LETTER

A hot topic in hot times: how media coverage of climate change is affected by temperature abnormalities

Silvia Pianta and Matthew R Sisco

1 Bocconi University, Milan, Italy
2 RFF-CMCC European Institute on Economics and the Environment, Milan, Italy
3 Columbia University, New York, NY, United States of America

E-mail: silvia.pianta@unibocconi.it

Keywords: climate change, media coverage, temperature, temperature abnormalities

Supplementary material for this article is available online

Abstract

Media coverage of climate change is argued to be a fundamental factor shaping climate change attitudes and possibly behaviors, but its trends and determinants are still underinvestigated. In this paper, we analyze a comprehensive dataset representing more than 1.7 million online news articles covering climate change in the 28 countries of the European Union in 22 different languages for the period 2014–2019. We combine our news dataset with observed temperature data to investigate whether and how temperature abnormalities influence media coverage of climate change. We find that the strongest determinants of media coverage are positive deviations from short-term average temperatures. Abnormalities with respect to average temperatures in recent years have stronger effects than abnormalities with respect to temperatures in baseline periods that climatologists use to identify changes in climate. This suggests that the media are less influenced by scientific accounts of climatic changes than by shorter-term changes in weather patterns.

1. Introduction

Human attention is a scarce resource and without sufficient societal attention to climate change we may not be able to properly address this fundamental challenge. The news media have a unique ability to draw public attention to societal problems like climate change. The media have been shown to have an impact on political outcomes like government policy and voting behavior in different contexts (Eisensee and Strömberg 2007, Prat and Strömberg 2013). The impact of media coverage of climate change on public concern has also been investigated in a series of studies (Brulle et al 2012, Carmichael and Brulle 2017). Media coverage of climate change could therefore be a crucial factor influencing support for ambitious climate policies or directly influencing climate policy decisions. However, the trends and drivers of media coverage of climate change are not yet well understood. Building on evidence regarding the impact of temperature abnormalities on climate change attitudes and attention (Webe 2016), we investigate whether and how temperature abnormalities impact media coverage of climate change.

We combine observed temperature data with an unprecedented dataset representing 1.7 million online news articles in 22 different languages covering climate change in the 28 countries of the European Union. Our data span the period from April 2014 through October 2019. To the best of our knowledge, this is the first effort to investigate the impact of temperature abnormalities on media coverage of climate change employing a comprehensive dataset of online news across a wide set of countries. We test the impact of different measures of abnormality and find that the strongest determinants of media coverage are positive deviations from short-term average temperatures. Abnormalities with respect to average temperatures in recent years have stronger effects than abnormalities with respect to temperatures in baseline periods that climatologists use to identify changes in climate. This suggests that the media are less influenced by scientific accounts of climatic changes than by shorter-term changes in weather patterns.
2. Literature and motivation

Previous studies have presented extensive evidence that temperature abnormalities increase people’s climate change belief and concern, at least in the short-term (Bergquist and Warshaw 2019, Druckman 2015, Egan and Mullin 2012, Hamilton and Stampone 2013, Howe and Leiserowitz 2013, Kaufmann 2017, Konisky et al 2016). Local temperature abnormalities have also been found to influence climate change-related social media activity and internet search activity (Kirilenko et al 2015, Lang 2014, Sisco et al 2017).

There are several reasons why attention to climate change may be increased by experienced temperature fluctuations. Noticeable weather abnormalities may simply remind individuals of the problem of climate change due to a mental association between climate change and abnormal weather. Additionally, citizens may look to their own experiences with weather as a direct source of information about the issue. As climate change is a complex phenomenon, individuals may form their climate change attitudes by using personal experiences of local weather in place of more relevant but less accessible information like scientific evidence regarding global climate patterns. The replacement of inaccessible attributes with simpler and more available associated attributes is a cognitive heuristic referred to as attribute substitution and documented in a wide range of decision-making contexts (Gilovich et al 2002). Past work has found evidence that attribute substitution is employed in the construction of climate change attitudes (Zaval et al 2014). These accounts of how local weather can affect individuals’ climate attitudes make evident the possibility that local weather may also affect media attention to the issue.

We investigate how media coverage of climate change is impacted by local temperature trends employing a comprehensive dataset of online media coverage of climate change in the 28 countries of the European Union in the period from April 2014 through October 2019. Very few studies have investigated media coverage of climate change across a wide set of countries and languages. Two notable exceptions are Vu et al (2019), who investigate frames of climate change in the print press of 45 countries, and Schmidt et al (2013), who investigate the country-level determinants of media coverage in 27 different countries.

While previous studies of media coverage of climate change analyze the print media, usually focusing on a relatively small set of newspapers, we present a comprehensive dataset of online media coverage of climate change across a wide set of countries, sources, and languages. The print media are today read by fewer people (in 2018 only 26% of Europeans declared that they read the print media every day) and usually by the most educated sections of the population (Eurobarometer 2018). Online news are more widely read, with 63% of Europeans reading online news sites according to the most recent Eurostat data (Publications Office of the European Union 2019). Analyzing online news activity can therefore provide more accurate representations of the news most citizens are currently exposed to.

Previous studies investigating the relationship between temperature and media coverage of climate change mostly tested the impact of present temperature, finding null results (see for instance Schäfer et al (2014), but see Shanahan and Good (2000) as an exception). As climate change is related to changes in temperature, we hypothesize that media coverage of climate change is influenced by temperature abnormalities, rather than by simple temperature levels. Building on studies on the determinants of climate change attention and of perceptions of climate conditions (Ripberger et al 2017, Sisco et al 2017), we expect that media coverage of climate change responds in particular to short-term abnormalities—deviations of temperature from recent averages. As climate change is related to temperature increases, we also hypothesize that positive short-term deviations—temperatures warmer than recent averages—are comparatively stronger predictors of media coverage of climate change. We expect that long-term abnormalities—deviations from temperature in baseline periods employed by climate scientists to define climatic changes—have a smaller and less significant impact on media coverage of climate change, compared to short-term abnormalities. This mirrors an attribute substitution heuristic: short-term abnormalities are a more available experience compared to long-term abnormalities, even though the latter more closely mirror scientific definitions of climatic changes.

3. Data

Our dataset of online media coverage of climate change includes data on 1 703 456 articles published between April 2014 and October 2019 in the 28 countries of the European Union in 22 different languages. It features news mentioning the keywords ‘climate change’ or ‘global warming’ translated into the main spoken languages of each country. The translations of these keywords into 22 European languages were completed with the guidance of native speakers from each language (see more details on the dataset and on the translations of keywords in the Supplementary Material (stacks.iop.org/ERL/15/114038/mmedia)).

We developed the dataset by employing a script to

4 The index of climate change keywords in European languages we developed for this study is on its own a resource potentially valuable to future studies. We include it in table S1 in the Supplementary Material of this publication and make it available online at https://github.com/silviapianta/pianta_sisco_2020_climate_change_keywords.
gather articles including the keywords among the articles collected by the Europe Media Monitor (EMM). The EMM is a service developed by the European Commission Joint Research Centre, collecting news published on the internet in up to 70 languages (Steinberger et al. 2013). To the best of our knowledge, our dataset is the first comprehensive multi-year dataset of media coverage of climate change across Europe.

We obtain temperature data from the E-OBS dataset, which provides high-resolution daily gridded observational temperature data in Europe since 1950 (Cornes et al. 2018). We first compute daily, weekly and monthly average temperatures at the country level. Second, we compute a series of short-term temperature abnormality measures, defined as the difference between average temperature in each country in each time period (day, week, and month of the year) and average temperature in the same country and time period in the previous \( n \) years, with \( N = 1, 2, 3, \ldots, 20 \). Third, we compute long-term temperature abnormality measures, corresponding to what climate scientists define as changes in climate. Our main long-term abnormality measure is defined as the difference between average temperature in each country in each time period (day, week or month of the year) and average temperature in the same country and time period in the period 1951–1980. This baseline period is employed in most analyses of climatic changes and global surface temperature change (Hansen et al. 2010). We develop a second measure of long-term abnormality to use in robustness checks, employing the period 1961–1990 as baseline (Hulme et al. 1999; Mitchell and Jones 2005).

4. Methods

To investigate the relationship between temperature abnormalities and media coverage of climate change, we combine our dataset of media coverage with data on observed temperatures in the 28 EU countries. We use regression analysis to test our hypotheses. Media coverage is quantified as the number of articles mentioning climate change or global warming in each country, standardized by the country-specific standard deviation, so that equal weight is assigned to relative variations in different countries. Our main model specification is the following:

\[
Y_{jtm} = \alpha + \beta_{\text{temp}}t_m + \phi_j^Cj + \theta_t + \psi_m^Cjt + \zeta_m + \epsilon_{jtm}
\]

where \( Y \) represents the number of articles in country \( j \) in time period \( t \) in calendar month \( m \), standardized by the country-specific standard deviation, and \( \text{temp} \) represents the measure of temperature abnormality in in country \( j \) in time period \( t \) in calendar month \( m \), \( \phi_j^Cj \) represent country fixed effects, \( \theta_t \) represents a time trend, \( \psi_m^Cjt \) represent country-specific time trends, and \( \zeta_m \) represents a calendar month fixed effect that controls for seasonality. Together, the latter four terms allow us to control for general time-variant unobserved factors—including the increase in overall media activity over time, time-invariant and time-variant country-level unobserved factors, and for seasonality. The results are essentially unchanged when country-specific time trends and calendar month fixed effects are omitted (see table S4 in the Supplementary Material).

5. Media coverage of climate change in Europe in 2014–2019

Media coverage of climate change has consistently increased since 2014. The average daily number of climate change articles in 2019 is 4.8 times the average in 2014. Examining the overall trend since 2014, peaks of attention to climate change in the media are present in the months of November or December of every year, corresponding to the Conferences of the Parties of the United Nations Framework Convention on Climate Change (see figure 1). Since the beginning of 2018, and in particular in 2019, the rate of increase in media coverage of climate change has significantly risen. This trend is evident in most EU countries.

Media coverage of climate change is quite heterogeneous across countries, with a 2019 daily average in our data of 304 articles in the United Kingdom of Great Britain and Northern Ireland, 228 in Germany, 172 in Italy, between 30 and 45 in Austria, Belgium, and Portugal, and of less than 10 in Estonia, Luxembourg and Latvia (see the map in figure 2 and table S3). Population-weighted measures of media coverage suggest that, while country size and population clearly influence the level of media coverage of climate change, they do not fully explain cross-country variability.

6. The impact of temperature abnormalities on media coverage of climate change

We first test the impact of short-term temperature abnormalities on media coverage of climate change, examining the differentiated impact of negative and positive abnormalities. We then compare the impacts of short-term abnormalities, long-term abnormalities—which mirror definitions of climatic changes by climate scientists, and temperature levels.

We show below results for data aggregated at the weekly level. In the Supplementary Material, we show that analyses for daily and monthly data present essentially equivalent results (see tables S7–S12). We report analyses with non-standardized measures of media coverage in tables S14 and S15. To support the robustness of our results we also ran placebo tests using future temperature to predict past media coverage and find, as expected, null results (see tables S17 and S18).
Focusing on short-term abnormalities, we compare the impact of abnormalities defined as deviations from average temperatures in the same week of the year over the last 1 to 20 years. As shown in figure 3 and in table S16, deviations from temperatures in baseline periods ranging from the previous 2 to 20 years all significantly predict media coverage of climate change. The model that best fits the data and presents the strongest effects is the model with temperature abnormalities computed with respect to the previous 5 years. Effect sizes decrease for somewhat shorter and longer baselines, and are halved for baselines based on the previous 15 to 20 years. Deviations from temperatures in the same time period in the previous year have no statistically significant impact on media coverage of climate change.
Media coverage is therefore more impacted by deviations from temperatures in a baseline period that is at the same time recent but not too short. This is probably due to the fact that, in line with the recency effect found in psychological studies, whereby more recent events in a series are remembered more strongly, temperatures experienced more than 8 or 10 years ago are less available in memory (Baddeley and Hitch 1993). At the same time, recent baseline periods including only the last 2–3 years might be relatively too short to define ‘normal’ temperature levels.

As deviations from average temperatures in the previous five years are the strongest determinants of media coverage of climate change, we present in Model (1) of table 1 results of a model testing their impact, controlling for time trend, seasonality, time-invariant and time-variant country-specific unobserved factors.

Having found an impact of short-term temperature abnormalities on media coverage of climate change, the question of how exactly abnormalities impact media coverage remains open. Do all deviations from short-term averages matter equally, or only positive deviations—temperatures warmer than short-term averages—have an impact? To investigate the differential impact of positive and negative temperature abnormalities, we construct two variables containing a linear spline of our standard five-year temperature abnormality variable with a knot at 0. Model (2) in table 1 shows the impacts of negative and positive short-term temperature abnormalities with respect to the previous five years. The impact of positive abnormalities is positive and significantly bigger in size than the impact of the simple abnormality measure presented in Model (1). Temperatures colder than recent baselines also increase media coverage of climate change, but temperatures warmer than recent baselines have a considerably stronger effect. This suggests that the impact of short-term temperature abnormalities on the media is driven by temperatures perceived as warmer than normal.

We hypothesized that short-term temperature abnormalities are stronger predictors of media coverage compared to long-term abnormalities. To test this hypothesis, we compare the impact of deviations from average temperatures over the previous five years with the impact of deviations from temperatures in the period 1951–1980, which is the baseline period most often employed by climate scientists to define climatic changes. Long-term abnormalities are computed as the difference between average temperature in each country and week and average temperature in the same country and week in the period 1951–1980.

We find that deviations from average temperatures in 1951–1980 have an impact on media coverage of climate change that is approximately half in size compared to that of short-term abnormalities (compare Models (1) and (2) in table 2). Results are equivalent when using 1961–1990 instead of 1951–1980 as baseline period to compute long-term abnormality (see table S5). These results suggest that actual climatic changes manifesting as deviations from less recent baseline periods are less significant.
Figure 3. Estimates of the effects of different measures of short-term temperature abnormalities on standardized media coverage of climate change. Abnormalities are computed as the difference between present weekly temperature and temperature in the same week in different baselines, ranging from the previous year to the previous 20 years. Error bars represent +/- one standard error. The blue line is a moving window average of the coefficient estimates over different baseline periods.

Table 1. Short-term Temperature Abnormality and Media Coverage of Climate Change.

| VARIABLES                        | (1)     | (2)   |
|----------------------------------|---------|-------|
| Coverage                         | Coverage| Coverage|
| Short-term Abnormality           | 0.018***| -0.018***|
|                                  | (0.004) | (0.005) |
| Neg. Short-term Abnormality      |        | 0.050***|
|                                  |        | (0.008) |
| Pos. Short-term Abnormality      | 0.026   | -0.079*
|                                  | (0.021) | (0.030) |
| Constant                         |         |       |
| Observations                     | 8,065   | 8,065 |
| Adjusted R-squared               | 0.355   | 0.358 |
| Country FE × Time trend          | ✓       | ✓     |
| Month FE                         | ✓       | ✓     |

Clustered standard errors in parentheses

*** p < 0.001, ** p < 0.01, * p < 0.05

Notes: Standard errors are clustered at the country level. Media coverage is measured as the weekly number of climate articles per country divided by the country-specific standard deviation. In Model (1), temperature abnormalities are computed as the difference between average temperature in each country in each week and average temperature in the same country and week over the previous 5 years. In Model (2), negative and positive short-term temperature abnormalities are computed employing a spline of the variable employed in Model (1):

Neg.Temp.Abnormality = Temp.Abnormality if Temp.Abnormality < 0 ; Pos.Temp.Abnormality = Temp.Abnormality if Temp.Abnormality > 0.

As mentioned above, previous studies of media coverage of climate change have mostly tested whether present temperature, rather than temperature abnormalities, impacts the level of attention that the media devotes to climate change. Temperature levels have in general been shown to influence not only economic activities, from agricultural productivity to labor supply (Carleton and Hsiang 2016), but also a wide range of human behaviors, from aggressive behavior and criminal activity (Baylis 2020, Ranson 2014), to performance in math tests (Graff Zivin et al. 2018) and immigration adjudications (Heyes and Saberian 2019). Building on such evidence, we test whether present temperature affects online media coverage of climate change.

We find that simple measures of present temperature have a marginally significant impact on media coverage of climate change, and that their impact is approximately half in size compared to the effect of short-term abnormalities—and equivalent in size to the impact of long-term abnormalities (compare Models (2) and (3) in table 2). Once short-term temperature abnormality is controlled for, the impact of temperature on media coverage becomes insignificant (see table S6). This suggests the impact of short-term abnormality is stronger and more robust than the impact of simple measures of temperatures. While temperature levels do impact a series of human behaviors, the attention that the media devotes to climate change is more strongly influenced by perceptions of abnormal temperatures rather than raw measures of temperature.
Table 2. Comparing the Impact of Short-term and Long-term Temperature Abnormalities and Present Temperature on Media Coverage of Climate Change.

| VARIABLES                      | Coverage 1 | Coverage 2 | Coverage 3 |
|--------------------------------|------------|------------|------------|
| Short-Term Abnormality         | 0.018***   | (0.004)    |            |
| Long-Term Abnormality          | 0.010**    | (0.004)    |            |
| Present Temperature            | 0.009*     | (0.004)    |            |
| Constant                       | 0.026      | 0.016      | 0.046*     |
| Adjusted R-squared             | 0.355      | 0.353      | 0.353      |
| Country FE × Time trend        | ✓          | ✓          | ✓          |
| Month FE                       | ✓          | ✓          | ✓          |

Clustered standard errors in parentheses

Notes: standard errors are clustered at the country level. Media coverage is measured as the weekly number of climate articles per country divided by the country-specific standard deviation. We compare here the impact of short-term temperature abnormalities, long-term temperature abnormalities, and present temperature on media coverage of climate change. In Model (1), short-term temperature abnormality is computed as the difference between average temperature in each country in each week and average temperature in the same country and week over the previous 5 years. In Model (2), long-term temperature abnormality is computed as the difference between average temperature in each country in each week and average temperature in the same country and week over the baseline period 1951–1980.

7. Conclusion

In this paper, we investigate whether and how temperature abnormalities influence media coverage of climate change. We employ a comprehensive dataset of media coverage of climate change in the 28 countries of the European Union, with data representing 1.7 million online articles published between April 2014 and October 2019 in 22 different languages. We find that short-term temperature abnormalities—i.e. deviations from temperatures experienced in recent years—significantly increase media coverage of climate change. This effect is driven by positive temperature abnormalities—temperatures warmer than recent years’ averages. Interestingly, deviations from temperatures in baseline periods that climatologists use to define climatic changes have a considerably smaller effect compared to that of short-term abnormalities.

Deviations from weather conditions in recent years have also been found to shape discussions about weather on social media (Moore et al 2019) and to influence perceptions of climatic conditions (Ripberger et al 2017). Here, we find that temperatures warmer with respect to recent years increase the attention that the media devote to climate change. This effect may be due to an attribute substitution mechanism, with coverage of climate change increasing because temperatures warmer than recent years’ averages are interpreted as evidence of climate change. Or climate change might simply become associatively more salient when it is ‘warmer than usual’.

Media coverage is driven by both demand and supply. On the one hand, warmer temperatures might increase interest and salience of climate change for editors and journalists, who might consequently increase the coverage of the topic. On the other hand, journalists or editors may be taking advantage of short-term temperature abnormalities to increase coverage of climate change because they anticipate a broader interest among the public. Without readership data, we are unfortunately unable to disentangle these effects in this paper.

The intensity of media coverage and the frames of policy issues present in the media play a key role in influencing public attitudes toward such issues (Bolsen and Shapiro 2018, Shapiro et al 2011, Zaller 1992). The news media have also been shown to influence a wide range of political outcomes, including public expression, national agendas and policy decisions (King et al 2017, Strömberg 2015). Given the fundamental role of the media in the public sphere, investigating determinants of coverage of climate change is extremely important. Providing the first test of the impact of temperature trends on online media coverage of climate change—using data from 28 countries over 6 years, this paper helps answer this question.

Our findings do not support such a strategy of delaying ambitious climate policy implementation as public attention seems to be driven more by short-term temperature fluctuations in temperature than by objective climatic changes.

Acknowledgments

The research leading to these results has received funding from the European Research Council under the European Community’s Programme ‘Idea’—Call identifier: ERC-2013-StG / ERC grant agreement n 336703—project RISICO “RISK and uncertainty in developing and Implementing Climate change policies”. Building the dataset on media coverage of
climate change would not have been possible without the Europe Media Monitor, which provides a fundamental service not only to citizens and policy makers but also to researchers. The authors would like to thank two anonymous referees for their precious feedback and comments, and Elke U. Weber, Valentina Bosetti, and the translation assistants for their support.

**Author contributions**

S P and M R S designed the research and compiled the dataset. S P performed the analyses. S P and M R S analysed the results. S P wrote the manuscript with significant contributions from M R S.

**Competing interests**

The authors declare no competing interests.

**ORCID iDs**

Silvia Pianta  
https://orcid.org/0000-0002-0624-2292

Matthew R Sisco  
https://orcid.org/0000-0003-0296-7664

**References**

Baddeley A D and Hitch G 1993 The recency effect: Implicit learning with explicit retrieval? *Memory Cognition* 21 146–55

Baylis P 2020 Temperature and temperament: Evidence from twitter *J. Public Economics* 184 104161

Bergquist P and Warshaw C 2019 Does Global Warming Increase Public Concern about Climate Change? *J. Politics* 81 686–691

Bolsen T and Shapiro M A 2018 The US news media, polarization on climate change and pathways to effective communication *Environ. Communication* 12 149–63

Brulle R J, Carmichael J and Jenkins J C 2012 Shifting public opinion on climate change: an empirical assessment of factors influencing concern over climate change in the us, 2002–2010 *Clim. Change* 114 169–88

Carleton T A and Hsiang S M 2016 Social and economic impacts of climate Science 353 109337

Carmichael J T and Brulle R J 2017 Elite cues, media coverage and public concern: an integrated path analysis of public opinion on climate change, 2001–2013 *Environ. Politics* 26 232–52

Cornes R C, van der Schrier G, van den Besselaar E J and Jones P D 2018 An ensemble version of the e-obs temperature and precipitation data sets *J. Geophysical Res.: Atmospheres* 123 9391–9409

Druckman J N 2015 Eliminating the local warming effect *Clim. Change* 5 176–207

Egan P J and Mullin M 2012 Turning personal experience into political attitudes: The effect of local weather on americans’ perceptions about global warming. *J. Politics* 74 796–809

Eisensee T and Strömberg D 2007 News droughts, news floods and us disaster relief *Quarterly J. Economics* 122 693–728

Eurobarometer 2018 Media use in the European Union—standard eurobarometer 90 Autumn 2018

Gilovich T, Griffin D and Kahneman D 2002 Heuristics and Biases: The Psychology of Intuitive Judgment (Cambridge: Cambridge university press)

Graff Zivin J, Hsiang S M and Neidell M 2018 Temperature and human capital in the short and long run *J. Association Environ. Resource Economists* 5 77–105

Hamilton I. C and Stampone M D 2013 Blowin’ in the wind: Short-term weather and belief in anthropogenic climate change *Weather Climate Society* 5 112–19

Hansen J, Ruedy R, Sato M and Lo K 2010 Global surface temperature change *Rev. Geophys.* 48 2010RG000345RG4004

Heyes A and Saberian S 2019 Temperature and decisions: evidence from 207,000 court cases *Am. Economic J.: Appl. Economics* 11 238–65

Howe P D and Leiserowitz A 2013 Who remembers a hot summer or a cold winter? the asymmetric effect of beliefs about global warming on perceptions of local climate conditions in the us *Glob. Environ. Change* 23 1488–500

Hulme M, Mitchell J, Ingram W, Lowe J, Johns T, New M and Viner D 1999 Climate change scenarios for global impacts studies *Glob. Environ. Change* 9 53–519

Kauffman R K, Mann M L, Gopal S, Liederman J A, Howe D, Pretis F and Gilmore M 2017 Spatial heterogeneity of climate change as an experiential basis for skepticism *Proc. of the National Academy of Sciences* 114 67–71

King G, Schneer B and White A 2017 How the news media activate public expression and influence national agendas *Science* 358 776–80

Kirilenko A P, Molodtsova T and Stephenkova S O 2015 People as sensors: Mass media and local temperature influence climate change discussion on twitter *Glob. Environ. Change* 30 92–100

Konisky D M, Hughes I and Kaylor C H 2016 Extreme weather events and climate change concern *Clim. Change* 134 533–47

Lang C 2014 Do weather fluctuations cause people to seek information about climate change? *Clim. Change* 125 291–303

Mitchell T D and Jones P D 2005 An improved method of constructing a database of monthly climate observations and associated high-resolution grids *Int. J. Climatology: A J. Royal Meteorological Society* 25 693–712

Moore P C, Obradovich N, Lehner F and Baylis P 2019 Rapidly declining remarkability of temperature anomalies may obscure public perception of climate change *Proc. of the National Academy of Sciences* 116 6905–10

Prat A and Strömbäck D 2013 The political economy of mass media *Advances in Economics and Econometrics* 2 135–87

Publications Office of the European Union. 2019 *Culture Statistics* Culture Statistics (Luxembourg: Publications Office of the European Union)

Ranson M 2014 Crime, weather and climate change *J. environ. economics and management* 67 274–302

Ripberger J T, Jenkins-Smith H C, Silva C L, Carlson D E, Gupta K, Carlson N and Dunlap R E 2017 Bayesian versus politically motivated thinking in human perception of climate anomalies *Environ. Res. Lett.* 12 114004

Schäfer M S, Ivanova A and Schmidt A 2014 What drives media attention for climate change? explaining issue attention in Australian, German and Indian print media from 1996 to 2010 *Int. Communication Gazette* 76 152–76

Schmidt A, Ivanova A and Schäfer M S 2013 Media attention for climate change around the world: A comparative analysis of newspaper coverage in 27 countries *Glob. Environ. Change* 23 1233–48

Shanahan J and Good J 2000 Heat and hot air: Influence of local temperature on journalists’ coverage of global warming *Public Understanding Science* 9 285–96

Shapiro R Y, Jacobs L R and Edwards III G C 2011 *The Oxford handbook of American public opinion and the media* (Oxford: Oxford University Press)

Sisco M R, Bosetti V and Weber E U 2017 When do extreme weather events generate attention to climate change? *Clim. Change* 145 227–41
Steinberger R, Pouliquen B and Van der Goot E 2013 An introduction to the europe media monitor family of applications arXiv:1309.5290

Strömberg D 2015 Media and politics Annual Review of Economics 7 173–205

Vu H T, Liu Y and Tran D V 2019 Nationalizing a global phenomenon: A study of how the press in 45 countries and territories portrays climate change Glob. Environ. Change 58 101942

Weber E U 2016 What shapes perceptions of climate change? New research since 2010 Wiley Interdisciplinary Reviews: Climate Change 7 125–34

Zaller J R 1992 The nature and origins of mass opinion The Nature and Origins of Mass Opinion (Cambridge: Cambridge university press)

Zaval L, Keenan E A, Johnson E J and Weber E U 2014 How warm days increase belief in global warming Nat. Clim. Change 4 143