

Dominant frames in legacy and social media coverage of the IPCC Fifth Assessment Report

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The media are powerful agents that translate information across the science-policy interface, framing it for audiences. Yet frames are never neutral: they define an issue, identify causes, make moral judgements and shape proposed solutions. Here, we show how the IPCC Fifth Assessment Report (AR5) was framed in UK and US broadcast and print coverage, and on Twitter. Coverage of IPCC Working Group I (WGI) was contested and politicized, employing the 'Settled Science, Uncertain Science, Political or Ideological Struggle and Role of Science' frames. WGII coverage commonly used Disaster or Security. More diverse frames were employed for WGII and WGIII, including Economics and Morality and Ethics. Framing also varied by media institution: for example, the BBC used Uncertain Science, whereas Channel 4 did not. Coverage varied by working group, with WGIII gaining far less coverage than WGI or WGII. We suggest that media coverage and framing of AR5 was influenced by its sequential three-part structure and by the availability of accessible narratives and visuals. We recommend that these communication lessons be applied to future climate science reports.

People rely on media representations to help interpret and understand the complex issues surrounding climate science, governance and decision-making¹. There is no straightforward relationship between audiences and media—the media do not simply deliver information to a passive audience². However, media representations do help bound debate—acting to widen (or constrict) the breadth of what is discussed, shaping the nature of peoples' engagement with the issue³, and inhibiting or supporting science-society interactions around climate change⁴. The production and consumption of climate change media is a major constituent of the 'cultural politics of climate change'⁵. For over a decade, studies have explored the ideologies and journalistic norms apparent in print media coverage (for example, refs 3,4).

However, significant gaps in understanding remain because, so far, researchers have largely relied on aggregator news services that provide only newspaper text. Thus, we know little about how climate change is portrayed on television (the main source of news for most people⁶) or in online media (the main source of news for younger people⁶). In addition, because newspaper studies are limited to text transcripts, they do not analyse the rich visual detail of the printed page, despite the important role of visual information in opinion formation on climate change⁷. Finally, many climate media studies have focused on a single country, limiting opportunities for international cross-comparison—especially important in the context of climate change to understand how different news regimes may influence public opinion⁸ and considering the increasingly international nature of today's news media.

We present a frame analysis of the IPCC AR5 reports. The IPCC is the pre-eminent boundary organization on climate change, exerting a profound influence on how science enters the policy realm^{9,10}. Past IPCC reports have shown a marked increase in media reporting across the working groups (ref. 11; WGI: The Physical Science Basis; WGII: Impacts, Adaptation and Vulnerability; WGIII: Mitigation of Climate Change¹²), making the publication of each

working group report a key event in the public debate about climate change. Previous IPCC reports have not been without criticism regarding their communication. Although most analyses have focused on the language used by the IPCC to communicate uncertainty^{13–15}, others have examined TV (refs 16–18), print¹⁹ or online media²⁰ coverage. Our analysis examines both text and visuals, and compares across print (newspaper), broadcast (television) and online social media (Twitter) reportage. We sample print and broadcast media from both the UK and the US, and the social media analysis has international coverage (see Methods).

Framing and the frame schema

The concept of framing is used to investigate how media and audiences co-construct news events^{21,22}. It holds similarities to concepts of the explanatory theme²³ and discourse analysis²⁴. Common framing definitions (for example, ref. 25) are critiqued as insufficient for rigorous analysis²⁶ and for contributing to theoretical and empirical vagueness²⁷. Thus, we use Entman's definition: 'to frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation'²⁸.

The frame schema was developed qualitatively and inductively by examining climate change frames in elite discourses, mass media research, and peoples' everyday perceptions (Supplementary Information 1 and Supplementary Table 1). The frames became fully defined by examining the IPCC data set for frames' constituent elements (including metaphors, imagery, typical sources). This approach identified all 'culturally available frames'²⁵ and those available to journalists²³; and helped situate the frames in socio-political context²³. Box 1 briefly describes the ten frames (full frame schema in Supplementary Table 2; see Supplementary Information 2). Quantification of the different frames was undertaken once the frame schema was fully defined.

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Box 1 | An overview of the ten climate change issue frames*.

Frame	Brief description
Settled Science (SS)	Emphasis on the science of climate change (across any WG) and the broad expert consensus. Considerable evidence of the need for action. Science has spoken, others must act. Uncertainty or scepticism quashed.
Political or Ideological Struggle (PIS)	A conflict over the way the world should work; over solutions or strategy to address climate change (above disagreements over science). A battle for power (for example, between nations or personalities).
Role of Science (ROS)	Explores the role science plays in society. May debate transparency, funding or public awareness; especially in relation to institutions, for example, IPCC.
Uncertain Science (US)	Focus on uncertainty—in climate science, impacts or solutions. May question anthropogenic nature of climate change, or discuss natural variability. We cannot act, should not act, or will struggle to act.
Disaster (D)	Predicted impacts are dire. Impacts are numerous, discussed in detail, and threaten all aspects of life. Impacts will get worse, we are not well prepared.
Security (S)	A threat to human security. Could be energy, water or food security, or a threat to the nation state (for example, migration).
Morality and Ethics (ME)	An explicit and urgent moral, religious, or ethical call. ME1: for action. Strong mitigation, and protection of the most vulnerable. ME2: for no action. Likely to discuss scientific uncertainty.
Opportunity (O)	Climate change poses opportunities. Either O1: as a way to re-imagine how we live; for example, to further human development, to invest in co-benefits. O2: there will be beneficial impacts so no intervention is needed. Likely to mention uncertainty.
Economic (E)	Discusses growth, prosperity, investments, markets. Provides economic costs. Economics implies either E1: taking action now. Details potential economic actions (for example, divestment). E2: action is hugely expensive (or too costly in context of other priorities). Likely to mention uncertainty.
Health (H)	Climate change poses a danger to human health, for example, malnutrition, air quality. Urgent action required.

*See Supplementary Information 1 for details of how the coding schema was developed, and Supplementary Table 2 for the full coding frame schema.

Newsworthiness of the IPCC reports

We evaluated newsworthiness of the IPCC reports by examining issue attention and prominence in the media sources across both countries and all WGs (as refs 16,29). In legacy media, the IPCC gained far more attention in the UK (87 articles, 20 broadcasts) than the US (30 articles, 6 broadcasts). Even considering the unequal broadcast lengths (some were 30 min, others an hour), UK broadcasters spent nearly five times more airtime reporting the IPCC than US broadcasters (1 h 23 min 53 s in the UK, 17 min 53 s in the US); a pattern also evident in print (67,385 words in the UK; 25,482 words in the US). WGIII garnered the least coverage of all (total item count: 65 WGI, 51 WGII, 27 WGIII). The period of attention was fairly brief for TV, with 46% of broadcasts occurring the week before and 54% on the press release day. Print attention was more evenly spread, with 33% of coverage the week before, 19% on the day, and 48% the week after (Supplementary Information 3 and Supplementary Fig. 3a–c).

The prominence of the IPCC reports was fairly low, particularly in the US. It gained few headline broadcasts on TV, and although it made several newspaper front pages (9 UK front pages, 7 US), none of these front-page stories carried an image. A larger number of UK broadcasts had footage filmed either on location or at the IPCC WG venue (12 UK, 4 US). WGI and WGII were more prominent than WGIII. In print, a diversity of images were featured in both WGI and WGII (27 images) compared with WGIII (5 images). On TV, WGIII broadcasts were more likely to be filmed in the TV studio, rather than on location as they had been for WGI and WGII.

The prominence of the IPCC was high on Twitter. Each WG caused a peak above background activity for climate-related hashtags (#climatechange, #globalwarming). The dedicated hashtags (#IPCC, #AR5) saw most activity (Supplementary Fig. 2). Issue attention, tracked using #IPCC, mirrored legacy media. The greatest number of users were active, and most tweets were sent, during WGI (64,219 tweets; 26,623 users), with least during WGIII (31,047 tweets; 14,982 users). Attention was very brief, with just a 2–3 day peak in activity. There was high turnover

in the populations tweeting about each WG, with <4% of users tweeting for all WGs and most (84%) tweeting about just one (Supplementary Fig. 3).

Framing of the IPCC reports

Across all media types, we found that some frames (SS, PIS, US, ROS and D) were more frequently used than others (ME, E, O or H). This was most pronounced on TV, where only five primary frames were used in all.

Differences in framing by WG

There were marked differences in framing across the WGs (Fig. 1). In UK broadcasts, SS and US were common in WGI, with some PIS, D and S. D dominated for WGII. SS was used to report WGIII in the UK. US TV coverage was low overall, but within this, D was the most used frame (Fig. 1a–c).

In print, PIS was common across all WGs. SS was frequently used for WGI and WGIII, whereas D was common for WGII. US and ROS frames were also used for WGI, especially in the UK. US was almost absent in WGII and WGIII. Despite lower overall coverage for WGII and WGIII, a greater diversity of frames was evident, including S, ME1 and both versions of the O and E frames. The H frame was used just once, in UK WGI print coverage (Fig. 1d–f).

SS dominated Twitter coverage, especially for WGI and WGIII. As in print, D (and to some extent, S) was more common in WGII. There was some use of US for WGI, but not for WGII or WGIII. ROS was used fairly consistently across all three WGs (and was used differently to legacy media, featuring IPCC authors, journalists, sceptics and others discussing WG report writing in real time). Levels of PIS were consistent but relatively low across all WGs. Again, WGII and WGIII saw a wider use of frames than WGI, including the ME1, O1 and E1 frames (Fig. 1g–i).

Differences in framing by media outlet

Comparing TV news programmes of the same (30 min) duration, US broadcasts were not only less numerous, but were shorter on average than UK items (BBC average broadcast length 3 min 23 s,

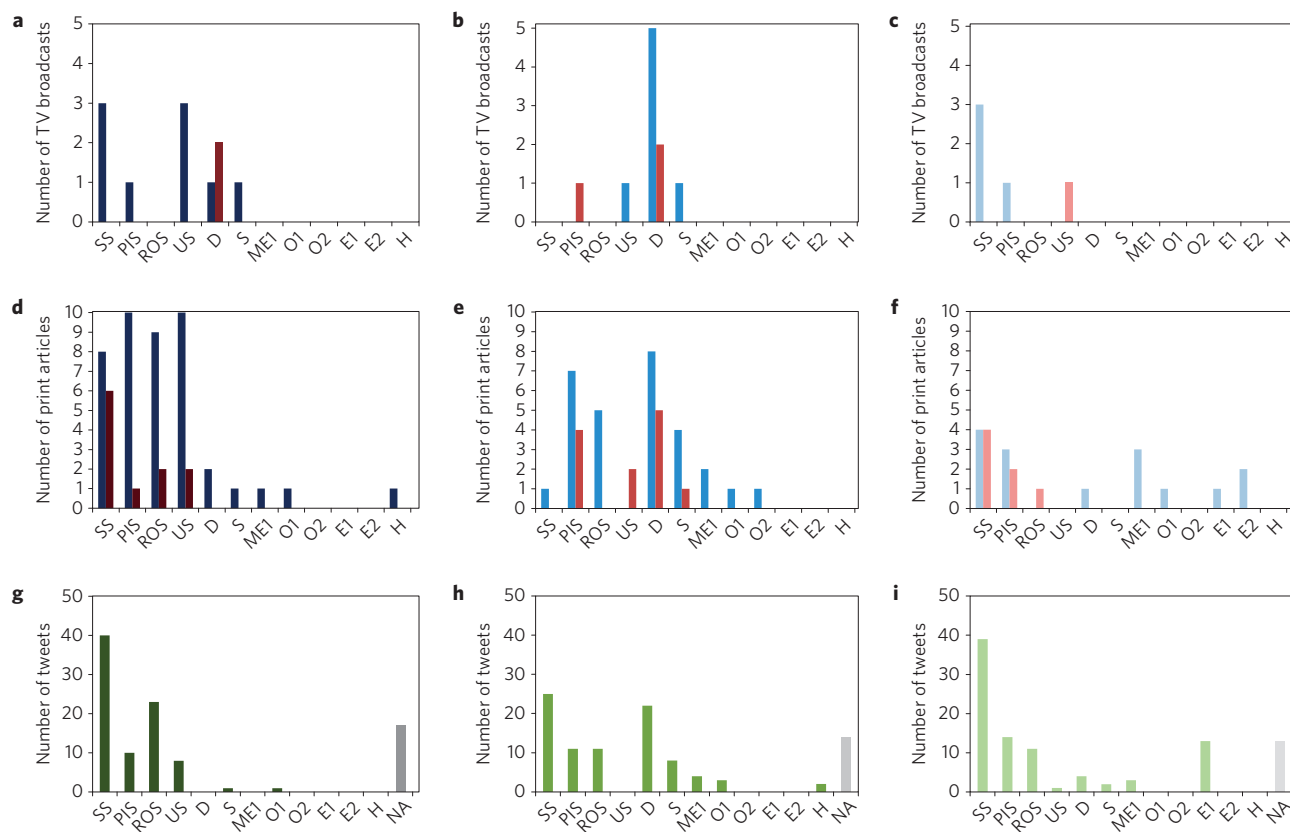


Figure 1 | Frames evident in media coverage of the IPCC WG reports. UK in blue, US in red, social media in green; with frame abbreviations along the x axis (defined in Box 1). **a**, WGI broadcast. **b**, WGII broadcast. **c**, WGIII broadcast. **d**, WGI print. **e**, WGII print. **f**, WGIII print. **g**, WGI Twitter #IPCC. **h**, WGII Twitter #IPCC. **i**, WGIII Twitter #IPCC. The NA category (grey bars) shows tweets that could not be assigned a frame (see Methods).

8 broadcasts; ITV 3 min 09 s, 5 broadcasts; ABC 2 min 22 s, 2 broadcasts; NBC 2 min 44 s, 2 broadcasts). Channel 4 (C4) News did not use US but often used D and S. In contrast, both BBC News, and to a lesser extent, ITV News, used US (Fig. 2a). US polarization was evident in the broadcast media surveyed, with frame use differentiated by media outlet along partisan lines (D, ABC, NBC; PIS, MSNBC; US, Fox). Duration of broadcast by frame shows similar results (again, with the caveat of unequal news programme length; Fig. 2b).

In print, the UK broadsheets had the largest amount of coverage (Fig. 2c). The UK newspaper *The Guardian* had by far the greatest amount of print news coverage, much of which used PIS. The *Guardian* exhibited a diversity of frames (including E1, H, ME1 and O1). *The Telegraph* also used a diversity of frames, some of which deeply conflict with one another (both O frames; and US/SS). Much of the *Daily Mail* coverage used US, and never SS; the *Mirror's* coverage was the opposite. The US print media had low levels of coverage and so assessing frame usage is difficult. However, the *Wall Street Journal* did seem to be further from the consensus science position than other US newspapers. None of the US print outlets used O, ME, E or H as a primary frame.

Implications for climate communication

First, the three WGs were not all equally newsworthy, with WGIII being consistently the least newsworthy. This finding on newsworthiness is surprising given that WGIII contains much newsworthy material (for example, what energy future do we want? Should energy provision be more equitable? Should consumption of red meat be restricted?). All of these seem compelling issues for news media, certainly in comparison with the physical science focus of WGI.

The results on newsworthiness could be due to three factors (and their interaction):

- Sequential release of the WG reports. WGI was released in September 2013, whereas WGII and WGIII were just a fortnight apart in March–April 2014. This probably led to a decline in interest in WGIII, particularly for legacy media, as journalists and editors perceived a ‘climate story fatigue’. This sequential IPCC structure, combined with bunched release dates for WGII and WGIII, will always favour reporting of WGI and WGII, to the detriment of WGIII. Our findings echo a (print only) study of the IPCC Fourth Assessment Report¹⁹ suggesting that this is an ongoing structural issue.
- Translation of technical writing into media narratives. All WGs have a Summary for Policymakers¹², but it is a highly technical 30+ page document³⁰. Only WGI released a two-page summary of its headline statements³¹. Keywords from the WGI headline statements document did appear in print articles, suggesting that this IPCC presentation format may have increased reportage on WGI. Qualitative research with journalists would be required to triangulate this result.
- Availability of compelling narratives. Human interest stories and (especially for broadcast) compelling photos, graphics or live-action video are a key requirement for news media³². Both WGI and WGII have well-developed and culturally available dramatic narratives and visuals (for example, duelling experts for US in WGI; the doom-laden and visually rich stories of D for WGII). In contrast, it seems that WGIII narratives and visuals are not well developed or culturally available, so therefore WGIII has largely failed to meet news values of dramatization or personalization. This is despite the potential of frames such as H, which has both compelling visual imagery and the ability to construct personal narratives (for example, linking air pollution in cities to WGIII’s focus on climate mitigation).

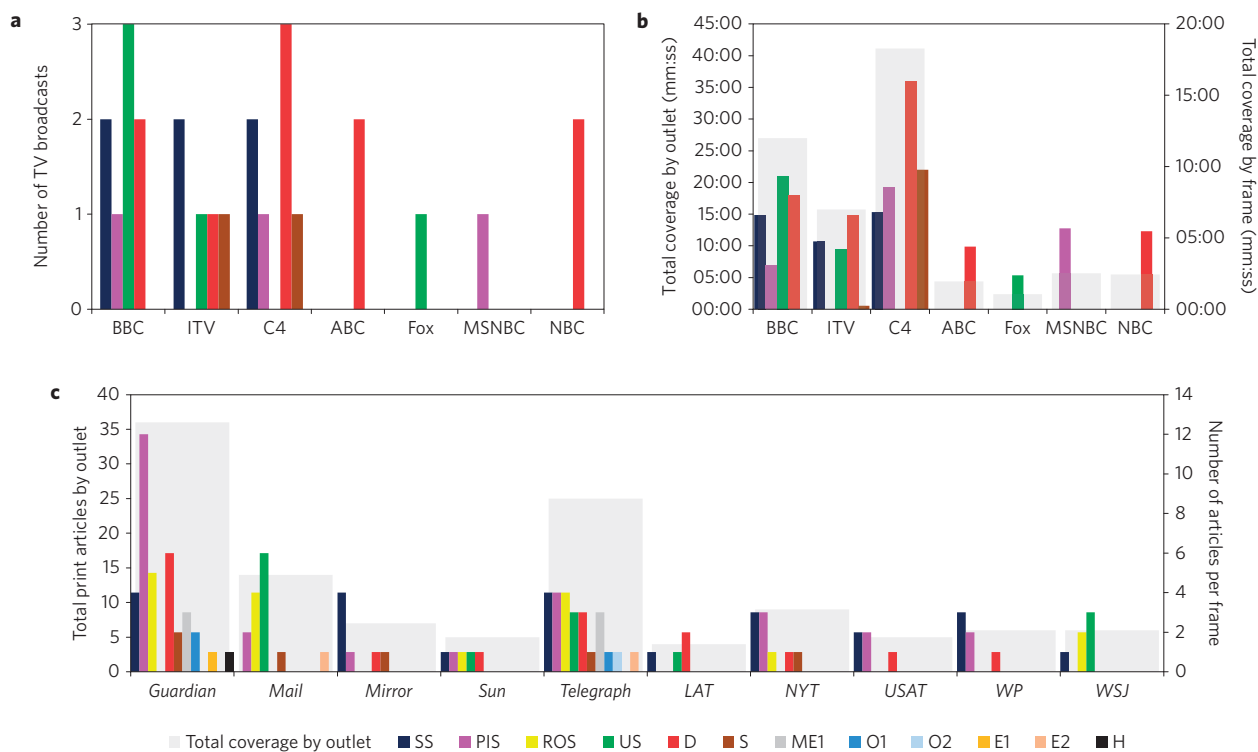


Figure 2 | Frames evident in media coverage of the IPCC, shown by media outlet. Colours show level of coverage by frame (see legend definitions in Box 1); grey shading shows total coverage by outlet. **a**, Broadcast media by number of items. **b**, Broadcast media by broadcast length (note standard BBC, ITV, ABC and NBC broadcasts are 30 min long, other broadcasts are an hour). **c**, Print media, shown by number of items.

Second, different frames were prominent across the WGs. SS was frequently used in coverage of WGI and WGIII, with D more frequent for WGII. US was commonly used in WGI, but far less so in WGII or WGIII. The use of particular frames for particular WGs is not inevitable—SS is an equally serviceable frame instead of D for reporting WGII. However, as described above, news values of dramatization combined with the need for compelling visuals³² make reporting WGII as D an appealing proposition, especially for commercial news organization. However, although D framing of climate change may make commercial sense, it is likely to actively disengage audiences from feeling a sense of self-efficacy³³. Conversely, the O, E and ME frames, which might support self-efficacy, were relatively rare. The absence of H is particularly surprising considering the human interest, and thus news values, that this frame offers.

Third, different frames were used by different media: TV used just a few different frames; print heavily used PIS; and Twitter saw greater use of SS. The explanation for this may lie in journalistic routines²⁷, where the format of the news item can act to favour certain frames—the in-depth political analysis of a newspaper’s opinion pages, or the drive for dramatic visuals in broadcasts, for example. The Twitter findings emphasize the need for further research on Twitter communities of practice and tweet content.

Fourth, media outlets favour particular frames. The frames used give an insight into how media outlets position themselves to appeal to certain audiences^{23,27}. For example, *The Guardian* has positioned itself as ‘the world’s leading liberal voice’³⁴ and thus it is unsurprising that it has the highest level of coverage, much of which is framed as PIS. It is also evident that media organizations attempt to appeal to divergent views within their readership, as part of their news media commercial strategy²³. For example, *The Telegraph* uses deeply conflicting frames, which is consistent with the employment of journalists who hold polarized views on the issue¹⁷. As a public service broadcaster, the BBC has a rather

different remit to commercial organizations, and it has encountered several challenges over its reporting of climate change³⁵. This may be reflected in their use of US, especially when compared with its absence on Channel 4.

In conclusion, we have presented a rich and in-depth coding schema of the ten different frames that exist in US and UK reportage of the IPCC. Our results show that the cultural availability of visual content and accessible storylines, along with the sequential structure of the IPCC WGs, clearly influenced media coverage and framing of the IPCC AR5, at least in these two countries. Co-produced research is needed—with journalists, scientists and institutional actors—on the moment of news production, to help explore and explain these trends. Audience studies examining the impact of exposure to different frames is also required. Future studies should seek to expand the countries examined, to determine whether these trends are also seen beyond English-speaking, Western nations. Integrating this knowledge into the design and communication of future IPCC assessments—and including others (artists, film-makers, journalists) in the conversation on developing potential narratives and their associated visuals—would facilitate communication of climate change, and offer audiences a more diverse selection of frames with which to engage with the issue.

Methods

The US and UK were selected for legacy media analysis as both have high per-capita emissions, host active contrarian voices, and have media organizations that exert influence beyond the nation state (for example, *The Guardian*’s online climate coverage³⁴). Both are active players in the climate policy arena (the UK has attempted to position itself, with the 2008 Climate Change Act, as a policy leader; whereas the US has seen struggle between the executive and legislative branches (in other words, between President Obama and Congress) to move forward with federal climate policy). These characteristics shape how each nation acts in the international climate policy arena, where both are influential players³⁶. This makes them salient cases for examining media representations in shaping the cultural politics of climate change.

Data were collected over a fortnight for each WG, centred on the day of the IPCC press release as follows: WGI: 21 September 2013 to 4 October 2014; WGII: 24 March 2014 to 6 April 2014; WGIII: 7 April 2014 to 20 April 2014. All media for analysis were selected on the basis of influence (circulation, audience) and ideology.

Hard copies of newspapers were collected. Daily newspapers (and their associated Sunday papers) were selected to ensure diversity in type (broadsheet, mid-market, tabloid) and high circulation along with influential national readership. In the UK these were: *The Guardian*, *Daily Telegraph*, *Daily Mail*, *Daily Mirror* and *Sun*; and in the US: the *LA Times*, *New York Times*, *USA Today*, *Washington Post* and *Wall Street Journal*. NexisUK (<http://www.lexisnexis.com/uk/nexis/>) was used to search for articles containing the keywords 'climate change' or 'global warming', and either 'IPCC' or 'Intergovernmental Panel'. Articles identified by the keyword search were located in hard copy. Those substantively relating to the IPCC report were included in the data set ($n=117$).

The flagship television news bulletin was analysed for three UK and four US channels: BBC News at Ten, ITV News at Ten and Channel 4 News in the UK; and NBC Nightly News, ABC World News, Fox News Special Report and MSNBC's The Rachel Maddow Show in the US. UK news was recorded using Box of Broadcasts (bobnational.net). In the US, transcripts of broadcasts were obtained from NexisUK. Relevant video footage was then obtained from the Vanderbilt Television News Archive, and where this was not available, by searching for video clips online. As with print, TV items were analysed where reports were substantively about the IPCC ($n=26$). TV footage was transcribed, with screenshots collected each time the picture changed.

For print and TV, we measured attention and prominence of news items. Attention was measured by volume, including the number of news items, and the minutes of coverage (TV) or word count (print). Prominence was measured by examining aesthetic and positioning devices, including images or infographics, front-page counts (print), and format and headline items (TV) (drawing on refs 16,29).

For social media, we collected all tweets using relevant hashtags (#climatechange, #globalwarming, #IPCC, #AR5) from 01 September 2013 to 31 May 2014. (Note that only around 2% of tweets contain geographic metadata, making analysis of tweets by nation problematic³⁷; however hashtag analysis of IPCC WGI indicates presence of twitter user communities in Australia, US, Canada and UK²⁰, which may be indicative of the tweet geography in all WG tweet reportage.) This was used to calculate daily volumes of tweets and active users. We then isolated all tweets using #IPCC within the same time periods as the legacy media analysis. From these tweets, we identified 'retweets' whereby one user re-transmits a message received from another; retweets are used to spread content and are likely to imply endorsement. For each WG, we created a social network of users in which a link A-B indicates that user B retweeted user A. We measured user influence as their Katz centrality³⁸ in the social network. Katz centrality assigns a score to each node based on connectivity, giving high scores to nodes connected to many other nodes, with additional weighting for connections to nodes that are themselves well connected. In effect, here Katz centrality identifies users whose content is most widely shared, on the basis of primary and secondary retweet activity. For each WG, we analysed frames used in a sample ($n=100$) of tweets drawn from the set of all original (non-retweet) messages by the top-50 users (ranked by Katz centrality).

All media items (broadcasts, articles, tweets) were manually coded using the frame schema, paying particular attention to the presence or absence of quoted sources, keywords, stock phrases, imagery, metaphor and narrative themes²⁸ (Supplementary Table 2). Analysis also took account of the item morphology and structure, including: the page set-up, headline, lead paragraph, word count and positioning in newspapers; the anchor introduction, wrap-up, location and placement within TV broadcasts; and hashtags, mentions, tweeter profiles and URLs on Twitter. For some tweets (for example, where the tweet was very short and had no linking URL), assigning a frame was not possible ('NA' grey bars, Fig. 1).

A randomly selected sample of all media items (45 items; 10% of sample) was selected to compare inter-coder reliability. Two coders independently coded the sample, assigning a primary code to each media item using the frame schema codebook (Supplementary Table 2). This achieved an inter-coder reliability rate of 91%, above the established accepted criteria for inter-coder reliability³⁹. The coders then independently analysed the full data set. Any disagreements were discussed between coders, and resolved.

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Author contributions

S.O'N. conceived the study, designed the frame schema, collected the US TV data, and coded and analysed the data. H.T.P.W. collected and analysed the Twitter data. T.K. contributed to coding and frame development. B.W. collected all UK data. M.B. collected US newspaper data. All authors contributed to writing the paper.

Additional information

Supplementary information is available in the [online version of the paper](#). Reprints and permissions information is available online at www.nature.com/reprints. Correspondence and requests for materials should be addressed to S.O'N.

Competing financial interests

The authors declare no competing financial interests.