Forecasting Change: Climate Connections in Canadian Extreme Weather Reporting

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Abstract

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Canadians from coast to coast are experiencing the consequences of the increase in extreme weather events, like the unprecedented 2023 forest fire season. With the impact these extreme events have on public life, the Canadian media cover them extensively, and thus they make up a significant proportion of the news as they occur. The number of these events is said to continue increasing, as the scientific consensus states climate change and rising temperatures will continue to influence the frequency and intensity of extreme weather. In recent years, scientists have begun conducting extreme event attribution (EEA) studies which link certain events to climate change. While some argue that journalists should mention these EEA studies in their coverage, others argue making explicit connections to climate change is enough to fully inform the public. Even with this newly emerging debate, little is known about how the Canadian media mention or connect climate change to extreme weather events. Using a text as data approach, with automated content analysis, this thesis explores how five Canadian media outlets cover four types of extreme weather events, by comparing reporting from 2019 and 2023. This work aims to examine how the media mention climate change, whether they connect extreme weather events to climate, and how they make that connection. The results show that overall, the proportion of climate connection used in the coverage of extreme events by the selected Canadian media increased from 2019 to 2023. Additionally, both the proportion of climate mentions and connections are greater than those found in existing studies.

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Chapter 1: Introduction

In recent years, Canada, like much of the world, has seen an increase in the number of extreme weather events impacting the country (Statistics Canada, 2023). In the summer of 2023, Canadians experienced the worst wildfire season on record, spanning from coast to coast (Natural Resources Canada, 2023). Since then, there has also been a plethora of other devastating extreme events worldwide like the Jasper, Maui, and Los Angeles fires, flooding from hurricanes Helene and Milton, all the while 2024 was deemed the hottest year on record (NOAA, 2024). The rise in global temperatures and the impacts of climate change are expected to increase both the severity and frequency of extreme weather phenomena (IPCC, 2021). Extreme events are seen as newsworthy by the media and the public alike, leading to an increase in the number of extreme weather stories in daily news coverage (Hazard Owens, 2022). Using a text as data approach, which combines automated and manual content analysis, this thesis compares how the anglophone and francophone national news media connect extreme weather events to climate change.

While there is significant research examining Canadian media's coverage of climate change (DiFrancesco & Young, 2011; Young & Dubas, 2012; Stoddart et al., 2016), there has been little focus on the inclusion of climate connections in their reporting of extreme weather events (Davidson et al., 2019; Hopke, 2020). However, this topic has been explored internationally (Schäefer et al., 2014; Berglez & Lidskog, 2019; Painter et al., 2020). This research explores the relationship between climate change connection and type of extreme event in the press, as this determines whether certain events are more commonly linked to climate change than others. According to the World Meteorological Organization, extreme weather includes events such as forest fires, flooding, deep freezes, hurricanes, tornadoes, and heatwaves

(WMO, 2023). The present study focuses on the coverage of forest fires, floods, ice storms and extreme cold, since event attribution studies have shown the possible effects of climate change on their occurrence probability and severity (Chen et al., 2020; Cohen et al., 2021; Klima & Morgan, 2015; WWA, 2023). Canada is warming at twice the global rate, and experts project the effects of climate change to "intensify in the future" (Bush & Lemmen, 2015, p. 5). With these projections, the Canadian media will continue to and likely increase its coverage of extreme weather events. This increase presents an opportunity to more accurately cover these events by making direct connections between them and climate change.

Despite trust in the media having decreased in recent years, a significant number of Canadians still rely on the mainstream news media to obtain their news, which highlights the role it has on informing the population (Newman et al., 2023). Research is needed to obtain a better and more complete understanding of how the Canadian media cover and connect extreme weather events to climate change, as they can shape the landscape and knowledge of climate change in Canada and perhaps influence action.

Based on the existing research, this study proposes to answer the following research questions:

RQ1: How did the Canadian media use climate change mentions and connections in their coverage of forest fires, floods, ice storms, and extreme cold in 2019 compared to 2023?

RQ2: What is the relationship between climate mention and connection and year, event type, or media language?

RQ3: Who are the journalists connecting extreme events to climate change?

To explore these research questions, this thesis uses a quantitative content analysis research method with a text as data approach. In quantitative content analysis, text is categorized

for analysis, thus producing “numerical descriptors” of a corpus (Coe & Scacco, 2017). Text as data refers to “an approach in which the analysis of text is, to some extent automatically conducted by machines” (Hase, 2023). In tandem with manual coding, this approach allows for a large corpus of articles to be analyzed for multiple variables including the dependent variable climate connection and the independent variables of extreme weather type, language, and media sources from the coverage during 2019 and 2023. The resulting data allows for a comprehensive comparison between media sources and time periods.

Both the years of 2019 and 2023 experienced El Niño (the natural phenomenon of warming water in the Pacific Ocean) which led to their selection as the research period (NOAA 2019; NOAA, 2023). Also, they both experienced severe extreme weather events, namely floods and forest fires, which supports a balanced comparison. The extreme weather events of focus chosen for this thesis (forest fires, floods, ice storms and extreme cold) ensure events of both cold and warm seasons are analyzed. This allows for a comparison between the extreme events associated with heat and those with the cold.

The study examines articles published online from five national Canadian news media outlets, which include The National Post, The Globe and Mail, CBC News National, Radio Canada Info - National, and La Presse. These media organizations are selected because of their ongoing news coverage, their substantial audiences, their language of publication, and their online accessibility. According to the 2024 Reuters Digital News Report, online platforms were the most used source of news in 2024 by Canadians (Brin & Charlton, 2024). The rise of the internet has shifted the Canadian media landscape, with the majority of Canadians forgoing printed news, which is why this study focuses on online articles. In that same report, all sources

used in this work are part of the top 12 English or French online news sources, demonstrating their importance and reach to the public.

Also, they are all presumed to accurately report on extreme weather events as part of their news coverage and thus, use climate attributions.

The research begins by using online databases, and the four extreme event types as keywords to create a corpus of articles published by each media outlet during 2019 (January 1, 2019, to December 31, 2019, inclusively) and 2023 (January 1, 2023, to December 31, 2023, inclusively). Following the collection, the corpus is analyzed for climate mentions and connections using a combination of automated keyword spotting and manual-coding (see Chapter 3 for more details). The articles are first run through a script which matches climate change keywords, and the sub-corpus of positive climate mentions are analyzed manually for climate connections. These findings provide an overview of the extreme weather event stories by source, including both mentions of and connections to climate change. The results demonstrate some journalistic decisions taken when covering an extreme weather event by Canadian media outlets.

The purpose of the study is to explore how the Canadian media cover extreme weather events and if and how they connect these events to climate change. Much of the existing literature is focused on how American or international media outlets connect climate change, leaving significant gaps in the literature on Canadian media. The existing Canadian literature has not accounted for francophone sources in their work, which neglects many news organizations who may be using climate connections in their coverage of extreme events. Additionally, there has been little insight as to how climate connections are made, what factors influence their likelihood of being used, and who the journalists are using them in their stories. Given that the

existence of climate change is no longer debated (IPCC, 2021) and many extreme events have been linked to climate change in Canada alone in the past few years, research is needed to examine how the Canadian media connect extreme events to climate change. My thesis fills some of the gaps in climate change attribution research, by analyzing the data comparatively, accounting for the media sources, language of publication, and multiple extreme weather events.

My research furthers the scholarship and understanding of climate change attribution in Canadian media. Currently, the literature exploring how Canadian media outlets attribute climate change to extreme events is lacking, with few existing studies (Davidson et al., 2019; Hopke 2020a). Filling some of the gaps can open conversations and reflections as to how the media cover these events. It will also provide journalists and editors with the insight into how their coverage of extreme weather and climate change can evolve with the emergence of new climate science. Further, according to Boykoff (2011), the media provides a venue for discussions of climate science and policies to take place. Thus, exploring how climate connections are made is not only important for journalists to ensure accurate dissemination of environmental and climate science, but also for activists, policymakers, and researchers who can use these findings as tools for communicating their own ideas and information to the public. As written by journalist Sarah Sands in the foreword of Clarke and Otto's climate journalism guide:

> We have increasingly scientific guides to reporting the real weather. This is important for accuracy in journalism. The next time the contentious commentator rolls his eyes and questions global warming after a snowfall in November, we can produce weather event attribution data to explain more precisely the cause and effect. (Clarke & Otto, 2022, p.5)

By articulating the impacts of anthropogenic climate change in extreme weather reporting, a fuller picture is exposed to the public, which will hopefully lead to a better understanding of climate change.

Chapter 2: Literature Review

This research intersects with various fields, including scholarship in science communication, environmental journalism, and extreme weather attribution. The following section presents an overview of how the media report on extreme weather and climate change, explores how the media connects climate change to extreme weather events, and places the practices of Canadian media in context. Finally, it provides a brief examination of automated content analysis in journalism and communication studies and the theoretical framework used in this thesis.

2.1 Extreme Weather and Climate Change Coverage in the News Media

It is important to first mention the difference between an extreme weather event and an extreme climate event. The National Oceanic and Atmospheric Administration (NOAA) define an extreme weather event as, "A time and place in which weather, climate or environmental conditions rank above a threshold value near the upper or lower ends of the range of historical measurements" (2020). This would include droughts, heatwaves, wildfires, deep freezes, hurricanes, and cyclones. Conversely, an extreme climate event is defined as "a pattern of extreme weather that persists for some time, such as a season" (IPCC, 2021, p. 1522). For example, the IPCC categorizes a wildfire burning over an entire season as an extreme climate event. As both definitions are similar, and people use them interchangeably, they are collectively referred to as climate extremes (IPCC, 2018). Also important is mentioning that the effects of climate change on extreme weather events are no longer debatable. According to the IPCC "It is an established fact that human-induced greenhouse gas emissions have led to an increased

frequency and/or intensity of some weather and climate extremes since pre-industrial time, in particular for temperature extremes" (IPCC, 2021, p. 1517).

As Backemeyer et al. (2017) wrote, "Short-term, highly visible negative weather events appear to have the immediacy that turns them newsworthy" (p. 1047). Given the negative impacts on the public, extreme weather events are prevalent in the media's news coverage. As early as the 1700s, the media would report the consequences of extreme events on food and crops (Boykoff, 2011). However, it goes without saying that there have been changes to the way the news media cover these events, including dominant themes, frames, and voices used. An area of concern from many scholars has been the repeated use of climate skeptics as sources, which was once prevalent in environmental reporting and has influenced the current polarization of climate change and extreme weather (Boykoff, 2011; Boykoff & Boykoff, 2007). Although, when examining various extreme weather event stories in the past few years, the number and likelihood of quoting climate skeptic or denialist voices have decreased (Batizou 2022; Burgess et al., 2020; Strauss et al., 2022, Weiner et al., 2021). Authoritative voices frequently appear in extreme weather stories, as Cordner and Schwartz (2019) found that fire officials, federal agencies and elected officials were the most quoted sources. Further analysis showed that in the climate change reporting of three American legacy print media, over half the sources were politicians, followed by organizations/groups and then scientists (Rice et al., 2018). Interestingly, in extreme weather and environmental stories, the number of scientific and academic voices are significantly lower than politicians, and citizen voices—the voices of the most impacted by extreme events—are nearly non-existent (Cordner & Schwartz, 2019).

As seen by the most prominent voices, many of the most salient themes and frames of extreme weather reporting also focus on politicians and the economy. Looking at the coverage of

forest fires in Alberta, Davidson et al. (2019) concluded that the most prominent thematic coverage was risk, followed by the economy, then ecology/management. Likewise, in a comparative study of four American newspapers, the common theme of needing better fuel management was prominent throughout all sources (Morehouse & Sonnett, 2010). The authors note significant differences in the presence of other themes such as the economy, which they conclude demonstrates each news media's particular role in the public life. According to a comparative study examining many extreme weather and climate events over a nine-year period, the most common frames were destruction or damage of buildings or homes (25% of all stories), cost of disaster (17%) and evacuation and transportation issues (15%) (Houston et al., 2012). The most common themes and frames focus on the economy and the crisis nature of the event, overlooking many potential themes such as science, the environment or climate change. Understandably, not every news story will, nor must focus on environmental or climate change themes, but their overall percentage is quite low. The percentage of environmental and climate change frames will be explored in the following section.

A common theme in the existing literature is the undeniable challenge for most non-science journalists to accurately communicate the complicated science behind extreme weather and climate change, especially when much of it remains quite abstract (Berglez & Lidskog, 2019; Hopke, 2020a; Hopke & Wozniak 2025; Morehouse & Sonnett, 2010; Painter & Hassol, 2020; Strauss et al., 2022; Ungar, 1999). Notably, many news organizations do not have specialist environmental reporters who are qualified and comfortable to report on the scientific nuances of these events, which creates a significant difference in the quality of extreme weather coverage (Hopke, 2020a). According to Painter and Hassol (2020), many journalists who are knowledgeable on climate science are not comfortable using extreme weather attribution (EEA)

studies, which they believe may be because some of the effects of anthropogenic climate change may seem contradictory to the "expectations of those unfamiliar with physics" (p. 186). Importantly, limitations exist within extreme weather attribution studies. As the techniques are still developing, varying findings and opinions are sometimes concluded for the same event (Stott et al., 2016). Additionally, using different research questions and definitions in EEA studies of the same event can lead to debate over attribution, as was seen in the Californian drought (Osaka et al., 2020). The qualitative findings of Osaka and Bellamy (2020) demonstrate the limitations of EEA studies by interviewing journalists about their coverage of the 2011 to 2017 Californian drought. The journalists stated that due to the nuances and scientific uncertainty in the published studies, they were "especially cautious about making strong statements connecting weather events and climate change" (p. 21). Thus, if the journalist does not feel comfortable communicating an area of science they do not fully understand, they are likely to forgo mentioning it in their coverage.

Accurately reporting on extreme weather events is essential for an informed public and as Hopke (2020b) states, science communication is not solely about communicating science, but also about enacting action and societal change. Researchers suggest that when journalists cover extreme weather events and mention or connect them to climate change as they happen, while also ensuring a variety of expert sources, they allow readers a better understanding of how these events impact people—and now the readers—on a daily basis (Morehouse & Sonnett, 2010; Painter & Hassol, 2020; Ungar, 1999; Zanocco et al., 2018). Painter and Hassol (2020) argue that covering the consequences of climate change on extreme weather events as they are happening can create action and foster solutions. In a recent study by Visconti and Young (2024), they identified that wildfires were found to have a short-lasting but significant effect on the

acknowledgement of climate change and approval of climate actions. If a reader sees the effects of extreme weather firsthand and can connect the event to climate change, it could enact a stronger want for climate action.

It is equally as important to be reflective on the underrepresented information and voices. According to Morehouse and Sonnett (2010) "the discursive marginalization of environmental advocates' voices and to a lesser extent, fire ecologists' and other scientists' perspective" stunt the public's understanding of extreme events (p. 393). Ungar (1999) echoes these thoughts, mentioning that with the media focusing on the idea of global 'warming' and not discussing the impacts to the climate leaves the public uninformed. Extreme weather and climate change reporting have changed overtime, resulting in new ideals of what constitutes quality coverage. It is vital that future work examine how the coverage continues to evolve, including the analysis of sources, dominant frames, and narratives, and how the stories are mentioning climate change.

2.2 Climate Change Connections

Extreme event attribution (EEA) is a relatively new science in which researchers attempt to identify "what extent anthropogenic or natural influences have altered the probability or magnitude of a particular type of event having occurred" (Stott et al., 2016, p. 25). Scientists can use historical trends to model the effects of human-induced climate change and therefore provide a degree of certainty as to whether an extreme weather event is the result of climate change. Independent, governmental and NGO researchers have conducted many studies which provide insight into the significance of climate change on extreme events. An event attribution study conducted on the 2023 forest fires in Quebec found the fires to be 50% more intense, and seven times more likely to occur, thanks to climate change (Barnes et al., 2023). Those results confirmed an earlier study by Dahl and colleagues (2023) who found that emission from major

carbon producers contributed to nearly half of the forest area burned in Western Canada and the U.S. between 1986 and 2021.

According to Carbon Brief (2022), as of 2022, there are over 400 peer-reviewed event attribution studies, which they have visualized into an interactive map of various extreme weather events around the world. Thereby, the news media not only have access to reports by the IPCC and the United Nations, but they also have access to EEA studies which they can use in their coverage of extreme weather events.

In one of the only studies analyzing the use of EEA studies in the media's coverage of extreme weather, Painter et al. (2020) found that only 6 of 61 articles mentioned EEA studies when comparing the coverage of both a heatwave and extreme rainfall in India. Interestingly, Strauss et al. (2022) found that while there was a general lack of understanding of EEA studies by journalists, many conveyed the importance of mentioning a link between climate change and heatwaves. Osaka et al. (2020) noticed an increase in the salience of climate attribution in the coverage of the Californian drought in 2014 and 2015 once EEA studies were published. This suggests that while not all media mention EEA studies, they are a tool to increase the mentioning of climate attribution in news pieces. In other words, news media have a multitude of scientific evidence at their disposal to accurately cover extreme weather events, and exploring how they are used will provide a better understanding of how complex scientific climate issues are communicated. Hopke (2020a) found that media organizations with specialist reporters like *The New York Times* and Climatewire were more likely to discuss climate change when covering heatwaves and wildfires. This is likely because the media organizations are paying to have expert reporters with the knowledge and confidence needed to communicate climate science. As stated by Battistoli et al. (2018) "the *strength* of the connection between climate change and the

intensity of storms can be and should be debated. But the *existence* of that connection should not be the subject of debate, at least of any informed debate" (p. 77).

Although there have been many studies exploring how media cover climate change and environmental issues, there has been little work examining how the media connect extreme weather events to climate change. Nevertheless, a common theme throughout the existing literature is the small proportion of stories which mention and attribute extreme weather events to climate change (Battistoli et al., 2018; Batizou, 2022; Berglez & Lidskog, 2019; Cordner & Schwartz, 2019; Davidson et al., 2019; Gavin et al., 2011; Good, 2008; Painter et al., 2020; Weiner et al., 2021). In one of the first studies to examine the link between climate change and extreme weather in news media, Gavin et al. (2011) found that in the British media's coverage of floods during 2001 to 2006, only 55 of the more than 1200 articles mentioned "climate change" or "global warming." In the years since, other researchers have examined if the media have mentioned climate change in the coverage of extreme weather events, a general overview of the existing literature is shown in Table 1.

Table 1

Summary of existing literature about media coverage of extreme weather events and climate change

Article	EW Event	Corpus year(s)	Country analyzed	Number of news outlets	Number of stories	Element coded	Proportion found
Gavin et al. (2011)	Floods	2001-2007	UK	8	1,262	Climate change mention – start of story	4.4%
Berglez & Lidskog (2019)	Wildfires	2013-2016	Sweden	Database-wide	330	Climate change mention	11.2%
Cordner & Schwartz (2019)	Wildfires	2015-2016	USA	Database-wide	177	Climate change mention	13.6%
Battistoli et al. (2018)	Hurricanes	2017	USA	4	630	Climate change mention	3.7%
Davidson et al. (2019)	Wildfires	2000-2017	Canada	2	1,498	Human-caused climate change frame	2.0%
Weiner et al. (2021)	Hurricanes	2017	USA	6	1,057	Climate change mention	26.7%
Hopke (2020)	Wildfires, heatwaves	2013-2018	India, USA, China, Europe (AFP), Canada	37	27,721	Climate change mention	Wildfires 7.98% (2013), to 19.15% (2018)
Batizou (2022)	Heatwaves	2018	UK	6	205	Climate change mention	12.7%
Painter et al. (2021)	Heatwaves	2019	European Countries	20	2,447	Climate mention	10.9%
						EEA mention	2.0%
Burgess et al. (2020)*	Wildfires	2019-2020	Australia	Database-wide	700	Climate mention	29.0%
						Climate connection	16.0%

Hatch et al. (2023)*	Wildfires	2023	Canada	Database-wide	5,346	Climate change mention	16.5%

Note. The articles with * indicate a non-peer-reviewed report. Studies are ranked by their corpus ending years.

When examining the coverage of international wildfires by Swedish media during two periods (February 2013 to August 2014 and September 2014 to March 2016), the authors noted that 11% of the coverage made a reference to climate change (Berglez & Lidskog, 2019). Similarly, in a study examining the coverage of the 2019 heatwaves in Western Europe by German, French, Dutch, and British media, roughly 10% of articles mentioned climate change (Painter et al., 2021). As shown through the aforementioned studies, the percentage of stories mentioning climate change appears to have steadily increased since the early 2000s, which could be due to IPCC reports and EEA studies. Hence, my research analyzes extreme weather coverage comparatively, providing insight into the progression of climate change attribution by the media during a time of scientific consensus.

As recounted in a study by Weiner et al. (2021), 22% of all US hurricane coverage during the 2017 season by six American newspapers: the *New York Times,* the *Seattle Times,* the *Houston Chronicle,* the *Wall Street Journal,* the *Columbus Dispatch,* and the *South Florida Sun-Sentinel,* referenced climate change in their articles, although only 99 articles did so implicitly. However, when examining the coverage of the 2017 hurricanes Harvey and Irma specifically, Battistoli et al. (2018) found that only 3.65% of the coverage by the *New York Times*, the *Los Angeles Times*, the *Houston Chronicle*, and the *Tampa Bay Times* included "climate change" and/or "global warming." Although there is a lack of studies which focus on the use of climate change attribution by news media for the same event, the analyses of the 2017 American hurricanes above demonstrate a significant difference in their findings of climate change

mentions. As the observed period length of both studies differ due to examining an extreme event compared to a weather period, the corpus size is affected. Of course, it is worth noting how periods may influence the overall salience of climate change attribution and extreme weather coverage. Additionally, the difference in findings amplifies the importance of examining both local and national media sources, their political leaning, and comparing extreme weather events to weather periods.

The type of extreme weather event also influences a journalists' usage of climate connection, with weather often associated with hot conditions more likely to be attributed to climate change than other extreme events (Molder & Calice, 2023; Osaka & Bellamy, 2020; Painter et al., 2020; Unger, 1999). When comparing American news coverage of extreme weather events throughout the late 60 and late 90s, Ungar (1999) saw the American media focused their climate change narratives on hot temperatures. He stated, "Extreme hot spells are probably the most accessible and believable sign of climate change in the public arena" (p. 137). The findings are congruent with those of Molder and Calice (2023), who found wildfires to be more directly connected to climate change than hurricanes. It seems that American media in particular connect hot temperatures to climate change more than cold, as Osaka and Bellamy (2020) also confirm the emphasis on connecting hot extreme weather events to climate change. Journalists they interviewed stated that while they were once more cautious connecting climate change to extreme weather, in their coverage of heatwaves they now often use generic statements like "these are becoming more likely because of climate change" (p. 20). Similarly, Strauss et al. (2020) found that the journalists they interviewed believe it is acceptable to make a link between heatwaves and climate change if they received a quote from a qualified source. Hence, journalists may connect heatwaves to climate change through a quote but are less likely to make

a direct connection themselves. Internationally, Painter et al. (2020) found that Indian media mentioned climate change more frequently to heatwaves (21%) than extreme rainfall (9%) yet were more likely to make a direct link to climate change for the rainfall event (69%) compared to the heatwave (31%). The findings across countries seem to have similarities, although further exploration is necessary to compare the number of mentions and connection for various hot and cold extreme weather events. My research expands upon the findings above, to examine how journalists cover various extreme events, with particular emphasis on the type of extreme event.

2.3 Climate Change Connection in Canadian Media

Much of the existing literature focuses on American news media, with few studies focusing on international media, and even less on Canadian media. As demonstrated above, many US-based studies mentioned highlight the lack of climate change connection in American extreme weather coverage, which many researchers believe the number of connections should be higher.

Analyses of the use of climate change attribution to extreme weather by Canadian media have produced mixed results. Hopke (2020a) found that during 2013 and 2018, the percentage of climate change attention in Canadian media's coverage of heatwaves was 19.7% and 8.3% respectively. This means that the Canadian media were more likely to make mentions of climate change in their articles than the other countries in the study. Alternatively, Davidson et al. (2019) examined environmental articles focused on forests by Albertan media between 2000 and 2017 and found that in the coverage of two local newspapers, the *Calgary Herald* and the *Edmonton Journal*, only 2% of the articles mentioned human-induced climate change. Interestingly, both newspapers had been in close proximity to major fires, including the 2016 Fort McMurray fire,

yet other themes such as the economy and risk took precedence over climate change. In contrast, in a report analyzing the coverage Canadian forest fires in 2023 by national media, Hatch et al., (2023) found that 16.5% of the coverage included connections to climate change. However, none of these authors accounted for francophone publications in their analysis of the Canadian media, which excludes the majority of the news media in Quebec.

The media landscape in Canada is unique, due in part to the bilingual status of the country. In one of the few articles to compare the differences between the climate change coverage of francophone and anglophone Canadian media, Young and Dugas (2011) found that francophone newspapers were more likely to give more front-page space to climate change articles, were less likely to quote businesses and were more likely to have ecological themes in their coverage. While many Canadian researchers have stated that excluding French media as a limitation, the significant differences in English and French coverage prove the importance of including both languages. Arguably, we do not have literature which examines the use of climate attribution for the entirety of Canada. Thus, it is essential to ensure the inclusion of both languages in future research.

2.4 Automated Content Analysis in Journalism Studies

Obtaining a better understanding of how the Canadian media connect climate change to extreme weather events requires a large number of articles to be analyzed. Although large corpuses can be analyzed manually, in this case, automated content analysis is preferable. Automated content analysis (ACA) is defined as "an approach in which the analysis of text is, to some extent, automatically conducted by machines" (Hase 2023, p. 23). Many disciplines use automated text analysis to explore different variables in a large corpus or dataset, limiting the

number of people required to manually code, saving both time and money, and making it possible to analyze amounts of data which are not accessible to hand-coding. Communication scholars have been using automated text analysis for some time, as it helps untangle the complexities of communication in large corpora and mitigate some of the restraints by human coders (van der Meer 2016; Ardent & Karadas, 2017). Similarly, with the digitization of news and subsequent access to databases and archival texts, some journalism studies scholars have also begun implementing automated text analysis in their studies (for an overview of journalism ACA approaches, see Boumans & Trilling, 2016). Flaounas et al. (2012) used automated content analysis to sort roughly 2.5 million articles into story-type categories, and to analyze the large corpus for readability, linguistic subjectivity, and gender imbalances. The authors state using ACA allowed them a corpus size which was "previously unreachable" (p. 102). Rather than choosing a smaller corpus or every x-number of articles to read, automated text analysis allows for an expanded corpus size and for every article to be analyzed.

In addition to allowing larger corpus sizes, ACA can also "reduce manual workload or increase reliability . . . by identifying relevant documents for a following (manual) in-depth analysis" (Günter & Quandt, 2016). Using topic modelling, which are algorithms built to find patterns in language, researchers can let the programmable models detect words and patterns which they can further analyze themselves. Hase et al. (2023) propose breaking down the use of automated content analysis into three distinct categories: elements, structures, and processes. The authors use the existing framework of Boczek and Hase (2020) to propose that ACA can analyze actors, semantic aspects of language, salience of keyword mentions and source content. In a recent study examining climate connection in the United States, Molder and Calice (2023) used automated content analysis to find frames and themes for their corpus of roughly 8900 articles.

Though automated content analysis can be helpful in journalism research, there are some notable limitations. First, unlike humans, computers cannot understand all the complexities and nuances of written text, so they can overlook or mistake aspects of language a human coder would not (Günter & Quandt, 2016). Additionally, beginning to automate one's content requires an understanding of statistics, mathematics, and coding which are not areas of knowledge every journalism or communications studies researcher has, though some journalism schools are beginning to implement them in their curriculum (Boumans & Trilling, 2016). Nonetheless, accounting for such limitations allows for quick analysis of large corpora, aligning journalism studies with the work of other disciplines, such as in linguistics, which readily apply ACA in their work (Bednarek & Carr, 2021). Combining the use of both automated and manual content analysis will allow for the analysis of a larger number of articles written by more sources, better locate and identify instances of climate connection, and streamline statistical tests.

2.5 Theoretical Framework

This thesis uses Reese and Shoemaker's (2013; 2016) Hierarchy of Influences Model as a framework to understand how various macro- and micro- level factors influence the media's content. The model outlines five levels of influence which can be visualized in the form of rings, ranging from the outer most, macro level, *social systems* to the inner most, micro level, *individual*. In between these are the levels of *routines*, *organization*, and *social institution*. Reese and Shoemaker explain that using this framework "helps disentangle the relationship among individual-level professionals and their routines, the organizations that house them, the institutions into which they cohere, and the social systems within which they operate and help maintain" (2016, p.390).

In other words, this model deconstructs some of the layers of influence behind the content and thinks of content as a variable which is shaped by a multitude of outside forces. This study focuses on two primary levels: the *individual level* (micro) and the *organizational level* (mid-level). The *individual level* focuses the individuality of the communicator, and the variables which go into their choices, particularly their journalism beat which may lead to their decisions to use climate connections. On the other hand, the *organizational level* examines how media organizations themselves shape content, such as through editorial practices. By applying this model, this study analyzes the extreme weather content for external and internal factors that influence the use of climate connections, which is lacking in the existing Canadian literature.

Chapter 3: Methodology

This study explores how the Canadian media connect various extreme weather events to climate change in the years 2019 and 2023, using a quantitative content analysis, with a text as data research approach. Text as data is defined as some text being "automatically [analyzed] by machines," allowing for large corpora of text to be coded quicker and more content to be analyzed (Hase, 2023). In a quantitative content analysis, text data - which is often treated as qualitative data - is transformed into "numerical descriptors," which is useful for statistical analyses (Coe & Scacco, 2017). Combining manual and automatic coding allows for a comprehensive comparison of climate mentions and connections between years and analysis of their relationship between journalistic variables.

Since this project focuses on Canadian media, articles of both of Canada's official languages – English and French – are included in the analysis to account for the cultural and linguistic landscape of the country. Articles are also analyzed for the impact of various independent variables on climate connection and climate mention, including event type, language, publication, and year. These variables provide a broader understanding of the external factors influencing the media's content. A small case study is also conducted, providing a preliminary exploration of individual journalists' use of climate connections in extreme weather reporting, which focuses on climate connections at the individual level. The code used for data analysis of this thesis is available upon request.

3.1 Corpus Selection and Collection

The corpus for this study consists of articles mentioning extreme weather events published by five Canadian national news media: The National Post, The Globe and Mail, CBC News National, Radio-Canada Info - National, and La Presse, and collected from the online

databases ProQuest Canadian Newstream and Eureka. Articles were collected for two time periods: from January 1, 2019, to December 31, 2019, inclusively, and from January 1, 2023, to December 31, 2023, inclusively. The media were selected based on their national coverage, large readership, and daily publications.

Both databases were necessary since The National Post and The Globe and Mail are archived in ProQuest, whereas CBC, Radio-Canada, and La Presse are archived in Eureka. Many of the publications publish both online and in print; however, some do not. Thus, in addition to the large number of Canadians who solely use online platforms for news, I decided to collect the online publications from each media rather than print or both. Boolean queries were executed on both databases with pre-tested extreme weather event keywords for wildfires, floods, extreme cold, and ice storms, for each publication, both years, and in the language of publication (see Table 2 for the wildfire query, and supplement materials S1 and S2 for queries of all events). Each publication had its articles saved in its own folder by extreme weather events for both years.

Prior to collecting the data for the final corpus, I conducted test queries to see the results with various keywords. First, I read articles about each of the events and collected frequently mentioned keywords. Each test query would begin with the most basic keywords, and I would note the number of articles outputted. I would increase the number of keywords until I no longer obtained new articles, or when new articles became irrelevant. This approach provided the most comprehensive keyword list to obtain the most relevant extreme weather articles for my corpus. Additionally, it was through this test that I realized the keywords used for floods would output many irrelevant articles, and was prepared to be extra cautious in the cleaning process (which is further discussed in the following sections)

Table 2

Example query for the extreme weather event of wildfires

Extreme Weather Event	**Query**	**Language**
Wildfire	Forest fire OR forest fires OR wildfire OR wildfires	English
Wildfire	Feu de forêt OR feux de forêt OR SOPFEU	French

From Eureka, a single PDF document of all articles from a Boolean query and their accompanying metadata in and RIS file was downloaded. I imported the metadata data into Zotero, a bibliography management system and subsequently exported it into a csv file. Since the Eureka data was in the form of a PDF, the text had to be extracted for content analysis. To extract the text, I ran a script using the Python library PyPDF2 which extracted the textual information from the PDF and outputted it into a single txt file. Then, using built-in Python functions, this large file was split into one txt file per article by using a pattern of words as a splitter, which appeared at the start of each article: "This article appears in." Using the same Python functions, any extra, irrelevant words and symbols in the beginning of the text file were removed and the first seven words in every text file was used to rename them, resulting in the text files named as the articles' title. Finally, I used Pandas and the built-in Difflib modules to match text files by title to the titles in the bibliographical data csv file and output their text into a new column. When an article was unable to be matched, the text was added into the csv file manually. This happened very rarely, usually with the preprocessing of an accent from a French character which no longer matched the title identically. Also, I manually checked the text to ensure the correct text was in the articles' row. Once the text was in the csv file, there were a

total of 88 columns. I removed the non-relevant columns and added the columns for the coding of climate connection, climate mention, extreme weather events one to four, resulting in 14 columns.

For articles collected from ProQuest, the results from each query were downloaded into a single txt file, alongside the corresponding metadata, which was available in a csv file. Using a portion of the same splitting script for the Eureka articles and a new personalized splitting marker: “Last updated …” each article was segmented into a separate text file. As above, each article was renamed and matched, non-matched articles had their text manually inserted and were checked to ensure text accuracy. The columns were cleaned to remove unnecessary ones, and the necessary new columns were added to match those in the Eureka csv files and for coding purposes.

For the whole corpus once collected and sorted into csv files, to allow for easier handling of French accents and characters, each csv file was exported as an Excel file. For the number of articles to be less overwhelming, I stored the scraped data in a tiered folder system, categorized by publication, year, and event. To summarize, the corpus was stored in 40 smaller datasets, which I combined before the analysis.

3.2 Corpus Cleaning

Each data set (n=40, total articles=9549) was cleaned individually, undergoing multiple cleaning steps. First, a dataset was uploaded to OpenRefine, an open-source application, for data pre-processing recognized by many data scientists (Kusumasari & Fitria, 2016). Duplicates were removed, which were all articles with the same headline and date. Then, I manually examined the files without duplicates by reading headlines to ensure the articles were relevant to the

extreme weather event(s). All articles deemed irrelevant were discarded, this includes guides (guide for a trip to a new city), newsletters, book reviews, and news highlights (the headlines of the biggest news stories of the day or week). To further ensure the corpus only consists of news and opinion pieces, I used a Python script which assessed whether an article is more than 100 words or 4 sentences. Those which were less than the set parameters were discarded, since they were not news or opinion stories, but rather summaries or links to radio/television stories. Since the keywords for the event of flooding collected all articles mentioning flooding or flood, I took particular care to ensure non-relevant articles were removed. Using the Excel find function, I searched for the terms "flood of" and "flood the" and each flagged each instance. Then, each was read, and I removed any which were unrelated to the extreme weather event of flooding, such as those discussing the "flood of refugees" or "protesters flooding the street".

Once I cleaned the datasets at the event level, by publication and year, the datasets (n=40) were merged to create new datasets of all events by publication and year (n=10). For example, a dataset for The Globe and Mail 2019 would contain all articles from 2019 of all four weather events. Since the articles were initially cleaned at the individual event level, when merged together, any duplicates were articles with multiple extreme weather events and are coded as such.

In the original dataset, each article was represented in a single row, with up to four event columns (Event 1 to Event 4). The event columns were categorically coded for the presence of multiple extreme weather events, as needed. So, articles which mentioned multiple events had values in multiple event columns. Since the data analysis was conducted in Python, I used the melt function which reshaped the data frame to ensure accurate count of the frequency of event mentions, by not inflating the total number of articles. This function converted the wide format -

multiple event columns - into a long format, which combines all event mentions into a single column while keeping the same number of articles. I realized melting the data frame needed to be done once I was obtaining results with more articles than I knew I had. Melting the data ensured that the extreme weather event count was based on individual occurrences, allowing for accurate frequency analysis.

The final cleaned datasets included all news and opinion articles relevant to the extreme weather event, which are longer than 4 sentences or 100 words, and stored in folders by year and publication. To summarize, climate mention and climate connection coding took place on datasets which contained all the articles of extreme events for one year by one publication. Once completed, the 10 datasets merged to one large dataset. During the cleaning process, 4514 articles were removed, resulting in a final corpus (n=5395) of extreme weather articles. These articles were made up of roughly 2000 duplicates scraped from the databases, 1500 were articles with multiple events (whose duplicates were removed and recoded in the event columns), and 1000 were non-news articles.

3.3 Automated Content Analysis of Climate Mentions

A major goal for this thesis was to become proficient in text mining and using quantitative research methods in journalism studies. Thus, to analyze climate mentions and connections in Canadian extreme weather reporting, I wrote a keyword spotting script in Python. First, each article needed to undergo pre-processing so the text can be analyzed. Pre-processing is the step which "reduces text units to those features that are informative for detecting difference or similarities between different text units and dismisses features that are not" (Hase, 2023 p. 25). In other words, the researcher makes the text easier for the computer to read and understand.

There are many ways to pre-process textual data, decided upon by the researcher, as there is no "standard" pre-processing steps (Benoit, 2020). So, for this work, I chose to pre-process every text file using the built-in string method in Python to convert all text to lowercase, and the re library to remove extra lines.

To code for climate mentions, which is defined as using a climate keyword in an extreme event story, I used a Python script with a list of pre-defined climate keywords (for full list of keywords, see supplemental materials S2) to binary code each article. The script searches the text column of each Excel file and adds binary coding (1 = climate mention, 0 = no climate mention) in a new column of climate mention, along with the sentence(s) in which the climate keyword(s) occurs in a secondary sheet in the Excel file. In the script, I also employed regular expressions (wildcards) and string concatenation which ensures the identification of all relevant variations of the keywords. Regular expressions allow for a more flexible pattern matching, which captures different forms and spelling of the terms, while concatenation captures combinations of the keywords to account for variations. Since the PDF text scraping words may misspell words and have them in an incorrect form, implementing concatenation and wildcards ensures capturing the most keyword mentions. I ran the code repeatedly for each dataset, ten times total. The climate mention results are from the keyword spotting script, although random manual checks were performed, and no inaccurate coding was found.

3.4 Climate Connections

Climate connections, which are defined as connecting human climate change to extreme weather, in either severity, likelihood, or frequency, was coded manually. Although some existing studies use climate mentions interchangeably with climate connections, mentioning climate keywords does not always create a connection between an event and climate change. For

example, an article is coded positive for climate mention when quoting British Columbia's Minister of Emergency Management and Climate Readiness Bowinn Ma, since climate change is in their title. Thus, I read every single article positively coded for climate mentions (n=1714), and further binary coded for climate connection (1= climate connection made, 0= no climate connection made). I manually coded each dataset, ten times in total.

3.5 Statistical Tests and Analyses

First, to provide an overview of my corpus, I provide the results of descriptive statistical analyses, namely frequencies and counts, in tables. Subsequently, to answer RQ1, I conducted chi-square tests between the independent variables of language, publication, year, and event types and my dependent variables, climate mention and climate connection, to explore relationships. Then, to build upon those results and asses the strength of the relationships, I used Cramer's V tests. Based on the findings of strength, and to see whether there are trends and correlations between independent and dependent variables, I explored the effect of publication type, extreme events, language and year on climate connections. Then using *z*-tests to explore RQ2, I examined the effects of individual categories of the independent variables event type and publication, and how they have changed over time between 2019 and 2023. Finally, to answer my last research question, RQ3, and examine which journalists use climate connections in the reporting of extreme weather events, I used Radio-Canada and CBC's 2023 coverage of all events as a small case study to analyze the author data for frequencies and trends.

3.6 Journalist Sub Corpus CBC & Radio Canada

To explore the potential effect of journalists and climate connections, I created a sub corpus for CBC and Radio-Canada of all articles from 2023 using Python's Pandas library. By filtering all CBC and Radio-Canada extreme weather articles for the year 2023, I exported a corpus of articles (n=1176) which includes authors' names. The two media were chosen as the publications of focus for this small case study due to the availability of their author data, they are Canada's national public broadcaster, and in 2021 CBC committed to increasing their climate change journalism (Fenlon, 2021). To prepare the corpus for analysis, the author names were cleaned, ensuring no name was misspelt, and articles with no authors are dropped (n=288). Articles from news agencies and wires (La Presse Canadienne, Reuters, etc.) as their authors were recoded as wire, and those with CBC or Radio-Canada as the author was recoded as in house. These articles without a named author were dropped too, since there was no significant association found when comparing the climate connections between in-house and wire articles to articles with named authors. The final journalist corpus consisted of 428 articles with named authors. Similar to the process used for extreme weather events, I melted the author data using the melt function to account for articles with many authors. Following the analysis of climate connection counts, the top journalists with the most climate connections had their journalist type coded. I identified and coded the journalist types, using CBC and Radio-Canada's webpages, LinkedIn, and personal communications, categorizing them as specialized (health & science, climate, science, or environmental), or general reporters.

Chapter 4: Analysis and Results

4.1 Corpus Description

The final corpus consists of 5395 extreme weather event articles, published online by 5 Canadian media publications in 2019 and 2023. Table 3 shows that the articles are divided as roughly 60% (3268) anglophone and 40% (2127) francophone, and range by publication from 1363 to 786 total articles. The National Post and Radio-Canada account for the largest proportion of articles in the sample, at 25.3% and 24.9%, respectively. CBC and The Globe and Mail make up an additional 18.1% and 17.2% of the sample, while La Presse contributes the remaining 14.6%.

Table 3

Descriptive Statistics of Dataset (n=5395)

Publication	**Language**	**Total Articles**	**Articles 2019**	**Articles 2023**	**Climate Mention**		**Climate Connection**	
					n	*%*	*n*	*%*
Globe and Mail	Anglophone	929	290	639	397	42.7	300	32.3
National Post	Anglophone	1363	1192	171	314	23.0	220	16.1
CBC	Anglophone	976	562	414	343	35.1	280	28.7
Radio-Canada	Francophone	1341	579	762	428	31.9	338	25.2
La Presse	Francophone	786	310	476	232	29.5	182	23.2
Total	-	5395	2933	2462	1714	-	1320	-

Notably, there is a 16.5% (471) decrease in the number of extreme weather event articles from 2019 to 2023. This decline comes at a time when the country experienced its worst forest fire on record during the spring and summer of 2023. Additionally, some publications exhibited significant individual changes in the number of articles published between the periods analyzed. The most notable decrease occurs by the National Post, which published 1192 extreme event

articles in 2019 but only 171 in 2023, a reduction of almost 90%. Given the large discrepancy between the two years, multiple databases were consulted to ensure accuracy, which resulted in the same number of articles, demonstrating no human error. Possible reasons for this decline including cuts to the journalism industry will be explored in the discussion section. Similarly, the CBC also saw a decline in articles, yet it was not as extreme as the National Post. The other publications saw weak to moderate growth in the number of extreme event articles, likely due to the gravity of the 2023 forest fire season.

Table 4

Climate Mention and Connection Proportion and Count by Publication for 2019 and 2023

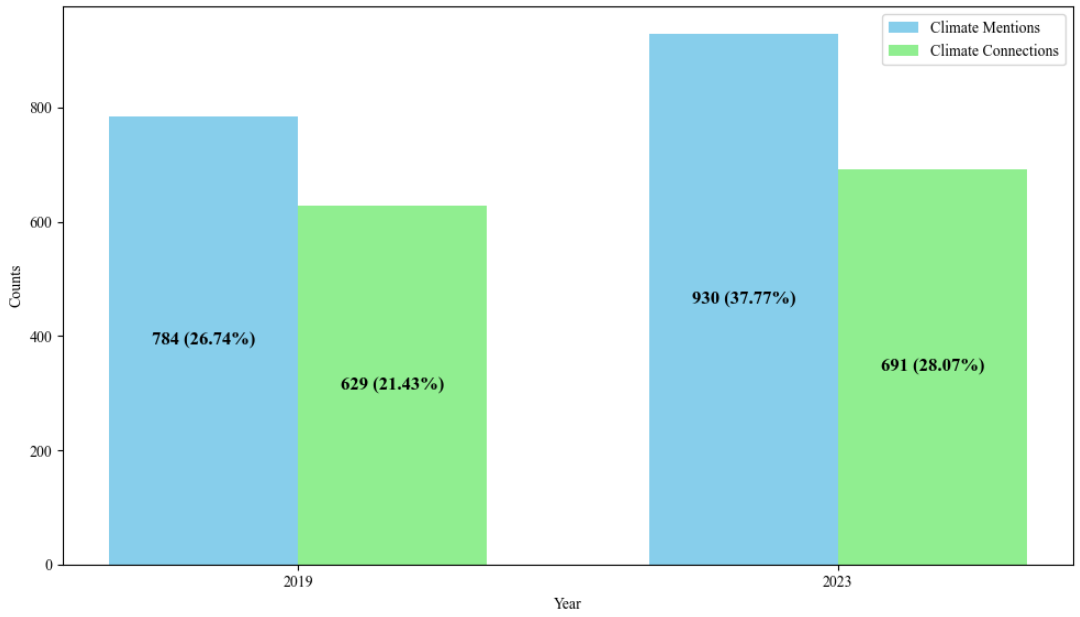
Publication	**Year**	**Climate Mention**		**Climate Connection**	
		n	Proportion (%)	n	Proportion (%)
Globe and Mail	2019	112	38.6	95	32.8
	2023	285	44.6	205	32.1
National Post	2019	258	21.6	199	16.7
	2023	56	32.8	21	12.3
CBC	2019	162	28.8	142	25.2
	2023	181	43.7	138	33.3
Radio-Canada	2019	167	28.8	131	22.6
	2023	261	34.3	207	27.2
La Presse	2019	85	27.4	62	20.0
	2023	147	30.1	120	25.2

Of the total corpus, 31.8% (1714) articles mention a climate keyword, while 24.5 (1320) make a climate connection. Further, of 1714 climate mentions, 77% go on to link an event to climate change, demonstrating a large likelihood of making a climate connection if a climate

keyword was used. As shown in Table 4, the proportion of climate mentions and connections range from 42.7% (The Globe and Mail) to 23% (National Post) for climate mentions, and from 32.3% (Globe and Mail) to 16.1% (National Post) for climate connections. In other words, the Globe and Mail is nearly twice as likely to connect an extreme weather event to climate change than the National Post. Similar proportions of climate connections are observed in the coverage of CBC (28.7%), Radio-Canada (25.2%), and La Presse (23.2%), showing that despite differences in climate connection counts, the outlets sustain a comparable proportion relative to their total extreme weather coverage. Similarly, comparing the proportion of climate mentions and connections between anglophone and francophone media, produced nearly identical results. The proportion of climate mentions for anglophone media was 32.2% compared to 31% for francophone. Outlets of both languages had a climate connection proportion of 24.4% (see supplemental S4).

Figure 1

Comparison of Total Climate Mentions (n=1714), Connections (n=1320), and Proportions by Year

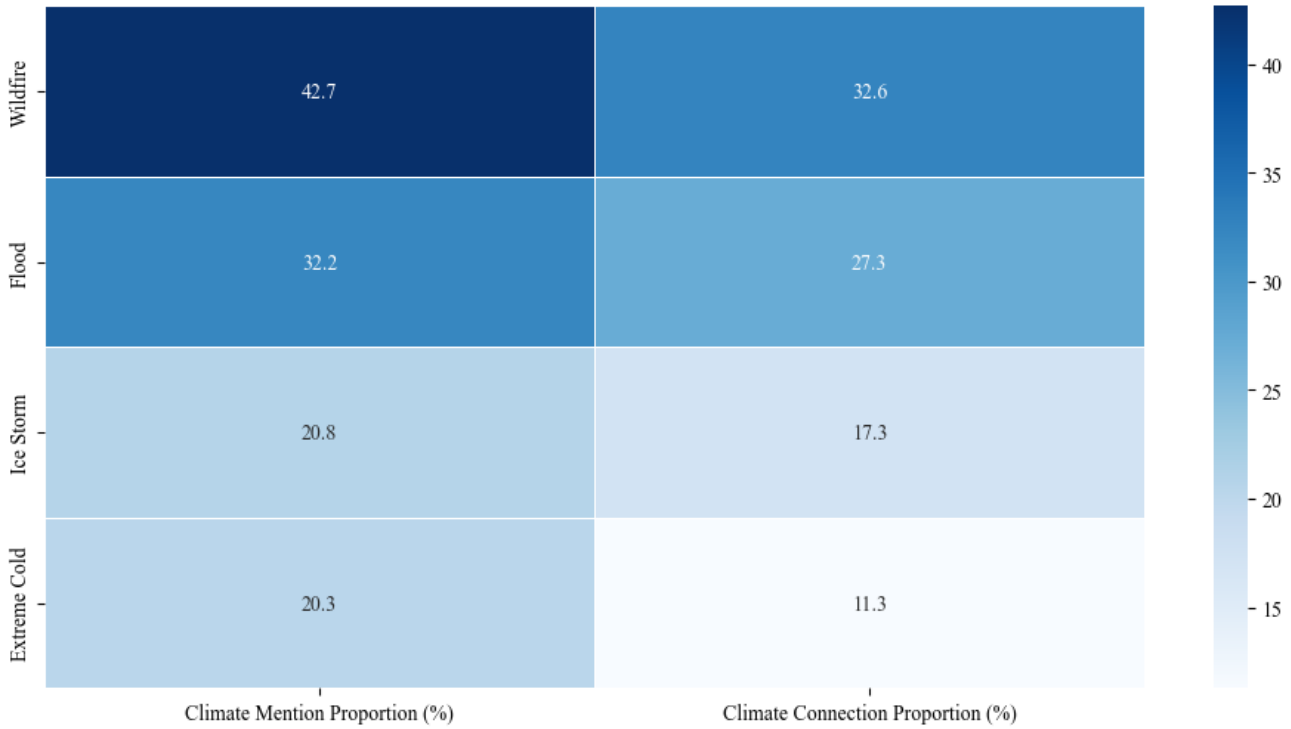


Comparing the number of climate mentions and connections between 2019 and 2023 show that regardless of the decrease in the total number of extreme weather coverage, the count and proportion of mentions and connections increased. As illustrated in Figure 1, from 2019 to 2023 there was an increase of 146 climate mentions and of 62 climate connections. Although the increase may seem slight, it is important to account for the decrease in the number of extreme weather articles between the two years. Climate mentions rose by 18.6% between 2019 and 2023, while climate connections increased by 9.9%. Accounting for the number of articles, we also see that the proportions of both climate mentions and connections increased steadily.

When exploring individual extreme events, the results in Figure 2 demonstrate that both the number and proportion of climate mentions and connections differ based on the event. Wildfires and floods are those most often discussed relative to climate change, with 42.7% of wildfire and 32.2% of flood articles mentioning a climate change. Similar proportions are also seen for climate connections, with wildfires and floods once again having the highest proportion of articles making a connection between the event and climate change. Interestingly, even though ice storms (20.8%) and extreme cold (20.3%) have similar mention proportions, ice storms are more likely to be connected to climate change than extreme cold events, given their climate proportion of 17.3% and 11.2%, respectively. Although we can define ice storms as cold event due to its inclusion of ice, warmer weather enables the phenomenon to occur, like forest fires and floods. This could explain why unlike extreme cold, the majority of climate change mentions in ice storms will further link to climate change, even though they make up relatively little of the extreme weather coverage (which is further explored below).

Figure 2

Heatmap of the Proportion (%) Climate Mentions and Connection Per Extreme Event (n=4)



4.2 Evolution of Corpus Over Time

In Figure 3, the frequency of extreme weather articles are compared over ISO week, by year. Interestingly, there are similar peaks during both years, particularly for flooding (weeks 11 to 16) and wildfire (weeks 19 to 37) seasons. Although the number of articles published in 2019 is greater than of those published in 2023, the peak during ISO week 24 of 2023 demonstrates the severity and newsworthiness of Canada's worst forest fire season.

The frequency of mentions and coverage of various extreme events in the Canadian media differ greatly by event type. Floods (3012) and wildfires (2549) are the events most mentioned by the media. By comparison, ice storms (284) and extreme cold (222) received significantly less coverage.

Figure 3

Comparison of articles from 2019 (n=2933) to 2023 (n=2462) over time (ISO Week)

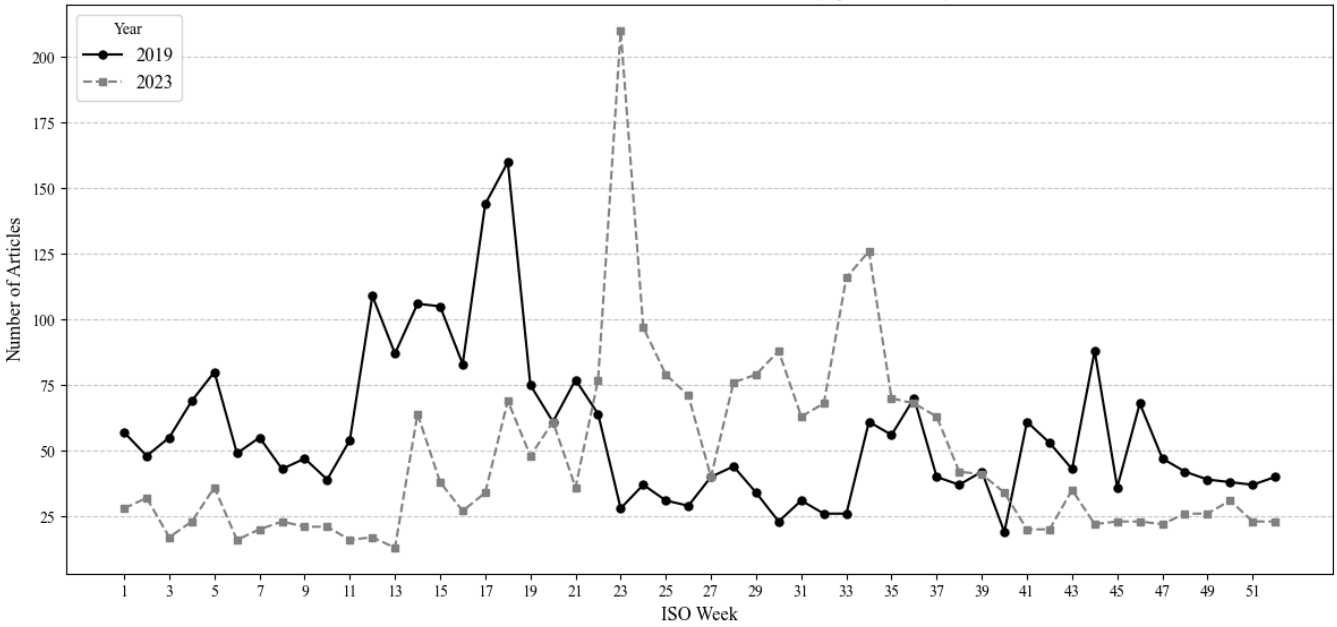


Table 5

Event Frequency in Extreme Weather Coverage by Publication Between Years (n=6067)

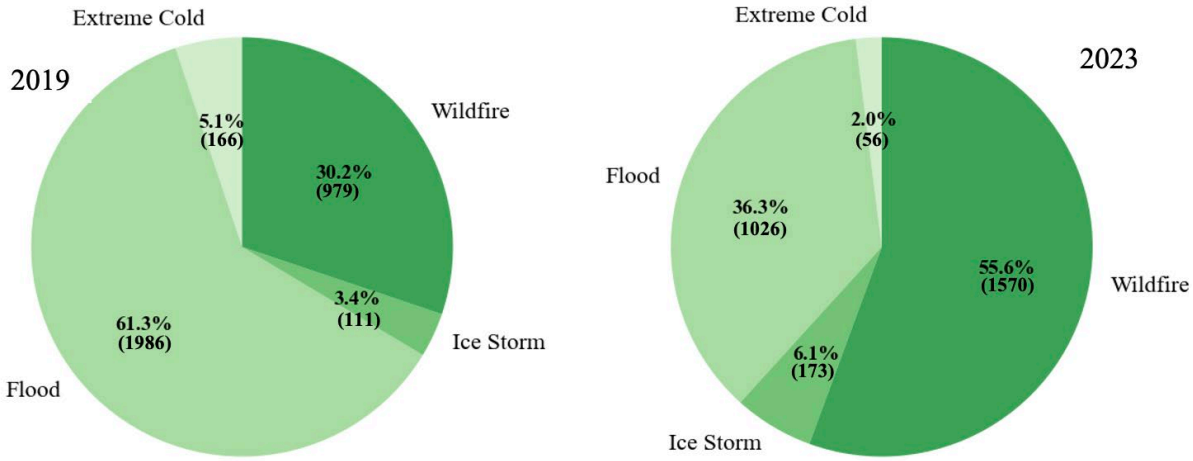
	Year	Wildfire	Flood	Extreme Cold	Ice Storm
Globe and Mail	2019	160	142	26	0
	2023	429	331	14	6
National Post	2019	294	924	63	3
	2023	120	71	6	1
CBC	2019	316	324	29	13
	2023	312	140	11	6
Radio-Canada	2019	164	377	33	44
	2023	465	321	9	59
La Presse	2019	45	219	15	51
	2023	244	163	16	101
Total	-	2549	3012	222	284

Note. Count is based on frequency of each event mentioned across all articles.

The proportion of media coverage of extreme events also shifts between 2019 and 2023, as demonstrated in Figure 4. Likely due to the gravity of the 2023 wildfires, the proportion of wildfire articles in the total coverage shift significantly, increasing from 30.2% of the total extreme weather coverage in 2019 to over 55% in 2023. In contrast, the proportion of flooding coverage decreased from 61.3% in 2019 to 36.3% of the coverage in 2023. Similar to their small counts, extreme cold and ice storms make up little of the extreme weather coverage.

Figure 4

Comparison of Event Distribution in Extreme Weather Coverage: 2019 vs 2023 (n=6067)



Note. Count is based on frequency of each event mentioned across all articles.

4.3 Statistical Analysis

To explore the relationship between the independent variables of publication, extreme event type, year and language and the dependent variables of climate mention and climate connection, the corpus was analyzed using statistical tests in Python with the SciPy library.

First, to answer RQ1, how the Canadian media used climate connections in their coverage of extreme events in 2019 and 2023, I conducted chi-square tests between all independent variables and my dependent variables to examine whether there were significant relationships between the categorical values. Subsequently, I used Cramer's V tests to assess the strength of those relationships. Then, based on the strength, and to answer RQ2, whether there are trends and correlations between independent and dependent variables, I decided to focus on further exploring the effect of publication type, extreme events, language and year on climate connections. Using *z*-tests, I also examine the effects of individual independent variables and how they have changed over time. Finally, to see who the journalists are who use climate connections in the reporting, and answer my final research question, RQ3, I use Radio-Canada and CBC's 2023 coverage of all events as a small case study to analyze author data.

4.4 Relationships Between Climate Mentions, Climate Connections and Independent Variables

The results from the descriptive tests above, show the number of extreme weather event articles which mention and connect climate change with extreme weather events is relatively high. As this study aimed to analyze the number of climate mentions and connections, while also exploring the strength of the relationship between climate mentions and connections, and the variables of publication, events, year and language, chi-square and Cramer's V tests were performed.

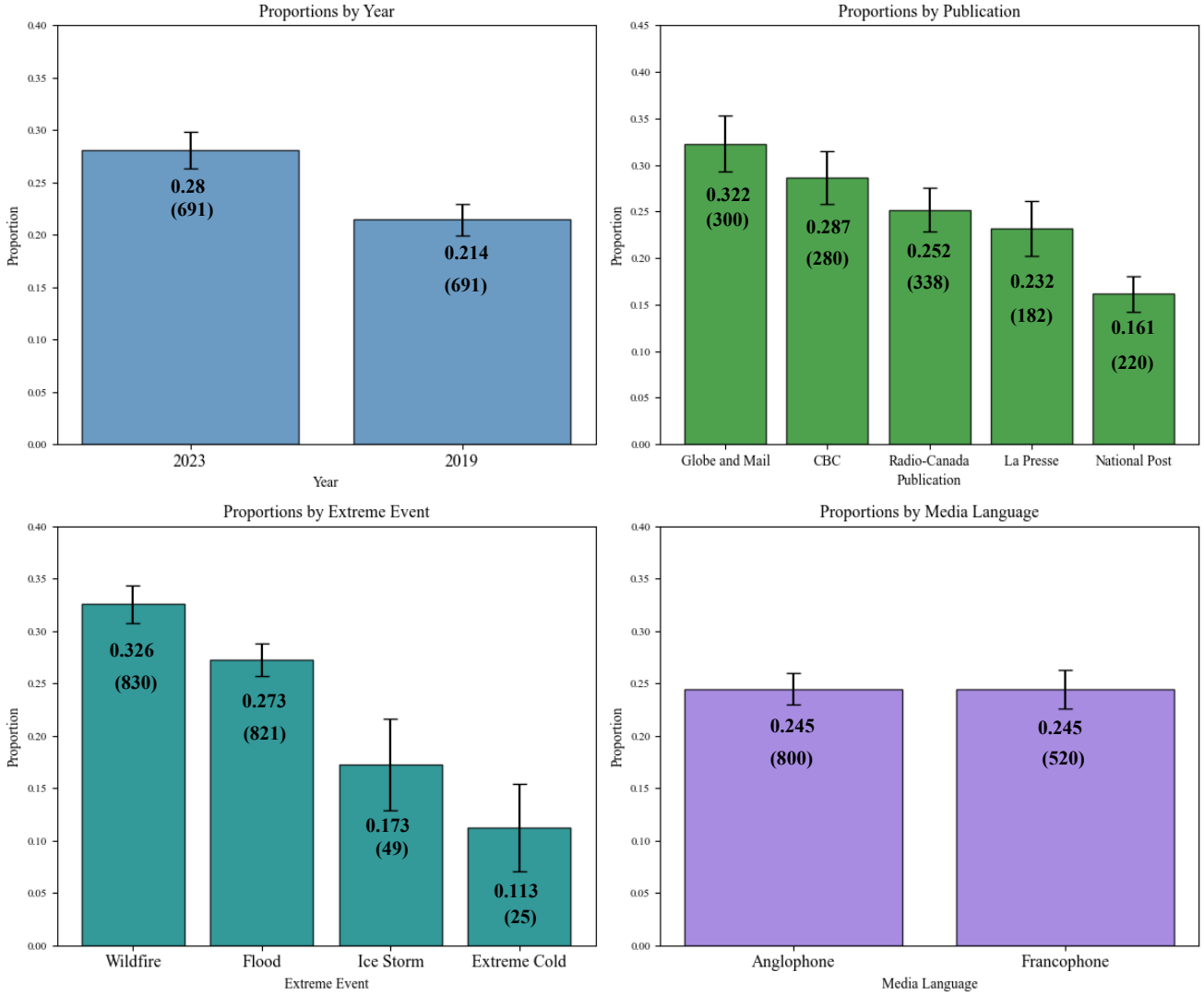
Initially, I conducted a proportion analysis with confidence intervals using the standard formula for proportion estimates (Figure 5) to examine how the climate connection vary across these independent variables. These results show that the National Post has a notably lower proportion of climate connections compared to all other media publications. The proportion of

The Globe and Mail, is roughly twice as high as in the National Post, suggesting the use of climate connections varies significantly by publication. Similarly, the results from event type demonstrate that climate connections are used less frequently in the coverage of ice storms and extreme colds in than those of wildfires and floods. The higher proportion of climate connections in 2023 compared to 2019 suggests an increase in the trend of climate related coverage in extreme weather reporting, which may potentially be related to the development of climate science and event attribution studies. Interestingly, the proportions of climate connections for both anglophone and francophone media are very similar, suggesting that language does not play a major role in the use of climate connections in extreme weather reporting.

The differences observed in the proportions of event type and publication suggest that these variables play a role in the likelihood of making climate connections in extreme weather coverage. To provide robustness and further validation to these results, I used chi-square and Cramer's V tests to measure statistical significance, with these results reported in Table 6.

Figure 5

Proportion Analysis of Climate Connections for Independent Variables of Year, Publication, Event Type and Language



Note. Proportions are calculated with a 95% confidence interval (CI) using the standard formula for proportion estimates across the variables: event type, publication, year and media language. N = 5395 for media language, publication and year, and N = 6067 for event

Although the above proportion analysis provides a starting point for climate connections, the associations between variables required further statistical analyses. First, I used chi-square tests to assess the associations and to determine whether the differences in proportions between categories were statistically significant. As shown by the *p*-values in Table 6, there are

significant relationships between climate mentions and publications, events, and years. To quantify the relationship, Cramer's V was conducted, which found that relationship observed was weak to moderate. Interestingly, both tests find no significant relationship between language and climate mentions. These findings are congruent to the descriptive statistics of the corpus in the previous sections which show the differences between the frequency of climate mentions and connections by publication, year, and event type.

Table 6

Associations of independent variables on dependent variables climate mention and climate connection (n=5395).

Dependent Variables	**Independent Variables**	**Cramer's V**	**χ^2**	**Chi-square p-value**
Climate Mention	Publication	0.140	106.37	<.001***
	Language	0.013	0.812	.368
	Event	0.125	84.06	<.001***
	Year	0.118	74.66	<.001***
Climate Connection	Publication	0.131	92.45	<.001***
	Language	0.0	0.0	1.0
	Event	0.096	49.6	<.001***
	Year	0.077	31.39	<.001***

Note. Degrees of freedom (df) = 1 for language and year, df = 5 for publication, and df = 4 for event. Statistical significance: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

4.5 Shifts in Climate Connections Between 2019 and 2023

To further explore the relationship between time and the independent variables of extreme events, and publication, chi-square, Cramer's V and *z*-tests were performed, and their results compared. The combination of these three statistical tests identified and quantified relationships between the independent variables and climate connections, and to confirm relationships between categories of the independent variables. While the results of the chi-square tests identify associations between independent and dependent variables, Cramer's V quantifies the association's strength. Additionally, *z*-test focus on the relationships within individual categories of independent variables and compare their proportions of climate connections between 2019 and 2023. Due to the associations found above, the variables of event type and publication are further analyzed.

Given the variation in the number of articles for the four extreme weather events and the intense 2023 forest fire season, it was thought the climate connection of extreme events would significantly change between years. In contrast, the results of the z-test in Table 7 demonstrate that time did not have a significant impact on wildfires; rather, floods showed a significant change in climate connection between 2019 and 2023. The proportion of climate connections in wildfire coverage decreased very slightly from 32.7% to 32.5%. Further, the proportion of climate connections for floods increased by 16%, even with fewer articles written in 2023, illustrating the growing understanding of the impacts of climate change on flooding. The other extreme weather events proved to have very weak or no relationship between time and extreme weather event for climate connections.

Table 7

Comparing Climate Connection Count and Proportion Between 2019 & 2023 by Event Type

Extreme Event	Climate Connection				Chi-square p-value	Cramer's V	z-test p-value
	2019		2023				
	Count	Proportion	Count	Proportion			
	n	*%*	*n*	*%*			
Wildfire	320	32.7	510	32.5	0.950	0.001	0.916
Flood	431	21.7	390	38.0	<0.001***	0.173	<0.001***
Extreme Cold	19	11.5	6	10.7	1.0	0.0	0.881
Ice Storm	17	15.3	32	18.5	0.595	0.032	0.489
Total	787	-	938	-	-	-	-

Note. Proportions are calculated based on number of individual event count relative to total sum of all events mentions. Statistical significance: *p < 0.05, **p < 0.01, ***p < 0.001.

As mentioned earlier, there were sharp changes in the number of articles written by some publications between 2019 and 2023. A similar trend is observed when comparing the number of climate connections made between the two years. Table 8 highlights these trends. The most notable change is observed, again, in the National Post, had a climate connection proportion of 23% (n=199) in 2019, and only 16.3% (n=21) in 2023. This decrease can, in part, be explained by the large decrease in total articles written, as seen in the data above. Despite the substantial reduction, the proportion of climate connections relative to the total number of articles shows marginal change, decreasing by 4.4%. Interestingly, although The Globe and Mail saw an increase of 110 climate connections, their proportion of connection decreased by 0.7%. This demonstrates that the increase in climate connections did not offset the effect of extreme weather event articles which did not make a connection. La Presse and Radio-Canada also saw moderate

increases to their connection proportion, with positive changes of 5.2% and 4.6% respectively. Also, even with a decrease in their connection count of 4, the CBC's connection proportion increased by roughly 1.3 times.

Table 8

Comparing Climate Connection Count and Proportion Between 2019 & 2023 by Publication

Publication	**Climate Connection**				**Chi-square p-value**	**Cramer's V**	**z-test p-value**
	2019		**2023**				
	Count	**Proportion**	**Count**	**Proportion**			
	n	*%*	*n*	*%*			
La Presse	62	20.0	120	25.2	0.108	0.057	0.091
Radio-Canada	131	22.6	207	27.2	0.067	0.050	0.058
CBC	142	25.3	138	33.3	<0.001***	0.086	<0.001***
Globe and Mail	95	32.8	205	32.1	0.897	0.004	0.838
National Post	199	16.7	21	12.3	0.175	0.037	0.142
Total	787	-	938	-	-	-	-

Note. Proportion percentages are calculated based on the number of climate connections relative to the number of articles per publication. Statistical Significance: *p < 0.05, **p < 0.01, ***p < 0.001

Observing the chi-square and *z*-test results, the CBC was the sole publication with significant change in their proportion of climate connections articles between 2019 and 2023. This increase of approximately 8% suggests the CBC's coverage of extreme weather events became more focused on linking these events to climate change. The low *p*-values for both chi-square and *z*-tests, support this finding. No other publication demonstrated a significant change

in either count or proportion as indicated by their high p-values, suggesting that the observed changes were not statistically robust.

From these findings comparing the independent variables to climate change connections, it is evident that certain publications and extreme events, notably CBC, and floods, saw significant changes in the proportion of connections made between 2019 and 2023. These shifts merit further exploration, such as examining the role of individual journalists, who may specialize in science or climate reporting and are more likely to feel comfortable connecting extreme events to climate change, particularly as new attribution studies and scientific evidence become available.

4.6 Effect of Individual Journalists

The analysis above demonstrated the association between publications and the likelihood of making climate connections. However, a potential confounding variable is the individual journalists who write the articles for the publications. To explore this effect, I conducted a small case study, examining the climate connections by the named authors of CBC and Radio-Canada's 2023 extreme weather coverage.

Since the goal was to begin exploring the hypothesis that it is the same few experienced science or climate reporters making the connections, I first used graphs to show the distribution of authors with their count and proportion of climate connections and used various statistical tests to test their associations. To ensure the anonymity of the top 10 journalists who made climate connections, each was renamed numerically and will be referred to as Journalist 1 through 10. As shown in Table 6, the proportion of climate connections in extreme weather articles written by both publications is similar. The proportion of climate connection for CBC is

only 1% more than Radio-Canada, even with CBC journalists making 49 more climate connections than journalists at Radio-Canada.

Table 9

Descriptive Statistics of Journalist Dataset (n=428)

Publication	Language	Total Articles	Authors Count	Author CC	Climate Connection (CC)	
					Count	Proportion
					n	*%*
CBC	Anglophone	264	113	57	108	40.9
Radio-Canada	Francophone	148	67	36	59	39.9
Total	-	428	180	93	175	-

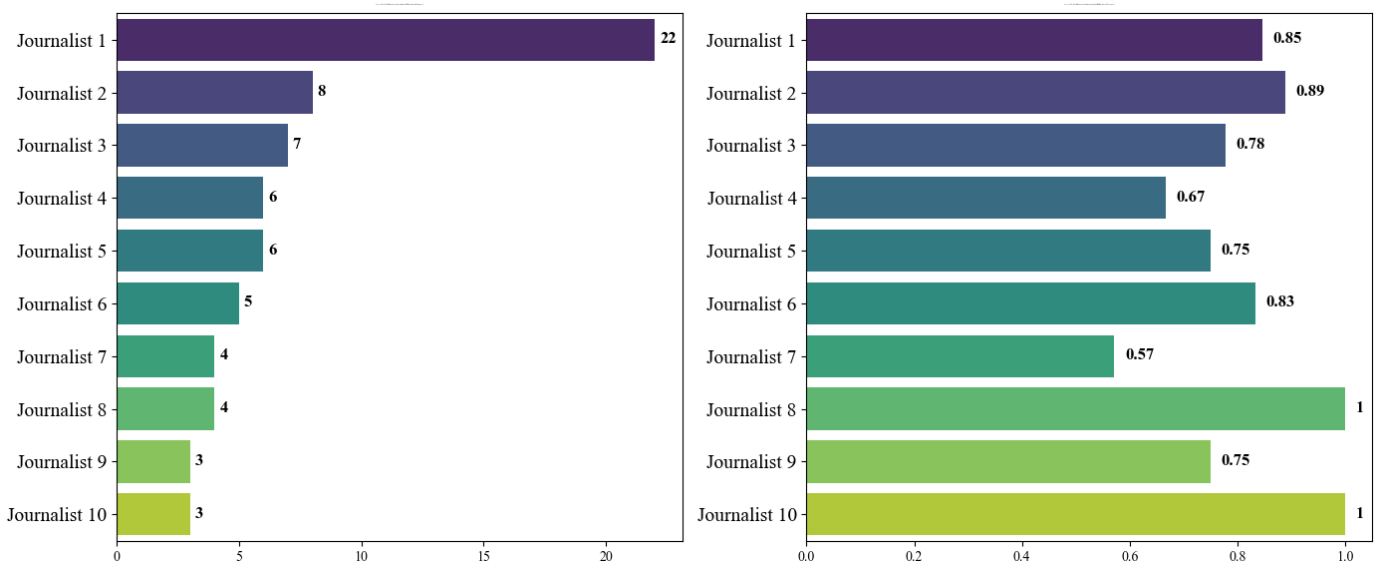
Note. Articles are only those with named authors. Although there are a total of 180 authors, only 179 are unique, as one author wrote for both publications. Proportion percentages are calculated based on the number of climate connections relative to the number of articles per publication.

Between both media, there were 93 authors who made at least one climate connection in their 2023 extreme event coverage. Of all authors, roughly half (51.7%) made a climate connection. Among those who made a connection, the number of mentions ranges from 1 to 22. To better visualize the authors, the 10 authors with the highest number of climate connections are shown, as the majority of authors made fewer than 5 connections. Figure 6 demonstrates the variability between the top climate connection authors, in both counts and proportion. Journalist 1 of the CBC was the journalist with the most climate connections, with 22 instances, which is 14 more than Journalist 2 of Radio-Canada, who had the second most climate connections. Examining the proportion of climate connections to each authors' total published number of extreme weather articles, Journalist 2's articles (89%) are slightly more likely to make climate connections than Journalist 1's (85%). Two journalists, Journalist 8 and Journalist 10 (both of

the CBC) incorporated climate connections in all their extreme weather articles. Although, they wrote relatively few extreme weather articles, publishing four and three respectively.

Figure 6

Count and Proportion of the Top 10 Authors for Climate Connections



To determine statistical significance between authorship and climate connections, I used chi-square and Cramér's V tests. First, the chi-square test results which was performed on all journalists, reveal a significant association between authorship and connection, as evidenced by the low *p*-value in Table 10. This implies that some authors are more likely to make and use climate connections in their extreme weather articles than others. To better assess the strength of the association, Cramér's V test was performed, resulting in a strong relationship between journalist and climate connections. Using both tests, I confirmed an association and a strong relationship between authorship and climate connection which suggests that certain journalists are more likely than others to make climate connections, supporting my hypothesis that is likely only a few journalists who continuously make these connections.

Table 10

Results of Association Between Climate Connection and Authorship

Statistic	Value
χ^2	261.87
p-value	0.0005
Degrees of Freedom	178
Cramér's V	0.782

Note. Tests performed on all unique authors (n=179) and their respective climate connections

Since individual journalists are also of interest, and the relationship between authorship and climate connection was established above, I explored the journalist type for the top 10 journalists. Table 11 shows the journalist type distribution for those who made the most climate connections. The results show that 70% of the journalists are specialized reporters, with a focus on either science, the environment, or environmental policy. Among the 68 total climate connections made by the top 10 authors, roughly 81% are made by specialized journalists. In contrast, only 13 connections were made by general reporters, highlighting a significant difference in the use of climate connections between those with a specialized science or environmental background and those who are general reporters.

Although general reporters account for less climate connections overall, their proportional use of climate connections was noteworthy. For example, Journalists 8 and 10 had 100% climate connection proportion (n=4 and n=3), while the other general reporter, Journalist 5 had 75% (n=6). Conversely, two specialized reporters, Radio-Canada's science reporter Journalist 7 (57%) and environmental reporter Journalist 4 (67%) had the lowest proportion of climate connections in their extreme weather stories.

These findings suggest that journalists whose beat is either science, the environment, or climate change, are significantly more likely to include climate connections in their coverage of extreme weather events. However, the results also show that certain general reporters do incorporate climate connections, albeit in a smaller number of articles they publish on weather events.

Table 11

Overview of Top 10 Journalists with Most Climate Connections with Journalist Types

Journalist	**Publication**	**Journalist Type**	**Climate Connection**	
			Count	**Proportion**
			n	%
Journalist 1	CBC	Climate	22	0.85
Journalist 2	Radio-Canada	Environmental	8	0.89
Journalist 3	CBC	Environmental & Energy Policy	7	0.78
Journalist 4	Radio-Canada	Environmental	6	0.67
Journalist 5	CBC	General	6	0.75
Journalist 6	CBC	Science	5	0.83
Journalist 7	Radio-Canada	Science	4	0.57
Journalist 8	CBC	General	4	1
Journalist 9	CBC	Health & Science	3	0.75
Journalist 10	CBC	General	3	1
Total			68	-

Note. Proportion is calculated based on the number of climate connections relative to the number of articles per journalist.

From the primary results of this case study, it does appear that individual journalists influence the likelihood of an extreme weather event articles making use of climate connections. The low chi-square *p*-value and high Cramér's V identify a strong association between journalist and climate connection, which support my starting hypothesis. Further, when analyzing the top 10 journalists, specialized, science and climate-environmental reporters were more likely to make climate connections and had more connection counts than general reporters. While this small case study was just a starting point for exploring potential effects of individual journalists, the next step should include the reporter type for all journalists, explore why some general reporters are comfortable making climate connections, larger sample sizes, and comparing all journalist, not just the top 10.

Chapter 5: Discussion

This study set out to explore if and how the Canadian media connect extreme weather events to climate change. The goal was to use computational analysis coupled with manual coding to answer the following research questions:

RQ1: How did the Canadian media use climate change attribution in their coverage of forest fires, floods, ice storms, and extreme cold in 2019 compared to 2023?

RQ2: Are there trends and correlations between climate mention and attribution and year, event type, or media language?

RQ3: Who are the journalists connecting extreme events to climate change?

3.1: Is it always the same journalist(s) using climate connections? Do they have a background in science or environmental reporting?

In this chapter, I will summarize and contextualize the results, discuss the limitations and provide insights for future research.

The findings of this thesis reveal that the Canadian media mention climate change in 31.8% of their extreme weather event articles published in 2019 and 2023, with 24.5% of the articles making a climate connection. Nearly all of the independent variables explored were found to be significant on the likelihood of making climate connections: only language was found to have no effect, which will be discussed. Time also had significant effect on climate connections, as the connections proportions shifted for individual publications and events from 2019 to 2023. A majority of journalists in the case study who made the most climate connections were those who specialize in either science, climate or the environment, emphasizing the importance of having a specialized reporter on staff.

5.1 Climate Mentions and Connections in Canadian Extreme Weather Coverage

The results of this study demonstrate greater proportion of climate mentions (34.1%), and connections (24.5%) compared to the findings of existing literature (Batizou, 2022; Battistoli et al., 2018; Berglez & Lidskog, 2019; Cordner & Schwartz, 2019; Davidson et al., 2019; Gavin et al., 2011; Hopke, 2020a; Painter et al., 2021; Weiner et al., 2021). This increase is likely influenced by several factors, including corpus size, country of study, examining multiple extreme events, and the period analyzed. Notably, 2023 was the worst wildfire season on record in Canada (Natural Resources Canada, 2023), with attribution studies linking these fires to climate change (Barnes et al., 2023; Boulanger et al., 2025). This suggests that during severe and historical weather events, Canadian media coverage is more likely than the media of other countries to include and emphasize climate change connections. In the Canadian context, these results are significantly greater than the those of Davidson et al (2019) and Hopke (2020a). Davidson et al (2019) found that only 2% of roughly 24000 forest fire articles written between 2000 and 2017 by Alberta media mentioned human caused climate change. Similarly, Hopke (2020a) reported that of the forest fire articles in their corpus written by media from Canada, China, India, the United States and the United Kingdom, 8.28% of articles by Canadian sources mentioned climate change. Contrary to existing Canadian studies, this work accounts for both the country's official languages and multiple extreme events, broadening the understanding of how media report on extreme weather events and make climate connections in Canada.

The individual extreme events studied played a significant role in the frequency of climate mentions and connections in extreme weather coverage. Given that the events were selected based on their association to climate change, it was expected that forest fires 32.6% (n=830) and floods 27.3% (n=821) would be the most frequently attributed to climate change.

This aligns with the work of Molder and Calice (2023) who compared the American coverage of wildfire and hurricanes, which showed that journalists were more likely to connect wildfires than hurricanes to climate change. The lower connection frequency of ice storms (17.3%) and extreme cold (11.3) may stem from them not being perceived in the same way as floods and forest fires. Forest fires and hurricanes often occur in hot condition, which most people instinctively perceive as climate change related. Conversely, snow events and extreme cold are sometimes used by skeptics to "disprove" climate change, which scientific evidence disproves. Echoing this difference in event type, Osaka and Bellamy (2020) reveal that journalists are more comfortable connecting hot events like heatwaves to climate change than cold events. Interestingly, ice storms also require mild temperatures, even though they are often seen in the winter when most people anticipate cold weather (NOAA, n.d.). This may explain why they were more frequently connected to climate change than extreme cold events.

The publications of study were chosen for their large audiences, languages, and diversity of ownership types. The results showed that The Globe and Mail had the highest proportion of both climate mention (42.7%) and connections (32.3%). When comparing the two public broadcasters, CBC had a slightly greater proportion of climate connections (28.7%) compared to Radio-Canada (25.2%), and La Presse, a Quebec-based publication had a similar climate proportion (23.2%) to that of the Radio-Canada. Other studies have also explored the effect media types have on climate mentions and connections. Batizou (2018) saw that the left-leaning British broadsheet media T*he Guardian* made the most references to climate change in the coverage of heatwaves, compared to lower frequencies in right and centre-right leaning broadsheets the *Telegraph* and the *Times*. Building upon Batizou's results, Hopke and Wozniak (2025) also found significant differences in both mentions and attributions between UK media

organizations. Their results showed that 47% of *The Guardian*'s heatwave articles made climate connections, compared to 14% of the articles published by the rest of the UK media they studied.

Since this was the first study looking at climate connections in both francophone and anglophone media, the results serve as a starting point for future Canadian research. Although language was not found to be a significance factor in the likelihood of climate connections, with a different corpus, this may not be the same result. In this study, two francophone media were chosen, compared to the three anglophone media. Even with one less source, the francophone media published 2,127 total articles and made 520 climate connections, compared to 3,268 total articles and 800 connections by the anglophone media. If a third francophone media were to be added, the number of climate connections could increase, which could lead to language becoming a significant variable on the likelihood of making connections. Following studies examining the extreme weather coverage and use of climate connections by the Canadian media should ensure both official languages are present.

5.2 Evolution of Climate Connections Through Time

After establishing the relationship between the independent and dependent variables, I performed additional analyses to examine how different categories of variables changed between 2019 and 2023. The goal was to identify which extreme events and publications showed significant changes in their proportions between the two time periods. The results show that in addition to considerable changes in climate connection counts and proportions, for certain categories of the independent variables – floods and the CBC - the proportion changes were significant. Given the severity of the forest fire season in 2023, the number of climate connections increased by 190, which was as expected. However, this proportional change was

not statistically significant. Even with the unprecedent forest fires season, the events which saw an increase in their climate connection proportion between 2019 and 2023 were floods, from 21.7% to 38%, and ice storms, from 15.3% to 18.5%. The increase in climate mentions from year to year for extreme weather events is similar to what has been found in other studies. In their analysis comparing the coverage of hurricanes and wildfires in American media from 2016 to 2021, Molder and Calice (2023) found that the proportion of climate mentions increased steadily over time.

The proportional increase in climate connections made by the CBC was found to be significant, with 25.3% of their extreme event coverage having climate connections in 2019, compared to 33.3% in 2023. Given the CBC's 2021 pledge to increase climate change coverage, this result was expected. In their study, Hopke (2020a) concluded that elite climate reporting media – media with resources for climate change journalism - were more likely to mention climate change than other media, for both heatwaves and wildfires, every year from 2013 to 2018. Interestingly, while the National Post saw a decrease of 178 climate mentions, between 2019 and 2023, this shift was not deemed significant due to a proportional decrease of only 4.4%. The other publications had varying increases in the number of climate connections they made in 2023, but again, their proportional changes were not found to be significant. The developments of event attribution science may have provided journalists with stronger evidence supporting the link between climate change and extreme events, contributing the increases observed between the two periods.

5.3 Decreasing Media Attention of Extreme Weather Events

A notable and incidental finding was the substantial decrease in the number of articles published overall and by individual publications through the periods examined. The most prominent shift was that of the National Post whose publication count decrease by roughly 86% from 2019 to 2023. This again, came at a time when Canadians were experiencing a public crisis, with most of the country being engulfed in flames. The precarity of the media in Canada is well-established, and those financial struggles were only exacerbated by the COVID19 pandemic. Nearly 450 news outlets have closed across the country between 2008 to 2021, with roughly 63 of those closing since the pandemic (Government of Canada, 2022). Similar to other struggling Canadian news outlets, in January 2023, Postmedia - the American-owned Canadian media conglomerate which the National Post falls under - announced they would be laying off 11% of their editorial staff (Leavitt, 2023), which may explain the decrease in its publication count. Perhaps no longer having such strong Canadian ties, coupled with less reporters, resulted in a major decrease of their extreme event coverage. Nevertheless, such a significant decrease in extreme weather coverage during the most destructive forest fire season is extremely concerning and is a research area which requires further work.

The CBC was the only other media studied whose article output declined in 2023, publishing 150 articles less than they did in 2019 despite the historical wildfire season of 2023 and many important flooding events. The other media sources The Globe and Mail, Radio-Canada, and La Presse increased their extreme weather outputs. They all published at least 150 articles more in 2023 than in 2019, and The Globe and Mail increased their output by nearly 76%. The comparison of the publication rate of extreme weather stories between 2019 and 2023 was an interesting incidental finding. The shifts in publication between years and media

organizations warrant further exploration, particularly in relation to the effects of media layoffs and budget cuts on extreme weather event coverage, as well as broader trends in Canadian media publication habits and frequency.

5.4 Influence of Individual Journalists on Climate Connections

Following personal discussions with journalists and others working in the news industry, the results of the small case study examining the Radio-Canada and CBC journalists who made climate connections in extreme weather coverage during 2023, is as expected. It was assumed that there would be a few journalists who repeatedly made connections, and those that would have a specialized beat in science or climate reporting would be more likely to do so. The results confirmed these hypotheses, with 7 of the top 10 journalists to make the most connections being specialized reporters. Similarly, in their 2020 study, Hopke found that media organizations with climate or environmental reporters on staff were more likely to have climate change issue attention in their coverage of heatwaves and wildfires. While it is likely that editorial and organizational norms or decisions are at play, it seems that individual journalists play a significant role in the likelihood of using climate connections in their reporting. In a more recent study, Hopke and Wozniak (2025) concluded that speciality reporters were nearly three times more likely than their non-specialist counterparts to discuss the link between climate change and heatwaves.

When exploring the climate connection counts and proportions of the top 10 journalists, we see that many would make climate connections repeatedly throughout their extreme weather event coverage. For example, Journalist 1 made climate connections in 22 of their 26 articles, and Journalist 2 had 8 connections in their 9 total articles. Most journalists would make

connections frequently, in nearly all of their stories. Interestingly, the two journalists who had 100% climate connection proportion of their extreme event coverage were Journalists 8 and 10, who wrote a total of 3 and 4 articles, respectively. In future work, it would be useful to conduct mixed-methods research, combining the quantitative data obtained from the articles and metadata with qualitative interviews with reporters and editors, which would allow for more nuance.

5.5 The Hierarchy of Influence and Climate Connections in Extreme Weather Reporting

The finding that journalists with specialized beats are more likely to make climate connections than those who are general reporters, aligns with the *individual level* of the Hierarchy of Influence Model. The journalists who chose to make connections in their weather reporting likely have an understanding and confidence in communicating complicated scientific concepts to the public. Perhaps this stems from their educational backgrounds, previous journalism experience, or personal interest. Further research, such as interviewing and collecting further demographic and background data could provide further insight into how the individual communicator (individual-level factors) influence the use of climate connections in the extreme weather content.

Nonetheless, *organizational level* factors such as organizational support, editorial choices and newsroom guidelines also influence attributing an extreme event to climate change. Further evidence is the variations in the proportion of climate connections and connections between media sources. The CBC is a notable example, having increased their connection proportions from 2019 to 2023, after committing to focusing even more on climate change journalism. This increase suggests that newsroom policies and editorial commitments play an important role in how climate connections are integrated into extreme weather content.

5.6 Limitations and Future Research

Although the results of this study provide valuable insight into how the Canadian media cover, mention, and connect extreme weather to climate change, it has some limitations. First, this study used time as a categorical value, comparing articles from the years 2019 and 2023. Doing so allowed for a comparative analysis between the selected El Niño years, however, in future studies, using time as a continuous variable would provide further insights into trends across multiple years. Secondly, this work was limited to only looking at five Canadian publications and was not equal in the proportion of francophone and anglophone media. Although the number of publications in this study is still greater than those of other works, future research could build upon these findings and include other media publications, with a focus on other medium like print and audio/visual. Including alternative and climate/science-focused publications such as The Narwhal would allow for a comparison between media who actively focus on climate change and those who do not. Similarly, including other forms of journalistic content will allow for a comparative analysis between platforms, particularly since Canadians still acquire news from various sources. Given this was the first study to include francophone sources, future work must include others to see how language effects likelihood of making climate connections. Lastly, although the exploration of individual journalists was done through a small case study, future work should combine mixed-method research with a larger corpus. Interviewing journalists and editors would further explore whether making climate connections are a personal choice or influenced by newsrooms, editors, etc. Lastly, although the methods used in this thesis allow for a larger number of articles to be analyzed, this was possible due to using queries in online databases an automated keyword spotting script which have some limitations. The query used to scrape articles on the extreme weather event flood also scrapped

many articles irrelevant to the weather event, particularly articles about immigration. To negate this, I used keyword generated sentences (i.e. “flood of” for flood of immigrants) to remove irrelevant articles and ensure that those remaining were about the weather event floods. Also, since I employed an automated keyword spotting script, it flagged every instance of the climate keywords, regardless of context. This had a limited impact on the analysis, since every article coded positive from the keyword spotting script for climate mentions was subsequently read and manually coded for climate connection. However, if one were to employ the code to use as the sole coding of climate connection, further refinement and care must be taken.

5.7 Implications

Overall, this study shows that the selected Canadian media has increased its use of climate mentions and connections in its coverage of extreme weather events from 2019 to 2023. In addition, it suggests that individual journalists and newsrooms play a significant role in and how journalists make the link between an extreme event and climate change. My research provides a venue for discussion, particularly about how media organizations, journalists and other individual can improve and enhance the ways they communicate the link between climate change and extreme weather events to the public. This study set out to provide a basis for news organizations to compare their coverage and use of climate mentions and connections to others across the country. Having a starting point will allow media to question, reflect, and improve their reporting, and perhaps even create commitments or internal guidelines like those of the CBC. In the time of scientific consensus on climate change, climate and science communicators, activists, experts, and policymakers can also employ these results to strengthen their strategies of conveying this consensus to the public.

Chapter 6: Conclusion

When I began working on this thesis, it was the early days of what ended up being the worst wildfire season on record in Canada. As I continued through the process of writing this thesis, it felt like a new extreme weather disaster was happening all the time: Maui, Jasper, and Los Angeles experienced desolation, hurricanes Helene and Milton flooded southern American states, and there were countless days of record-breaking heat. Waking up each morning, I would read the news, being met with the reality that the world was on fire, underwater or boiling, all the while people were losing their belongings, the forests and infrastructures were being destroyed, and people were dying. If there is any solace, it is that the results of this thesis show that selected Canadian media do make the climate change connections in their coverage of extreme weather events, with even more climate change mentions.

The aim of this thesis was to explore if and how the Canadian media connect climate change to extreme weather, whether this relationship changed over time, and to explore who the journalists were that use climate connections in their coverage of extreme events. The findings demonstrate that the selected Canadian media explored in this thesis used climate mentions and connections in a much greater frequency of extreme event articles than found in previous studies. Additionally, we saw that the independent variables of publication, year and event type played a role in the proportion of mentions and connections, and a relationship between them was established. The variable of language was not found to be a factor in the likelihood of implementing a climate connection. However, this was the first work which included both anglophone and francophone extreme weather event articles, and further research is needed to see how this would change given a corpus with other media sources.

Although the number of extreme weather event articles decreased considerably from 2019 to 2023, which was likely due to the major cuts across Canadian newsrooms, the overall proportion of climate mentions and connections increased. This comparison of time also gave light to an incidental finding which saw the decline of extreme weather event articles during the country's worst forest fire season, and an even larger decrease in articles from the National Post. Even though this is likely a consequence from job cuts, it is a result which requires further research as this may be affecting more than just a few media organizations. Lastly, I established a starting point for future research exploring the role of journalist type – an *individual level* factor influencing climate connections. The results found that journalists who had a specialized beat in science or the environment were considerably more likely to convey the link between climate change and extreme weather, than those who are a general reporter. This suggests that media organizations should make more of an effort to employ and support these specialized reporters.

A goal for this work was to increase my knowledge and abilities in using Python to assist in analyzing large amounts of text data, which I accomplished. By implementing automated content analysis through the use of a keyword spotting script, I was able to analyze thousands of articles in a relatively short amount of time. Since I wanted to explore both climate mentions and connections, the shortcomings of an automated keyword spotting script which would flag any keyword regardless of context was overcome by reading each article to code for connections. In addition to the results from the exploration of the corpus, these methods demonstrate how other journalism and communication studies researchers can implement automated content analysis into their own work.

From journalists, to scientists, to the public, I hope you find some comfort in these results, which show that for the most part, climate mentions and connections increased in Canadian news articles from 2019 to 2023. These findings allow editors, journalists, and others to reflect on their own practices and hopefully, implement new guidelines to continue improving their reporting of extreme events so that it remains the most accurate. From the 2023 Canadian forest fire season alone, there have been multiple event attribution studies published, linking the fires to climate change (Barnes et al., 2023; Boulanger et al., 2025). Such studies can and should be used by journalists to convey the impacts of climate change on extreme events – events which are affecting Canadians from coast to coast.

I hope this thesis becomes a stepping stone for future research, as science demonstrates that climate change will continue making more frequent and severe weather disasters (IPCC, 2021). We must continue to increase the knowledge and understanding of how the media convey the consequences of climate change, particularly in the time of increased polarization and threats to the funding of Canadian media. Are the media accurately covering extreme weather events if they are not mentioning the impacts of climate change? I truly believe Battistoli et al., (2018) said it best:

> "The *strength* of the connection between climate change and the intensity of storms can be and should be debated. But the *existence* of that connection should not be the subject of debate, at least of any informed debated" (p. 77).

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Supplemental Material

Table S1

Climate Change Keywords and Their Regex Patterns for Automated Keyword Spotting

Keyword	English Pattern (Regex)	French Patter (Regex)
Climate	climate(s)?	climat(ique)?
Global warming	global warming	rechauffement de la planete
Greenhouse gas	greenhouse gas(es)?	effet de serre
GHG	ghg(s)?	\bges\b
Carbon footprint	carbon footprint(s)?	empreinte carbone
Net zero	net zero	net zero
Netzero	netzero	-
Decarbonization	decarbonization	decarbonation
Carbon natural	carbon neutral(s)?	carbonet\w*
Carbon capture	carbon capture(s)?	carbonet\w*
Climatologist	climatologist\w*	climatologue
Carbon compensation	-	compensation carbone
Climate skeptic	-	climatosceptique

Table S2

English Event Keywords Queries

Event	Keywords
Wildfires	forest fire OR forest fires OR wildfire OR wildfires
Floods	flood OR floods OR flooding
Extreme Cold	“extreme cold” OR “polar vortex”
Ice Storm	“ice storm” OR “ice storms”

Table S3

French Event Keywords Queries

Event	Keywords
Wildfires	“feu de foret” OR “feux de foret” OR “incendie de foret” OR “incendies de foret”
Floods	inondation OR inondations
Extreme Cold	"froid extreme" OR "temperatures polaires" OR "vortex polaire" OR "vague de froid polaire" OR "vague de froid extreme" OR "vague de froid arctique"
Ice Storm	“pluie vergalcan” OR “verglas” OR “verglacantes”

Figure S4

Proportion of Climate Mentions and Climate Connections by Publication Language