COMMUNICATING EXTREME WEATHER EVENT ATTRIBUTION

Research from India and Kenya
Full report

DR. MIRIANNA BUDIMIR AND SARAH BROWN

PRACTICAL ACTION
Consulting

COMMUNICATING EXTREME WEATHER EVENT ATTRIBUTION

Research from India and Kenya
Full report

DR. MIRIANNA BUDIMIR AND SARAH BROWN

The Schumacher Centre
Bourton on Dunsmore
Rugby
Warwickshire
CV23 9QZ
United Kingdom
Telephone: +44 (0) 1926 634403
Email: consulting@practicalaction.org.uk
www.practicalaction.org

Authors: Dr. Mirianna Budimir and Sarah Brown
Cover photo: Knud Falk / IFRC Climate Centre
Design: Practical Action Latin America

March, 2017

About this report

This report summarises the findings of a research project by Practical Action Consulting (PAC) in India and Kenya. It was commissioned by the Raising Risk Awareness (RRA) initiative. The RRA initiative is focused on strengthening networks, technical capacity and communication of the attribution of extreme weather events in East Africa and South Asia.

RRA is a partnership of the World Weather Attribution (WWA) initiative and the Climate and Development Knowledge Network (CDKN). WWA is an effort led by Climate Central, in collaboration with the Red Cross Red Crescent Climate Centre, University of Oxford, University of Melbourne, and the Royal Netherlands Meteorological Institute.

Acknowledgements

Thanks to all the people involved in this research project. They include KR Viswanathan (India), Rajeev Jha (India), Gautam Gupta (India), Elvin Nyukuri (Kenya) Abraham Kisang (Kenya), Jechoniah Kitala (Kenya), Sarah Standley-Johansen (UK), Alicia Quezada (Peru), Giorgio Madueño (Peru), and Sharon Mackenzie (UK), from Practical Action Consulting. Also, thanks go to Julie Arrighi (Red Cross Red Crescent Climate Centre), Roop Singh (Red Cross Red Crescent Climate Centre), and Irina Feygina (Climate Central).

Photographer: Tamara Leigh/IFRC-Climate Centr

Introduction

Climate change attribution analysis assesses the likelihood that a particular extreme weather event has been made more or less likely as a result of anthropogenic climate change. Communication of extreme event attribution information in the immediate aftermath of an extreme event provides a window of opportunity to inform, educate, and affect a change in attitude or behaviour in order to mitigate or prepare for climate change. Timely access to this information can help decision makers to ensure that appropriate adaptation and investment decisions are prioritised.

Effective communication of climate change attribution information is critical to ensuring that decision makers at all levels do indeed understand and are able to act upon such information. In early 2017 this research project examined the most effective methods, phrases and tools for communicating climate change attribution information, considering comprehension, ease of understanding, and willingness to take action across a range of different actors in two countries (Kenya and India).

This research first compiles key lessons on climate information/extreme event attribution communication from the literature. It then examines awareness of climate change, preferences for phrasing/presentation of climate change attribution information, and most trusted conveyors of such information. Data was collected from national high-level decision makers, national and local media, and general public in locations across India and Kenya. The final section extracts key conclusions and recommendation to improve future communication of extreme event climate change attribution information.

Purpose

This research project will help examine and provide guidance on how best to communicate attribution information to high-level decision makers, the media, and the general public on extreme weather event.

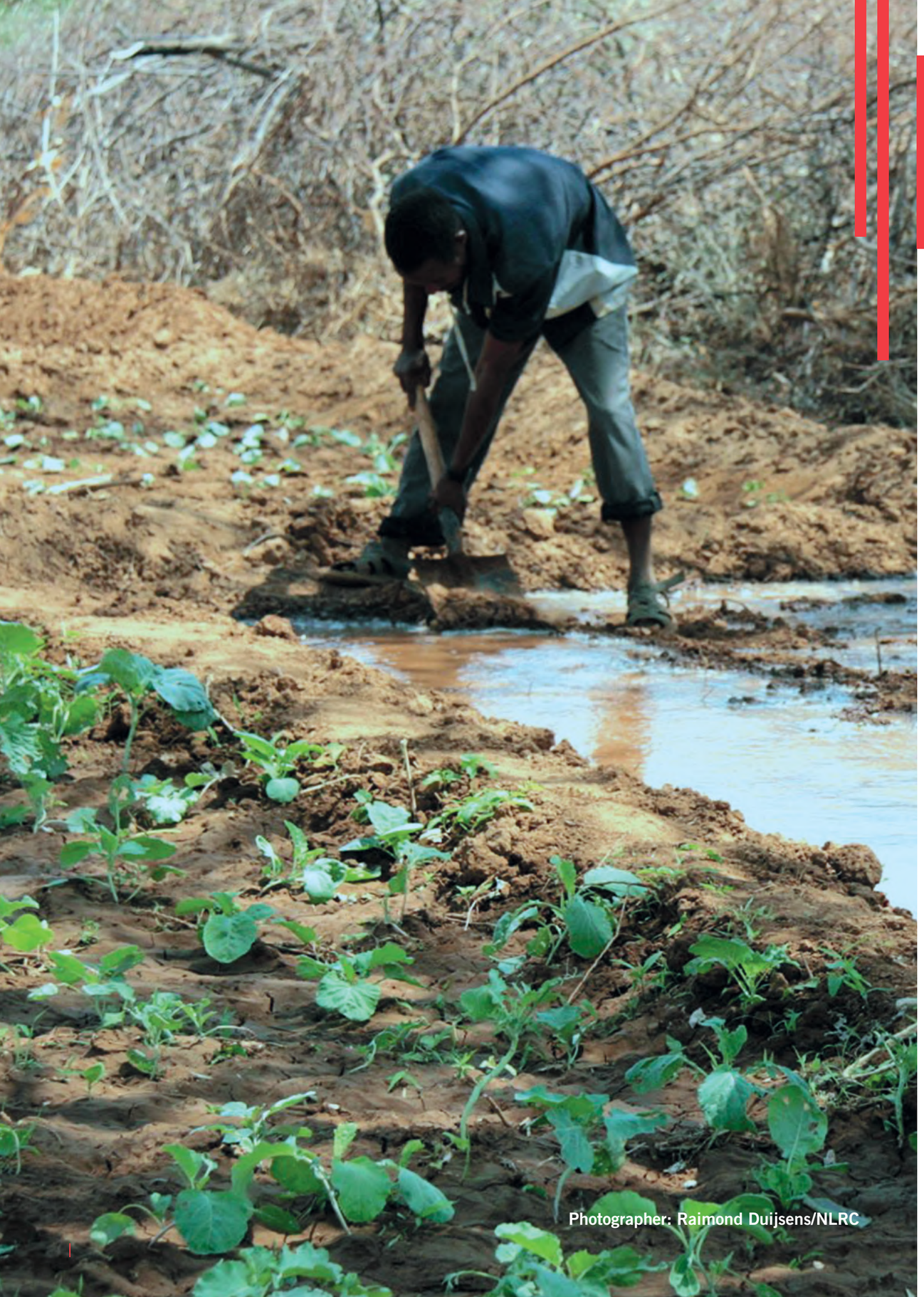
Guiding research questions

1 effective **phrasing** of attribution information

2 appropriate **visual** communication of attribution information

3 **trusted** sources and channels to communicate information

Photographer: Raimond Duijsens/NLRC



Photographer: Raimond Duijsens/NLRC

Literature review:

communicating climate information

Despite advances in climate science, communication of climate information to end users remains a challenge (Wilkinson et al, 2015). Climate change and climate variability is immensely complex and uncertain (Moser, 2010; Scienseed, 2106). Communicating uncertainty is essential as it allows end-users to make better informed decisions and helps manage user expectations (Wardekker et al., 2008; WMO, 2008; Padgham et al., 2013). Communicating climate information is also challenging as it is hard to see, has geographically and temporally distant impacts and lacks immediacy between cause and effect (Spence and Pidgeon, 2010; Moser, 2010; Kandlikar et al., 2005; Kaufmann et al., 2016)

The difference between climate change and climate variability

Climate variability refers to the way the climate fluctuates yearly above or below a long-term average value. Climate change is a longer-term continuous change in average weather conditions or range of weather. Climate change is slow and gradual and is very difficult to perceive without scientific records. Both climate variability and climate change affect present climate. Climate variability is 'superimposed' on the long-term climate change evolution.

The literature (see Annex 1) contains a number of lessons on how to effectively communicate climate change and uncertainty, lessons that hold relevance for extreme event climate change attribution communication:

Photographer: Tamara Leigh/IFRC-Climate Centre

1 Identify objectives

Any communication strategy must first define its goals, objectives and purpose of the communication (Scienseed, 2016), whether to inform and educate (Renn and Levine, 1991; Moser, 2010), to advocate or change attitudes, or to prompt action or behaviour change (influencing individuals, policies, or legislative actions) (Scienseed, 2016; Moser, 2010).

2 Tailor to stakeholders

Stakeholder values, attitudes, concerns, knowledge of climate change, language, personal and social aspirations, amongst other characteristics, should all be taken into consideration when determining what and how to communicate (Moser, 2010; Morss et al., 2005; Weiss et al., 2000; Padgham et al., 2013). Information has greater value when disseminated in a way that enables end-users to apply it in context (Weiss et al., 2000; Moser and Dilling, 2012).

3 Tailor presentation of uncertainty to different stakeholders

The level, type, and content of uncertainty information needed will depend on the end-user (WMO, 2008). Policy makers need to first know the scientific evidence of what is certain, and later hear the uncertainties (Scienseed, 2016). Emergency responders may require detailed quantitative estimates of uncertainty, enabling development of response plans prescribed to defined thresholds (WMO, 2008; Morss et al., 2005). Practitioners often find the best information they can quickly and easily obtain and interpret to make time sensitive decisions (Morss et al., 2005). In theory practitioners might appreciate scientific information accompanied by a quantification or analysis of uncertainty, but in practice they often make discrete choices among alternatives, usually under a deadline (Morss et al., 2005). Sometimes, additional analysis of scientific uncertainty will have little effect on decision making, either because major components of the uncertainty are irreducible, or because the effects of scientific uncertainty are negligible compared to other factors (Morss et al., 2005).

4 Engage stakeholders

Communication between providers of information and decision makers/users is the most effective method of determining who key stakeholders are and what information they need to make decisions (Wilkinson et al., 2015; Morss et al., 2005; Padgham et al., 2013). This approach lets decision makers' needs determine the content of communications, prioritising information that is relevant to decisions that need to be taken, rather than information scientists think are important (Wilkinson et al., 2015; Pidgeon and Fischhoff, 2011; Khan and Kelman, 2012). Establishing relationships, trust, and credibility over a period of time between suppliers and end-users requires active and early engagement (Jagtap et al., 2002; Morss et al., 2005; Hellmuth et al., 2011; Padgham et al., 2013).

5 Understand stakeholder need

Understanding end-user concerns and interests, core values, pre-existing knowledge/lack of knowledge, misconceptions, and beliefs can enable tailored communications (Scienseed, 2016). For example, in weather forecasting, useful information aims to meet recipient needs in terms of timing, climate parameters, spatial and temporal resolution, and accuracy (Wilkinson et al., 2015). The IRI-IFRC Map Room tailored climate information to the needs of end-users, evolving through multiple iterations with continuous feedback from partners (Hellmuth et al., 2011). Technical language was reduced, to make the Map Room more 'disaster-manager oriented', qualitative descriptions replaced numerical descriptions, colour scales were changed to make them more intuitive, and convenience and efficiency has also been improved, to enable users to access the most relevant information as quickly as possible (Hellmuth et al., 2011).

6 Consider how decisions are made

Communication approaches need to take into account how people make decisions and process information, particularly when dealing with challenging concepts such as risk, climate change, and disasters. Scientific literature is characterised by objectivity and impersonality (Scienseed, 2016). This style is essential for communication within the scientific community, but does not fit well outside this sphere (Scienseed, 2016).

7 Ground in user experience

Scientific facts can be more effectively accepted and applied when accompanied by social examples and human stories (Scienseed, 2016; Moser, 2014). Re-translating statistical information into examples grounded in stakeholder experience can enable more intuitive understanding of risk and probabilistic information, and better motivate planning and action (Marx et al., 2007; Moser, 2010). Communications designed to recall and highlight relevant personal experience in the form of scenarios, narratives, and analogies can elicit more active responses from the public and policy makers in engaging with forecasts of climate variability and climate change, and influence both individual behavioural intentions and public policy preferences (Scienseed, 2016; Marx et al., 2007).

8 Consider how to communicate uncertainty

Improving our understanding of how people learn and reason about uncertainty can improve communication of climate uncertainty (Marx et al., 2007; Morss et al., 2008). Research indicates respondents prefer weather forecasts that express uncertainty compared to single-valued forecasts (Morss et al., 2008). Respondents had more confidence in shorter lead time forecasts showing a general sense of relative accuracy or uncertainty (Morss et al., 2008). Research has shown that people have difficulty in understanding quantification of risk, often interpreting information with bias depending on the level of perceived threat (Patt and Schrag, 2003; Simonovic, 2002; Scienseed, 2016; Morss et al., 2008). For example, there are common misconceptions by laypeople particularly for long term averages and return periods; for example the concept of a 1-in-100 year flood is commonly misinterpreted as a flood that occurs once every hundred years (Simonovic, 2002; Sayers, 2016).

Photographer: Knud Falk/ Climate Centre

9 Adapt scientific language for a lay audience

The scientific sphere has a specific way of communicating within the community. A common criticism in the literature arises when scientists do not change their communication strategy when dealing with people outside the community.

Scientists and technical experts use too much jargon, scientific terms and acronyms in their communications with non-experts (Scienseed, 2016; Meinke et al., 2006). In any communication strategy, the communicator must speak the same language as the audience – this is not isolated to the spoken language (such as English, Swahili, or Hindi), but also to the terminology and level of understanding (Scienseed, 2016; Padgham et al., 2013; Hassol et al., 2016).

10 Use clear, unambiguous language

There needs to be a balance between avoiding technical terms and avoiding oversimplification; concepts should not be dumbed down or delivered in a condescending way (Scienseed, 2016). Unnecessary information should be discarded, limiting the information to the essential ideas and concepts in one clear message that is locally relevant (Wardekker et al., 2008; Scienseed, 2016; Moser, 2010; Padgham et al., 2013). Care must be taken to use unambiguous and consistent terminology when relaying uncertainty information (WMO, 2008). Surveys among users can be useful methods of taking language and cultural differences into account, to enable clear interpretation (WMO, 2008).

11 Consider impact

Information on the consequences of climate change or variability can aid understanding, rather than just communicating a prediction (Marx et al., 2007; EUCLEIA, 2013).

12 Express uncertainty

The most common way of expressing uncertainty information is to use quantitative probabilities (WMO, 2008). Communication formats that use percentages and non-numerical text are generally more liked than relative frequency and odds (Morss et al., 2008). Although probabilities are a commonly accepted means of communicating uncertainty information, they are associated with particular communication difficulties. For example, many users simply want to know whether a particular predicted event will happen or not, and are uninterested in probabilistic predictions, often viewing them as an attempt from communicators to avoid responsibility and 'hedge their bets' (WMO, 2008).

Qualitative information can assist in explaining uncertainty using more familiar terms to lay audiences (WMO, 2008). Descriptors can be used when presenting information, using phrases such as 'chance of', 'one or two', 'later', 'developing', or 'in the area' (WMO, 2008). These descriptions should however be confined to pre-defined or well-understood terms, as there is a high risk of misinterpretation (WMO, 2008; Wardekker et al., 2008). There is significant evidence so suggest people misinterpret qualitative descriptors of risk and uncertainty (Patt et al., 2003; Wallsten et al., 1986; Windschitl and Weber, 1999; Weber and Hilton, 1990). For example, the use of qualitative probability descriptors such as 'likely' or 'highly likely', as used in the IPCC reports, are interpreted as containing information about event magnitude as well; people are more likely to associate more certain sounding probability descriptors with more serious consequence events (Patt et al., 2003).

13 Include numerical information

Supplementing verbal terms with numerical ranges can increase understanding (e.g 'It is very likely (greater that 90%) that hot extremes, heat waves, and heavy precipitation events will continue to become more frequent') (Scienseed, 2016).

Scales and indices can be used to define the most common uncertainty terms, but care is needed as terms such as 'probable', 'possible' and 'chance' are open to a range of interpretations. If terms such as these are used, they need to be clearly defined to the user and used consistently (Wardekker et al., 2008; WMO, 2008). Uncertainty ratings can also be assigned to forecasts with a simple confidence index, representing reliability on a scale of 1-10 (WMO, 2008).

14 Include visual information

Non-text visual representations of uncertainty include graphs, spatial depictions, icons, and colour. Whilst there is a proliferation of research on the verbal communication of climate change, there is much less on visual communication (Chapman et al., 2016). Error bars can also represent the range of possible values (WMO, 2008; Harold et al., 2016; Moss and Schneider, 2000). Graphical depictions can be useful presentation styles for web-based displays, and can be accompanied by explanatory information to help users interpret complex information (WMO, 2008; Harold et al., 2016). Uncertainty information also lends itself to spatial depiction, by presenting a prediction and the uncertainty associated with it on a chart or map (WMO, 2008; Harold et al., 2016). Icons can be useful for a quick pictorial image on television or a web site; common practice is to superimpose the uncertainty information in numerical terms on the icon (WMO, 2008). Colour can be a powerful tool for conveying information and meaning, but needs to be used carefully (Harold et al., 2016). Colour choice should always be tested with the intended user to ensure the right message is being conveyed (WMO, 2008). It is also important to use colour scales which can be clearly read by those with colour blindness (WMO, 2008).

15 Consider trust

The credibility of the source of information dictates whether information is trusted (Moser, 2010). Trust is based on perceptions of a range of factors: competence (the degree of technical expertise assigned to a message or a source); objectivity (lack of biases in information as perceived by others); fairness (acknowledgement and adequate representation of all relevant points of view); consistency (predictability of arguments and behaviour based on past experience and previous communication efforts); and faith (perception of 'good will' in composing information) (Renn and Levine, 1991; EUCLEIA, 2013; Meinke et al., 2006). Scientists are often held in privileged positions as knowledge holders, messengers, and interpreters of climate information (Moser, 2010; Rabinovich et al., 2012). Trust in messengers is context-dependent (Rabinovich et al., Moser, 2010; Hassol et al., 2016) and trusted sources of information should be identified and confirmed by consulting the intended audience.

16 Framing

Climate change information cannot be presented in a neutral manner without context; therefore the framing of the information is important (Spence and Pidgeon, 2010). Research has demonstrated that the way climate change is framed can have a substantial influence on the way the information is received (Spence and Pidgeon, 2010). For example, attribute framing is the process of highlighting some particular aspect, or attribute, of the target object or issue, such as emphasising the uncertainties in climate information (Spence and Pidgeon, 2010). Outcome framing, by contrast refers to presenting an issue in terms of gains or losses, such as emphasising the gains in climate change mitigation (Spence and Pidgeon, 2010). Framing can deeply influence how persuasive the information is (Moser, 2010). Frames are activated by words, imagery, symbols, and non-verbal cues such as messengers, music, tone of voice, and gestures (Moser, 2010).

17 Ensure messages reach the targeted end user

There often is a gap in the end-mile of communication, in whether the message reaches those in need, whether the information is understood, and finally if it is acted upon (Paton, 2008; Harris, 2015; Howell, 2014). Risk information may be understood, but individuals may not take action if they do not believe that action will ameliorate hazard consequences, or if they do not know what action to take, or do not have the capabilities to act (Paton, 2008; Moser, 2014).

As a key goal of risk communication is encouraging people to adopt protective measures in advance of hazard activity, it follows that there needs to be understanding and monitoring of whether the communication has achieved this purpose (Paton, 2008). A common gap in communicating climate information is a lack of monitoring whether the information has been received, understood, and acted upon; i.e. whether the information had the intended effect (Scienseed, 2016; Moser, 2010; Paton, 2008).

Extreme event attribution communication

In the immediate aftermath of an extreme event, awareness and interest in climate change impacts increases, and the event itself provides a relevant experience, enabling people to understand the information more effectively (Hassol et al., 2016; Howell, 2014).

It is vital, particularly due to the complexity of climate change, and the science behind extreme event attribution, that the issue is framed and communicated clearly, otherwise contradictory findings can result in misunderstanding, or confusion of the message (Stott et al., 2016; Hassol et al., 2016).

Climate scientists often receive a high volume of media enquiries in the aftermath of extreme weather events, showing a demand for information on whether the event can be causally linked to climate change (Stott et al., 2016). In addition, decision makers wish to know whether such events could have been anticipated, and whether they are likely to become more or less frequent in the future due to climate change (Stott et al., 2016). Better attribution information can also be of potential use to the insurance industry, those developing climate adaptation strategies, and for disaster risk reduction (Stott et al., 2016).

From previous extreme event attribution communication studies, stakeholders have expressed their continued frustration with scientists' difficulty to communicate attribution science in a way accessible to a lay audience (Stott and Walton, 2013). Successful communication of scientific findings needs to build upon previous studies of climate information communication, particularly working with end-users to establish their needs and questions, adapting scientific language for lay understanding, and translating into native languages (Stott et al., 2016). Decision makers and wider society need clear statements of the meaning and also implications of scientific extreme event attribution findings (Stott et al., 2016).

There have been a limited number of studies (some currently ongoing) on communicating attribution information (Hassol et al., 2016). One study concluded that the use of confidence statements involving thresholds of attributable risk (e.g. the chance of the event has at least doubled or halved because of climate change) were positively received in communication sessions with potential users of such information (Stott et al., 2016).

Photographer: Tamara Leigh/IFRC-Climate Centre

Methodology

The research study utilised a mix of quantitative and qualitative analysis of primary data. This was predominantly collected through semi-structured interviews with key informants from public, media and high-level decision makers, also including some small focus group discussions.

Research locations

At public level, data was collected from Bihar and Uttar Pradesh in India and Kwale and Turkana in Kenya. Locations were selected based on criteria including levels of poverty/ vulnerability, exposure to natural hazards (drought, floods, heat waves), stability, DRR capacity, and language (to enable research to be conducted in English, Hindi and Swahili).

Bihar is highly vulnerable to hydro meteorological disasters, with North Bihar in general being highly flood prone and South Bihar being drought prone. Uttar Pradesh experiences periodical floods, high-level of water stress, heat waves, drought, famine, and cold waves. Hindi is widely spoken and understood in both Uttar Pradesh and Bihar. Turkana and Kwale are both significantly affected by the current drought. Swahili is spoken widely in Kwale; in Turkana, a small proportion of the population speak Swahili, most of the population speak the Turkana language Ngaturkana.

A questionnaire was used as a guide to gather quantitative and qualitative information on a range of phrases, testing participants' understanding of the terms and statistics presented. The questionnaire was tailored for the public, with an alternative version available for the high-level decision makers and media. In addition, information was gathered on visual representation of similar information. The text was also translated into Swahili and Hindi (see Annex 2). Data was also gathered on the most trusted sources of climate and weather information. Approximately 40 high-level decision makers, 19 media, and 100 pubic participants were sought for this study for each country. The public participants were divided equally between two districts or counties within each county.

Background

information on interviewees

The table below shows the sources of primary data, indicating numbers of participants within each user group.

Country	Kenya			India		
User Group	High-level decisión makers	Media	Public	High-level decision makers	Media	Public
Men	20	4	53	32	10	66
Women	4	5	47	8	0	34
Total	24	9	100	40	10	100

Participants' ages ranged from under 20 years to over 60 years old, with 37% of participants falling within the 40-50 years' age bracket. Educational backgrounds ranged from never attending school (32% of the public level participants) to PhD level education (mostly within the high-level decision makers group). 85% of public participants had children. 86% of public participants in Kenya and 29% of public participants in India requested the statements to be read out loud to them, suggesting difficulty reading and/or possible illiteracy. There was difficulty reaching a gender balance target amongst participants; overall the participants can be divided into 65% men and 35% women (see section on limitations of the study).

Among the participants, there was a high-level of awareness of extreme events and climate change. Over 99% of all respondents believe that climate change is affecting their region. In Kenya 100% of high-level decision makers and media interviewed believe that climate change is affecting their region. 90% of respondents knew of a specific extreme weather event caused by climate change. In contrast, 70% of India media participants did not know of a specific extreme weather event caused by climate change. The majority of Indian and Kenyan high-level decision makers and public participants are worried about the effects of climate change, believe that climate change will have a significant impact on their lives, and feel that they are not prepared for climate change. 39% of all participants are extremely worried about climate change; 37% believe climate change is having a high impact on their region; only 3% of participants believe they are highly prepared for climate change.

Photographer: Tamara Leigh/IFRC-Climate Centre

In India, the most common extreme weather event examples provided by participants included heat waves, flooding, and cyclones or storms. Other extreme events mentioned included drought, landslides, and avalanches. The public also commonly mentioned unpredictability of weather.

In Kenya, the most common extreme weather event examples provided by most participants were drought, changes in rainfall patterns, flooding, and extreme winds. The current drought was commonly mentioned. Other extreme weather events mentioned included heat waves, storms, and hail. The public participants in particular mentioned the effects they had witnessed to their livelihoods, whereas the high-level decision makers referenced changes in frequency, duration, or severity of extreme events. The public understood and could provide real life experiences of the changes in the climate conditions, comparing twenty years ago to present conditions; they were very aware of changing climate.

The majority of Kenyan high-level decision makers and Indian media participants believe it is sometimes possible for scientists to know how much climate change affects specific extreme weather events. The majority of the Kenyan public believe it is always possible for scientists to know how much climate change affects specific extreme weather events. Of the remaining participants, the majority believe it is possible most of the time for scientists to know how much climate change affects specific extreme weather events.

Photographer: Knud Falk/ Climate Centre

Results

The research focused upon participants' understanding of:

- Probability
- Intensity
- Frequency
- Uncertainty

In addition, preferred and trusted sources of climate and weather information were researched. Within pre-determined stakeholder groups there was a range of responses and levels of understanding for each statement and visual. Common and repeated feedback is emphasised in the analysis, without losing information on the range of opinions.

The statements shown below were tailored for each country, with references to 'the current drought' shared with interviewees in Kenya, and references to 'the 2016 Rajasthan heat wave' used in India.

The participants were initially presented with the first statement (the most complex statement), and tested on their understanding of the statement; the interviewer recorded whether the participant understands the statement (see table A1 in Annex 3). The participants were then asked to self-report whether they found the statement easy, hard, or impossible to understand (see Annex 3). The participants were then shown the remaining statements in sequence, and their feedback and levels of understanding were recorded.

Probability

Interviewees reviewed alternative phrasings for expressing probability. They were initially presented with statement 1 (see statements below). Statement 1 was generally well understood – 84% of participants understood it correctly (see table A1 in Annex 3), 85-100% of interviewees in India found it easy to understand, and 63-74% of high-level decision makers and public interviewees in Kenya found it easy to understand. Only 44% of media stakeholders in Kenya found it easy to understand (see table B1 in Annex 3).

Statement 1

"Climate change increased the **probability** of the current drought by **40%**"

Statement 2

"Climate change increased the **likelihood** of the current drought by **40%**"

Statement 3

"Climate change increased the **chances** of the current drought *by* **40%**"

Statement 4

"Climate change made the current drought **one and a half times as likely**"

Statement 5

"Climate change increased the **chance** of the current drought by **one and a half times**"

Quantitative results

Interviewees were asked which of the five statements was easiest to understand (see table B2 in Annex 3). Preferences were reasonably spread across all five options, with option 5 the least selected. There was a general preference for the options using percentages over statements 4 and 5.

Stakeholders in Kenya considered statement 2 ('increased likelihood by 40%') and statement 3 ('increased chance by 40%') the most understandable options (statement 2 was preferred by 36% high-level decision makers and 45% public; statement 3 was preferred by 27% high-level decision makers and 63% media).

Stakeholders in India selected statement 2 (30% public), statement 3 (31% high-level decision makers and 33% media), and statement 1 (41% high-level decision makers).

Qualitative feedback on intensity phrases

In Kenya, the high-level decision makers generally preferred the statements which contained the percentages, finding the statement with '*one and a half times*' confusing and open to interpretation. In Kenya, many of the high-level decision makers disliked the term '*likelihood*' in statement 2. Many expressed difficulty understanding terms like '*probability*', '*likelihood*', and '*chance*'. It was noted that the Ministry of Environment and Natural Resources in Kenya uses the term '*chance*' when referring to probability.

In India, the high-level decision makers in general did not have much confusion over the probability statements, regularly responding that they all made sense, but participants often showed preference of probability terms and percentages over '*one and a half times*'.

There was a request for a more explicit explanation of a baseline comparison from the high-level decision makers, i.e. is this 40% increase in probability compared to pre-1900, or the last decade, or the previous drought event.

A few high-level decision makers preferred the use of the term '*significantly*' in place of percentages. There was a suggestion also to replace the word '*chances*' with '*possibility of occurrence*'. Another suggestion was to provide a timeline of perhaps ten years and refer to frequency of occurrence, rather than probability. There was also a request for the information to be accompanied by future projections in relation to heat waves, and also advice on what needs to be done.

Many respondents in Kenya felt terms like '*probability*' and '*likelihood*', and the percentages, would not be well understood by, for example, farmers. It was felt that language would need to be simplified, especially as English is a second language for many Kenyans. Some requested simplification of the statements, and removal of percentages or amounts, e.g. '*climate change is the main cause of the current drought*'. It was also noted that the Kenyan general public talk about '*variable weather*' when they describe climate impacts, rather than '*climate change*'. When translated into the local language, there were difficulties in distinguishing between '*probability*', '*likelihood*', and '*chance*' (often the translation of these terms into local languages use the same term – see Annex 2).

One media respondent interpreted probability information as referring to increased severity and frequency. On another occasion, there was confusion about the increased probability by 40%; the participant wondered what the other 60% of the drought was due to.

When describing the information back to the interviewers, most public participants communicated that climate change increased the chances of drought, but excluded mentioning probability, likelihood, and any statistical information. In most cases, the participants understood the concept that climate change is increasing the chances of drought, but were uncomfortable with statistical information and concepts. In addition, there were likely difficulties in translating this type of statistical information in the local languages (see section on translating into Swahili and Hindi).

In India, interviewers felt that the public participants understood the overall message of the work but they may not have understood the context and full implications of climate change. The difference between '*probability*', '*likelihood*' and '*chance*' was questioned by participants. The word 'chance' was understood more by the public, whereas 'probability' and '*likelihood*' confused them.

Frequency

Interviewees reviewed alternative phrasings for expressing frequency. They were initially presented with statement 1 (see statements below), which was well understood; 79% of participants understood it correctly (see table A1 in Annex 3). 80% of all participants found it easy to understand (see table B3 in Annex 3).

Statement 1

"Climate change has increased the return time of extreme heat events, like the 2016 Rajasthan heat wave, from a **1 in 20-30 year event to a 1 in 7-10 year event**".

Statement 2

"Climate change has increased the **frequency** of extreme heat events, like the Rajasthan heatwave, so that **events that used to happen about twice in a lifetime now occur about 4 times in a lifetime**".

Statement 3

"Climate change has **increased the frequency** of extreme heat events, like the 2016 Rajasthan heat wave, **by a factor of two**".

Statement 4

"Climate change has **doubled the frequency** of extreme heat waves, like the 2016 Rajasthan heat wave".

Statement 5

"Extreme heat events, like the 2016 Rajasthan heat wave, now occur **twice as often** due to climate change".

Quantitative results

Interviewees were asked which of the five statements was easiest to understand (see table B4 in Annex 3). Preferences were well spread across four of the five options, with few interviewees selecting statement 3 ('*factor of two*'). 34% of participants found statement 2 the easiest to understand.

Statement 5 ('*twice as often*') was considered the most understandable option for the majority of high-level (65%) and media (57%) stakeholders in Kenya. Public stakeholders in Kenya also selected statement 5 (21%), as well as statement 2 ('*twice in a lifetime now occur 4 times in a lifetime*') (36%) and statement 4 ('*doubled frequency*') (21%).

Statement 2 (26% high-level, 43% public) and statement 4 (32% high-level and 50% media) were also selected by a majority of interviewees in India, as well as statement 1 ('*increased return time from 1 in 20-30 to 1 in 7-10*') (23% high-level and 50% media).

Qualitative feedback on intensity phrases

Frequency was better understood by Kenyan participants compared to probability information. However, frequency was less well understood by some respondents in India, particularly for the public; some participants misunderstood the concept of frequency. This was likely due to the difficulty of translating the term '*frequency*' into Hindi (see translation section).

Many respondents found the terms '*factor of two' and 'twice as often*' hard to understand. '*Return time*' was notably difficult or impossible for many people to understand, even amongst those with statistical or science backgrounds. The public in Kenya understood the general concept of increased number of occurrences, but found the exact description of the increase (such as '*factor of two*') to be too complicated.

The statement using the '*lifetime*' measurement of time range was heavily criticised particularly amongst Kenyan high-level decision makers as a lifetime varies between people, with poorer people having a much shorter lifespan. There was a suggestion from Kenyan high-level decision makers to refer to climate change as a climate shift or climate trend, and also to tie climate change to specific, relevant impacts of climate change, such as water stress or low river flows.

It was suggested by media participants that statements 2 and 3 could be made clearer. One participant thought the sentences were too long to communicate effectively.

It was pointed out that in some statements the 'business as usual' frequency was not specified, and this information could help to make the information clearer if a baseline was provided to compare to. There was a suggestion for the statement: '*Climate change has increased the frequency of extreme heat events (like the Rajasthan heatwave), i.e. events that used to happen about twice in a lifetime now occur about 4 times in a lifetime*'.

Photographer: Knud Falk/ Climate Centre

Intensity

Interviewees reviewed alternative phrasings for expressing intensity. They were initially presented with statement 1 (see statements below). Overall, 80% of participants understood this correctly (see table A1 in Annex 3); 75% found it easy to understand. This was well understood by interviewees in India (85-100% found it easy to understand). Findings were more mixed in Kenya with 71% of the public finding it easy to understand, but only 52% of high-level decision makers and 22% of media (with 45% of media in Kenya reporting it as hard to understand and 33% as impossible to understand) – (see table B5 in Annex 3).

Statement 1

"Climate change increased the **intensity** of the current Kenya drought by approximately **20%**".

Statement 2

"Climate change increased the **severity** of the current Kenya drought by approximately **20%**".

Statement 3

"Climate change increased the **strength** of the current Kenya drought by approximately **20%**".

Statement 4

"Climate change made the current Kenya drought **20% worse.**"

Quantitative results

Interviewees were asked which of the four above statements was easiest to understand (see table B6 in Annex 3).

Preferences were well spread across the four options, with statement 3 ('*increased strength*') least selected.

Statement 2 ('*increased severity*') was considered the most understandable option for the majority of high-level (57%) and media (50%) stakeholders in Kenya. Public stakeholders (54%) preferred statement 4 ('*worse*').

Statement 2 (40% high-level, 50% media) and statement 1 ('*increased intensity*') (50% media) were selected by Indian stakeholders. Indian public stakeholders were fairly evenly spread across all 4 options.

Qualitative feedback on intensity phrases

The term '*strength*' to describe drought was disliked by high-level decision makers in Kenya. They explained that the term '*strength*' for them is usually used to represent or describe something physical, rather than something more intangible such as drought, increasing temperatures, or lack of rain. Some struggled with the term '*intensity*', finding it too technical, or having less familiarity with the term. Overall, many participants tended to use the term '*severity*' when describing the drought themselves.

In India, the high-level decision makers generally understood the statements and found them to be clear. However, some participants found the terms '*intensity*', '*severity*', and '*strength*' not necessarily to be interchangeable, and each has a different meaning or association with it.

There were requests for a clearer definition of what is being measured in terms of '*intensity*', '*severity*', and '*strength*' across the high-level decision maker and media participants e.g. in what way is the drought worse or more severe? There were suggestions of providing some sort of scale or measurement to refer to changing severity, such as the duration or impacts (number of people affected, number of livestock lost) of the extreme event. One participant in India suggested that instead of presenting the information in terms of percentage increase in severity, the increase in degrees Celsius should be provided.

There were also requests for a baseline comparison of whether this change is in reference to the previous year, previous decade, or previous century. It was frequently noted that there needed to be a baseline to compare the change in severity to an earlier situation.

Many public participants from Kenya did not like the inclusion of the percentages in the statements, and some suggested to use the terms '*worse*' instead of '*severity*' and '*intensity*', which they found too technical.

Uncertainty

Interviewees reviewed alternative phrasings for expressing uncertainty. They were initially presented with statement 1 (see statements below). 67% of the participants understood the statement correctly (see table A1 in Annex 3); 64% found it easy to understand. This was well understood in India (78-100%), but less well understood in Kenya (with only 50% of high-level decision makers, 22% of media and 38% of public reporting it as easy to understand) – (see table B7 in Annex 3).

Statement 1

"Climate change increased the chances of the 2016 Rajasthan heat wave by **40% (+/- 10%)".**

Statement 2

"Climate change increased the chances of the 2016 Rajasthan heat wave by **40% (30-50%)".**

Statement 3

"Climate change increased the chances of the 2016 Rajasthan heat wave by a **range of 30-50%, best estimates are approximately 40%".**

Statement 4

"Scientists are **fairly certain** that climate change increased the chances of the 2016 Rajasthan heat wave by **40%".**

Quantitative results

Interviewees were asked which of the four statements was easiest to understand (see table B8 in Annex 3). Statement 3 and statement 4 were preferred over the other two options (statement 3 was preferred by 43-50% media, 33-41% high-level decision makers and 16-37% public. Statement 4 was preferred by 24-38% high-level decision makers, 43-50% media and 14-61% public).

Qualitative feedback on intensity phrases

In Kenya, the high-level decision makers had a range of responses and levels of understanding related to the uncertainty information provided in these statements. Those with statistical backgrounds found statement 1 easier to understand due to their familiarity with the way this information is typically provided to them, and found that the other statements were too vague, open to interpretation, less accurate, and too lengthy. However, other participants within this stakeholder group found the uncertainty and ranges of statistics too confusing and unnecessarily complicated.

There was a range of suggestions for making these statements easier to understand; some suggested removing the uncertainty and making the sentences shorter, others suggested the qualitative explanation of uncertainty ('*fairly*') should be removed as this was too open to interpretation. One participant suggested removing the range, but providing the range of statistics if the stakeholder required it, but accompanied with more explanation and also the implications of the uncertainty.

The media participants in Kenya generally found these statements including uncertainty to be too confusing and providing too much information. Some completely ignored the '(*+/-10%*)' uncertainty statistic as they could not understand it. There were multiple suggestions from participants to completely remove the uncertainty, and even the statistics, preferring language such as '*four times as likely*' and '*fairly certain*' over the technical terms, however, others did not like the term '*fairly certain*'.

In Kenya, almost all the public participants interviewed found the uncertainty information very difficult. They found all the statistics difficult to understand, and requested only the barest of information to be provided. Most of the public were not able to explain the uncertainty in their own words. Some interpreted this information as there being no truth or evidence behind the statistics, and the information was therefore all guesswork.

In India, the majority of high-level stakeholders found these statements to be 'fine', stating they understood the scientific analysis process and the inherent uncertainty and variability in results. Some stated that using terms such as '*chances*', '*approximately*', and '*fairly certain*' were too subjective and therefore these statements are more difficult to convince policy makers of the seriousness of climate change and extreme weather events. However, some found the uncertainty to be confusing, also highlighting that the public would require much more time and concentration to be able to understand these statements.

Single statements

Interviewees were next shown a series of single statements, each followed by a simplified version.

Single statement A

Statement A: "Results were inconclusive and evidence for a link to climate change cannot be made at this time."

Simpler statement A: "Scientists were not able to conclude whether climate change affected this extreme weather event".

Quantitative results

In total, 58% of participants understood the first statement correctly (see table A1 in Annex 3); 51% found the statement easy to understand; and 77% found the second statement easier and preferable to the first. Interviewees in India found the first statement easy to understand (70% high-level decision makers, 80% media, 65% public). Interviewees in Kenya showed a mixed response, with 64% of high-level decision makers finding it easy to understand, but only 29% media and 31% public (table B9 in Annex 3).

A significant number of interviewees across all categories found the second (simpler) statement easier to understand (48% high-level decision makers, 71% media, 82% public in Kenya; 73% high-level decision makers, 90% media, 41% public in Kenya – table B10 in Annex 3).

Qualitative feedback

In Kenya, amongst high-level decision makers there was some confusion over the part referring to '*cannot be made at this time*', as it suggests that given more evidence and time, a better or more comprehensive conclusion and link to climate change is possible in the future. Some found the phrasing and terminology of the statements difficult and an uncommon or grammatically incorrect way of phrasing the information. One participant warned that this statement could be interpreted that 'we are safe' from climate change. Some suggestions for making this statement clearer were that thresholds could be used. Alternative messages included: i) '*As of now, further scientific research needs to be undertaken to link extreme events to climate change*'; and ii) '*From the current results, there is no clear linkage to climate change*'. It was emphasised that the message and tone should be adapted for the intended audience.

In Kenya, a media representative suggested replacing the word '*affected*' with '*caused*'. Some from the media inferred that the scientists were assuming or estimating. Some requested more background context and follow up evidence to be provided alongside the statement.

In India, amongst high-level decision makers, one participant suggested using the term '*attribution*' within the statement to make it clearer. Some suggested that in the absence of any observed relationship, no statement should be made about inconclusive results.

Single statement B

Single statement B: 'Climate change did not affect the chances of this extreme weather event'.

Quantitative results

In total, 68% of participants understood this statement correctly (see table A1 in Annex 3); and 60% found it easy to understand. The majority of interviewees found the above statement easy to understand (65% high-level decision makers, 58% public in Kenya and 88% high-level decision makers, 100% media and 59% public in India). A majority of the Kenya media found it hard to understand (57%) – (see table B11 in Annex 3).

Qualitative feedback

In Kenya, there was some confusion amongst high-level decision makers on whether the statement is referring to the event or the chances of the event. There was also a query about the difference between slow and

Photographer: Tamara Leigh/IFRC-Climate Centre

sudden onset extreme events, and whether this statement is appropriate for both types. One participant suggested replacing '*chances*' with '*probability*'. One suggested there was a need to provide a memory of previous specific events to compare it to. A few participants suggested inserting the word '*occurring*' to the statement to make it clearer, i.e. '*Climate change did not affect the chances of this extreme weather event occurring*'.

The media participants suggested changing the phrasing of '*affect*' to '*have any effect on*'. One participant suggested simplifying the information further for the audiences they communicate to, e.g. '*climate change is not a cause of this extreme weather event*'. One participant criticised the statement for its ambiguous meaning.

The public participants generally interpreted this as the extreme weather event was not caused or linked to climate change. There was some confusion over this statement from many participants as they did not believe this statement to be true, based on their experiences with climate change and extreme weather events. However, a few participants recognised that extreme weather events are caused by a variety of factors, not only climate change.

In India, some high-level decision makers suggested rephrasing the statement, such as: i) '*Climate change did not affect the probabilities of this extreme weather event*'; and ii) '*The likelihood/probability of this extreme weather event was not affected by climate change*'.

Single statement C

Statement C: "This extreme weather event was not as severe as expected, when compared to predicted regional climate change trends".

Simpler statement C: "This extreme weather event was not as bad as we expected given how climate change is affecting this region".

Quantitative results

In total, 54% of the participants understood the first statement correctly (see table A1 in Annex 3); 48% found it easy to understand; and 84% found the second statement preferable and easier to understand. High-level decision makers in Kenya and India both found statement 3 easy to understand (58% and 73%). Responses were more mixed for Media (43% Kenya, 80% India) and public (55% Kenya, 39% India). (Table B12 in Annex 3).

A significant number of interviewees across all categories found the second (simpler) statement easier to understand (53% high-level decision makers, 57% media, 90% public in Kenya; 73% high-level decision makers, 80% media, 48% public in India – table B13 in Annex 3).

Qualitative feedback

In Kenya, some of the high-level decision makers found the first statement to be confusing and repetitive. A common criticism was the lack of reference to further information on the regional trends the statement refers to. Suggestions included either cutting out the reference to regional trends, or alternatively supporting the statement with more information on regional trends.

The media had some difficulty over the predicted climate change trends, and pointed out that this would be difficult for the layperson to understand. One interpreted this as the scientists' predictions were wrong.

There was some confusion over the predicted regional trends, and what they referred to for the public participants. Generally, the statement was interpreted correctly, and participants used similar language to the statement when explaining the information in their own words. However, one interpreted the information as the predicted climate change is not true.

In India, the media suggested the simpler statement was too general and therefore not fit for the mass media. It was suggested there should be more information on where predicted regional climate change trends came from.

General feedback

Distrust of science

In Kenya, there were several references to extreme events and climate change being God's plan that therefore cannot be explained by science within the public community. In these cases, the participant found their reasoning to be particularly supported by the uncertainty or range estimates, and also the single statements. They reported this supports their truth that scientists cannot understand God's grand plan and therefore they should not try to quantify something we do not understand and cannot measure.

Clarification of slow onset events

There was confusion over what was referred to as the current drought as there are sometimes multiple drought phases in one year, and often several years in a row. This distinction of what extreme event is being referred to will likely need better clarification, particularly for slow onset extreme weather events such as droughts, where the 'start' and 'end' of the event is not evident or defined without further clarification.

Confusion over extreme event attribution

On some minor occasions, there was some confusion or misunderstanding of the extreme event attribution concepts the statements were trying to convey. On several occasions, there was confusion over what the 40% increase was in relation to, and also why it would not be 100% sure. One participant was confused about the remaining 60%, and another asked why there was any uncertainty in these statistics; they reasoned that if the drought has already happened or is happening, then there is not probability or uncertainty.

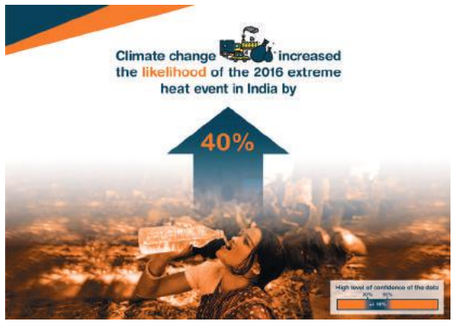
Visuals

Interviewees reviewed five country-specific visuals (shown below) and provided feedback on the ease of understanding and preferred visual. Visuals 1, 2 and 3 were easily understood by a high percentage of most stakeholders. Visuals 4 and 5 were easily understood by a smaller number.

In both India and Kenya, all stakeholders found the confidence indicator confusing; interviewees frequently recommended it be removed.

Many respondents disliked the infographic for climate change (used in all visuals). Some were unclear what the image showed. Many did not see a link between traffic/emissions and climate change. There was frequent suggestion that the climate change image needed to be made relevant for the intended stakeholder, such as representing climate change impacts on livelihoods or land use practices.

Visual 1



Quantitative results

In total, 86% of participants understood Visual 1 correctly; 78% found it easy to understand. A majority of stakeholders in India found Visual 1 easy to understand (90% high-level decision makers, 100% media, 73% public). In Kenya, a majority of high-level decision makers (59%) and public (98%) similarly found it easy to understand. Media stakeholders (67%) found it hard to understand (Table B14 in Annex 3).

Qualitative feedback

In Kenya, the high-level decision makers, media and public participants were confused by the background picture used in Visual 1. Several did not think it represented drought conditions (water-filled containers, clouds in sky). Many participants were confused by the arrow, interpreting it as merely an arrow to the statement, rather than a representation of increasing likelihood. It was also recommended that specific photos from Kenya should be used. It was suggested that the picture could use more relevant images, such as representing scarce water, broken ground and starving or dead animals. In India, there was a suggestion that the photo could be changed to reflect issues related to livelihoods affected by heat waves. It was suggested on several occasions that a before and after photo comparison should be used here instead, e.g. showing 10 years ago on the left, and today with drought conditions on the right, with an arrow going from left to right. This suggestion should be considered with caution as it is likely to misrepresent reality. It was suggested likelihood should be replaced with chance.

Visual 2

Quantitative results

In total, 86% of participants understood this visual correctly; 79% found the visual easy to understand. A majority of stakeholders in India found Visual 2 easy to understand (79% high-level decision makers, 80% media, 79% public). In Kenya, a majority of high-level decision makers (52%) and public (100%) similarly found it easy to understand. Media in stakeholders (78%) found it hard to understand (Table B15 in Annex 3).

Qualitative feedback

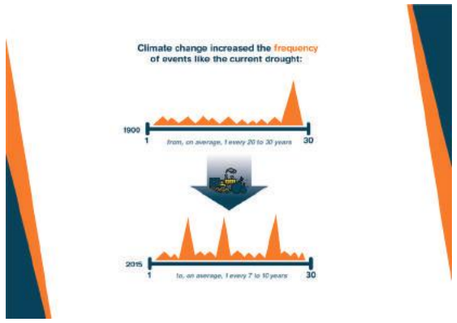
In Kenya, similar to Visual 1, interviewees didn't think the picture represented drought and felt the arrow merely pointed to the text rather than represented an increase. It was suggested that a baseline or comparison of before and after would be better to show an increase in severity from 'then' until 'now'. There was also confusion over the term '*intensity*' from some participants.

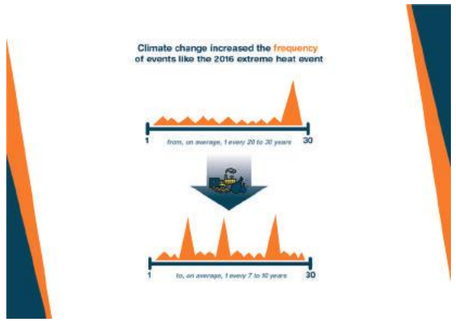
In India, the high-level decision makers were confused by the arrow – interpreting it as going from one place to another within the image, rather than increasing intensity. It was suggested the statistical information should show increase in degrees rather than percent severity. Participants from both high-level decision makers and the public suggested using a different picture.

There was some confusion by public participants in Kenya (and media in India) that Visual 1 and Visual 2 were not different – they were unable to differentiate between increase in probability and increase in severity. They interpreted it as increased severity in both cases.

In Turkana, Kenya, public participants in general understood the visuals, but found the scientific terms hard to understand. The participants were interested in the overall message of the visuals, but uninterested in the percentages. Overall, Visuals 1 and 2 were preferred over the remaining visuals for this group of participants as the pictures presented the drought event they were currently experiencing.

Visual 3





Quantitative results

In total, 83% understood this visual correctly; 77% of participants found this visual easy to understand. A majority of stakeholders in India found Visual 3 easy to understand (74% high-level decision makers, 60% media, 84% public). In Kenya, a majority of high-level decision makers (65%) and public (83%) similarly found it easy to understand. Media stakeholders (78%) found it hard to understand (Table B16 in Annex 3).

Qualitative feedback

In Kenya, some high-level decision makers were confused by Visual 3, particularly if they did not have a scientific background. In contrast, those with a scientific background often criticised the visual for not having labelled both axes, and for not showing real data. It was suggested by these participants on several occasions to label the taller peaks as representing drought conditions, and also to remove the smaller peaks, as these could be interpreted as drought events too. It was suggested by some that pictures such as visuals 1 and 2 were preferable on some occasions, but other participants found this visual easier to understand than visuals 1 and 2. One participant suggested shortening the second timescale to only cover a range of 10 years and only one peak.

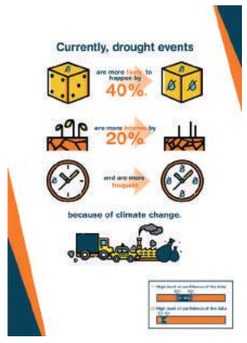
In Kenya, media level participants were confused by the 'triangles' in the image. It was suggested the shapes should be changed, and the peaks colour-coded with an appropriate key to represent green (non-drought) and brown (drought) conditions. There was some confusion over the different heights of the triangles and what they represented. It was suggested the years should be labelled.

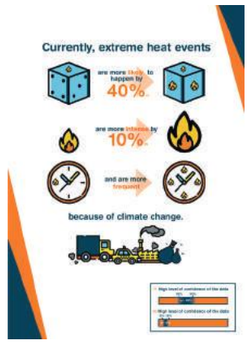
There was some confusion from the public participants in Kenya – some participants were unable to understand the image at all, but some found it easy and clear to understand. In their own words, participants compared the 'olden days' or 'long time ago' to present conditions, and were able to interpret the increase in frequency of drought events. However, one participant interpreted the graph as showing drought now happens three times in a year.

In India, the majority of high-level decision makers found this visual to be clear and easy to understand. There was some confusion over the arrow pointing down. There was a suggestion to place the timelines side by side and read from left to right. It was requested that the years should be referenced. It was noted that without the text, the visual would be incomprehensible.

The media participants in India found the visual to be informative, but suggested there needed to be more attention paid to the audience, noting that the public may not be able to understand the visual.

Visual 4





Quantitative results

Interviewees showed a mixed response to Visual 4. In total, 66% understood it correctly; 56% found it easy to understand. In Kenya, high-level decision makers were split between finding it easy to understand (48%) and hard to understand (48%). The majority of the media in Kenya found it hard to understand (78%). Kenyan public (76%), high-level decision makers in India (63%) and media in India (80%) found it easy to understand. 49% of public in India found it hard to understand. (Table B17 in Annex 3).

Qualitative feedback

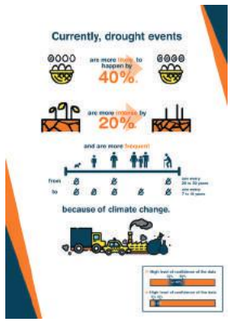
In Kenya, the high-level decision makers with scientific backgrounds criticised that the numerical percentage increase did not match an increase in the visual (e.g. the number of droplets on the dice not increasing by 40%). There was criticism over the repetitious information having probability and frequency information within one visual.

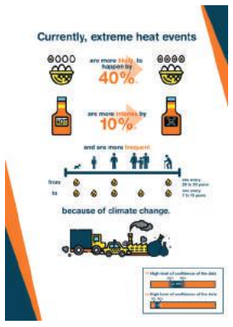
In Kenya, among the high-level decision makers and media participants, there was confusion over the use of the droplet crossed through to represent drought conditions. Several participants in both the high-level decision maker and media groups disliked the use of the clocks to represent frequency – some participants tried comparing the clock time on both infographics. Some participants disliked the dice image to represent probability – pointing out that not everyone understands dice, particularly some Kenyans. There was a suggestion to change the plant images – showing green healthy vegetation on the left, or alternatively maize plants as these are more representative of the crops grown in Kenya. The presentation of a 'before' and 'after' concept here was well liked among many participants.

In Kenya, the public participants found the images of the dice and clock confusing. They found the visual had too much information contained in one image. They found it difficult to connect the images and the percentages.

In India, the high-level decision makers in general found the visual to be clear. Some criticised the visual for having both probability and frequency within one visual as these repeat the same information and therefore one is redundant. The participants found the confidence level confusing and unnecessary. Some disliked the clock image. The high-level decision makers, media, and public all responded that the visual had too much information within one visual and therefore was confusing. It was suggested the visual could be broken down and to show one set of information at a time to be easier to understand (e.g. just show the increase in severity).

Visual 5





Quantitative results

Interviewees showed a mixed response to Visual 5. In total, 65% understood it correctly; 53% found it easy to understand. In Kenya, high-level decision makers (68%) and media (78%) found it hard to understand. Public in Kenya (70%) and media in India (80%) found it easy to understand. High-level decision makers and public in India were split between finding it easy or hard to understand. (Table B18 in Annex 3).

Qualitative feedback

In Kenya, the high-level decision makers generally found the lifetime representation of the frequency information to be confusing; there was criticism over the measure of 'lifetime' not being replicable across the population as lifetime varies between people, and is shorter for some sub-population demographics. It was suggested a shorter timeline would be needed as droughts happen almost every year in Kenya. Several people within the high-level decision-maker, media and public groups did not realise the image was intended to represent a timeline.

The eggs in a basket image representing probability was found to be confusing for many participants within all stakeholder groups; often they did not know what it was supposed to be. It was suggested by one participant in Kenya that perhaps mangoes instead of eggs would be easier to understand.

In India, participants found this visual to be too cluttered and trying to show too much information. There was a suggestion to split up the infographic and also to remove the confidence level. Some media participants suggested the infographic was too alarming, rather than being informative and raising awareness. Some preferred the dice in Visual 4 to the eggs in Visual 5.

The infographics in Visuals 4 and 5 were difficult for the public participants to understand. Translation into the local language was difficult, with participants saying that drought and climate change were the same thing. Public participants who were illiterate were not in a position to understand the statement, unless the statements were translated and communicated verbally in the local language by the interviewers.

Translation

into Swahili and Hindi

There was some difficulty translating the phrases from English directly into Swahili and Hindi. Some terms did not have a direct translation, or different English words had the same translation. A full translation of all phrases into Swahili and Hindi is available in Annex 2.

In Swahili, the words '*likelihood*', '*probability*', and '*chance*' all have the same or similar meaning. There is not a separate translation for each of the words. For example, direct translation of '*probability*' and '*likelihood*' is '*uwezokano*'. '*Chance*' was translated as '*nafasi*' in Swahili, but when used in the specified sentence, it makes no sense and is confusing. Participants struggled to understand phrases, and also the difference between translations of probability and likelihood.

Words such as '*severity*', '*strength*', and '*intensity*' were confusing when translated into Swahili ('*nguvu*', '*uzito*', '*makali*'). Participants preferred the word '*worse*' ('*mbaya*'), which they found easier to understand. Participants found the statements on frequency easier than probability statements, and intensity statements the hardest. Interviewers believe this was because of translation difficulties, rather than preferences for statistics over other phrasing of statistics. There was also confusion of negative sentences for example, the phrase '*Climate change DID NOT affect....*' was often interpreted as '*Climate change DID affect...*'.

The statements that contained percentages were better answered when translated into Swahili compared to descriptors of increases such as '*one and a half times*'. This is because there was more confusion when trying to translate the descriptors. For example, the terms '*doubled*' and 'twice as often' had a similar meaning when translated. However, there was still a challenge in understanding percentages. Most participants rarely use percentages in their daily language. Instead, numbers or descriptive levels were more familiar, for example, '*chini*' (*low*), '*katikati*' (half or minimum), and '*Juu sana*' (high-level); this is how Kenya Meteorological Department reports the weather information in Swahili.

It was also difficult to translate the uncertainty into local languages in Turkana, and most statistics were difficult to translate. For example, the phrase '*Climate change has increased the frequency of droughts, like the current Kenya drought, by a factor of two*' does not have a direct translation in local languages in Turkana.

In Hindi, the word '*frequency*' was difficult to translate. Also, '*intensity*' was one of the confusing words encountered during the research. Some high-level decision makers also had difficulty with the word, and the similarity to '*severity*' was confusing for them. Some participants identified that '*intensity*' is based on observed facts, whereas '*severity*' is based on magnitudes that vary from region to region based on several socio-economic factors. The Hindi translation of the word also presented some confusion.

The issue of translation into local language was less problematic with public participants in India because of the proliferation of English language ability amongst the public. Some of the population may not have complete understanding and knowledge of English language, however, they apply and use a lot of English words and terms while speaking in their local language. For example, the words '*climate change*', '*season*', and '*weather*' are frequently used by the public in conversation. However, for maximisation of communication efforts, correct translation into local languages will definitely enhance the quality of understanding.

Trust

The following table outlines the most common sources of climate and weather information for each stakeholder. The top four sources are ranked in order of those most commonly used, to those less commonly used, and the most trusted source of information is highlighted.

Kenya			India		
High-level decision makers	Media	Public	High-level decision makers	Media	Public
National Meteorological Agency	**National Meteorological Agency**	**Radio**	Internet news sites	**TV**	**TV**
Internet news sites	Internet news sites	TV	TV	National Meteorological Agency	Print News
NGOs	NGOs	Neighbor	Print News	Social media	Radio
Government websites	TV – government websites – farmer groups	Print news	**National Meteorological Agency**	Internet news sites – print news – NGOs – farmer groups	Internet news sites

In India, among the high-level decision makers and media, whenever the participants referred to TV, they typically meant TV channels run by the government or the public sector. These channels source information provided by the national meteorological agency.

Trust in climate scientists

The table below shows the percentage of participants within each stakeholder group who trust climate scientists, and the level of their trust. 51% of participants sometimes trust climate scientists; 42% always trust climate scientists.

	Kenya			India		
	High-level decisión makers	Media	Public	High-level decision makers	Media	Public
Always	52%	16%	53%	45%	20%	24%
Sometimes	48%	83%	28%	55%	80%	75%
Never	0%	0%	18%	0%	0%	1%

Qualitative information

The reasons Kenyan high-level decision makers gave for trusting climate scientists included the status of climate scientists as those that hold the most reliable expertise, knowledge, resources, and data on climate information. There was fairly high faith in the scientific method and reliability of the process of scientists as those that have the greatest understanding of the climate and weather systems. The communication or synthesis of scientific information was criticised as not being appropriate for stakeholders. There was also recognition that climate and weather scenarios can sometimes be, and sometimes have been, inaccurate or wrong.

There was some criticism from the Kenyan media that the generalisation of scientific information can result in incorrect predictions. However, there was also trust in the scientific method of generating information.
The Kenyan public participants who trusted climate scientists explained that this trust was based on climate scientists' presentation of facts and having the most information, or more information than the public. Some participants recognised that although predictions are not always accurate, sometimes they do provide accurate information; also, it was stated that the climate scientists have the best information and there is nowhere else to go for better information.

Some Kenyan public participants expressed reservation over climate scientists, citing that they are not sure if they are always representing the truth to them. Sometimes the information presented is not accurate, or the predictions are unreliable. There was criticism over contradictory information provided on climate change, or difficult/confusing language. A few participants stated the reason scientists cannot be accurate or understand what is happening in

the climate or weather is because it depends on God, and it cannot be understood by people.

In India, high-level decision makers who trust climate scientists did so because they are the experts, are engaged in and analyse the data more rigorously and systematically than other groups, and use sound scientific methodologies to reach a conclusive point. Some participants noted that climate scientists have no reason to be disbelieved as they use a pure scientific method, and provide peer reviewed, and evidence based information. They also put their credibility 'in the firing line'.

There was some criticism that sometimes, scientific studies are scattered or sporadic and do not have the correct sample size or study design. There was reservation for some climate information due to the complexity of climate change. One participant cited there are too many conflicting opinions on climate change (and whether it really exists), but the evidence is far too damning to ignore. There was some mistrust over the funding of research and the vested interests of those that fund the science, potentially influencing the results. One participant did not completely trust the computer models used to generate climate information.

The media participants in India trusted climate scientists depending upon the source, if the argument is substantiated with data.

Trust in media

The table below shows the percentage of participants within each stakeholder group who trust media sources, and the level of their trust. 55% of participants sometimes trust the media; 42% always trust the media.

	Kenya			India		
	High-level decisión makers	Media	Public	High-level decision makers	Media	Public
Always	10%	0%	67%	35%	10%	24%
Sometimes	90%	83%	27%	65%	90%	68%
Never	0%	17%	6%	0%	0%	2%

Qualitative information

In Kenya, high-level decision makers typically evaluated each source of media information on a case-by-case basis to establish whether they trusted the information. This was based on the source of the original information, for example if the original source was the national meteorological department, or the United Nations, then the information was considered more trustworthy.

The high-level decision makers in Kenya sometimes mistrusted the media, because of problems in the media's understanding or synthesis of scientific information; it was recognised that sometimes the media does not understand the science and therefore can miscommunicate the information. There was also some cynicism over the intended purpose of the information; there was recognition that space and time within media platforms can be purchased to disseminate unsubstantiated or wrong information, or that sometimes the overall message of the information can be swayed by political affiliation. There was recognition that media sources may be unreliable as their end purpose is to sell news, and they therefore could distort or exaggerate information to sensationalise it. However, there was also recognition that sometimes the media can be very accurate as they can show events as they have occurred (e.g. TV news).

In Kenya, public participants trusted the media sources more than high-level decision makers did largely due to the accessibility, availability, and ease of understanding from the media sources. It was also noted that this information is often provided in their local dialect, and therefore is their main source of information. There was some implicit trust that the media sources their information directly from the meteorological organisations or government, and their aim is to inform the public and disseminate information to the public on important issues. The participants also noted that the information communicated by media channels is instantaneously supported with visible evidence or personal accounts, for example via filmed footage on TV news. These 'witness accounts' makes the media more trustworthy, because the viewer can see the evidence clearly for themselves.

In India, the high-level decision makers that trusted TV and newspapers did so because there was belief that the information originated from reliable sources of information, such as the national meteorological agency. Some participants noted that they evaluated the information provided based on where the information was originally sourced from. It was highlighted that news items are also often presented alongside empirical data and analysis. However, some participants mistrusted the media because they can be politically driven.

Photographer: Knud Falk/ Climate Centre

Trust in government

The table below shows the percentage of participants within each stakeholder group who trust government officials, and the level of their trust. 51% of participants sometimes trust the government officials; 43% always trust the government or officials.

	Kenya			India		
	High-level decisión makers	Media	Public	High-level decision makers	Media	Public
Always	57%	17%	58%	50%	20%	25%
Sometimes	43%	66%	31%	50%	80%	73%
Never	0%	17%	11%	0%	0%	2%

Qualitative information

In Kenya, the high-level decision makers trusted government officials based on where the information was originally sourced. Some implicitly trusted government agencies as they were the official sources of information, stating they have no alternative motive. Some stated their trust in these government groups was because they have climate data, and their information is evidence based; they also have a mandate and responsibility to source, interpret, and disseminate information and are therefore accountable for the information they provide, making them trustworthy.

The media in Kenya base their trust on government agencies on each piece of information, doing background checks on the sources of information, and checking whether the information is corroborated by alternative sources. There was some criticism that the information from government sources can be inconsistent and unreliable at times.

In Kenya, the public participants who trusted government agencies gave multiple reasons for trusting these sources. This was largely based on an established prior relationship; government agencies often work with the community regularly and so are known and can also be reached easily. Those that work within the community have historically provided training, education, empowerment, and information regarding climate change and therefore are trusted sources of information. The reason given for trust in government agencies was that they often provide assistance to the public in times of need. There is therefore an established trusting relationship between the public and the agencies, which has developed over time. There was recognition that they are more informed on these issues than the public, and have a mandate to provide information. There were minor instances where government agencies were criticised for providing inadequate information. One participant distrusted government agencies, because the participant perceived the agencies to be the only people providing information on climate change, and therefore mistrusted the government's intended purpose.

In India, there was general trust of government agencies by high-level decision makers, often citing that they provide information only after rigorous analysis of evidence from authenticated sources. It was also highly recognised that they are accountable for the information they provide. However, one participant noted that governments have other agendas and interests and therefore cannot be fully trusted.

The media participants in India trusted government sources, depending upon the source, if the argument is substantiated with data.

Interpretation

of implications of content

The participants were asked whether they wanted to know more about extreme event attribution information, and to rank their response on a scale of 1 to 10, with 1 representing 'definitely no' and 10 representing 'definitely yes'.

Overall, there were positive responses from all participants wishing to know more about extreme event attribution information; 41% of participants responded 'definitely yes' when asked if they wanted to know more. However, this enthusiasm varied based on the stakeholder. 66% of the Kenya high-level decision makers and public participants responded they definitely did want to know more. For the Indian high-level decision makers, and Kenyan media participants, this was lower at 50-57%. Only 30% of the India media participants definitely wanted to know more about extreme event attribution. 90% of the India public participants responded between 5 and 10 on the scale, indicating a positive response, but less definite than other stakeholders.

What will participants use extreme event attribution information for?

High-level decision makers suggested a range of uses they would have for extreme event attribution information, the most common use cited was better knowledge, preparation, planning, influencing policy decision makers, and to help explain the importance of climate change in adaptation strategies.

The information would be useful for improving awareness to help explain and support the reality of climate change, for both community level and also international audiences. Several participants noted the importance of providing evidence to support international climate negotiations, to advocate for investment in climate smart policies and programmes at national level, and to support policy research. One participant noted the information would be useful to help quantify the increase in insurance premiums due to climate change. One participant mentioned it would be useful for supporting funding initiatives to help affected communities under international climate funds, and to help prioritise adaptation strategies for the future.

Media participants suggested information on extreme event attribution could be useful for their own knowledge, raising awareness and improving public understanding of climate change links to extreme events, and also for helping to plan for future changes to climate.

Public participants believed they would find the information useful for planning, preparedness, education, and decision-making purposes. Some participants mentioned using the information to mobilise youth on climate change issues. A few participants said they did not need to know this information.

How can extreme event attribution information be made more useful, relevant, or improved?

High-level decision makers requested the information be provided at a higher spatial resolution, making the information specific for a region or ecological zone. There were frequent suggestions to include local knowledge and to incorporate traditional communication methods into the structure of disseminating the information. Including leaders within the communities in education and outreach programs to aid understanding of extreme event attribution information was suggested. It was recommended to continue to publish academic papers on the studies to provide a robust evidence base to support the information provided.

There was an emphasis from both high-level decision maker and media stakeholders that more information to explain the statements is needed for those without a scientific background, additional educational products will be needed to support the information, in layman's language, but without distorting the true meaning. It was requested that academic journal articles should be rewritten for non-scientific audiences. This included removing technical jargon, emphasising the practical aspects and implications of the research, and tailoring the content to be understandable for non-experts. This information could then also be

used further as material and inputs for preparations of training of sub-national government officials. This information will need to be co-produced with local, in-country producers of climate information, such as the national meteorological department. It was emphasised that the language and communication method would need to be adapted for each stakeholder, and even within the high-level decision maker stakeholder group, there would need to be adjustments based on audience. This should be developed through partnerships with relevant government ministries, departments, and agencies.

Media participants emphasised that these new emerging issues are important, but will need to be simplified for the media to have better understanding and uptake. They emphasised that the statements on extreme event attribution will need to be supported by evidence of the scientific linkages. It was suggested that in-country communication experts within the climate change field should be hired and consulted to create and adapt the visuals and phrases. The Shamba Shape-Up TV series in Kenya was suggested as a useful medium for disseminating information to the public. Media participants linked to radio programs suggested the information should be simplified and then disseminated through vernacular media platforms. They also expressed interest in working on extreme event attribution information education and dissemination, including creating more forums for discussion. It was suggested that workshops, site visits, and training sessions should be offered to journalists to help them better understand the science and issues related to not only extreme event attribution, but also climate change more broadly.

Public participants requested more education and training opportunities on climate change, not only on extreme event attribution. There was a request also to make the information available at a higher spatial resolution and ensure it is not only applicable to farmers, but also applicable to pastoralists, who may need different information, provided through a different source, on a different spatial scale or scope. Participants wanted better access to information alongside better provision of information on mitigation. Regular workshops and training programs were suggested, as well as providing films in local language, and communication through social media. There was also an emphasis on including traditional knowledge and involving farmers.

Motivation to take action

Participants were asked whether they had any plans or intentions to respond to or prepare for climate change, in light of the information provided on extreme events attributed to climate change. 65% responded they did have plans or intentions to respond to climate change. The table below outlines their ranked, most common responses, by stakeholder. Apart from the India public stakeholders, there was strong indication of participants' willingness to prepare for climate change.

Stakeholder	'Yes' responses	Most common plans or intentions for those that responded 'yes'
India high-level decision maker	95%	Seek further information on how climate change affects extreme weather events.
		Prepare for climate change impacts.
		Seek further information on climate change.
		Think about how to better incorporate resilience to climate impacts in my work.
Kenya high-level decision maker	100%	Think about how to better incorporate resilience to climate impacts in my work.
		Prepare for climate change impacts.
		Seek further information on how climate change affects extreme weather events.
India media	100%	Seek further information on climate change.
		Seek further information on how climate change affects extreme weather events.
Kenya media	100%	Seek further information on climate change.
		Think about how to better incorporate resilience to climate impacts in my work.
		Seek further information on how climate change affects extreme weather events.
		Prepare for climate change impacts.
India public	23%	Seek further information on climate change.
		Prepare for climate change impacts.
		Seek further information on how climate change affects extreme weather events.
Kenya public	84%	Seek further information on climate change.
		Prepare for drought events in particular.
		Seek further information on how climate change affects extreme weather events.
		Prepare for climate change impacts.

Participants were then asked whether they had any plans or intentions to contact authorities to improve responses to climate change, considering the information provided on extreme events attributed to climate change. 71% of participants responded they did have plans or intentions to contact authorities to improve responses to climate change. The table below outlines their responses, by stakeholder. Apart from the India public stakeholders, there was strong indication of participants' willingness to contact authorities to improve responses to climate change.

Stakeholder	'Yes' responses	Most common authorities specified to contact if responded 'yes'	Most common actions stated if responded 'yes'
India high-level decision maker	95%	National government	Training and education
			Resilient crops and farming practices
		Local government	More resilient homes
			Improve infrastructure preparedness
Kenya high-level decision maker	100%	Local government	Resilient crops and farming practices
		National government	Training and education
		International organizations	Improve infrastructure preparedness
		Academia and science researchers	Prepare for emergency situations
India media	100%	Media	Training and education
			Resilient crops and farming practices
		National government	Improved infrastructure preparedness
		Local government	Prepare for emergency situations
Kenya media	100%	Agricultural centers	Training and education
		National government	Resilient crops and farming practices
		Local government	More resilient homes
India public	34%	Agricultural centers	Prepare for emergency situations
		Municipal or infrastructure planners	Resilient crops and farming practices
		Emergency and safety responders	
		National government	Improved infrastructure preparedness
		Media	
Kenya public	90%	Agricultural centers	Resilient crops and farming practices
		National government	Prepare for emergency situations
		Emergency and safety responders	Improved infrastructure preparedness
		Media	More resilient homes
			Improved health services to prepare for impacts

The information participants want to receive on climate

There was a common request for climate information to be downscaled to the local areas and ecological zones to provide more l ocal information that is useful. There was also a request for early warning information with an increased lead time, specifying the exact location, duration, likely impacts (particularly on livelihoods, ecosystems, and economies) and advice on risk reduction or mitigation methods are needed for extreme weather events. There was a request for more information on the effects and impacts of climate change, as well as solutions for those impacts. They emphasised a need to provide information on both positive and negative impacts of climate change. One person suggested the rules and regulations related to climate change be strengthened if the effects of climate change are to be reduced.

The public participants in Kenya requested more information on rainfall early warning and drought indexing, information on how to react in case of emergencies, advice on how to manage and prevent climate change. There was a request for more information aimed at pastoralists, rather than solely at crop farmers. In India, the high-level decision makers requested more detailed information regarding the impact of heat waves and drought on different sectors such as food security, health, and livelihoods. There was a suggestion from media stakeholders that often communities want yes or no answers and forecasts, so communication to them must be clear and sure. There were suggestions to strategically simplify the complex information for farmers to avoid confusion, and focus instead on providing information on adaptation and preparation methods that have been proven to work. For this, a larger evidence base is needed of what works and what does not in response or preparation for climate change, with special attention paid to the various and different contexts; there is no one-size-fits-all solution.

It was recognised there is a need for improved infrastructure and human capacity, especially dissemination of information to raise awareness and understanding within communities of the effects and impacts of climate change and how to build resilience. More training is required at the high-level decision-maker level on the science and interpretation of climate science. There was also a repeated request from public participants

particularly in Kenya for more training and education opportunities, and requests for scientists to listen to the elders' experience and work with the local community to effect change. There is a need for more education and communication campaigns to increase awareness, training on adverse effects of climate change and ways to mitigate them at individual, community, local, district, and national levels.

There was a repeated emphasis on the need to link both scientists and communication experts, as well as local communities, incorporating traditional communication methods. It was also emphasised that the way of communicating climate information will need to be adapted for the range of intended audiences, particularly to reach the most vulnerable and marginalised communities or individuals within the larger demographic. In India, the media participants emphasised that the climate change topic is important and evolving and is of great interest. However, the public were less aware of the impacts, or the latest research. It was emphasised that it is important to engage stakeholders in continuous dialogue to raise awareness of climate change and interventions.

In Kenya, the media requested more visual representations of climate change and effects, such as maps. There was also a suggestion that radio is an influential source of information particularly in rural and northeastern Kenya, and can be used to educate and increase awareness of locals. It was emphasised this information needs to be in the local language whenever possible. There was a suggestion from a participant in India that creating short films to illustrate the effects of climate change with real life examples would increase people's awareness of the threat of climate change.

Photographer: Knud Falk/ Climate Centre

Photographer: Tamara Leigh/IFRC-Climate Centre

Limitations

of the study

Variations within sub-groups

It should be recognised that levels of understanding, and preference for the way information is communicated to individuals, is dependent upon a wide range of factors, and therefore preferences will vary not only across stakeholder groups, but also within them. In addition, even within stakeholder groups, there are sub-groups which are likely to have a different opinion and understanding of terms and concepts. For example, within the high-level decision maker group, there are specialist climate scientists, social scientists, NGOs, government officials, and practitioners. The way that extreme event attribution is communicated to specialist climate scientists with a statistical background should be different from the information communicated to practitioners who may not have the same background knowledge.

Questionnaire

The most common feedback on the questionnaire from all stakeholders was the questionnaire was much too long. However, among the high-level decision makers and public participants, even those who acknowledged the questionnaire and interview process was lengthy, appreciated the exercise and the knowledge they gained from the experience.

The questionnaire could benefit from being adapted for stakeholders within overarching stakeholder categories. High-level decision makers also highlighted their confusion about whether to answer for themselves, or to provide their views on what would best suit the wider public.

There was also positive feedback from high-level decision makers and public participants that they were very interested to hear that this information on extreme event attribution will be available. They emphasised that it is very exciting and useful information.

Gender imbalance

A gender balance of participants was sought during the collection of the data. However, the data collected overall shows a gender imbalance (65% men, 35% women). At the high-level decision-maker and media level there was a striking gender imbalance, with data gathered predominantly from men. When seeking participants from these stakeholders, the interviewers sought the most appropriate representative within the decision-making organisation; the gender imbalance likely reflects the gender imbalance of employees within these stakeholder groups.

During correspondence, further interviews were requested with other members of each organisation, particularly seeking women to interview within the organisation.

There was also an imbalance within the public level participants (59% men, 41% women). During the data collection process, when the number of male participants was reached within each community group, the interviewers sought to balance the number of male participants by seeking out female participants before moving onto the next community location. However, the interviewers experienced difficulty in finding similar numbers of women willing to participate in the study within the time constraints of the project. The higher numbers of men within the public participants therefore reflects the greater availability and willingness of men to participate in the study. To ensure the perspectives of women are captured, gender disaggregated data has been analysed at public level (Annex 3). There was a similarity between men and women's answers throughout the responses.

Photographer: Knud Falk/ Climate Centre

Photographer: Tamara Leigh/IFRC-Climate Centre

Conclusions

and recommendations

Analysis of the quantitative and qualitative data enables some recommendations to be drawn. Annex 4 consolidates these recommendations into a basic guide on phrases that are most likely to be understood for each stakeholder group.

However, it must be remembered that there was a range of responses, understanding, and preference from within each stakeholder group. Therefore, this guidance should be used with caution. Further investigation is needed into communicating this complex information. Further breakdown of stakeholders is needed and further investigation of translation into local languages is needed. It is recommended that continuous dialogue with the stakeholders is needed as extreme event attribution science develops and further studies are conducted.

Probability

In Kenya, high-level decision maker and media stakeholders prefer percentage information. The term '*chance*' is preferred in general and is used by the Ministry of Environment and Natural Resources within Kenya to communicate probability information. For those stakeholders with a scientific background, '*probability*' was preferred due to familiarity.

In Kenya, the public found the concept of probability very difficult to understand. The information on frequency was easier for this group to understand. It is recommended that probabilistic information is not communicated to this group. Also, it is recommended that statistical information is not communicated to these stakeholders, based on their own requests and lack of understanding.

In India, high-level decision makers showed preference for '*probability*' and use of percentages. They did not find there to be much difference between the terms '*probability*', '*likelihood*', and '*chance*'.

In India, media participants showed a preference for the term '*chance*' and for percentage information. However, there was a broad range of responses for these statements, which is likely linked to the knowledge background of each participant.

In India, the responses from the public was unclear, showing a range of preferences. There was difficulty understanding the difference between '*probability*', '*likelihood*', and '*chance*', however '*chance*' was preferred overall.

Frequency

In Kenya, high-level decision makers understood the statement on '*return time*', but found this option difficult. For both high-level decision makers and the media, there was general preference for the statement using the phrase '*twice as often*'. The use of '*lifetime*' was heavily criticised.

In Kenya, the public exhibited a range of responses, with some confusion over the measure of increase. It is suggested that the statement should be simplified to '*drought occurs more often because of climate change*'.

In India, there was a range of responses from high-level decision makers. Phrases such as '*factor of two*' and '*twice as often*' were considered difficult to understand. Some preferred the '*return time*' information, which is likely due to their scientific background.

In India, media participants preferred statements on '*return time*' and '*double the frequency*', but further investigation is needed due to the low response rates for this stakeholder group.

In India, there was a range of responses from the public; the statement on '*frequency…twice in a lifetime*' was the easiest to understand. There was general difficulty understanding '*frequency*'. It is recommended that probability information may be preferable for this stakeholder group.

Intensity

In Kenya, both high-level decision maker and media stakeholders preferred '*severity*'. The term '*strength*' was disliked amongst stakeholders for describing drought. Public participants preferred the term '*worse*'; this may be due to translation difficulties for other terms. It is also recommended for this group to remove the statistical information.

In India, high-level decision maker and media participants showed preference for '*severity*' or '*intensity*', but requested further clarification of the measurement used. The public participant responses were very evenly spread across statements, with '*strength*' and '*worse*' marginally preferred.

Uncertainty

Stakeholders in Kenya and India preferred statement 3 '*increased the chances… by a range of 30-50%, best estimates are approximately 40%*' and statement 4 '*Scientists are fairly certain that climate change increased the chances of the current drought heat wave by 40%*'. Amongst the Kenyan public there was a clear preference for '*fairly certain*' over numerical uncertainty statistics.

The degree to which stakeholders understood the information on uncertainty varied with their background knowledge. It is suggested that for the majority of stakeholders, uncertainty information is confusing and unnecessary, and therefore should be excluded. Media and public participants both had difficulty with uncertainty information.

High-level decision makers with statistical backgrounds or working within climate science preferred statement 1 '*Climate change increased the chances of the 2016 Rajasthan heat wave by 40% (+/- 10%)*' because it contains the purest information. It is suggested that the uncertainty information could be made available to those who wish to know more.

Single statement A

"Results were inconclusive and evidence for a link to climate change cannot be made at this time".

From the results, it is advised that care needs to be taken with communicating this statement as there is room for misinterpretation. In Kenya, high level decision makers were divided according to whether they preferred the main statement or a simplified version (see below). There is a need for further division of the stakeholder group into sub-groups. The media and public showed clear preference for the simpler statement '*Scientists were not able to conclude whether climate change affected this extreme weather event*'. In India, all stakeholders showed preference for the simpler statement.

Single statement B

"Climate change did not affect the chances of this extreme weather event".

This statement was found, in general, to be easily and correctly understood by all stakeholders and countries. There is a recommendation for a slight alteration of the statement to improve the clarity and grammar: '*Climate change did not have any effect on the chances of this extreme weather event occurring*', however, this should be tested before being used.

Single statement C

"This extreme weather event was not as bad as we expected given how climate change is affecting this region".

It is suggested that if the first statement is used, it needs to be accompanied by more information on the predicted regional trends. There was consensus across all stakeholder groups and countries that a simpler statement '*This extreme weather event was not as bad as we expected given how climate change is affecting this region*' is easier to understand.

Visuals

The public showed a preference for visuals containing photographs. The public were less interested in the statements and statistical information. There was some confusion by participants about what information the picture visuals were communicating. It is recommended that communication of this information should focus on severity, not probability as this is easier for all stakeholders, particularly the public. It is also recommended to improve upon these visuals by using pictures of 'before' and 'after' images for comparison, and these images should be specific to the location.

The climate change icon needs to be changed or removed entirely. It needs to be representative of what the stakeholder and country perceive as 'climate change'. It is recommended to collaborate with designers and communicators within a specific country to develop an alternative icon, particularly focusing on the effects of climate change, such as on livelihoods.

For all visuals, the confidence level should be removed. This information only confuses people, or is ignored.

High-level decision makers preferred Visual 3 with the graph. However, this visual may need to be altered by providing more scientific representation of the information, such as labelling the axes, labelling the peaks, colour coding the peaks, or providing a key or label to identify what the peaks represent.

Visuals 4 and 5 will need more work; there was general consensus that there is too much information contained in each visual. It is recommended that they are broken up to provide separate infographics on probability, intensity, and frequency. In Kenya, the drought intensity image was well-received in general. The dice, eggs in a basket, and clock were not well received or understood by any stakeholder group. The timeline image was confusing for some, but clear for others, and may require further investigation or alteration. The drought indicator using a droplet that has been crossed through needs to be redesigned.

It is suggested that focus groups and specialist designers within each country are needed to further investigate non-text communication of extreme event attribution information, working with people who are illiterate.

Trust

There is a need to work with the main trusted sources of information for each stakeholder to develop a communication strategy and not just phrases and images for each stakeholder group.

In both Kenya and India, high-level decision makers source most of their climate and weather information from the national meteorological department. The media also source their information from the national meteorological department, but will need training and education or tailored resources to be able to understand and then communicate information on extreme event attribution to the public. It is recommended that extreme event attribution scientists work with the national meteorological department, and in-country communication specialists to develop a communication strategy and disseminate information.

The public in Kenya received most of their climate and weather information through radio or TV, in India they receive it through TV and newspapers. It is recommended that scientists and communicators work with appropriate media outlets to create TV and radio programs, and publish newspaper articles to increase knowledge and awareness amongst the public and also to disseminate extreme event attribution.

There is a high-level of public trust in established relationships with local government personnel, NGO practitioners, and leaders who work within communities. It is recommended that the public can be reached by communication specialists working with NGOs, local government and leaders within communities to provide training, education, and information to these key leaders and trusted sources. The information can then be disseminated further via local, traditional means.

Translation

In Kenya, there is difficulty in translating the following terms into Swahili: *probability/likelihood/chance, intensity/severity/strength,* and *climate change/weather*. In India, there is difficulty translating '*frequency*' and '*intensity*' into Hindi. More focus would be needed on working with native speakers to ensure terms are clearly understood, and then considering most appropriate options for translating to retain the core meaning, rather than attempting direct translation. Beyond Swahili and Hindi, translation into other local languages will be needed in both Kenya and India for communication to the public.

Next steps

It is emphasised by all stakeholder groups that information on extreme event attribution needs to be at a high spatial resolution, for the information to be useful and applicable to local contexts.

Extreme event attribution information will need to be supported by education and awareness raising, and accompanied by advice on ways to mitigate against extreme events and climate change. This information needs to be developed in collaboration with in-country stakeholders and communication specialists. It is recommended that the communication channel will also need to be included in the development of communication material, for example media organisations.

Further research would be useful to further refine communication of attribution information in specific locations. Women-only groups should be prioritised, in order to increase outreach to this group. Further investigation into differences within stakeholder groups is recommended, particularly within the high-level decision maker stakeholder group, to tailor the content to the end-user. Further research needs to be conducted for other local languages, in areas where Swahili or Hindi are not the native language. This will require working with native speakers to establish terms and phrases that are understood within the local context, rather than translating from English to a secondary language.

Conclusion

It should be recognised that the information required to communicate extreme event attribution analysis is extremely complex. The information requires the end-user to understand climate change, the link between climate change and extreme weather events, technical terms such as probability, intensity, and frequency, and statistical information (whether in numerical or qualitative form). It is noted that the phrases presented in this report will need to be accompanied by further information on extreme event attribution during near-real-time information communication. In addition, further education and resources are needed at all stakeholder levels to increase understanding and awareness of extreme event attribution, and also more generally of climate change.

These resources need to be tailored to the needs of the end user, and should be created in collaboration with them, taking into account their needs, levels of knowledge, and language requirements. It is recommended that communication outreach strategies should be co-developed with key leaders and communicators within stakeholder groups. This includes developing non-text communication and educational material with in-country communication specialists.

This report provides recommendations and guidance on extreme event attribution communication to high-level decision makers, media, and the public. It should be recognised that these recommendations are guidelines; further research is recommended into this complex issue of communicating attribution information. The guidance is not applicable to regions outside of the study areas; there was variation between Kenya and India stakeholder responses, so future extreme event attribution studies in other countries will require research into how to communicate the information appropriately for a given location. It has been emphasised that even within the stakeholder groups in this research study, there is variation in individuals' levels of understanding and preferences for phrasing of extreme event attribution information. Further investigation into differences within stakeholder groups is recommended, particularly within the high-level decision maker stakeholders.

Within the public participants group, it has been noted that there needs to be further research into communicating attribution information in native languages. This will require working with native speakers to establish language and phrases that effectively communicate the intended information, rather than translating

directly from English into Swahili or Hindi. It is also noted that there is a need for additional local language communication phrases, apart from Swahili and Hindi, to be researched in both Kenya and India to increase the effectiveness of communication to the public.

Whilst the communication of extreme event attribution information is complex and requires further investigation, it should be noted that there is a high-level of interest in this information across all stakeholders. There is high interest in both the issue of climate change and extreme events within all stakeholders in this research. The majority of participants were aware that climate change is occurring, resulting in more severe and frequent extreme weather events. They are worried about the effects, and wish to know more about ways to mitigate against the effects of climate change. There was a clear expression of interest in extreme event attribution information across all stakeholders in Kenya and India, and many participants indicated they wished to know more.

Annex 1: Bibliography

Alam, M, and Shahriar, S.M., 2013, Climate change awareness in Asia: as assessment of the Climate Asia Blog, Asian Politics and Policy, Vol. 5, Issue 3. pp492-496.

Billett, S., 2009, Dividing climate change: global warming in the Indian mass media, Climatic Change.

Chapman, D.A., Corner, A., Webster, R., and Markowitz, E.M., 2016, Climate visuals: a mixed methods investigation of public perceptions of climate images in three countries, Global Environmental Change, 41, 172-182.

Easterling, D.R., Kunkel, K.E., Wehner, M.F., and Sun, L., 2016, Detection and attribution of climate extremes in the observed record, Weather and Climate Extremes, 11, 17-27.

EUCLEIA, 2013, EUropean CLimate and weather Events: Interpretation and Attribution, Deliverable D4.4, Empirical working paper: perceiving attribution.

Gambhir, V., and Kumar, P., 2013, How the people of India live with climate change and what communication can do, Climate Asia report, BBC Media Action, UKaid.

Hansen, J.W., Masons, S.J., Sun, L., and Tall, A., 2011, Review of seasonal climate forecasting for agriculture in sub-Saharan Africa, Experimental Agriculture, Volume 47 (2), pp. 205-240.

Harold, J., Lorenzoni, I., Shipley, T.F., and Coventry, K.R., 2016, Cognitive and psychological science insights to improve climate change data visualization, Nature Climate Change, Review Article, Vol. 6.

Harris, A.J.L., 2015, Forecast communication through the newspaper. Part 2: perceptions of uncertainty, Bulletin of Volcanology, 77, 30.

Hassol, S.J., Torok, S., Lewis, S., and Luganda, P., 2016, (Un)natural disasters: communicating linkages between extreme events and climate change, WMO Bulletin, 65, 2.

Hellmuth M.E., Mason S.J., Vaughan C., van Aalst M.K. and Choularton R. (eds) 2011. *A Better Climate for Disaster Risk Management*. International Research Institute for Climate and Society (IRI), Columbia University, New York, USA.

Howell, R.A., 2014, Investigating the long-term impacts of climate change communications on individuals' attitudes and behavior, Environment and Behavior, 46, 1, 70-101.

Jagtap, S.S., Jones, J.W., Hildebrand, P., Letson, D., O'Brien, J.J., Podesta, G., Zierden, D., and Zazueta, F., 2002, Responding to stakeholder's demand for climate information: from research to applications in Florida, Agricultural Systems, 74, 415-430.

Kandlikar, M., Risbey, J., and Dessai, S., 2005, Representing and communicating deep uncertainty in climate-change assessments, Comptes Rendus Geoscience, 337, 443-455.

Kaufmann, R.K., Mann, M.L., Gopal, S., Liederman, J.A., Howe, P.D., Pretis, F.,

Tang, X., and Gilmore, M., 2016, Spatial heterogeneity of climate change as an experiential basis for skepticism, PNAS Early Edition.
Khan, S., and Kelman, I., 2012, Progressive climate change and disasters: communicating uncertainty, Natural Hazards, 61, 873-877.
Leiserowitz, A., and Thaker, J., 2012, Climate change in the Indian mind, Yale Project on Climate Change Communication, GlobeScan Incorporated.
Liang, X., Tsai, J-Y., Mattis, K., Konieczna, M., and Dunwoody, S., 2014, Exploring attribution of responsibility in a cross-national study of TV news coverage of the 2009 United Nations climate change conference in Copenhagen, Jounral of Braodcasting and Electronic Media, 58(2), 253-271.
Marx, S.M., Weber, E.U., Orlove, B.S., Leiserowitz, A., Krantz, D.H., Roncoli, C., and Phillips, J., 2007, Communication and mental processes: experiential and analytic processing of uncertain climate information, Global Environmental Change, 17, 47-58.
Meinke, H., Nelson, R., Kokic, P., Stone, R., Selvaraju, R., and Baethgen, W., 2006, Actionable climate knowledge: from analysis to synthesis, Climate Research, 33, 101-110.
Morss, R.E., Wilhelmi, O.V., Downton, M.W., and Gruntfest, E., 2005, Flood risk, uncertainty, and scientific information for decision making: lessons from an interdisciplinary project, BAMS, American Meteorological Society.
Morss, R.E., Demuth, J.L., and Lazo, J.K., 2008, Communicating uncertainty in weather forecasts: a survey of the U.S. public, Weather and Forecasting, Volume 23.
Moser, S.C., 2010, Communicating climate change: history, challenges, processes and future directions, Climate Change, Volume 1.
Moser, S.C., 2014, Communicating adaptation to climate change: the art and science of public engagement when climate change comes home, *WIREs Climate Change* 2014, 5:337–358.
Moser, S.C., and Dilling, L., 2012, Communicating climate change closing the science-action gap.
Moss, R.H. and Schneider, S.H., 2000: Uncertainties in the IPCC TAR: Recommendations to lead authors for more consistent assessment and reporting. In: Guidance Papers on the Cross Cutting Issues of the Third Assessment Report of the IPCC [eds. R. Pachauri, T. Taniguchi and K. Tanaka], World Meteorological Organization, Geneva, pp. 33-51.
Padgham, J., Devisscher, T., Togtokh, C., Mtilatila, L., Kaimila, E., Mansingh, I., Agyemang-Yeboah, F., Obeng, F.K., 2013, Building shared understanding and capacity for action: insights on climate risk communication from India, Ghana, Malawi, and Mongolia, International Journal of Communication, 7, 970-983.
Paton, D., 2008, Risk communication and natural hazard mitigation: how trust influences its effectiveness, International Journal of Global Environmental Issues, Vol 8, Nos. 1-2.
Patt., A.G., and Schrag, S.P., 2003, Using specific language to describe risk and probability, Climatic Change, 61, 17-30.
Pidgeon, N., and Fischhoff, B., 2011, The role of social and decision sciences in communicating uncertain climate risks, Perspective, Nature Climate Change, Vol 1.
Rabinovich, A., Morton, T.A., and Birney, M.E., 2012, Communicating climate science: The role of perceived communicator's motives, Journal of Environmental Psychology, 32, 11-18.
Renn, O., and Levine, D., 1991, Credibility and trust in risk communication, in R.E. Kasperson and P.J.M. Stallen (eds.). Communicating Risks to the Public. 175-218, 1991 Kulwer Academic Publishers, Netherlands.
Sayers, P., 2016, Communicating the chance of a flood: the use and abuse of probability, frequency and return period, http://www.eci.ox.ac.uk/research/water/forum/Communicating%20the%20chance%20of%20a%20flood%20-%20the%20use%20and%20abuse%20of%20retrun%20period.pdf
Scienseed, 2016, Communicating climate change and biodiversity to policy makers, A guide by Scienseed SL for the Bern Convention (Council of Europe), Madrid, 2nd May 2016.
Simonovic, S., 2002, Non-structural measures for water management, Water International, 27, 1.
Spence, A., and Pidgeon, N., 2010, Framing and communicating climate change: the effects of distance and outcome frame manipulation, Global Environmental Change, 20 (4). pp. 656-667. ISSN 0959-3780
Stott, P.A., and Walton, P., 2013, Attribution of climate-related events: understanding stakeholder needs, Weather, Vol. 68, No. 10, Royal Meteorological Society.
Stott, P.A., Christidis, N., Otto, F.E.L., Sun, Y., Vanderlinden, J.P., van Oldenborgh, G.J., Vautard, R., von Starch, H., Walton, P., Yiou, P., and Zwiers, F.W., 2016, Attribution of extreme weather and climate-related events, WIREs Clim Change 2016, 7:23–41.
Wallsten, T. S., Fillenbaum, S., and Cox, J. A.: 1986, 'Base Rate Effects on the Interpretation of Probability and Frequency Expressions', *Journal of Memory and Language* 25, 571.
Wardekker, J.A., van der Sluijs, J.P., Janssen, P.H.M., Klopogge, P., and Peterson, A.C., 2008, Uncertainty communication in environmental assessments: views from the Dutch science-policy interface, Environmental Science and Policy, II, 627-641.
Weber, E. U. and Hilton, D. J.: 1990, 'Contextual Effects in the Interpretations of Probability Words: Perceived Bas Rate and Severity of Events', *Journal of Experimental Psychology: Human Perception and Performance* 16, 781.
Weiss, A., Van Crowder, L., and Bernardi, M., 2000, Communicating agrometeorological information to farming communities, Agricultural and Forest Meteorology, 103, 185-196.
Wilkinson E., Budimir M., Ahmed A.K., and Ouma G., 2015, 'Climate information and services in BRACED countries', Resilience Intel.
Windschitl, P. D. andWeber, E. U.: 1999, 'The Interpretation of 'Likely' Depends on the Context, but '70%' is 70% – right? The Influence of Associative Processes

on Perceived Certainty', *Journal of Experimental Psychology: Learning, Memory, and Cognition* 25, 1514.
WMO, 2008, Guidelines on communicating forecast uncertainty, WMO/TD-No.1422, Geneva.

Annex 2: Translation into Swahili and Hindi

Swahili translations of statements

Probability statements

Statement 1: "Climate change increased the probability of the current drought by 40%."
Mabadiliko ya hali ya nchi imeongeza uwezokano wa Ukame uliopo sasa kwa asili mia arobaini.
Statement 2: "Climate change increased the likelihood of the current drought by 40%."
Mabadiliko ya hali ya nchi imeongeza uwezokano wa Ukame uliopo sasa kwa asili mia arobaini.
Statement 3: "Climate change increased the chances of the current drought by 40%."
Mabadiliko ya hali ya nchi imeongeza nafasi ya kuwepo kwa Ukame uliopo sasa kwa asili mia arobaini.
Statement 4: "Climate change made the current drought one and a half times as likely."
Mabadiliko ya hali ya nchi imefanya Ukame uliopo sasa kuwepo mara moja na nusu.
Statement 5: "Climate change increased the chances of the current drought by one and a half times."
Mabadiliko ya hali ya nchi imeongeza nafasi ya kuwepo kwa Ukame uliopo sasa kwa mara moja na nusu.

Frequency statements

Statement 1: "Climate change has increased the return time of droughts, like the current Kenya drought, from a 1 in 20-30 year event to a 1 in 7-10 year event."
Mabadiliko ya hali ya nchi imeongeza wakati wa marudio ya ukame kama ukame uliopo sasa nchini Kenya, kuanzia moja kwa muda wa miaka ishirini hadi thelathini hadi moja kwa miaka saba hadi kumi kwa mwaka.
Statement 2: "Climate change has increased the frequency of drought, like the current Kenya drought, so that events that used to happen about twice in a lifetime now occur about 4 times in a lifetime."
Mabadiliko ya hali ya nchi imeongeza marudio ya ukame kama ukame uliopo sasa Kenya, ili matukio yaliyokuwa yakitendeka mara mbili kwa maisha sasa yatendeka karibu mara nne kwa maisha.
Statement 3: "Climate change has increased the frequency of droughts, like the current Kenya drought, by a factor of two".
Mabadiliko ya hali ya nchi imeongeza marudio ya ukame, kame vile ukame uliopo Kenya kwa kiasi cha mara mbili.
Statement 4: "Climate change has doubled the frequency of droughts, like the current Kenya drought".
Mabadiliko ya hali ya nchi imeongeza mara mbili marudio ya ukame kame vile ukame uliopo sasa Kenya.
Statement 5: "Droughts, like the current Kenya drought, now occur twice as often due to climate change".
Ukame, kama ukame uliopo sasa Kenya, sasa watokea mara mbili kila mara kwa sababu ya mabadiliko ya hali ya nchi.

Intensity statements

Statement 1: "Climate change increased the intensity of the current Kenya drought by approximately 20%".
Mabadilko ya hali ya nchi imeongeza uzito wa ukame uliopo sasa Kenya kwa asili mia ishirini.
Statement 2: "Climate change increased the severity of the current Kenya drought by approximately 20%".
Mabadiliko ya hali ya nchi imeongeza uzito zaidi wa ukame uliopo sasa Kenya kwa asili mia ishirini.
Statement 3: "Climate change increased the strength of the current Kenya drought by approximately 20%".
Mabadiliko ya hali ya nchi imeongeza nguvu ya ukame uliopo sasa Kenya kwa asili mia ishirini.
Statement 4: "Climate change made the current Kenya drought 20% worse". *Mabadiliko ya hali ya nchi imefanya ukame uliopo sasa Kenya kuwa mbaya zaidi kwa asili mia ishirini.*

Uncertainty statements

Statement 1: "Climate change increased the chances of the current Kenya drought by 40% (+/- 10%)".
Mabadiliko ya hali ya nchi imeongeza nafasi ya kuwepo kwa ukame uliopo sasa Kenya kwa asili mia arobaini (Ongeza au Ondoa asili mia kumi)
Statement 2: "Climate change increased the chances of the current Kenya drought by 40% (30-50%)".
Mabadiliko ya hali ya nchi imeongeza nafasi ya kuwepo ukame Kenya kwa asili mia arobaini (kati ya asili mia thelathini hadi hamsini).
Statement 3: "Climate change increased the chances of the current Kenya drought by a range of 30-50%, best estimates are approximately 40%". *Mabadiliko ya hali*

ya nchi imeongeza nafasi ya kuwepo ukame Kenya kwa kiwango cha kati ya asili mia thelathini na hamsini, kamili kabisa ni karibu asili mia arobaini.
Statement 4: "Scientists are fairly certain that climate change increased the chances of the current Kenya drought by 40%."
Wanasayanzi wanajua kiasi kuwa mabadiliko ya hali ya nchi imeongeza nafasi ya kuwepo ukame iliopo sasa Kenya kwa asili mia arobaini.

Single statement A

Statement A: "Results were inconclusive and evidence for a link to climate change cannot be made at this time."
Matokeo hayakukamilika na ushahidi wa kulinganisha mabadiliko ya hali ya nchi hauwezi fahamika kwa sasa.
Simpler statement A: "Scientists were not able to conclude whether climate change affected this extreme weather event".
Wanasayanzi hawakuweza kutoa usahihi kamili kama mabadilko ya hali ya nchi imechangia matukio haya ya hali ya anga ya kiasi Kikubwa.

Single statement B

Statement B: "Climate change did not affect the chances of this extreme weather event".
Mabadiliko ya hali ya anga hayakuchangia nafasi ya kuwepo matukio ya hali ya anga ya kiasi kikubwa.

Single statement C

Statement C: "This extreme weather event was not as severe as expected, when compared to predicted regional climate change trends."
Matukio haya ya hali ya anga ya juu hayakuwa mabaya vile ilitarajiwa ukilinganisha na utabiri wa mabadiliko ya nchi inavyotendeka.
Simpler statement C: "This extreme weather event was not as bad as we expected given how climate change is affecting this region."
Matukio haya ya juu ya hali ya anga hayakuwa mabaya kama vile ilivyotarajiwa kulingana na mabadiliko ya hali ya anga sehemu hii.

Hindi translations of statements

Probability statements

Statement 1: 'Climate change increased the probability of the 2016 Rajasthan heatwave by 40%.'
'2016 मे राजस्थान मे गर्म हवाएं चलने की संभावना को जलवायु परविर्तन ने 40 % तक बढ़ाया।'
Statement 2: 'Climate change increased the likelihood of the 2016 Rajasthan heatwave by 40%.'
'जलवायु परविर्तन ने 2016 मे राजस्थान मे गर्म हवाएं चलने के आसार को 40 % तक बढ़ाया।'
Statement 3: 'Climate change increased the chances of the 2016 Rajasthan heatwave by 40%.'
'जलवायु परविर्तन की वजह से 2016 मे राजस्थान मे गर्म हवाएं चलने की आशंका 40% तक बढ़ी।'
Statement 4: 'Climate change made the 2016 Rajasthan heat wave one and a half times as likely.'
'जलवायु परविर्तन ने 2016 मे राजस्थान मे गर्म हवाएं चलने की संभावना लगभग डेढ़ गुना तक किया।'
Statement 5: 'Climate change increased the chances of the 2016 Rajasthan heat wave by one and a half times.'
'2016 मे राजस्थान मे गर्म हवाएं चलने की संभावना जलवायु परविर्तन से लगभग डेढ़ गुना तक बढ़ी।'

Frequency statements

Statement 1: 'Climate change has increased the return time of extreme heat events, like the 2016 Rajasthan heat wave, from a 1 in 20-30 year event to a 1 in 7-10 year event.'
'जलवायु परविर्तन ने 2016 मे राजस्थान मे गर्म हवाएं चलने जैसी भीषण गर्मी के रटिर्न टाइम को 20 से 30 साल मे 1 से बढ़ाकर 7 से 10 साल मे 1 किया है। '
Statement 2: 'Climate change has increased the frequency of extreme heat events, like the Rajasthan heatwave, so that events that used to happen about twice in a lifetime now occur about 4 times in a lifetime.'
'जलवायु परविर्तन ने 2016 मे राजस्थान मे गर्म हवाएं चलने जैसी भीषण गर्मी की फ्रीक्वेंसी को बढ़ाया है, जसिसे जो गर्मी पहले आमतौर पर एक जीवनकाल मे 2 बार पड़ती थी, वो अब करीब 4 बार पड़ती है।'
Statement 3: 'Climate change has increased the frequency of extreme heat events, like the 2016 Rajasthan heat wave, by a factor of two.'
'2016 मे राजस्थान मे गर्म हवाएं चलने जैसी भीषण गर्मी की फ्रीक्वेंसी को जलवायु परविर्तन ने दोगुना तक बढ़ा दिया है।'
Statement 4: 'Climate change has doubled the frequency of extreme heat waves, like the 2016 Rajasthan heat wave.'
'जलवायु परविर्तन से अत्यधिक गर्म हवाएं, जैसी 2016 मे राजस्थान मे लू चली थी, चलने की संभावना दोगुनी हो गई है।'
Statement 5: 'Extreme heat events, like the 2016 Rajasthan heat wave, now occur twice as often due to climate change.'
'जलवायु परविर्तन से 2016 के राजस्थान की हीटवेव जैसी अत्यधिक गर्मी अब पहले के मुकाबले 2 बार पड़ती है।'

Intensity statements

Statement 1: 'Climate change increased the intensity of the 2016 Rajasthan heat wave by approximately 10%.'
'जलवायु परविर्तन ने 2016 राजस्थान की गर्म हवाओं की तीव्रता को करीब 10% तक बढ़ा दिया।'
Statement 2: 'Climate change increased the severity of the 2016 Rajasthan heat wave by approximately 10%.'
'जलवायु परविर्तन ने 2016 के राजस्थान की गर्म हवाओं की भयंकरता को करीब 10% बढ़ा दिया।'
Statement 3: 'Climate change increased the strength of the 2016 Rajasthan heat wave by approximately 10%.'
'जलवायु परविर्तन की वजह से 2016 के राजस्थान की गर्म हवाओं की तेज़ी करीब 10% बढ़ गई।'
Statement 4: 'Climate change made the 2016 Rajasthan heat wave 10% worse.'
'जलवायु परविर्तन की वजह से 2016 की राजस्थान की गर्म हवाएं 10% ज़्यादा बदतर हुईं।'

Uncertainty statements

Statement 1: 'Climate change increased the chances of the 2016 Rajasthan heat wave by 40% (+/- 10%).'
'जलवायु परविर्तन ने 2016 में राजस्थान में गर्म हवाएं चलने की संभावना 40% (+/- 10%) तक बढ़ाया।'
Statement 2: 'Climate change increased the chances of the 2016 Rajasthan heat wave by 40% (30-50%).'
'जलवायु परविर्तन ने 2016 में राजस्थान में गर्म हवाएं चलने की संभावना 40% (30-50%) तक बढ़ा दिया।'
Statement 3: 'Climate change increased the chances of the 2016 Rajasthan heat wave by a range of 30-50%, best estimates are approximately 40%.'
'जलवायु परविर्तन ने 2016 में राजस्थान में गर्म हवाएं चलने की संभावना को 30 से 50 फीसदी यानी अंदाज़ के मुताबकि करीब 40% बढ़ा दिया।'
Statement 4: 'Scientists are fairly certain that climate change increased the chances of the 2016 Rajasthan heat wave by 40%.'
'वैज्ञानिकों को पूरा अनुमान है कि जलवायु परविर्तन की वजह से 2016 में राजस्थान में हीटवेव की संभावना 40% तक बढ़ गई।'

Single statement A

Statement A: 'Results were inconclusive and evidence for a link to climate change cannot be made at this time.'
'परिणाम अधूरे थे और जलवायु परविर्तन से इसका संबंध अभी नहीं जोड़ा जा सकता।'
Simpler statement A: 'Scientists were not able to conclude whether climate change affected this extreme weather event'.
'वैज्ञानिक नहीं पता लगा सके कि जलवायु परविर्तन की वजह से ये खराब मौसम आया या नहीं।'

Single statement B

Statement B: 'Climate change did not affect the chances of this extreme weather event'.
'जलवायु परविर्तन की वजह से इस खराब मौसम की संभावना नहीं बनी।'

Single statement C

Statement C: 'This extreme weather event was not as severe as expected, when compared to predicted regional climate change trends.'
'यह खराब मौसम उतना भयंकर नहीं था, जितनी क्षेत्रीय जलवायु परविर्तन के ट्रेंड के आधार पर भविष्यवाणी की गई थी।'
Simpler statement C: 'This extreme weather event was not as bad as we expected given how climate change is affecting this region.'
'यह खराब मौसम उतना भी खराब नहीं था, जितना इस क्षेत्र में जलवायु परविर्तन के मद्देनज़र हमें आशंका थी।'

Annex 3: Data tables

Table A1: Percentage who understood the first statement correctly.

	Kenya			India		
	High-level	Media	Public	High-level	Media	Public
Probabiitiy	88	78	74	79	100	94
Frequency	91	89	72	77	100	93
Intensity	91	56	70	83	100	88
Uncertainty	90	22	38	83	100	86
Single statement 1	86	57	31	77	100	68
Single statement 2	90	100	57	83	100	61
Single statement 3	84	57	57	65	50	41

Table B1: Percentage finding the first probability statement easy/hard/impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	63	44	74	72	77	85	100	93	97	85
Hard	37	56	18	19	17	15		6	1	15
Impossible			8	9	6			1	1	

Table B2: Percentage of participants who found each probability statement the easiest to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Statement 1	9	13	15	18	19	41	11	23	28	12
Statement 2	36	25	45	50	56	21	11	30	30	30
Statement 3	27	63	11	20	2	31	33	12	11	15
Statement 4	5	0	13	10	11	3	22	29	24	36
Statement 5	23	0	15	2	11	5	22	6	7	6

Table B3: Percentage finding the first frequency statement easy/hard/impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	70	67	72	71	74	83	100	93	92	94
Hard	30	22	21	27	13	17		6	6	6
Impossible		11	7	2	13			1	2	

Table B4: Percentage of participants who found each frequency statement the easiest to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Statement 1	9	29	15	14	24	23	50	17	20	12
Statement 2	17	14	36	50	33	26	0	43	46	35
Statement 3	0	0	0	0	0	6	0	17	18	12
Statement 4	9	0	28	22	27	32	50	20	14	32
Statement 5	65	57	21	14	15	13	0	4	2	9

Table B5: Percentage finding the first intensity statement easy/hard/impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	52	22	71	68	74	85	100	87	86	88
Hard	43	45	22	28	15	15		10	11	9
Impossible	5	33	7	4	11			3	3	3

Table B6: Percentage of participants who found each intensity statement the easiest to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Statement 1	10	13	16	15	24	37	50	22	25	18
Statement 2	57	50	16	26	12	40	50	25	21	32
Statement 3	0	13	13	6	9	3	0	27	30	21
Statement 4	33	25	54	53	55	20	0	27	24	29

Table B7: Percentage finding the first uncertainty statement easy/hard/impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	50	22	38	40	38	78	100	87	89	82
Hard	41	22	38	40	36	22		11	9	15
Impossible	9	56	24	20	27			2	3	3

Table B8: Percentage of participants who found each uncertainty statement the easiest to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Statement 1	19	0	4	4	11	10	0	19	20	18
Statement 2	10	14	19	33	32	24	0	29	27	32
Statement 3	33	43	16	29	21	41	50	37	38	32
Statement 4	38	43	61	59	29	24	50	14	12	15

Table B9: Percentage finding the single statement A (first statement) easy/hard/impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	64	29	31	38	24	70	80	65	68	59
Hard	23	71	57	52	62	28	20	32	30	35
Impossible	14		12	10	13	2		3	2	6

Table B10: Percentage who found single statement A (simpler statement) easier to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easier	48	71	82	82	82	73	90	41	41	41
Same	10	14	11	16	7	11	10	30	26	32
Harder	43	14	7	2	11	16		28	33	24

Table B11: Percentage finding the single statement B easy/hard/impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	65	43	58	59	51	88	100	59	65	47
Hard	30	57	33	33	34	12		24	18	35
Impossible	5		9	9	9			17	17	18

Table B12: Percentage finding single statement C easy/hard/impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	58	43	55	58	52	73	80	39	38	41
Hard	42	43	37	35	37	27	10	35	30	44
Impossible		4	8	6	9		10	25	30	15

Table B13: Percentage who found the second (simpler) statement for single statement C easier to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easier	53	57	90	93	88	73	80	48	50	44
Same	21	14		0	0	22		39	14	12
Harder	26	29	10	7	21	5	20	13	36	44

Table B14: Percentage finding visual 1 easy/hard/impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	59	22	98	98	98	90	100	73	75	68
Hard	32	67	1	2	0	10		26	24	29
Impossible	9	11	1	0	2			1	1	3

Table B15: Percentage finding visual 2 easy/hard/ impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	52	11	100	100	100	79	80	79	83	71
Hard	43	78				18	20	20	17	26
Impossible	4	11				3		1		3

Table B16: Percentage finding visual 3 easy/hard/ impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	65	22	83	85	80	74	60	84	91	73
Hard	30	78	17	15	10	26	40	14	9	24
Impossible	5							1		3

Table B17: Percentage finding the visual 4 easy/hard/ impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	48	22	76	81	71	63	80	42	42	41
Hard	48	78	24	19	29	29	20	49	50	47
Impossible	4		0			8		9	8	12

Table B18: Percentage finding visual 5 easy/hard/ impossible to understand.

	Kenya					India				
	High-level	Media	Public	Public Male	Public Female	High-level	Media	Public	Public Male	Public Female
Easy	32	22	70	71	69	45	80	47	47	47
Hard	68	78	28	29	27	42	20	46	49	41
Impossible			2		4	13		7	5	12

Annex 4: Paired statements

This table provides a guide on the most commonly understood and preferred phrases for each stakeholder group, for different scientific information on extreme event attribution. It must be remembered that there was a range of responses, understanding, and preference for phrases, terms and statistical information from within each stakeholder group. Therefore, this guidance should be used with caution.

Scientific statement: Probability		Anthropogenically-induced climate change resulted in an increase in the probability of event X by a factor of X.
Kenya	High-level decision makers	Climate change increased the probability of the current drought by 40%.
		OR
		Climate change increased the chances of the current drought by 40%.
	Media	Climate change increased the chances of the current drought by 40%.
	Public	*Use frequency information instead of probability information.*
India	High-level decision makers	Climate change increased the probability of the 2016 Rajasthan heatwave by 40%.
	Media	Climate change increased the chances of the 2016 Rajasthan heatwave by 40%.
	Public	Climate change increased the chances of the 2016 Rajasthan heatwave by 40%.

Scientific statement: Frequency		Human-induced climate change increased the risk of the event to be exceeded in the location from a X in X year event to a X in X year event.
Kenya	High-level decision makers	Climate change has increased the return time of droughts, like the current Kenya drought, from a 1 in 20-30 year event to a 1 in 7-10 year event.
		OR
		Droughts, like the current Kenya drought, now occur twice as often due to climate change.
	Media	Droughts, like the current Kenya drought, now occur twice as often due to climate change.
	Public	Droughts, like the current Kenya drought, now occur more often due to climate change.
India	High-level decision makers	Climate change has increased the return time of extreme heat events, like the 2016 Rajasthan heat wave, from a 1 in 20-30 year event to a 1 in 7-10 year event.
		OR
		Climate change has increased the frequency of extreme heat events, like the Rajasthan heatwave, so that events that used to happen about twice in a lifetime now occur about 4 times in a lifetime.
		OR
		Climate change has doubled the frequency of extreme heat waves, like the 2016 Rajasthan heat wave.
	Media	Climate change has increased the return time of extreme heat events, like the 2016 Rajasthan heat wave, from a 1 in 20-30 year event to a 1 in 7-10 year event.
		OR
		Climate change has doubled the frequency of extreme heat waves, like the 2016 Rajasthan heat wave.
	Puplic	Climate change has increased the frequency of extreme heat events, like the Rajasthan heatwave, so that events that used to happen about twice in a lifetime now occur about 4 times in a lifetime.
		OR
		Use probability information instead of frequency information.

Scientific statement: Intensity		Anthropogenically-induced climate change resulted in an increase in intensity of event X by a factor of X.
Kenya	High-level decision makers	Climate change increased the severity of the current Kenya drought by approximately 20%.
	Media	Climate change increased the severity of the current Kenya drought by approximately 20%.
	Public	Climate change made the current Kenya drought worse.
India	High-level decision makers	Climate change increased the intensity of the 2016 Rajasthan heat wave by approximately 10%.
		OR
		Climate change increased the severity of the 2016 Rajasthan heat wave by approximately 10%.
	Media	Climate change increased the intensity of the 2016 Rajasthan heat wave by approximately 10%.
		OR
		Climate change increased the severity of the 2016 Rajasthan heat wave by approximately 10%.
	Public	Climate change increased the strength of the 2016 Rajasthan heat wave by approximately 10%.
		OR
		Climate change made the 2016 Rajasthan heat wave 10% worse.

Scientific statement: Uncertainty		Anthropogenically-induced climate change increased the probability of extreme event X by X (+/-X%).
Kenya	High-level decision makers	*Provide uncertainty information as a follow up.*
	Media	*Provide uncertainty information as a follow up.*
	Public	*Do not provide uncertainty information.*
India	High-level decision makers	Climate change increased the chances of the current Kenya drought by a range of 30-50%, best estimates are approximately 40%.
	Media	*Provide uncertainty information as a follow up.*
	Public	*Provide uncertainty information as a follow up.*

Scientific statement: A		Results were inconclusive and no attribution statement can be made at this time.
Kenya	High-level decision makers	Results were inconclusive and evidence for a link to climate change cannot be made at this time.
		OR
		Scientists were not able to conclude whether climate change affected this extreme weather event.
	Media	Scientists were not able to conclude whether climate change affected this extreme weather event.
	Public	Scientists were not able to conclude whether climate change affected this extreme weather event.
India	High-level decision makers	Scientists were not able to conclude whether climate change affected this extreme weather event.
	Media	Scientists were not able to conclude whether climate change affected this extreme weather event.
	Public	Scientists were not able to conclude whether climate change affected this extreme weather event.

Scientific statement: B		Comparing the ensemble models, we find a nonsignificant change in the likelihood of extreme event X with a return time of X years due to anthropogenic emissions.
Kenya	High-level decision makers	Climate change did not affect the chances of this extreme weather event.
	Media	Climate change did not affect the chances of this extreme weather event.
	Public	Climate change did not affect the chances of this extreme weather event.
India	High-level decision makers	Climate change did not affect the chances of this extreme weather event.
	Media	Climate change did not affect the chances of this extreme weather event.
	Public	Climate change did not affect the chances of this extreme weather event.

Scientific statement: C		This extreme weather event was not as severe as expected, when compared to predicted regional climate change trends.
Kenya	High-level decision makers	This extreme weather event was not as bad as we expected given how climate change is affecting this region.
	Media	This extreme weather event was not as bad as we expected given how climate change is affecting this region.
	Public	This extreme weather event was not as bad as we expected given how climate change is affecting this region.
India	High-level decision makers	This extreme weather event was not as bad as we expected given how climate change is affecting this region.
	Media	This extreme weather event was not as bad as we expected given how climate change is affecting this region.
	Public	This extreme weather event was not as bad as we expected given how climate change is affecting this region.

This publication is an output from the Raising Risk Awareness project. The project is funded by the UK Department for International Development (DFID) through the Climate and Development Knowledge Network (CDKN), and by Eric and Wendy Schmidt through Climate Central, Inc. CDKN is a programme funded by DFID and the Netherlands Directorate-General for International Cooperation (DGIS) for the benefit of developing countries. *This publication has been prepared for general guidance on matters of interest only, and does not constitute professional advice. You should not act upon the information contained in this publication without obtaining specific professional advice. The views expressed and information contained in this publication are not necessarily those of, or endorsed by DFID, DGIS, Eric and Wendy Schmidt, Climate Central, Inc.; or the entities managing the delivery of CDKN; or the entities implementing this project, which can accept no responsibility or liability for such views, completeness or accuracy of the information or for any reliance placed on them. No representation or warranty (express or implied) is given as to the accuracy or completeness of the information contained in this publication, and, to the extent permitted by law, DFID, DGIS, Eric and Wendy Schmidt, Climate Central, Inc.; or the entities managing the delivery of CDKN; or the entities implementing this project do not accept or assume any liability, responsibility or duty of care for any consequences of you or anyone else acting, or refraining to act, in reliance on the information contained in this publication or for any decision based on it.*

Copyright 2017, All rights reserved

Photographer: Knud Falk/ Climate Centre