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LETTER

What's not trending on Weibo: China's missing climate change discourse

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Abstract

Given the central role of People's Republic of China (PRC) in the global climate crisis, discussion and analysis of Chinese actions and pledges on decarbonization abound. However, less examined are the popular 'demand' side of climate change politics inside of China. Our article explores a new set of data to gauge public discourse in China related to climate change by looking at trending topics on the prominent social media platform, Sina Weibo. In over 348,000 trending topics on Weibo from June 2017 to February 2021, we find only 336 unique topics, that is 0.12%, related to climate change. Even in the rare occasions when climate-related topics start trending, we find a general lack of substantive engagement in Weibo posts.

Introduction

Climate change represents a massive threat to people, firms, countries, and the international order. Playing a central role in the climate crisis is the People's Republic of China (PRC), which became the world's largest carbon emitter fifteen years ago. In 2020, China emitted roughly 30 percent of all global emissions. Given these well-known facts, the politics of climate change in China holds a critical place in understanding its global shape.

Discussion and analysis of Chinese actions and pledges on decarbonization abound.[3] China's own media discusses climate change and government actions, albeit focusing on the international prestige that China earns from its pledges to action and the economic opportunities afforded by a green transition and only rarely providing deep explorations of the expected costs of continued climatic shifts or connecting particular events to the broader phenomenon of climate change (Downie and Wallace 2021).

However, less examined are the popular 'demand' side of climate change politics inside of China. For instance, urban air pollution became a major focus of attention in the early 2010s in China as cities like Beijing suffered from 'crazy bad' particulate density, leading to fury online.[4] These outbursts quickly were followed by increased government action and attention to urban air pollution issues.[5] Surveys suggest that Chinese citizens believe in the reality of climate change, but there is little work exploring attitudes in depth, let alone connecting them to words or actions. Is there evidence of popular demands for climate action on Chinese social media?

In this paper we explore climate change discourse in China through the lens of Weibo, particularly its trending topics which account for a plurality of the site's traffic. In over 348,000 trending topics on Weibo from June 2017 to February 2021, we find only 336 unique topics, that is 0.12%, related to climate change. This paucity of topics shows only tenuous connections to major climate events–weather-related disasters either in China or abroad or international meetings. To be sure, the lack of climate trending topics does not suggest a

[3] See, for instance, Lewis 2012, Nahm 2021, Davidson 2021.
[4] Wallace 2022.
[5] Wallace 2022.

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complete absence of discussion of climate on Chinese social media, just that it rarely draws attention of the scale to signify popular demand for action. In the rest of the paper, we explore these patterns and attempt to interpret the absence of prominent climate change discourse on this major platform.

Context

China's status as a carbon goliath is well-established. Globally, China represents 33% of CO2 emissions from energy and is essentially the only place in the world still constructing new coal plants.[6] Yet to characterize China's position vis-a-vis climate change solely by its massive emissions misses out on its dominance in many of the key components of a clean energy transition, particularly in renewable energy and electric vehicles. Over 90% of wafers, a key link in the solar photovoltaics (PV) supply chain, are manufactured in China.[7] The country has subsidized production and deployment of renewable energy, deployed more solar and more wind than the rest of the world in 2020, accounted for over 40% of global electrified transport investment in 2021.[8]

Beyond this context, the Chinese government has made a series of pledges in its Nationally Determined Contributions related to its carbon emissions, most notably to peak emissions before 2030 and achieve carbon neutrality before 2060. Given its large share of global emissions, this 2060 pledge is seen as crucial for the fight to keep warming in check.[9] However, the 2030 pledge, while perhaps better than nothing, is viewed dubiously and perhaps even negatively colors the 2060 pledge as it suggests that delays will rule the day for another near decade. The regime's navigation of its decarbonization has been analyzed principally through the political economy lens, looking at electricity and industrial production, construction, and other energy intensive industries, the employment in those sectors, and the difficulties of smooth reallocation to a cleaner development model. That is, the actors involved are taken to be the government, often separated into central and local or sectoral players, major corporations in competing sectors (often but not always state-owned), and perhaps workers as a class.

Comparatively little attention has been spent on considerations of popular attitudes towards and discussion of climate change in China. The first decade of the 2000s saw Chinese citizens and civil society protest particular projects for environmental reasons, such as dams (Mertha 2009). At the beginning of the 21st Century, Chinese people used online fora to complain about pollution and seek assistance, including in a famous case where 'a torts lawsuit filed by 1721 villagers in Nanping County in Fujian against a chemical plant' (Lei 2017, p. 141).[10] Yet, like most protests inside China, the issues being objected to were particular and local in their scope rather than systemic and national (or global).[11] So environmental organizations that likely were concerned about climate change kept most of their advocacy efforts pointed at local issues (Dai and Spires 2018, p. 63).

Importantly, online discussion of urban particulate pollution seems to have been a major contributor to the government's war on pollution. In 2008, the US Embassy in Beijing collected data on particulate matter and published it hourly on twitter with its @BeijingAir account.[12] In the fall of 2011, the air quality in Beijing was twenty times the World Health Organization's guideline level, exceeding 500, while the city's official reported statistics stated only that the air was 'slightly polluted.' The pollution, and the discrepancy, led noted real estate developer Pan Shiyi to post multiple calls for the Chinese government to monitor PM2.5 rather than just PM10 (larger particles) to his over sixteen million followers on Weibo. One poll that he posted saw over 90% of 40,000 respondents agreed with this recommendation. Only days later, Wen Jiabao, then China's Premier, acknowledged that the government needed to improve its environmental monitoring and bring its results closer to people's perceptions.[13] New standards on air pollution further restricting sulfur dioxide and nitrous oxides and adding PM2.5 were put into place in February 2012, with publicly reported stations in dozens of cities by the end of that year.[14] Shortly thereafter, Wen's successor, Premier Li Keqiang declared a 'war on pollution,' and air quality has improved dramatically in the half-decade since.[15]

Media attention to climate change has been focused on the pledges themselves and the international prestige that they have accrued for China rather than the changes in the society or economy that they likely entail.[16] Comfort *et al* 2020 find, perhaps unsurprisingly, that government voices tend to dominate in Chinese media presentations of climate change. While major weather events that climate change makes more likely are

[6] IEA 2022, CREA 2022.
[7] BloombergNEF/CSIS 2021.
[8] IRENA 2021, BloombergNEF 2022.
[9] e.g. Tooze 2020.
[10] See also Stern 2011.
[11] O'Brien and Li 2006, Lorentzen 2013.
[12] Demick 2011, Wallace 2022.
[13] CCICED 2012, Oliver 2014.
[14] Oliver 2014, p. 61.
[15] Greenstone *et al* 2021. For more on the details of the expanded information, see Barwick et al 2019.
[16] Downie and Wallace 2021.

increasingly covered in the United States and Europe with a climate change lens, in China, this perspective is less evident.[17]

China's public sphere has tightened significantly in the past decade, with crackdowns on feminists, labor activists, and lawyers as well as the carceralization of Xinjiang. Individuals with large online following (colloquially referred to as 'big Vs' for their verified status) also were pressured and controlled.[18]

While surveys too have become harder to conduct with the tightening ideological controls of the Xi administration, data exists on public perceptions related to climate change. A decade ago, the presence of skepticism about climate change to the point that it could be considered akin to 'denialism' was evident in China (Liu 2015). However, the past half-decade has seen this nascent rejection of the scientific realities of climate change has evaporated (Dembicki 2017), although remnants of ultranationalists reject some climate change messaging as attempts by the West to 'quash China' (Liu and Kan 2021). Wang and Zhou (2020) review national surveys and find high levels of awareness and stated willingness to act on climate change. The World Values Survey found more than two-thirds of Chinese respondents prioritized protecting the environment over economic growth.[19] A 2020 survey of Chinese university students found climate change as the most serious issue facing the world (Jiang 2020).

Prior work has examined climate change discourse on Weibo. Liu and Zhao (2017) described patterns of posting surrounding the 2015 Paris climate summit and found that while the topic exists, there is little engagement and what is posted tends to focus on international issues. They also find some evidence of the 'climate change is an attempt by the west to keep China down' narrative (p. 421), but a main takeaway is that the discourse treats climate change as something with 'little connection to China's national context' (p. 413). A study looking at social media use during a major rainstorm that hit Wuhan in 2016 found no evidence of climate change among the various topics discussed (Fang *et al* 2019).

Research design

To examine this aspect of China's climate change discourse, we assembled a dataset of all hashtags that have trended on Weibo— a prominent social media platform in China, with around 200 million daily active users in the time period we analyze.[20] We then use three groups of keywords to filter out hashtags related to climate change.[21] We then implemented a conservative strategy of manually dropping irrelevant topics from the search results, while also adding additional topics based on a manual search of all trending hashtags.[22] Our search yields a total of 403 trending hashtags related to climate change out of 348,580 trending hashtags from 2017/6/1 to 2021/2/22.[23] In a minority of cases, one hashtag would trend for more than one day.[24] We then manually entered the current (2022/3/18) discussion data (views and posts) from Weibo for each trending hashtag when available.

Out of the 336 unique climate change hashtags, we further collected 38875 individual posts under a sample of 95 unique hashtags. Weibo has imposed a limitation on the number of posts users could access for each search: only 50 pages of results may be displayed and additional results are not available. In order to best capture the trending moment, which is when the topics are most likely to be influential, we have restricted our post-scraping to posts that are posted within a 72-hour-timeframe of the hashtag's trending.[25] Using Octopus Scraper (see description in the appendix), we designed a simple procedure to scrape a post's content, poster name and Weibo id, poster's Weibo status (verified, vip, unverified, etc), data and time posted, type of device used to make the post, and reactions towards the post (retweet, like, and comment).[26]

[17] e.g. Burger *et al* 2020, Cho 2021.

[18] See, for instance, Svensson 2014.

[19] Q111.- Protecting environment vs. Economic growth. See Haerpfer *et al* 2020. This is also consistent with Wang *et al* 2017, which provided survey evidence of six broad aspects of public awareness of climate change beliefs.

[20] Trending hashtags are defined as having appeared on Weibo's complete trending hashtag list which includes 50 topics for at least 10 min, through the EnlightentData service. Shortly thereafter, Enlightent Data shut down their service, limiting our access to subsequent trending hashtag data.Weibo user data is obtained from https://statista.com/statistics/1058070/china-sina-weibo-dau/

[21] The first list of keywords include variations of Chinese translations for the phrase 'climate change;' the second list is from a BBC report on climate-change-related keywords; and the third list is created based on substantive knowledge. For full coding rules, see appendix A2.

[22] Manual coding is done based on the content of the hashtag itself, rather than the content of posts that include the hashtag. Namely, if a hashtag is labeled 'climate change is a hoax,' it will be included in our dataset, regardless of how many posts under this hashtag are actually discussing climate change. Conversely, a hashtag that says 'rice dumplings are tasty' will not be included in the dataset, even if there are posts discussing climate change using this hashtag. Replication files are available upon request.

[23] There are a few days when Weibo trending list function was shut down for upgrade/improvement per government regulation.

[24] There are 67 instances of repeated hashtags. Repetitions are counted as separate data points.

[25] That is, posts from the day before, day of, and day after the hashtag trended. The scraping was done over the summer of 2021 (from June 2021 to August 2021), so some posts may have been deleted by users or the platform by the time we scraped the data.

[26] Our scraping method was limited to textual data, so pictures and videos are omitted from our dataset.



Figure 1. Trending Topics Screenshot.

Trending topics provide a critical resource to examine what is happening on social media platforms like Weibo. The design of Weibo's trending hashtag list is very similar to that of other prominent social media platforms inside and outside China. Trending hashtag list is a list of topics that are the most popular on the platform at the moment. A partial list with the top 10 trending hashtags is displayed on the search bar, the home page, and next to the user's timeline. The complete list with the top 50 trending hashtags is available with a click of the mouse. Given the trending hashtag list's omnipresence on Weibo, the meta-information about user interest the list presents is an important guide for users.

The trending list consists of four parts: the ranking of the topic, the topic itself, a summary number, and sometimes an emoji or a character at the end. As the screenshot of the interface in figure 1 below shows, while Sina Weibo does not disclose its promotion algorithm, the topic's ranking is determined by the number that follows, which I term the Popularity Index. Thus, even without the actual algorithm, it is fair to assume that Sina Weibo implies that Popularity Index is a summary of user behavior data (such as comments, reposts, likes, etc) that contribute to a particular topic's placement on the trending list.

As mentioned above, we also collected posts from a substantial subset (95 of 336) climate-change-related trending hashtags. Since these hashtags are coded based on the content of the hashtag, rather than the content of the posts, we further analyzed the relevance, sentiment, and originality of posts. We manually coded 12828 posts from 19 hashtags, which constitute about 33% of all posts scraped. 18 of these hashtags are selected based on the number of posts we scrape,[27] and the additional hashtag 'climate change is a hoax' is our highlight case study. We further coded posts for relevance, promotions, sentiment, and originality.[28]

We analyze data for trending topics on Weibo from mid-2017 until early 2021 collected from the social media analysis firm, Enlightent Data. Our main finding is a simple one. The paucity of climate change among trending topics is nearly complete. We find that on an average day, there are 258.78 topics that trend on Weibo; yet despite this proliferation, it takes three days on average to find a single topic that is climate-change-related. Visually, this small of a percentage virtually disappears from a pie chart as seen in figure 2. We emphasize this point repeatedly because in the rest of the analysis discusses what we do see in this limited amount of data.

In addition to the paucity of climate-change-related-topics, we also find that people do not post a lot about these topics, even when they are trending. Over the span of 72 h, for the full set of trending topics there are 409.2 posts on average which had been read 76.27 million times and had 60935.52 posts, as of August 2021. Each individual post gets 13.7 comments, 12.9 retweets, and 41.7 likes on average.[29]

To put the data into perspective, on average, for the subset of trending topics related to climate climate-change, they rank 165.62 (out of an average of 258.78 trending topics per day, so around 64%). The average of

[27] This, however, is not necessarily indicative of the actual popularity of hashtags at the time of trending. As discussed before, there is a possibility that some posts have been deleted post-trending.

[28] For details on coding procedures, see the online appendix.

[29] Retweets are counted as separate posts, even though their content is just 'Retweet (*zhuanfa weibo*).'

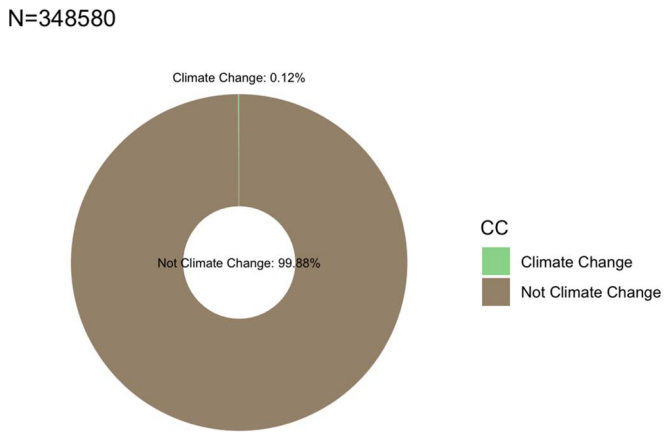


Figure 2. It rounds to zero.

Table 1. CC Individual Posts Descriptive Statistics —Engagement.

	Relevant	Original	Retweet	Promotion	Total
Count	9785	7396	2898	1366	12828
Percent	76.28%	57.66%	22.59%	10.65%	100%

Table 2. CC Individual Posts Descriptive Statistics —Sentiment.

Sentiment	Supportive	Skeptical	Neutral/NA	Total
Count	5734	115	6979	12828
Percent	44.70%	0.90%	54.40%	100.00%

the highest ranking these topics achieve during 24 h is 26.41, which falls out of the recommendation/search bar Weibo shows on its homepage (further reduces exposure). In short, people are not extremely enthusiastic about climate change even when it's trending.

The paucity of data is quite consistent across time, with the exception of a small uptick in 2019 when 0.1923% of all topics are climate-change-related (figure 3). To put that into perspective, the next highest level is seen in the first two months of 2021 with 0.1452%. The uptick in 2019 is mainly driven by a burst of 148 climate-change-related topics that managed to trend in the later half of the year. During this time (2019/5 to 2019/12), the content of posts that trended suggests that this burst is mainly driven by international discourse.[30] To highlight the trend analysis and low share, we compare the prevalence of climate topics with the Chinese actress Yang Mi, who individually trends more consistently than the range of climate topics in this time period.

The most influential topics during this time (defined as topics that have trended for longer than 10 h within a day) are directly attributable to international advocates and climate scientists, such as Nobel prize winner Kevin Trenberth, British climate scientist Tom Matthews' report on extreme weather and impacts on human body, and Nobel prize winner Paul Crutzen's theory of anthropocene. It is harder to differentiate between second-tier topics (between 5 and 10 h trending) and less influential topics (those that trend under five hours) based on content. Nonetheless, these topics are still dominated by international discussions, including United Nations or foreign government actions, activist Greta Thunberg, observable events outside of China likely made more extreme by climate change, and expert opinions or scientific findings.

Climate change trending topics: patterns and content

We sort climate-change-related trending topics into 4 categories based on their content: Science, Action, Discourse, and Impact (see figure 4 for topic diversity over time).[31] The smallest category is Science (9.7%), which includes topics that relate primarily to scientific reports, expert opinions/comments, and scientific

[30] It's also worth noting that the trend holds during the COVID-19 pandemic outbreak in China.

[31] This classification only looks at the hashtag, and does not consider individual posts under the hashtag (which, as will be illustrated later, do not always align with the hashtag).

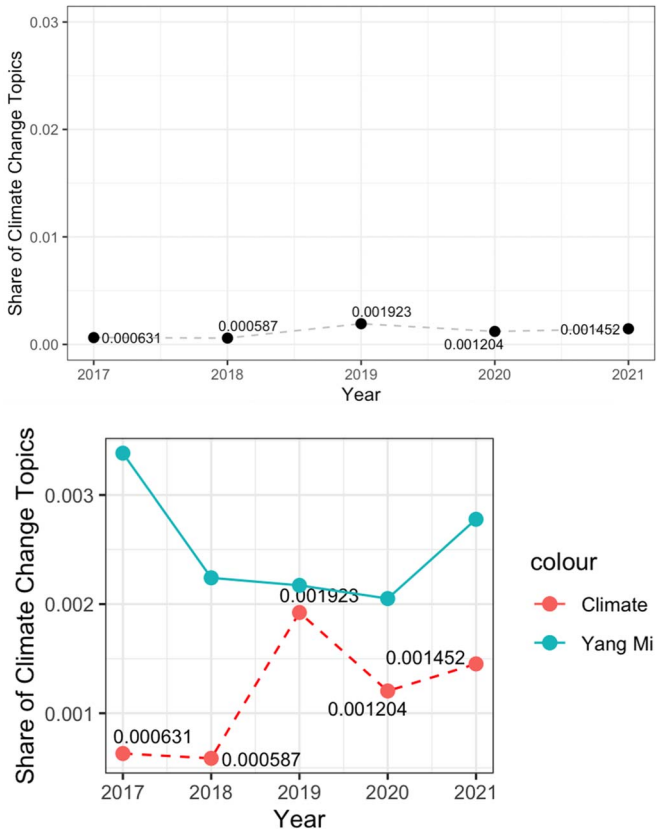


Figure 3. Basic Time Trends.

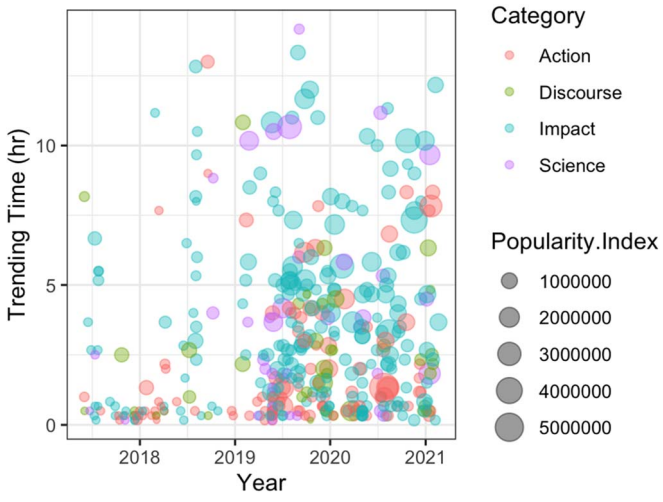


Figure 4. Diversity of topics over time.

theories (e.g. human body approaches heat tolerance limit). We categorize topics as related to 'Discourse' (10.4%) when topics follow, capture, or engage public discussions, e.g. Greta Thunberg's speeches or Trump denying climate change. Action is the second largest category with 26.3% of the trending topics. We code topics as 'Action' if either some entity–such as a government, individual, firm, or other–takes action to mitigate or adapt to climate change but also include particular non-actions or actions that cut against mitigation or adaptation (such as Chinese scientists covering icebergs with cloth, and US quits Paris Agreement). The largest category is 'Impact' (53.6%) which is about impacts of climate change. These impacts include both long-term, large-scale impacts that may or may not have taken place (e.g. Antarctic sea-ice declining, hottest year in a

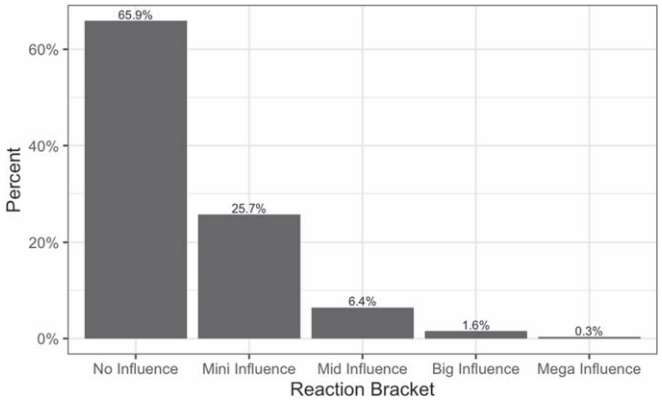


Figure 5. Most Posts Receive Little Reaction.

century), and capture momentary but visually powerful representations of climate change impacts (e.g. starving polar bear, video of iceberg falling apart). In short, impact (both long-term and short-term) seems to dominate climate-change-related trending topics.

One thing worth noting is that there is no straightforward correlation between major climate-change-related events (such as weather-related disasters and international meetings) and climate-change-related trending topics on Weibo. On the one hand, what trends on Weibo can be peculiar: explosive fires in the US received barely any traction on the platform despite their disastrous impacts, clear links to climate change, and having sparked extensive discussion on Twitter. On the other hand, Weibo is oddly good at picking up striking images less directly connected to significant events, such as depictions of starving polar bears or melting icebergs.

Out of the 38875 posts we have collected, 38% are made by unverified users, 43% by verified users, and 19% by VIP users. Status certainly matters on Weibo. Summing comments, retweets, and likes to create a 'reaction score' (see figure 5), 66% of all posts receive 0 reaction (i.e., no comment, retweet, or like), just over a quarter receive mini-influence (0–10 reaction score), 6.4% elicit mid-influence (10–100), 1.5% see big-influence (100–1000, and only 0.3% achieve mega-influence (1000+).

In our data, we found 88 mega-influencers who posted 128 distinct posts, eliciting 1,399,729 reactions (over 10935 per post). On average, these mega-influencers have 22 million followers, as of October 2021, and can be divided into three categories: the plurality, 43, are in we-media (individual bloggers or small groups), 27 are in established media (most of which are state-affiliated media or commercial networks such as Sina Weibo itself), and 18 others. 31 out of the 102 posts are made by state-affiliated accounts (mostly state-affiliated media, but we also observe some government Weibo accounts posting about climate change).

One question to ask is whether individual posts engage with climate change substantively. We evaluate posts on two metrics: relevance–engagement with the trending topic–and originality–not a verbatim repetition of another post (table 1). Even including retweets with empty content as relevant, we find only 76.28% of posts to be relevant. As for originality, our conservative measure codes 57.66% of the posts as original, but this is an overestimate, as many posts are not just verbatim quotes but their content is highly similar. What do people post about under climate change hashtags if not climate change? 10.65% are explicitly attention-grabbing promotion posts.[32]

A second basic aspect of the discourse to capture relates to sentiments towards beliefs in the reality of climate change (See table 2). After dropping unoriginal and unrelated posts, among the rest of the posts that actually express some attitudes towards climate change, skepticism is scarce. Only 0.90% of posts are skeptical of climate change, whereas 44.70% of all posts believe that climate change is real.

Our effort represents an attempt here to describe the presence of climate change in Weibo's trending topics, an underlying assumption is that more discourse suggests more salience of the phenomenon. As such, beyond the sentiment coding just described, we paid particular attention to one trending topic: 'climate change is a hoax.' This topic seems to be based on a 2017 statement by then US President Donald Trump. We sort posts into three categories: simple retweets, attention-grabbing, and supportive or skeptical. Again, like with the rest of the post-level analysis, the content is thin. Fully 54.4% of posts are just retweets or verbatim repetitions of other posts. Similarly, attention-grabbing posts that free-ride on the hashtag's trending topic for exposure to promote goods and services irrelevant to climate change make up an even larger share of the posts (74.0%). The style of

[32] This is a conservative measure for promotions. See the online appendix for coding details.

these advertisements is quite repetitive, even robotic. These two categories obviously have significant overlap. Finally, the minority of posts (17.2%) that do engage substantively are divided into supportive (14.4%) and skeptical (0.4%) of the reality of climate change. This belief in the phenomenon's underlying reality, however, does not necessarily translate into belief in the desirability of Chinese actions. For instance, a common sentiment espoused under this topic is that climate change represents a debt that the developing world owes to the planet that should not be paid by developing countries.

Discussion

How should we interpret our main finding—climate change rarely enters public discussion on Weibo ? One concern is that the lack of climate change hashtags on Weibo is a result of censorship rather than public disinterest. To test for this alternative explanation, we match climate change hashtags to their most similar non-climate counterparts and collected posts under all hashtags in 2022/11.[33] Our retrospective scrape shows no statistically significant difference between climate and non-climate hashtags.

To further contextualize our finding, we also provide a comparison of climate change discussion on Weibo versus major newspapers in China and Twitter.[34] Consistent with our Weibo finding, major Chinese newspapers show a general lack of coverage of climate change and this trend holds for the past two decades. In contrast, we find suggestive evidence that climate change is more actively discussed on Twitter than on Weibo.

Conclusion

In sum, we find that climate change discourse remains niche on Weibo, almost never even reaching the trending topics list. Even in the rare occasions when climate-related topics near the top of the heap and start trending, the actual substance present in posts is quite minimal. Those topics that do trend tend to be connected to international rather than domestic connections that might be more politically sensitive. Any deliberation on the platform is hidden amongst a flood of promotional activities and attention-grabbing posts.

While we cannot rule out the possibility that the lack of climate topics on the trending list is related to the country's censorship apparatus, we find little evidence that such actions have taken place.

Data availability statement

The data generated and/or analysed during the current study are not publicly available for legal/ethical reasons but are available from the corresponding author on reasonable request.

Appendix

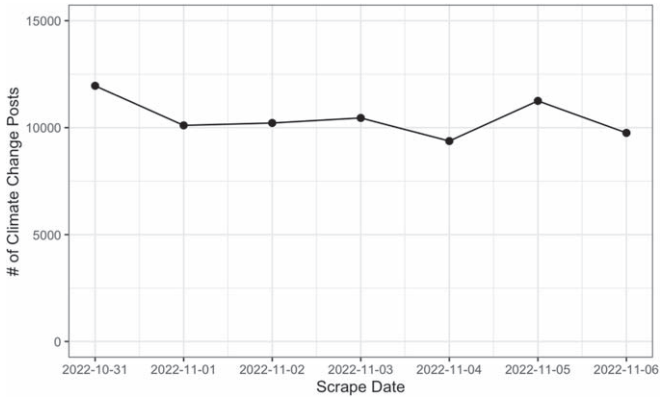


Figure A1. Streaming Posts.

[33] For full testing details, see appendix A3 Censorship Checks.

[34] See appendix A4.

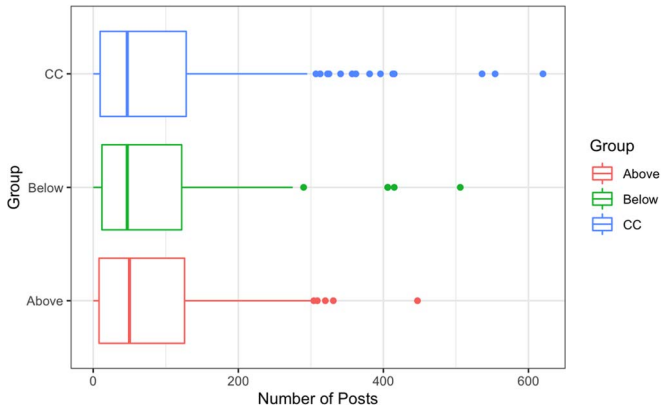


Figure A2. Matching Censorship Check.

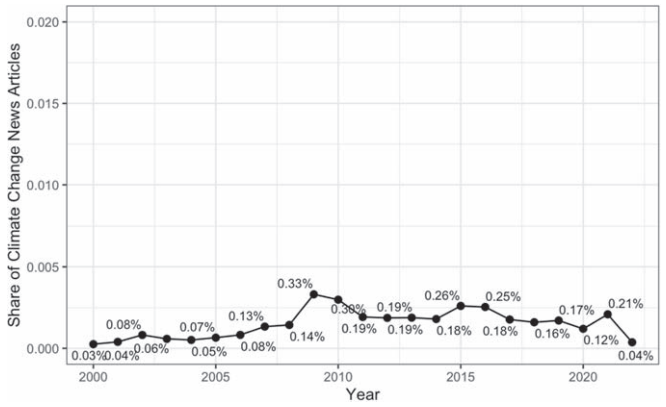


Figure A3. Climate Change Newspaper.

Table A1. Matching Fixed-Effects Regression Results.

Models	Model 1 (Levels)	Model 2 (Binary)
Dependent Var.:	Number of Posts	Number of Posts
Above	−11.27 (7.75)	
Below	−14.15 (9.05)	
Climate Change		12.71 (7.47)
Fixed-Effects	—	—
Day	Yes	Yes
—	—	—
S.E.: Clustered	by: Day	by: Day
Observations	540	540
R2	0.58749	0.58735
Within R2	0.00922	0.00888

A1. Data Services

Trending Hashtags: we rely on Enlightent Data (Yunhe Shuju) to collect trending hashtags from Sina Weibo. Enlightent Data is a commercial company that builds one of the most comprehensive databases on Chinese social media platforms including Sina Weibo, Toutiao, Douyin, and other video apps. Its web scraping tool automatically records Sina Weibo's trending hashtags every 10 min and generates a complete list at the end of the day that includes the topic, its cumulative Popularity Index, the highest ranking it achieved in the day, and for

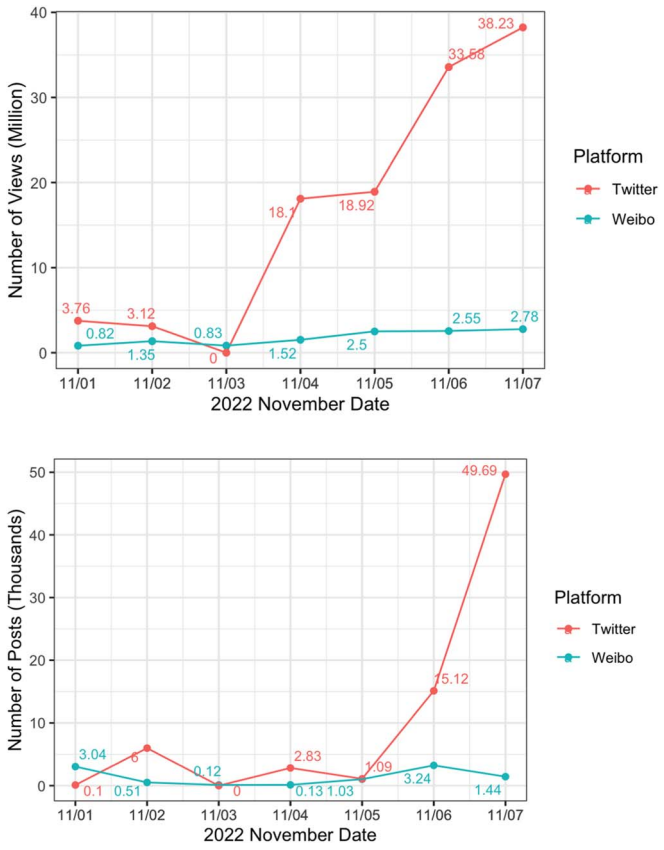


Figure A4. Weibo vs Twitter.

how long the topic remains on the trending list in a day.[35] In total, we collected 348,580 trending topics from 2017/6 to 2021/2.

Individual Posts: we use Octopus Scraper (Bazhuayu Caijiqi), a China-based web-scraping tool to collect individual posts on Weibo. Octopus Scraper is a powerful scraping tool that allows for flexible scraping designs and also provides various existing designs to facilitate scraping. Weibo-scraping is one of the key features of Octopus Scraper. Since Sina Weibo only shows 50 pages of search results, we limit our search of posts to posts that include the hashtag and were posted within a 72-hour-timeframe of the hashtag's trending. In the rare case of when a certain hashtag trended for two consecutive days, we extend the timeframe to a 5-day window. We scraped 38875 posts from a sample of 95 unique topics and coded around 30% of the posts for further analysis.

Relevance is defined as whether a post is substantively about the hashtag topic or not. A post is coded to be irrelevant if it does not include any information about climate change aside from the hashtag.[36] Among the irrelevant posts, many are classified as 'promotion posts,' i.e., attempts to grab the attention of the audience for another topic or advertising a product. We impose a strict definition for promotion posts: a post is considered to be a promotion if it includes a hashtag or a link that explicitly tries to divert viewers to another topic or if it includes content that is clearly promotion in nature (e.g. excerpts of an online novel, recipes promotions, and beauty product advertisements). Second, we coded a post based on its sentiment towards climate change. Sentiment is defined narrowly as whether the post believes or does not believe in climate change. If a post is coded as irrelevant, its sentiment is coded as NA. If a post is coded relevant, but there is not enough information to decide a post's sentiment, it is coded as neutral. Finally, we coded posts based on their originality. A post is coded original if it is not a verbatim copy of another post.[37]

[35] Weibo updates its trending hashtag list every minute, so there is a chance that we have missed some hashtags. However, if a hashtag has only trended for fewer than 10 min (i.e., did not make the top 50 list), it might not be very influential to begin with.

[36] We have a generous definition of relevance in the sense that if a post has effectively no content (e.g. the content of the post is just 'Retweet'), it will be categorized as relevant. This definition works against our thesis that climate change discourse is scarce and inactive.

[37] Again, this definition works against our thesis that climate change discourse is scarce and inactive.

A2. Coding Rules

Trending Hashtags: out of the 348,580 trending topics we collected using Enlightent Data, we have identified 403 trending hashtagas that are related to climate change. Since some of the trending hashtags have trended more than once, only 336 out of the 403 topics are unique. These climate-related trending hashtags are coded based on the following procedure. First, we use three sets of keywords to search for climate-change related topics. The first set of keywords include different Chinese translations of 'climate change': global warming (*quanqiu biannuan*), climate warming (*qihou biannuan*), climate change (*qihou bianhua*). The second set of keywords is selected from the BBC article on COP 26 titled 'Unlocking Keywords Related to Climate Change' [1]. This set include 13 keywords: climate summit (*qihou fenghui*), The Paris Agreement (*bali xieyi*), COP26, IPCC, 1.5 degrees celsius (1.5 *sheshidu*), 1.5°C, carbon footprint (*tan zuji/tan jiaoyin*), carbon neutrality (*tan zhonghe*), emission (*paifang*), feedback loop (*fankui huan/fankui huilu*), geoengineering (*diqiu gongchengxue*). The third set of keywords is generated based on our substantive understanding, which include: green (*lvse*), carbon dioxide (*eryanghuatan*), warming (*biannuan*), high temperature (*gaowen*), South Pole (*nanji*), North Pole (*beiji*), sea level (*haipingmian*), energy (*nengyuan*), hydrogen (*qing*), climate (*qihou*), greenhouse (*wenshi*), temprature (*wendu/qiwen*), save energy (*jieneng*), reduce emission (*jianpai*). In total, the keyword search results in 718 trending hashtags, but this result is highly inaccurate as some of the keywords have multiple meaning and are frequently used in a non-climate-change-related context (espeically *lvse*, the color green). We then manually dropped 331 irrelevant hashtags from the keyword search result. As the keyword search maybe imcomplete or biased (depending on which keywords we include to begin with), we also did a manual search for climate-change-related topics, which gives us 113 results. After dropping duplicates (i.e., topics identified to be climate-change-related using the keyword search and the manual search), we eventaully coded 403 topics to be climate-change-related.

Individual Posts: we manually code 12828 individual posts from 19 unique topics for post-level analysis. We are interested in three aspects of individual posts: relevance, originality, and sentiment. Relevance is defined as whether the post actually engages with the content of the trending hashtag, i.e., whether the post is climate-change related. A post is coded to be irrelevant if it does not include any information about climate change aside from the hashtag. Among the irrelevant posts, many are classified as 'promotion posts,' i.e., attempts to grab the attention of the audience for another topic or advertising a product [2]. If the post has no content, i.e., simply says 'Retweet' or nothing other than the hashtag, it is coded as relevant. Originality is defined as a post that is not a verbatim recount of another post. Again, this is an overestimation, as many posts might not quote another post verbatim, the content is highly similar. Finally, for posts are coded to be relevant and have content, we categorize them into supportive, skeptical, or neutral based on whether they express belief or disbelief in climate change.

[1] COP 26 Unlocking Climate Change Keywords (COP 26 *jie suo qi hou bian hua de guan jian ci*): https://www.bbc.com/zhongwen/simp/science-59038780.

[2] A rule of thumb for coding promotion posts is to see if the post includes a link or hashtag that directs readers to the promoted content.

A3. Censorship Checks

Test 1 Rescrape Collected Posts: we have resraped all the posts in our analysis using the same hashtags, procedure, and data service on 2022/10/31. This round of rescrape yields 10985 posts, which is significantly fewer than what we had. However, this may not necessarily be interpreted as censorship as users might simply delete their own posts over time as well.

Test 2 Download Streaming Posts: we further track the 95 sample hashtags over a 7-day period (2022/10/31 to 2022/11/6) and monitor whether the streaming poss under each hashtag disappeared (see figure A1). This test reflects the disappearance of posts (which may or may not be attributed to censorship) in late 2022. However, it does not necessarily capture the period we've studied, i.e., 2017–2021. Our results suggest that posts are relatively stable over the 7-day period.

Test 3 Matching Hashtags: finally, we provide a more direct test of possible censorship back in 2017 to 2021. We use a matching design where each climate change hashtag is matched with the two most similar hashtags based on their overall popularity index of the day they trended. The advantage of this design is that we control for relative popularity (which is correlated with the number of posts for each hashtag) while allowing for topic variety. For example, a climate change hashtag that was the 23th most popular of the day it trended is matched with the 22nd and 24th most popular hashtags of the same day. This procedure yields 224 additional matched control topics.[38] Intuitively, if there existed climate-change-specific censorship, it would not affect the control hashtags which cover a wide range of topics. In other words, the number of posts for each matched trio

[38] 224 in total because we had 112 hashtag/day and 95 unique CC hashtags. Matching is performed on a hashtag/day basis.

(1 climate hashtag and 2 non-climate hashtags) should be roughly the same given their relative historical popularity, if there was no climate-change-specific censorship. We've rescraped climate change hashtags and their matched pairs on 2022/11/2. While we find that posts are missing from both climate and non-climate hashtags, the important takeaway is that there is no statistically significant difference between climate and non-climate posts. This is shown in figure A2, and we further verified this conclusion with two fixed-effect regressions (table A1). Model 1 includes three levels of independent variables: hashtags that are just one place above or below the climate change hashtag, and climate change hashtags. Model 2 is binary — climate or non-climate change hashtags. No coefficient is significant at the traditional levels of statistic significance.

A4. Printed Media and Twitter

Printed Media in China: we searched for climate change (*qihou bianhua*) in all newspapers in the CNKI dataset and calculated the proportion of climate change articles across the years.[39] The result is quite consistent with our Weibo finding (see figure A3), i.e., there has been a consistent lack of climate change discussion.

Twitter: due to data availability constraints, we cannot perform the same procedure for Twitter as we did for Weibo. We instead have included something from the present moment that does show differences between the platforms. Given that at this moment, there is a climate change topic (COP27) which is both trending on Weibo and Twitter. We've plotted views and posts in figure A4, and while we acknowledge that this is certainly far from a 'global context comparison,' we think it indicates differences in the platforms and the general missingness of climate change discourse on Weibo.[40]

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