

# Disputed climate science in the media: Do countries matter?

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## Abstract

This article presents findings from a large-scale newspaper analysis of climate change discourses in four developed countries, using corpus linguistics methodology. We map the discourse over time, showing peaks and troughs of attention and explaining their causes. Different connotations of common terms such as *global warming* and *climate change* in different countries are analysed. Cluster and key-word analysis show the relative salience of specific words and word combinations during crucial periods. We identify main claims makers and the relative visibility of advocates and sceptics. The main finding is that former are far more prominent in all countries. We also look at the coverage of 'climategate'. Finally, we make reference to existing theoretical frameworks.

## Keywords

climate change, framing risk, media and science, media representations, public understanding of science, science communication, science experts

## Introduction and overview

There is a widespread concern among climate scientists, environmentalists and policy makers that they are in a war of words on climate change and seem to be losing out. Sir John Houghton told the BBC:

We are ... losing that war because we're not good at PR. Your average scientist is not a good PR person because he [sic] wants to get on with his science ... So we need to look, I suppose, for some good PR people to help us get our messages across in an honest and open and sensible way, without causing the sort of furore, the sort of polarisation that has occurred because of the people who are trying to deny it, and trying to deny it so vehemently that the media is taking so much notice of them. (BBC online news, 11 February 2010)

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Similar statements have been made over the 20-year period since climate change, and climate science, became an object of public debate. We will reconsider such claims by analysing press coverage from four countries. The article has a broader aim, though: it aims to understand how the issue has been framed and the reference to prominent actors over time.

In recent years several studies have examined media coverage of climate change in specific countries. There are media analyses of the press in the UK (Carvalho and Burgess, 2005), USA (Antilla, 2005; Nisbet, 2009), Norway (Ryghaug et al., 2010) and India (Billett, 2009) – to name a few. There have also been comparative studies, such as Boykoff (2007) on the USA and the UK, Brossard et al. (2004) on France and the USA, and Grundmann (2007) on Germany and the USA. Most of the studies either adopt a qualitative analysis based on small samples, a quantitative analysis of frequencies, or a combination of both. Grundmann and Krishnamurthy (2010) conducted a pilot study on the USA, the UK, France and Germany, using corpus linguistics methods. Rather than using samples, this method allows us to analyse a complete body of text and to combine frequency and semantic analysis in new ways. The present article will also use corpus methodology comparing the same four countries.

Computer analysis of text in electronic format (corpus linguistics) has developed to permit researchers (1) to base their work on much larger data sets than previously, (2) to reduce their need to rely on native-speaker linguistic intuition to determine what is typically said or written, and (3) to track down patternings that manual analysis could not achieve in practice. A large body of research has developed in connection with the technologies: McCarthy and O’Keeffe (2010: 7–11) mention language teaching and learning, discourse analysis, literary studies and translation studies, forensic linguistics, pragmatics, sociolinguistics, media discourse and political discourse. Our study here fits within media discourse, but essentially corpus linguistics has become a bridging technology for researchers in many fields, because text is so characteristic of human endeavour.

It is possible to notice, trace and theorize about a linguistic patterning observed in a single text or a small sample of text, and this is what traditionally was done by students of literature, politics, etc. The use of much more extensive data sets brings about two main differences. First, it becomes virtually impossible to have read the entire data set. This is an important limitation (to be placed with the fact that written text is often accompanied by images and diagrams and is sited within a context usually involving related talk and always in connection with other writings, which corpus methods do not yet allow us to study). Second, it becomes possible not only to detect whole corpus-wide patternings as stated above, but to assess the salience even of small-scale patternings using statistical tools. An example would be Scott’s key-words technique as explained in the ‘Attention Spikes’ section below, but there is notable work by many other researchers, such as Biber. His multi-dimensional analysis work ‘identifies the frequent linguistic co-occurrence patterns in a language, relying on inductive empirical/quantitative analysis’ (Biber, 2010: 246) and picks out dimensions (each of which is a ‘constellation of linguistic features that frequently co-occur in texts’ (Biber, 2010: 246)). Much of this work is *corpus-driven* (as opposed to *corpus-based*, see Tognini Bonelli, 2001) in that the linguistic constructs emerge from the corpus because of the corpus tools and the statistics, and not from the researcher’s pre-conceptions.

We will present findings from a comparison between four developed countries that have been covering climate change regularly. Using corpus linguistics methodology we will map the discourse of climate change over an 11-year period. We will use the conceptual tools of *claims makers* and *frames* (Trumbo, 1996) to analyse the textual database we have created. We make use of WordSmith Tools software (Scott, 2008). This allows us to analyse discourse contexts (and semantic fields and meanings) in which a word is used. Here we apply collocation, cluster, and key-word analysis.

Collocation analysis gives an insight into the connotations of important words. We show that different terms are favoured in newspaper coverage to describe climate change (global warming, greenhouse effect, climate protection) and that these terms are closely associated with different words in different countries.

Analysis of clusters allows us to select the most frequently occurring word clusters (n-grams) for comparative analysis. We show how important words are embedded in clusters in different ways across countries.

Key-word analysis establishes the relative salience of specific words from one time period compared to the whole corpus. This allows us to examine specific dynamics in greater detail, especially for the period after 2005.

After presenting empirical findings we will make reference to existing theoretical frameworks. Of special interest are the issue attention cycle and path dependent analysis. Given the nature of our mainly inductive methodology we will do this only towards the end where we will compare some claims from previous research with our data.

## Previous findings

Grundmann (2007) analysed the US print media for the period 1988–2004 and found that at the beginning of regular press coverage of climate change in the USA (1988 and 1989) advocates of climate policy were the dominating reference point for the US media. This was due to James Hansen's famous testimony at a Senate hearing in New York. Soon sceptics gained enormous visibility given their relatively small number. Their peak of attention was in 1997, the year of the Kyoto negotiations. The Intergovernmental Panel on Climate Change (IPCC), the third main actor in the game, received significant media attention in the years when its reports were published. Grundmann (2007) also looked at the German print media and found that in comparison to the USA, far more reference was made to the IPCC and advocates of stringent climate policies – climate sceptics barely get mentioned. Several advocate scientists are highly visible in the German press, including Hartmut Grassl, Klaus Hasselmann, Hans-Joachim Schellnhuber and Paul Crutzen. No German sceptical scientist was visible. Whenever reference was made in the German print media to sceptical scientists, they were from abroad. As in the USA, the IPCC is highly visible in the German media during the years when it releases its reports. However, the study examined only scientists as claims makers. This limitation needs to be overcome as politicians and other actors are clearly engaged in the climate change discourse.

Grundmann and Krishnamurthy (2010) examined the structure of the climate change discourse in the UK, USA, France and Germany by analysing the relative importance of specific expressions (such as global warming, greenhouse effect or climate change) and their collocations. They found that in the French and German press a moral frame was much more evident compared to the American or British press. They also found that the issue was relatively more important in the French and German press given their smaller size of newspaper content in LexisNexis. However, they stress that their findings were based on a pilot study based on LexisNexis data that had not been cleaned. Notorious problems with LexisNexis data are the changing population of newspapers over time and the presence of a large but unknown number of duplicates.

## Mapping the discourse on climate change

For the analysis presented here, a corpus was created using full text newspaper archives from the LexisNexis database. We used the search terms *climate change*, *global warming* and *greenhouse*

effect for the UK and USA. For France we used *changement climatique* (=climate change), *effet de serre* (greenhouse effect), *réchauffement de la planète* (planet warming) and *réchauffement climatique* (climate warming), and for Germany *Klimawandel* (climate change), *globale Erwärmung* (global warming), *Treibhauseffekt* (greenhouse effect), *Klimaschutz* (climate protection) and *Klimakatastrophe* (climate catastrophe).

The acquisition policies of LexisNexis lead their data archive to over representation of Anglophone news sources. We have tried to mitigate this bias through the creation of a corpus that is similar in size, based on several criteria. We included only newspapers that had reported on climate change in every year from 2000 to 2010. We then selected the top 10 newspapers in each country, measured by the number of news stories on the topic, but with some adjustments reflecting circulation (see Online Appendix Table 1).<sup>2</sup> The LexisNexis corpus was cleaned up using a purpose-built program that also excluded newswires and nearly all duplicates. This resulted in a corpus of 106.5 million words for all four countries. The total number of news stories varies from 45,000 (USA) to 61,000 (UK) with France and Germany in between. The total circulation of the newspapers in our sample varies from 2.3 million (France) to 5.7 million (UK). This indicates that the UK newspapers had more stories circulated to a wider audience than the other countries.<sup>2</sup>

Month-by-month corpora were built, one for each national set, using all the relevant search-phrases. From these, frequency lists with search terms were calculated for the period 2000–10. Figure 1 shows the distribution of attention across the four countries, giving the total of all search terms.

Looking back over the last decade across the four countries, we see some early peaks in 2000 and 2001, but the issue really took off after 2005. Germany attaches especially high importance to this issue in 2007, and Germany and the UK show an equally high peak towards the end of 2009. Several events drove the attention levels, among them the US withdrawal from the Kyoto process (2001), the G8 summit in Gleneagles, Scotland (July 2005); Hurricane Katrina (August 2005); the release of the film *An Inconvenient Truth* (May 2006), the Stern Review (October 2006); the IPCC Fourth Assessment Report (early 2007) and the Nobel Prize to the IPCC in October 2007. Towards the end of 2009, just before the Copenhagen summit, media attention surges again in all four countries, only to be followed by a sharp slump, falling to levels seen around 2005.

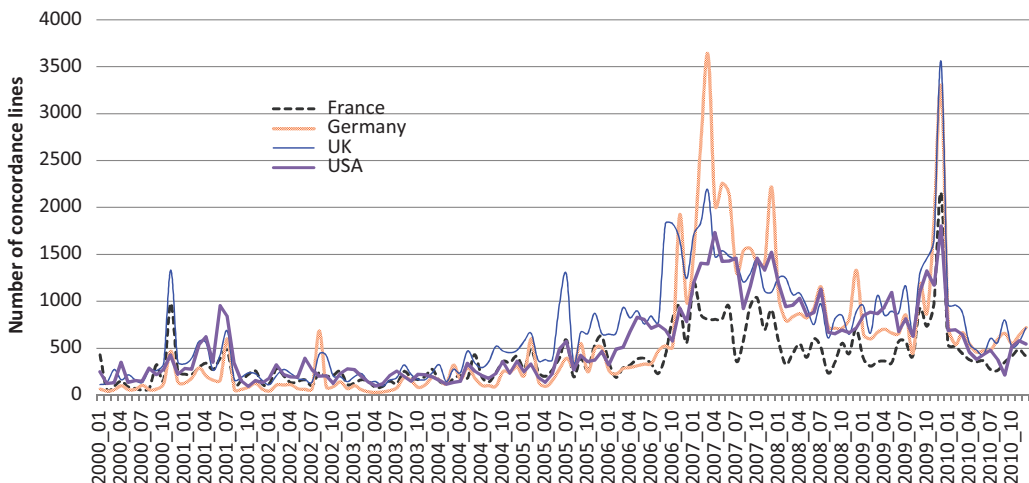


Figure 1. Monthly data using all search terms.

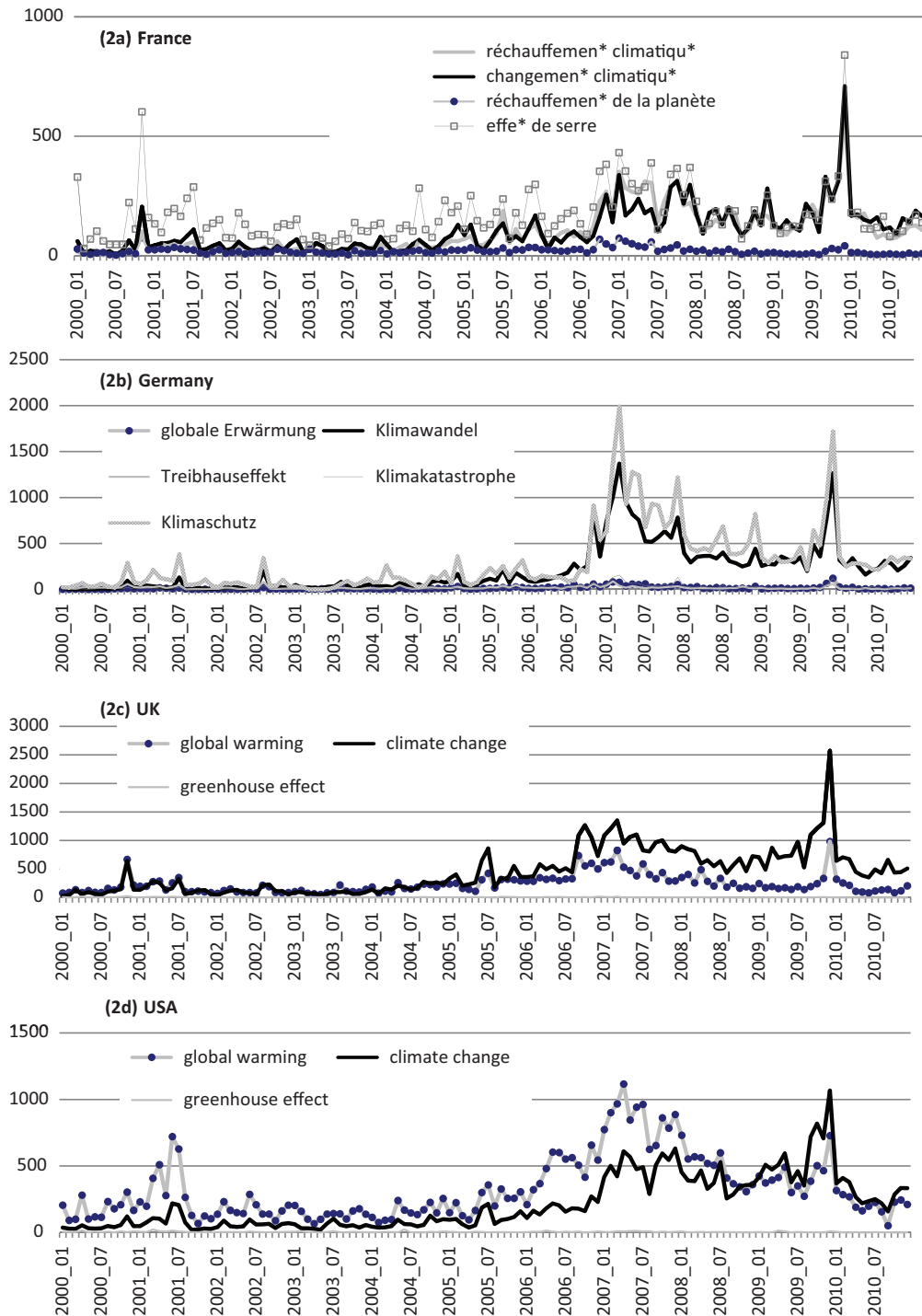


Figure 2. Country-specific search terms over time, 2000–2010.

The national sub-corpora allow us to map the use of different search terms over time (see Figure 2) using monthly data.

We note that different terms are preferred in different countries. All countries frequently use *climate change* or its equivalent. However, the most frequent term in France is *effet de serre* (with 22,084 concordance lines compared to 13,815 for *changement climatique*); in Germany it is *Klimaschutz* (38,566, compared to 27,772 for *Klimawandel*). *Klimakatastrophe* pales in comparison (2,614). That term, unique to German-speaking countries, was thought to be highly evident in previous research (Grundmann, 2007).

Only in the UK is *climate change* the dominating term (58,721 concordances) while the USA shows a preference for *global warming* until 2009 (43,742 concordances). Apart from France, the term *greenhouse effect* is used very rarely.

## What is in a word?

Many have speculated about the ‘intrinsic’ meaning of terms such as *global warming* and whether this is more alarming than, say, *climate change* (see Grundmann and Krishnamurthy, 2010 referring to President Bush Jr; Whitmarsh, 2009: 416 referring to lay audiences). We conducted a collocation analysis (see Online Appendix Table 2 for details) with the following results.

Climate *change* is a term widely used in all four countries. Its collocations in France and Germany show *lutte* and *Kampf* (fight). The UK mentions *tackle*, *convention* and *against*, while the USA seems more detached, emphasizing words such as *panel* and *effects*. The press in both countries sees a close link to *energy* and *global*. In addition, in the USA the frequent appearance of *legislations* as a collocate of climate change is noteworthy.

The German press uses the term *Klimaschutz* (literally *climate protection*) as the most relevant term; this has a positive connotation as is evident in the word *Beitrag* (contribution), in contrast to *Klimawandel* (climate change), which tends to associate closely with a negative – *gegen* (against). This positive/negative framing is unique to the German discourse. It allows calling for a ‘fight against’, but also phrasing this effort as a ‘contribution to’. What is more, this contribution seems to be linked to the *Thema Umwelt* (environment issues) with a role to play for *Wirtschaft* (the economy).

The most frequently used term in the US press is *global warming*. It has collocations that emphasize the effects of *gases* and *emissions*, and they seem to be described as *pollution*. *Energy*, *Kyoto* and *combat* are also visible. This suggests a less dramatic use of words compared to the other three countries when looking at the most frequently used term.

Cluster analysis, the next step in our investigation, shows the actual context of the search term in phrases and repeated sequences of words. Again, we differentiated between different search terms and their popularity in the four countries.

Again, the German *Klimaschutz* emphasizes the positive contribution for the protection of the environment and the climate. However, when talking about *climate change*, the press in Germany, France and the UK use clusters stressing the *fight against* climate change or the need to *tackle* it. The US press uses *impact* and *issue* much more frequently, but *fight* is a much less prominent term. Collocation analysis and word clusters both show that there is an emphasis on fighting climate change in the European press but much less in the US press. A close comparison of UK and US clusters on climate change shows the UK press mentioning *the dangers of global warming*, which is absent in the USA. Clusters with *climate change* in the USA portray the issue very much as scientific with reference to the IPCC. The UK, too, mentions the panel, but includes *effects*, *impact* and *fight against*. The French press also has this element of pure science as the word clusters of

*effet de serre* show. However, the collocations of *effet de serre* reveal an additional political and moral dimension of the discourse, showing *lutte, contre, responsables*.

## Who speaks for climate?

We now come to the question of which actors or claims makers (Trumbo 1996) are particularly visible in the newspapers. For each country we identified central claims makers from politics, science and pressure groups who engage in the issue, distinguishing between *advocates* and *sceptics*.<sup>3</sup> We used the same set of names for all countries in order to see any patterns of cross-national diffusion. *Advocates* use knowledge claims to advance ambitious climate mitigation targets. We have identified them through previous reading of the literature, using salient names in the corpus, and adding additional names through peer consultation. We also included environmental pressure groups and green parties (see Online Appendix Table 3).

Claims makers from various sectors in society are active in the climate discourse. The French and German presses give twice as much attention to advocates as the UK and US presses.

France and the US show higher visibility for individual advocates; in Germany and the UK environmental organizations and pressure groups are much more important. Among individual advocates politicians are more visible than scientists, but both tend to be confined to their countries, with a few exceptions. Al Gore is by far the most important reference in the USA and is also highly visible in other countries. But the UK's Milibands (we left the identity deliberately ambiguous as both Ed and David were in favour of ambitious climate policy goals), Germany's former environment ministers Toepfer, Trittin and Gabriel, and the French Hulot and Voynet are not visible beyond their own countries. In the USA, James Hansen is the most visible advocate scientist (though his significance pales in comparison to Gore), in the UK it is Nicolas Stern, in France Jean Jouzel and in Germany Schellnhuber. Nicolas Stern and his review had a high impact in the UK, but even more so in France. In comparison to other countries in our sample, the French press pays more attention to climate scientists in general, and to scientists based in other countries (Hansen, Schmidt, Bolin, Watson).

Let us now turn to the sceptics. We define sceptics as individuals who use knowledge claims in order to promote a wait-and-see approach, usually by casting doubt on the theory of anthropogenic global warming. Table 4 (Online Appendix) shows the visibility of sceptics identified through the same process as described above for the advocates.

Regarding the visibility of sceptical voices, similar conclusions can be drawn as with the advocates. Individual sceptics are far more visible than pressure groups or think tanks. Sceptical politicians (Senator Inhofe and Lord Lawson) score higher than scientists. Al Gore, the most visible advocate, is quoted 25 times more often than Michael Crichton, the most visible sceptic across national boundaries. Sceptics are above all visible in their own countries. However, neither France nor Germany have high-profile politicians speaking as climate change sceptics. In the French press climate scientist Claude Allègre (a scientist who served as minister in the Jospin government) has a very high visibility but, again, this influence is restricted to France. Lord Lawson's visibility is limited to the UK. In Germany the most important sceptical references are to the renowned late novelist Michael Crichton (author of *State of Fear*) and the Global Climate Coalition. Crichton is the only sceptic who is very visible across all four countries. The US press gives nine times more attention to sceptical voices compared to Germany, and four times more than the UK.

The list of sceptical groups was drawn up using websites such as Corporate Europe Observatory. This website lists eight think-tanks that it considers influential: International Policy Network (IPN), the Global Warming Policy Foundation, the Spanish Instituto Juan de Mariana, the Danish

CEPOS, the French Institut Économique Molinari, the Austrian Hayek Institute and Germany-based CFACT Europe. However, as our analysis shows, these are not very visible in the print media. There is a noticeable difference in visibility between corporate interest groups and think-tanks on one side and environmentalist groups on the other. This could indicate that it is seen as legitimate to lobby for the environment but not for private interests. Private interest groups seem to prefer claims makers, especially scientists, to cast doubt on anthropogenic global warming. This has the side effect that the science becomes the battleground for interest politics.

In Figure 3 we summarize the visibility of advocates, sceptics, and the IPCC over time.<sup>4</sup> Different patterns can be seen across countries. In France the discourse tends to be dominated by advocates, with some additional visibility of environmental NGOs in 2010. Also the USA shows a dominance of advocates but NGOs virtually play no role at all. This picture is reversed in the UK where the major reference is to NGOs and Greens until October 2006, when the Stern review was published. Before that time, advocates in the UK were virtually invisible. However, the surge of attention in Britain in 2006 was led by advocates. Environmental pressure groups remain highly visible but individual advocates get peak attention in 2007 and 2009. The UK press is unique in that advocates enjoy high visibility even after the downturn of attention at the end of 2009 (ironically, this is the context of John Houghton's remark from the beginning of the article). Germany, like the UK, shows strong NGO presence between 2006 and 2009. They are a dominating reference point in the media, much more than individual advocates. Some advocates in Germany are also members of the Green party, which was in government from 1998 until 2005. This has probably given them increased visibility.<sup>5</sup>

The time series indicate a very low visibility of sceptical voices in all countries. All countries show higher visibility of advocates and of the IPCC.

Figure 4 shows the period from 2005 to 2010, focussing only on the visibility of advocates and sceptics. We see a much higher level for advocates with the USA trailing the EU countries. Sceptics are on average more visible in the USA than in Europe, but the peaks of attention belong to France in 2006 and 2010, and to the UK in 2009.

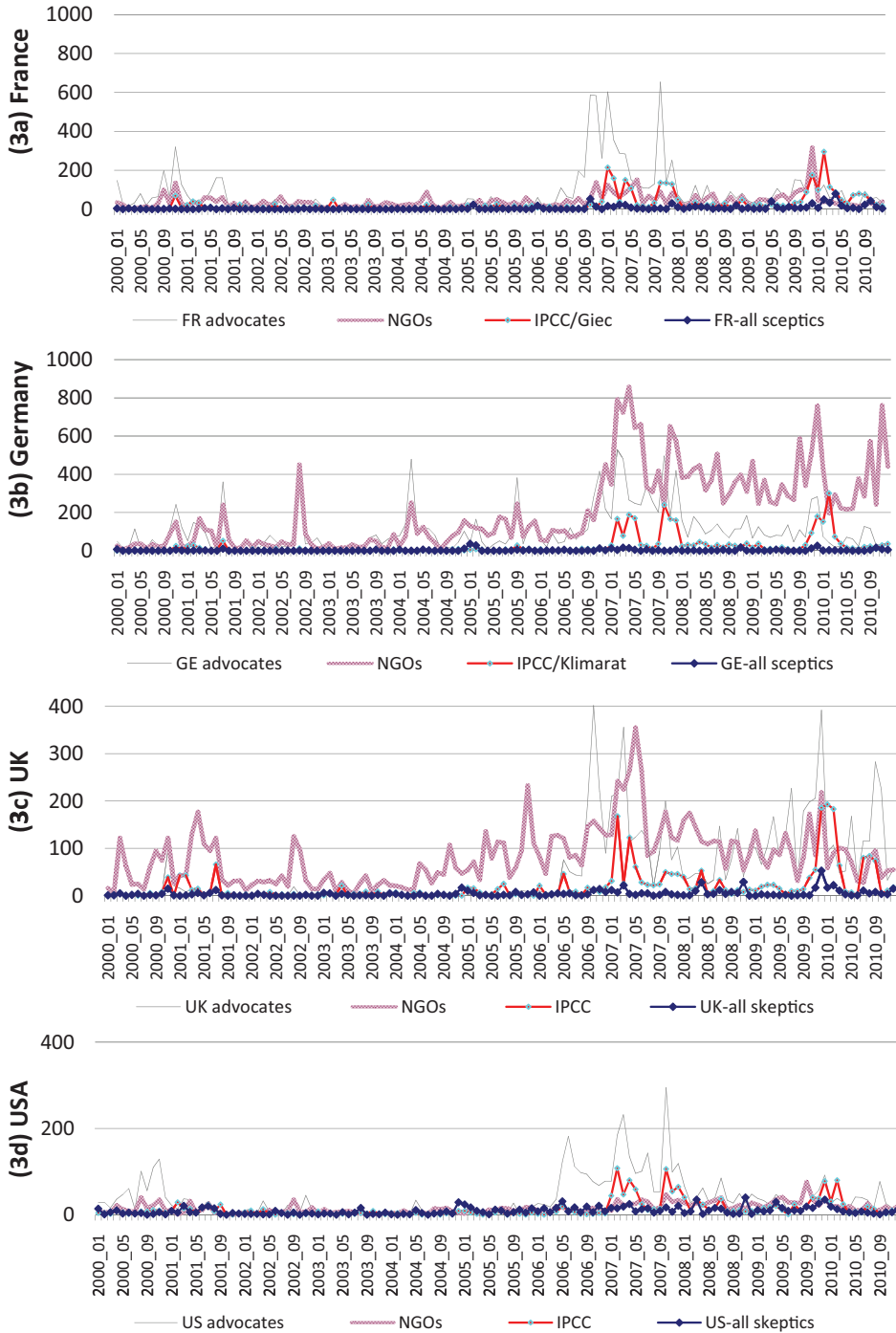
## Attention Spikes

In what follows we analyse the period 2005–10 in greater detail. Our data shows a sharp rise of attention after 2005, which we attributed to several high-profile interventions from advocates of ambitious climate policies. But this rise is not caused by the same events and actors across countries. Using key-word analysis we are able to trace the different domestic drivers of attention.

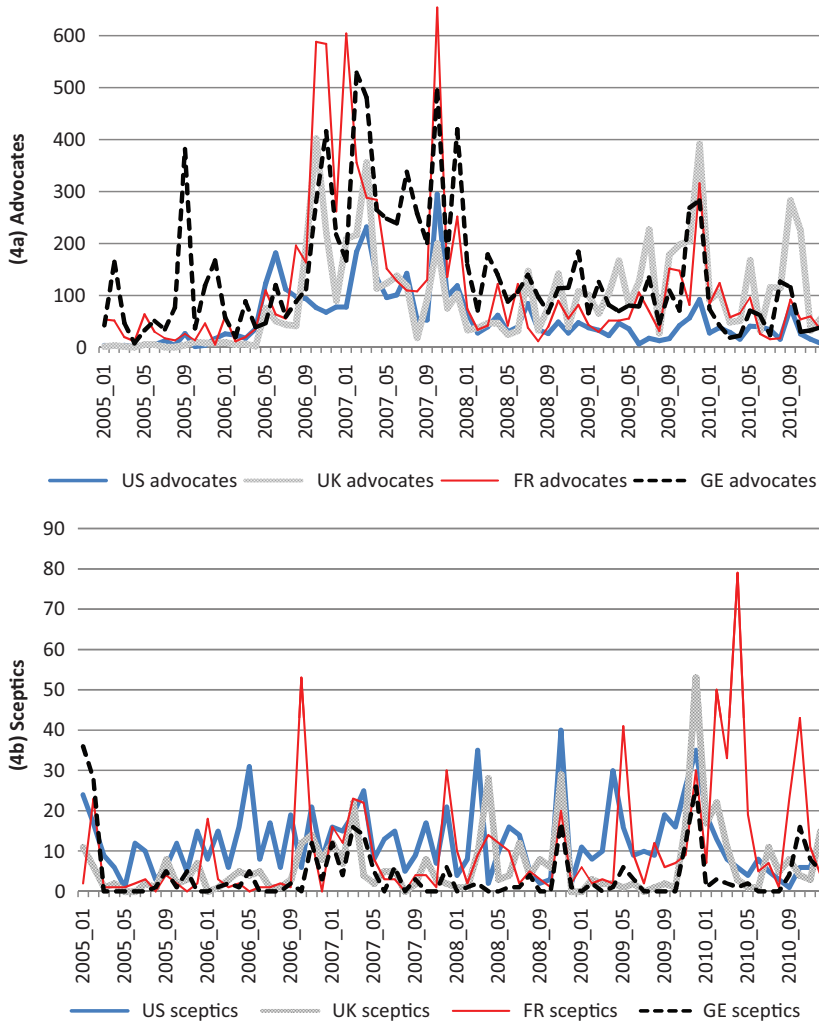
This procedure (see Scott, 1997) uses a verbatim comparison of the frequency of each and every term in a document, with the frequency of the same term in a reference corpus. The comparison uses the log-likelihood statistic (Dunning, 1993) and throws up as 'key' all items where the statistical significance of this comparison meets a given threshold criterion usually set at  $p = 0.000001$ . We selected the top key words, based on a combination of keyness and frequency, excluding alien words and characters (e.g. *All rights reserved*, *http*, *Edition*, etc.).

The prevalence of similar and different key words points to two related processes. One is to do with synchronization of public discourses across jurisdictions (Grundmann 1999), the other with the strong influence of domestic politics on issues of global reach such as climate change. We see a strong synchronizing effect in 2005 when the UK hosts the G8 summit in Gleneagles and Hurricane Katrina hits New Orleans. These two events were prominent in all four countries. Tony Blair tried to put climate change on the international (and domestic) agenda and Katrina was seen as a possible harbinger of climate change. Also in 2005 an anti-poverty campaign is visible in the





**Figure 3.** References to advocates, sceptics, environment NGOs and the IPCC. Note the different scales for France/Germany and UK/US.



**Figure 4.** Advocates and sceptical voices, 2005–10. Note the different scale for advocates and sceptics.

UK and US corpus. In 2006 we see a split in attention to two different events. While the US, France and Germany discuss Al Gore's film *An Inconvenient Truth*, the UK marvels at the publication of the Stern Review (salient in France, too). In 2007 the climate summit in Bali is key in all countries. 2008 sees the US presidential election and grave concerns across all countries about a global food crisis triggered by bio-fuels, which had already surfaced in the USA in 2007. In 2009 Barack Obama and Copenhagen are the central theme in all countries. The email scandal does not register highly in our key-word analysis. In 2010 COP16 in Cancún, Mexico is prominent in all countries, except the USA, where the BP oil spill takes centre stage. The USA is not much interested in COPs or G8 summits (except Gleneagles and Copenhagen).

While several international events led to a synchronization of attention issues across the four countries, in 2008 and 2010 see domestic issues driving the agenda, such as elections or

parliamentary initiatives. Visibility of domestic politicians tends to be confined to their country with the exception of US politicians, who are reference points across all countries. Germany pays special attention to Russia in many years. France shows the climate activist Hulot twice as key (in 2006 and 2007) and the climate sceptic Allegre as key in 2010.

How do our results compare with research based on a smaller sample? Max Boykoff writes on the period after 2005: ‘The two largest increases in coverage in the UK took place during June–July 2005 and September–November 2006. June–July 2005 was marked by two particularly prominent moments that garnered heavy newspaper coverage: the Group of Eight (G8) Summit ...’ For the US rise in attention he identifies several causes, such as the Stern Review and COP12 in Nairobi, but also ‘the mid-term Congressional elections and prominent state-level climate policy action. For instance, Arnold Schwarzenegger gained widespread recognition for approving a California bill to cap industrial greenhouse-gas emissions, which helped his re-election campaign’ (Boykoff, 2007: 473–474).

Our data show that Gleneagles is important in all countries but Nairobi does not show up in the USA, nor in the UK (it does in France and Germany). The Stern Review is not highly visible in Germany or the US (but in the UK and France). Schwarzenegger’s policy initiatives in California are highly important for US press coverage in 2007, but neither in France or Germany, nor the UK. As the analysis above shows, there are several additional drivers of attention during these six years that have become visible through corpus analysis.

## ‘Climategate’

Towards the end of 2009 we see another peak in media attention, and a sharp drop at the beginning of 2010. The peak was caused by the Copenhagen summit and the subsequent drop may be seen as an inevitable result of media attention cycles, especially on the backdrop of a disappointing summit. Some commentators have speculated that the University of East Anglia email scandal (‘Climategate’) played a role in this and that scepticism about anthropogenic climate change is on the rise as a result. While we see a rise in scepticism in all countries, the peak attention occurs in France (see Figure 4). Frequencies alone do not tell us very much, so we performed another collocation analysis and searched our corpus for the terms *climategate*, *East Anglia*, *CRU*, *research unit* and *emails*. From November 2009 to December 2010 there were 346 references in the French press, 799 in the German press, 2,214 in the UK press and 1,756 in the US press. In Germany the strongest and most frequent collocations of these terms are *Hacker*, *interne* und *Affaere*, indicating that the release of the emails was seen as illegitimate. In France the strongest collocation is with *affaire*, suggesting more neutrality. The US press shows the words *stolen* and *hacked* as significant ( $N = 137$ ), much more frequent than *leaked* ( $N = 44$ ). By contrast, in the UK press the lemma *leak* ( $N = 285$ ) is salient and much more frequent than *hack* ( $N = 77$ ).

The words *leaked* and *hacked* are different with regard to their ethical connotations in this context. The use of *hacked* (or *stolen*, or *illegally obtained*) clearly condemns the email release, whereas the use of *leaked* stipulates that there must have been an inside source (maybe a disgruntled colleague or student?) who published the correspondence and documents. In this reading, the content of the emails is the main ethical concern, not the act of releasing them. It is therefore fitting that the term ‘climategate’ (with the obvious connotation to ‘Watergate’ and other ‘gates’ that stand for wrongdoing) was coined by James Delingpole, a British journalist who used it on his blog before covering the issue in the *Daily Telegraph*. The *Telegraph* and the *Times* exploited this scandal well before the *Guardian* or *Independent*. Both the *Times* and the *Telegraph* had earlier tendencies towards scepticism, as Carvalho and Burgess (2005) demonstrated. The UK press, unlike the

press in Germany and the USA, does not see the release of these emails as legitimate. However, 'climategate' became an accepted term also in these countries that could indicate that the wrongdoing is not attributed to the East Anglia researchers but to hackers who illegally published the mails.

In conclusion, the high visibility of sceptics in the French press does not seem to be related to the East Anglia email affair. The only link between the two is evident in the UK.

## Do countries matter?

Grundmann (2007: 427) summarized the differences and commonalities between the USA and Germany as follows: 'the slant of media reporting on climate change issues is broadly in line with government policies and the broader political climate prevalent in both countries. There is a strong green movement and political representation in Germany but not in the US.' We can confirm this assessment on the basis of a much larger data set. However, we find limited support for the statement that 'the US press gives much space to the climate sceptics, in line with its strong fossil fuel lobbies and a wait-and-see government policy'. As this analysis shows, sceptics are less prominent in the USA than advocates, and less prominent than the IPCC. Their visibility is higher compared to Germany and the UK, but not to France.

It would be interesting to relate these findings to a discussion of national political culture and whether it matters. Lack of space does not allow us to do so in depth. Nevertheless, we offer a few speculative comments. UK and French political culture arguably has a bearing on the relative salience of different frames and actors. While France shows a strong reliance on the IPCC as the authoritative and objective institution expressing expertise on the matter, reflecting a culture that tries to de-emphasize personal and entertainment aspects from the scientific, giving less weight to sensationalism (Brossard et al. 2004: 363), it also gives prominence to sceptical voices in the media. France has the highest level of visibility for individual sceptics (see Online Appendix Table 4). The UK enters the game via a cost-benefit analysis and top government intervention, arguably reflecting two mainstays of her political culture.

Theoretical explanations aside, our dataset shows that the role of civil society is clearly different in Europe and the USA. Environmental NGOs and Green parties and pressure groups are much more visible and influential in Europe (with the possible exception of France) compared to the USA. Germany is outstanding in this regard because of the presence of the Green Party and the activity of its environment ministers. In the USA, a Hollywood blockbuster got the climate issue onto the agenda and its main protagonist gained enhanced visibility through the sharing of the Nobel Prize and, in addition, accepting the Oscar on stage (albeit the award went to the director of *An Inconvenient Truth*). Al Gore has been one of the main drivers of the US discourse since the early 1990s.

Moreover, all countries show different domestic policy issues that drive the climate change agenda and attention levels. The USA gives most prominence to entertainment aspects within the discourse. This is evident if we look at the most visible sceptic, the late novelist Michael Crichton and the movie *An Inconvenient Truth*. The USA also shows weak connotations of central terms (climate change, global warming) with alarm, action or moral frames.

## Theoretical implications

The ups and downs of attention around the climate change issue have been interpreted as examples of the issue attention cycle (Trumbo, 1996). However, if one uses the five stages identified by Downs it is open for debate how to define these phases. Writing in the mid-1990s, Trumbo

(1996: 275–276) speculated that we might see the climate change discourse entering the fifth and final stage in 1995, ‘a prolonged limbo – a twilight realm of lesser attention or spasmodic recurrences of interest’ (Downs, 1972: 40). With hindsight, it seems obvious that the real rise of the climate discourse only began after 2005. Over the years there has been an increase of reporting on the issue with frequent signs of wavering between different stages, for example between alarmed discovery and realization of the cost. One could date the second stage to the early 1990s when US president George Bush Sr declared that he would counter the greenhouse effect with the ‘White House effect’, a clear sign of euphoric discovery, soon to be replaced by the ‘realization of cost’ (Downs’s second stage). But one can see a rediscovery of the issue many times over the 20-year period and it is not clear if it can rise again after the fall in 2010. So far, it has not reached the final stage and it is an open question whether it will reach such a stage in the future. Because of the competition of news and the limited ‘carrying capacity’ of public attention other issues will always be on the rise with a tendency to replace climate change as top news (Hilgartner and Bosk, 1988). A constant alarm of the public via the news media over a single issue is unattainable.

A second theoretical perspective is offered by path dependency analysis. In this approach, early events in a chain of events are crucial for the further development (David, 1985, Goldstone, 1998). We can confirm this with the case of Germany, which used dramatic language from the outset, and gave no attention to sceptical voices. The alarm rose again in the concluding months of 2009. The East Anglia scandal could not dispel this attitude. The release of the emails was seen as illegitimate. Likewise, France has a history of privileging the IPCC as reference point (while it has one influential domestic sceptic). The UK attended to the issue of climate change with an ‘alarmed discovery’ after 2005, arguably triggered by government strategies of putting climate change on the international and domestic agenda. However, earlier positions of scepticism (Carvalho and Burgess, 2005) had not become extinct and came back to some extent in the reporting on ‘climategate’. On balance, the UK press is the only one in the sample that sees the release of the emails as legitimate. And this did lead to an increased visibility of sceptical voices in the UK press (see Figure 4). Finally, the USA has seen the presence of sceptical voices from the start of the discourse in the late 1980s, which manifests itself in higher average levels of visibility, compared to the other countries in our sample.

## Conclusion

Coming back to the initial questions, Are climate scientists losing the PR war? And: Do countries matter? We can state the following. All countries show a dominance of advocates over sceptical voices for the period 2000–10. Sceptics are much more visible in the USA and France compared to Germany and the UK. Al Gore is the dominant reference point across all countries and there is a dominance of political actors over scientists within the group of advocates. However, in 2009–10 there is a slump in attention given to advocates. The UK is peculiar, as it shows three peaks in these 24 months, in December 2009, May 2010 and September 2010. But the sceptics have not been able to exploit this situation as their much lower level of coverage shows (see figure 4 and note the different scales. France shows a high visibility of sceptics). This is line with our keyword analysis, which shows the salience of *climato-sceptiques* in 2010 in France (see Online Appendix Table 5).

Despite the powerful tools provided by corpus linguistics, there are important limitations. The first has to do with the search routines that can be performed on the basis of automated software. These are limited to verbal expressions that do not allow us to search for frames directly. We addressed this problem through a combination of deductive and inductive methodology. Using

specific words and word combinations as indicators of claims makers and frames informed our deductive work. The deductive method led to important insights about the role of scientists, politicians and green pressure groups. The inductive method was used for our key-word analysis, which enabled us to analyse the shifts in public discourse from 2005–10.

The second limitation lies in the different nature of linguistics and sociology. We have to be careful not to over-interpret our findings. While, for example, a frequency list of a Shakespeare play may tell us something about the play because we know the text is read and studied carefully, the same cannot be assumed of those who read the news on the train to work. In other words, we cannot assume that word frequencies have a direct impact on readers. And we cannot assume that high levels of media reporting will automatically lead to political attention (see the literature on public opinion formation, e.g. Bryant and Zillmann 2002). Peaks of media attention do not necessarily translate into more public concern – the opposite may be the case and we might see ‘climate change fatigue’ (Nordhaus and Shellenberger, 2009). High levels of media attention need to be taken up by political agenda setting, otherwise an issue will not be considered for policy making. Evidence also suggests that political elites and their agreement or disagreement is crucial in this regard. Brulle, Carmichael, and Jenkins (2012) note that ‘When elites have consensus, the public follows suit and the issue becomes mainstreamed. When elites disagree, polarization occurs, and citizens rely on other indicators, such as political party or source credibility, to make up their minds.’ This appears to be the case with climate change in the USA and could explain the low salience of climate change on the political agenda. Further research is needed for the analysis of the link between levels of media reporting and policy uptake (such work would need to re-evaluate the research in the field of cultivation analysis and Advocacy Coalition Framework, see Morgan and Shanahan 1996; Sabatier and Jenkins-Smith 1993).

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## Notes

1. In the case of Germany we excluded the bi-monthly *Energie & Management* (circulation 7,500) and included *Focus Magazin*. For the US, we excluded *The Washington Times* (circulation 100,000) and included *USA Today* instead.
2. We realize that our cross-section of newspapers reflects the media landscape in each country. For example, UK papers include broadsheets and tabloids, which is not the case in other countries. Also, the nature of regional newspapers varies across countries. Future work could examine to which extent this matters, assuming that different types of newspapers have different editorial styles, audience reach, ideological positions etc. (see Bell 1991).
3. This dichotomy has the advantage that it makes the identification of central claims makers easy and follows an established distinction between ‘crusaders’ for the case and their opponents. However, it

makes it difficult to account for independent voices in between who have been visible for an extended period of time. For example, we find that Roger Pielke Jr and Sr get 32 references in the US press, Hans von Storch gets 216 in Germany. These voices are seen as sceptics by the advocates and as advocates by the sceptics. They prefer the term ‘honest brokers’.

4. Because of their low numbers, data for sceptics include individual sceptics and sceptical non-governmental organizations (NGOs).
5. We did not count politicians such as Trittin as part of an environmental organization but as individual advocates, because we define advocates as visible individuals who use knowledge claims to foster (ambitious) climate mitigation policies.

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### Author biographies

Reiner Grundmann’s current recent research focuses on the discourse of climate change, using a comparative approach across nations. He has published several influential papers on the Kyoto Process and the IPCC. He is a co-author of The Hartwell Paper. His book publications include *Marxism and Ecology* (Oxford University Press, 1991), *Transnational Environmental Policy* (Routledge, 2001), *Experts: The Knowledge and Power of Expertise* (with Nico Stehr, Routledge, 2011) and *The Power of Scientific Knowledge* (with Nico Stehr, Cambridge University Press, 2012).

Mike Scott is a corpus linguist. He has published a number of books and articles on corpus linguistics, particularly concentrating on the notion of keyness, e.g. *Textual Patterns: Keyword and Corpus Analysis in Language Education* (with C. Tribble 2006, Benjamins), and *Keyness in Texts* (with M. Bondi, 2010, Benjamins) but his main production has been of corpus software. He created and still develops WordSmith Tools, published by Oxford University Press since 1996, and currently at version 6.0.