

1 **Is there a climate change reporting bias? A case study of English language news articles,**
2 **2017-2022**

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8 **Abstract:** How weather hazards are communicated by the media is important. Which risks are
9 understood, prioritised, and acted upon, can be influenced by the level of attention they
10 receive. ~~In this paper the~~ methods used are advanced Google searches of media articles and
11 the emergency disaster database (EM-DAT) that consider the weather hazards floods, heat
12 waves, wildfires, storms and droughts from 2017 - 2022. ^{Results suggest that} Storms are more likely to be reported
13 than any other climate risk. But wildfires generate more news articles per event. Bias in
14 reporting needs to be addressed and is important because it can exacerbate un-
15 preparedness.

The present work investigates if the number of weather hazards news articles increased since 2017; which weather hazards receive the most attention in the news articles; and how often is climate change discussed in these news articles in relation to weather hazards.

16 **Plain Text Summary:**

17 Climate change is increasing the risk of weather hazards (i.e. Storms and Heatwaves). Using
18 open science methods it is shown that there is a bias in weather hazard reporting. Storms
19 have had a large number of articles in the last five years. But, wildfires have a large number
20 of articles per individual occurrence. Science and media collaborations could address the bias
21 and improve reporting.

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29 **1. Introduction**

30 The Intergovernmental Panel on Climate Change's AR6 report demonstrates that storms,
31 flooding, heat waves, wildfires and droughts have been increasing in intensity and frequency
32 with climate change (IPCC, 2021). Since 2017, there have been a number of notable weather
33 events: Pacific Typhoon season 2018, European floods in 2021, Mediterranean heatwave and
34 wildfires in 2021 (Gao et al., 2020; Kreienkamp et al., 2021; Sjoukje Philip et al., 2021; Sullivan,
35 2021).

36 Communication of a risk does not always lead to the risk being understood (Porter and Evans,
37 2020), however the media is a key actor in communicating climate change and has a moral
38 obligation to highlight the risk of extreme weather and what action is needed(Boykoff and
39 Yulsman, 2013; Kitzinger, 1999).In addition, it has been found that the media gives more
40 attention to sensationalist views on climate change, instead of the consensus view (Meah,
41 2019; Petersen et al., 2019).

42 Research demonstrates that the bias in reporting hazards and climate change leads to
43 attention and material resource deficit, not fully recognising or addressing the risk
44 (Brimicombe et al., 2021a; Howarth and Brooks, 2017).In comparison, it has been found that
45 when visual hazards such as floods and storms (Wilby and Vaughan, 2011) are used to
46 demonstrate climate change risk there is an improved understanding of climate risk, also
47 known as objectifying climate change (Höijer, 2010).

48 Reported here for the first time, this study uses open science principles (Armeni et al. 2021;
49 Nosek et al. 2015) alongside the advanced search tools provided by Google, and the
50 emergency database (EM-DAT) (CRED,2020), to examine how weather hazards are mentioned
51 in news articles, from 2017-22. The aim is to understand: (1) has the number of articles
52 focused on weather hazards increased since 2017; (2) which weather hazards receive the
53 most attention; and (3) how often is climate change discussed in relation to those weather
54 hazards.

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58 **2. Methods and Data**

59 All the methods and data chosen by this study are in keeping with open data and open
60 science. Open data is where the research results are reproducible and transparent, whilst
61 open science is a term given for removing the barriers for sharing any kind of output (Armeni
62 et al., 2021).

63 **2.1 Advanced Google Search**

64 An advanced Google search of the news category was carried out for the period 1st January
65 2017 to the 1st January 2022. The search involved two stages: first, a search for all news
66 articles in the period containing keywords – flood, heat wave, wildfire, storm and drought,
67 was conducted, and second, this search criterion was repeated with the keywords – climate
68 change(cf. Brimicombe et al., 2021). Each hazard was evaluated separately and their results
69 compared, with duplicated results not included. Articles that mention more than one weather
70 hazard are counted twice.

71 To counter any overestimates that occur where articles are not discussing a weather hazard
72 but are using the term to describe something else, the approach taken is to look at the first
73 100 articles headlines and remove articles not discussing a weather hazard, to give a better
74 estimate of the true number of news articles. Examples included articles discussing ‘Goal
75 droughts’, ‘NFL Storm’ and ‘Glass Animals single Heatwave’. Then, this proportion of articles
76 was removed from the overall total, giving a new overall count of articles. For example, for
77 Storms in 2017, the initial search returned 6.31 million articles, but 21 out of the first 100
78 were not about the weather hazard so 4.98 million articles were counted for Storms.

79 Limitations of this method do remain it can still capture articles not explicitly about the
80 weather hazard, however, this is limited by the proportional approach taken. In addition, it is
81 only likely to capture the English news media and will give a slightly different number of
82 articles between users. As such it is recommended that further in-depth research should be
83 carried out looking at news media sentiment.

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87 2.2 EM-DAT Hazard Reporting

88 To supplement the findings of the advanced google search, another source of data is used
89 that is in keeping with open science, the emergency events database (EM-DAT). EM-DAT is
90 the leading international disaster database, it contains details of over 22,000 mass disasters
91 worldwide since 1900 and is compiled from a range of sources including UN agencies and
92 Non-Governmental Organisations (NGOs) (CRED, 2020). This provides an overview of the
93 number of weather hazards that have occurred every year for the last 5 years. This then allows
94 for an assessment on average how many articles have been written about each weather
95 hazard. Table 1 shows a count of the weather hazards every year from 2017 to 2021
96 considered by this study included in EM-DAT (CRED, 2020).

97 *Table 1: Displaying the total number of disaster reported per weather hazard for the last 5*
98 *years as reported by EM-DAT (CRED, 2020).*

Hazard/Year	2017	2018	2019	2020	2021	Total
Drought	12	17	15	10	15	69
Heat wave	1	14	17	4	2	38
Flood	127	128	195	202	222	874
Storm	130	96	91	128	119	564
Wildfire	15	10	14	8	19	66
Total	285	265	332	352	377	1611

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100 Limitations of this method are that there are biases in how hazards in this database are
101 reported and there is under-reporting of hazards by this database (Brimicombe et al., 2021a;
102 Gall et al., 2009). In addition, this database only includes hazards that are considered a
103 disaster, where an agency declares a state of emergency, or where it is reported that over
104 100 people have been affected(CRED, 2020). However, it remains the most comprehensive
105 source of reported weather hazards (Brimicombe et al., 2021a; Gall et al., 2009).

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110 **3. Results**

111 **3.1 have the number of weather hazards news article increased since 2017?**

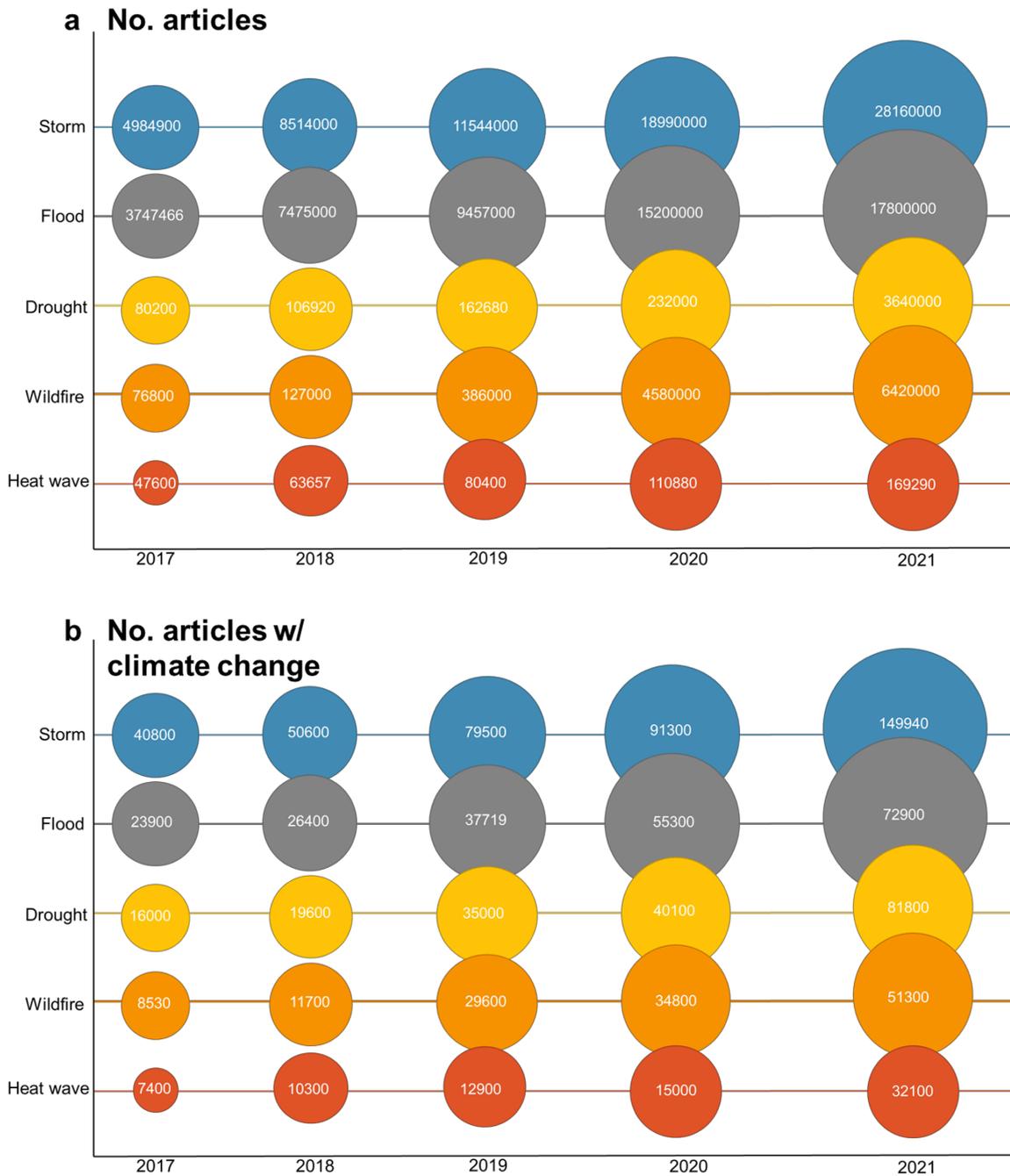
In a total of over 142 million articles scored in the five years

112 There has been an increase in the number of English language news media articles for all
113 weather hazards from 2017 to 2022. in 2021, 28.1 million articles are about storms, whereas
114 169,000 articles are about heat waves (Figure 1). Of interest, only 0.7% of all news articles
115 mentioned climate change and the weather hazard together. The results for number of
116 articles mirror those for overall news articles written.

117 **3.2 Which weather hazards receive the most attention in news articles?**

118 The results in section 3.1 change when the number of articles is considered as a proportion
119 of the number of weather hazards reported in EM-DAT in table 1. The approach taken here is
120 to aggregate the totals for the 5 years per hazard to reduce the influence of the under-
121 reporting bias in EM-DAT. Table 2 is another representation of the reporting bias introduced
122 by EM-DAT where total costs for each hazard each year are show, no losses are attributed to
123 heat waves, the results for total damages mirror those for total number of article written. It
124 can therefore be suggested that articles are more likely to be written for hazards that have
125 the biggest financial loss reported for them.

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128 *Figure 1: number of articles per hazard per year for 2017 to 2022 a) indicates overall article*
 129 *numbers whilst b) indicates only articles that contain the weather hazard and climate change*
 130 *as its subject.*

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135 *Table 2: Sum of Total Damages for each hazard per year as reported by EM-DAT (CRED, 2020)*

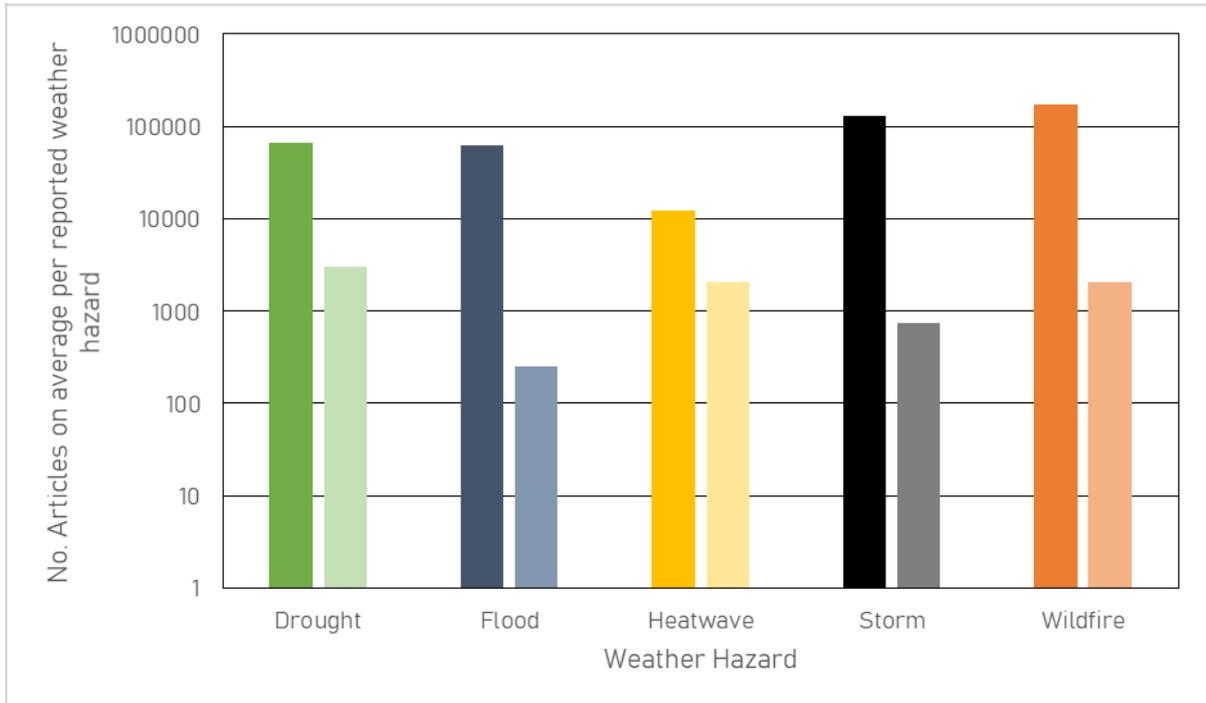
Hazard/Year	2017	2018	2019	2020	2021	Total
Drought	\$ 6,767,619	\$ 10,093,560	\$ 143,086	\$ 7,852,337	\$ 12,500,000	\$ 37,356,602
Heat wave						\$ -
Flood	\$ 22,484,1	\$ 21,273,576	\$ 39,033,864	\$ 53,874,005	\$ 75,957,000	\$212,622,545
Storm	\$301,722,795	\$ 78,567,020	\$ 61,089,189	\$ 92,336,036	\$137,675,753	\$671,390,793
Wildfire	\$ 18,706,572	\$ 24,605,677	\$ 3,954,463	\$ 11,696,841	\$ 9,253,912	\$ 68,217,465
Total	\$349,681,086	\$134,539,833	\$104,220,602	\$165,759,219	\$235,386,665	\$989,587,405

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137 Overall, on average for each individual weather hazard, 89,000 articles were written,
 138 however, the picture for each hazard varies widely, for example one storm can have 10 times
 139 more articles written about it than another, and a future study on this would be beneficial.
 140 On average per wildfire, there have been in total 175,000 articles written in the last 5 years
 141 (Figure 2). The weather hazard with on average the least number of articles per weather
 142 hazard occurrence over the last 5 years are heat waves with 12,000 articles (Figure 2).

per weather hazard occurrence

This paragraph still remain confusing...Please explain how did you obtain these numbers, and if this is the case make again reference to table 1



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144 *Figure 2: The average number of articles per individual hazard category for the last 5 years.*
 145 *Dark colour is total number of articles and light colour is articles including climate change.*

146 **3.3 how often is climate change discussed in these news articles in relation to weather**
 147 **hazards?**

148 Overall, on average for each individual weather hazard, 650 articles were written that also
 149 consider climate change. The hazard with the most articles written is drought, on average
 150 per drought, there have been ³⁰⁰⁰3k articles in the last 5 years (Figure 2). The weather hazard
 151 with on average the least number of articles per weather hazard occurrence over the last 5
 152 years are floods with 200 articles (Figure 2).

153 *Again, please explain how did you obtain these numbers, and if this is the case make again reference to table 1*

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160 **4. Discussion**

161 **4.1 Why are some hazards discussed by the English Language News media more?**

162 Heat waves have the least amount of news media articles. This should not be of surprise given
163 other research demonstrating the consistent underreporting of this weather hazard
164 (Harrington and Otto, 2020; Vogel et al., 2019). It however, may be of surprise given the
165 number of record-breaking heat waves during recent years such as the June 2021 Pacific
166 North-West heat wave which was attributed to climate change (Sjoukje Philip et al., 2021).

167 How notable events or weather hazards get attention and are reported is subject to
168 'newsworthiness', which can also be known as the political economy between society and the
169 media (Boykoff and Yulsman, 2013; Kitzinger, 1999). This is made up of 4 main factors: *the*
170 *availability effect/heuristic which is if a hazard is presented as risk before it is more likely to*
171 *be remembered in this manner, stories from impacted groups, geographically bound and are*
172 *visually impactful* (Kitzinger, 1999; Tomlinson et al., 2011). The results of this study show that
173 the hazards that fit the criteria the most were storms which have the most articles by quantity
174 and wildfires that have the most articles per individual occurrence.

175 **4.2 How does the English Language News Media discuss climate change and hazards?**

176 The number of articles on average per individual weather hazard that also considers climate
177 change is not following the 'newsworthiness' criteria and therefore drought, wildfire and heat
178 waves have the most articles. Instead, the media can be suggested to follow the science
179 where it is seen these hazards are easier to attribute to climate change than floods or storms
180 (Ciavarella et al., 2020; Kreienkamp et al., 2021). Whilst the media does have a moral
181 obligation and plays a key role in communicating climate risk, how science, the public and
182 those in position of power communicates climate change has influence on what is portrayed
183 by the media (Boykoff and Yulsman, 2013; van der Hel et al., 2018; Howarth and Anderson,
184 2019).

185 Therefore, it could be suggested that this reporting of climate change has come about by the
186 increasing collaboration between science (across career stages) and the media examples
187 include Science Media Centre, The Conversation and Voice of Young Science. This comes in

188 spite of the discourse around the role of science in both communication and policy spaces
189 (Boykoff and Yulsman, 2013; Pielke, 2007).

190 **4.3 Why is consistent reporting important?**

191 Attention deficit in the English Language News Media leads to a lack of investment in
192 adaptation for some hazards, making us unprepared. In addition, this pushes us towards more
193 precarious tipping points where adaptation becomes more a challenge for society (Howarth
194 and Brooks, 2017). This study's results highlight a huge reporting bias in favour of storms and
195 wildfire in the news media. This has a material cost where storms receive more research,
196 funding and policy than other hazards (Brimicombe et al., 2021b; Harrington and Otto, 2020;
197 Howarth and Brooks, 2017; Vogel et al., 2019).

198 However, despite ranking second in terms of the overall number of articles, per individual
199 occurrence floods have the least number of articles. This could be an indication that there are
200 a bigger range of number of articles written per flood (i.e. one flood has 1 million articles but
201 another only has 1,000 articles) and this is something that should be explored further in a
202 news media sentiment study, with particular focus given to geographical bias.

203 **4.4 What does using an open science approach demonstrate?**

204 This study uses advance google search trends to show the bias that is apparent in the English
205 Language News Media surrounding weather hazards and climate change. This is not the most
206 robust method to carry out a study of this kind, however it is the most accessible. For example,
207 long-scale newspaper databases are not free to access.

208 Using an open science approach highlights the transparency surrounding the reporting bias
209 (Armeni et al., 2021). This is a positive because it means that it is easy to track improvements
210 and changes in reporting. Bias reduces the ability of reporting as a tool to reduce hazard risk
211 and highlighting it is the first step in changing the narrative (Brimicombe, et al., 2021a,b).

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216 **5. Conclusion**

217 There is a bias in terms of which weather hazards English language news media report on,
218 and a bias in terms of which weather hazards are linked to climate change. This is important
219 because in terms of material cost some hazards have more investment than others. This leads
220 to hazards being subject to under preparedness as a result of underreporting of their impacts.
221 Reporting is a key way that we can improve communication and plays a part in avoiding
222 societal tipping points. This study suggests greater collaboration between scientists (across
223 career stages) with the English news media is key to improve reporting overall and continue
224 to grow the reporting of the risk of weather hazards and their intrinsic links with climate
225 change.

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227 **Disclosure Statement:**

228 *The author reports there are no competing interests to declare.*

229 **Data availability:**

230 All data is available via advance Google searches and the EM-DAT database.

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