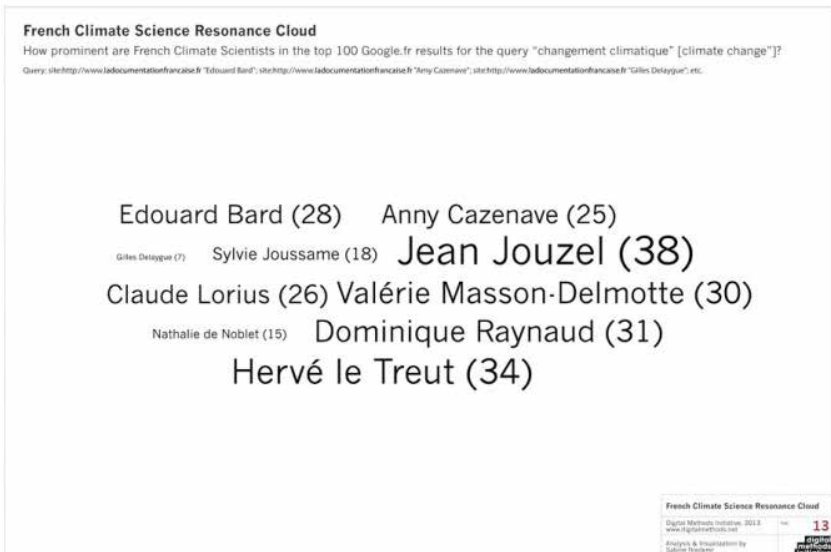
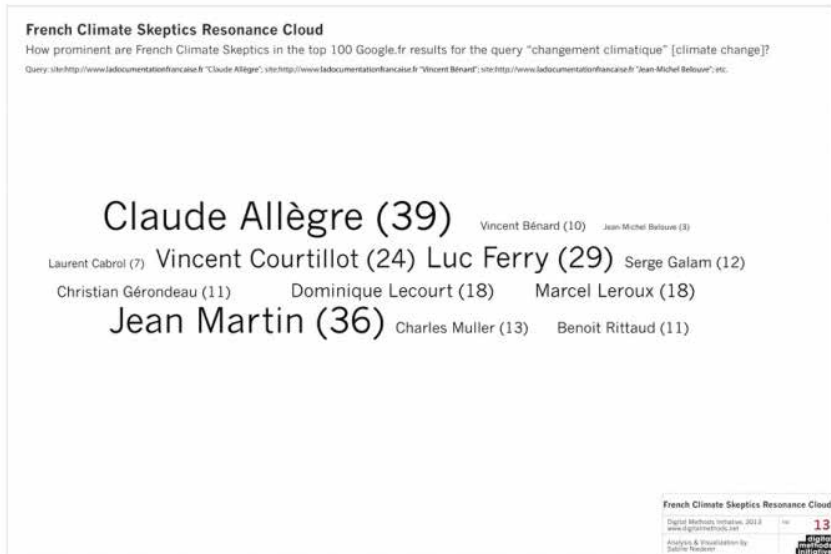


Fig. 13: French Climate Change Resonance Clouds. Resonance clouds of French climate change skeptics and other climate scientists in the online 'changement climatique' issue space (through Google.fr).

The same procedure was followed for the prominent climatologists (Figure 13, bottom). There Jean Jouzel, long-term vice-president of the IPCC, leads the way but in all resonates slightly less than the most prominent skeptic Claude Allègre, whose leading position does not come as a surprise. The next most resonating skeptic however is in fact a surprise: Jean Martin, a pseudonym for the author of the blog 'Pensée Unique' (a small node on the skeptics' network map). At the time of the first analysis (which Delbecq and I conducted in 2010) it was unclear who this author was; shortly after this analysis was published he revealed his identity as Jacques Durand, a renowned climate scientist.⁴¹ On his blog – the title of which refers to a right-wing critique of left-wing ideological politics – he explained his reasons for remaining anonymous, stating that he did not want to cause his colleagues and employers any trouble.⁴² In third place we find Luc Ferry, former Minister of Education (2002-2004) and well-known philosopher and secular humanist. The top three skeptics in 2013 is the same as in 2010.

In second place for the non-skeptical scientists after Jean Jouzel comes Hervé le Treut, climatologist and director of the Institut Pierre-Simon Laplace (IPSL) which consists of 'six laboratories (LATMOS, LISA, LMD, LOCEAN, LPMAA, LSCE) whose research topics concern the global environment' (IPSL 2013). More than in 2010 most of the other scientists resonate profoundly in the top sources (in 40-50% of the 65 top sources). Their top two is the same as in 2010 but in third place, which used to be glaciologist Claude Lorius, we now see Dominique Raynaud. Raynaud is emeritus research director of the French national research center CNRS and co-author of the 2007 IPCC report.

The top sources for climate change range from governmental websites to environmental organisations and environmental news sites (such as goodplanet.org). Jouzel resonates in eight of the top 10 results and places well throughout the ranked sources in the news as well as in governmental sources (Figure 14, top). Jouzel shows particular resonance in governmental sources such as developpement-durable.gouv.fr, the site of the French ministry of Ecology, Sustainable Development and Energy and government-funded research such as cea.fr, the site of a technological research organisation.

The source cloud for the top skeptic Claude Allègre shows most resonance in the number one source, the website of the French Public Administration, responsible for publishing mainly governmental reports (Figure 14, bottom). Furthermore he resonates less in the top sources but is mentioned often throughout the ranked list, also in government sites and the European portal Europe.eu. More than Jouzel he resonates in the environmental news website Goodplanet.info.

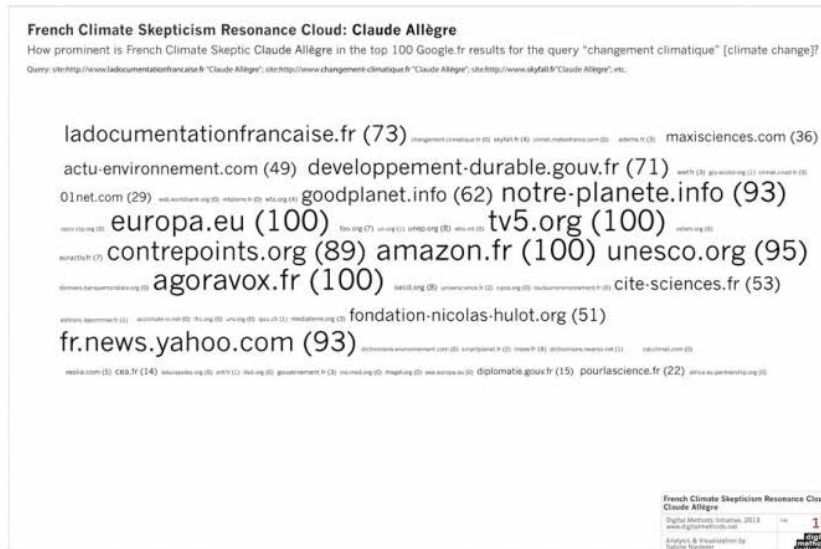
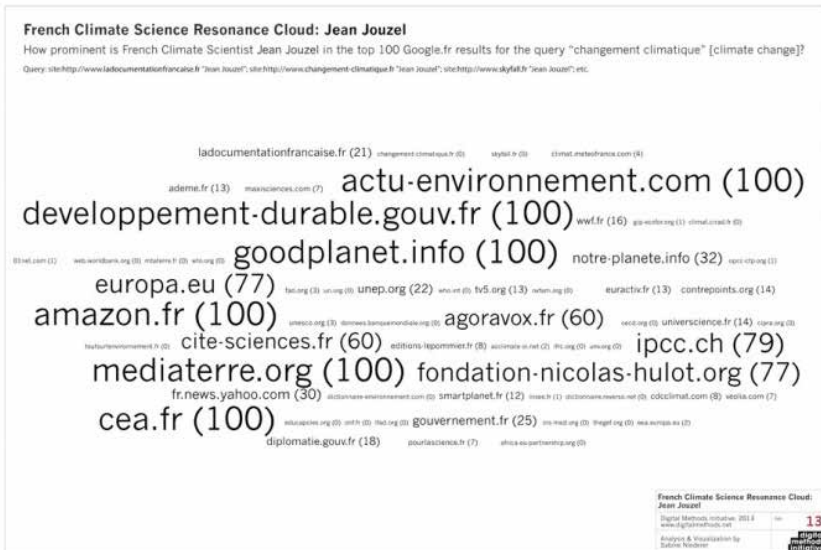


Fig. 14: Climate Change Source Cloud for Jean Jouzel; Climate Change Source Cloud for Claude Allègre.

The comparative resonance analysis of skeptics and others shows that while skeptics make it into the top of the results and are prominent in the news it

varies per country whether they also make it into the sites of government, research institutes, and environmental organisations. The most prominent Dutch skeptics resonate well in the news and on one dedicated climate blog but generally resonate in fewer sources than the other short-listed climate scientists. In contrast the French skeptics closely resemble the remainder in that they resonate throughout the ranked results and share outlets.

This method of controversy mapping showing the prominence of specific actors within an online issue space fits the model of issue-centric analysis as prominent practice in controversy mapping. This method suits the charting (or 'scraping', in line with Rogers and Marres) of a debate including the shared notions of the actors involved (also over time) and has been applied for instance in the mapping of the debates about the declining populations of bees and that of the 2012 Olympic Stadium in London.⁴³ In the next section I will move to an actor-centric approach and focus not on the issue at hand (climate change) but on the actors (the short-listed skeptics) in order to map their other issues.

Skeptics have issues

This last case study offers a radical turn from the known fact that all issues have their skeptics. What if the skeptics have other issues? What I will research in this brief exploratory study is whether skeptics are professional climate experts or professional skeptics. If they are skeptical of other issues, are they most skeptical about climate change? I start answering this question by taking the short list used in the scientometric analysis and simply collecting publication lists from the short-listed skeptics' personal websites as well as Google Scholar, sourcewatch.com, and motherjones.com; I also include a special report on the skeptics on businessandmedia.org, the skeptic-friendly neo-liberal watchdog.⁴⁴

The publications retained for the analysis are skeptical of climate change or other issues. The objects of skepticism are listed and counted and then visualised in a Dorling map (Figure 15) where the bubbles are scaled according to the issue occurrence within the skeptics' publications.

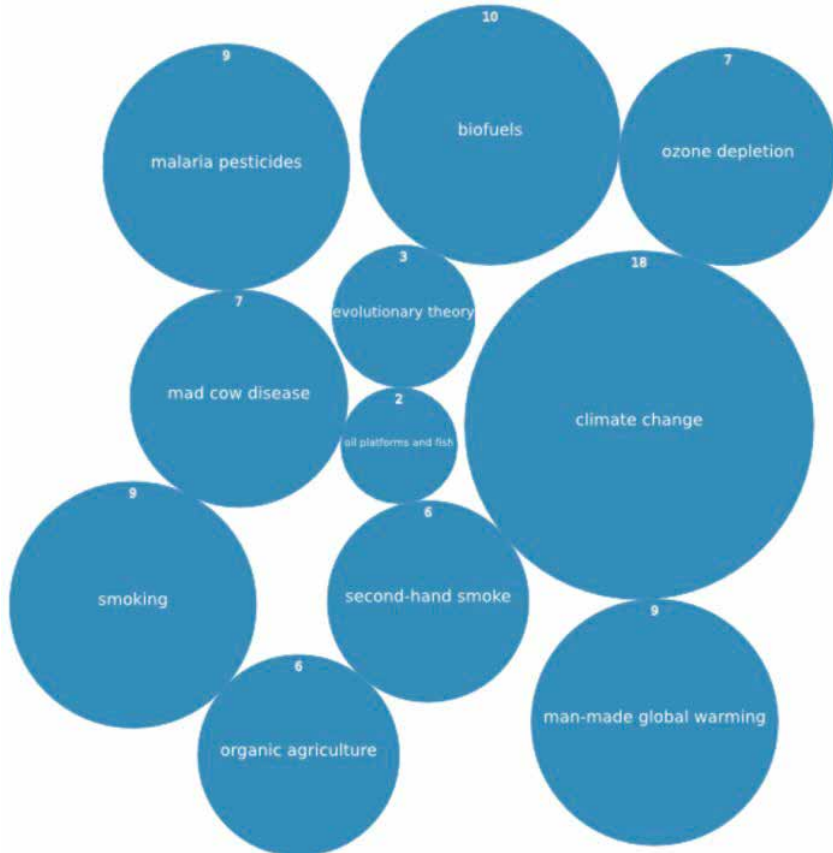


Fig. 15: Climate Skeptics' Related Issues. Dorling Map showing the issues other than climate change that skeptics publish on.

The Dorling map shows that apart from climate change the skeptics are skeptical of a series of other issues; these other issues include topics that are environment-related such as wind energy, biofuels, ozone depletion, and organic agriculture; as well as health-related issues such as the dangers of smoking and second-hand smoke, the human variety of mad cow disease (Creutzfeld-Jacob disease), and the environmental hazards of the Malaria mosquito pesticide (DDT). Another striking issue that is slightly more on topic is that of 'oil platforms and fish' which refers to the papers by Paul Driessen on how oil platforms can function as reefs, arguing that 'oil and fish can mix';⁴⁵ also, evolutionary theory is the object of skeptical writings. Overall, while the short-listed skeptics are skeptical about a series of other issues they are most skeptical about climate change.

Where controversy analysis often centers on an issue (or a set of issues) this actor-centric approach chosen here follows the actor across issues. This further complicates the characterisation of the skeptics as they are not only focusing on climate change in their skeptical endeavors. These findings have a number of implications. First of all, on a methodological level, it provides a shift from the idea that all issues have skeptics (or that a skeptical stance is part of science) to skeptics having issues. Second, as the scientometric analysis showed us that these skeptical scientists are part of the scientific mainstream this raises questions about the employment of their expertise. Why do they write about these other issues whilst being climate scientists? Are their publications on related issues also part of the scientific mainstream in their respective fields? Finally, on a meta-level, what kind of controversy analysis does such an actor-centric approach offer? It seems to offer a means to trace a controversy outside of the boundaries of a single issue which could help to test the commitment of an actor to a specific issue and reveal a much richer and more complex 'issue ecology'.

Conclusions

This article uses Web data to research the place and status of skepticism within the climate science and the climate controversy. The study starts with a scientometric analysis looking at the distribution of disciplines and shared places of publication. Scientometric data shows that the climate change skeptics are part of climate science sharing both a distribution of disciplines and a mainstream of prominent scientific outlets. Besides being 'mainstream' skeptics as well as others have their own unique outlets and disciplines, their respective 'fringes' if you will.

Hyperlink analysis provides a view on the associational profiles of these actors. For the French and Dutch skeptics it shows the prominence of skeptical Anglo-American sources appearing in their hyperlink networks. Other French scientists link to reputable French science institutions and labs. Other Dutch scientists have a more heterogeneous network including science and government as well as news media. The Dutch and French skeptics form an international network by linking to both (international) skeptic blogs and the subjects of their criticism. They grant the most reputation – a highly central positioning in the network – to the Intergovernmental Panel on Climate Change; their major 'controversy object' is the largest node in the network.

Web resonance analysis scoring the prominence of one or more actors in a demarcated issue space (i.e. a set of online sources) allows for a further comparison between skeptical scientists and others. Furthermore the output of a source cloud allows for the analysis of actor-friendly sources. The comparative analysis shows different ‘profiles’ per country. The most prominent Dutch skeptics resonate well in the news and on one dedicated climate blog but generally resonate in fewer sources than the other short-listed climate scientists. In contrast the French skeptics closely resemble their counterparts in that they resonate throughout the ranked results and share the same outlets.

Studying the skeptics with Web data shows that they are indeed in the center or mainstream of climate science and of the online climate debate. However their hyperlinking behavior is different from that of other scientists, associating mostly with blogs, many of which are Anglo-American. Shifting focus from the issue space to an actor-centric perspective skeptics have related issues, some of which are well outside of the climate debate.

Future analysis could be a broader national comparative research showing the place of climate change skepticism across countries. Resonance analysis would also benefit from a longitudinal approach where not only can we see the resonance of the actors over time but also the top sources for the issue of climate change and their coverage of these prominent actors. In that same vein scientometric analysis could be complemented by a close reading of the skeptic-‘friendly’ as well as other journals.

The related issues analysis would benefit from a more robust methodology to enable comparative analysis of these issues for skeptics and other scientists of various countries. This is less of a radical move than it may seem at a first glance. One of the prominent Dutch skeptics is the president of Stichting Skepsis, the Dutch skepticism foundation with a wide variety of ‘neighboring’ issues among which are homeopathy and psychotherapy. Such insights add to the understanding of a controversy and reveal a complex ecology of debates, enabling a mapping of the distances and connections between them.

Notes

1. ‘Climate change skeptics’ refers to those skeptical of climate change and its sub-issues such as man-made global warming, unprecedented global warming (temperature rises), and the methods employed to study climate change.
2. <http://climateconferences.heartland.org/first-iccc/> (accessed 14 February 2013).
3. Oreskes 2007.

4. Schmidt 2010; Oreskes 2007.
5. <http://www.exxonsecrets.org/index.php?mapid=1804> (accessed 14 February 2013).
6. Wouters 1999.
7. Dekker 2008.
8. This comparative study of national skeptics is part of the EU-project (FP7) 'Electronic Maps to Assist Public Science' (EMAPS) and the Issue Mapping course at the University of Amsterdam, New Media and Digital Culture MA.
9. Latour 2005, p. 32.
10. Skeptical Science 2010.
11. Mann et al 1999.
12. Soon & Baliunas, 2003.
13. Jones 1998; Weart 2008.
14. Mann et al 2003. The letter was signed by: Michael Mann, University of Virginia, Charlottesville; Caspar Amman, National Center for Atmospheric Research, Boulder, Colorado; Ray Bradley, University of Massachusetts, Amherst; Keith Briffa, Philip Jones, and Tim Osborn, Climatic Research Unit, University of East Anglia, Norwich; Tom Crowley, Nicholas School of the Environment and Earth Science, Duke University, Durham, North Carolina; Malcolm Hughes, Laboratory of Tree-Ring Research, University of Arizona, Tucson; Michael Oppenheimer, Princeton University, New Jersey; Jonathan Overpeck, Department of Geosciences and Institute for the Study of Planet Earth, University of Arizona, Tucson; Scott Rutherford, University of Rhode Island, Narragansett; Kevin Trenberth, National Center for Atmospheric Research, Boulder, Colorado; and Tom Wigley, University Corporation for Atmospheric Research and NCAR, Boulder, Colorado.
15. For this case study I worked with Andrei Mogoutov (data analyst and developer of the ReseauLu software for scientometric analysis) and Bram Nijhof and Richard Rogers (University of Amsterdam). For the compilation of the list we triangulated: McCright & Dunlap 2003; http://www.motherjones.com/news/featurex/2005/05/exxon_chart.html, http://www.sourcewatch.org/index.php?title=Climate_change_skeptics and http://en.wikipedia.org/wiki/Category:Global_warming_skeptics. Frederick Seitz passed away prior to the conference yet has been kept on the list.
16. Hoggan & Littlemore 2009, p. 4.
17. Oreskes 2004.
18. Cook 2013.
19. Brin & Page 1998.
20. Bruns 2007.
21. Rogers & Marres 2000, p. 157.
22. Rogers 2004, p. vii.
23. KNAW 2012, p. 34.
24. 'De mensheid verandert de samenstelling van de dampkring snel en ingrijpend. De toegenomen concentratie kooldioxide en andere broeikasgassen kan niet gebagatelliseerd worden', KNAW 2012, p. 34.
25. Wolters 2011a.
26. Wolters 2011b.
27. Ibid.
28. This center located next to the Dutch parliament building hosts political press conferences and debates.
29. Labohm 2011.
30. If they do not have their own website the URL of their organisation is listed; if available then also their personal page on that website.

31. http://www.govcom.org/Issuercrawler_instructions.htm.
32. Venturini 2010, p. 5.
33. The Lippmannian Device (also referred to as the Google Scraper) was developed by Govcom.org and the Digital Methods Initiative, <https://wiki.digitalmethods.net/Dmi/ToolLippmannianDevice>.
34. Aan de Brugh 2007.
35. Labohm 2006.
36. Huet 2010.
37. Enserink 2010; Huet 2010.
38. Delbecq 2010.
39. The software used for this analysis is the IssueCrawler, network visualisation software developed by the Govcom.org Foundation.
40. This is the smaller light-green node in the bottom center of the map which refers to the following URL: http://www.meteo.psu.edu/holocene/public_html/shared/articles/MBH98-corrigendum04.pdf.
41. Delbecq & Niederer 2010.
42. Ramonet 1995.
43. Melchior & Mélard 2009; Yaneva & Dunn 2009.
44. Sites used include: <http://scholar.google.com>, http://www.sourcewatch.org/index.php?title=Global_warming_skeptics, <http://www.businessandmedia.org/special-reports/2007/globalwarming/SkepticalScientists.asp>, http://www.motherjones.com/news/2005/05/exxon_chart.html.
45. Driessen 1985.

References

- Brin, S. and Page, L. 'The Anatomy of a Large-Scale Hypertextual Web Search Engine', 1998. <http://infolab.stanford.edu/~backrub/google.html> (accessed on 14 February 2013).
- Brugh, M. Aan de. 'Liberaal in de strijd tegen klimaatgekte'. *NRC* 19 February 2007. <http://vorige.nrc.nl/article1771418.ece> (accessed on 14 February 2013).
- Bruns, A. 'Methodologies for Mapping the Political Blogosphere: Explorations Using the IssueCrawler Research Tool', *First Monday*. 12(5), 2007. <http://firstmonday.org/ojs/index.php/fm/article/view/1834/> (accessed on 14 February 2013).
- Business and Media Institute. *Skeptical Scientists*, 2007. <http://www.businessandmedia.org/specialreports/2007/globalwarming/SkepticalScientists.asp> (accessed on 10 January 2010).
- Cook, J. *The Scientific Guide to Global Warming Skepticism*, 2010. http://www.skepticalscience.com/docs/Guide_to_Skepticism.pdf (accessed on 14 February 2013).
- Cook, J., Nuticelli D., et al. 'Quantifying the consensus on anthropogenic global warming in the scientific literature', *Environmental Research Letters*, 8(024024), 2013.
- Dekker, A. *The politics of association on display: Interview with Richard Rogers*. Amsterdam: Netherlands Media Art Institute, January 2008. <http://nimk.nl/eng/the-politics-of-association-on-display> (accessed on 14 February 2013).
- Delbecq, D. 'Dossier climato-sceptiques', *TerraEco*, April 2010: 50-62.
- Delbecq, D. and Niederer, S. 'Climatosceptiques et climatologues, quelle place sur l'internet?', *Effets de Terre*, 12 April 2010. <http://effetsdeterre.fr/2010/04/12/climatosceptiques-quelle-place-sur-linternet/> (accessed on 14 February 2013).
- Driessen, P. 'Oil Platforms as Reefs: Oil and Fish CAN Mix', *Coastal Zone conference proceedings*, 1985: 1417-1438.

- Electronic Maps to Assist Public Science (EMAPS), <http://www.emapsproject.com/> (accessed on 14 February 2013).
- Enserink, M. 'French Researchers Ask Science Minister to Disavow Climate Skeptic', *Science Insider*, April 2010. <http://news.sciencemag.org/scienceinsider/2010/04/french-researchers-ask-science-m.html> (accessed on 14 February 2013).
- Greenpeace. *ExxonSecrets*, <http://www.exxonsecrets.org/index.php?mapid=1804> (accessed on 14 February 2013).
- IssueCrawler. *Instructions of use*, http://www.govcom.org/Issuecrawler_instructions.htm (accessed on 14 February 2013).
- Heartland Institute. *ICCC-1, 2008*, <http://climateconferences.heartland.org/first-iccc/> (accessed on 14 February 2013).
- Hoggan, J. and Littlemore, R. *Climate cover-up: The crusade to deny global warming*. Vancouver: Greystone Books, 2009.
- Huet, S. 'Climat: 400 Scientifiques signent contre Claude Allègre', *Liberation Sciences Blog*, 1 April 2010. <http://sciences.blogs.liberation.fr/home/2010/04/climat-400-scientifiques-signent-contre-claude-allègre.html> (accessed on 14 February 2013).
- IPCC Homepage, <http://www.ipcc.ch> (accessed on 14 February 2013).
- Labohm, H. 'The French Climate Skeptic', *Ideas in Action*, 2006. http://www.ideasinactiontv.com/tcs_daily/2006/09/the-french-climate-skeptic.html (accessed on 14 February 2013).
- _____. 'Klimaatseptici verzoeken KNAW klimaatrapport in te trekken', *De Dagelijkse Standaard*, October 2011. <http://www.dagelijksstandaard.nl/2011/10/klimaatseptici-verzoeken-knaw-klimaatrapport-in-te-trekken> (accessed on 14 February 2013).
- Latour, B. *Reassembling the social*. Oxford: Oxford University Press, 2005.
- Lippmannian Device. <https://wiki.digitalmethods.net/Dmi/ToolLippmannianDevice> (accessed on 14 February 2013).
- Maanen, H. Van (ed.). *Klimaatverandering: Wetenschap en Debat*. Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen, 2011. http://www.knaw.nl/Content/Internet_KNAW/publicaties/pdf/20101047.pdf (accessed on 14 February 2013).
- Mann, M.E., Ammann C.M. et al. 'On Past Temperatures and Anomalous Late-20th Century Warmth', *Eos*, 84(27), 2003: 256. http://www.meteo.psu.edu/holocene/public_html/Mann/articles/articles/eos03.pdf (accessed on 14 February 2013).
- Mann, M.E., Bradley R.S. and Hughes M.K. 'Northern Hemisphere Temperatures During the Past Millennium: Inferences, Uncertainties, and Limitations', *Geophysical Research Letters*, Vol. 26(6), 15 March 1999: 759-762.
- McCright, A. M. and Dunlap R.E. 'Defeating Kyoto: The Conservative Movement's Impact on U.S. Climate Change Policy', *Social Problems*, 50(3), 2003: 348-373.
- Melchior, A. and Mélard F. 'Dying out of Bees: A Case Study of the dying out of bees (*Apis mellifera*) in the Walloon region (Belgium)', 2009. <http://mappingcontroversies.net/Home/PlatformDyingBees> (accessed on 14 February 2013).
- Michaels, D. *Doubt is their product: How industry's assault on science threatens your health*. Oxford: Oxford University Press, 2008.
- Mother Jones. 'Put a tiger in your think tank', 2005. <http://motherjones.com/politics/2005/05/put-tiger-your-think-tank> (accessed on 14 February 2013).
- Oreskes, N. 'Beyond the Ivory Tower: The Scientific Consensus on Climate Change', *Science*, 3 December, Vol. 206(5702), 2004: 1686.
- _____. 'The Scientific Consensus on Climate Change: How Do We Know We're Not Wrong?' in *Climate change: What it means for us, our children, and our grandchildren* edited by J. Dimento and P. Doughman. Cambridge: MIT Press, 2007: 65-99.
- Oreskes, N. and Conway E.M. *Merchants of doubt: How a handful of scientists obscured the truth on issues from tobacco smoke to global warming*. New York: Bloomsbury Press, 2010.

- Ramonet, I. 'La pensée unique', *Le Monde Diplomatique*, January 1995. <http://ww.monde-diplomatique.fr:1995:01:RAMONET:1144> (accessed on 14 February 2013).
- Rogers, R. *Information politics on the web*. Cambridge: MIT Press, 2004.
- Rogers, R. and N. Marres. 'Landscaping Climate Change: a mapping technique for understanding science and technology debates on the World Wide Web', *Public Understanding of Science* 9, 2000: 141-163.
- Schmidt, C.W. 'A Closer Look at Climate Change Skepticism', *Environmental Health Perspectives*, 118(12), 2010: A536-A540.
- Skeptical Science. 'Skeptical Science App'. <http://itunes.com/apps/skepticalscience> (accessed on 14 February 2013).
- Soon, W. and Baliunas S. 'Proxy climatic and environmental changes of the past 1000 years', *Climate Research* 23, 2003: 89-110.
- Sourcewatch. 'Global Warming Sceptics', http://www.sourcewatch.org/index.php?title=Climate_change_skeptics (accessed on February 2013).
- Union of Concerned Scientists. 'Smoke, Mirrors and Hot Air: How ExxonMobil uses big tobacco's tactics to manufacture uncertainty on climate change', 2007. http://www.ucsusa.org/assets/documents/global_warming/exxon_report.pdf (accessed on February 2013).
- Venturini, T. 'Building on Faults: How to Represent Controversies with Digital Methods', *Public Understanding of Science*, OnlineFirst doi: 10.1177 /0963662510387558, 2010. <http://pus.sagepub.com/content/early/2010/12/03/0963662510387558.full.pdf+html> (accessed on 14 February 2013).
- Washington, H. and Cook, J. *Climate change denial: Heads in the sand*. Oxford: Earthscan, 2011.
- Weart, S. *The discovery of global warming*. Cambridge: Harvard University Press, 2008.
- Wolters, T. 'Alarmistische KNAW in grote problemen', *Climategate.nl*, 2011a. <http://climategate.nl/2011/10/25/alarmistische-knaw-in-grote-problemen/> (accessed on 14 February 2013).
- Wolters, T. 'Bad science in alarmist report from Royal Dutch Academic Council', *Climategate.nl*, 2011b. <http://climategate.nl/2011/10/19/bad-science-in-alarmist-report-from-royal-dutch-academic-council/> (accessed 14 February 2013).
- Wouters, P. *The citation culture*. Dissertation. Universiteit van Amsterdam, 1999.
- Yaneva, A. and Dunn, N. *The design of the London olympics stadium*. Manchester: Manchester School of Architecture, 2009. <http://www.msa.ac.uk/mac/london/presentation-controversy> (accessed on 14 February 2013).

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