Research Note

Politicization and Polarization in Climate Change News Content, 1985-2017

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Abstract

Despite concerns about politicization and polarization in climate change news, previous work has not been able to offer evidence concerning long-term trends. Using computer-assisted content analyses of all climate change articles from major newspapers in the United States between 1985 and 2017, we find that media representations of climate change have become (a) increasingly politicized, whereby political actors are increasingly featured and scientific actors less so and (b) increasingly polarized, in that Democratic and Republican discourses are markedly different. These findings parallel trends in U.S. public opinion, pointing to these features of news coverage as polarizing influences on climate attitudes.

Keywords

climate change, computerized content analysis, news, politicization

Political divisions around climate change have grown in the United States over the past 30 years (Dunlap & McCright, 2008; Dunlap et al., 2016). Beliefs about climate change have become a marker of partisan affiliation, with

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Democrats generally more likely than Republicans to believe that humans are causing climate change and to support policy actions to address it (McCright & Dunlap, 2011; Nisbet, 2009). This attitude polarization has led to increasing attention to the role that news coverage has played in shaping public opinion, particularly the ways in which politicization and polarization in news coverage have affected public attitudes (Bolsen et al., 2014; Brulle et al., 2012; Druckman et al., 2013).

This article expands our understanding of the degree of politicization and polarization in climate change newspaper coverage between 1985 and 2017. While previous content analyses highlight that politicization and polarization are present in climate change coverage, extant research has not measured these phenomena in ways that facilitate comparisons over time. As a result, we have a poor understanding of how changes in these influential features of coverage may have affected attitudes over time. In short, describing trends in politicization and polarization in climate change news coverage is an important step toward understanding why and how U.S. public opinion has become increasingly polarized, despite increasing scientific consensus on the reality and anthropogenic sources of climate change. To address this research gap, the present study develops content-analytic measures of politicization and polarization, and then examines how politicization and polarization have changed in national and major regional newspaper climate change coverage between 1985 and 2017.

Background

News coverage is likely to have a strong influence on public attitudes about climate change. Traditional news reporting remains the dominant way that the U.S. public learns about scientific issues, outweighing internet searches, entertainment programing, and government agencies (National Science Board, 2016). For this reason, a great deal of research has investigated the prevalence of influential features of news coverage (Feldman et al., 2012; Feldman et al., 2017; Hart & Feldman, 2014; Nisbet, 2009; Trumbo, 1996) and how these factors affect the public's environmental attitudes (Bolsen et al., 2014; Brulle et al., 2012; Carmichael, Brulle, & Huxster, 2017; Druckman et al., 2013; Slothuus & De Vreese, 2010; Wiest et al., 2015). Across these studies, researchers have documented how politicization and polarization have particularly strong impacts on partisans' beliefs about climate change (Bolsen et al., 2014; Brulle et al., 2012; Druckman et al., 2013). Given opinion polarization around climate change in the United States and the evidence that news coverage can have marked impacts on environmental attitudes, it is important to understand the degree to which climate change news coverage has been politicized and polarized over time.

Previous research suggests that journalistic biases encourage politicized coverage of environmental issues (Boykoff, 2011; Boykoff & Luedecke, 2016). Journalistic norms of personalization, dramatization, and conflict are key contributors to politicized climate coverage. Personalized stories highlight narratives of competing actors rather than analyzing broader economic, social, and political factors (Bennett et al., 2007; Boykoff & Boykoff, 2007; Feldman et al., 2017; Guber, 2013). Dramatic coverage captures audiences' attention by focusing on embittered conflict, momentous events, or devastating impacts, rather than persistent problems (Bennett et al., 2007; Wilkins & Patterson, 1987). Additionally, this tendency toward conflict politicizes climate coverage by prominently featuring political actors as official sources that can speak for competing factions (Bennett et al., 2007). While an engaging style of coverage in a competitive, audience-seeking environment (Bennett et al., 2007), the resulting politicization encourages individuals to follow political elites' opinions rather than those of scientists (Bolsen et al., 2014; Slothuus & De Vreese, 2010).

Given these politicizing norms, it is unsurprising that previous work has found evidence of politicization in climate change news. Early work described how scientists were used as sources less frequently as climate change became more politicized, being displaced by politicians and interest groups (Trumbo, 1996). Until the mid-2000s, journalists regularly "balanced" scientifically supported positions with contrarian claims of political actors (Boykoff & Boykoff, 2004), creating perceptions of scientific uncertainty (Boykoff & Boykoff, 2004; McCright & Dunlap, 2003, 2011). Journalists later sought to correct "false balance" by emphasizing the dominant view among scientists that climate change is real and primarily caused by anthropogenic sources (Boykoff, 2007; Boykoff & Boykoff, 2007; Brüggemann & Engesser, 2014; Hiles & Hinnant, 2014; Schmid-Petri et al., 2015). However, the practice of contextualizing contrarians' claims continues to feature political actors in opposition to scientific actors (Brüggemann, 2017). While a great deal of previous work has clearly demonstrated the presence of politicization, the limited time frames of previous work has make it difficult to evidence claims about how journalistic practices have increased or decreased politicization in climate change news over time. Given that politicization influences public attitudes (Bolsen et al., 2014; Slothuus & De Vreese, 2010), it is important to investigate how politicization in climate change news coverage has changed over time.

Previous work suggests that climate change coverage is polarized in addition to politicized. In coverage of policy and impacts, journalists perpetuate narratives of political conflict and strategy, highlighting conflict between partisans' positions (Brüggemann & Engesser, 2014; Feldman et al., 2017; Gibson et al., 2016; Hart & Feldman, 2014; Hiles & Hinnant, 2014). Additionally,

content analyses have found that more conservative news sources are more likely to feature political conflict, negative economic consequences, and scientific uncertainty when discussing climate change than nonconservative sources (Feldman et al., 2012; Feldman et al., 2017).

The degree of polarization in climate change news is important to document because polarized environments strongly affect how individuals evaluate information. Polarization intensifies the impact that partisan elites have on individuals' issue attitudes while decreasing the impact of other substantive information, leading individuals to become more confident in their less substantiated beliefs (Druckman et al., 2013). Given that public opinion has become polarized over time (Dunlap et al., 2016), it is reasonable to assume that polarization has similarly increased in news coverage. However, previous work has not documented changes in the degree of polarization in climate change news coverage over time, resulting in a poor understanding of the nature of this influential feature of in climate change coverage.

In sum, there are good reasons to expect that (a) media matters to attitudes on climate change and (b) media provides information about climate change that is politicized and polarized. There has nonetheless been little work that traces the extent to which climate change coverage has become politicized and polarized over an extended period of time. The objective of the present research is to fill this gap by tracing the levels of politicization and polarization in climate change news coverage between 1985 and 2017. To do this, we develop novel quantitative measures of politicization and polarization using both dictionary and unsupervised machine learning content-analytic methods, applied to a vast body of climate change newspaper coverage during this time period.

Method

Data

We built a database of environmental news coverage from 1980 to 2017 using the Lexis-Nexis Web Service Kit, which accesses the standard Lexis-Nexis databases in a way that facilitates large-scale downloads of full-text content. We captured a broad range of articles by conducting a search of articles tagged with the "Environment" search term in Lexis-Nexis (code STX001940). This code captures most if not all environmental content, from weather and science to current events and legislation.

Our analyses draw on eleven major newspapers, including a combination of national papers and large regional papers from every region of the United States, for which full-text content is available over an extended period of time

Table 1. Newspapers.

Newspaper	Date range available	No. of articles	No. of climate change articles
Boston Globe	1984-2017	140,681	7,095
Chicago Tribune	1983-2017	254,566	6,018
Denver Post	1996-2017	70,427	2,843
Houston Chronicle	1989-2017	128,877	5,162
Los Angeles Times	1985-2017	296,024	8,659
New York Times	1980-2017	276,711	13,951
Orange County Register	1987-2017	121,939	2,123
Philadelphia Inquirer	1994-2017	67,235	2,190
Tampa Bay Times	1987-2017	181,059	2,532
USA Today	1989-2017	46,302	2,657
Washington Post	1980-2017	209,618	9,979

(Table 1). However, we do not have access to all newspapers from the 1980s onward. The analyses and results presented below, therefore, draw on data from four newspapers whose coverage we have since 1985: *The New York Times, The Washington Post, Los Angeles Times* and *Chicago Tribune*. Focusing on these newspapers means that the observed trend is unaffected by the entry of other, regional newspapers. That said, to ensure that our results are not driven by our focus on these four newspapers, we compared the results presented here with results from analyses run with all eleven newspapers. The results from all 11 papers, presented in Supplemental Figure A1, show very similar trends to the results presented here.

We first identified articles related to climate change, as well as articles about other issues for the sake of comparison, with topic dictionaries (Table 2). Any article mentioning at least one of the words in these dictionaries was listed as being related to that topic. The final column of Table 1 shows the number of articles from each newspaper that mentioned a word in our climate change dictionary at least once. These are the articles most central to the results presented here.

Note that the articles selected for inclusion in our database were predicated on Lexis-Nexis' determination that the content of the article was in some way associated with the topic indicated by the subject code. It became clear by looking at a subset of articles that the article need not be solely or dominantly about the topic to receive the associated subject code. Additionally, articles including a mention of a term in our climate change dictionary sometimes discuss climate change in only a very small portion of the article. To ensure

Table 2. Dictionaries.

Dictionary	Words
climate change	global warming, climate change, greenhouse gas*
fracking	fracking
hurricanes	hurricane*
recycling	recycling
republican	republican*, gop, conservative*
democrat	democrat*, liberal*
science	scientist*, research*, professor*

Note. Keywords ending with an aterisk also captured plural forms.

that our findings are in fact driven by content about climate change, we have run analyses with both (a) the entire article and (b) the 100 words surrounding mentions of climate change. The latter results provide a valuable check on the former ones. Supplemental Figure A2 shows a similar trend as analyses using the full text of the article.

All content analyses were run in R using a combination of text-mining packages, including tm (Feinerer & Hornik, 2017; Feinerer et al., 2008), stringr (Wickham, 2018) and quanteda (Benoit, 2018). The relative simplicity of our dictionary-based searches was aided by our focus on relatively straightforward topics and actors (i.e., those which can be reliably captured using a limited number of words), and hypotheses designed specifically to be testable using dictionary searches.

Politicization

Though previous content analyses have documented that climate change coverage is politicized (Boykoff, 2007; Boykoff & Boykoff, 2004, 2007; Brüggemann, 2017; Brüggemann & Engesser, 2014; McCright & Dunlap, 2003, 2011; Hiles & Hinnant, 2014; Schmid-Petri et al., 2015; Trumbo, 1996), it has failed to document trends in politicization over time. To address this gap in the extant literature, we utilized a novel method for measuring politicization in climate change news which was capable of comparing politicization in climate change news coverage at different points in time: mean mentions of political actors captured with dictionary-based content analytic methods. This measure is in line with previous work in which presence of partisan actors is central to most conceptualizations of politicization (Bolsen et al., 2014; Boykoff & Boykoff, 2004, 2007; Brulle et al., 2012; Feldman et al., 2017; Guber, 2013; Hart & Feldman, 2014; McCright & Dunlap, 2011; Nisbet, 2009; Wilkins & Patterson, 1987). Political actors are similarly important in the literature

examining the norms and frames that are politicizing (Bolsen et al., 2014; Carmichael et al., 2017; Druckman et al., 2013; Feldman et al., 2017; Hart & Feldman, 2014; Nisbet, 2009; Slothuus & De Vreese, 2010; Wiest et al., 2015). To capture politicization in 30 years of climate change news coverage, therefore, we used dictionaries to count mentions of Republicans and Democrats separately, as well as mentions of scientists (final three rows of Table 2). We did not capture proper names for any of these groups. There are, of course, many proper names used, but journalistic norms are that at least the first mention of any actor comes alongside a mention of their title or profession (i.e., "Republican Senator . . ." or "Professor of . . .") and we additionally wanted to capture mentions of parties above and beyond names.

This approach assumes that the presence of political actors in news about climate change indicates politicization. It offers no indication of how nonofficial political actors, like activists, may politicize news coverage in short-lived "media storms" or by putting an issue onto the public agenda in the first place (Montpetit & Harvey, 2018). This approach also fails to capture the ways in which journalists may politicize news content by highlighting certain impacts or mitigation policies (Hart & Feldman, 2014). For these reasons, and because our dictionaries will miss some relevant mentions of politicians and scientists, we expect that to the extent that there is mismeasurement, it will be in the direction of under- rather than overestimating politicization in news content. Nevertheless, our measure captures what we view as "raw politicization," the relative frequency of partisan actors in news coverage, which are central to most conceptualizations of politicization in previous work (Bolsen et al., 2014; Boykoff & Boykoff, 2004, 2007; Brulle et al., 2012; Feldman et al., 2017; Guber, 2013; Hart & Feldman, 2014; McCright & Dunlap, 2011; Nisbet, 2009; Wilkins & Patterson, 1987).

This approach has the advantage of being easily applied to large bodies of data. This is important to the study of climate change coverage, as identifying changes in coverage over time requires a measure, which can be applied to a very large number of news articles. This measure has the additional advantage of facilitating comparisons over time and between issues. We conduct a simple test of the concurrent validity of our measure of polarization by comparing the politicization detected in climate change coverage to politicization in coverage of other environmental issues for which we expect varying degrees of politicization. Figure 1 shows results of our dictionary search for four topics: two known to be politically divisive, global warming and fracking (Pew Research Center, 2015), and two expected to show rather less politicization, recycling and hurricanes.

We expect politicization to be reflected by increasing references to political actors. This is exactly what we see in the top-left panel of Figure 1. In the

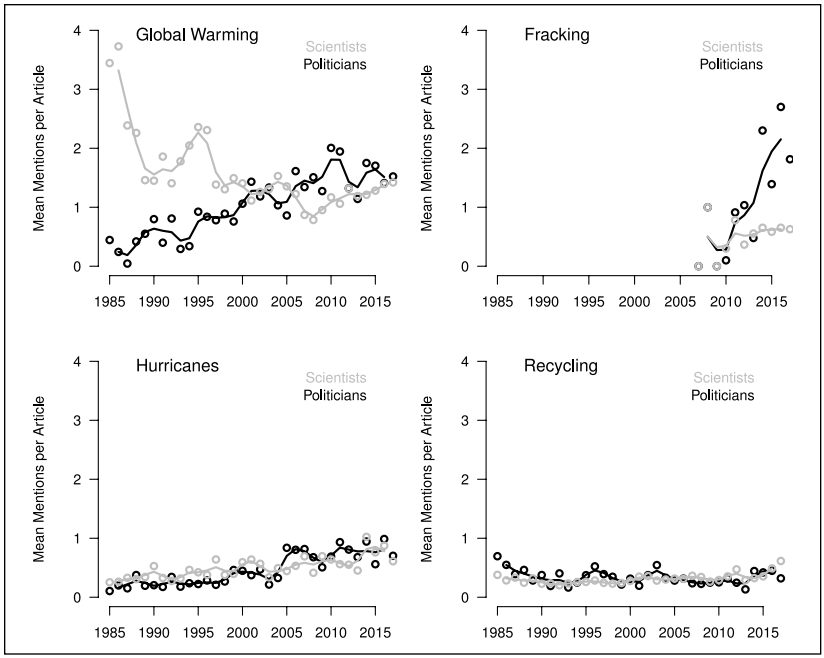

Figure 1. Politicization in news coverage of environmental issues.
Note. Circles show annual values, lines show smoothed 3-year moving average trends.

1980s and 1990s, there are far more mentions of scientists than politicians. However, increasing references to politicians, as well as declining references to scientists, leads to a marked change over the time period examined. By the 2000s, references to scientists have declined and, in most years, scientist mentions are outnumbered by politician mentions.

We take this as a signal of increasing politicization in climate change coverage between 1985 and 2017. Figure 2 shows mentions of Democrats and Republicans separately. It suggests that our politicization measure is not driven by one party or the other—mentions of both parties increase over time. That said, it is notable that mentions of Republicans have outnumbered mentions of Democrats in recent years.

Polarization

Public opinion on climate change has become polarized, with partisans reporting increasingly dissimilar opinions over time (Dunlap et al., 2016). Given

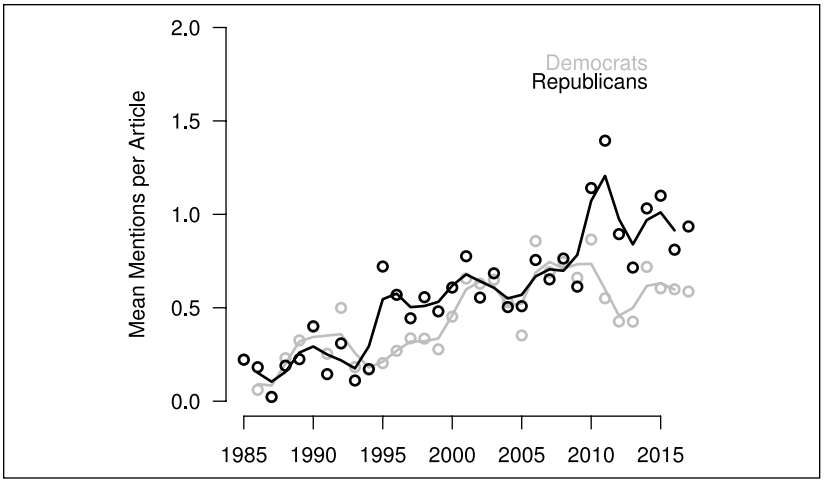

Figure 2. Politicization in global warming coverage, partisan actors.
Note. Circles show annual values, lines show smoothed 3-year moving average trends.

the polarization in public opinion, a key media research question is whether news coverage contains polarization as well. Previous work has found that different news sources vary in coverage of consequences, impacts, and uncertainties around climate change (Feldman et al., 2012; Feldman et al., 2017). However, we are not aware of previous work that has examined trends in polarization—whether polarization has increased or decreased in climate coverage over time. Examining trends in polarization is important to understanding the context of changes in politicization. That is, changes in politicization offer how often politicians are mentioned in news coverage, whereas polarization offers insight into the differences in how politicians of different parties talk about the issue during changes in the amount of coverage politicians receive. In highly polarized contexts, individuals are not only strongly influenced by the views of their political elites but are also more inclined to reject or counter argue other sources of information (Druckman et al., 2013).

However, capturing polarization in political speech over time is not straightforward. One argument is that the presence of politicization implies polarization—there would not be reporting about politicians unless there was political debate, and there would not be political debate unless there were differences in party positions. This need not be the case, however. Party mentions could indicate that both parties are working hard to address an issue in roughly similar ways. This seems unlikely given what we know about environmental politics in the United States, but the analyses above cannot easily address this issue.

The critical quantity where polarization is concerned is, we believe, the difference between the language used by Republications and the language used by Democrats. Word frequencies across parties may offer a useful illustration, but such frequencies cannot easily summarize the vast number of words used, or not used, by each party. We consequently opt for a more statistically ambitious approach to capturing cross-party differences in language: We use unsupervised machine learning methods to extract a single dimension based on the words used by each party in 2-year periods corresponding to a Congress, and then examine the degree to which that dimension is correlated with partisanship, over time.

We do this using Wordfish (implemented in *quanteda*), an approach developed to identify dimensions in political speech (Slapin & Proksch, 2008). Wordfish is an unsupervised machine learning approach, which estimates a single latent dimension based on word frequencies. The method has been used, for instance, to estimate changes over time in the ideological positions of party manifestos (Slapin & Proksch, 2008) and political speeches (Proksch & Slapin, 2010), as well as the success of lobbying groups at influencing policy (Klüver, 2011, 2012).

Wordfish has been described in detail elsewhere (Slapin & Proksch, 2008). That said, the idea of Wordfish is relatively straightforward, and worth reviewing briefly here. In short, Wordfish is premised on the notion that the "position" of a text will be reflected in word frequencies. The procedure estimates the likelihood of word mentions in each document relative to their frequency in other documents, and it assigns weights to words based on the extent to which those words distinguish documents across a single latent dimension. That estimated dimension is identified through an iterative expectation-maximization algorithm and each document's score on that latent dimension is the central output from Wordfish, and the focus of our analysis below.

We suggest that this method of estimating partisan positions from texts also offers the ability to quantitatively measure the degree of polarization in news coverage. The crux of our approach is this: differences in the language used to discuss climate change can be captured by a single dimension, estimated based on word frequencies and co-occurrences in climate change coverage. That dimension will not capture all of the different ways in which climate change can be discussed, of course, but it will capture the most important or common differences. The degree to which that dimension is aligned with partisanship will then tell us about the extent of partisan polarization. Put differently, that dimension will capture the degree to which Republican and Democratic discourses have differed from one another in the past 30 years of climate change news coverage.

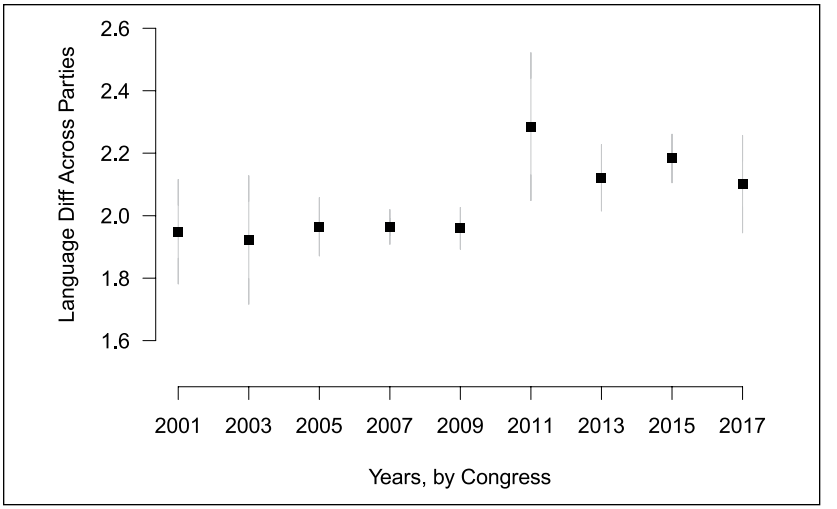

Figure 3. Polarization of partisans' language, by Congress.

The process by which we estimate polarization is as follows. We estimate the "position" of paragraphs associated with Democratic and Republican actors along a single dimension, as estimated by Wordfish. We first identify paragraphs which mention climate change and either Republicans or Democrats, but not both. We run Wordfish over those paragraphs, doing so produces a "position" for each paragraph, and those values are averaged for each party in 2-year periods corresponding to each Congress. Figure 3 presents the difference between the estimated positions of Republican and Democratic paragraphs on this single dimension, over time. Point estimates of the difference are shown as squares, with 95% confidence intervals as gray lines.

Increasing polarization—specifically, party differences in the language used when discussing climate change—should produce increasingly divergent "positions," and increasing differences over time. This is what we see in Figure 3. That said, the nature of the change is not gradual. Polarization in climate change coverage, by our measure at least, remained essentially consistent until 2011. In 2011, coverage of climate change began featuring more polarized partisan discourses than coverage in preceding years.

Note that this increase in polarization occurs a few years after political actors begin to outnumber scientific actors in coverage (see Figure 1). Perhaps more important, it also happens at the same time as there is a spike in Republican vis-à-vis Democratic mentions (see Figure 2). It thus appears as though 2010 to 2011 were watershed years in coverage of climate change.

Following an increase in political actors, these years included an (thus far permanent) increase in the visibility of Republican actors in climate change articles and a concurrent (and thus far permanent) increase in polarization in language about climate change.

Discussion

This study finds novel evidence of increasing politicization and polarization in U.S. newspaper climate change coverage. While previous research has noted that climate change news coverage from different time periods is politicized, this study is the first to demonstrate an increase in politicization of climate change news coverage between 1985 and 2017. This increase is evidenced by the increase in mentions of political actors. While politicization is increasing, mentions of scientists are decreasing in climate coverage, which may indicate that scientific discourse is being replaced by political discourse. The increasing politicization in climate change coverage between 1985 and 2017 has likely contributed to increasing public opinion polarization over the same period of time, given the ways in which politicization has been shown to lead individuals to follow the positions of political elites (Bolsen et al., 2014; Slothuus & De Vreese, 2010).

Our study finds not only that politicization has increased over time, but also that politicization is a very common feature of climate change news. Our study finds that political actors are mentioned, on average, at least once in every climate change news article since the 2000s. (And as a reference, recall that politician mentions outnumber scientist mentions from 2006 onward.) Additionally, the increasing volume of climate change articles published over time means that even individuals who only attend to some news some of the time are exposed to coverage that associates climate change with political partisanship. Given the increasing frequency with which political actors appear in climate change coverage, it is unsurprising that partisan divisions have emerged in U.S. public opinion about climate change over the past 30 years.

This study also offers, for the first time, insight into the degree of polarization in climate change coverage between 1985 and 2017. The level of polarization appears consistent in news until 2011, when we see greater polarization in news coverage. At this time, we also see Republican mentions beginning to outnumber Democratic mentions in coverage. Though our study does not investigate why Republicans begin to outnumber Democrats at this time or the nature of polarized discourses, previous work has noted several factors that may have affected the journalistic and political environment concerning climate change at this time. Increased polarization may be driven in part by

the success of Tea Party candidates in the 2010 election, who are more likely to oppose climate policy than non-Tea Party Republicans (Hamilton & Saito, 2015; Mayer & Smith, 2017). From this time, belief in climate change increasingly became a litmus test of partisan identity (McCright et al., 2014), with some conservative politicians backtracking on previous support for climate action (Childress, 2012). Additionally, the hacking of climate scientists' e-mails, called "Climate-gate," in 2009 facilitated the spread of denialist narratives. Earlier, opponents of climate policies had stressed scientific uncertainty (Nisbet, 2009), but at this time, opponents claimed that the released emails evidenced that climate science was a hoax (Leiserowitz et al., 2013). This time marked both increased opposition to and rejection of climate science by Republican politicians, which is likely why we see evidence of increased polarization in news coverage at this time. However, further work is needed before making claims about the nature of the more polarized content we observe starting in 2011.

A strength of the present study is the use of the full available population of environmental news articles in national and major regional U.S. newspapers appearing between 1985 and 2017. This corpus puts us in a better position to explore over-time trends than previous studies (Boykoff, 2007; Boykoff & Boykoff, 2004; Feldman et al., 2017). Given this limitation in previous work, claims about increasing or decreasing politicization and polarization relied on comparing different conceptualizations, coding schemes, and sources of data. With our data, we are able to make direct comparisons about the prevalence of politicization and polarization in news coverage over the same 30-year period that longitudinal data on elite and public opinion is available. We see this as an important step toward understanding how media coverage may have affected public attitudes about climate change over the past 35 years.

Our method of measuring politicization using dictionary-based searches with concise dictionaries is broadly reproducible, as shown through our comparisons between (a) multiple issues, (b) national and regional newspapers, and (c) whole articles and relevant paragraphs (see the Supplemental Appendix). Our method of investigating polarization using the scaling technique, Wordfish, also offers promising means of quantitatively measuring the degree to which discourses associated with partisan actors are polarized. This is the first study we are aware of to measure polarization in news in a way that facilitates comparisons of degree over time.

It is nevertheless the case that our measure of politicization only captures mentions of partisan actors, not others who may contribute to political debate. The measure also does not capture other features of politicized content, including the choice to highlight certain risks and solutions over others (Hart & Feldman, 2014) or the decision to contextualize contrarians, which some argue

departs from "objective" reporting to reflect normative values (Brüggemann, 2017). As noted above, political actors are a central feature of politicization, and their presence is component to many conceptualizations of politicization (Bolsen et al., 2014; Boykoff & Boykoff, 2004, 2007; Brulle et al., 2012; Feldman et al., 2017; Guber, 2013; Hart & Feldman, 2014; McCright & Dunlap, 2011; Nisbet, 2009; Wilkins & Patterson, 1987). We thus consider our measure to be an efficient and justifiable means of analyzing a large body of data; but we suspect that it slightly underestimates the true prevalence of politicization in news content. Additionally, our measure of polarization does not directly offer insight into how Republican and Democratic discourses differ. It is also of substantive interest to identify the different considerations that partisans assert when publicly discussing climate change.

Overall, this study demonstrates that politicization in climate change news coverage has increased over time and that mentions of Democrats and Republicans are associated with increasingly polarized language. While our study does not directly test the influence of news on public opinion, we note that the increasing politicization in news coverage parallels the increased polarization of U.S. public opinion on climate change (Dunlap et al., 2016; McCright & Dunlap, 2011). Given media and partisan influences on attitudes (Druckman et al., 2013; Hart & Nisbet, 2012; Slothuus & De Vreese, 2010; Wiest et al., 2015), the parallel over-time trends suggest news coverage as a contributing factor toward political divides in public beliefs about climate change.

Authors' Note

The data that support the findings are available from Lexis Nexis, but restrictions apply to the availability of these data, which were collected under license and so are not publicly available. Coded data are, however, available from the authors and distributed through the Harvard Dataverse.

Declaration of Conflicting Interests

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Supplemental Material

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