

THE 2022 INDIAN HEATWAVES

EXPLORING MEDIA COVERAGE
IN ENGLISH, HINDI, MARATHI
AND TELUGU



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EXECUTIVE SUMMARY

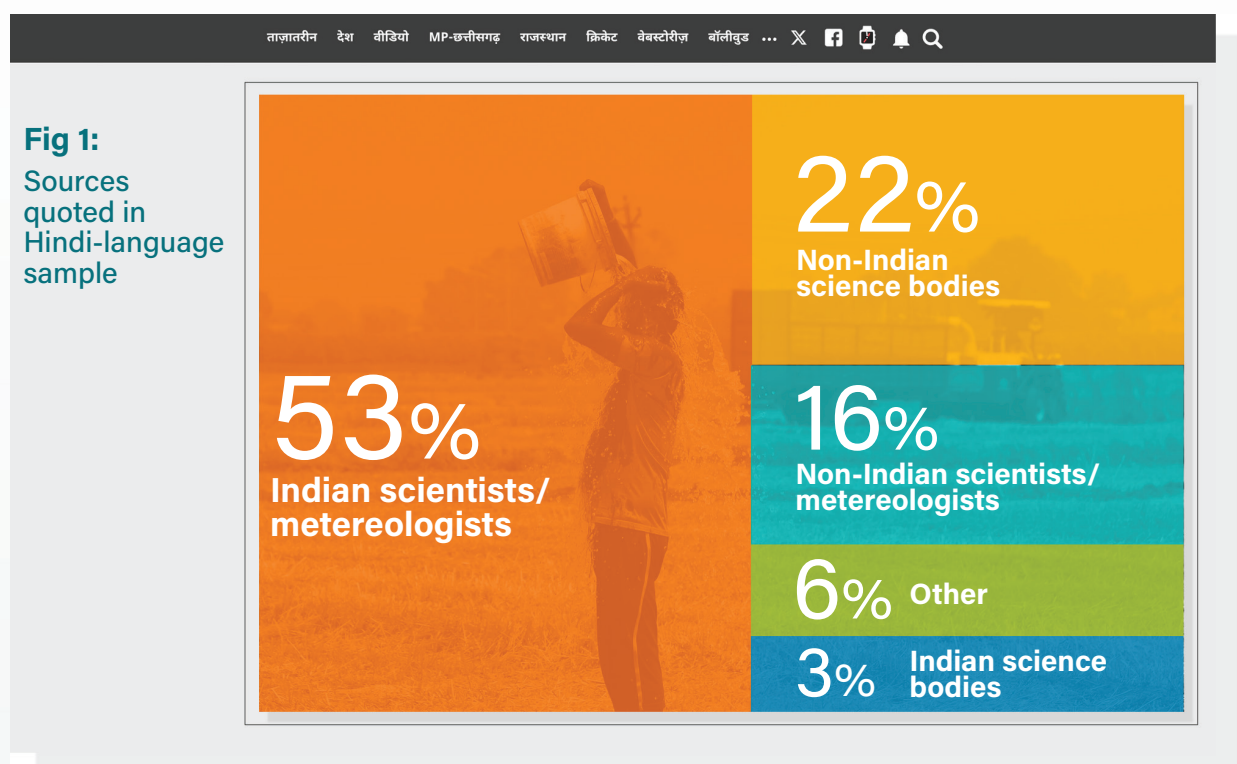


Courtesy: Indian Express

The heatwave affecting India from March to May 2022 was exceptional for its record temperatures, its early onset, its unusually long duration and the large area that was affected. It was responsible for at least 90 deaths, wheat crop failures, widespread power outages and 300 forest fires. According to the science organization World Weather Attribution, the heatwave was made 30 times more likely due to climate change. We evaluated the media coverage of the heatwave from March to May 2022 in English, Hindi, Marathi and Telugu media outlets. We also included a limited number of videos in English. Using manual content analysis, we find that:

- ☀️ A high percentage of English-language articles accurately reported the links between climate change and the heatwave when both issues were covered in the same news article. More than 70% of the articles either presented climate change as making the 2022 heatwave more intense or more frequent, or used a variant of a generic trend statement such as 'this heatwave is the sort of event which (scientists say) could become more frequent and/or intense in the future!' There were only a handful of scientifically inaccurate statements such as 'the heatwave was caused (solely) by climate change' (binary causation statements).
- ☀️ In contrast, in the Hindi-language sample, a large portion did use a direct binary causation statement to describe the link between the heatwave and climate change (67%), a much higher figure than for our English-language sample (19%). The overwhelming majority of these were statements such as 'The temperature rise in the country is the result of global warming!' However, as with the English-language sample, there were also a limited number of examples of multiple causation such as 'Global warming is also one of the main reasons for the rise in temperature,' which is more scientifically accurate.

- ☀ The two EEA studies by the UK Met Office and the World Weather Attribution (WWA) group released in May 2022, were widely quoted in both the English-language and the Hindi-language news sites (18% and 26% respectively), but not in the English-language videos. With few exceptions, these studies were reported accurately.
- ☀ A very high percentage of the quotes about the links between the heatwave and climate change came from Indian scientists or meteorologists both in our English and other-language samples (See Figure 1 for the results from the Hindi-language sample). In contrast to previous studies of the Indian media coverage of extreme weather events (Painter et al., 2020), our results show that Indian government officials, politicians and NGOs were very seldom quoted about the link, and when they were, it was to make scientifically accurate statements about the link rather than to suggest that by blaming climate change, they could be exonerated from responsibility.



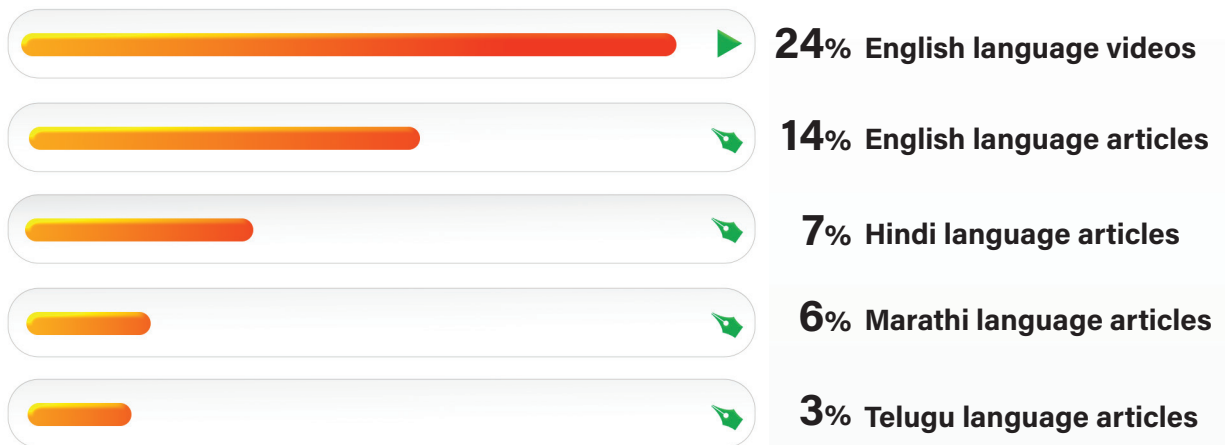
- ☀ In common with the practice in many other countries, the Indian media did not forefront or mention the link between the heatwaves and climate change as much as they could. This is particularly true given that some climate scientists now say that climate change plays a role in every heatwave occurring, by making it more intense or likely¹. **In our case study of the 2022 heatwave, 272 articles out of a total of 1,930 English-language articles covering the heatwave in the three**

¹ See for example, <https://www.thetimes.co.uk/article/are-we-to-blame-for-the-heatwaves-friederike-otto-can-tell-us-kp3xjqhw6>

months under review mentioned some type of link to climate change or global warming, equivalent to 14%. The equivalent figure for news videos is 24%, and for the other language sites lower at between 3% and 7% (See Figure 2). A strong case can be made that the link to climate change could have been more emphasised in some of the media coverage, particularly in the early days of the heatwave in March and April.

Fig 2:

Sources: Percentage of articles on the heatwave mentioning climate change



☀ In contrast to the images used by some Western media in the coverage of heatwaves in India and elsewhere, there was no usage of images of people enjoying the heat (known as 'fun in the sun', see O'Neill et al., 2023) in our sample. On the contrary, most of the images accompanying the texts were of ordinary people seeking relief from the sun in the shade, under umbrellas, or drinking and soaking themselves with water. (See image from NDTV)



Record Heat: Delhi recorded its second hottest April this year since 1951. (Representational)

Image Courtesy:
NDTV

- ☀️ Across all our samples, journalists regularly covered three aspects that affect the impact of the heatwave on ordinary people, namely emergency responses, disaster planning, and vulnerabilities. Indeed, our sample both in English and Hindi included comments and quotes from Indian experts stressing the need for building public awareness, adequate preparation, the implementation of Heat Action Plans and the importance of an integrated policy approach to reducing the impact of the heatwave on the vulnerable. However, at least in our sample, it is also the case that there were few examples of journalists holding local, regional and national governments to account.
- ☀️ In general, the Hindi-language coverage did at times show inaccuracies in its reporting of the links between climate change and the heatwave. However, journalists working at Hindi outlets have less access to resources and training compared to reporters in English. Also, general reporters rather than specialist science/health correspondents covered the heatwave. Often the articles were written by 'staff', rather than named journalists. The Hindi titles cater to different audiences and news formats/styles. Journalists also face the difficulty of translating or transliterating scientific or quasi-technical terms into Hindi or other languages.

We make several recommendations for different sectors, including offering wider training programmes for general reporters working in languages other than English and for regional press, making guidelines available in different languages on how to report accurately on heatwaves and other extreme weather events and their relation to climate change, and encouraging journalists to give sufficient weight to all aspects of the heatwave story including holding local, regional and national authorities to account for their plans to prepare for, and respond to, the impacts of such events affecting the more vulnerable sectors.



INTRODUCTION

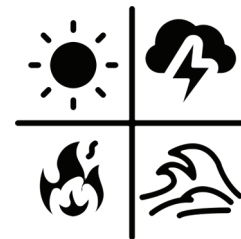
The heatwave affecting India from March to May 2022 was exceptional for its record temperatures, its early onset, its unusually long duration and the large area that was affected. It was responsible for at least 90 deaths, wheat crop failures, widespread power outages and 300 forest fires. March was declared the hottest in 122 years since the Indian Meteorological Department (IMD) started maintaining records. The heat was particularly difficult for the most vulnerable and exposed people who run their livelihoods out of doors, such as street vendors, construction workers, farm workers, and traffic police. The extreme heat left 90 percent of the country's 1.4 billion inhabitants vulnerable to public health risks like heatstroke, food shortages, and even death (Debnath et al, 2023).

The wave of heatwaves attracted a large volume of sustained coverage in a wide variety of Indian media, including legacy titles, digital start-ups, and television, both in English, Hindi and regional languages – a range of platforms and languages seldom included in Indian media studies. For this reason, we analysed a large number of articles, reports and video coverage from a variety of media outlets, including online news coverage and TV, popular English-language titles, and news outlets in Hindi, Telugu and Marathi. Using manual content analysis, we focused on a series of key questions about the coverage, including whether and how the link with climate change was made, the sources for describing the link, and the political dimensions to tackling the heatwaves.

EXTREME WEATHER EVENTS

There are several reasons why it is important to study extreme weather events, their links to climate change and the way they are communicated, particularly via the media.

Firstly, climate change is altering the frequency, duration, and intensity of many types of extreme weather events, including heatwaves, droughts, heavy rainfall, and fire weather conditions (IPCC, 2023). The IPCC warned in 2021 that extreme weather events would increase in South Asia, including India, and that heatwaves would become more intense and frequent in the 21st century (IPCC, 2021). Soaring temperatures in the future are likely to hinder India's development goals (Debnath et al., 2023).



Secondly, a particular branch of climate science has boomed in the last few years, which aims to establish how much more likely or intense individual extreme weather events have become as a result of man-made climate change. These are known as Extreme Event Attribution (EEA) studies (Stott et al., 2016). Their number has grown to over 400 peer-reviewed studies looking at weather extremes around the world, from wildfires in the US and heatwaves in India and Pakistan to typhoons in Asia (Carbon Brief, 2022). When it comes to extreme heat events, of the 152 assessed by scientists, 93% concluded that climate change made the event or trend more likely or more severe. However, it is very important to stress that not all extreme weather events are made more likely or severe by climate change. For example, a study by the WWA of the drought in southern Madagascar in 2021 concluded that climate

change had not altered the frequency or intensity of the drought, and that poverty, poor infrastructure and dependence on rain-fed agriculture were the main drivers of the ongoing food crisis there (Harrington et al., 2022).

Thirdly, a growing body of environmental NGOs, journalists, politicians, and climate change researchers often describe extreme weather events as 'teachable moments', with the implicit assumption that extreme weather could help to mobilize climate action by countering the perceived invisibility and psychological distance of climate change (Ettinger and Painter, 2023).

Fourthly, most people in most countries get most of their information about climate change from the media (Schäfer and Painter, 2021), so how journalists report extreme weather events and their links to climate change is of central importance to public awareness and responses. Public opinion can inform and influence policymaking at the local, regional and national level.

Several EEA studies have concentrated on India and its experience of extreme weather events, and particularly heatwaves and floods. Of particular importance to this paper is the study of the 2022 heatwaves released on 23 May 2022 by the World Weather Attribution Group (WWA), which is a major coordinating group of scientists from all around the world working in this field (Zachariah M. et al., 2022). In this case, scientists from India, Pakistan, the Netherlands, France, Switzerland, New Zealand, Denmark, USA and the UK collaborated to evaluate the extent to which human-induced climate change altered the likelihood and intensity of the heatwave. The second study of relevance is the one produced by the UK Met Office and released a few days before the WWA study, on 18 May 2022 (Christidis N., 2022). Both studies concluded that the heatwave was made much more likely as a result of man-driven climate change. It is important to note the publication dates of the two studies as they were released as the heatwaves were continuing.



Courtesy: PTI



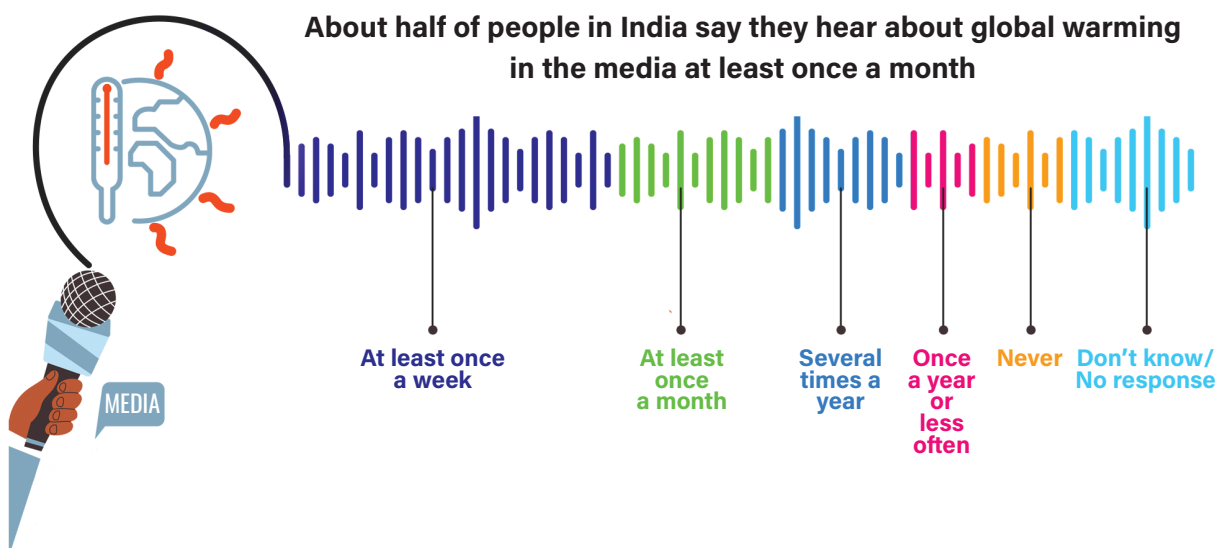
Courtesy: ANI

INDIA AS A CASE STUDY

India is the world's third largest national emitter of carbon dioxide due to its large population of more than 1.3 billion, although the per-capita emissions are much lower than other advanced and developing economies. It is extremely vulnerable to the effects of climate change, particularly because almost half of the population works in agriculture and other climate sensitive sectors (Chand and Singh, 2022). It is experiencing both more frequent dry spells and more intense wet spells during the monsoon season (Krishnan et al, 2020). Research suggests that more than 80 percent of the population lives in districts highly vulnerable to extreme weather events (Mohanty and Wadhawan, 2021). Heat Action Plans have been implemented in 17 states and more than 130 cities which are designed to give early warnings and reduce the negative health impacts of extreme heat and prevention and control of heat-related illnesses (Golechha et al., 2021), with mixed results (Pillai and Dalal, 2023). Survey work carried out in 2021/22 across a nationally representative group of adults found that a large majority of Indians say they have observed changes in local climate and weather patterns in their own area, and in the particular case of heatwaves, a majority (56%) say hot days have become more frequent in their local area (although 18% say they have become less frequent, and 23% say there has been no change). (Leiserowitz et al., 2022)

Moreover, India boasts what is probably the world's most vibrant and diverse media system in which traditional or legacy media still perform well in print and online, despite the strong growth in television and social media as sources of news and the arrival of several successful digital-born media (Ejaz et al., 2022). In 2016 the country had six of the top fifteen media organizations with the largest print circulations in the world (WAN-IFRA, 2016). Most of these are in Hindi, spoken as a first language by around 44% of the population. Indeed in 2011, India had twenty languages which were spoken by at least 1.8 million people, including in order, Hindi, Bengali, Marathi, Telugu, Tamil and Gujarati (Office of the Registrar General, 2011). This compares with only a few hundred thousand Indians who speak English as a first language, although maybe as many as 200 million speak it as a second language and around 30% speak it to some extent.

Fig 3:
Global Warming in the Indian media



According to the comprehensive 2022 study 'Climate Change in the Indian Mind' (Leiserowitz et al., 2022), just over half of Indians (52%) say they hear about global warming in the media at least once a month, including 35% who say they hear about it at least once a week. Nearly a third (33%) say they hear about global warming in the media only several times a year or less often, including 11% who say they never hear about it via the media. (See Figure 3) As regards different media sources used for climate change information, online survey work carried out in 2022 of the English-speaking population shows that social media and messaging apps are particularly important for Indian news consumers, but television, online sources and newspapers are still significant, representing 68% of the surveyed population (Ejaz et al. 2022). (See Figure 4)

Fig 4:
Sources of Climate News or Information by Country

Values in %	Brazil	France	Germany	India
TV News	29	44	37	21
Online (incl. social & messaging)	38	27	19	32
Social Media	21	11	8	19
Messaging Apps	9	2	2	13
Radio News	9	18	27	6
Newspaper	8	13	14	15
Elsewhere	24	27	22	22

Source: Ejaz et al., 2022, p.11

India is also one of several countries where researchers have studied in detail the media coverage of extreme weather events (Painter and Hassol, 2021). For example, Hopke (2019) found that only 9% of the articles examined in four Indian English-language newspapers and one newswire mentioned climate change in the coverage of heat waves between 2013 and 2018. However, she did not include articles in other languages than English. Painter et al (2020) studied the coverage of two Indian extreme weather events in 2015 and concluded that journalists rarely made the link to climate change; they most commonly used generic phrases to describe the link such as 'this extreme weather event is consistent with what we expect from climate change'; politicians and NGOs often 'blamed' climate change without reference to the science; and only a few quoted EEA studies looking at how anthropogenic climate change had made the events more or less intense or frequent. However, this study is now dated, and only included English-language legacy print media.

Several studies have identified the opportunities and challenges for journalists covering extreme weather events (Painter et al., 2020; Painter and Hassol, 2021; Strauss et al., 2021). The WWA is one of several organizations to publish guidelines for journalists in various languages including English, Hindi and Bengali². It summarizes the three common mistakes made by media outlets and journalists as 'ignoring climate change as a cause of the event, attributing the event to climate change without providing any evidence for that claim, and attributing an extreme weather event to climate change as the sole cause.'³ As the WWA explains it, the mistakes happen partly 'because the question of whether climate change caused an event, while seemingly reasonable, is poorly posed. [...] climate change cannot cause an event (in a binary use of the term 'cause') because all weather events have multiple causes, which includes chance due to the chaotic nature of day-to-day weather. But climate change can affect how likely and how intense an event was.' A particular challenge in the past has been what journalists should say about extreme weather events and climate change before EEA studies are available (although such studies are now often being published whilst an extreme weather event is occurring, particularly in the case of heatwaves).⁴ However, this should not prevent journalists from explaining the possible links. Phrases have often been used such as 'scientists say that these types of extreme weather events will be many times more likely over the coming decades.'

Another issue attracting debate is the images editors and journalists use to illustrate the texts reporting on heatwaves. Depicting people 'having fun in the sun' such as children splashing in city fountains, crowded beaches, or eating ice creams has provoked criticism for first, downplaying the experiences of those vulnerable to heatwaves such as the elderly, and second, for ignoring the opportunities for imagining a more climate-resilient future. Many newspapers in Northern Europe were found to have often depicted people having fun in or by water to illustrate the 2019 summer heatwaves (O'Neill et al., 2023). This has been contrasted to Indian media coverage of heatwaves where it has been more common to see compelling visual portrayals of everyday life such as ordinary people seeking shade and water to cool down (O'Neill, 2022).

Finally, when reporting about extreme weather events, it is important for journalists to stress that independent of climate change, natural hazards such as heatwaves, droughts and floods become disasters as a result of societal vulnerability. A focus on EEA studies can run the risk of displacing attention from such vulnerability and disaster planning (Lahsen and Ribot, 2021). As Raju et al. (2021) have pointed out, blaming natural or climate change-related causes can engender a politically convenient crisis narrative that is used to justify inadequate or reactive disaster laws and policies, when it is most often people's social and economic status that determines the nature of differential and disproportionate impacts. They argue that 'a discourse in which the role of human activity in disasters is clearly communicated—as opposed to blaming Nature or the Climate—will be more conducive to a proactive, equitable and ultimately successful approach to reducing impacts of disasters' (ibid., p.1).

² <https://www.worldweatherattribution.org/reporting-extreme-weather-and-climate-change-a-guide-for-journalists/>;
See also <https://www.climatecentral.org/toolkit-heat> and <https://www.sciline.org/climate/climate-change/heat-waves/>

³ <https://www.worldweatherattribution.org/reporting-extreme-weather-and-climate-change-a-guide-for-journalists/>, p.4

⁴ See for example, <https://www.niemanlab.org/2023/08/journalists-can-help-explain-climates-role-in-extreme-weather-even-before-all-the-data-comes-in/>

RESEARCH QUESTIONS

Based on this context, we formulated the following three sets of research questions:

1

Attribution science

Are the heat waves seen by the media as a simple 'weather issue' or are the links to climate change mentioned and explored? Do the media accurately portray the (complexity of the) link to man-made climate change? Are the Extreme Event Attribution (EEA) studies included in the coverage, and if so, how?

2

Sourcing

Who is quoted on the links to climate change (NGOs, local or national politicians, scientists, emergency services, ordinary people suffering impacts etc.)?

3

Political Dimensions

Are there signs in the quotes or coverage that politicians (and other sectors) are viewing the heatwaves/climate change as a political issue requiring policy and action initiatives? Are there indications that politicians and others, by blaming climate change, are abnegating responsibility for addressing local drivers of extreme weather impacts?

CHOICE OF MEDIA OUTLETS, ARTICLES, AND RESEARCH METHODS

A majority of India's most widely read newspapers and online sites are published in languages other than English. According to the Audit Bureau of Circulations, in April 2023 five of the top eight were in Hindi including Dainik Bhaskar on top of the list with a daily circulation of 3.57 million, and Amar Ujala with 1.74 million⁵. The largest newspaper in Telugu, Eenadu, has a daily circulation of 1.3 m, making it India's seventh largest print outlet. The Daily Sakal in Marathi has over one million in circulation. For this reason, we included six Hindi news outlets in our analysis, and one in Telugu and one in Marathi. We chose Telugu as it is the official language of the states of Andhra Pradesh and Telangana in central Eastern India, which were badly affected by the heatwaves. It is spoken by more than 75 million speakers. Likewise, we included Marathi as the western state of Maharashtra contains India's most populated city (Mumbai), and was also strongly affected by the heatwave. It is spoken by around 83 million people.

Although Hindi language news sources are read or watched by much larger audiences, English-language legacy media still receive a large percentage of the media advertising revenue and exert a considerable influence over national policy and opinion. The Times of India has the largest daily circulation in English in the world at 1.87 million (as measured in the second six months of 2022). The Hindustan Times is also widely read with a circulation of around 740,000⁶. Despite the overwhelming

⁵ [http://www.auditbureau.org/files/JD%202022%20Highest%20Circulated%20\(across%20languages\).pdf](http://www.auditbureau.org/files/JD%202022%20Highest%20Circulated%20(across%20languages).pdf)

⁶ Ibid.

presence and growth of television audiences, television coverage is rarely included in Indian media analysis, so we included a selection of news videos from major outlets largely drawn from their televised reporting, mostly in English.

The methods for selecting the media outlets and articles are described fully in Appendix 1. These gave us a large and varied sample of media coverage of the heatwave for the three-month period from 1 April to 30 June 2022 consisting of i) after culling, 114 articles in English from six of the most read news online sites; ii) an initial sample of 40 articles from six popular news sites in Hindi (culled to 27 after taking out articles which may have mentioned climate change but did not make a direct link to the 2022 heatwave), 2 from the most popular newspaper in Telugu and 5 from the most popular news site in Marathi; and iii) an initial sample of 39 news videos from television coverage in English and Hindi accessed via a news video search on YouTube, which was culled to 10 in English which mentioned the link to climate change. These are summarized in Table 1.

English-language news sites		Hindi-language news sites	
	No. of articles coded		No. of articles coded
Hindustan Times	40	Dainik Bhaskar	7
Times	27	Dainik Jagran	7
Mint	19	News18	4
The Hindu	12	Aaj Tak	3
NDTV online	9	Zee News/DNA	3
The New India Express	7	Amar Ujala	3
	114		27

Telegu news sites		Marathi news sites	
	No. of articles coded		No. of articles coded
Eenadu	2	Daily Sakal	5

Videos (English)		No. of videos coded	
The Times Group			5
India Today			3
NDTV			2
			10

We designed and then applied the same codebook, consisting of 30 variables, to each of the articles or videos both in English and the other languages, to be able to have detailed answers to our Research Questions posed above (See Appendix 2 for code book). A team of four coders, of whom three were of Indian nationality with an understanding of Hindi, Marathi and Telugu between them, divided up the articles and videos. Coder reliability scores can be seen in Appendix 1. We also used the Google Translate API for Hindi, Marathi and Telugu to translate the texts into English and thus support the coding of the articles in those languages. Google Translate has been shown to provide robust results for climate change coverage in the media for some languages (Reber, 2019; Hase et al., 2021), although not for Hindi and other Indian languages. All the results of the coding can be found in a database, available under request.

RESULTS

1. MAKING THE LINK TO CLIMATE CHANGE OR GLOBAL WARMING

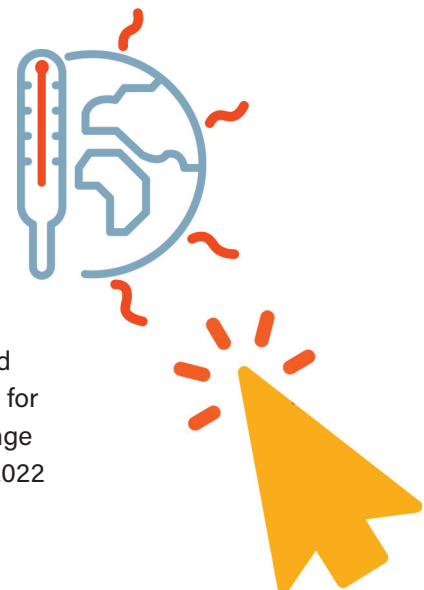
Based only on our Factiva search in five of our six English-language titles (Hindustan Times, Times of India, Mint, the Hindu, and The New India Express (TNIE)), the search terms 'Heatwave' OR 'Heat AND wave' gave us a total of 1,762 articles for the mention of the search terms anywhere in the article for the period under scrutiny. Again, only using Factiva, the search terms (heatwave OR heat wave) AND (climate change OR global warming) gave a total of 260 articles, equivalent to 15% of all mentions. That is to say, approximately 1 in every 7 articles which covered

the 2022 Indian heatwave included some mention of climate change or global warming. There are some marked differences between outlets, as The Times of India (19%) and the Hindustan Times (15%) showed a higher percentage of mentions of the link, whereas TNIE showed the lowest (6%).

We could not include NDTV online in these figures as we used its own website search function and not Factiva. However, a search there for 'heatwave' gave a result of 168 articles, whilst a search for 'climate change' and 'heatwave' gave 12 results, which is equal to 7%. So for the whole English sample, 272 articles out of a total of 1,930 articles about the heatwave mentioned a link to climate change for global warming, equivalent to 14%. For the English-language videos, 10 of them (24%) had some mention of climate change or global warming in their reporting of the heatwave.

The figures are noticeably lower for the news sites in other languages. The search engines on three of the six Hindi sites were unreliable or unusable due to the search terms not providing robust enough samples or no samples at all for the period under examination. However, of the three sites where we could carry out a roughly similar exercise (Zee News/DNA, Amar Ujala and News 18), the searches for 'heatwave' articles in the same period gave a result of 179 articles, of which 12 mentioned a link to climate change or global warming, equivalent to 7%, i.e. one in every fourteen articles. News18 had the highest percentage at 10% of articles, followed by Zee News with 6% and Amar Ujala with 4%. (See Appendix 1 for full details of methods)

It was a similar story for Eenadu, the news site in Telugu. We found 66 articles covering the heatwave in the print version of the paper for April and May, but only two of these made the link to climate change (3%). In Marathi, the Daily Sakal published 77 articles about the 2022 heatwave of which 5 mention the link between climate change or global warming and the heatwave, equivalent to 6%.



2. DESCRIBING THE LINK TO CLIMATE CHANGE

The results of the coding of the 114 articles in the English-language sites show that:

- ☀ A high percentage of articles accurately reported the links between climate change and the heatwaves. 81 of the articles (71%) either presented climate change as making the 2022 heatwave more intense or more frequent, or used a variant of a generic trend statement such as this heatwave is the sort of event which (scientists say) could become more frequent

and/or intense in the future'; or (past trends) 'If we look at heatwaves in the last five years, if we see the trend, it becomes clear that it is because of climate change'; 'Climate change is making these types of events more likely';

- ☀ A relatively small percentage of the articles (22 = 19%) used a direct, binary causation statement such as 'the heatwave was due to climate change.' However, in many cases, these causation statements were often qualified either in the sense that climate change was described as one of the factors causing the heatwaves (along with local weather factors), or with phrases such as 'there is compelling evidence that a significant portion of it is due to human-induced climate change,' or by 'qualified causation' such as in the phrase 'the climate crisis is likely responsible for what is happening.' Examples of the wide variety of phrases in the three categories of 'direct causation,' 'multiple causation' and 'qualified causation' and used in our sample can be seen in Appendix 3.
- ☀ Also, in this context it is worth stressing that nearly two out of every five articles (44 out of 114 = 39%) accurately mentioned other factors explaining the occurrence and/or severity of the heatwave other than climate change such as weather phenomena (e.g. anticyclones over western parts of Rajasthan in March, the absence of rain-bearing 'Western disturbances', solar insolation, hot weather from arid regions, or structural factors such as urbanization, pollution, or evaporation).
- ☀ Over half the articles (58 = 51%) included a description or quote in which the link between the heatwave and climate change was portrayed in a different way, i.e. neither as causation or as the heatwave made more likely or frequent, or as a generic trend statement. These showed a wide variety, such as 'The fingerprints of climate change are all over this disaster,' 'the heatwave is a clear indicator of climate change,' or 'Scientists have linked the early onset of an intense summer to climate change.' Most of these were not as scientifically accurate as they could have been but nor were they inaccurate.
- ☀ In our sample of ten videos, there was a relatively high percentage of direct causality statements (5/10 = 50%) such as 'experts claim that the heat is due to the accumulation of GHGs in the atmosphere,' or variations on the heatwave being 'due to' or 'because of' climate change. However, 7/10 (=70%) of the articles included a generic (trend) statement such as 'the heat-trapping consequences of global warming imply that climate extremes such as heatwaves are expected to rise in frequency,' and a wide variety of descriptions of the link between climate change and the heatwave such as climate change being 'a grim reminder of the climate change impact,' or the heatwave being a 'climate change-led event.' What was missing were specific intensity or frequency statements linked to the 2022 heatwave, due to the absence of the reporting of the two EEA studies.

- ☀ In the Hindi-language sample, a large portion of the articles used a causation statement to describe the link between the heatwave and climate change (18/27 = 67%), a much higher figure than for our English language sample. The overwhelming majority of these were direct binary causation statements such as 'The temperature rise in the country is the result of global warming' or 'Meteorologists believe that the reason for this record-breaking heat is global warming' or 'all this was the result of changes in weather due to human activities i.e. climate change.' However, as with the English-language sample, there were also a limited number of examples of multiple causation, such as 'Global warming is also one of the main reasons for the rise in temperature.' In this context, it is worth stressing that over half of the articles (15/27 = 56%) accurately mentioned other factors behind the heatwave, such as the absence of rain-bearing 'Western disturbances'; or urbanization and pollution.
- ☀ Just over half the sample in Hindi (15/27 = 56%) included what could be interpreted either as a phrase suggesting the 2022 heatwave was more intense or more likely as a result of climate change, or that it was the sort of extreme weather event had become more intense/likely. However, in the wide variety of other phrases used to describe the link, some were accurate (such as 'the heatwave is directly related to climate change'), but others were inaccurate such as 'The effect of climate change is manifested in every extreme event of the weather'⁷, or 'The average global temperature is rising by one degree Celsius every year'⁸.
- ☀ In Marathi, there was only one causality statement in the five articles from the Daily Sakal which mentions the link. This was not inaccurate as it states 'According to experts, rising temperatures are the result of changing natural cycles and global warming'⁹. There is also an accurate statement present in another story that says 'Increasing carbon emissions have increased the number of heat waves and this is likely to be a sign of climate change'¹⁰. In Telugu, there was one article published on 1 May 2022 which suggested that global warming was the main cause of the increase in intensity in heatwaves like that of 2022.



7 See for example, <https://www.jagran.com/delhi/new-delhi-city-ncr-read-expert-view-and-know-why-the-summer-record-of-122-years-was-broken-in-april-jagran-special-22677327.html>

8 <https://www.amarujala.com/photo-gallery/bizarre-news/india-pakistan-heat-wave-warning-know-what-scientist-said-news-in-hindi?pageId=5>

9 <https://www.esakal.com/vidarbha/nagpur/global-warming-has-hit-nagpur-sub-capital-maharashtra-india-kgm00>

10 <https://www.esakal.com/maharashtra/heat-wave-will-hit-india-and-maharashtras-vidarbha-in-coming-4-5-days-imd-india-alerts-hbk87>

3. QUOTING ATTRIBUTION STUDIES

☀️ 21 of the 114 news articles in our English-language sample quoted either the WWA EEA study of 23 May (17) or the Met Office EEA study of 19 May (4), equivalent to nearly one in five (=18%). Five of the six five media outlets covered one or both of them. TNIE covered neither. The Hindustan Times stood out for covering the WWA report in seven different articles, and also discussed attribution studies in another three. Six of these ten articles were written by their chief environment and climate correspondent, Jayashree Nandi.¹¹

☀️ None of the ten videos in our sample included mention of the two EEA studies. An additional search on Google for YouTube videos and the individual sites for the dates of 23 or 24 May (the release of the WWA report) came up with nothing on NDTV, India Today, ABP, TNIE, or Mint. However, we were monitoring mostly short-form videos on YouTube whereas some of the stations' longer-format programmes may have covered the issue. For example, NDTV discussed the link in its "Left, Right and Centre" show on 29 April with IPCC authors Professor Krishna AchutaRao and Professor Navroz Dubash.¹² Dubash was quoted as saying that "extreme weather events are consistent with what science is predicting, what we are seeing now is the first manifestation of climate change – not a future issue, but a here and now issue". Moreover, NDTV covered both the WWA report and the UK Met Office report in its online reporting on 19 and 24 May¹³, as did India Today on 24 May.¹⁴

☀️ **Hindi-language results:** 7 of the 27 articles quoted the Met Office or WWA study, equivalent to 26% of the articles, a higher proportion than that of the English-language sample. It is noteworthy that the Met Office report received coverage in four articles (Amar Ujala, Dainik Jagran, Dainik Bhaskar and News18 one each), compared to the WWA report only getting covered in three articles (Aaj Tak, Dainik Bhaskar and News 18, one each). The Met Office report was quoted accurately, and particularly the statement that the heatwave had become 100 times more likely as a result of climate change. However, in one article in Aaj Tak, the site reported the WWA report inaccurately that 'heatwaves would be 30 times more deadly' rather than the heatwaves being 30 times more likely.¹⁵

¹¹ See for example her article on 24 May, <https://www.hindustantimes.com/india-news/climate-crisis-link-to-march-april-heatwave-101653330186346.html>

¹² <https://www.carbonbrief.org/media-reaction-south-asias-2022-heatwave-and-the-role-of-climate-change/>

¹³ NDTV 19 May <https://www.ndtv.com/world-news/climate-change-making-heatwave-in-india-more-intense-more-frequent-2989331> (Bloomberg); <https://www.ndtv.com/india-news/climate-change-made-indias-2022-heatwave-30-times-more-likely-report-3003122> (AFP)

¹⁴ <https://www.indiatoday.in/environment/story/global-warming-climate-change-india-killer-heatwave-report-1953261-2022-05-24>

¹⁵ <https://www.aajtak.in/science/story/india-pakistan-be-ready-to-face-30-times-more-heat-says-experts-tstr-1469580-2022-05-24>

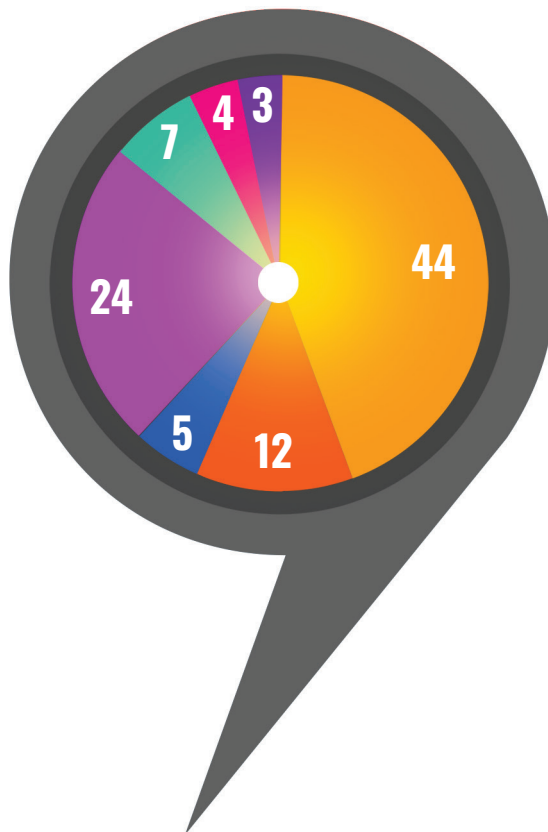
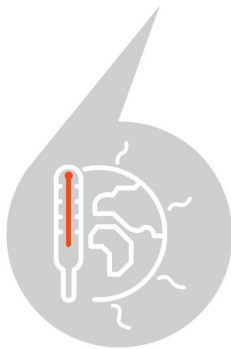
☀️ **Other-language results:** Eenadu in Telugu had one article which reported (mainly accurately) on the results of the Met Office study. Likewise, the Daily Sakal (in Marathi) also reported on the same Met office report, which in general was an accurate representation of the study. However, neither online site reported on the WWA study.

☀️ It is also important to note that our sample in all languages included several quotes from the 2022 IPCC WGII report on impacts, adaptation and vulnerability, and some mentions of other reports by Greenpeace and the IMD. However, these reports were not specifically about the role of climate change in the 2022 heatwave.

**4.
QUOTING
SOURCES**

English-language results

☀️ The articles overwhelmingly quoted scientists or science bodies about the link between the heatwave and climate change, whereas in contrast, NGOs and Indian politicians were rarely present. Figure 5 shows the percentage breakdown for the 114 English-language articles, in which the key statistic is that 85% of sources in direct quotes are scientists or science bodies (either Indian or international), and only 6% NGOs and 5% politicians. 44% of all the quotes were from Indian scientists or meteorologists.



- Indian Scientists/ Meteorologists
- Non-Indian Scientists/ Meteorologists
- Indian Science Bodies
- Non-Indian Science Bodies
- NGOs
- Indian Politicians
- Other

Fig 5:
Sources quoted
by type in English-
language articles (%)

- ☀ It is a similar picture for our video sample. Of the eleven interviewees appearing on screen, all are Indian (unsurprisingly perhaps, due to the difficulty of getting international scientists on screen). 7 of the appearances are of scientists or meteorologists from the IPCC, IMD, IIT (Indian Institute of Technology) or Skymet (one interviewee appears in two different videos), 2 are from the NGO CSE (Centre for Science and Environment), 1 is a climate activist, and 1 is the former head of the Climate Change section of the Department of Science and Technology. So, over 70% are Indian scientists.
- ☀ In our Hindi sample, there are 32 quotes, of which over half (17/32= 53%) are Indian scientists or meteorologists. The second largest category is non-Indian science bodies (namely the UK Met Office and the WWA) - 7 such quotes (=22%), followed by non-Indian scientists (5/32 = 16%), one Indian science or meteorological body (the IMD), and 2 'other' (See Figure 2 in Executive Summary) There are no quotes from Indian politicians, government representatives or NGOs.
- ☀ In our Telugu sample, one scientist is quoted from the Indian regional Met Office, mentioning a link to climate change. No one else is quoted. Similarly, in the Marathi sample, another scientist from a regional Met Office is quoted in one of the five articles, but there are no other quotes.

5. POLITICAL RESPONSIBILITIES

In answer to our third set of research questions about the political dimensions to the coverage, we found that in our English-language sample, there were only four quotes from politicians or government officials, two of them in the Hindu and two in the HT. However, all four of the quotes came not from political parties but from ministers or representatives of Ministries – one from the science minister, one from the secretary at the Ministry of Earth Sciences (and a climate scientist), and two from a former secretary of the Ministry

of Earth Sciences. It is hard to argue that any of them were abnegating responsibility for the need for government action by blaming climate change (or developed countries' responsibility for causing it). As noted above, there were no quotes from politicians or government officials in our Hindi, Telugu and Marathi samples.



“Partly due to La Nina, this temp. difference was absent and so the western disturbances that came to India were weak with hardly any rain”

M. Ravichandran
Secretary, Ministry of Earth Sciences and climate scientist

APRIL 6, 2022

“Global warming [is] to blame.”

Jitendra Singh
Science Minister

HT Hindustan Times

MAY 4, 2022

"My feeling is that the recent heatwave spell in India is a result of climate change."

M Rajeevan
Former Secretary, Ministry of Earth Sciences.

MAY 7, 2022

"With climate change, we are going to see three things with heatwaves: higher intensity; an increase in duration from, say, 5 days to 7-8 days at a stretch; and a larger impact area"

M Rajeevan
Former Secretary,
Ministry of Earth Sciences.

MARCH 16, 2022



"These heatwaves are not usual for Maharashtra during this time. Temperatures are rising because of the global warming."

Dr Akhilesh Gupta
Sr Advisor & Former Head - Climate Change,
Department of Science and Technology

"The most effective way to reduce the negative impacts of a heatwave is to develop a comprehensive response plan that combines individual strategies into an integrated approach, including cultural, institutional, technological, and ecosystem-based adaptations."

Moreover, a former secretary of India's Ministry of Earth Sciences, Dr M Rajeevan Nair, wrote an opinion piece for the HT of 16 May in which he speaks not only about the need for an attribution study ("Unless we do an in-depth attribution study, it is tough to attribute a heatwave event to human influence"), but also eschews any mention of a climate change link reducing government responsibility. On the contrary, he writes:

And adds that

"Due to the efforts taken up by the ministry of earth sciences, a reliable heatwave warning system is now available [...]. In addition, there is a good synergy between the India Meteorological Department, and central and state disaster management authorities, which culminated in the development of heatwave action plans by a few states. However, more collaborative work is needed on heatwave impacts."

6. EMERGENCY RESPONSES, DISASTER PLANNING, VULNERABILITIES

Our sample of 114 English language articles would suggest that the journalists did regularly cover three aspects that affect the impact of the heatwave on ordinary people, namely emergency responses, disaster planning, and vulnerabilities. Nearly two out of every five articles included a discussion of some aspect of the vulnerabilities (45 out of 114 = 39%), while the figures for mentions of the emergency responses (such as activation of heat plans) and disaster planning are 27% and 32% respectively.

Several editorials and opinion pieces discussed the need to address policy responses. As early as 12 April, the HT published an editorial stressing that¹⁶

"[A] robust public health policy response to extreme heat events must include early warning systems, effective outreach strategies to improve community awareness, and tailored measures to reach vulnerable populations...in consultation with local communities"

Also in the HT, an opinion piece on 10 May not only accurately discussed attribution studies, but used them as the context for a 'climate-resilient India' where building public awareness, adequate preparation and implementing local and indigenous solutions should form part of the response.¹⁷ Finally, an opinion piece on 16 May clearly laid out the importance of an integrated policy approach to reducing the impact of the heatwave.¹⁸

Several other quotes from Indian scientists, such as Roxy Matthew Koll from the IITM (Indian Institute of Tropical Meteorology), stressed the importance of not using climate change as an escape for local action, and the need for a range of policies to combat the effect of heatwaves on the vulnerable including effective emergency responses and heat action plans¹⁹. Coverage of the WWA report around 24 May also often cited the report in stressing the importance of heat action plans, such as the quote, "Heat Action Plans that include early warning and early action, awareness raising and behaviour changing messaging, and supportive public services can reduce mortality", found in the coverage by the Mint²⁰, and similar quotes in the HT²¹ and the Hindu²².

16 <https://www.hindustantimes.com/editorials/tackling-extreme-heat-risks-in-india-101649771333914.html>

17 <https://www.hindustantimes.com/opinion/focus-on-indigenous-and-local-solutions-to-deal-with-heatwaves-101652194299006.html>

18 <https://www.hindustantimes.com/opinion/heatwaves-are-the-new-normal-study-the-hazards-101652715793627.html>

19 See for example, <https://www.ndtv.com/india-news/heatwaves-floods-and-heavy-rain-india-battling-climate-change-and-it-is-getting-worse-warn-experts-2980331>

20 <https://www.livemint.com/news/india/climate-change-increases-probability-of-heatwaves-by-a-factor-of-30-wwa-study-11653393237937.html>

21 <https://www.hindustantimes.com/india-news/climate-crisis-link-to-march-april-heatwave-101653330186346.html>

22 <https://frontline.thehindu.com/dispatches/south-asia-climate-change-boosted-heat-wave/article65457089.ece>

Only one video (from Times Now on 16 March²³) mentioned the importance of considering emergency responses, national heat plans and vulnerabilities, but this could be due to the exceptional length of this video (over 12 minutes) compared to an approximate average length of 2-3 minutes. However, in our Hindi sample, there was wide coverage of the three aspects affecting impacts: emergency responses were mentioned in 4 articles (4/27 = 15%), heat plans in 8 (8/27 = 30%) and vulnerabilities in 10 (10/27 = 37%). For example, an article published in Dainik Jagran on 27 April²⁴ quoted Dr Abhiyant Tiwari, programme manager at the Gujarat Institute of Disaster Management, as stressing the need to cut GHG emissions, but also the need “to ensure adaptation measures in our action plans to deal with the heat. Such as public cooling areas, ensuring uninterrupted power supply, availability of safe drinking water and working hours of workers in the most vulnerable category, especially on days of extreme heat.” Dr. Dilip Mavalankar, the Director of the Indian Institute of Public Health in Gandhinagar, was also quoted on highlighting the need for local authorities to publicise warnings via the media about the effects of the heatwave, particularly in March and April, when “people are less adaptable to the heat and are not ready to tolerate the sudden heat.”

However, across our sample, there were also several examples of the coverage stressing the hardship and vulnerabilities of certain sectors like laborers and street sellers without spelling out the need for coordinated policies to reduce the impacts on them from such heatwaves, i.e., making the link more clearly between the heatwave and what affects its impact. It is also the case that there were very few examples in our sample of journalists holding local, regional and national governments to account for the effectiveness of their Heat Action Plans to combat the heat impacts, or their degree of preparedness. This observation is supported by other Indian observers who argue that heatwaves are still covered largely as a weather issue, where much of the content is giving information rather than making authorities accountable.²⁵ However, it may well have been the case that outside our sample period, and our selection of articles to code (i.e. only those where climate change is mentioned), Heat Action Plans and other government responses came under more scrutiny.

7. IMAGE OF HEATWAVES

We were unable to do a full analysis of our samples to ascertain the dominant images in the coverage of the heatwave, because many of the articles were derived from a Factiva search (where only text is available). However, of the first 15 articles in our sample from The Times of India and 15 from the Hindustan Times, not one showed an image in its lead photograph of an individual or group of people ‘having fun in the sun.’ The HT sample consisted mostly of images of people seeking shade, drinking water to cool off, or wearing scarves around their heads; the impacts on agriculture; and people and animals seeking relief. The Times of India sample showed images of the hot sun and a heat haze; people seeking shade, scarves round heads, staying cool indoors, drinking water; burning ground fires and parched earth; and a woman cooking a roti on a car bonnet. The articles in Hindi were also frequently illustrated with images of people seeking ways to cool down (See image below).

²³ <https://www.timesnownews.com/videos/mirror-now/urban-debate/why-is-indias-financial-capital-melting-the-urban-debate-video-90277148>

²⁴ <https://www.jagran.com/delhi/new-delhi-city-ncr-the-month-of-last-march-was-the-hottest-month-during-the-last-122-years-meteorologists-told-the-big-reason-behind-this-jagran-special-22666904.html>

²⁵ See for example, climate activist Disha Ravi, quoted in <https://www.carbonbrief.org/media-reaction-south-asias-2022-heatwave-and-the-role-of-climate-change>

Likewise, in our sample of 10 videos, none showed moving or static images of people having a good time. There were occasional images of children cooling off under a water spout, or people eating ice creams on the street, but these were more suggesting ways that people were seeking respite from the heat, rather than enjoying their time in the sun.

Image used to illustrate story published by Aaj Tak on 24 May 2022



Image Courtesy: AP

These images contrast with an image used to illustrate a BBC News story on 16 May 2022 about the Indian heatwave which originally used pictures of kids playing in the sun, before criticism about the image prompted the BBC to change it to a man cooling himself down with water.²⁶

The predominance of images in the Indian media depicting the harsh impacts of the 2022 heatwave points to the differences between the negative perception of heatwaves in countries where hot weather and heatwaves are more common and the more positive perception in Northern European countries, particularly the UK, where very hot, sun-drenched days are seen by many as a welcome departure from historically mild temperatures.



²⁶ <https://www.bbc.co.uk/news/world-asia-india-61242341>; <https://www.carbonbrief.org/media-reaction-south-asias-2022-heatwave-and-the-role-of-climate-change/>

CONCLUSIONS

There are several limitations to our study. We only included articles falling within the March to May 2022 period. We did not include longer-format television programmes, short-form videos in languages other than English, and social media posts, which may have altered our results. We used Google Translate as a back-up for translating articles from Hindi and Marathi, and despite the coder reliability checks, different coding practices may have reduced the accuracy of some of the results. We also did not code for where the articles appeared either on the news sites or in the newspaper lay out, which may have given an indication of how seriously the different media groups were treating the heatwave compared to other stories at the time. For example, it has been noted that it took some time before some of the major Indian newspapers put the heatwave on the front page²⁷.

Despite these limitations, and in answer to our research questions, our results suggest that in common with journalists in other countries covering extreme weather events, the link to climate change was not made as forcefully as it could have been. Our figure of 14% of articles for the English-language sites is higher than some previous studies of Indian coverage (e.g. 9% of all articles in Hopke (2019)), but still relatively low. Even though caution should be expressed before making too close a comparison with other country results as the methods used were different, it is worth mentioning a recent study of the coverage of the 2019 European heatwaves in France, Germany, the Netherlands and the UK, which suggests a wide range of results depending on the country and the media outlet from 7% (France) to 27% (UK) (Painter et al., 2021). However, the UK figure was inflated by the inclusion of articles from the Guardian, which mentioned the link frequently, often by using phrases, even before the publication of relevant EEA reports, such as 'Scientists have said Europe's 2019 heatwave, like last year's, was closely linked to the climate emergency and that such extreme weather events will be many times more likely over the coming decades.' In this context, it is worth comparing an article in the Guardian of 28 April about the 2022 heatwave in India, which included the phrase 'Heatwaves have killed more than 6,500 people in India since 2010, and scientists say climate change is making them harsher and more frequent across South Asia'²⁸.

A strong case can therefore be made that climate change could have been more fore-fronted in the Indian media coverage, particularly in the early days of the heatwave, even before EEA studies had been carried out. This was certainly the view of some Indian observers, including Manisha Pande from the digital media-monitoring platform NewsLaundry, who argued that – with some exceptions – “sustained focus on climate change is completely missing” from Indian television news channels, whose coverage is largely “driven by events and sensationalised headlines, never any focus on climate change. For heat, it's a weather-related news update and not climate-related.”²⁹ Another Indian commentator, Chetan Bhattacharji, pointed out in a comment piece on NDTV online on 1 May³⁰ that three top newspapers in Delhi led with the power shortage stories, but 'climate change' or any

27 <https://www.carbonbrief.org/media-reaction-south-asias-2022-heatwave-and-the-role-of-climate-change>

28 <https://www.theguardian.com/world/2022/apr/28/extreme-heatwave-in-india-and-pakistan-causes-power-and-water-shortages>

29 See Manisha Pande quoted in Carbon Brief, 4 May 2022, <https://www.carbonbrief.org/media-reaction-south-asias-2022-heatwave-and-the-role-of-climate-change>.

30 <https://www.ndtv.com/blog/why-its-not-just-another-heatwave-just-a-coal-power-crisis-2935977>

similar phrase wasn't mentioned on the front pages of these reports. In other words, there are several examples where the link to climate change is the missing ingredient in the reporting.

On a more positive note, we can see that the coverage in English is very different to, and more accurate than, that found in a previous study of two 2015 extreme weather events in India. There are far fewer binary causality statements, many more trend and attribution statements, more quoting of attribution studies, and widespread quoting of Indian scientists compared to NGOs and politicians. For example, the study of the 2015 events found that EEA studies were only quoted in 6 out of 61 articles (<10%) analysed over a much longer period, compared to our figure of 18% over a period of three months. Perhaps more importantly, in the first study a stand-out result was the high percentage of articles (44%) which included a phrase from politicians, NGO representatives, or others, linking the event to climate change or blaming climate change for the event without quoting any scientific report. Such comments were absent from this study, either in English or other languages.

The coverage in the Hindustan Times stands out for the high number of articles, including a mention of the link to climate change, the accuracy of their descriptions of the link, the frequency of increased intensity or frequency statements, and the quoting of EEA studies on ten different occasions. This may well be related to the fact that many articles in the sample were authored by the paper's climate and environment correspondent.

Our results also suggest some differences between the coverage of English-language and other language news sites in terms of the absolute number of articles mentioning the link to climate change, and the accuracy of some of the reporting about the link. As mentioned above, the average for the number of articles in English mentioning the link to climate change was 14%, and 24% for videos. In contrast, the figures for the articles in Hindi, Telugu and Marathi lay between 3% and 10%. The news articles in other languages also contained many more direct binary causation statements about the link (suggesting inaccurately that climate change was the sole cause of the heatwave). Although the EEA studies were covered, there were occasional inaccuracies in the reporting. It is also worth investigating why the Met Office report featured more than the WWA report in the non-English coverage, and why the latter only appeared in 3 of the 34 articles in Hindi, Telugu and Marathi. The WWA needs to check that its reports are reaching key titles in languages other than English. However, several contextualizing points should be made. Firstly, many of the articles in Hindi, Telugu and Marathi were much shorter than those found in the English language sample. For example, most of the Daily Sakal articles were very short, consisting of only three paragraphs and thus limiting the possibility of including more material on the link to climate change. Most focused on charting the (record) temperature increases, their impacts, and offering advice to citizens. In Eenadu, the majority of articles focused on the specific temperatures of the day, often accompanied by graphics listing the highest recorded temperatures of the day, without much explanation of their causes or their impact on people.

Many of the differences are to be expected given the different resources and training available to reporters in English and reporters in other languages, the absence of specialist correspondents, the different audiences and news styles of these outlets, and the difficulty of translating or transliterating scientific or quasi-technical terms into Hindi or other languages. For example, the Hindi press uses terms such as 'global warming' or 'decarbonization' in Hindi or Devanagari script, without translating it into local languages or idioms, which may limit how people make sense of the terms. Often the terms 'Climate Change' and 'Global Warming' appear in headlines in English in the Hindi language sites (see image below). This last issue is important for public awareness or understanding as it is likely to limit the role of the regional media in helping their readers understand the concept of global warming and how to engage with the issue.

Headline from article in Aaj Tak, 24 May 2022.

The screenshot shows the Aaj Tak website interface. At the top, there is a navigation bar with the Aaj Tak logo and menu items: Home, Waqna, Bharat, Manoranjana, Bijnais, Khel, Dharm, Ladfstail, and Web Store. Below the navigation bar, there is a section for Hindi News and a Feedback button. The main headline reads: "Climate Change: भारत-पाकिस्तान को करना होगा आफत का सामना, 30 गुना ज्यादा घातक होंगी हीटवेव्स". Below the headline, there is a sub-headline: "भीषण गर्मी की मार झेल रहे भारत और पाकिस्तान के लिए बुरी खबर है. वैज्ञानिकों ने चेतावनी दी है कि वैश्विक तापमान ऐसे ही बढ़ता रहा, तो आने वाले समय में और ज्यादा गर्मी झेलनी पड़ सकती है." Below the sub-headline, there is an advertisement for a dog product with the text "PROTECT EVERY SINGLE MOMENT AGAINST TICKS AND FLEAS" and a "Learn more" button. Below the advertisement, there is a small box labeled "3rd party ad content". At the bottom of the screenshot, there is a photograph of a hand holding a red water bottle, pouring water.

It may well be the case that there are parallels with the differences in reporting climate change and other environmental issues between English-language and Urdu-language newspapers in Pakistan, where mass circulation Urdu-language newspapers tend to under-report climate change or ignore it completely, prefer more sensationalist news stories, and lack reporters well-versed and trained in climate issues (Qusien and Robbins, 2023).

Finally, we have noted the presence of several articles, particularly opinion pieces, discussing the need for coordinated planning and responses, but the virtual absence of articles in our sample holding local, regional or national authorities to account for their emergency responses or the effectiveness of their Heat Action Plans. In this we agree with the critique of the Indian media for focusing too much on the story as a weather issue, a record-breaking phenomenon, the impact on vulnerable sectors, and at times a climate-change related issue, but not enough on the actions and planning by governments to prepare for, and mitigate, the impacts. The essential challenge for journalists is to ensure that all aspects of the heatwave story, and particularly the link to climate change, advice to ordinary citizens, and the government efforts to mitigate the impacts, are given as much weight as the more 'sensationalist' aspect such as the record temperatures being broken or rotis being cooked on the bonnet of a car.

RECOMMENDATIONS

Although several training programmes and events have already been carried out for Indian journalists covering extreme weather events, we suggest that these are targeted at those general reporters covering heatwaves in regional media outlets. These should aim to give such journalists more exposure to EEA science, scientists and meteorologists.

In particular, training should include a focus on including the link to climate change in stories about heatwaves more frequently, what can be said accurately in the absence of EEA studies, and how to get access to the latest EEA studies. Ideally, journalists should also ask Indian scientists or authors of EEA studies about the limitations and methodology of their research, and try to determine the level of confidence in their results.

Climate scientists say that it is advisable to stay clear of any suggestion that climate change directly causes any extreme weather event in a binary sense (there are multiple causes); instead, it creates the conditions in which an extreme weather event is more/less severe, or more/less likely to occur.³¹

It is also important to stress that the link between climate change and individual events is just one aspect of the heatwave 'story': Record-breaking temperatures, what individuals should do, and the widespread impacts are also important dimensions. Crucially, journalists should pay equal attention to whether there are good local or national government policies in place to reduce vulnerabilities and impacts, and whether these are being effectively put into practice.

NGOs working in this area should help to identify obstacles to more complete reporting of heatwaves, particularly for regional non-English language reporters, such as lack of time for field reporting (about impacts), lack of training in climate science, lack of access to experts and local sources, or lack of time or space in their news outlets. They should also ensure that the online resources offering guidelines for reporters covering extreme weather events are available in all the main languages spoken in India. A country-specific online resource would be also be a useful addition.

Outreach work would also be useful with other sectors operating in this field, such as regional/national authorities/NGOs working on disaster risk reduction and responses, and climate scientists working at the IMD and other science institutions; this could aid communication efforts (with the media) by stressing the links to climate change and the multiple dimensions to the heatwave story.

³¹ https://www.worldweatherattribution.org/wp-content/uploads/ENG_WWA-Reporting-extreme-weather-and-climate-change.pdf, p. 4.

APPENDIX

APPENDIX 1 METHODS

ENGLISH LANGUAGE ONLINE SITES

1. We based our selection of English-language media outlets on the RISJ DNR 2022, p. 135³². We chose the titles appearing in the list of most read news sites, and used the Factiva search engine to give results for those covering the link between the heatwave and climate change/global warming to a significant degree.

We used the search terms '(heat AND wave) OR heatwave', and then 'heatwave' OR 'heat wave' AND 'climate change' OR 'global warming', for the period 1 March 2022 to 31 May 2022.

The results showed that Times of India, the Hindustan Times (HT), the Hindu, the New Indian Express (TNIE) covered the heatwaves extensively, as did Mint. However, from the RISJ list, using Factiva, NDTV online, India.com, New18, India Today, Republic TV online and DD News registered 2 or less articles for the full search terms and were therefore left out. However, as NDTV is a well-known and well-used website and channel, we then searched on NDTV's own website (www.ndtv.com) using the same search terms and period.

2. We then complemented these results with a Google site search for the initial five titles to make sure we included all relevant articles (e.g. search terms 'heatwave' AND 'climate change' OR 'global warming' site:hindustantimes.com) and a newspaper's own search engine on its site. The aim was to catch the maximum number of articles for each media title.

Our initial search gave us a total of 162 articles where climate change or global warming was mentioned: Times of India - 50 articles from Factiva; 2 from Google search; HT - 48, all from Factiva; Hindu - mixture of Factiva and Google site search, total of 22 articles; Live Mint - 14 from Factiva and 5 from Google search = 19; TNIE - 7 from Factiva and 5 from Google search = 12. NDTV - 12 from their own site search engine.

3. Filtering or 'culling' criteria: we took out all those articles which were repeats or letters and where i) the only mention of climate change was in the titles of quoted experts (e.g. 'Mahesh Palawat, vice-president (meteorology and climate change), Skymet Weather Services...'; ii) there was no reference to the specific case of the Indian heatwaves of 2022 (e.g. where the article was about the Antarctic), iii) where heatwaves in general in India were only being discussed (e.g. in IPCC reports), and iv) repeats. Opinion pieces were included, but not letters to the editor.

This gave us a total of 114 articles to code, broken down into Hindustan Times (40), Times of India (27), Mint (19), the Hindu (12), NDTV (9) and TNIE (7).

4. Finally, we used the search terms 'Heatwave' OR 'Heat AND wave' to get a sense of the total number of articles in our five titles which covered the heatwave. Using Factiva, this gave us a total of 1,762 articles for the mention of the search terms anywhere in the article, and 1,175 for a mention

32 <https://reutersinstitute.politics.ox.ac.uk/digital-news-report/2022>

of the search terms in the headline or opening paragraph. Using the results for the number of articles which mention the link to climate change, we could then work out the percentages of how many of these mentioned any link to climate change or global warming (see Results, section 1).

VIDEO SELECTION

The website YouTube Data Tools (https://tools.digitalmethods.net/netvizz/youtube/mod_videos_list.php) was used to retrieve lists of the 300 most relevant YouTube videos during the same period as the online articles according to the search terms 'India' and 'heatwave'. Most of these were in English, but some were in Hindi and regional languages. The tool also gives data on the number of views for each video. These varied from hundreds of thousands to less than one hundred.

We made an initial selection of those media outlets featured in the news online article selection in English, i.e. the Times of India group, HT, the Hindu, Mint, NDTV and the New Indian Express. The Times Group (ET, Mirror Now and Times Now) had several videos in the list (17), NDTV (in English) had 11, but Mint and NIE only had one and two respectively, and HT and the Hindu none. So we decided to include India Today (part of the Aaj Tak group) as a major broadcast player. This added another 10 videos to the sample. This gave us an initial sample of 41 videos, which were then processed to select only those mentioning a link to climate change. After culling these were reduced to 10 videos to code. We included in the coding not just the content of the video, but for the text appearing underneath the video, or in the strapline.

HINDI LANGUAGE ARTICLES

Four titles were initially included, namely Amar Ujala, Dainik Jagran, Dainik Bhaskar, and Aaj Tak. The first three appear high up the list of the 2023 Audit Bureau of Circulation's highly circulated newspapers³³, whilst Aaj Tak is one of the most watched Hindi television channels, with a widely read news site. Traditional search engines such as Factiva or Lexis-Nexis do not include Hindi language titles, so we first tested whether the sites' own search engines were usable. This did not prove viable for many of the sites (Aaj Tak, Dainik Jagran, Dainik Bhaskar), so using the search terms 'heatwave' and 'climate change or global warming' (first in English then using Google translate for the terms), we relied on Google search, then linked through to other articles mentioned in the initial search results, often found in other sections of the site such as Science. This gave us an initial total of 23 articles for the same period as in the selection of articles in English.

After culling those articles not directly talking about the 2022 heatwave, we were left with 16 articles. Given the small number of articles, we decided to include more Hindi media outlets taken from the RISJ DNR 2022 report³⁴, namely News18 and ZeeNews/DNA/India.com, and again to use Google search, backed up by searches, where possible, on the outlets' main websites. After culling, this gave us a total of 27 articles, divided into Dainik Bhaskar (7), Dainik Jagran (7), News18 (4), Aaj Tak (3), Zee News/DNA (3) and Amar Ujala (3).

For the results in Section 1, for Zee News/DNA (<https://www.dnaindia.com/hindi/>), we used the search terms 'heatwave 2022' on the website <https://www.dnaindia.com/hindi/>, and used the first ten pages of results to identify 69 relevant articles in the period March to May 2022; we then used the search terms 'climate change' or 'global warming' which gave no relevant results - but a separate search using Google in Hindi came up with four articles; $4/69 = 6\%$.

³³ [http://www.auditbureau.org/files/JD%202022%20Highest%20Circulated%20\(across%20languages\).pdf](http://www.auditbureau.org/files/JD%202022%20Highest%20Circulated%20(across%20languages).pdf)

³⁴ https://reutersinstitute.politics.ox.ac.uk/sites/default/files/2022-06/Digital_News-Report_2022.pdf, p. 134

We used a similar method for Amar Ujala, <https://www.amarujala.com/>, which 62 results for search term 'heatwave 2022' from March to May 2022 inclusive; 2 from search on own site, 1 from Kartiki via Google search, for relevant results for climate change; $3/62 = 5\%$.

And for News 18, <https://hindi.news18.com/>: heatwave 2022 search term for March to May 2022 gave 48 positive results on first ten pages of results (about 120 articles); search term 'climate change 2022' gives 5 relevant results for same period, 'global warming 2022' gives no relevant results. $5/48 = 10\%$.

TELUGU LANGUAGE ARTICLES

The website search using the same search terms and the same period for Eenadu (<https://www.eenadu.net/>) resulted in only a few articles. So a physical search of the newspapers was conducted in a university library. The newspaper archives were available only for the months of April and May 2022. We found 66 news articles on heatwaves, out of which only 2 articles reported heatwaves with reference to climate change, which were coded for analysis.

MARATHI LANGUAGE ARTICLES

We used the website of the Daily Sakal, namely <https://www.esakal.com/>, and its search engine. The Google translator Marathi to English was then applied. The search terms 'heat and wave' were then entered, which gave over 2,000 results. We examined the first 30 pages of results (i.e. 600 articles) and selected the articles which focused on the heatwave for March to May 2022. (Not possible to enter dates or Boolean operating words such as AND or OR). We then entered the search term 'Climate Change' which gave over 3,000 results. We examined the first 500 articles, and selected the ones which were relevant to the 2022 heatwave. We then entered the search term 'Global Warming' which also gave over 19,000 results. Again, we examined the first 500 articles for those relevant to the 2022 heatwave. We then consolidated the results into one Excel sheet, organized by date. We did not include videos. 77 articles were about the heatwave, of which 10 mentioned a link to climate change or global warming in general, which were culled to 5 after omitting those not discussing the link between climate change and the 2022 heatwave.

CODER RELIABILITY

The articles in English were coded by JP and VB. 5 articles were used to check coder reliability, with results entered into the website <http://dfreelon.org/recal/recal2.php>. Of the 27 variables in the coding sheet, 21 showed 100% agreement between the two coders. The six other variables (v5, v6, v10, v13, v20 and v21) showed a score of between 0.571 and 0.64 according to Krippendorff's Alpha (equivalent to one example of a mismatch in the coding i.e. 80% agreement). These six variables were further discussed and discrepancies ironed out.

Hindi language coding was carried out by JP, JT and KN. 5 articles were used initially to check coder reliability, with results entered into the website <http://dfreelon.org/recal/recal3.php>. Article 1 showed a score of 0.855 according to Krippendorff's Alpha; Article 2 – 0.575; Article 3 – 0.859; Article 4 – 0.896; Article 5 – 0.858. Any score over 0.8 is considered satisfactory. On further examination, the major discrepancy with the coding of Article 2 was the lack of precision as to whether all quotes found in an article should be coded or just those referring to the link between the heatwave and climate change

(v17, v18, v19, v20, v21, v22, and v23). This was discussed and the code book clarified, so that only the latter was included. A further five articles were then coded, and there was 100% agreement between the three coders for the coding of these seven variables in four of the articles and 81% agreement for the fifth. This was considered a satisfactory percentage score.

Marathi language coding: VB and JP coded all five articles. There was only disagreement in one story for v3di whether this was present or not. This was discussed and agreement reached. Telugu language coding: a single coder (JT) was used for the two articles. Video coding in English: A single coder (JP) was used.

APPENDIX 2 CODEBOOK – THE 2022 INDIAN HEATWAVES

Introduction: This project is interested in the media coverage of the 2022 heatwaves and the link to human-induced climate change or global warming. There were intense heatwave spells from March 11 to 19, March 27 to April 12, April 17 to 19, April 23- May 2, May 7-16 and May 19-21, according to the India Meteorological Department (IMD). March was declared the hottest in 122 years since the weather bureau started maintaining records.

The heatwaves attracted a considerable amount of general coverage in the media at the time, in part because of the widespread impacts, but also due to the rarity of the event – the large area that was affected, the unusually long duration and the early onset in spring.

We are only interested in coding those articles where there is a mention of any link between climate change (cc) or anthropogenic global warming (AGW). Sometimes the possible link to human-induced cc or AGW is left implied. If the implication is strong, please code accordingly. If you think the link is too weak, don't code. If in doubt, consult.

Codes: If not stated otherwise, the codes are 0 for not mentioned and 1 for mentioned. Enter the code in that variable's cell. Please do not leave any cells empty. If something is not mentioned, there should be a 0 in that cell.

FORMAL VARIABLES

- a. Coding unit: Give the article a unique number. E.g. your first coded article becomes the number 101, the second 102, 103 etc.
- b. Coder 1: James; Coder 2: JT; Coder 3 etc.
- c. News organization e.g. Times of India, Hindustan Times, etc.
- d. Day XX
- e. Month XX (numerically)
- f. Year XXXX
- g. Title: Copy the title of the article to avoid typos.
- h. Author: *Copy the name of the author or agency (e.g. Reuters).*
- i. Type of article: 1 Straight report/reportage/feature; 2 Opinion (editorials, columns or blogs); 3. News ticker/live blog/newsletter 4. Other (e.g. video)
- j. Which section of news outlet: 1. National news; 2. International news; 3. City news; 4 Other; 5 not known (*if unclear, code as 5*)

SECTION A

Strength of link to climate change

1. Are the following aspects of the 2022 heatwaves mentioned in at least one sentence of the article?
Multiple aspects possible.
 - 1a. (Record-breaking) temperatures, warnings of high temperatures, forecasts Yes 1, No 0
 - 1b. Impacts (on people, economy, energy needs, water security, wheat crop, schools, environment, animals) Yes 1, No 0
 - 1c. Government responses at local, regional or national level Yes 1, No 0
 - 1d. Personal advice in dealing with heatwave, such as 'stay out of the heat' Yes 1, No 0
 - 1e. Explicit link to climate change (or related terms/concepts such as global warming, climate crisis, climate emergency, greenhouse gas emissions)? Yes 1, No 0

If answer to 1e is No (0), stop coding the article.

SECTION B

2. Extent of link made between the heatwaves and climate change

- 2a. How much does the article focus on any link between human-induced climate change or global warming and the specific heatwave, or Indian heatwaves in general? Headings and subheadings should be counted as a sentence.

Code as 1, 2 or 3:

- 1 Just mentioned (no more than one sentence)
 - 2 Significant mention (2 – 5 sentences)
 - 3 Major focus (more than 5 sentences)
- 2b. Is there a statement in the headline or the first paragraph explicitly or strongly implicitly making the link with climate change?

Yes 1, No 0

Example: 'Climate change: Heatwave made up to 3C hotter by warming'

SECTION C

Framing of link

3. When the link between the 2022 heatwave and climate change is present, is it framed in terms of direct causality, altered likelihood or intensity, indicative of a trend, or other phrases?
 - 3a. **Direct causality:** some variation of climate change (partly) causing the heatwave: This could include phrase such as 'cc was a factor in the heatwave', 'cc is to blame for the heatwave', or 'the heatwave happened because of climate change', 'the heatwave is due to/owing to/the result of cc', 'the heatwave is all but impossible without the heatwave', 'the only reason for the heatwave is cc.'

Examples: 'Professor John Smith said the scientific evidence robustly points to the current heatwave being caused by human induced climate change.'

'This heatwave spell wouldn't have been possible without the human-induced climate crisis'

Yes 1, No 0

Please add the phrase describing the causality in the cell under the cell you have marked as Yes (1).

3b. Likelihood:

A likelihood statement, referring to the 2022 heatwave, such as 'the 2022 heatwave was made 30 times more likely as a result of climate change or global warming'

Examples: 'Dr Mariam Zachariah, Research Associate at the Grantham Institute, Imperial College London, said, "The recent high temperatures in India were made more likely by climate change" (Times of India)

Yes 1, No 0

3c. Intensity or Severity:

An intensity or severity statement such as 'the heatwave was made ten times more intense as a result of climate change'

Yes 1, No 0

Other statements making link to climate change

- 3di. A generic, long term phrase referring to trends (where the 2022 heatwave is mentioned in the context of a trend, either future or past). This variable is different to 3b in that 3b refers specifically to the 2022 heatwave made x times more likely, as opposed to 'this sort of event becoming more likely.'

Examples: 'this heatwave is the sort of event which (scientists say) could become more frequent and/or intense in the future'; or (past trends) 'If we look at heatwaves in the last five years, if we see the trend, it becomes clear that it is because of climate change'; 'Climate change is making these types of events more likely';

Yes 1, No 0

Examples from sample: 'It is well-known that global warming is sparking extreme temperature events, such as heatwaves, across the world' (Hindustan Times); 'One of the major projections of the recent IPCC sixth assessment report is that heat waves are going to rise' (H Times); "'If you are looking for the clearest signal of climate change in India, then heat waves are a classic example. They are unavoidable and will occur more frequently," Mishra said. (LiveMint) 'It is premature to attribute the extreme heat in India and Pakistan solely to climate change. However, it is consistent with what we expect in a changing climate.' The Hindu.

- 3dii. Other more general phrases such as the 2022 heatwave being proof of/evidence for/indicator of/consistent with climate change or 'climate change is playing a role in the heatwave', 'cc linked to the heatwave'

Yes 1, No 0

Examples: 'In yet another reminder of the expanding and deepening footprint of the climate crisis, India is facing a nationwide surge in heatwaves' Times of India

'This unusual heatwave, coming earlier than usual in the year, has been linked to the climate crisis'

'India is bearing the brunt of what is said to be the impact of global warming'

SECTION D

Mention of science papers or studies, or scientists or NGOs linked to those papers/studies

4a. Was any attribution, cause, or description about the event implicitly or explicitly based on an academic, scientific or NGO study?

Yes or No

If yes, was it:

4b. Report by UK Met Office released on 18 May 2022

<https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2022/southern-asian-heatwave-attribution-study-2022> Yes or No

4c. Report by World Weather Attribution released on 23 May 2022

<https://www.worldweatherattribution.org/climate-change-made-devastating-early-heat-in-india-and-pakistan-30-times-more-likely/> Yes or No

4d. Greenpeace report on 17 May 2022

<https://www.greenpeace.org/static/planet4-india-stateless/2022/05/d8525fe4-india-heatwave-trends-report-final.pdf> Yes or No

4e. Other

Yes or No

SECTION E

Source for quote about link

5. Did the article include a direct quote from a report, scientist, NGO spokesperson or politician or an indirect quote clearly linked to any of the above, which mentions either the possible link between the 2022 heatwave and human-induced climate change, or any other possible cause of the event (not the damage or impact from the event)?

NB If the same source is quoted twice or more, just code the first time.

5a. Yes or No; If yes, please write name of first three quoted in the following columns (AB, AC, AD), followed by 5b: (1) individual scientist, (2) academic and scientific institutions and bodies, (3) politician, (4) other

SECTION F

Other Factors

Does the article mention factors beyond climate change that influence heatwave impacts, such as effective emergency responses, effective disaster preparation/planning, and community vulnerabilities and exposure?

- 6a. Emergency responses Yes or No
 - 6b. Disaster planning (including heat action plans) Yes or No
 - 6c. Vulnerabilities Yes or No
7. Does the article include a statement outlining possible contributing factors to the occurrence/severity of the heatwave other than climate change such as weather phenomena (e.g. anticyclones over western parts of Rajasthan in March, the absence of rain-bearing 'Western disturbances', solar insolation, or hot weather from arid regions) or structural factors (e.g. urbanization, pollution, evaporation)

(Yes 1 No 0)

APPENDIX 3 EXAMPLES OF CAUSATION STATEMENTS

(All quotes taken from the English-language sample)

1. Direct causation (climate change or global warming the sole cause)

Temperatures are rising because of global warming

Why is it exceptionally warm this year? The only reason is global warming

Jitendra Singh said "global warming" was to blame

The root cause for increase in such events in the India-Pakistan region is global warming due to human-made carbon emissions.

Adverse weather events like increased temperatures due to the effects of climate change can ...

As India faces a mayhem in terms of climate and weather, owing to pollution and climate change,....

2. Multiple Causation (climate change/global warming as one of the causes)

Mumbai faces extreme heat conditions due to global warming and urbanization

The heatwave is happening because of the Western Disturbance and global warming

"Change is natural, but this can also be a result of global warming," said Mohammad Hussain Mir, meteorologist at Srinagar centre of IMD

Overall global warming is also one of the main reasons

There is compelling evidence that a significant portion of it is due to human-induced climate change

India's warming is the result not only of local factors but also global warming

Change is natural, but this can also be a result of global warming

More than one scientific authority along with several scientists have suggested that this heatwave spell wouldn't have been possible without the human-induced climate crisis

3. Qualified causation

The climate crisis is likely responsible for what is happening

That's probably due to climate change

Whether the March-April extreme heatwave spell in India happened solely because of the climate crisis is now an obsolete question because most extreme heatwave events globally are to a large extent because of the climate crisis

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