DISSEMINATING CLIMATE CHANGE KNOWLEDGE
Representation of the International Panel on Climate Change in three types of specialized discourse

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Abstract – Regarding such a complex issue as climate change, it is crucial to understand how specialised knowledge is conveyed to the public. The Intergovernmental Panel on Climate Change (IPCC) is often considered the main source of scientific knowledge on climate change. This paper aims at understanding how knowledge produced by the IPCC is disseminated in three types of documents, with various degrees of specialisation, Earth Negotiation Bulletins, United Nations reports and the general-interest press, over two time periods (2009-2010 and 2014-2017). To do so, the analysis combines the tools of corpus linguistics and discourse analysis, which puts quantitative results in context. Identifying IPCC collocates enables to specify the context of use according to sub-corpora. This reveals that although the IPCC is referred to as a knowledge-provider in all corpora, there are variations as to the degree of trustworthiness given to the institution as well as to the amount of detail given on results. Looking at explicit quotations according to their theme, wording and type of reported speech confirms this. Recontextualization processes in the press corpora entail more reformulation and explanatory comments. The scientific nature of the work is made more explicit in the United Nations reports and Earth Negotiation Bulletins. Differences between the six sub-corpora can be analysed according to generic specificities and time frames revealing the increasingly central role of the IPCC as a trustworthy provider of scientific knowledge on climate change.

Keywords: International Panel on Climate Change; Specialised Knowledge; Recontextualisation; Genre Analysis.

1. Introduction

To assess human-induced climate change and its effects, it is necessary to draw on knowledge from diverse disciplines, such as, for example natural physics, climatology, geography, economics, political theory, to name but a few (Colson *et al.* 2009). This helps explain the importance of the role of the International Panel on Climate Change (IPCC) in publishing referential reports on human-induced climate change. Although this organisation does not

produce new results on the topic, it is quoted as a reference on climate change knowledge owing to its function of synthetizing and evaluating all available publications on this topic. Given the number of disciplines involved, knowledge on climate change is not driven by disciplinary specialization but by policy needs, as the international community strives to find applicable solutions against climate change. The IPCC responds to these needs by publishing comprehensive research on the subject as well as giving advice to policymakers. On account of this role and its link to intergovernmental decision-making organisations, the status of the specialized knowledge it provides may be a topic of controversy (Aykut, Dahan 2015). Our aim here is to examine this role by looking at how the content of its reports is disseminated through different forms of communication. To do so we constituted a corpus of published, written documents on climate change that can be broken down into six sub-corpora reflecting generic specificities and diachronic variation. We intend to find out whether the status of the IPCC as a specialized knowledge-provider is context-specific. To do so, we consider how the content of the reports is disseminated across different genres and time periods. After a brief presentation of the theoretical framework to our analysis, we use corpus linguistic tools to analyse the contexts in which the IPCC's name is mentioned. Collocates and concordance lines of the term IPCC are analysed, and quotations of the IPCC are considered in context and classified according to content, type of quotation and wording. Our overall purpose is to contribute to a better understanding of the role of the IPCC as a knowledge-provider and to track discursive variation across discourse communities and time periods.

2. Methods

2.1. Corpus Linguistics and Genre Analysis

Our interest for the specialized knowledge produced by the IPCC emerged from our reading on climate change negotiations, in which it is quoted as an essential knowledge-provider, resulting in our hypothesis that this representation of the IPCC may be considered context-specific. A comparison of discourses from different types of specialized texts may indeed show that there is little consensus on the trustworthiness of this institution and that its results are considered with more distance in some contexts. Our aim is to better understand how the knowledge produced is recontextualized. According to Fairclough (2003, p. 51), recontextualization is "a movement from one context to another, entailing particular transformations consequent upon how the material that is moved, recontextualized, figures within that new context". When considering scientific knowledge, it is all the more interesting to analyse "contextualization procedures which make the

communication of science not only possible, but useful and attractive" (Calsamiglia 2003, p. 146). It is particularly important to gain an understanding of these questions concerning climate change knowledge because of the "particularly multivoiced and multifaceted nature of the climate change debate, with a wide range of actors and voices, which causes multiple communication challenges" (Flottum 2017, p. 1).

   The tools we draw on to explore this question derive from corpus linguistics (CL) combined with specialized genre analysis. CL traditionally refers to a quantitative approach to language based on the identification of statistically-significant occurrences in large electronic general language datasets. These quantitative methods have been fruitfully combined with other more qualitative perspectives on language such as genre analysis (Handford 2010), specialized discourse (Koester 2010) or Critical Discourse Analysis (Baker 2006), amongst others. Combining statistical methods with methods which are more attentive to context presents a number of advantages as summarised by Handford (2010, p. 256):

> Corpora have much to say about language, but they can be lacking in contextual interpretability; genres are intrinsically contextual entities, but their linguistic features may be under-exposed.

Even in specialized domains, which are traditionally considered less prone to diachronic terminological variation, an attention to historical context is now becoming increasingly widespread (Dury 2013; Dury, Picton 2009). In the case of a relatively recent specialized field like that of climate change, this temporal dimension can be seen as particularly relevant, since the theory on the topic as well as the discourse that describes it tend to evolve rapidly.

   Our analysis is based on the comparative study of three discursive genres (Partington, Marchi 2015) that represent different levels of dissemination regarding knowledge produced by the IPCC. A genre is defined as a class of communicative events sharing a set of communicative purposes, a rationale that establishes constraints in terms of content, positioning and form (Swales 1990, p. 46). Comparing different genres thus implies taking into account the specific features of each genre, as well as an understanding of the discourse community (Swales 1990, p. 21) that produces it and its level of specialization. As for specialized discourse, the following definition by Gotti (2003, p. 24) is most appropriate to our purposes here:

> the specialist use of language in contexts which are typical of a specialized community stretching across the academic, the professional, the technical and the occupational areas of knowledge and practice.

Our first two corpora can undoubtedly be considered as being specialized in the field of climate change since they are produced by discourse communities

familiar with this kind of knowledge, that is, the people in charge of communication during the conference of the parties (ENB corpus) and members of UN organizations (UN corpus). The third corpus, in contrast, is composed of general-interest press articles and represents popularization discourse (Gotti 2004). The three corpora are more precisely described in the following section.

2.2. Corpus constitution and description

2.2.1 Corpus constitution

As explained in paragraph 2.1, our analysis is based on the comparison of three different corpora composed of texts with distinct generic features. The questions of sample size and representativeness are central to the process of corpus building. Although different theories exist as to the ideal size of a corpus (Nelson 2010, p. 58), there seems to be a degree of consensus regarding the view that specialized corpora may be smaller than general corpora without losing any of their interest as an object of study, as explained by Koester (2010, p. 67):

> Where very large corpora, through their de-contextualisation, give insights into lexico-grammatical patterns in the language as a whole, smaller specialised corpora give insights into patterns of language use in particular settings.

Flowerdew (2004) lists six parameters according to which a corpus can be considered specialized: the specific purpose for compilation, the contextualisation in the case of a specific setting or communicative purpose, the genre, the type of text, the subject matter and the variety of English.

Our corpora may be considered specialized corpora according to three of the parameters listed by Flowerdew. Subject matter is the most obvious. The texts from our three corpora all focus on climate change. Genre is the second feature as our three corpora are genre based, as explained in paragraph 2.1. And, finally, contextualisation, since a specific setting and dates were among the elements which defined the constitution of our corpora. We gathered reports from international organisations and articles from the press, both in the United Kingdom and the United States. Concerning the dates, given that the highly mediatised events of COP15[1] and COP21[2] were milestones in climate change negotiations, we gathered documents published in the wake and aftermath of the event for each corpus, thus narrowing down our corpora to time frames situated between 2009-2010 and 2014-2017.

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[1] Conference of the Parties 15, which took place in 2009 in Copenhagen.
[2] Conference of the Parties 21, which took place in 2015 in Paris.

Different levels of specialization may be observed in the constituted corpora. The first level belongs to a genre produced by a discourse community (Swales 1990) relatively familiar with climate change knowledge: people in charge of communication during the Conference Of the Parties. The documents included in these corpora are homogeneous and are all produced by the same institution: Earth Negotiation Bulletins (ENB) are summaries of the discussions which took place during COP negotiations. They are published by the International Institute for Sustainable Development and can all be downloaded directly from their website. All the documents published during the two time frames under scrutiny were selected for our two ENB corpora.

The second level of specialization concerns that of UN reports, which remain quite technical in their approach to the issues discussed, though they target a wider public. After identifying the UN institutions likely to publish such reports, we visited their websites and used their search engine to find documents of interest, which we classified according to the date of publication. These reports all deal with issues directly related to climate change and contain either the term "climate change" in their title or a related term like "climate mitigation", "climate deal", "climate action". Their length varies greatly, ranging from three- to two-hundred pages.

The third level of specialization concerns the dissemination and media coverage of the IPCC in the general-interest press, i. e. conveying specialized information to lay audiences (Moirand 2004, p. 84; Merhy 2010, p. 30). This may be viewed as a popularization corpus, as it implies recontextualization of the specialized information, as explained by Gotti (2014, p. 23):

> According to this new approach, popularization is thus not just seen as a category of texts, but as a recontextualization process that implies relevant changes in the roles taken on by the actors and institutions involved, and their degree of authoritativeness.

Recontextualization in the general press implies an adaptation of the discourse to different types of constraints such as "public interest and concern, market demands, the newspaper's ideological slant, and competition from other types of media" (Gotti 2014, p. 27). In this respect, it is worth pointing out that the treatment of science by the press is almost always marked by ideology, especially as pertains to the geographical area the articles are published in, the editorial line of the newspaper, or simply the dominant world vision at a certain time and place (Carvalho 2007; Boykoff, Boykoff 2007). It is thus primordial to take these parameters into account when constituting a press corpus. For the 2014-2017 sub-corpus, we chose four newspapers which represented two distinct geographical areas and diverse political opinions, as summarized in table 1:

Newspaper	Country	Political opinion
The Guardian	UK	left, liberal
The Daily Telegraph	UK	conservative
The New York Times	USA	liberal, democrat
USA Today	USA	centrist

Table 1
Description of the 2014-2017 corpus.

The 2009-2010 sub-corpus is smaller due to the unavailability of sources during this period; in fact, only the *Daily Telegraph* and *The New York Times* could be accessed for articles dating back to that time. Nevertheless, it may be considered a representative sample of a comparison corpus since it involves two different countries and divergent political leanings. The corpus was constituted with the help of the Europress database, using an extensive set of keywords including "climate change" and "IPCC", but also combinations of words such as "justice", "energy", "ecology" or "distribution". Our aim was to obtain a corpus representative of what was published on the topic of climate at the chosen periods.

2.2.2. General description of the corpus

In table 2 the data concerning our corpora are detailed.

	Number of words	Number of Documents	Publishing Organisations	Time Span
Earth Negotiation Bulletins	227,831	24	International Institute for Sustainable Development Reporting Services	2009-2010
	247,709	23		2015-2016
United Nation Reports	745,181	14	World Bank, UNEP, UNDP, REDD+, CBD[3]	2008-2010
	725,751	19		2014-2016
The Press	195,651	185	*The Daily Telegraph*, *The New York Times*	2009-2010
	423,459	429	*The Guardian, The Daily Telegraph, The New York Times, USA Today*	2014-2017

Table 2
General corpus description.

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[3] Convention on Biological Diversity.

As seen in table 2, there is some discrepancy in sizes between our different sub-corpora. However, if the issue of size is central in deciding whether a corpus is representative of a specialized discourse, or not, the total number of words alone is not a sufficient criterion. In the BNC, 40,000 words were considered a target sample for different varieties of English. However, in the case of long reports, which is the case of our UN corpus, 40,000 words would potentially only cover one file. The number of files is also a relevant criterion and, for a genre in which files are longer, a greater number of words should be targeted. Although our first press sample is not vast in terms of words count, it nevertheless includes 185 articles, which represents a relatively high number of articles for the 2009-2010 period during which climate change coverage in the press was not as frequent as today. As Koester (2010, p. 71) affirms "many of the limitations of a small corpus can be counterbalanced by reference to the context" and the specificity of the texts gathered in this corpus counterbalances its relatively small size. As such, concerning the press corpus, we considered that the number of files and the representativeness of the sample of newspapers counterbalanced the relatively low word count. As for the ENB corpora, all the documents published at the dates of interest were included, thus eliminating the need for selection or extension of the corpora. In the case of the UN corpora, on the other hand, we did strive to find a balance between word count and number of documents.

2.3. Corpus Linguistics tools

Corpus linguistics offers a wide range of tools to the language analyst trying to describe distinctive features of a corpus. All of them are related to statistical considerations concerning lexical units and their relations. Our aim was to look at the context surrounding the phrase "International Panel on Climate Change" in its developed and abbreviated form, "IPCC". To do so, looking at collocates was a first step. "Collocates are useful in that they help to summarise the most significant relationships between words in a corpus" (Baker 2006, p. 118). Regarding the software TXM (Heiden *et al.* 2010) we used the log-likelihood feature. We needed to adapt the settings according to the number of words in our sub-corpora. The ratio named "indice" in the software, which indicates the statistical significance of the phenomenon observed, had to be adapted according to the size of the corpus. We used ratio 5 on the UN corpora where the word count is high. For the smaller press and ENB corpora, ratios 1 or 2 were more relevant, whereas for the 2009-2010 press corpus only ratio 1 gave results. We examined the contexts of the words in a window including ten words on the left and ten words on the right. We considered the first fifty lexical items after having deleted punctuation, numbers, but also verbs, as we wanted to deal with them separately. To sort verbs from the rest we used the part of speech tool integrated in the TXM

software (Tree Tagger). We compared the results for each sub-corpus to highlight their respective specificities.

In a second stage we focused on collocate verbs. For each sub-corpus we considered the first ten results, including cases where the IPCC was in a subject or object position, to determine the type of action it is shown as being involved in. Verbs were then sorted according to semantic characteristics. Finally, going over all the concordance lines, we identified extracts where the IPCC words were quoted and determined the type of reported speech (Charaudeau 1992) used, the topic, the type of wording and the recontextualization process involved. In each case, the aim was to uncover patterns of meaning regarding the representation of the IPCC in the three genres over the two time periods.

3. Comparative analysis of collocates of IPCC in the three corpora

3.1. Concordance tables

Our preliminary step was to determine the frequencies of occurrences of "IPCC" in our corpora and how they were distributed across types of discourse and time periods.

	IPCC	Intergovernmental Panel on Climate Change
UN 2008-2010	367	106
UN 2014-2016	236	81
ENB 2009-2010	62	12
ENB 2015-2016	90	12
Press 2009-2010	42	60
Press 2014-2017	96	42

Table 3
Occurrences in the six sub-corpora.

Table 3 confirms the importance of the IPCC in the UN and ENB corpora. The acronym is clearly preferred to the developed form. In the press, however, the developed form is preferred in 2009-2010, while the acronym has more occurrences in 2014-2017. Acronyms are considered a sign of the degree of specialization of a discourse (Gotti 2003), which suggests that discourse on the IPCC in the press has grown to be more specialized over time. This is perhaps due to the institution becoming more familiar to the public. There are also marked differences in the way the institution is named

in the different newspapers, as table 4 shows.

	IPCC	Intergovernmental Panel on climate change
The Guardian	59	22
The Daily Telegraph	77	29
USA Today	2	Ø
The New York Times	Ø	51

Table 4
Occurrences in the press corpus.

Although the two US newspapers tend not to use the acronym "IPCC", several occurrences of the full name of the institution were found in the *New York Times* corpus. These appear most particularly in 2009-2010 (45 occurrences), – suggesting that the US press considers the public to be less familiar with this institution. Furthermore, there is a frequent tendency to explain what the IPCC is in the American press corpus, such as "a UN climate panel" (5 occurrences in the *New York Times*), "the UN climate change panel" (2 occurrences) "the climate change panel" (5 occurrences), or "the world's top climate science panel" (1 occurrence).[4] In contrast, the British press mentions the acronym "IPCC", but rarely adds an explanation as to what the institution is, or even its full name. It may suggest that the IPCC is considered a widely known institution in the UK, while it is not the case in the US.

3.2. Semantic categories identified in nouns

So as to determine the type of context in which the IPCC appears in each of our corpora, right and left noun collocates were identified. Table 5 shows the general results, among which several semantic categories could be identified. The acronym form was used for this calculation. To facilitate comparability of results, information is given about the number of co-frequencies and the ratios in brackets. Uppercase and lowercase fonts are distinguished.

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[4] Since these formulations are difficult to identify systematically as referring to the IPCC, they were not taken into account in the analyses of coocurrents.

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	2009-2010	2014-2017
ENB	Intergovernmental (11; 21), Panel (11; 21), Assessment (8; 14), Guidelines (5; 11), Inventories (5; 11), Pachauri (5; 10), Gas (5; 9), Report (7; 9), Greenhouse (5; 8), Expert (6; 8), phone (6; 8), Change (11; 7), Fourth (5; 7), Meeting (4; 7), AR4 (4; 7), Emirates (4; 7), Climate (13; 7), Special (6; 6), Arab (4; 6), Task (3; 6), Guidelines (3; 6), Abu (3; 6), Dhabi (3; 6), National (5; 6), location (5; 6), Report (4; 5), Rajendra (3; 5), 33rd (3; 5), approval (3; 5)	Stocktake (15; 15), Intergovernmental (9; 14), Hoesung (6; 12), Lee (6; 12), Panel (8; 12), assessments (7; 10), inputs (9; 10), global (16; 10), advice (6; 9), special (8; 9), assessment (9; 8), location (7; 7), Inventories (5; 7), Guidelines (5; 7), phone (6; 7), Change (11; 6), fax (6; 6), science (6; 6), reports (8; 6), AR6 (3; 5), Secretariat (7; 5), products (4; 5), Climate (12; 5), Special (4; 4), Panel (3; 4),
UN	AR4 (61; 99), Intergovernmental (43; 56), Panel (46; 52), Change (75; 41) Report (42; 33), Climate (75; 32), Assessment (32; 28), Fourth (22; 24), Cambridge (26; 20), WG (64; 19), ppm (15; 16), SPM (8; 14), Policymakers (7; 10), WMO (6; 10), According (12; 9), Synthesis (7; 9), Summary (9; 9), report (16; 9), evidence (16; 9), CO2-eq (9; 9), NY (8; 8), Press (12; 7), Geneva (7; 7), University (13; 7), Source (14; 6), Meteorological (5; 6), scenarios (10; 6), sensitivity (4; 5)	AR5 (42; 79), Intergovernmental (25; 33), Panel (51; 33), Change (43; 28), scenarios (37; 28), WGIII (12; 26), Climate (50; 24), Report (25; 19), report (25; 15), carbon (28; 14), database (13; 14), Assessment (16; 12), dioxide (16; 11), Synthesis (12; 11), warming (14; 11), Working (12; 9), Policymakers (5; 9), latest (6; 8), Summary (6 ; 8), Group (11 ; 8), Appendix (4; 7), Meyer (4; 7), Chapter (9; 7), scenario (14; 7), subset (5; 6), WG (3; 6), Cambridge (8 ; 5), Geneva (5; 5), GWPs (5; 5), Switzerland (5; 5), scientific (6; 5), chance (6; 5)
Press	chairman (4; 4), claim (2; 2), climate (6; 2), credibility (2; 2), head (3; 3), inquiry (2; 2), management (3; 4), panel (5; 6), report (6; 3), review (3; 3), errors (2; 2), organisations (2; 3), change (6, 4), IAC (2; 4), Intergovernmental (6; 6), Pachauri (5; 4)	balance (2; 2), chair (2; 2), chairman (4; 3), Climate (20; 12), crisis (4; 2), department (2; 2), draft (3; 2), group (4; 2), member (3; 2), panel (3; 2), Panel (8; 13), report (38; 37), route (2; 2), science (5; 2), heatwaves (2; 2), reports (3; 2), shortages (3; 4), thanks (2; 2), Change (2; 22), College (2; 2), Imperial (2; 3), Intergovernmental (20; 34), Jean (2; 4), Jouzel (2; 4), Masson-Delmotte (2; 4), Pachauri (3; 4)

Table 5
List of "IPCC" collocates.

Two main semantic categories emerge in the three corpora, namely work and results. The list of collocates of IPCC in the two ENB corpora share many lexical units in common: Intergovernmental, Panel, Assessment, Guidelines, Change, Special. All of these figure in titles published by the IPCC which are quoted in the ENB, like, for example the *Guidelines for National Greenhouse Gas Inventories*, quoted in both, or Special Reports on different topics treated by the IPCC. In the first ENB corpus the *Special Report on Renewable Energy Sources* is quoted. In the second, a task force named Task Group on Data and Scenario Support for Impact and Climate Analysis is mentioned. Sometimes, the reports published by the IPCC are referred to in more general descriptive terms like in the expression "IPCC assessment", "IPCC report", which explains the presence of these lexical units in both columns of the table. On the same line "IPCC inputs" and "IPCC products" figure in the

second corpus. An unexpected lexical unit found in both columns is "phone". This is because, at the end of the ENB documents, information concerning the next IPCC meeting indicating location, address, fax number and phone number is provided. This also explains the presence of lexical units like "fax", "location" and names of countries and cities.

If we focus on the differences between the first and the second ENB corpora, we find different proper names like Rajendra Pachauri in the first and Lee Hoesung in the second. This is because they are the chairmen of the IPCC, Rajendra Pachauri from 2009-2010 and Lee Hoesung from 2014-2017. Other lexical units that appear in the second corpus are linked to a change in the international context surrounding the IPCC. The presence of "Stocktake" and "Global" is the most obvious. "Global Stocktake" was a term coined in the article 14 of the Paris Agreement to refer to a key mechanism of the Agreement. It implies that all signatory parties assess the collective progress towards achieving the purpose of the agreement and its long-term goals every five years. It is discussed at length during the COP22 as the ENB reports published on this conference testify, one of the key points being to work out how the IPCC can help with this Global Stocktake. Another collocate which appears in the second corpus is "Science" notably in extracts in which people speaking for the IPCC intervene to highlight how important it is to base decisions on science.

The UN collocates are comparable to those found in the ENB. Indeed, most of them are lexical units extracted from titles published by the IPCC. We also find detailed references about the publications that explain the presence of lexical units such as "Geneva", "Press", "Cambridge". Parts of reports are also referred to with the acronym "SPM", standing for Summary for Policy Makers. The acronym WG is also used to allude to a part of the report, as it stands for Working Group referring to the three IPCC working groups, each with its specific disciplinary specializations and each publishing a separate part of the assessment report. "Evidence" and "scientific" refer to the work of the IPCC, highlighting its scientific basis. "Chance" appears in the expressions "likely chance" and "66% chance", used to estimate how likely it is for an event planned by the IPCC to take place. However, a notable difference with the ENB is that we find more collocates concerning precise results published by the IPCC. "Ppm" and "CO2-eq", for instance, are found in extracts concerning estimates on maximum concentrations. "Carbon" and "dioxide" also appear in statements about calculations on maximum carbon concentrations provided by the IPCC. "IPCC scenarios", "scenario databases", "subset of scenarios", "limiting warming to 2°" are other examples of references to results found in the IPCC reports. The comparison of collocates in the UN and the ENB corpora tends to indicate

that in both, the IPCC is a reference for specialized knowledge on climate change.

In the press corpora, the semantic category of work is mainly mentioned through the documents produced by the IPCC, especially with the words "report" or "draft". The lexical unit "report" is largely predominant as a coocurrent in 2014-2017. References to the participants via their status, such as "chairman", "head" or "member", are also present in both corpora, likewise via the proper nouns, like, for instance Rajendra Pachauri and Jean Jouzel, the chair and vice-chair of the IPCC.

The semantic category of results is also treated differently. While the ENB corpus refers to the results of the IPCC mainly to insist on scientific validation, scientific processes are never discussed in any of the corpus newspapers. In 2009-2010, there is no mention of the scientific results obtained by the IPCC, except through the titles of the documents produced by the institution. In 2014-2017, the focus lies on the topics dealt with in the reports, with coocurrents such as "balance", "crisis", "food", "science" or "heatwave", for instance:

> In a report to be released today, the IPCC warns of flooding, droughts, heatwaves and food shortages that are likely to result from rising temperatures and extreme weather patterns. (Telegraph 2014).[5]

Interestingly, while results are often presented as facts, the negatively connoted coocurrent "claim" used by *The Daily Telegraph* in the 2009-10 corpus seems to reflect doubts as to the reliability of the specialized knowledge of the IPCC itself:

> The IPCC claimed that up to 40 per cent of the Amazonian forests could be badly affected by global warming. The claim was tracked back to a report by WWF and the IPCC was criticised for using environmental groups as sources. The claim continues to be contested. (Telegraph 2010)

The single occurrence of this critical evaluative stance with regard to the IPCC's specialized knowledge may be accounted for by the conservative political tendency of *The Daily Telegraph*. The fact that it is absent from the more recent corpus may also indicate that representations of the IPCC have evolved, as section 4.3 will develop.

In the press corpus, there is a clear diachronic evolution between the sub-corpora, the 2009-2010 corpus being the only one to contain references

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[5] Quotes are identified with the name of the author organisation or newspaper and the year of publication in the whole paper.

to the lack of credibility of the IPCC, with coocurrents such as "credibility", "inquiry", "review" or "errors", for instance:

> Errors in the 2007 assessment report, including a prediction that the Himalayan glaciers could disappear by 2035, have threatened to overshadow the United Nations' message that climate change is a significant threat requiring urgent collective action. (NYT 2010)

These references are to be interpreted with regard to the Climategate scandal: in 2009, internal messages were hacked from the Climatic Research Unit of the University of East Anglia which worked closely with the IPCC. Although the emails mainly concerned everyday communication between scientists, certain phrases were interpreted as proof that evidence of anthropogenic climate change had been manipulated and subsequently used by climate deniers to defend the idea of a scientific conspiracy on climate change. The fact that the scandal broke only weeks before the Copenhagen summit, which gave a large coverage to climate discussions, may explain why it lastingly damaged the reputation of the IPCC. Though references to controversies on climate in the 2009-2010 corpus are unsurprising, this type of coocurrent completely disappeared in 2014-2017.

To conclude on this point, while the same semantic categories appear in all the three corpora, their content differs. Though in each case collocates suggest that the IPCC is mainly referred to in terms of its work and the results of its publications, the results are described in greater detail in the UN corpora. The ENB corpora provide fewer technical details. The press tends to focus on some general aspects of the publications and it does not provide any technical details or explanations of the scientific processes involved. Finally, the diachronic variation tends to suggest that the position of the IPCC as an essential knowledge-provider on climate change has been strengthened between the first time period and the second.

3.3. Semantic categories identified in verbs

We used the part of speech identification tool TreeTagger, which is integrated to TXM, to highlight the verbs co-occurring with "IPCC" in the right and left contexts (3/3), retaining the first ten results for each corpus. Table 6 summarizes the results, with co-frequencies and ratios indicated between brackets:

	2009-2010	2014-2017
ENB	Use (4; 4), **observed** (2; 4), follow (2; 2), **discussed** (4; 2), **reported** (4; 2)	**Inform** (9; 11), substantiated (2; 4), derived (2; 4), **Inform** (2; 3), provide (7; 3), **determined** (2; 3), refine (2; 3), distinguishing (2; 3), **relayed** (2; 3), **questioned** (2; 2)
UN	**Reported** (7; 8), **estimated** (6; 7), **published** (7; 6), **based** (6; 5), **concluded** (4; 4), **stated** (3; 4), **evaluate** (3; 3), **reported** (4; 3), **described** (3; 3), **underlined** (2; 3)	**Based** (18; 8), **indicated** (4; 6), **concludes** (4; 5), **published** (4; 4), limiting (4; 3), **states** (3; 3), **shown** (5; 3), **analyses** (2; 3), **estimated** (3; 2), **concluded** (2; 2)
Press	was (4; 1), made (2; 2), **said** (5; 1), does (2; 1)	write (2; 3), **concluded** (2; 3), **found** (3; 3), **warned** (2; 2), **finds** (3; 6), **says** (6; 4), **warns** (5; 8)

Table 6
Verb collocates of "IPCC".

Most verbs in the three corpora are reporting verbs, which figure in bold in our table. All in all, we found a strong diversity of reporting verbs. According to Hyland (2002), reporting verbs can be categorized according to process types and evaluative stances. Roughly speaking, process types refer either to research acts, cognition acts or discourse acts. Evaluative functions can either reveal supportive stances towards the author's claims ("affirm", "explain", "note"), tentative stances ("postulate", "hypothesize"), critical stances ("evade", "exaggerate") or neutral stances ("describe", "say").

In the ENB corpus, the reporting verbs refer either to research acts ("observe", "determine") or to discourse acts ("discuss", "report", "inform", "relay", "question"). The stance is either neutral or supportive. There are no examples of tentative or critical stances. Two exceptions to reporting verbs are worth noting: "to use" and "to distinguish". By checking the concordance lines, we observed that the verb "to use" appeared four times in the following type of extract: "On common metrics, parties discussed whether to use the Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report (AR4) for GWPs" (ENB2016). In one case, it is the IPCC that is asked to use another document as a reference: "Parties discussed requesting the IPCC to use scientific developments on wetlands to fill gaps in the 2006 IPCC Guidelines" (ENB2016). This suggests that the negotiators also consider intervening in the work of the IPCC and issuing guidelines. In the case of "distinguishing", which is not a reporting verb, the concordance lines revealed the verb was used with the verb "called for" in the context of advice given on how to use IPCC results:

> On sources of input, many agreed that the scientific inputs should be mainly derived from the IPCC and called for distinguishing between sources, such as the IPCC, and information. (ENB 2017)

Overall, in the ENB corpus, some occurrences suggest that the role of the IPCC is not just to inform but also to be a service provider (suggested with the verb "to use") and a collaborator.

It seems noteworthy that in the case of the UN, we find nearly exclusively reporting verbs, with one exception in the second. Like in the ENB corpora the verbs refer to research acts ("estimate", "base", "conclude", "evaluate", "analyse") and to discourse acts ("report", "publish", "state", "describe", "underline", "indicate", "show") and the evaluative function is mainly supportive or neutral. The verb "estimate" may be seen as having a tentative stance although this is context-dependent. The verb "show" expresses a strong supportive stance.

In the press, quotes are used by journalists to delegate the responsibility of the content to their sources so as to appear more neutral, but the authors may nevertheless "influence our interpretation by their use of adverbs, adjectives and introductory verbs" (Komur 2004, p. 61). The analysis of these verbs is thus crucial to understand how a journalist represents the source it evokes. The small size of the 2009-2010 press corpus makes it difficult to obtain results on such a specific search. However, in the 2014-2017 corpus, reporting verbs are the most frequent, belonging to the category of research acts ("find", "conclude") or discourse acts ("say", "write", "warn") (Hyland 2002). Most of the reporting verbs used are neutral, which do not suggest any specific interpretation of the quote to readers, as it is the case of "say", "write" or "find". As research act verbs, "conclude" or "find" clearly highlight the scientific nature of the IPCC's work and findings, for example:

> The IPCC concluded in 2013 that even if the increasingly quixotic-looking safe limit of 2C of global warming were somehow achieved by the Paris talks, the sea would continue to wash over Kiribati and the Marshall Islands. (Guardian 2015)

These two verbs are used about twice as much in the *Guardian* and the *New York Times* as in the other two newspapers. This could be because they present a more positive view of the IPCC's work and endorse its scientific nature.

A similar discrepancy between the newspapers appears with the verb "warn", which belongs to the category of supportive reporting verbs. This verb underlines the role of the IPCC as not only a provider of knowledge, but also a stakeholder seeking to convince people of the dangers of climate change. The fact that it is more frequently used in left-leaning newspapers is thus consistent with their environmental commitment.

The collocate verbs used with the IPCC confirm the idea that it is often a reference since its results are quoted in all three corpora. However, we find more examples of a supportive stance in the ENB and UN corpus than in the press corpus, in which the majority of reporting verbs are neutral. Besides,

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verbs in the ENB corpus reflect the fact that the IPCC is also a collaborator whose work is used and discussed. To better understand these various roles, it is important to take a closer look at citations present in our different corpora.

4. Themes and aims of IPCC's quotes

4.1. Quotes in the ENB corpus

In the first time period sub-corpus we found eight quotes from the IPCC, all using indirect reported speech. In three cases, it was the IPCC chair who was quoted, as in the following extract:

> Rajendra Pachauri, Chair of the Intergovernmental Panel on Climate Change (IPCC), highlighted the consequences of failure to implement climate change mitigation policies on the basis of the Fourth Assessment Report. (ENB2015)

In the five other cases the IPCC was mentioned as an organisation, with no indication as to who was speaking. Concerning the themes found in the quotes, in three cases, the aim of the quote was to highlight the urgency of the situation and the necessity for policy makers to act quickly to limit climate change, as in the following example:

> According to the Intergovernmental Panel on Climate Change (IPCC), the effects of climate change are already being observed and scientific findings indicate that prompt action is necessary. (ENB2015)

In two cases, the IPCC was quoted as giving details about how deforestation increases carbon emissions. In one case the theme was the vulnerability of developing countries and the necessity of helping them. In two cases, details were given about the work of a special Task Group.

In the second time period, only three quotations were retrieved, two by the new IPCC Chair, Hoesung Lee, and one by his co-chair Hans-Otto Portner. As in the previous time period, the IPCC is mainly quoted to highlight that science is clear on the extent of climate change and the urgency to act. The following example seems significant from this point of view:

> Hans-Otto Pörtner, Co-Chair, IPCC Working Group II, stated that the role of science is to reduce uncertainties and lamented that thus far there has been a degree of societal inertia and inaction to address issues highlighted by science. (ENB2017)

Overall, the IPCC is the voice of science in the ENB corpus. Quotations from the IPCC are used to confirm the reality of the phenomenon of climate change. The validity of their statements is presented as unquestionable. Even in the

sub-corpus from 2009-2010 where the IPCC was subject to criticism because of the Climategate, the quotation is used to express a clear endorsement of the IPCC's results:

> Pointing to a recent incident involving the theft of emails from scientists at the University of East Anglia in the UK, Pachauri highlighted the IPCC's record of transparent and objective assessment. (ENB 2015)

During COP negotiations, IPCC reports are seen as presenting unambiguous scientific results which come as a warning to political representatives about the urgency to agree on solutions and implement them to fight the related risks.

4.2. Quotes in the UN corpus

In the 2009-2010 UN corpus, there are 110 occurrences of "IPCC" in brackets. In these cases, it is used as a reference to back up a statement. In the 2014-2017 corpus there are 57. This confirms that the IPCC is an essential source of knowledge in the UN reports. By looking through concordance lines and using punctuation marks and reporting verbs, we retrieved all occurrences of explicit reported speech whether it be in the direct or indirect form. For each statement we identified the main theme. Table 7 shows the most and least present themes in the quotations.

	UN1 Direct	UN2 Direct	UN1 Indirect	UN2 Indirect	Total
Scenario Results		2	3	10	15
Specific Ecosystems Impacted			10	1	11
Mitigation	2		3	5	10
Climate Change General	2	1	3	2	8
Agriculture and Food Security			2	3	5
Adaptation	2	1			3
Vulnerability	1	2			3
Small Islands	2				2
Human Impact on Climate Change	1		1		2
Carbon Budget		1		1	2
Role of IPCC	1				1
Methods for Assessment			1		1
Absorption			1		1
Economic Loss		1			1
Developing Countries				1	1
Cities' Impact				1	1
TOTAL	11	8	24	24	67

Table 7
Themes in UN quotations.

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To speak about the themes in table 7 the IPCC is explicitly considered a reference. The importance of the IPCC scenario results is clear as it is the main topic of the quotations. Here is an example of indirect quotation presenting scenario results: "IPCC (2007e) estimates that carbon prices of US $ 20-80 / tonnes CO2-eq would be required by 2030 to aim at achieving stabilization at around 500 ppm CO2-eq by 2100". The IPCC is also regularly quoted as an authority on the specific impacts of climate change on an ecosystem, as in the following example:

> According to the IPCC AR4, both tropical and temperate grasslands are sensitive to variability and changes in climate, which are likely to have strong effects on the balance between different life forms and functional types in these systems. (CBD 2009)

There is a higher frequency of indirect quotations than direct quotations. It is interesting to note that certain themes appear exclusively in direct quotations, such as, for example, those related to adaptation and vulnerability. This is probably because these are concepts coined by the IPCC and passages devoted to defining them are therefore quoted in direct speech, as in the following example:

> The Intergovernmental Panel on Climate Change IPCC defines adaptation as "adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. This term refers to changes in processes, practices, and structures to moderate potential damages to or benefit from opportunities associated with climate change". (UNDP 2009)

We noticed seven other occurrences in which direct quotes are used to present an IPCC definition, the exact wording of definitions being essential. This probably explains the high number of definitions among direct quotations. It may also be explained by a willingness on the part of UN institutions to establish terminological coherence by using similar terms and defining them identically. Another case in which direct quotes seem to be preferred to indirect ones is when introducing a controversial question. Small island states are seen as being particularly at risk as they are among the first directly impacted by climate change. The question of the status of their displaced inhabitants is therefore difficult to solve, as made explicit in the following extract:

> As the IPCC identifies, "the costs of overall infrastructure and settlement protection are a significant proportion of GDP and well beyond the financial means of most small island states". (UNEP 2010)

When evoking controversial questions, using the exact wording of the organisation quoted may facilitate a faithful presentation of its ideas. This is essential in the context of a debate. Other themes seem to be exclusively presented in indirect reported speech, such as, for example, impacted ecosystems. These questions may be seen as less controversial, which would explain why the exact wording used by the IPCC is not crucial.

Overall, looking through quotes from the IPCC in the UN corpus, there is no evidence of a questioning of the IPCC as an essential knowledge-provider. On the contrary, the great value of its findings is asserted several times, as in the following example:

> The Intergovernmental Panel on Climate Change (IPCC), which was set up by the World Meteorological Organization and the United Nations Environment Programme, is widely recognized as the principal authority for objective information on climate change, its potential impacts, and possible responses to these. (WTO 2009)

In view of these elements, we may conclude that its reports are presented as landmarks for the development of knowledge on climate change.

4.3. Quotes in the press corpus

Paragraph 4.2 has shown that most of the reporting verbs found in the press corpus were neutral. However, the journalist's attitude towards a quote is also reflected in the types of quotes used (Peynaud 2011), so that direct speech, indirect speech or paraphrasing are found in specific contexts. Indeed, quotation marks show the distance journalists take with the quote in a process of legitimization of the discourse (Adam, Lugrin 2006). Whether it is a question of quotes expressing opinion or highly specialized ones, using quotation marks allows journalists to mask their own voice behind those of more legitimate speakers (Marnette 2004). For instance, the wording of quotes is generally characterized by a low degree of technicality, accessibility to the general public being one of the aims of the general-interest press. The few technical terms that are used are mainly found in direct speech, which legitimizes the use of a term by clearly attributing it to an expert source as in the following example.

> The IPCC warns: "A large fraction of both terrestrial and freshwater species faces increased extinction risk under projected climate change during and beyond the 21st century, especially as climate change interacts with other stressors, such as habitat modification, over exploitation, pollution, and invasive species." (Telegraph 2014)

The low number of quotes related to the IPCC in the corpus made it possible to classify them into four main categories: direct, indirect, combinations of

both or paraphrases. Analysing the content and the aim of the quotes with regard to the types of quotes gives a more specific insight into how the knowledge produced by the IPCC is disseminated in the press. In addition to direct and indirect speech, combinations of both types of reported speech are often found in the corpus; in these cases, a short segment is between quotation marks in the middle of a sentence in indirect mode, for instance:

> The more the climate warms, the more people will experience "water scarcity", the IPCC finds. If carbon emissions remain high, droughts will become more frequent in dry regions by the end of the century although "water resources are projected to increase at high latitudes". (Telegraph 2014)

Occurrences of paraphrasing were also found, where the author summarizes the main ideas of the report, for example: "But the IPCC scientists call for trebling of the use of renewables takes on a new force if the world's fastest-growing polluter has made such a big move." (Guardian 2014) The results of the classification into four categories are shown in graph 1.
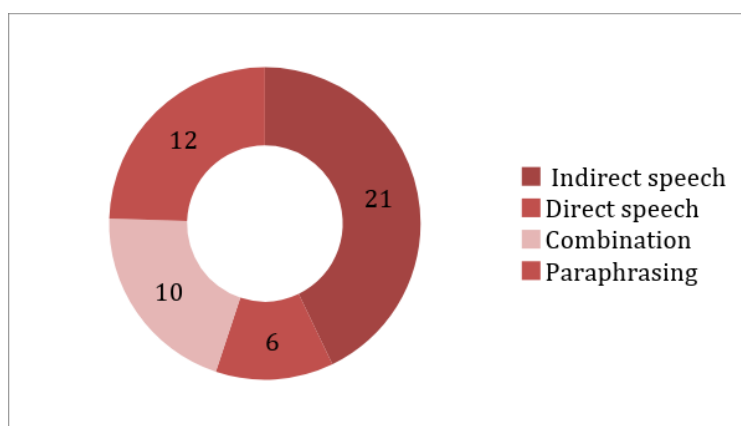
Graph 1
Types of quotes in the press corpus

The IPCC is sometimes the direct source of the quotes, particularly with regard to its prominent members. Rajendra Pachauri, chair of the IPCC from 2002 to 2015, is mentioned 77 times in the corpus. Jean Jouzel, vice-chair of the IPCC, is mentioned 3 times, and Valérie Masson-Delmotte, vice-chair of work-group 1, is mentioned twice as a collocate of "IPCC". Press quotes mainly deal with two topics: the dangers of climate change and the possible solutions, in equal proportions. Uncertainty about IPCC results is never explicitly mentioned. This is consistent with news values, as Carvalho (2007, p. 229) points out: "Uncertainty is a difficult issue for reporters, as news values of clearness and unambiguity demand 'facts' and lead to a streamlined image of scientific knowledge". However, although uncertainty is never the main topic of the quotes, it may appear in a more implicit form, through

modals, for instance:

> For example, the 2013 Intergovernmental Panel on Climate Change (IPCC) report says we can expect a warming of between 1.5° C and 4.5° C if we double atmospheric CO2 levels, but also acknowledges that the longer term warming (over centuries to millennia) "could be significantly higher" than that. (Guardian 2016)

A combination of direct and indirect speech is used here, with facts expressed in indirect speech and the modal phrase between quotation marks. This combination illustrates the fact that the journalist does not take responsibility for the hypothesis mentioned but attributes it to the IPCC directly in direct mode.

In contrast, several quotes, especially in the 2014-2017 corpus, stress the fact that the latest IPCC reports show more certainty about the possible consequences of climate change, for example:

> The latest IPCC report, the first update in seven years, confirms that climate scientists appear *more certain than ever before* that human behaviour is the key culprit for global warming.[6] (Telegraph 2014)

Results in this regard are remarkably similar between newspapers and periods, perhaps reflecting the fact that this treatment of uncertainty is mainly due to the genre of press articles.

The main aims of the quotes are first, to inform the public about the results obtained by the IPCC in a neutral manner by reporting facts and figures. 41% of the quotes correspond to such facts, while 43% refer to warnings expressed by the IPCC on the dangers of climate change. Finally, some quotes expressing criticism of the IPCC may take different forms. Facts and figures, which are non-polemical information, are often quoted in indirect mode or with a paraphrase, for instance:

> In a report to be released today, the IPCC warns of flooding, droughts, heatwaves and food shortages that are likely to result from rising temperatures and extreme weather patterns. (Telegraph 2014)

In contrast, direct quotes tend to contain an evaluation of the situation, especially in the case of warnings, since journalists are meant to preserve neutrality and thus cannot explicitly give an evaluation of the situation in their own voice. This process appears particularly clearly in combinations as, for instance:

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[6] Emphasis added.

> A report by the Intergovernmental Panel on Climate Change (IPCC) found it was still just possible to limit the rise in average global temperatures to 3. 6F (2C) by 2100, the level beyond which experts say the effects will be "dangerous". (Telegraph2014)

However, there are clear differences in the way the types of quotes are used by different newspapers. Indeed, the *Guardian* and the *New York Times* use more paraphrasing and indirect speech than the *Daily Telegraph* and *USA Today*. This division is consistent with their political leanings and clearly shows the attitude of the journalists towards the content of the IPCC. In the first two newspapers, facts and figures are often quoted in indirect speech modes or paraphrasing them. Only about 20% of the quotes include quotation marks, showing that the journalist integrates the IPCC's words into his own discourse, for instance:

> Depending on how sharply the world cuts carbon emissions, the Intergovernmental Panel on Climate Change (IPCC) predicts the global mean sea level will rise by 26-82cm between now and 2100. (Guardian 2015)

The IPCC is here considered a trustworthy source of information on climate change and its scientific nature is highlighted by the use of figures. In the *Daily Telegraph* and *USA Today*, in contrast, 50% of quotes contain quotation marks, thus underlining the fact that the journalist shows some distance with regard to the IPCC's words as, for instance: "'All aspects of food security are potentially affected by climate change, including food access, utilisation, and price stability,' the IPCC says." While left-leaning newspapers quote the knowledge produced by the IPCC as facts, the other newspapers chose to show more distance and to clearly attribute the words to the institution. This phenomenon is consistent throughout the two periods.

Finally, some quotes reflect a certain criticism of the IPCC's work, essentially in paraphrasing mode:

> If the IPCC report admits that the environmental crisis will not be felt equally across the population, it didn't push the argument until its logical political conclusion. (Guardian 2014)

However, there are only three quotes in the whole corpus reflecting such opinions, disseminated in three different newspapers, which seems to indicate that on the whole the press expresses little direct criticism of the IPCC. The press does, nevertheless, reflect the state of the opinion at a certain period of time. In the 2009-2010 corpora, the IPCC's credibility was questioned because of the "Climategate" and an exaggerated claim, according to many studies, that glaciers would disappear by 2035. This general loss of confidence in the IPCC is reflected in the immediate context surrounding the

acronym and the full name of the institution:

> Growing public skepticism has, in recent months, been attributed to news reports about e-mail messages hacked from the computer system at the University of East Anglia in Britain (characterized as showing climate scientists colluding to silence unconvinced colleagues) and by the discoveries of alleged flaws in reports by the Intergovernmental Panel on Climate Change. (NYT 2010)

The "growing public scepticism" mentioned here highlights the wide-scale consequences the scandal had on the image of the IPCC with the general public. In 2014-2017, scepticism towards IPCC results is presented as a minority opinion as the following extract testifies:

> And finally, he shared his views on what he described as the Obama administration's lies about global warming. It doesn't concern Mr. Murray that his climate views run counter to *the scientific consensus, which has found that warming is "unequivocal", according to the latest report from the Intergovernmental Panel on Climate Change.* "This global warming hoax," Mr. Murray told the students, "it's a movement that is destroying America." (NYT 2016)

In this example, the journalist refers to the "scientific consensus" that global warming is a reality. The minority opinion of Mr. Murray, who defends the opposite opinion, is inscribed within the dominant journalistic discourse and is largely discredited. The legitimacy of the institution is underlined by phrases such as "we know" or "thanks to", adjectives relating to the report like "comprehensive", or references to the many scientists who worked on the report and the scientific consensus that surrounds it.

5. Conclusion

Overall, the IPCC is presented as the main reference on climate change knowledge in the six sub-corpora analysed. All three sources disseminate the knowledge produced by the IPCC and stress the legitimacy of this source. However, the generic specificities of the three corpora show a contrasting use of the IPCC as a knowledge provider. In the UN and ENB corpora, the IPCC is mainly quoted to back up arguments about the reality of climate change and the necessity to fight it. Details are given about results of IPCC reports and the scientific nature of its work is highlighted. In the press corpus, the recontextualization process implies the use of fewer scientific terms and quotations which concern less technical aspects of its work. It is also the corpus in which there are most of the references to differing opinions. The diachronic perspective highlights an evolution in the representation of the

IPCC. Indeed, while the 2009-2010 corpora refer to the controversies that undermined the legitimacy of the institution at the time, scepticism towards its results is shown as a minority opinion in 2014-2017.

The use of six sub-corpora, representing three levels of dissemination over two time periods enables a varied approach to IPCC knowledge. Comparisons between the corpora have shown varied representations of the IPCC, depending on the level of specialization and political leaning in the case of newspapers. Knowledge-providers do not have the same role in the press as in a specialized corpus like that of the UN reports. To build on these results, we believe it would be interesting to use the collocates identified in the immediate contexts of the word IPCC to see if other knowledge-providers can be identified in our corpora. Similar methods could then be used for the three corpora, namely the analysis of collocates and quotations, to define the role of different stakeholders involved in climate negotiations and activism. Climate change is a field in which the production of knowledge is all the more important as it is an essential step towards the negotiation of an international agreement to limit climate change. A better understanding of knowledge dissemination in this field thus seems important. Although the IPCC figures as an essential source, it would be of interest to map the dissemination of other less widely known sources of knowledge so as to question or confirm the uncontested character of this leading institution.

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