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An Up-HILL Battle: Towards clearer terminology for High-Impact Climate Possibilities, including tipping points.

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Abstract. Climate science terminology increasingly shapes public and policy discussion, yet shared understanding of commonly used terms is often assumed. This study examines how people make sense of language associated with High-Impact Climate Possibilities (HICPs), sometimes referred to as high-impact low-likelihood climate events. Its aim is to inform the development of a glossary to support clearer and more consistent communication across and between specialist, policy and public contexts.

Using qualitative evidence from focus groups, we explored how participants interpreted key terms, how meanings were negotiated through interaction, and how emotional responses emerged. We found that meaning is frequently left implicit, with participants relying heavily on everyday language, personal experience and familiar metaphors when interpreting scientific terminology. As a result, everyday meanings often dominate sensemaking, diverging from scientific intent. Emotional responses were shaped less by the terms themselves than by the context in which they were encountered, including assumptions about timescale, likelihood and certainty that were not explicitly stated.

These findings highlight the risks of relying on assumed shared understanding when communicating HICPs. In response, we propose an evidence-informed glossary and communication guidance developed through iterative engagement with scientists, policy-facing colleagues and communicators. The glossary is intended as a practical framework to support clearer, more transparent and more consistent use of language, and as a foundation for further empirical work.

1. Introduction

The language of climate science does not remain confined to academic contexts, but percolates into public, political, and media discourse. The climate science community has been highly successful in bringing climate change into public awareness. Over the past five decades, it has moved from a largely academic concern to a mainstream societal issue – a regular feature of news coverage worldwide and the focus of international negotiations and political debate (Boykoff, 2011; Carbon Brief 2026). The central challenge today lies not in visibility, but in interpretation. Ensuring climate science is effectively communicated and informs meaningful action is now the priority.

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Climate change is the ultimate 'wicked problem' for society (Incropera, 2015), inseparable from emotions and politics, laden with uncertainty and complexity, and facing an ever-increasing tide of misinformation and misinformation. This makes climate communication inherently difficult, and given the stakes, the responsibility for navigating such communication should not rest on climate scientists alone. While climate scientists produce rigorous, evidence-based research, communication practices seldom receive the same level of systematic scrutiny (Wijnen et al., 2024). Instead, decisions around language and communication are frequently guided by assumptions or personal judgement rather than evidence-based insights into audience needs, sometimes due to a lack of formal training or institutional support. This reliance on assumptions risks policy or behavioural changes being based on a partial view of the underpinning science (Brügger et al., 2015; Howe et al., 2019; Young et al., 2019). Different scientists will inevitably bring their own perspectives to communication which can create the potential for real climate risks to be dismissed simply because those messages appear widely divergent. Addressing contemporary communication challenges requires the complementary expertise of social scientists and communication practitioners, whose insights and skills are essential for supporting effective engagement and strengthening the translation of climate science into informed action.

One pertinent illustration of these communication challenges is the rise of 'tipping points' framing. Since its introduction to climate science in 2005 (Hansen, 2005), tipping points discourse has expanded simultaneously across scientific and media domains, functioning as a 'boundary object' intended to convey the urgency of climate action to different social worlds (van de Hel et al., 2018). The climate scientists who adopted this framing sought to use it as a strategic communication tool, believing that invoking non-linear thresholds would play a transformative role in increasing climate risk perceptions (Russill and Nyssa, 2009). Empirical evidence for the effectiveness of this approach is, however, in short supply. Existing research on the impacts of such communication has found that public interpretations differ considerably from scientists' intentions (Bellamy, 2023), and there is no evidence that tipping points communication increases climate risk perception, strengthens efficacy beliefs (i.e., people's sense that action is possible and effective) or promotes climate action (Formanski et al., 2022; van der Hel et al., 2018; Nadeau et al., 2024). Critiques of tipping points framing have been growing, centred on arguments that concepts are not well-defined, that foregrounding highly uncertain global phenomena does not motivate positive engagement, and the limited utility for policy and governance (Kopp et al., 2025).

This issue has direct implications for decision-making. Our work with key UK government stakeholders at the science to policy interface has highlighted that the language applied to tipping points, and the wider umbrella category of so-called 'high-impact, low-likelihood' climate events (Wood et al, 2023), generates confusion for those working in policy. Interpretation of the term 'likelihood' can vary widely, and it is difficult to respond to dramatic language around specific climate hazards, without full knowledge of the strength of the available scientific evidence

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and the associated uncertainties. In this context, unclear and inconsistently defined terminology proves particularly problematic: many commonly used terms have everyday meanings that differ from their scientific usage, increasing the potential for misunderstanding across non-expert and policy audiences. Ambiguous or emotive language can complicate policy interpretation, and the absence of shared definitions makes it difficult to compare studies, assess the weight of evidence, or communicate collective scientific understanding. Where such terms appear without clear definition in authoritative assessments this can also raise questions of consistency and credibility, creating opportunities for misunderstanding or the spread of misinformation.

Despite the central role of language in climate communication, there remains limited empirical evidence examining how people actively negotiate and respond to commonly used terminology in practice. Existing studies tend to focus on stated definitions or individual interpretations (Bruine de Bruin et al, 2021; Reinsberg et al, 2025). Less attention has been given to how meanings are formed collectively, shaped by interaction, or influenced by emotion. As Formanski et al. (2022, pp. 8) observe, "*there are no evidence-based guidelines available on how communicators should discuss tipping points in public settings*." This gap is particularly problematic given the increasing visibility of the topic in scientific assessments (for example, IPCC, 2021 media reporting, and policy contexts.

Our study begins to address this gap, by examining how people make sense of terminology associated with 'high-impact, low-likelihood' (HILL) climate events. We set out with an overarching objective to promote greater clarity and consistency across scientific, policy, stakeholder and public communications when discussing these types of risks, primarily through development of a glossary for Met Office staff. Our work initially focused on collating commonly used terms and their accompanying definitions from authoritative published literature. This enabled us to establish a working baseline to further refine a glossary. From the outset, the process was designed to be co-developed through engagement with scientists, policy-facing colleagues, and communication practitioners, with the intention of fostering shared ownership, and ensuring the outputs were usable and clearly motivated. Through this early exploratory and participatory work, we also found that many widely used terms were not clearly defined, or were used inconsistently even within the scientific literature, with these ambiguities filtering into wider policy and public discourse. One specific issue was the interchangeable use of terms such as 'collapse' and 'shutdown' applied to studies of the Atlantic Meridional Overturning Circulation (AMOC), often without agreed definitions. By way of illustration, the word 'collapse' appears 79 times in the Working Group I report of the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report (AR6), yet this term is not defined in the text or in the glossary.

In response to these initial findings, this study took a deeper evidence-gathering approach, examining how different audiences interpret and respond to key terms, and whether these interpretations align with the intentions of scientists using them. Empirical findings from focus group discussions, described in detail in the Methods section, informed the

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development of a glossary and accompanying communication guidance that are more strongly grounded in both scientific practice and audience understanding than would otherwise have been possible.

One outcome of the initial exploratory process was the decision to adopt the term High-Impact Climate Possibilities (HICPs) to describe climate system responses whose probability is difficult to quantify but whose impacts could have particularly severe regional to global consequences. This term is used throughout this paper in place of labels such as 'HILL events' or 'low-–likelihood high-–impact (LLHI) outcomes', reflecting evidence-based concerns about how probability-based framing is interpreted outside specialist contexts, as well as the fundamental scientific difficulty of robustly quantifying probability for many such outcomes.

2. Study development and exploratory engagement

2.1. Research setting and positionality

This work was undertaken at the Met Office, the UK's National Meteorological Service, which advances weather and climate science to provide evidence and advice to support decision-making. Alongside its operational forecasting role, the Met Office undertakes climate science research through the Met Office Hadley Centre, which focuses on understanding climate variability, change, and impacts, and contributes to national and international climate assessments and evidence needs. The organisation brings together expertise across physical climate science, impacts and risk, communication, and policy engagement, meaning that scientific language must function across diverse professional and decision-making contexts.

Within the Met Office, the Knowledge Integration team operates at the interface of climate science, public communication, and government policymaking. Drawing on expertise in science communication, we facilitate multidisciplinary dialogue and engagement to support audiences' understanding, contextualisation, and appreciation of the relevance of complex science for policy development and real-world decision-making.

As Climate Science Communicators in the Knowledge Integration team, the two lead researchers have a unique and insightful perspective, informed by career experience in the science-policy-public interface. The analysis, therefore, is inevitably influenced by that existing knowledge and professional experience, as well as academic backgrounds in psychology and geography. This positionality underpins this research, with constitutive roles played in the interactions that informed this study.

2.2. Rationale for exploratory approach

Following the initial identification of challenges associated with the communication of HICPs, the study developed through an iterative and exploratory process rather than a fixed, pre-planned design. The approach evolved in

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response to insights gained along the way, reflecting the realities of taking a novel approach where there is limited prior work to draw on. In practice, this meant trying things, learning what worked and what did not, and adapting accordingly. While there are elements of the process we may approach differently in future, these insights could only have been gained by engaging with the problem in the first place. Although these activities do not form a formal part of the methodology or results presented here, they provide essential context for how the research unfolded and help explain the decisions that were made.

2.3. Initial evidence gathering

We began by pulling together an initial set of focus terms commonly used in climate science relevant to this topic, with particular attention to those associated with Earth system tipping elements, such as the AMOC. Where possible, definitions were drawn from IPCC reports. The exercise was not intended to produce a definitive glossary, but rather to establish a working baseline and to identify where definitions were missing, ambiguous, or contested. The process highlighted that even widely used terms were not always clearly or consistently defined, raising early questions about how these terms might be interpreted beyond scientific contexts.

2.4. Expert science engagement

Alongside this initial mapping, we engaged with a number of expert Met Office climate scientists, active in the international research community in this area, to explore how key terms were understood and used in practice. These discussions focused less on formal definitions and more on how language operates implicitly within scientific communities: what scientists assume others understand, how terms are used as shorthand, and where meanings may shift depending on disciplinary background or context. This engagement was particularly valuable in revealing how language that may appear precise and unproblematic within specialist expert communities, can carry assumptions that are rarely articulated, but which may matter greatly when communicating with wider and more diverse audiences.

2.5. Government stakeholder engagement

Engagement with key UK Government stakeholders supporting climate policy development, evolved over time and through multiple routes. Initially, insights were drawn from ongoing interactions embedded within regular iterative review and delivery processes related to work on this topic. These conversations surfaced early concerns about terminology, framing, and the potential consequences of language choices for policy interpretation and response.

To explore these issues in more depth, an online workshop was held with government stakeholders (n=16) in March 2025. The workshop included an overview of ‘HILL events’, a summary of recent AMOC research and scientific developments, and facilitated discussion around framing and language. Stakeholders were clear about the importance

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of achieving greater consistency and clarity in terminology. They emphasised the need for messages to prompt proportionate and appropriate responses, particularly in policy settings where language can influence risk perception and decision-making.

Following this, informal semi-structured interviews were conducted with a smaller subset of key government stakeholders (n=4). These interviews allowed for deeper exploration of the specific words, terms and framings that generated the greatest concern or confusion. They also provided space to discuss alternative language that stakeholders had encountered or adopted in practice, including terms they found helpful and those they considered unhelpful or misleading.

In June 2025, this engagement was extended through an in-person workshop involving a wider group of government stakeholders (n=20), alongside Met Office expert scientists. This session focused on facilitated discussion of a set of priority terms and the communication challenges they pose for policy. Bringing scientists and government stakeholders together enabled productive exchange across perspectives, and through plenary discussions participants reached consensus on several key points for further consideration.

2.6. Working group

Given the scale and diversity of research activity across the Met Office, it is not always easy to see how related work connects or where overlapping interests sit. To help bring together different perspectives, we established a cross-office working group of subject matter experts (n=12). The group provided a way to share insight, sense-check our approach as it developed, and reduce the risk of duplication or unintended impacts on related work.

The group also played an important role in shaping the work itself. Members provided expert challenge, helped refine thinking as understanding developed, and contributed to the iterative review and development of terminology. This enabled exploration of how language and framing vary across different user needs and disciplinary contexts, including meteorology, media and communications, climate services, stakeholder engagement, civil contingencies, climate security, and social science. Bringing together these complementary perspectives strengthened both the robustness and practical relevance of the work.

3. Methods

3.1. Study purpose and design

The purpose of this work was to develop a glossary and usage guidance to support clearer communication of HICPs. To inform this process, focus groups were conducted to gather qualitative evidence on how participants interpret, respond to, and negotiate meaning around selected focus terms. Recognising that focus groups offer insight into how

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people construct meanings in everyday life, both individually and through interaction (Bryman 2016), we selected this method to help bridge the evidence gap and test our assumptions about how language around high-impact climate possibilities is interpreted.

The focus groups were run internally within the Met Office. This reflected both the applied aim of developing a consistent Met Office language on the research topic and practical constraints related to funding, timescale, and access. With over a thousand staff members based at the Exeter headquarters, representing a wide range of backgrounds, professions, and expertise (with a vast array of employees having no formal scientific background), the potential internal participant pool offered access to diverse perspectives likely to mirror the mixed levels of expertise of potential future users of the glossary.

Conducting the focus groups internally supported our aim of ensuring the glossary was co-developed. By involving interested employees from across the organisation, we sought not only to gather valuable qualitative evidence, but also to raise awareness of and support for the project and afford participants a sense of agency and input in the process. We hoped also for the focus groups to themselves become vectors for cross-disciplinary discussion and stimulate collective sense-making through group activities.

3.2. Participant recruitment and sampling

Participants were initially recruited through an organisation-wide email circulated to approximately 1000 staff members in late July 2025, with encouragement of onward sharing. The email outlined an accessible, short summary of the study's aims and invited colleagues to register interest in participating in either the focus groups or in the expert working group. This approach reflects a form of volunteer sampling, whereby individuals self-select into a study based on their interest and willingness to participate – an approach commonly used in exploratory qualitative research (Etikan et al., 2016).

A total of 69 staff members responded via a Microsoft Form, providing their name, job role, profession, and information on how they currently engage with the topic, ranging from scientific research involvement (13) to involvement in customer or public communications (10), stakeholder engagement (7), general interest in the topic (15) or in language (11), or other forms of engagement or non-engagement (13). Of these, 57 individuals indicated a preference for participating in focus groups or stated no preference. This self-selected pool represented a wide range of professional backgrounds and job roles, seniority levels, and degrees of engagement with the subject matter.

In October 2025, respondents were contacted again to collect information about availability. From the 32 individuals who provided availability, participants were allocated into four groups, in line with established guidance that focus

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groups function most effectively with no more than eight participants (Barbour, 2018). In deciding focus group composition, we adopted a purposive sampling strategy, specifically aiming to maximise the diversity of expertise and perspectives in each group. Strategically approaching group composition allowed us to create varied samples, which enable the identification of commonalities and differences across participants (Bryman, 2016), as well as stimulate cross-disciplinary discussion. Group composition was also unavoidably shaped by pragmatic constraints including availability, scheduling practicalities, and the requirement for in-person attendance, introducing an element of convenience sampling typical in applied organisational research (Golzar et al., 2022).

After some last-minute withdrawals, the final sample consisted of 29 participants: two groups of eight, one of seven, and one of six. Gender balance was maintained within each group, and the distribution of professional backgrounds is summarised in Figure 1.

As is the case in most qualitative research, using a non-probability sampling approach does not allow for generalisation of results across a population (Etikan et al., 2016). Furthermore, we acknowledge that as Met Office staff, all participants' perspectives were likely shaped by the organisation's overarching focus on environmental and climate-related work, even where their expertise lay in other domains. This institutional embedding may introduce a shared set of assumptions, common frames of reference, and values that differ from those held outside the organisation. In addition to this, despite attempts to establish a safe and understanding group environment, the social makeup of the groups is likely to have influenced the opinions expressed, as is a common focus group limitation (Amir et al., 2024). 'Non-scientists' may have felt less able to offer their views, affording more authority to scientific participants who often assume the position of 'experts' in the group setting.

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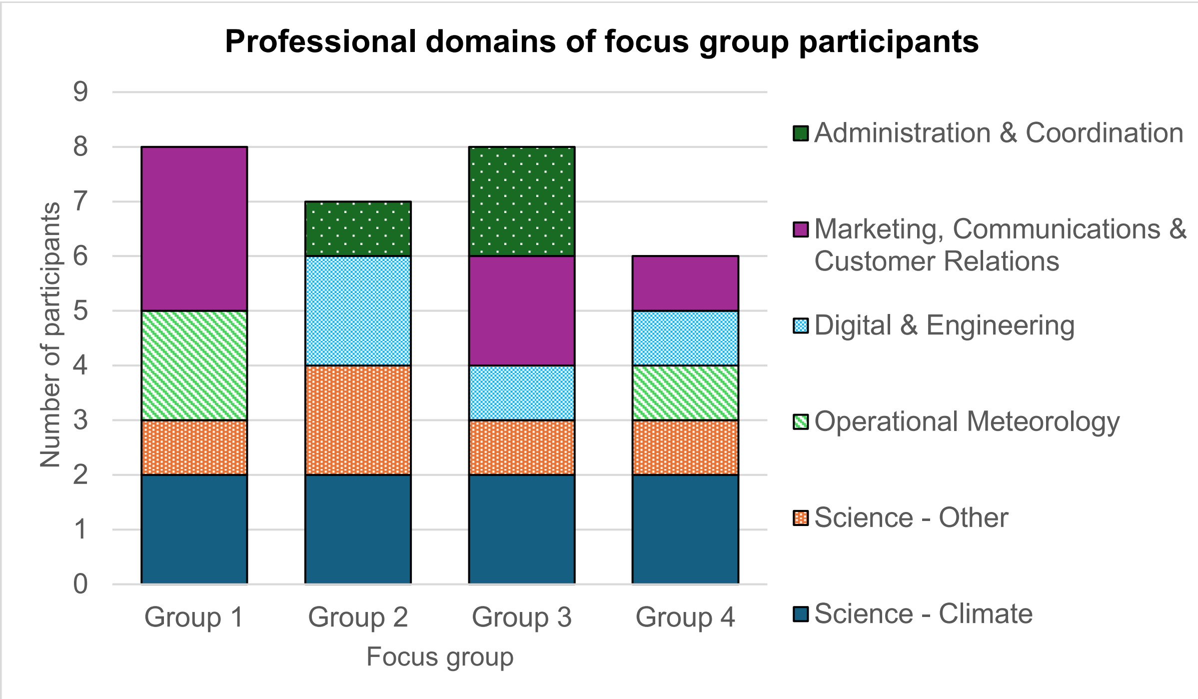

Figure 1: Professional domains of participants attending each focus group

3.3. Focus group procedure

Each focus group session lasted 90 minutes and was conducted in person in a meeting room at the Met Office's Exeter headquarters. The decision was taken to opt for fully in-person sessions, because physical presence fosters more natural interactions and stronger group dynamics, enabling deeper qualitative insights; subtleties can be drawn from non-verbal cues, atmosphere, emotion, and *how* things are said (Wilson et al., 2023). The activities were designed to involve movement and the use of physical cards and pens, and the controlled environment helped minimise distractions and support deeper engagement with the task.

To avoid biasing discussion, two neutral facilitators, experienced in workshop delivery but unconnected to the research topic, were appointed to lead the sessions. In line with the strengths of the focus group technique, which depends on allowing participants to shape the direction of dialogue and enabling new insights to emerge through interaction (Bryman, 2016), facilitators adopted a non-intrusive, non-leading style. They were asked to encourage contributions and challenges, gently refocus the conversation where necessary, and keep activities to time. A facilitator guide was provided, and a preparatory meeting ensured consistency of approach across groups.

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Each session began with a ‘group agreement’ slide outlining shared expectations around mutual respect, using simple language, active listening, balanced participation, collaboration, and adherence to the Chatham House Rule (Chatham House, n.d.) to ensure confidentiality. Then, personal introductions helped participants build familiarity and encouraged everyone to speak early on. The first activity followed, an ‘icebreaker’ activity, which was designed to allow all group members to make an early contribution whilst also orienting them towards the topic of the session.

3.3.1. Activity 1: Icebreaker

The icebreaker activity involved image selection. 35 images were laid out. These were sourced through Adobe Stock images using search terms ‘tipping’, ‘tip’, ‘environment’, ‘advocacy’, ‘action’, ‘crisis’, and ‘extreme weather’. A minority were sourced through more direct search terms like 'ocean' or 'rainforest' or 'ice' to depict common Earth System tipping elements. Images were selected to ensure a range of colours, tones, and interpretations were included. Participants were asked by the facilitator to “choose one image that resonates with you when I say, ‘tipping point’”. Each participant in turn then reflected on why they selected their image by feeding back to the group, prompted by questions on the slides asking, “why did you choose this image?” and “how does the image make you feel?”. As well as serving as a warmup activity to get participants thinking, this exercise was designed to elicit insightful information on participants’ understanding of the concept of ‘tipping points’ and the emotions and associations they held on this topic (**Error! Reference source not found.**).

Figure 2: Icebreaker images available for participant selection. (a) Consolidated images selected across four focus groups; (b) images not selected in any group.

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3.3.2. Activity 2: Definition matching

The second activity involved a definition-matching exercise. Participants were divided into two pre-determined breakout groups, balanced to maintain a variety of perspectives. Each sub-group received a set of twelve cards containing definitions: six drawn from the Cambridge Dictionary (2025) and six corresponding climate science definitions drawn by default from IPCC AR6 glossary (2021) where definitions existed (Table 1). In the absence of IPCC definitions, the definition for 'shutdown' was drawn from a recent scientific publication (Drijfhout et al., 2025), and the definition for 'collapse' was drawn from a Met Office article (Met Office, 2023).

Table 1. Outline of each of the selected focus terms and the corresponding climate science and dictionary definitions provided on the cards in Activity 2.

Focus term	Climate science definition	Dictionary definition (Cambridge Dictionary, 2025)
Tipping point	A critical threshold beyond which a system reorganizes, often abruptly and/or irreversibly (IPCC, 2021)	The time at which a change or an effect cannot be stopped
Threshold	A limit within the climate system (or its forcing) beyond which the behaviour of the system is qualitatively changed. (IPCC, 2021)	The level or point at which you start to experience something, or at which something starts to happen or change
Abrupt	A change in the system that is substantially faster than the typical rate of the changes in its history (IPCC, 2021)	Sudden and unexpected, and often unpleasant
Irreversible	The name given to a perturbed state of a dynamical system when, on a given time scale, recovery from this state due to natural processes takes substantially longer than the time scale of interest. (IPCC, 2021 [adapted])	Not possible to change; impossible to return to a previous condition
Collapse	A very weak state (Met Office, 2023)	To fall down suddenly because of pressure or having no strength or support

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Shutdown	When net northward transport below the mixed-layer is less than 2.5 Sv and the stream function at the depth of its 20th century maximum is less than 6 Sv (Drijfhout et al., 2025)	The act or process of ending the operations of a business, system, industry, etc., either temporarily or permanently

Participants were asked to review the cards and work as a group to try to match the definitions and suggest what term they might define. During the task, they were prompted to consider: (1) why they chose to pair particular definitions, (2) how closely the definitions matched, (3) whether they understood the definitions, (4) whether there was agreement on a corresponding term or whether multiple plausible options emerged. Whilst trying to match the pairs, the groups were also encouraged to suggest what their candidate term for each set of definitions could be and record these ideas on sticky notes alongside the cards (**Error! Reference source not found.**).

This task was designed to encourage collaborative negotiation of meaning; working in small groups required participants to justify their choices, articulate confusions, and make sense of the definitions together. By presenting the two sets of definitions, the exercise exposed contrasts between scientific and everyday meanings, and by removing the associated term, it tested the clarity of the definitions while prompting suggestions of alternative terminology. Completing this task also primed participants to think critically about language before moving into the later discussions.

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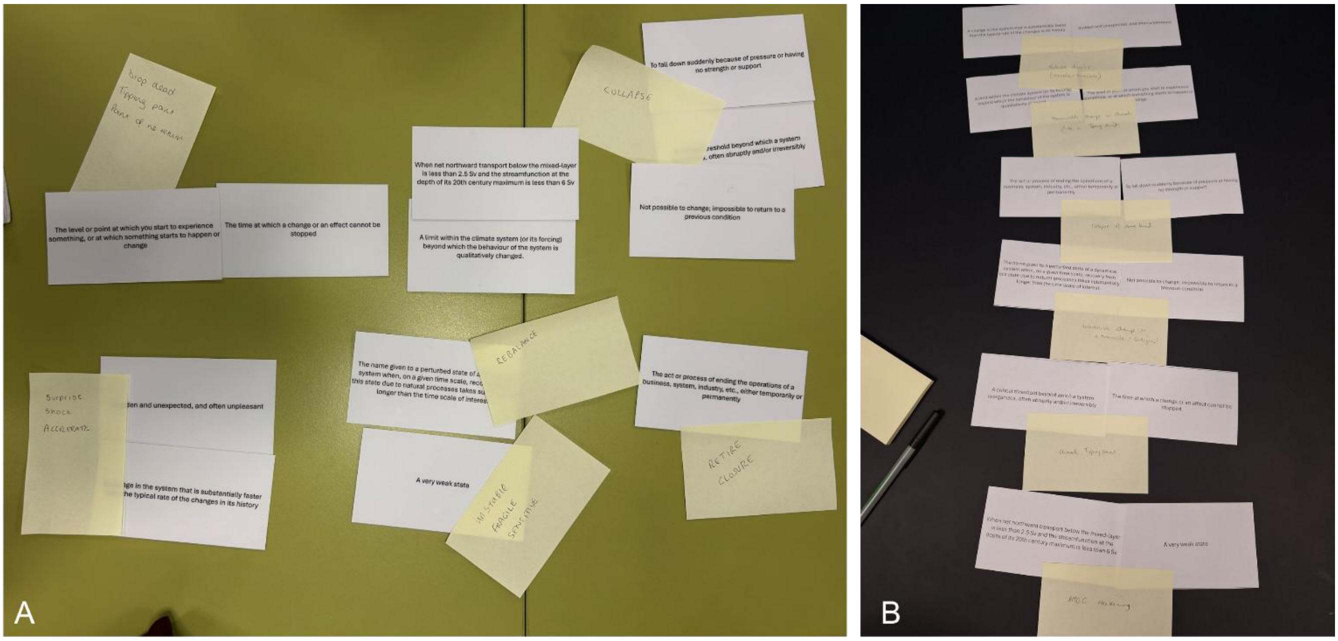

Figure 3: Final arrangements of definition cards and word suggestion notes produced by the two participant groups in Focus Group 1 (a) and (b).

3.3.3. Activity 3: Term reactions

The third activity captured individual, immediate responses to terminology before transitioning into collective group discussion. Each of the six focus terms was displayed on the screen in turn, accompanied by three prompts:

(1) “What does the term mean to you?”

(2) “How does the term make you feel?”

(3) “What alternative words could be used instead?”

Participants were given a few minutes to jot down their immediate responses to each term silently and independently on a sticky note. After participants had finished writing, the facilitator displayed the corresponding climate science and dictionary definitions (from the second exercise) on the board. These definitions served as discussion stimuli, encouraging participants to compare their initial intuitive reactions with the meanings given and to reflect on differences between both their interpretations and between the two definitions given.

This activity was designed to elicit both individual cognitive-emotional responses (via the sticky notes) and interactive, collective sensemaking insights (via the subsequent group discussion), thereby making use of the multi-level data collection strengths of the focus group method (Bryman, 2016). Although the emergence of the ‘correct’

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answers from Activity 2 was unavoidable, this occasionally enhanced discussion by prompting participants to reflect on their surprises or mismatches between their earlier guesses and the revealed terms.

Focus Group 1 (FG1) was disrupted by a fire alarm, resulting in approximately 30 minutes being lost to evacuation procedures. Due to time constraints, the facilitated discussion phase of Activity 3 was cut down in this group, and only brief reflections were collected. As a result, the qualitative richness of the discussion data from this group was more limited compared to other sessions, but the written sticky note data remained comparable.

3.4. Data collection

All the focus group sessions were audio-recorded, and the two lead-researchers attended each session as dedicated notetakers. We did not intervene in discussions, leaving facilitation to the neutral facilitators. Our role was to observe, document, and capture nuance, using a structured notetaking document for consistency. This template included sections for each activity, prompting us to capture insights like observations of interactions during the matching exercise, emotional tone of the icebreaker answers, general group dynamics, and non-verbal behaviours.

A notetaker was assigned to each breakout group for Activity 2 to ensure full coverage of small group dialogue. After each session, the two sets of notes were compared and merged into a single consolidated document for each group.

Photographs were taken of the outputs from group activities, including card arrangements, annotations, and the selection of images chosen in the icebreaker. All sticky-note responses from Activity 3 were transcribed verbatim into a spreadsheet. Audio recordings were transcribed using Microsoft Teams' automated transcription tool and then manually corrected for inaccuracies. The resulting dataset therefore comprised: (1) full focus group transcripts, (2) combined notetaking documents, and (3) a spreadsheet of all individual sticky-note contributions.

3.5. Analysis process

All material from the focus groups was examined through qualitative content analysis (Bryman, 2016).

Qualitative analysis software Nvivo15 was used to organise the data and facilitate the coding process, but all interpretative decisions were researcher-led, and coding was conducted manually to maintain close engagement with the data.

Focus group transcripts were analysed using an inductive thematic analysis approach, allowing codes and themes to emerge from the data (Hayes et al., 2023). After multiple readings of the four transcripts, line-by-line open coding was conducted. Initial codes were then grouped into recurring categories, which were refined through iterative comparison across transcripts, and then additionally through coding the notetaking documents. Further review and

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refinement of high-level themes took place through discussion with the lead author, and the results section is structured according to these prominent themes.

3.6. Reflexivity and researcher positionality

Subjectivity is inevitable in qualitative methodologies and in this particular study is an essential intelligence for interpreting the data and results. The presence of both the lead researchers in the focus groups was vital; to experience the dynamics of the groups, the atmosphere in the room, and the subtle undertones and specificities of interactions, embodiment in the space was crucial and reflexive notes on this experience were important for the analysis process. Furthermore, embodied knowledge of the overall iterative and exploratory process leading up to the specific focus group study was fundamental to inform the interpretation of the results in the multifaceted and complex wider context of this research.

4. Results

4.1. Personal preconceptions and sensemaking

Participants' reactions to terminology and definitions revealed how strongly personal preconceptions shape sensemaking. Across all four focus groups, individuals repeatedly anchored their interpretations of language in their own life experiences, professional contexts, or in everyday analogies, metaphors, or objects. To give but a few examples, abrupt was linked to interpersonal conflict "reminds me of people being rude" (FG3); collapse was visualised as a "line of dominoes" (FG2), a "folding chair" (FG2), or in context of "flooding and bridge and dam collapses" (FG4); and threshold was associated with severe weather warnings or imagined as a button being pressed.

Participants drew heavily on personal associations during the icebreaker exercise, which demonstrated very literally how central preconceptions were to how participants constructed meaning. Each person explained their specific reasoning behind associating 'tipping point' with the different images they chose, revealing a wide range of interpretive strategies. Across the focus groups, thirteen participants chose environmental scenes, such as sea ice or wildfire, often linking these images to their science-related professional contexts. Others drew instead on literal, autobiographical, or emotional associations: one participant chose an image of a pipe about to burst due to recent experience of house renovation; another chose an image of a chair because they imagined their daughter swinging on it; and another selected an image of money because they associated 'tipping point' with a well-known UK TV gameshow. Ten participants across the groups offered more metaphorical interpretations, with at least one person in each group selecting imagery related to dominoes to represent a cascade effect, and three people selecting imagery of a clock to convey a sense of time running out. These personalised sensemaking processes enabled all participants to

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engage with concepts and contribute their perspective, but they also underscored how easily divergent associations emerge, even just in the context of one term.

This range of personal preconceptions led participants to interpret the focus terms in conflicting ways. For example, one participant associated 'shutdown' with the gradual mortal decline of a vital organ, while others associated it with turning off a computer – an action perceived as fast and easily reversible. Additional associations included pandemic lockdowns, sporting terminology, and business closures. These differing mental models produced varied and sometimes contradictory interpretations of the term's implied permanence, speed, scale, agency, and emotional weight. This finding was evident across all of the six focus terms, illustrating how little shared meaning can be assumed.

A snapshot of the interpretations and associations for each term are illustrated in the word clouds in **Error! Reference source not found.**. These word clouds compile the sticky-note contributions from Activity 3, with the size of each word and phrase proportional to the frequency with which participants mentioned it. The most commonly associated responses with each term were: "permanent" (7) and "no going back" (7) for irreversible; "sudden" (26) and "unexpected" (10) for abrupt; "fall down" (13) and "break down" or "breakdown" (10 combined) for collapse; "stop" (21) and "turn off" (20) for shutdown; "limit" (13) for threshold; and "point of no return" (12) and "irreversible" (11) for tipping point.

4.2. Emotion & feeling

Across all focus groups, participants highlighted the emotional weight carried by some of the terminology. Across the full sample, 25 of the 29 participants chose images or provided explanations in the icebreaker that carried a distinctly negative emotional tone, highlight strong negative affect during this initial topic engagement. In every group the discussion arose that the terms seemed inherently negative; as one participant put it, "there's a lot of negative connotations to them, aren't there? Collapse. Shut down, tipping point. They sound bad." (FG1). Others similarly felt that the words predisposed them toward particular emotional reactions which could bias their interpretations of the underlying science, with one remarking "to me, abrupt definitely has negative connotations. That feels like in terms of science, it's presenting a kind of bias." (FG2) and another commented "to me they all have negative connotations. They seem pretty loaded." (FG2). These reactions are inevitably intertwined with the pre-existing associations discussed earlier; participants were not encountering neutral vocabulary, but terms already coloured by everyday meanings and personal framings. For some, this rendered the language overtly emotive: "I feel like collapse is a very emotionally charged word. I don't think you can say collapse without it being an emotional thing." (FG1). At the same time, a minority of participants expressed ambivalence or neutrality, noting that their emotional reaction would

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depend on the context. This nuance reinforces the idea that emotion emerges through the personalised intersection of language, experience, and the communicative setting in which the words are encountered.

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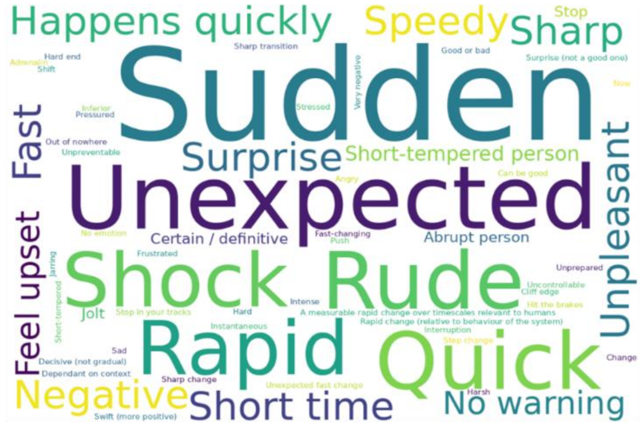
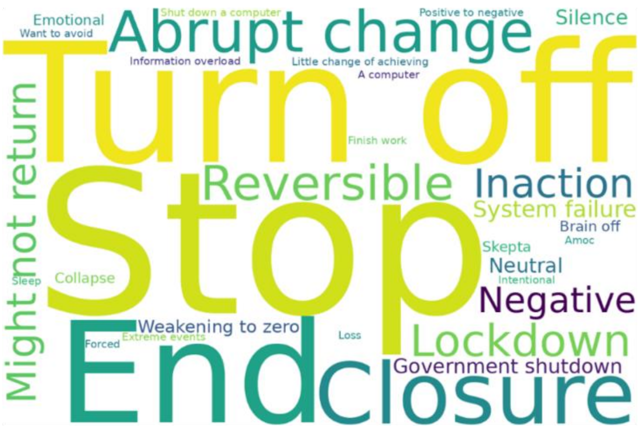
Word cloud 1: Irreversible

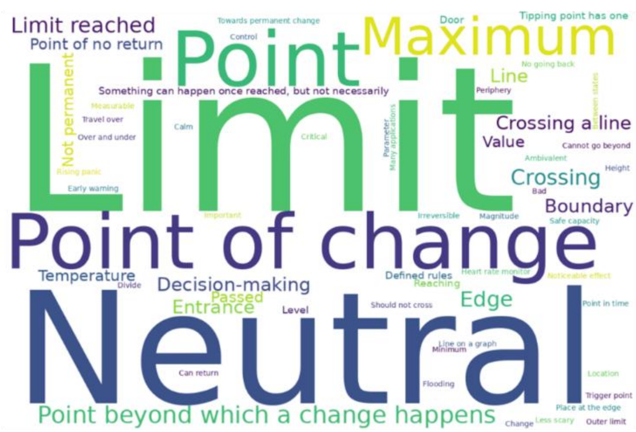


Word cloud 2: Abrupt

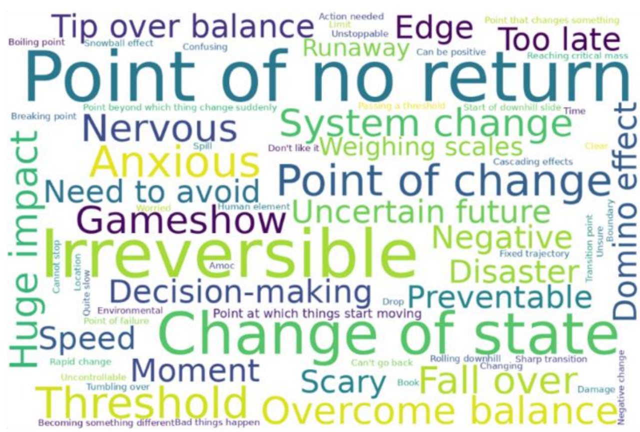


Word cloud 3: Shutdown

Word cloud 4: Collapse



Word cloud 5: Threshold



Word cloud 6: Tipping point

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Figure 4: *Word clouds showing individual responses to each term*

In some groups, the emotive nature of the terms was linked to a sense that the terms felt alarmist. This was debated in Focus Group 4, where participants raised the point that the terms felt more dramatic than their definitions: “On the climate side, it's kind of an alarmist definition, right? Well, not the definition, sorry the word, using the word… it’s quite…it’s a shocking word.” (FG4, discussing ‘collapse’). Groups asked questions about science communication strategies, wondering whether “somewhere along the lines there has been a conscious decision to try and make impact” (FG4), and questioning “how are these things intended to be read? What's the intention?” (FG2). Wider reflections on the intention behind scientific communication were explored: “if you’re trying to get the message across that this is a bad thing, those are probably the right sort of words” (FG1). Others were unsettled by the potential implications of language choices, noting that overly dramatic language might leave people feeling “paralysed…like can’t do anything to change it” (FG3) which participants reasoned was not a good premise for climate change communication.

In some cases these discussions gave rise to frustration, particularly pronounced in FG2, where perceived differences in scientific application and everyday understanding were identified as potentially misleading: “if that’s not what you really mean then don’t use it” and “the scientist is slightly misleading the public…yeah I don’t like that” (FG2). One participant expressed irritation with the reuse of language in different contexts: “I just wish that people would just make a new word…rather than reusing other ones that already have a meaning” (FG2).

4.3. Mismatch in scientific and everyday meanings

Across the focus groups, it became evident that in most cases, everyday interpretations of the terminology diverged substantially from climate science meanings. This misalignment was exposed during Activity 2 (definition matching), which most participants expressly voiced they found really challenging. Table 2 summarises the results of this activity. Half of the breakout groups across the sessions (four out of eight) managed to match only one or two intended pairs of definitions, and no group matched more than four out of six intended pairs. Where definitions were not successfully matched but a group came up with the intended focus term, in nine of these ten cases this was connected to the dictionary definition of the term, rather than the scientific definition.

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Table 2. Summary of results from definitions matching exercise in Focus Groups

Focus Term	Number of groups pairing both intended definitions (n = 8)	Number of groups pairing intended definitions AND focus term (n = 8)
Tipping point	4	4
Threshold	5	2
Abrupt	7	2
Irreversible	4	3
Collapse	1	0
Shutdown	0	0

Table 3 illustrates the variation in how intended definitions were matched and focus terms identified. While some definitions were more frequently paired this did not necessarily translate into identification of the intended focus term (particularly in the case of 'abrupt'). 'Collapse' and 'shutdown' proved consistently challenging across groups, reinforcing the strong potential for confusion around these terms, especially in the absence of context.

Table 3. Breakdown of results by breakout group Activity 2 with accompanying coding key.

Term	Tipping point	Threshold	Collapse	Shutdown	Abrupt	Irreversible
Group A	Y	P	P-DD	N	P	Y
Group B	P-SD	N	N	N	P	N
Group C	N	P-DD	P-DD	N	P	P-DD
Group D	Y	P	N	N	P	N
Group E	N	P	P	N	N	P-DD
Group F	Y	Y	P-DD	P-DD	Y	Y
Group G	P-DD	P-DD	N	N	P	P
Group H	Y	Y	N	N	Y	Y

Coding key

Y: Yes - Both intended definitions paired **and** correct term identified

P: Partial - Both intended definitions paired but incorrect term identified

P–DD: Partial - correct term identified with **dictionary** definition but incorrect scientific definition paired

P–SD: Partial - correct term identified with **scientific** definition but incorrect dictionary definition paired

N: No - definitions not matched and incorrect term identified

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When the definition pairings and intended focus terms were revealed, participants frequently expressed confusion, surprise, or outright objection. For example, the climate science definition of ‘irreversible’, which allows for a degree of impermanence, was strongly contested: “to me, that is not a definition of irreversible” (FG2), “I’m a scientist in a nearby field and that is not what irreversible means to me” (FG2). Similarly, objections arose around the term ‘abrupt’, with several participants struggling to reconcile a scientific definition that implied acceleration with everyday associations of an immediate stop (“hitting the brakes” (FG3)). As one participant explained, “something that is sudden and unexpected is very definitive. As opposed to the scientific definition, which is definitely not sudden, it's just saying faster than typical rate” (FG3), while another expressed ‘abrupt’ “doesn’t imply speed, it implies stopping to me” (FG2).

These semantic mismatches were especially pronounced for the term ‘collapse’, which generated prolonged discussion in every group. Participants in all groups objected to the idea that collapse could be defined as ‘a weak state’ in the case of AMOC, arguing that this conflicted with their understandings of the word. As one person put it “We didn't pair those together and I wouldn't describe collapse as a weak state” (FG4), while another firmly stated “Collapse is not a very weak state…No I’m not happy with that. Collapse is too late for that” (FG1). Additional confusion stemmed from the fact that both collapse and shutdown were interpreted grammatically as verbs/actions that happen, whereas the scientific definitions presented them as end states, more akin to nouns.

Overall, many participants found the scientific definitions difficult to understand. Some expressed complete uncertainty: “I have no idea what it's describing. It's describing something scientific, but I couldn't tell you in what field or what” (FG4). Others felt they could not reconcile definitions with the terms they are intended to define: “I don't think I’d ever have got to abrupt as the thing it was trying to describe.” (FG4). A few scientists acknowledged how challenging it really is to come up with a clear definition for scientific terminology, noting that many definitions emerge through group negotiations, with iterations of objections and modifications sometimes culminating in “something that’s almost unreadable” (FG4).

4.4. The importance of context

“I think if the scientific definition differs from the dictionary definition by like any significant amount, then there needs to be context provided so that anyone reading will be able to understand. Because without that context you have two sets of people, or maybe more, who will understand possibly that word in different ways. In ways that it wasn't intended to be read.” – (FG2)

A standout topic of all focus group discussions was the importance of context, particularly qualifying information related to timescales, which emerged as one of the most recurrent themes through the analysis process. Participants

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repeatedly drew out that context and qualification is essential to understanding, and the importance of this perhaps emerged significantly due to the deliberate lack of applied examples in the design of focus group activities. This finding is especially important in light of the previously discussed evidence of the gap between scientific and everyday meanings, and the influence of people's preconceptions; because terminology does not carry inherent shared meanings, contextualisation becomes essential to ensure that terms are interpreted as intended.

Discussion of timescales mainly centred around the difference between 'human' and 'climate/ planetary/ geological' timescales, particularly in relation to the definitions of the words 'irreversible' and 'abrupt', but also 'collapse' and 'shutdown'. Likely due to the scientific literacy of many attendees, the idea that there is a significant difference between timescales of interest in the climate context and in everyday understandings emerged multiple times, and this idea was identified as problematic for comprehension. "Yeah, like you're saying with the building analogy that collapse is quite a quick thing. Whereas if you're talking about climate timescales 200 years is not. I mean maybe on the climate side…but" (FG4). On this topic, groups worked together to explore this potential confusion, for instance a participant in Focus Group 2 (FG2) posed a question to a climate scientist "But then in the timescale is 100 years a very short time in context and therefore could it be rapid in that sense?" who responded by trying to explain rates of change in relation to AMOC. These exchanges revealed that participants were willing and able to engage with complex concepts but wanted explicit contextualisation to enable full understanding. The confusion expressed across the groups suggest that concepts such as 'irreversible' and 'abrupt' cannot be meaningful interpreted without anchoring them to relevant time horizons, particularly because these clash with existing temporal connotations attached to this language. This highlights that context should not be considered optional or supportive, but foundational for comprehension of climate processes.

5. Discussion

With this research, we set out to understand how people perceive and interpret the language used to communicate HICPs, and to test assumptions about how such language shapes understanding, emotion and judgement. Our aim was to generate evidence that could inform clearer and more consistent communication, through development of a glossary, particularly in areas where terminology carries heavy cognitive or emotional weight. This focus provided the foundation for analysing how participants made sense of scientific terms, where ambiguity created unintended interpretations, and how communicators might better support audiences in navigating complex and uncertain climate information.

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5.1. Underpinning theory behind findings

From the outset, what quickly became clear is the challenge extends beyond identifying the *right* terms. Much of the difficulty arises because meaning is often left implied. In a discipline shaped by uncertainty, long timescales and complex system behaviour, leaving assumptions unstated places a great deal of responsibility on audiences to decipher the context, relevance and intent.

Sense-making research helps explain what happens next. When key assumptions are left implicit, people rely on what they already know, what feels relevant and the cues available in the moment to work out the meaning for themselves (Dervin, 1983; 2005). When terminology is not clearly defined, people naturally fill the gaps using their existing mental models, the everyday working theories they use to navigate the world, along with analogies, associations and lived experience (Johnson-Laird, 1983; Morgan et al., 2002; Bruine de Bruin and Bostrom, 2013). This helps explain why familiar terms such as 'collapse' or 'irreversible' can feel more confusing than clarifying in the climate context. Their everyday meanings are strong, emotional and deeply embedded, and these meanings are applied to climate communication whether intended or not.

These processes do not happen in isolation. The way people construct meaning is shaped by the broader worldviews and paradigms they bring with them. These are the lenses through which we each view and interpret the world around us and are influenced by our values, identities and beliefs about how knowledge and reality are constructed (Creswell and Creswell, 2022; Blaikie and Priest, 2017). Put simply, a worldview shapes what feels plausible, what feels threatening and what feels worth acting on. At a deeper level, this involves assumptions about ontology, (i.e., what someone considers to be real or most important), and epistemology (i.e., what counts as legitimate knowledge or evidence). These are not abstract philosophical extras. They influence how uncertainty, probability and time are understood and help explain why two people can hear the same statement and come away with very different interpretations.

This is particularly relevant in climate science, where many physical scientists work from an ontology that treats reality as objective and observable, and from an epistemology that prioritises empirical, quantitative evidence. Not all audiences share these assumptions. Some take a more constructivist view, where reality and meaning emerge from experience, social context and interpretation. When communication rests only on an objective or 'postpositivist' worldview (Creswell and Creswell, 2022), it can unintentionally clash with the way some audiences make sense of information. What appears to a climate scientist as a clear and factual statement may not land in the same way for someone whose assumptions differ. This does not mean the audience fails to understand. It means they understand through a different set of assumptions. Recognising this can reduce frustration and support communication that connects across different ways of thinking.

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The emotional responses observed in this study also fit within this wider interpretive process. Reactions were not driven by dramatic language alone. They arose through how people evaluated or 'appraised' what a message meant for them. Appraisal theory emphasises that emotion depends on assessments of relevance, risk, control and the potential for action (Lazarus, 1991). When language gives a sense of inevitability or finality without explaining timescales, uncertainty or agency, people sometimes default to worst case conclusions. Under conditions of ambiguity, this can be a very rational response. Existing research shows that making climate change feel close or using fear-based messaging does not reliably motivate action and can produce unintended and counterproductive effects depending on audience and context (Brügger et al., 2015; Ettinger et al., 2021).

Furthermore, we also found that participants were not necessarily struggling to understand scientific terms. Rather, they questioned whether the language used felt fair, proportionate or sufficiently transparent. Their concerns often centred on what had been left unsaid, particularly around timescales, likelihoods and degrees of confidence. In one focus group exchange, participants discussed the term 'irreversible' in exactly these terms:

P1: "I guess to like someone in the public if they thought it was the one on the right [the dictionary definition]. It wouldn't really matter because maybe it's irreversible on, you know, 500 years, 1000-year time scale. If that happened, if say the AMOC collapses and it's not going to return for 1000 years. It doesn't really matter whether it's 1000 years or 10,000 years or never. It's multiple generations of that change. So, it still has that cutting impact. Obviously, the scientist doesn't really mean never."

P2: "So, then the scientist is slightly misleading the public when they say never"

P3: "Yeah I don't like that."

These reactions suggest that the issue was not a lack of knowledge but a desire for clearer context that aligns with how people make sense of information in their everyday lives. This is consistent with the contextual model of science communication, which argues that understanding is shaped by values, prior experience and relevance rather than by information alone (Brossard and Lewenstein, 2010). From this perspective, communication challenges again arise when key assumptions remain implicit or when language does not connect with the beliefs and interpretive frames audiences bring with them. Providing more information does not resolve this. Audiences need clarity about what scientists mean and why certain terms are used.

One participant illustrated this quite humorously when discussing geological time.

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"I guess when you think about it, just relating to the geological timeline. To think about something like the dinosaurs becoming extinct caused by an asteroid strike. It did not happen instantaneously; it took probably tens or hundreds of thousands of years for it to actually occur. Which, in geological time, is like the blink of an eye. But if we were there witnessing it, we would be like, huh, there are still a lot of dinosaurs around for many years."

This reflection highlights how scientific framings of time can differ sharply from everyday experience, and how easily misunderstandings can emerge when these assumptions are left implicit.

5.2. The glossary

Our findings and analysis highlights that the challenges in communicating HICPs do not arise simply from the choice of individual terms, but from the assumptions left implicit when those terms are used. Participants did not struggle to engage with the terminology itself but interpreted its meaning through everyday frames where assumptions about timescale, likelihood, uncertainty or scope were not made explicit. In response, a key outcome of this study was the development of a glossary (see Supplementary material).

The glossary is intended as an applied, evidence-informed response to the gap identified in the literature, where limited attention has been paid to how terminology is actively negotiated and responded to in real-world settings. It supports our overarching objective to build greater clarity and consistency across research, government and public communication, beginning within the Met Office. We recognise the significant scientific, professional and personal challenges involved in communicating these issues, and this work is not intended as a critique of existing practice. Rather, the glossary is intended to complement ongoing efforts by providing tools and recommendations (outlined further in this paper) that help align scientific intent with how language is understood and used in practice. It is not presented as a definitive or complete solution, but as an initial framework designed to encourage discussion and more consistent use of language.

Here, we outline each of the terms explored during the focus groups and how insights have been applied into the development of each. We often found climate science definitions were designed to capture the precision and specificity that defines scientific scope, whilst also being understandable for a wider non-technical audience to comprehend. Focus group findings show that neither of these intentions is often achieved. In our glossary, therefore, we propose that each entry is structured to reflect the different roles that terminology plays across audiences. Scientific definitions retain the technical precision required by specialists working directly with the underlying evidence. These are paired with plain language explanations, designed to make assumptions explicit and provide context that supports understanding across disciplines and professional domains where technical definitions alone may be insufficient. A final guidance and recommendations section draws directly on empirical findings to offer

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practical advice on how terms should be used in communication (whether scientific, stakeholder or public), including where additional temporal, spatial or situational context is needed, and why certain terms are not recommended due to ambiguity or risk of misinterpretation.

5.2.1. High-Impact Climate Possibilities (HICP)

We recognise that grouping phenomena such as tipping behaviours under an umbrella term persists in practice, so while individual phenomena should ideally be described separately, there is justification for retaining an overarching category. The term 'High-Impact Climate Possibilities' was developed to replace 'high-impact low likelihood (HILL) events' and to avoid embedding assumptions about likelihood within such a label. Insights from government stakeholders during the exploratory phase showed that terms such as 'low likelihood' were frequently misinterpreted or conflated with timescales and confidence, particularly in relation to AMOC change. 'Possibilities' was selected to reflect potential large-scale climate system responses without implying probability, timing, or certainty, as terms such as 'events' or 'outcomes' might. Where probability information exists for a specific HICP, we recommend that it should be communicated explicitly alongside confidence; where it does not, this absence should be stated. The definition excludes extreme forcing scenarios and compound weather events to avoid confusing phenomena that takes place on shorter weather timescales, therefore maintaining a focus on climate system responses.

5.2.2. Earth System Tipping Points

We retained the term 'tipping point' with the addition of 'Earth system' to distinguish physical processes that include climate and ecological changes, from social tipping points relating to societal change. We found that tipping 'point' was often confused with tipping 'element' i.e., AMOC as a tipping point rather than an Earth system element vulnerable to tipping. To avoid reinforcing an overly simplistic framing, the glossary distinguishes between tipping elements, tipping points, and post-tip transitions.

Focus group evidence indicated that participants broadly understood the term as describing a shift from one state to another. However, we identified that dominant understanding is largely based on a bifurcation-type analogy (for example, a tipping chair), implying a single sharp threshold and immediate transition. In contrast, climate system tipping can take multiple forms, including cases where multiple thresholds are crossed, responses are delayed or non-instantaneous, where steady change occurs too rapidly for a system to adapt (rate-induced tipping), or where internal variability and interactions with other systems trigger a shift (noise-induced tipping). We therefore remain sceptical that 'tipping point' is the most appropriate term but recognise that it is deeply embedded in general discourse and would be challenging to replace.

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5.2.3. Abrupt

Focus group evidence showed that 'abrupt' was almost always interpreted as meaning sudden and immediate. In contrast, scientific usage often referred to situations where change accelerates because the system's own internal processes reinforce it, even where this unfolds over much longer timescales. This mismatch between every day and scientific meanings risks misunderstanding. For this reason, we propose the term 'self-accelerating change', which more directly reflects the underlying scientific process without implying suddenness. Guidance is provided on the use of 'abrupt' where it is still considered appropriate and aligns more closely with everyday usage. In such cases, communicators are encouraged to provide additional context, particularly around timescales, to reduce ambiguity and support clearer interpretation.

5.2.4. Irreversible

The term irreversible was retained as its scientific intent broadly aligns with everyday meaning, though focus group evidence highlighted a need for clearer contextualisation. Participants frequently interpreted the term as implying an absolute "point of no return", which did not always match the underlying science. There was also confusion about whether irreversibility referred to a specific Earth system element, such as an ice sheet, or the Earth system as a whole. Scientists often assumed that irreversibility on very long timescales of 100 years or more would be understood as effectively permanent, but focus groups indicated this assumption was not shared. The definition has therefore been refined to emphasise scope and timescale, with additional guidance encouraging clearer explanation and the use of alternatives such as 'hard to reverse' where claims of permanence are not well supported.

5.2.5. Threshold

Although the scientific meaning of 'threshold' does not strongly diverge from everyday usage, focus group discussions showed that participants frequently associated the term with 'tipping point' rather than interpreting it independently. Given that 'threshold' is already well defined and widely used in the scientific literature, and that it did not add substantial clarity within the specific context of HICPs, it was not included as a standalone glossary term.

5.2.6. Collapse and Shutdown

The terms 'collapse' and 'shutdown' were found to be highly problematic. Focus group participants were unable to consistently reconcile scientific and dictionary meanings, and our literature review revealed no universally accepted or consistent scientific definitions. For the AMOC, 'collapse' may be used inconsistently to describe major weakening or loss of function, crossing a tipping point, the post-tip transition, or complete cessation to zero-strength, and was often used interchangeably with 'shutdown'. This ambiguity has significant implications for interpretation and policy response. Given the lack of definitional clarity and high potential for misinterpretation, use of these terms is not

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recommended in scientific, policy, stakeholder and public communications referring to physical climate system change. More descriptive language, accompanied by clear spatial and temporal context for the part of the climate system in question, is encouraged instead.

5.3. Value of the focus group setting

It is worth highlighting how this study demonstrated the value of multidisciplinary group exercises, such as focus groups, as methods of exploring language and sensemaking, and informing glossary development processes. Participants tested and refined their interpretations through discussion, challenged each other's assumptions and drew on collective experience. This aligns with dialogic models of communication (Ettinger and Painter, 2023), in which understanding emerges through conversation rather than simple information transfer. It also becomes easy to see how public 'misunderstanding' may be a predictable outcome of the ways terminology moves between scientific, media and public contexts.

A slightly surprising observation of the focus groups was the interactions of scientists. All participants were encouraged to approach the focus groups as exploratory discussions with no right or wrong answers. We observed, however, that those with scientific backgrounds sometimes oriented to the task as if correct interpretations existed. Climate scientists were often quick to assert their expertise during break-out discussions, even though the focus groups were concerned with how people respond to language rather than the science itself. This early self-positioning appeared to shape group dynamics. Participants without scientific backgrounds were often slower to contribute or to challenge interpretations that had been put forward by scientists, and facilitators frequently needed to prompt clarification or encourage questioning to support shared understanding. Although these dynamics were not formally analysed in depth, they were consistent across sessions and suggest that visible expertise and confidence may have influenced participation and the negotiation of meaning. It would be interesting to see if this is reflected in other settings and discourse too, and what effect this has on the way people interpret and understand climate information.

6. Conclusions

The primary aim of this study was to support greater clarity and consistency in the communication of HICPs, through the development of an evidence-informed glossary. Our findings demonstrate how context is fundamental to how terminology is understood, yet it is often left implicit. In practice, everyday meanings dominate sense-making, meanings shift across settings, and emotional responses are shaped more by experience and inference than by scientific evidence alone. As a result, some commonly used terms carry stronger negative affect, or imply certainty and finality, beyond what the science intends to convey. We applied these insights directly into the development of the glossary and, more broadly, in a set of recommendations arising from evidence gathered throughout the study. We

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now invite this glossary to be used, tested and scrutinised in practice, whether as a shared anchor for discussion, a prompt for further empirical work, or a starting point for collaboration between climate scientists, social scientists, communicators and specialist practitioners to develop clearer, more usable guidance as evidence and needs evolve.

7. Recommendations

The recommendations presented below are drawn directly from insights gathered across the literature review, interviews and workshops undertaken during the exploratory phase of this study, the focus group findings, and the iterative activity of developing the glossary itself – as outlined in the Discussion. Together, these strands provided both theoretical and practical insight into how terminology is interpreted, negotiated and responded to in real-world settings. They are intended to provide pragmatic guidance for scientists, communicators and organisations, supporting clearer, more transparent use of language when discussing HICPs, while remaining adaptable as understanding and communication needs continue to develop.

7.1. For scientists

Retain technical precision and pair it with clarity and context. Work with communicators to agree scientifically robust definitions **and** accompany them with plain language explanations. This includes timescales, conditionality, probability, reversibility and degrees of confidence.

Avoid relying on familiarity as a substitute for clarity. Terms that feel every day or intuitive to scientists often carry very different meanings for non-specialist audiences. Explain what the term means in context, not just what it is called.

Make implicit assumptions visible. Clarify what a statement does and does not mean. This reduces the likelihood that audiences will fill the gaps with unintended interpretations.

7.2. For communicators

Use emotional content carefully and purposefully. Avoid assuming that stronger emotional language increases engagement. Fear-based or urgency-focused messaging should only be used when paired with clear context <u>and</u> effective actions.

Provide context before asking audiences to react. Instead of making impacts feel spatially close, imminent or dramatic, explain the relevant timescales, uncertainty and agency so that people can orient themselves meaningfully.

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Support interpretation, not reaction. Help audiences understand why a term is being used, how it may be interpreted in different ways, what assumptions it carries, and what the science does and does not indicate.

7.3. For organisations

Treat terminology as shared infrastructure: Create and maintain tools such as glossaries, usage guidance and shared definitions so that communication across disciplines is consistent and interpretable.

Develop language collaboratively across disciplines: Break down siloes by involving multi-disciplinary scientists, communicators and social science practitioners when shaping terminology, recognising that words function differently across worldviews and professional cultures.

Take worldviews and identity seriously: Communication strategies should account for the ways trust, values and identity shape how messages land. Facts alone do not determine interpretation; framing and context matter.

Embed reflective practice: Through training and collaborative engagement**,** encourage teams to consider not only what the science says, but how audiences might understand it, and what assumptions might need to be surfaced for a fair interpretation.

8. Potential future research

The scale and complexity of terminology challenges highlighted by this study support a clear need for specialised, interdisciplinary expertise. Future work would benefit from involvement from researchers with significant and applied experience in language and linguistics, glossary and standards development, psychology, science communication, and behavioural science. Such expertise is critical not only for refining terminology, but for understanding how language is interpreted, trusted, and acted upon across different audiences and contexts.

It would be beneficial to test the terms, definitions, and plain-language explanations beyond the settings examined here. Evaluating their use across a wider range of communication contexts, such as media reporting, educational materials, policy briefings, and risk communication products, would help to identify where terminology is helpful, misleading, or actively counter-productive. This would also allow systematic assessment of how definitions perform when removed from the controlled environment in which they are first introduced.

Future research could explore extending the approaches used here to a much wider set of climate science terms. Many concepts beyond those examined in this study are used routinely across scientific, policy, and public contexts despite carrying implicit meanings that may diverge from scientific intent, such as ‘overshoot’. Applying interdisciplinary,

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evidence-led testing at a broader glossary scale could help identify where language consistently supports or undermines understanding, and inform more systematic, user-tested approaches to climate science terminology.

Relatedly, there is a strong case for extending this work into multilingual and cross-cultural contexts. Translation into other languages may introduce additional layers of ambiguity, particularly where colloquial usage, metaphorical, or culturally specific associations differ from those in English. Investigating how key terms are translated, understood, and used in different languages could help identify risks of miscommunication and support the development of more globally robust terminology.

Finally, future research could examine more closely what different audiences need from scientific language in order to support understanding at varying levels of technical competence. This could include how visible expertise and confidence shape participation, interpretation, and the negotiation of meaning. For organisations such as the IPCC, there is considerable value of greater and more systematic involvement of social scientists from different regions of the world, applying culturally informed behavioural and communication insights. Such contributions could help assess whether terms resonate with intended audiences, where they fail to do so, and how language might be adapted without compromising scientific integrity.

Data availability

The qualitative data generated in this study consist of focus group audio recordings, transcripts, written participant materials (e.g. sticky notes) and researcher field notes. These data contain personal views and discussion from Met Office staff and cannot be made publicly available in full due to confidentiality and ethical considerations.

Further information about the study design, data collection and analysis procedures is provided in the Methods section. Reasonable requests for access to additional anonymised data may be considered by the authors, subject to ethical approval and institutional constraints.

Author contributions

KM: Conceptualisation, supervision, methodology, investigation, formal analysis, writing - original draft, writing - review and editing. LM: Methodology, investigation, formal analysis, writing - original draft, writing - review and editing. RW, RS: Writing - review and editing. KM had final responsibility for the manuscript.

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Competing interests

The authors declare that they have no conflict of interest.

Ethical statement

This study was conducted in line with the Met Office's research integrity principles. It involved internal focus groups with professional colleagues and did not include members of the public or vulnerable groups. Participation was voluntary, with informed consent provided in advance, including information on the purpose of the research, data use, and the right to withdraw. Discussions followed Chatham House Rules, transcripts were anonymised prior to analysis, and care was taken to avoid harm or misrepresentation when reporting participants' views on potentially emotive climate terminology.

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