Deliverable 5.3: Analysis of how climate information and knowledge can help organisations prepare for the physical risks of a changing climate

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*** R**=Document, report; **DEM**=Demonstrator, pilot, prototype; **DEC**=website, patent filings, videos, etc.; **OTHER**=other

**** PU**=Public, **CO**=Confidential, only for members of the consortium (including the Commission Services), **CI**=Classified

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Executive Summary

The physical risks from a changing climate pose a threat to many societal, economic and environmental systems. The management of these risks are informed by scientific knowledge, such as climate science. However, our Rapid assessment of climate information user needs (D5.1) showed: a widespread pattern of limited use of climate information across various sectors; the existence of barriers hindering the effective utilisation of climate information; and user requirements emphasising the need for tailored information and data. The analysis presented in this deliverable expands the information in this rapid assessment, by assessing more in depth the actual use of weather and climate information by users as well as their willingness to use this information. The objective of Work Package 5 is to increase the usability of seasonal to decadal climate information for adaptation using social science methods. Task 5.3 contributes to this aim by improving our understanding of how climate information and knowledge can help organisations prepare for the physical risks of a changing climate. The information gathered in this deliverable aims to inform the climate outputs in ASPECT, particularly the developments in WPs 1-3, and that it provides some insights to be considered in the next interactions with the projects' community of interest, e.g. in the upcoming User Forums, and the recruitment of additional superusers to WP4. This work contributes to ASPECT's objective 5) Exploring for the first time how users can get value from considering information on seasonal / 1–5-year / 5–30-year time-scales together to improve decision making and 6) Designing and implementing a delivery system for the data and methods produced by ASPECT, enabling the scaling up of the use of climate risk information on the 1–30-year time-scale from beyond pilot studies to become a mainstream tool in adaptation.

The work of Task 5.3 explores how climate-sensitive organisations in Europe are affected by weather and climate, as well as the extent to which they are aware of and actively managing climate risk and utilising different types of climate information within their organisational decision-making processes. A large-scale survey was designed to ask the following questions to participants working in roles linked to risk analysis and management within businesses and organisations in Europe (n=1864):

1) How does concern about climate and weather risk compare with concern about other types of organisational risks?
2) How does weather and climate affect organisations in Europe?
3) What are the main drivers of climate risk management in organisations?
4) To what extent do organisations currently use weather and/or climate information?
5) What are unmet needs for climate information?

Our results reveal high concerns regarding physical climate risks, alongside broader concerns about other organisational risks, with higher concern exhibited by organisations with longer planning horizons than those which have only short planning horizons. The effect on organisations of climatic impact drivers, which represent physical climate system conditions (e.g., means, events, extremes) are explored, with impacts related to temperature and rainfall most commonly affecting organisations. When asked about the nature of the most significant weather of climate event to affect their organisation in the last three years, participants most

frequently selected extreme heat events, followed by heavy rainfall events, warmer climate over time, heavy snow and ice storms and air-pollution inducing weather. Whilst these different events affected organisations in different ways (e.g. heavy snowfall impacting logistics), effects on people' was the most frequent impact selected. This is aligned with risks to human safety and experience of past events being identified as the strongest drivers of climate risk management and climate information use for most organisations surveyed. With respect to current usage of climate information, the results showed that weather forecasts were most commonly used, followed by observations, sub-seasonal and seasonal forecasts respectively, with a smaller percentage of participants reporting using longer term climate information. However, a majority of respondents indicated that their organisation's longest planning horizon for important decisions was between 1-5 years, revealing alignment with interannual and decadal prediction timescales. While current users reported generally high satisfaction with the information they currently received, a desire for easier to understand and more accurate/reliable information was expressed. This resonated with the barriers to use climate information identified by non-users, for whom 'lack of expertise' and concerns about accuracy and reliability were commonly identified barriers to using climate information. While climate information is currently received in a manner of different formats (e.g. raw data, text, verbal reports, graphics, etc.), a common preference for visual representations was expressed by potential users.

About ASPECT

ASPECT aims to set up and demonstrate a seamless climate information (SCI) system with a time horizon up to 30 years and accompanied with underlying research and using climate information for sectoral applications. The project's goal is to improve existing climate prediction systems and to merge their outputs across timescales together with climate projections to unify a SCI as a standard for sectoral decision-making.

The project focus will be on European climate information, but we will also look where there is a wider policy interest (e.g., disaster preparedness) and in regions of European interest. We will maintain a strong link with the WCRP lighthouse activities to exploit learning for explaining and predicting earth system change. To provide a bandwidth diversity of information, the SCI system will be based on multi-model climate forecasts and will build on learning from projects such as EUCP. It will align with new activities on Digital Twins within Europe, including DestinE. The SCI will combine physical science aspects with those from other disciplines to ensure the information is robust, reliable, and relevant for a range of user-driven decision cases. The information package will incorporate baseline forecasts and projections (plus uncertainty), and will explore new frontiers (e.g., extremes which are of socioeconomic high-level interest).

To ensure success, the research will encompass: an understanding and attribution of various processes along timescales (such as exploring signal-to-noise ratio) and their impact on predictability, new ways of initialisation of the prediction systems, merging predictions with projections, provision of regional SCI for Europe by downscaling (statistical methods, AI) and HighRes models (including convection-permitting models) and innovative post-processing method enhancing the skill and robustness of the climate forecasts.

1 Introduction

This work aims to improve understanding of how climate-sensitive organisations in Europe are affected by weather and climate, as well as the extent to which they are using – and would like to use – climate information within organisation decision making processes. A large-scale survey was conducted of respondents in European organisations, to answer the following key questions:

1. How does concern about climate and weather risk compare with concern about other types of organisational risks?
2. How does weather and climate affect organisations in Europe?
3. What are the main drivers of climate risk management in organisations?
4. To what extent do organisations currently use weather and/or climate information?
5. What are unmet needs for climate information?
    a. How do users think that current provision can be improved?
    b. What information would non-users like to receive that they do not currently?
    c. What are the barriers to using weather and climate information?

2 Method

2.1 Approach

This task used a predominantly close-ended survey to gather broad and generalisable insights into the climate sensitivity and information usage of European organisations. This design allows responses to questions to be numerically coded as categorical, ordinal or scale variables. The goal of a quantitative survey approach is to allow generalisable inferences and conclusions about the relationships between variables to be drawn, rather than to gather detailed insights into the processes occurring in a specific case. Hence, it should be considered complementary to qualitative approaches like interviews and case studies, such as those conducted with Super Users in ASPECT Work Package 4, which function to provide in-depth insights into decision making processes and challenges of particular organisations.

2.2 Participant recruitment

Between October 2023 and January 2024, a survey targeting individuals working in climate sensitive organisations across a broad range of European countries was conducted, with responsibilities related to risk analysis or management. Participants were principally recruited both through the market research company Qualtrics (n=1773), with additional respondents being recruited through ASPECT colleagues' professional networks (e.g. organisations already in contact with National Meteorological Services) (n=91). To ensure the collection of relevant data from those with established sectoral experience, potential participants were screened-out if they indicated that their organisation was not climate sensitive, that they held junior roles (i.e. intern, apprentice, assistant) or had worked in the sector for less than one-

year. Most respondents were owners or held managerial or director positions (60%), over a quarter were in analytical roles (29%), and relatively few were in planning or policy roles (6%). Most of them had between 1 to 10 years of experience (62%), while over a third had more than 10 years of experience (38%). For a full list of written responses and their frequencies, see Appendix 2.1.

2.3 Survey Design

The survey was designed using the survey platform Qualtrics, with the survey provided in English, French, German, Spanish, Portuguese, Italian, Serbian and Swedish. Duplicate copies of the survey were created for the sample recruited through Qualtrics and the sample recruited through professional networks, with datafiles being merged post-data collection and marked as coming from Qualtrics or ASPECT networks. After being presented with an introductory screen outlining the aims of the survey and indicating that they wanted to proceed, potential participants completed a set of screening questions.

After passing the screening questions, participants were asked about their organisation's structure, their concerns about different types of risk, their plans or actions on climate risk management (if any), their level of sensitivity to different climatic impact drivers and usage of climate information. Depending on current usage of climate and weather information services the survey branched to explore both how climate services are used by current users and potential interest and barriers to use amongst non-users. The structure of the survey (Figure 1) is summarised below. Full details of all questions and response options can be found in Appendix 1.

2.3.1 Organisational structure

Participants were asked about their organisations size, sector(s) and geographic scope of operations, as well as their organisation's timescales for making important decisions (e.g. less than one month, 1-6 months, 6-12 months, 1-2 years…etc.). Note that this question asked "how far into the future does your organisation tend to plan at most" and therefore it should be considered that respondents may also frequently make decisions on shorter timescales. Respondents were also asked whether their organisation currently followed any climate related standards, policies, regulations or guidelines, and if they had a role in organisational decision making (which categorised them either as a 'decision maker' or not).

2.3.2 Organisational risks

Those who indicated that they were involved in organisational decision making were asked to indicate the extent to which their organisation was concerned with a series of seven areas of risk (climate impacts, government policy to reduce greenhouse gas emissions, economic, environmental, social, geopolitical, technological) on 4-point scales (1 = not concerned at all to 4 = very concerned, with a not applicable option).

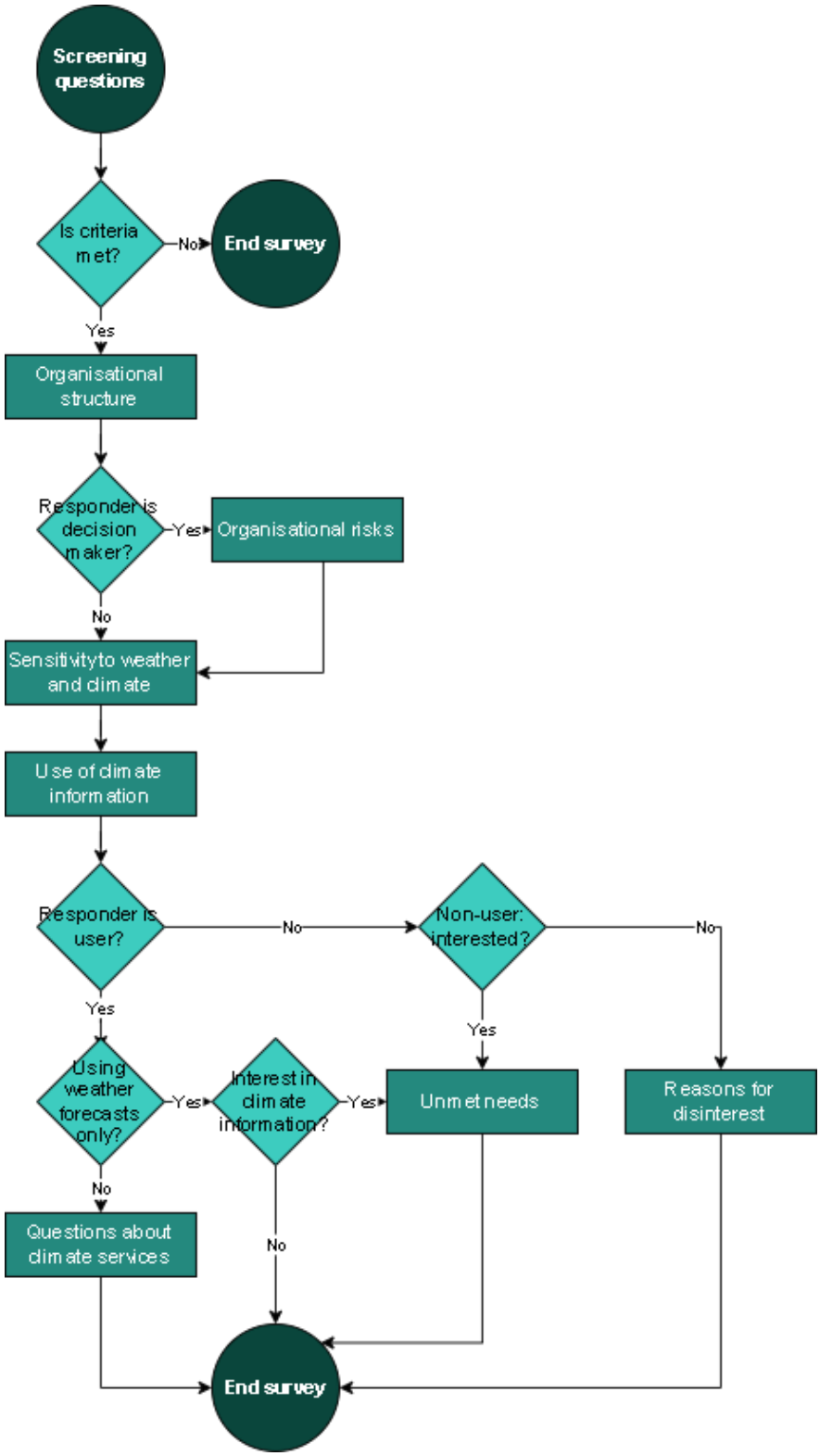


Figure 1: Diagram illustrating survey follow and branching

2.3.3 Sensitivity to climate and weather

Participants were first presented with six broad categories of Climatic Impact Drivers (CIDs, including temperature, rainfall, snow & ice, wind, coastal change, ocean change, from Ruane et al, 2022) and were asked to select all that affected their organisation. For each category selected, participants were then shown sets of specific types of events, impacts and impact driver and asked about the extent to which each of these affected their organisation on a scale of: 1 = completely negative, 2 = more negative than positive, 3 = neither positive nor negative, 4 = more positive than negative, 5 = completely positive, with a not applicable response available (see Table 1 for details). For example, participants who indicated that their organisation was affected by temperature were asked to rate how they were affected by extreme heat events, cold spells, frost, wildfires, warmer climate over time and cooler climate over time).

This approach was taken to reduce the number of irrelevant items participants might see. However, an additional list of CIDs that did not neatly fit in any of the six main climate impact driver categories were presented separately to all participants (lightening, fog, air pollution-inducing weather and radiation at surface).

The response options were given on a positive to negative scale to account for the fact that these events may be positive for some organisations and negative for others, as well as recognising that they may have elements that are both positive and negative (e.g. severe weather events such as heatwaves or heavy rainfall leading to more sales of certain products while disrupting logistics). After rating the extent to which the CIDs affected their organisation, participants were asked to select the one that was the most significant to their organisation in the last three years, and asked to indicate the ways in which this had affected their organisation (i.e. logistics, premises, people, processes, finance, insurance, with an open ended option to list any other areas of impact) and how they dealt with it (e.g. following a pre-defined plan).

2.3.4 Climate risk management

Participants were asked whether their organisation was actively trying to manage weather and climate risks. Those who answered positively were asked to indicate the drivers (e.g. experience of past events, organisational risk assessment, infrastructural durability, etc.) from a list of 15 items, with the possibility to list others in an open-ended response.

Table 1: List of specific climatic impacts drivers in each CID category.

Climatic impact driver category	Specific climatic impact drivers
Hot and/or cold temperatures	• Extreme heat events • Cold spells • Frost • Wildfires • Warmer climate over time • Colder climate over time
Wet and/or dry conditions	• Droughts • Heavy rainfall events • Surface water (torrential, flash) floods • Landslides due to heavy rainfall • Wetter climate over time • Drier climate over time
Wind	• Severe wind storms • Tropical cyclones • Sand and dust storms • Windier climate over time • Less windy climate over time
Snow and ice	• Heavy snowfall and ice storms • Hail • Ice sheet melt, lake melt, river ice melt • Snow avalanches • Freeze-thaw cycles
Coastal change	• Coastal floods • Coastal erosion • Sea-level rise
Ocean change	• Marine heat waves • Marine cold waves • Warmer oceans over time • Colder oceans over time • Changes in Ocean Chemistry
Miscellaneous (shown to all participants as they did not fall into other defined categories)	• Fog • Lightning • Air pollution-inducing weather • Radiation at surface

2.3.5 Usage of climate information

Participants were asked to indicate whether they were using climate information in their role, and if not, whether they could see themselves using it in the future.

Those who indicated that they were using climate and weather information were asked to select which types of climate-related information their organisation received (i.e. weather forecasts, observations, reanalysis, sub-seasonal, seasonal, interannual and climate projections). As some types of information may not be familiar to participants a short description of each was provided next to each answer (see Appendix 1).

The survey branched depending on current use:

- Those who indicated that they used a form of climate information other than/in addition to weather forecasts were branched to the questions set out in subsection 2.3.6.
- Those who indicated that they used weather forecasts only were branched to the questions set out in subsection 2.3.7.
- Those who indicated that they did not currently use climate or weather information, but might be interested in doing so in the future were branched to the questions in subsection 2.3.8.
- Those who indicated that they did not receive weather and climate information and were not interested were branched to the questions in subsection 2.3.9.

2.3.6 For current climate information users

For each type of information that they received current users were asked to indicate:

- How they received this information (raw data, orally, written text, visually, other)
- How often it was used (daily, weekly, monthly, every six months, annually, less than once a year, never)
- How it was used (e.g. informs risk management, informs day to day activities, informs strategic planning, etc.)
- The source of the information (e.g. National Meteorological Service, Intergovernmental Panel for Climate Change (mostly documents), Copernicus Climate Change Service, private provider, etc.)

For those CIDs that participants identified as affecting their organisation, they were asked to indicate which ones that they currently received climate and weather information for, with an optional open-ended question asking them if they were able to provide further details on specific products used.

To assess participants' perceptions of current provision they were asked to indicate their agreement using a series of descriptors about the climate information they received (e.g. affordable, easy to use, trustworthy) on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). They then selected from a multiple-choice list the ways in which they thought that provision might be improved (e.g. cheaper, easier to access, easier to understand, more accurate/reliable…etc.).

Questions were also asked about whether they paid for weather or climate information, how confident they felt in using the information (1 = not confident at all, 4 = very confident), and to indicate what was driving the use of climate and weather information in their organisations (e.g. experience of weather/climate impacts or trends, organisational risk assessment/management, risk to safety, climate standards, climate regulation…etc.).

2.3.7 For those using weather-forecasts only

Those who indicated that they used weather forecasts (up to 10-days in the future) only were asked if they would potentially be interested in receiving climate information at longer timescales. Those who answered yes were presented with the questions specified in 2.3.8. The survey finished for those who responded no or don't know.

2.3.8 For those who were not currently using climate information but were interested

Those who indicated that they were not currently using climate information, or were only using weather information, but that they were interested in doing so were asked what type of information they would be potentially interested in receiving (i.e. observations, reanalysis, sub-seasonal, seasonal, interannual, climate projections), as well as those events, impacts and/or trends they would like to receive climate information about, and how they would like to receive the information (i.e. raw data, written text, verbally, visually, or in another format). They were also asked to indicate the extent to which they agreed (1 = strongly disagree, 5 = strongly agree) to 12 statements about barriers to using climate information (e.g. too expensive, lack of knowledge, too difficult to understand…etc.).

2.3.9 For those not currently using weather or climate information who were not interested

Those who indicated they were not potentially interested in using weather or climate information were asked to indicate why, by selecting from a list of 12 reasons (e.g. not relevant to role in organisation, lack of familiarity with the topic of climate, difficult to understand…etc.), with an option to provide additional open-ended responses.

2.4 Data quality, screening and other considerations

Qualtrics removed responses that did not meet quality criteria (e.g. response time too fast to be credible, response where the same scale point was always selected, 'nonsense responses' entered into open ended question), with additional review of open-ended responses by the project team for coherence. Of a total of n=2818 responses gathered by Qualtrics n=1045 were either screened out due to insufficient experience or removed due to poor data quality. Nonetheless, as with any large-scale online data collection responses cannot be supervised directly. There could be inaccurate responses due to response error (i.e. selecting the wrong option by accident or misunderstanding a question), inattention or intentional malicious efforts to introduce bias. Given the large sample size however such responses are likely to add 'noise' (i.e. error) to the data but not bias the findings in a particular direction.

Additionally, it must be kept in mind that while the sampling is purposive and designed to reflect a broad range of organisations across a broad range of countries so that generalisable inferences can be made, participants were part of a group accessible to market research agencies and were willing to complete a survey on climate risk management. Likewise, in integrating and analysing the data from the self-recruited participants, it is acknowledged that this sample represents a group of respondents who are already engaged with climate services and thus their current use and approach may not mirror that of the broader population of European organisations. In interpreting the findings of the survey, it is thus acknowledged that 'least engaged' organisations may be under-represented. However, this issue is an inherent limitation of survey-based research, and difficult to avoid completely.

In analysing current and potential future usage of different types of climate information, it is noted that – despite short explanations being provided - many participants may not have distinguished between interannual/decadal predictions and climate projections, as interannual/decadal predictions are not yet widely available and used outside the research community. Hence, where logical to do so, these have been grouped.

2.5 Data Analysis

For each question analysed below, we calculated the percentage of respondents for each choice option. For some questions, we further explored the differences across various categories of organizations based on their primary locations, number of employees, sectors of activity, and longest planning horizons. The results of this type of analysis are also referred to as conditional distributions, in which the number of respondents (or responses) for each option is calculated at the category level and then divided by the total number of respondents (or responses) within the specific category of organizations.

For questions that allowed multiple answers, either the number of respondents or the number of responses is used for calculation, depending on the purpose of the analysis. In the corresponding figures, the title of the y-axis or x-axis indicates the exact type of observations used for calculation. Note that when the number of respondents is used for calculation, the cumulative percentage of options can exceed 100%. Conversely, when the number of responses is used, the cumulative percentage of options will sum to 100%.

As most of the variables captured in the survey are ordinal or categorical in nature, non-parametric tests and ordered regression approaches that have been used to assess effects are statistically significant. Specifically, Wilcoxon rank-sum tests (i.e., Mann-Whitney U tests) were used to assess statistical differences between different categories of organization as a robustness check. Ordered Logit (OL) regression models, meanwhile, were used to examine associations between items, in particular to assess the contribution of multiple independent variables to the prediction of specific dependent variables. We used the OL model instead of other choice models or linear regression models as the dependent variables in question are ordinal and cannot be treated as continuous.

3 Sample composition

3.1 Primary location of organisations in Europe

Respondents' organisations span a diverse range of European countries[1]. These countries are grouped so that each corresponds to one of the four regions defined for this survey: north, east, south, and west[2] (Figure 2). With the exception of Denmark and Portugal, there was ***strong representation from countries with larger populations and economies*** such as Spain, Italy, UK, France, and Germany. The most represented country was Denmark, which may suggest a higher awareness of climate sensitivities or that the sampling company found it easier to recruit respondents there.

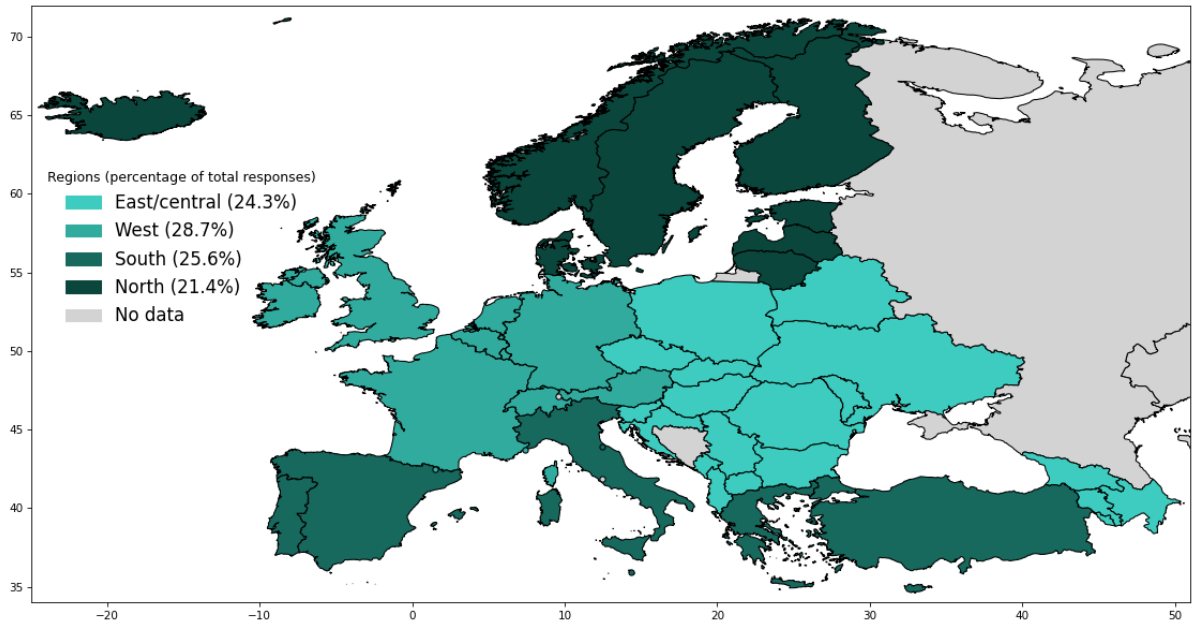


Figure 2: ASPECT regions of respondents' organisations in Europe.

3.2 Scale of organisations' operations

Respondents most commonly represent organisations that operate at the national level (42%). Nearly a third (31%) operate internationally, either within other European countries or globally. Local and sub-national organisations account for a similar share (28%). For organisations operating globally (n=257, 13.8% of the total sample), respondents were asked to indicate which continents their organisations operate in, with the option to select multiple continents. The most common regions of operation were North America (69%) and Asia (65%).

[1] For a country to be considered European, it must fall at least partially under any common geographical or political definitions of Europe.

[2] The definition of these four regions follows EuroVoc regional categorisation (https://en.wikipedia.org/wiki/EuroVoc).

The majority of respondents' organisations are medium to large, with 68% having more than 50 employees. Smaller organisations (10-49 employees) account for 22%, while those with fewer than 10 employees make up 11%.

3.3 Organisations' sector(s) of activity

A large ***majority of respondents represent private sector organisations*** (77%), particularly those operating at national or multinational levels (Figure 3). Additionally, 19% represent public or semi-public organisations.

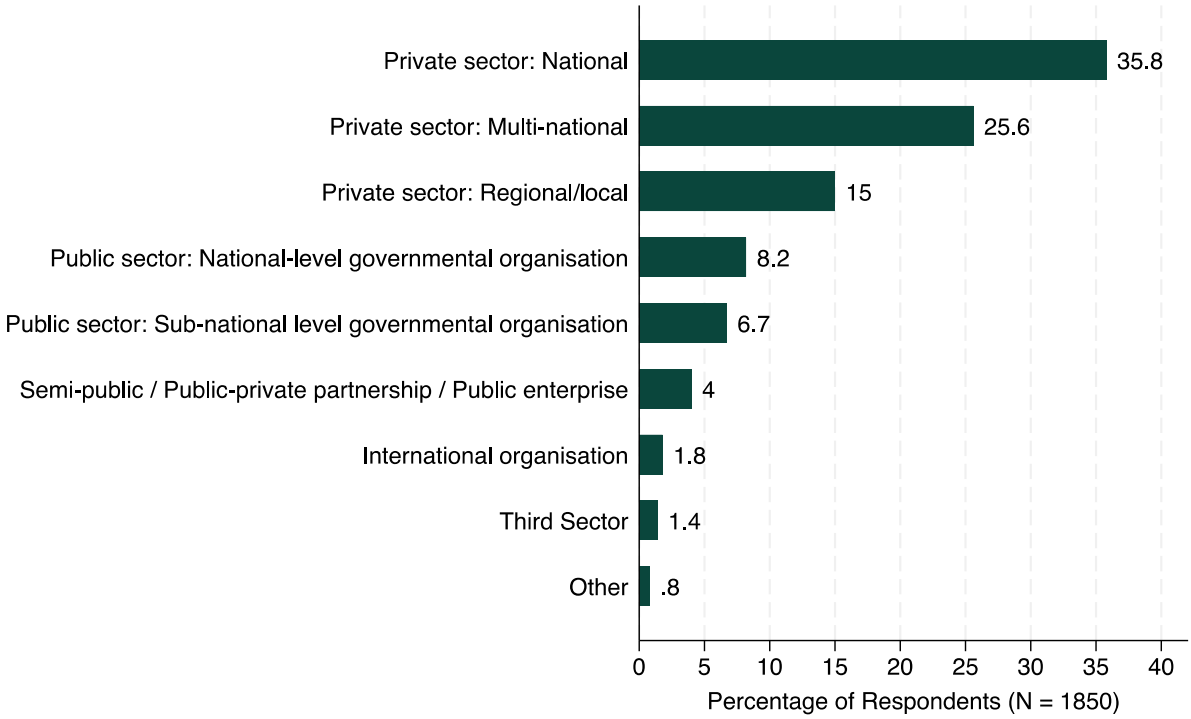


Figure 3: Classification of respondents' organisations.

Respondents' organisations represent a wide range of sectors, with multiple selection allowed. The most represented sector is ***manufacturing*** (18%) (Figure 4). Other well-represented sectors include ***construction*** (12%), ***transportation and storage*** (12%), ***information and communication*** (11%), and ***water and waste management*** (11%).

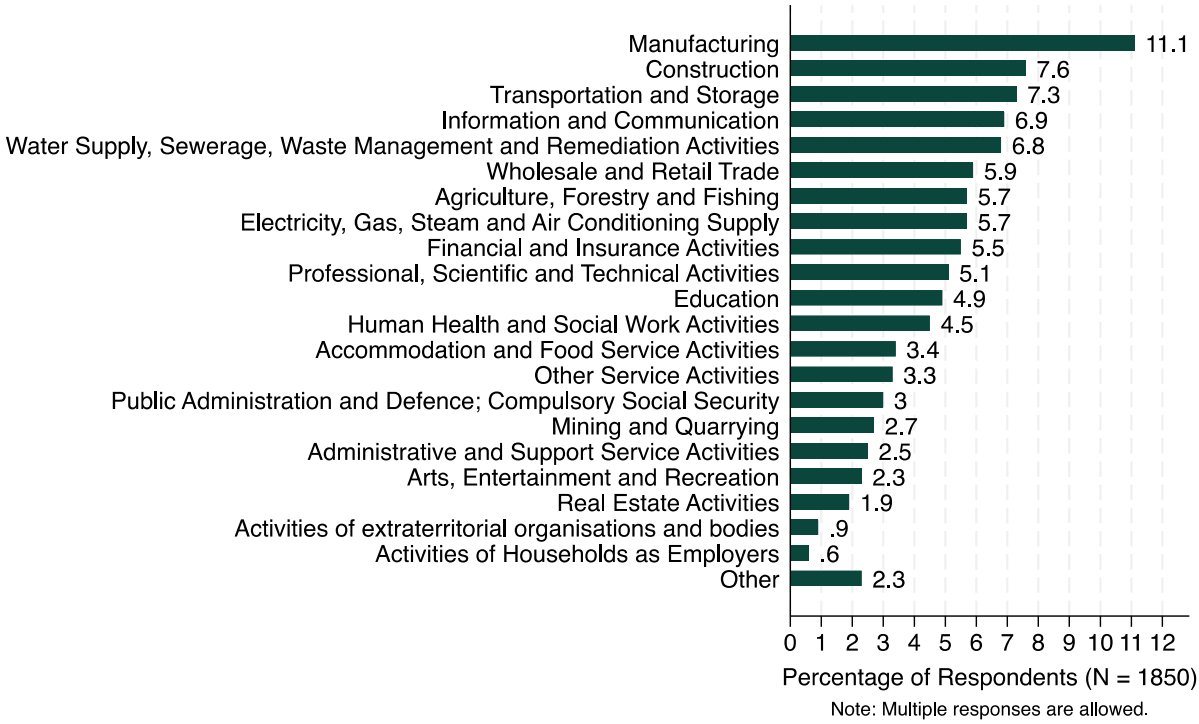


Figure 4: Respondents' organisations' main sectors of activity

3.4 Organisations' longest planning horizons for important decisions

For respondents who indicated that they were involved in organisational planning and/or decision making (n=1644), their longest planning horizons for important decisions, such as choosing locations or making major investments is explored. ***Most respondents indicated their longest organisational planning horizons between 6 months and 10 years (75%)***, with the most common range, reported by 20%, being between 2 and 5 years (Figure 5).

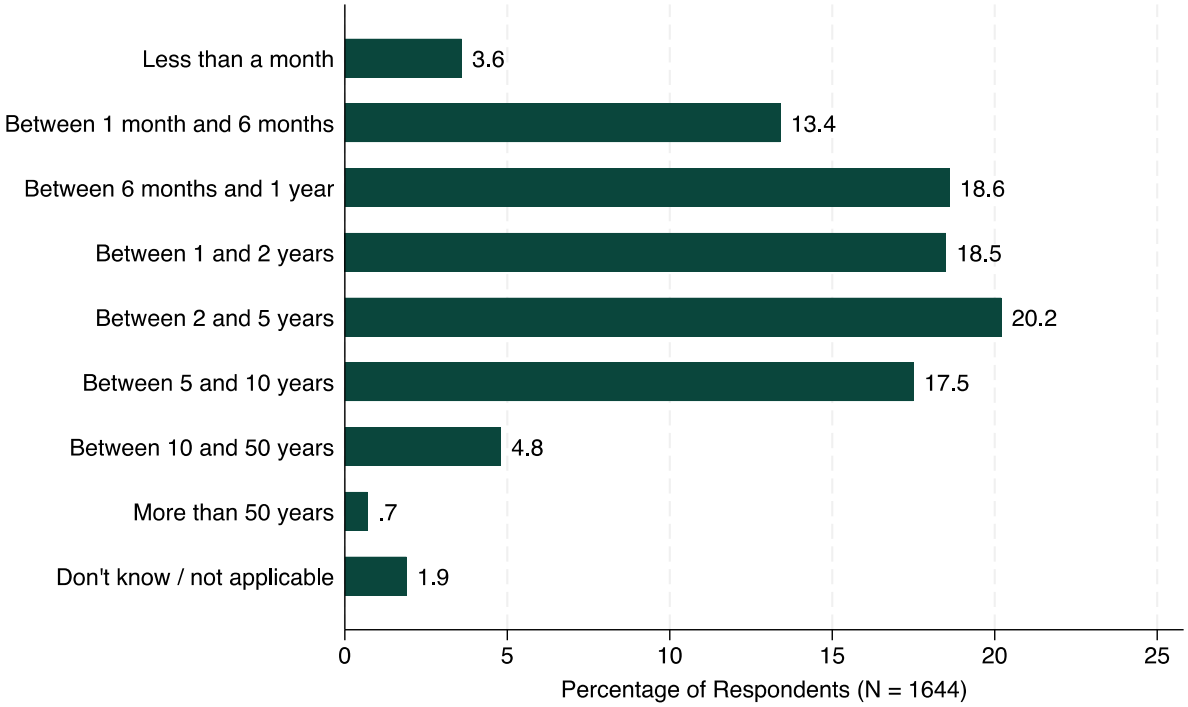


Figure 5: Longest organisational planning horizons for important decisions

4 Climate Risk Concerns and Climatic Impact Drivers (CIDs)

4.1 How do concerns about climate and weather risk compare with concerns about other types of organisational risks?

4.1.1 Overall

Respondents were asked to what extent their organisation is concerned about a range of risks on a scale of 1 to 4, where 1 represents “Not concerned at all” and 4 represents “Very concerned.” ***The majority of respondents' organisations (>75%) are either "fairly concerned" or "very concerned" across all risk categories*** (Figure 6). Organisations are most concerned about economic and climate risks, with 47% and 46% of respondents, respectively, being "very concerned." Social and environmental risks also rank high, with 40% and 45% of respondents expressing significant concern, respectively. These four types of risk received the highest proportion of 3 and 4 ratings, with more than 80% of respondents reporting a fair or high degree of concern. Conversely, the least concern is shown towards technological risks, risks associated with government policies to reduce greenhouse gas emissions, and geopolitical risks, with less than 40% of respondents being "very concerned" about each.

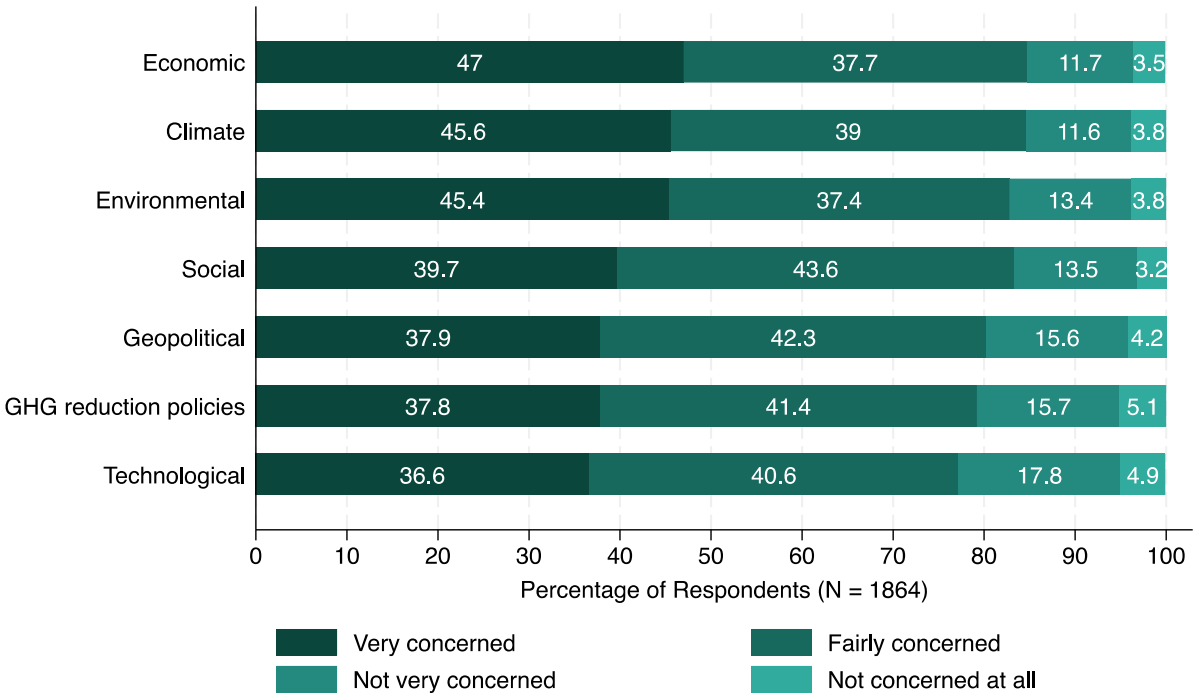


Figure 6: Relative concern for organisational risks

4.1.2 Climate risk concerns across organisation, region, size, sector and longest planning horizons

Respondents' concern about climate risk seems to be independent of the region and size of the organisations (i.e., number of employees), since respondents from organisations of all regions and sizes reported similar levels of concern. Furthermore, organisations of all regions and sizes report high sensitivity to climate risk, with a majority of respondents reporting fair to high concern regarding such risks.

Figure 7 breaks down the concern about climate risk by sectors. The private sector overall reports higher concern on climate risks than public and other sectors (i.e., Semi-public / Public-private partnership / Public enterprise, Third Sector, International organisation, and Other answers provided by respondents). However, when considering the detailed categories, public sector sub-national level governmental organisations (e.g., local government, local authority, municipality) and third sector (e.g., NGOs) report the highest concern to climate risks with a majority of their respondents selecting the ratings of 'Fairly concerned' or 'Very concerned', and the median respondent selecting 'Very concerned (Figure 7).

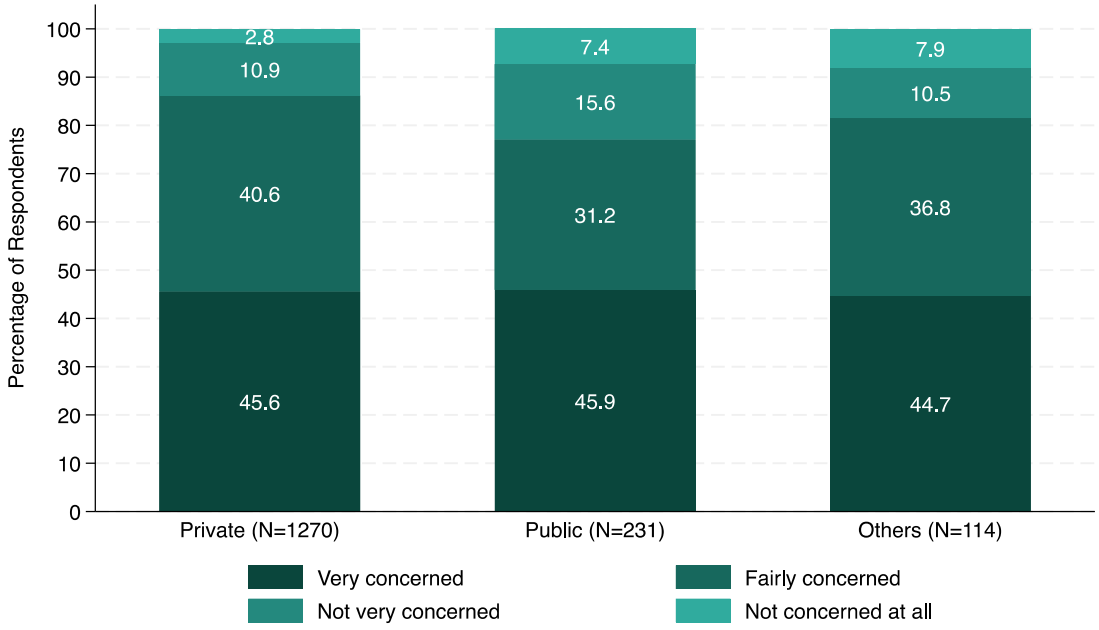


Figure 7: Concerns about climate risk by type of organisation

Figure 8 shows the respondents' concerns about climate risk over their planning horizons for important decisions. Organisations with longer planning horizons (more than 2 years) show significantly[3] more concerns about climate risk than organisations with shorter planning horizons. Respondents who don't have clear planning horizons or who think their organisations don't have applicable planning horizons also show high concerns.

[3] The difference between organizations whose longest planning horizons between1 and 2 years and those whose longest planning horizons between 2 and 5 years is statistically significant at the 90% confidence level (p=0.072) by Wilcoxon rank-sum test.

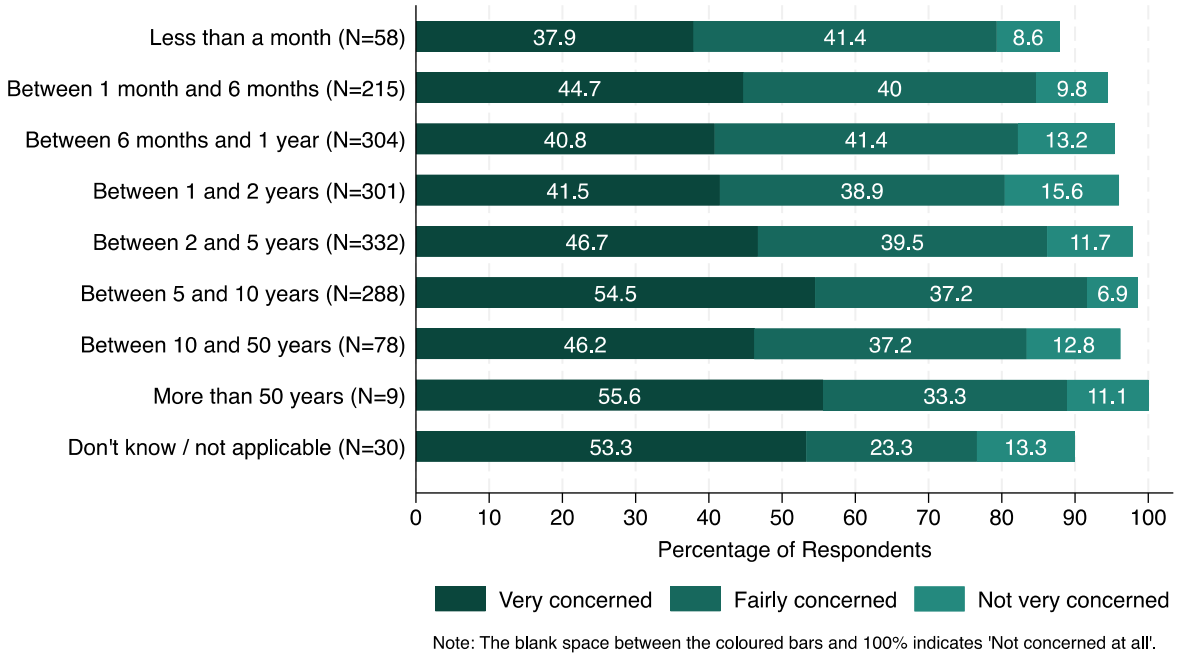


Figure 8: Concerns about climate risk by longest planning horizons

4.2 Which types of CIDs affect organisations' activities?

4.2.1 Overall

Respondents were asked which types of CIDs affect their organisation's activities, allowing for no or multiple selections. Among the 1796 respondents who choose to answer (96% of total number of responses), the ***most common impacts come from hot and/or cold temperatures and wet and/or dry conditions, both affecting over half of respondents (59% and 56%,*** respectively) (Figure 9). In total 574 (30.79%) respondents reported both groups of events which means that roughly every third surveyed organisation finds both extreme temperature and precipitation events to affect its activities. Coastal and ocean changes affect a smaller share of the respondents (18% and 8%, respectively).

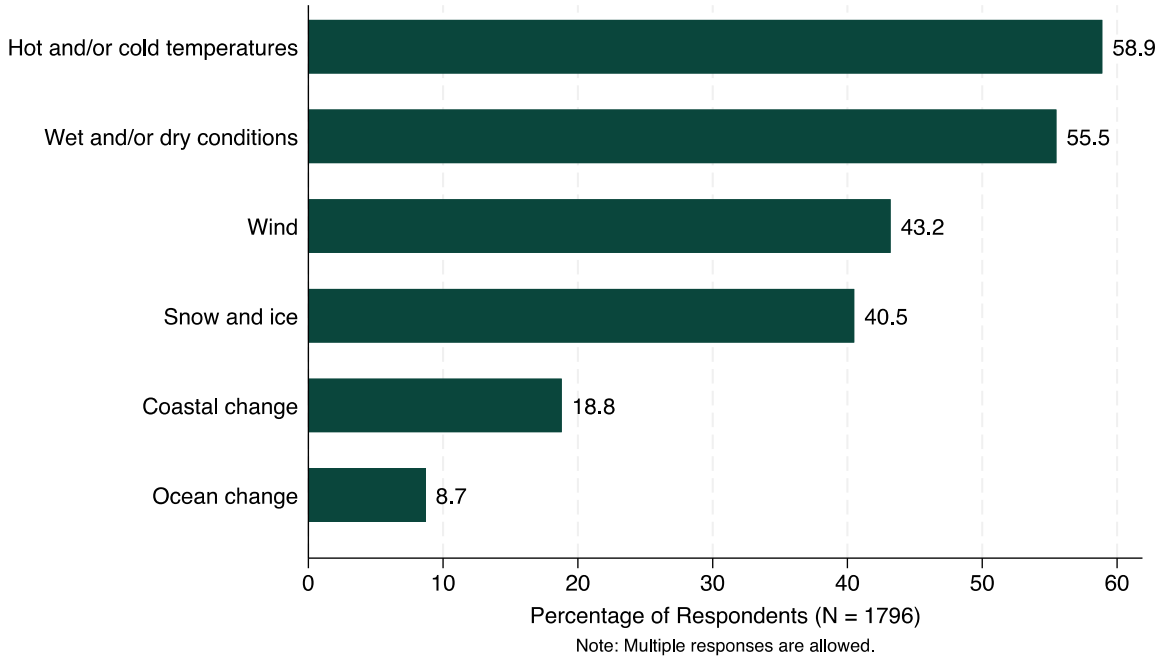


Figure 9: Impact of weather-related events/impacts or long-term climate trends on organisational activities.

4.2.2 CIDs across organisation region, size, sector and planning horizons

Similarly, region comparisons reveal that the most significant groups of CID in all regions are hot and/or cold temperatures and wet and/or dry conditions with between 24 and 30% share (Figure 10). Overall, relative distributions of CID per region are fairly similar with minor differences. Surveyed organisations from East/Central Europe are less affected by ocean change than organisations in other European regions since they are mainly landlocked countries, while organisations from the South are slightly more affected by hot and/or cold temperatures, consistent with regional climate.

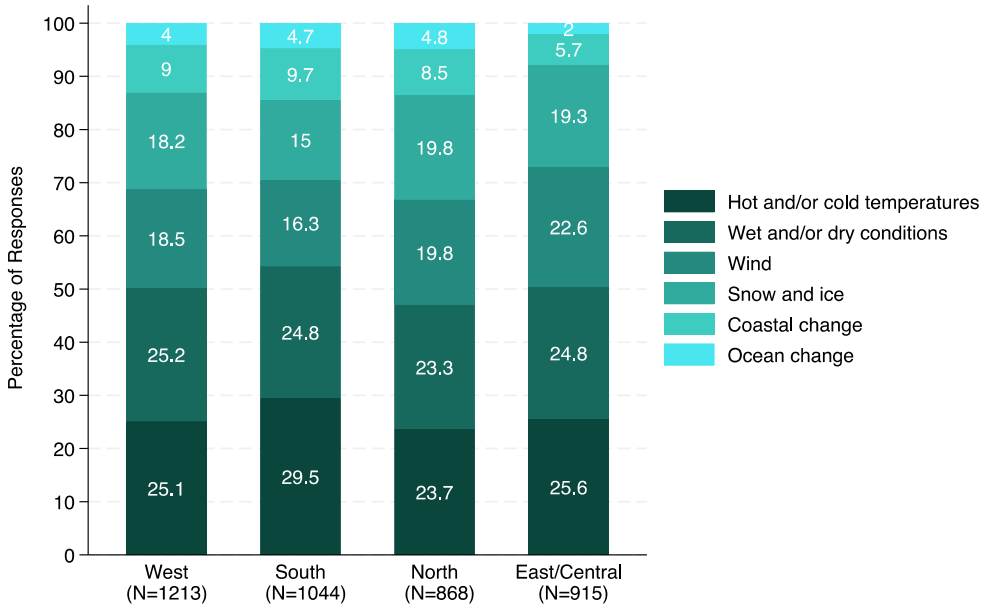


Figure 10: Distributions of reported CID within each European region.

Figure 11 shows the CID distribution for each type of organisation size[4]. For example, 30.4% of organisations among those having less than 10 employees agree that hot and/or cold temperatures affect their organisation's activities. Organisations with a smaller number of employees are more likely to be affected by hot and/or cold temperatures and wet and/or dry conditions, while organisations with larger size are more affected by snow and ice, coastal change and ocean change.

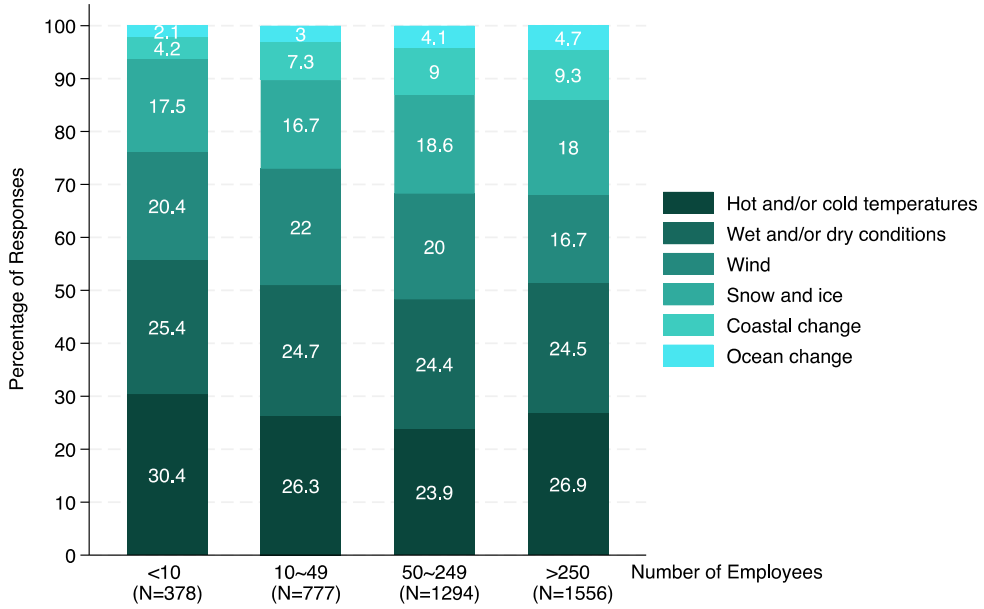


Figure 11: Distributions of reported CID within each type of organisation size.

[4] The statistical significance of the differences among categories can be found in Appendix III.

Private and public sectors are more affected by hot and/or cold temperatures, wet and/or dry conditions, and Wind, while less affected by ocean change than 'other' sectors. Only 3.6% of organisations in private sectors and 3.4% of organisations in public sectors think they are affected by ocean change. Private and public sectors are also less affected by coastal change and snow and ice, respectively.

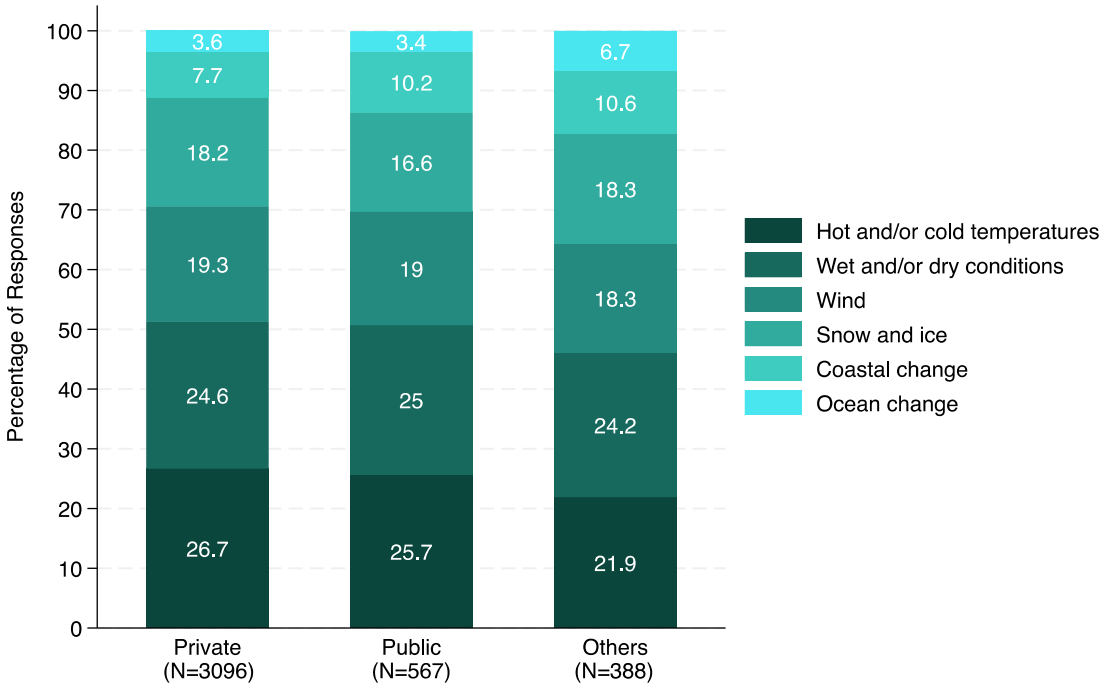


Figure 12: Distributions of reported CID within each sector.

Relative distributions of CID over different lengths of planning horizons are fairly similar, except organisations which plan more than 50 years ahead are more affected by ocean change while less affected by coastal change.

4.3 To what extent is sensitivity to specific CIDs associated with concerns about organisational risks?

An Ordered Logit regression model is applied to answer this question. The results of this correlation analysis are summarised in Table 2. **Sensitivity to nearly all specific climate events is positively correlated to perceived sensitivity to climate related risks at large**, which is an expected outcome. For example, respondents are 67%, 44%, and 37% more likely to report higher sensitivity to environmental risks if their organisations are sensitive to hot/cold temperatures, wet/dry conditions, and ocean change, respectively. They are 58%, 23% and 43% more likely to report higher perceived concerns for economic risks when their organisation is affected by hot/cold temperatures, wet/dry conditions and snow/ice, respectively. They are also 34%, 21%, 29%, and 33% more likely to be affected by social risks if their organisations are sensitive to hot/cold temperatures, wet/dry conditions, snow/ice, and coastal change, respectively.

An overall positive association between concern about other types of risk and reported sensitivity to CIDs, as also found (Table 2). While this does not necessarily imply causal relationships, it does nonetheless underscore the interrelationship between concern about physical climate risks and other organisational risks

Table 2: Odds ratios for climate sensitivity

	Dependent variables						
	Economic	**Environmental**	**Social**	**Climate**	**Geopolitical**	**Technological**	**GHG reduction policies**
Hot/cold temperature	1.577***	1.673***	1.337***	1.809***	1.141	1.188*	1.268**
	(0.154)	(0.162)	(0.128)	(0.178)	(0.110)	(0.113)	(0.122)
Wet/dry conditions	1.233**	1.438***	1.206*	1.271**	0.967	0.952	0.976
	(0.120)	(0.141)	(0.117)	(0.124)	(0.092)	(0.090)	(0.094)
Wind	1.108	1.091	1.002	1.479***	1.168	1.268**	1.171
	(0.110)	(0.105)	(0.097)	(0.148)	(0.112)	(0.121)	(0.114)
Snow and ice	1.427***	1.044	1.289**	1.432***	1.324***	1.044	1.025
	(0.147)	(0.105)	(0.129)	(0.145)	(0.133)	(0.104)	(0.103)
Coastal change	0.921	1.160	1.331**	1.509***	1.189	1.106	1.103
	(0.128)	(0.144)	(0.185)	(0.208)	(0.155)	(0.151)	(0.142)
Ocean change	1.230	1.367*	1.052	1.131	1.229	1.433**	1.234
	(0.245)	(0.246)	(0.193)	(0.225)	(0.230)	(0.259)	(0.231)
Control	√	√	√	√	√	√	√
Observations	1,609	1,614	1,611	1,615	1,591	1,603	1,595

Note: Odds ratios measure how likely the dependent variable is to occur when the value of other variables remains the same, if the independent variable changes by one unit. Robust standard errors are in parentheses. The control variable is the number of employees. *p<0.1; **p<0.05; ***p<0.01.

4.4 Key findings

- The majority of European organisations are concerned about physical climate risks.
- The association between sensitivity to CIDs and concern about both physical climate risk and broader organizational risks highlights potential interdependencies between these.

Together these findings indicate that a majority of European organisations are concerned about climate and weather risks, with concern higher amongst organisations with longer

planning horizons. Moreover, the intercorrelation between concern about different organisational risks (i.e. economic, climate, environmental, social, technological, GHG removal, geopolitical) and their association with sensitivity to CIDs, may be indicative of climate sensitivity having a compounding effect on other forms of organisational risk. While the correlational nature of this data means that direct causal inferences cannot be drawn with respect to the effect of specific CIDs on concern about broader organisational risks, the overall pattern is consistent recent frameworks of risk interdependency and compounding risk (e.g. Hoffart et al., 2024), which highlight the interlinkage of climate, financial and geopolitical risks.

5 How does weather and climate affect organisations in Europe?

5.1 Impact of weather-related events or long-term climate trends on organisational activities

Respondents, who previously indicated that their organisations are affected by any of the six CID categories (see Figure 9), were asked to rate the impact of related events, trends, and impacts on a scale of 1 to 5, where 1 represents "Completely negative", 3 represents "Neither positively nor negatively affected", and 5 represents "Completely positive". Additionally, respondents were asked to rate the impact of four more events which are fog, lightning, air pollution, and radiation at the surface.

Most respondents reported being more negatively than positively affected by weather-related events/impacts and climate trends, particularly extreme heat, heavy rain, and heavy snowfall and ice storms. The only event reported as having a more positive than negative effect was a less windy climate over time. Figure 13 shows the distribution of responses to this question across regions and sectors, ranging from completely negative (1) to completely positive (5). The boxes depict the central 50% of answers, and the dark green dots mark the median values. It indicates that organisations located in Northern and Eastern or Central Europe, as well as those in the private sector, believe that a less windy climate over time will have more positive impacts.

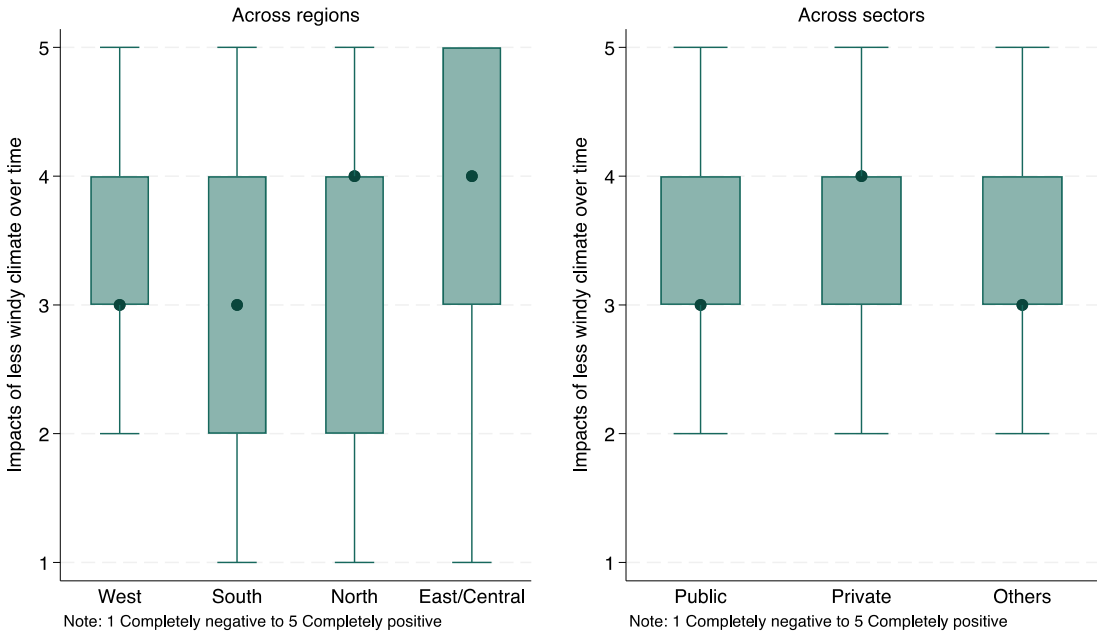


Figure 13 Reported impacts of less windy climate over time across regions and sectors.

Overall, the means and medians for all criteria were typically around 2 or 3, with a moderate level of variability (standard deviation typically between 1.2 and 1.4). Respondents were also

asked to give details of any other types of weather-related events/impacts or long-term climate trends that affect their organisations positively or negatively. For a full list of written responses, see Appendix 2.

5.2 Significance of weather-related events or climate-related trends

Respondents were asked to identify the most significant weather and climate-related events, trends, and impacts for their organisation over the last three years from a list of 35 possible options. The most commonly cited were ***extreme heat events (15%) and heavy rainfall events (8%)*** (Figure 14). Other notable impacts included a warmer climate over time (6%), heavy snowfall and ice storms (5%), and air pollution-inducing weather (5%). The least significant events, impacts, or trends were more related to coastal or ocean changes. A notable share of respondents (6%) indicated they did not know which was the most significant or that the question was not applicable to their organisation.

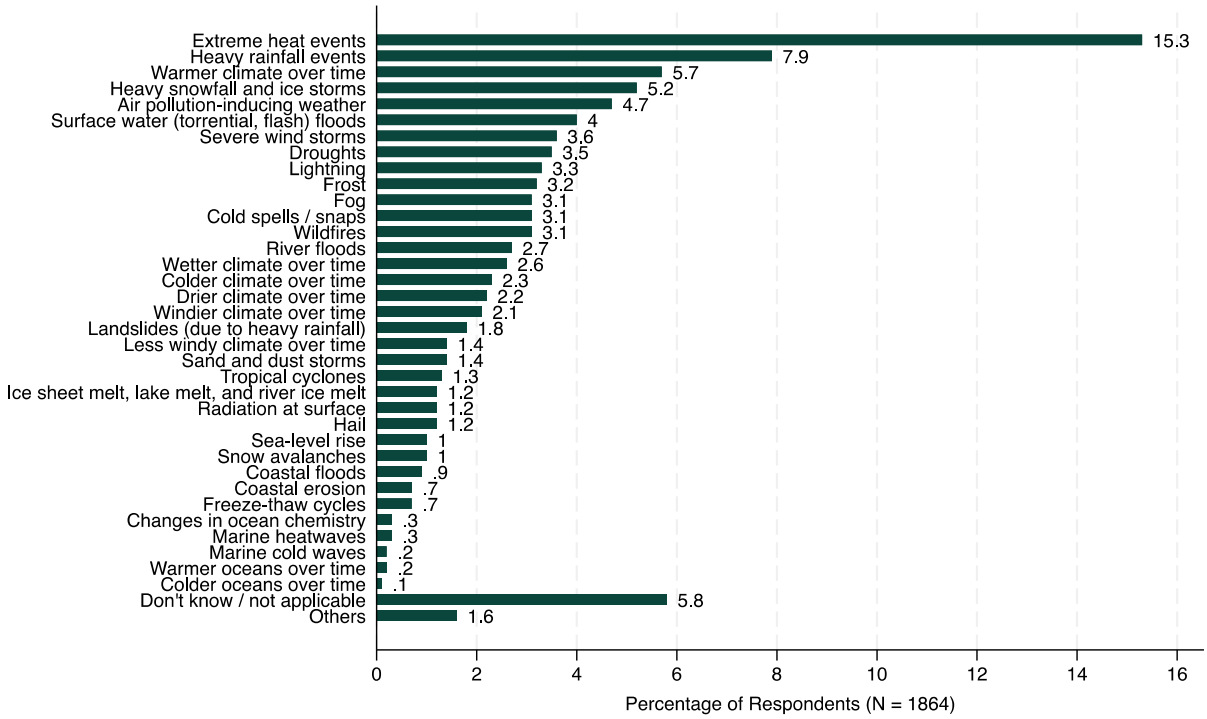


Figure 14: Significance of weather-related events/impacts or climate-related trends.

5.3 Impact of the most significant event, or trend on organisations

5.3.1 Overall

Respondents were asked how the most significant event or trend impacted their organisation, allowing for multiple selections. The most common impact was on people (43%), processes

(34%), and premises (33%) (Figure 15). Other notable impacts include external logistics (29%) and logistics (28%).

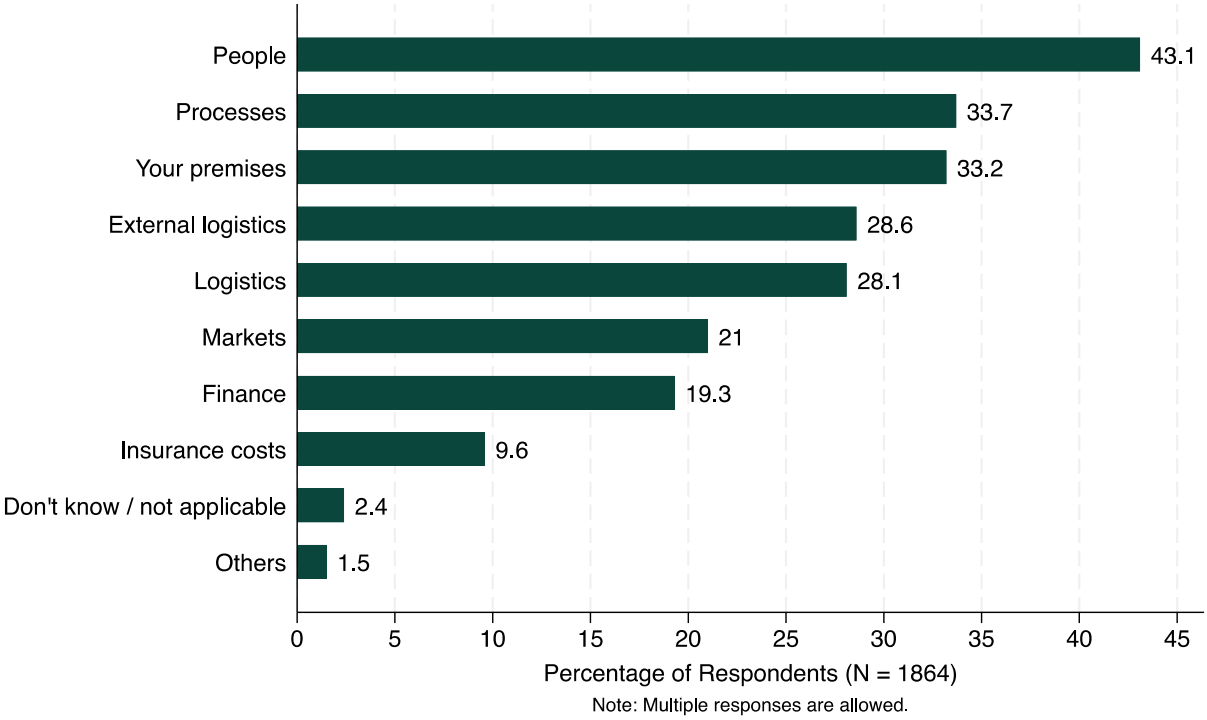


Figure 15: Impact of the most significant event, impact, or trend on organisations.

5.3.2 Impacts across organisation region, size, sector, and planning horizons

Conditional distributions of reported impacts across European regions, size, sector, and planning horizons are analysed, especially for the top 5 impacts. Distributions of reported organisational impacts of weather and climate were similar across European regions, with impacts on people, processes and premises being the most frequently reported impact and insurance the least. However, differences were found between organisations of different sizes and sectors[5].

[5] The statistical significance of the differences among categories can be found in Appendix III.

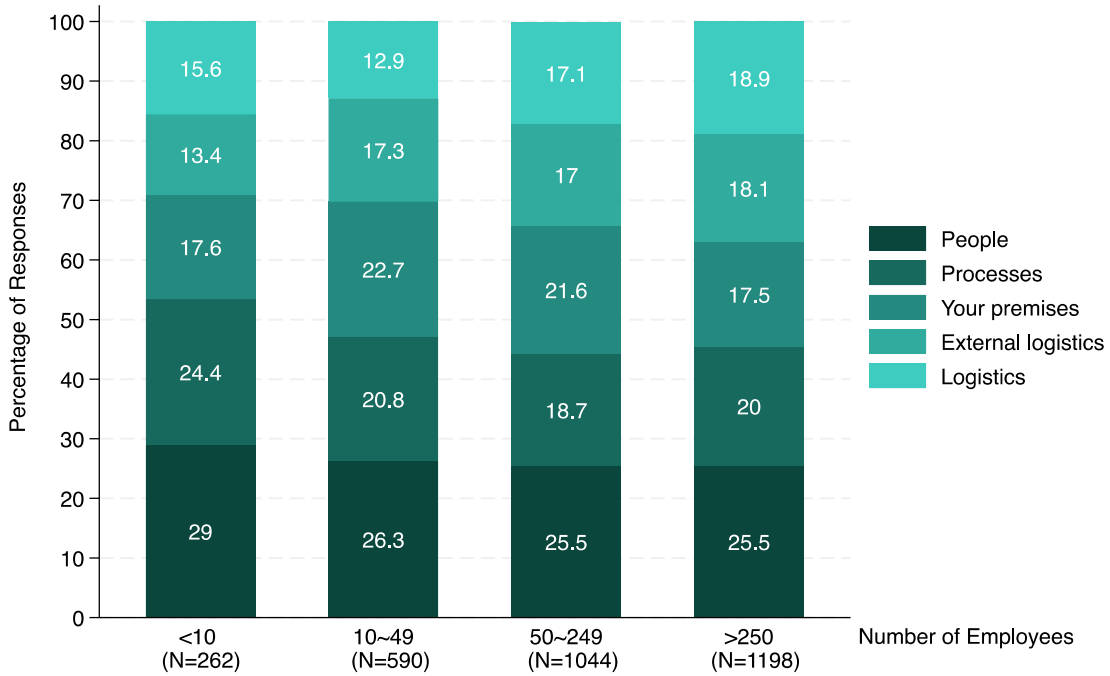


Figure 16: Distributions of reported impacts within each type of organisation size.

As shown in Figure 16 and Figure 17, compared to responses from other types of organization size, responses from organisations with no more than 10 employees report a higher percentage of impacts on people and processes, with fewer respondents reporting impacts on (external) logistics. A higher proportion of responses from the private sector report impacts on (external) logistics compared to public/other sectors, while for those in the public sector, a higher proportion of responses report impacts on people and premises than for the other/private sectors.

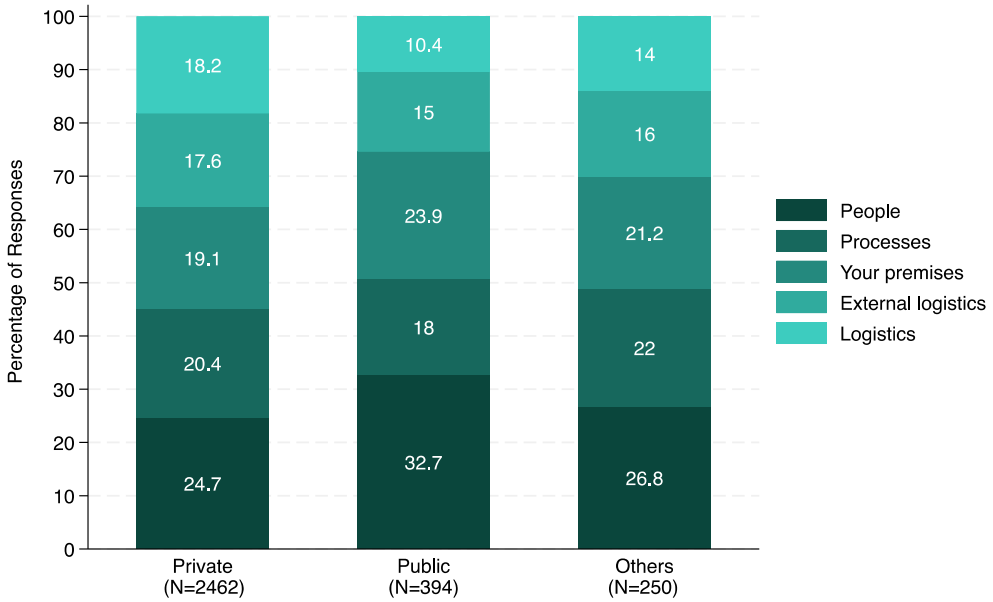


Figure 17: Distributions of reported impacts within each sector.

Figure 18 shows the distributions of reported impacts within each type of planning horizons. It can be found that organisations whose longest planning horizon is more than 50 years, believe that people and (external) logistics were significantly more impacted, though it should be noted that this group comprises a very small number of participants. Respondents who don't know the exact planning horizons also think a relatively high impact was on people.

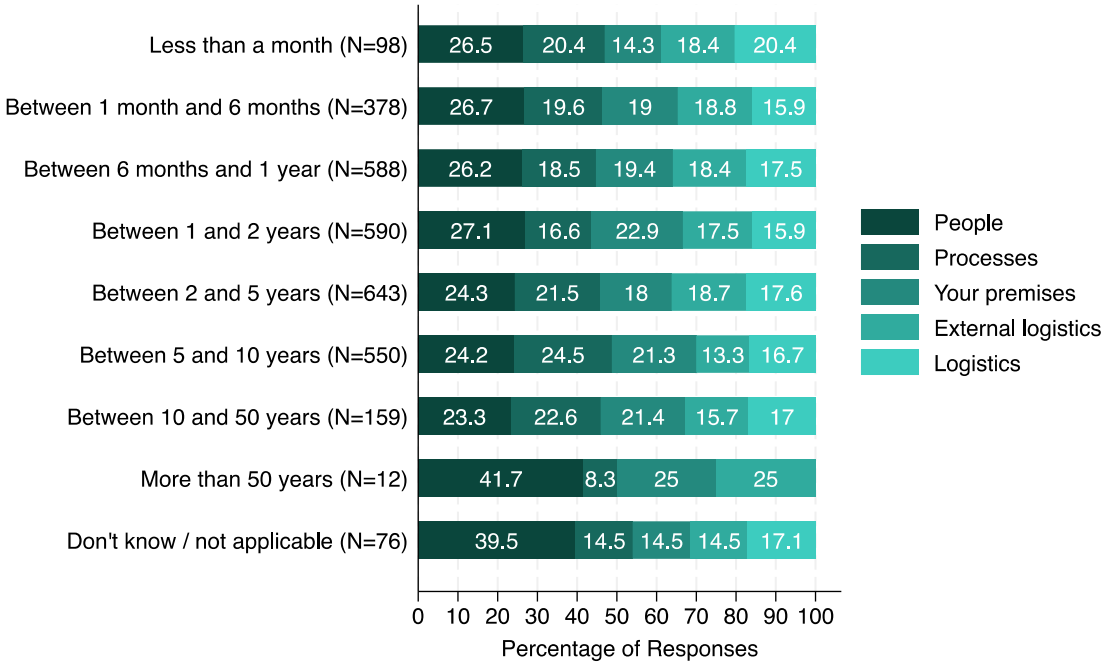


Figure 18: Distributions of reported impacts within each type of planning horizons.

5.3.3 Differences among top 5 most significant weather events

Distributions of impacts associated with the top 5 most significant reported events are presented in Figure 19. The conditional distributions of impacts associated with extreme heat events, heavy rainfall events and warmer climate over time are relatively similar. Organisations identified as being most significantly impacted by heavy snowfall and ice storms were more likely to be affected in terms of logistics but less so in premises, while the reverse was true for those experiencing air-pollution inducing weather.

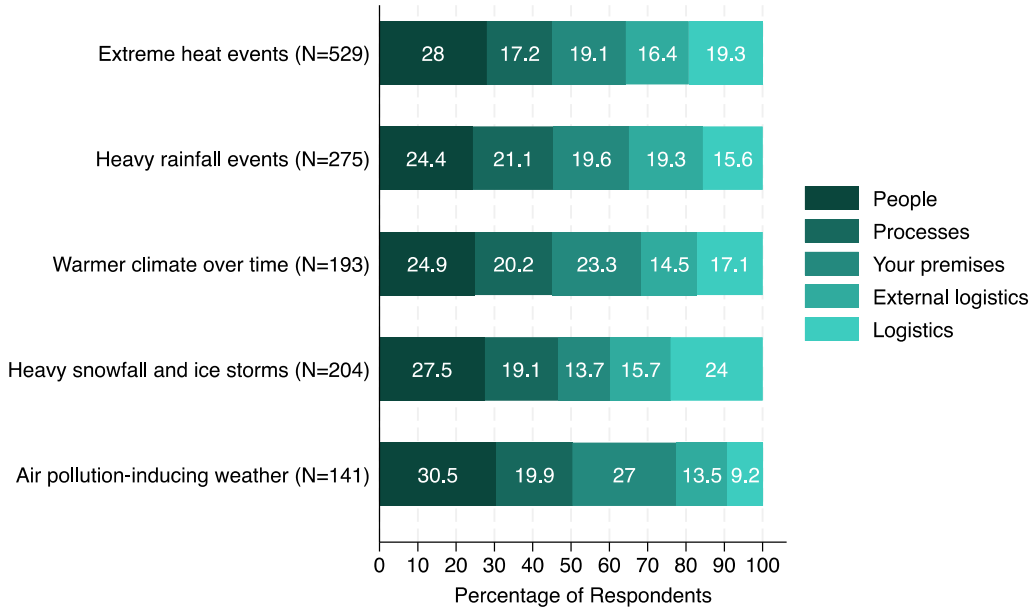


Figure 19: Distributions of reported impacts within each top 5 most significant reported events.

5.4 Timeframe to feel the impact on organisations

5.4.1 Overall

Respondents were asked how long it took to feel the impact of the most significant event on their organisations. The ***majority reported feeling the impact within days to weeks (42%) or months, up to a year (41%)***. A smaller portion experienced the impact after one year or more (13%) (Figure 20).

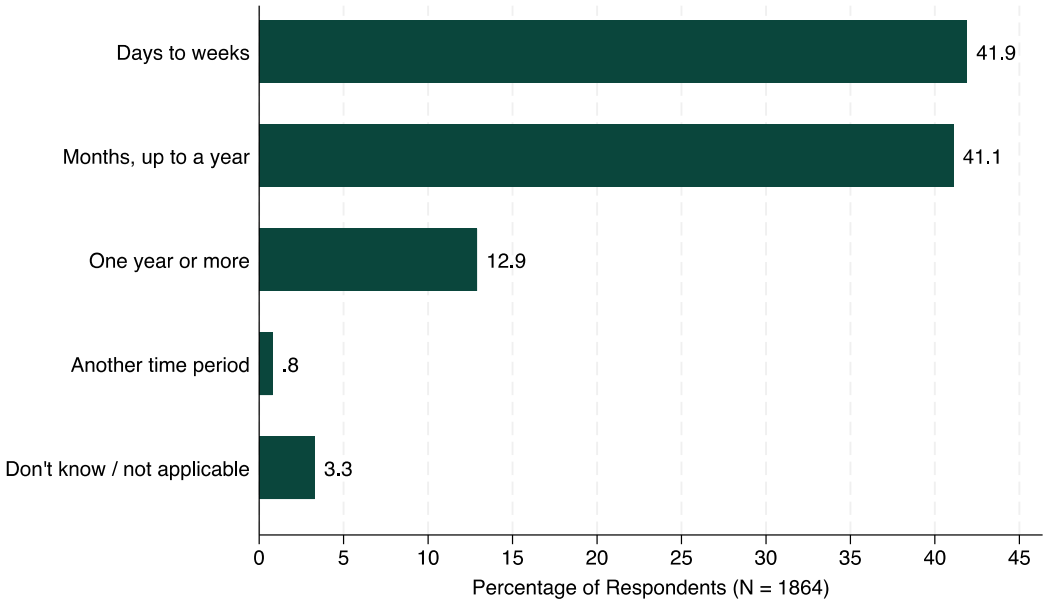


Figure 20: Timeframe to feel the impact of the most significant event on organisations.

5.4.2 Impact time frame across organisation region, size, sector, and planning horizons

The timeframe for experiencing the impact of the most significant climate/weather event differed across organisations' regions, sizes, sectors, and planning horizons. As shown in Figure 21, organisations located in Eastern or Central Europe were more likely to feel the impacts in months or within one year, and less likely to experience them in days to weeks[6].

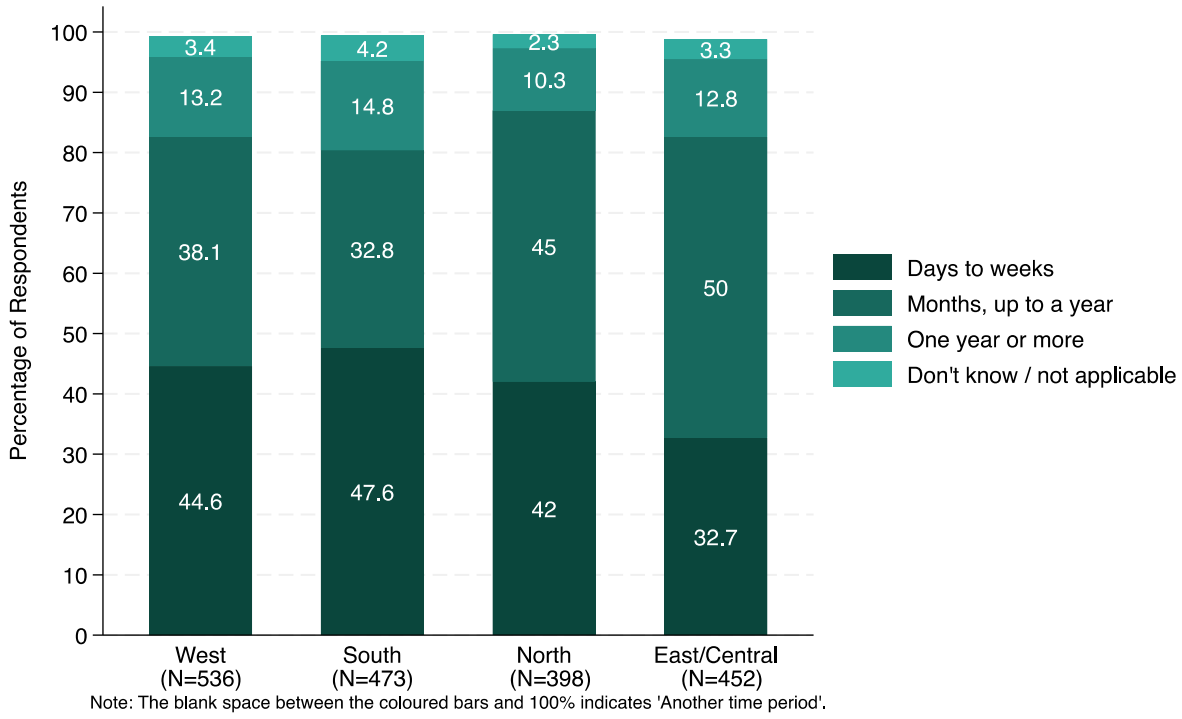


Figure 21 Distributions of timeframe within each European region

Both organisations with fewer than 10 employees and those with more than 250 employees were more likely to feel the impacts in days to weeks (see Figure 22). In contrast, medium-sized organisations with 10 to 249 employees were more likely to feel the impacts in months or within one year.

[6] The differences between Eastern or Central Europe and other regions are in most case statistical significant. Details of the tests can be found in the Appendix III.

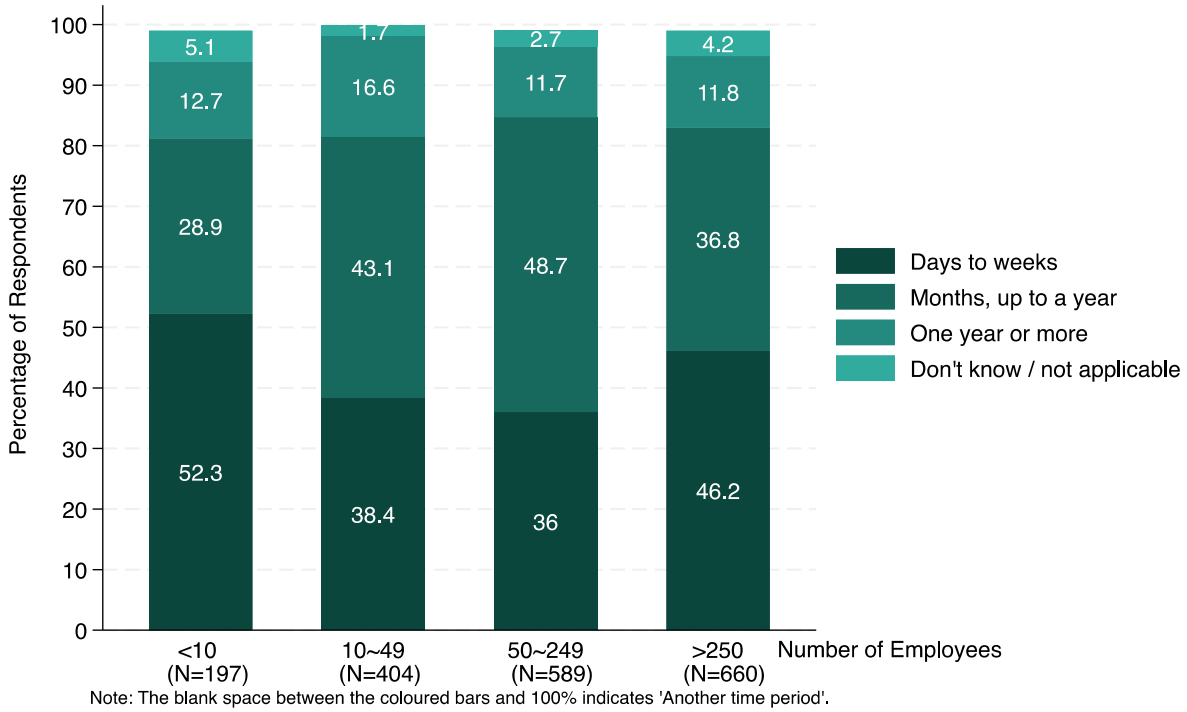


Figure 22 Distributions of timeframe within each type of organisation size

Regarding sectors (see Figure 23), more organisations in public and other sectors took a longer time (i.e., higher percentage for one year or more) to feel the impacts compared to the private sector.

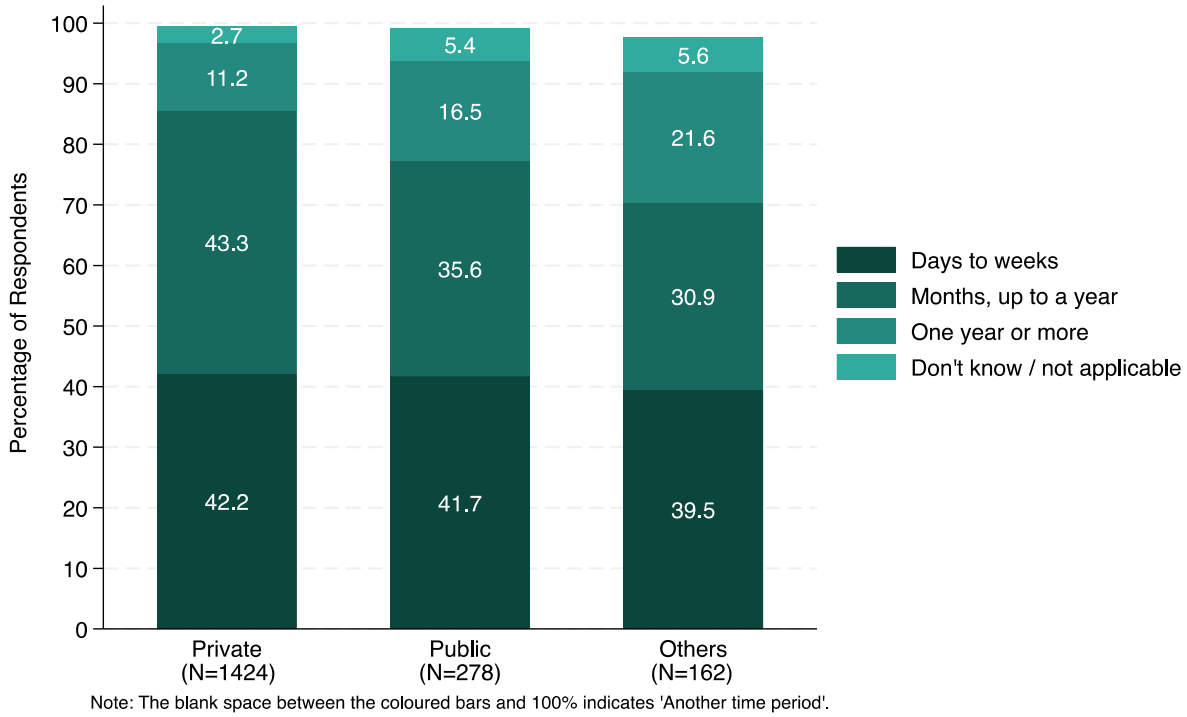


Figure 23: Distributions of timeframe within each sector

The percentage of organisations feeling the impacts in days to weeks decreases as the planning horizons get longer (Figure 24). However, the percentages of organisations feeling the impacts in months up to a year and in one year or more do not show a significant correlation with the length of their planning horizons, except for organisations that plan more than 50 years ahead, which show a significantly higher likelihood of feeling the impacts after one year. Respondents who are unsure of their organisations' planning horizons also show greater uncertainty regarding the time to feel the impacts.

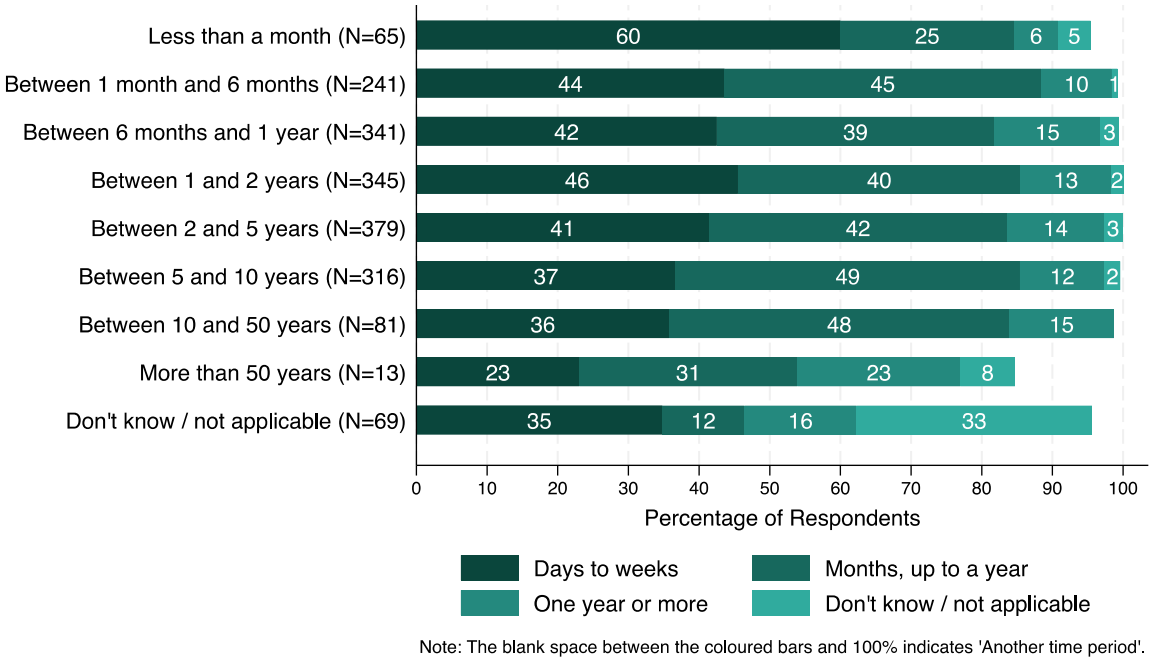


Figure 24: Distributions of timeframe within each type of planning horizons

5.4.3 Differences in impact timeframe for top 5 significant weather events

The conditional distributions of the reported timeframes for feeling the impacts across the top 5 most significant events are presented in Figure 25. The impacts of extreme heat events, heavy rainfall events, and heavy snowfall and ice storms were reported to be felt by organisations within days to weeks. The impacts of warmer climate over time and air pollution-inducing weather took longer to be felt, primarily occurring within months up to a year. The percentage of more than one year was highest for air pollution-inducing weather.

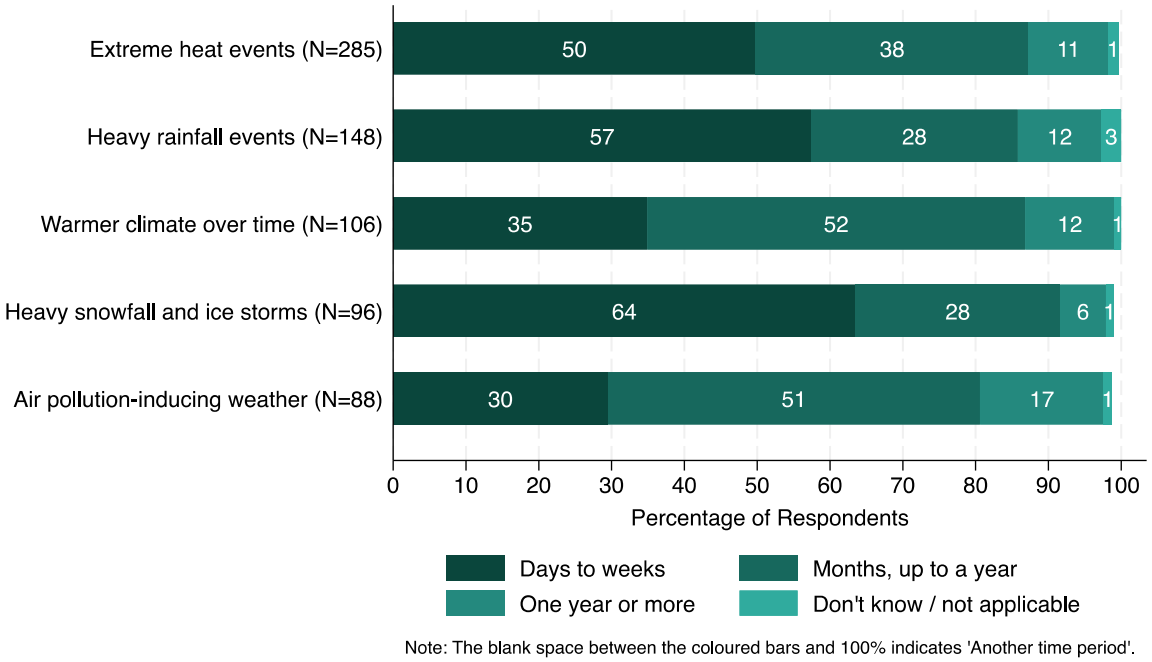


Figure 25: Distributions of timeframes to feel the impact within each top 5 most significant reported events.

5.5 Timeframe of impacts

Figure 26 represents the conditional distribution of timeframes across the reported impacts. The impacts on people, processes, premises, and external logistics show a similar distribution in the reported time to feel the impacts. Impact on logistics is more likely to correspond with a timeframe of days to weeks compared to other impacts. Where impacts related to markets, finance, and insurance costs were selected timeframes of a month to a year were more commonly indicated. However, it should be noted that as participants could select multiple impacts timeframes may reflect the most prominent or enduring.

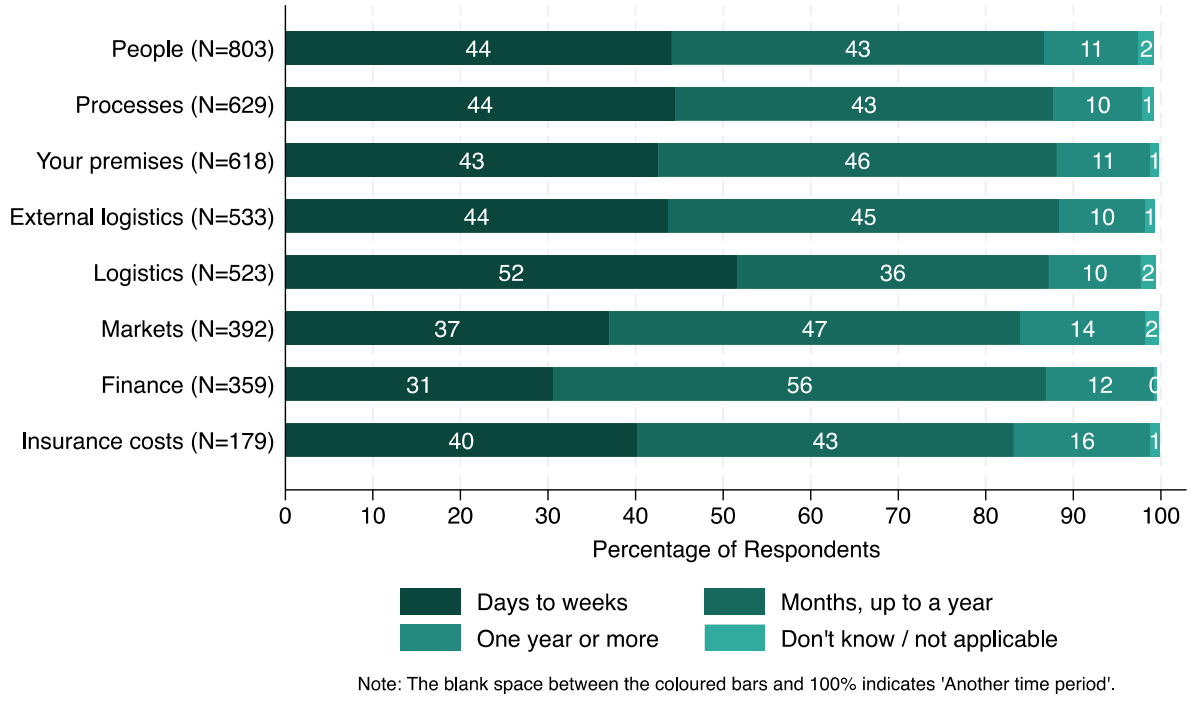


Figure 26: Distributions of reported impacts within each type of time frame to feel the impact.

5.6 Key findings

- High temperatures, heavy rainfall, warmer climate over time, heavy snowfall and air-pollution inducing weather were most frequently identified as the most impactful recent weather and/or climate event effecting the organisation.
- 'Impacts on people' was the most frequently selected category of CID impact and was particularly pronounced with respect to high temperatures and air pollution. Logistical impacts were commonly reported for heavy snow/ice.

The analysis highlights that, with the exception of decreases in strong winds, CIDs tend to have an overall negative impact on organisations. The positive response to decreasing winds is interesting given that wind energy is an important sector in its own right, as well as supplying energy for other sectors particularly in Northern Europe. However, most other organisations may directly see the impact of wind related damage to infrastructure and making outdoor activities more difficult, and may not consider indirect effects of less wind-generated power being available in these regions.

The presence of high temperatures, warmer climate over time and air-pollution inducing weather in the top five 'most impactful' events may reflect that the data collection was conducted shortly after the 2023 heatwave, where many areas in Europe saw record breaking temperatures (Copernicus, 2023). This was preceded by Summer 2022, where heatwaves and poor air quality were experienced across Europe (WMO, 2022). Likewise, a number of countries saw above average rainfall (Copernicus Climate Change Service, 2023).

Importantly, the analysis finds that while climate impacts are often discussed in terms of their implications for logistics and operations, impacts on people were the most frequently identified consequence of weather and climate events. This was particularly pronounced with respect to impacts related to air-pollution and high temperatures, potentially reflecting health impacts on staff & consumers. Logistical impacts were however, associated more with heavy snow/ice storms.

As expected from the nature of the CIDs, our findings also suggest that timescale of impacts reported for time-bound CIDs (i.e. heavy rainfall and heavy snowfall) are shorter than longer term trends (i.e. warmer climate over time). Likewise, smaller organisations with shorter planning horizons report earlier onset of impacts, potentially reflecting the nature of operations in these organisations as well as a more general shorter-term focus. Indeed, impacts on logistics are associated with shorter impact realisation timescales, while those associated with finances and markets are associated with longer timescales.

6 Climate risk management (adaptation) in organisations and its drivers

6.1 Climate-related policies, regulations, standards and/or guidelines

Respondents involved in organisational planning and/or decision making (n=1644) were asked whether their organisation follows any climate-related policies, regulations, standards and/or guidelines, allowing for multiple selections. ***Nearly half of the respondents indicated that their organisations followed climate-related standards (48%), guidelines (44%) and/or adaptation policies (43%)*** (Figure 27). These findings are similar among organisations with different locations, number of employees and sectors.

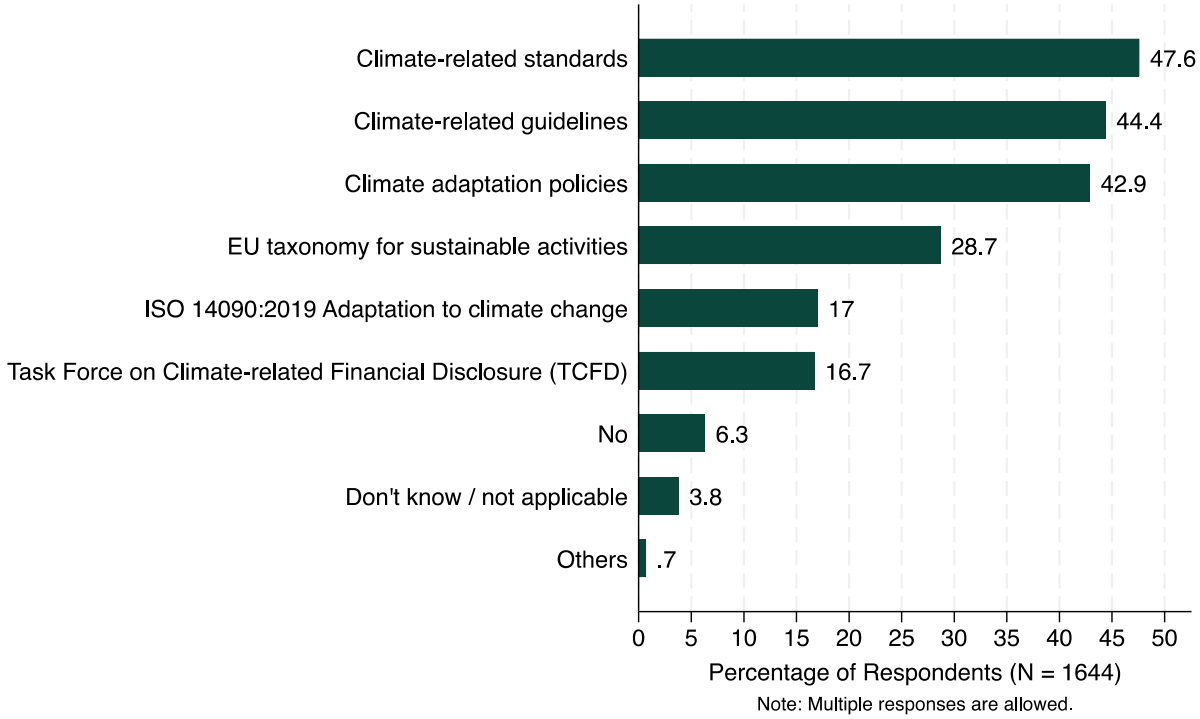


Figure 27: Climate-related policies, regulations, standards and/or guidelines.

Figure 28 presents the conditional distributions of climate-related policies, regulations, standards and/or guidelines across organisations with different longest planning horizons[7]. In assessing whether organisations with different planning horizons differ in terms of the drivers of climate risk management within their organisation, it was found that climate guidelines represent a proportionally larger driver of climate risk management for organisations with maximum planning horizons of 5-10 years than organisations with shorter maximum planning horizons. However, no difference was found for climate-related standards, the EU taxonomy or ISO14090-2019. Although climate adaptation policies represented a proportionally larger driver for organisations with the shortest planning horizons as compared to longer planning

[7] The statistical significance of the differences among categories can be found in Appendix III.

horizons, this difference is not statically significant, likely reflecting the comparatively small sample size of more than 50 years than other groups only 17 responses fell into this category.

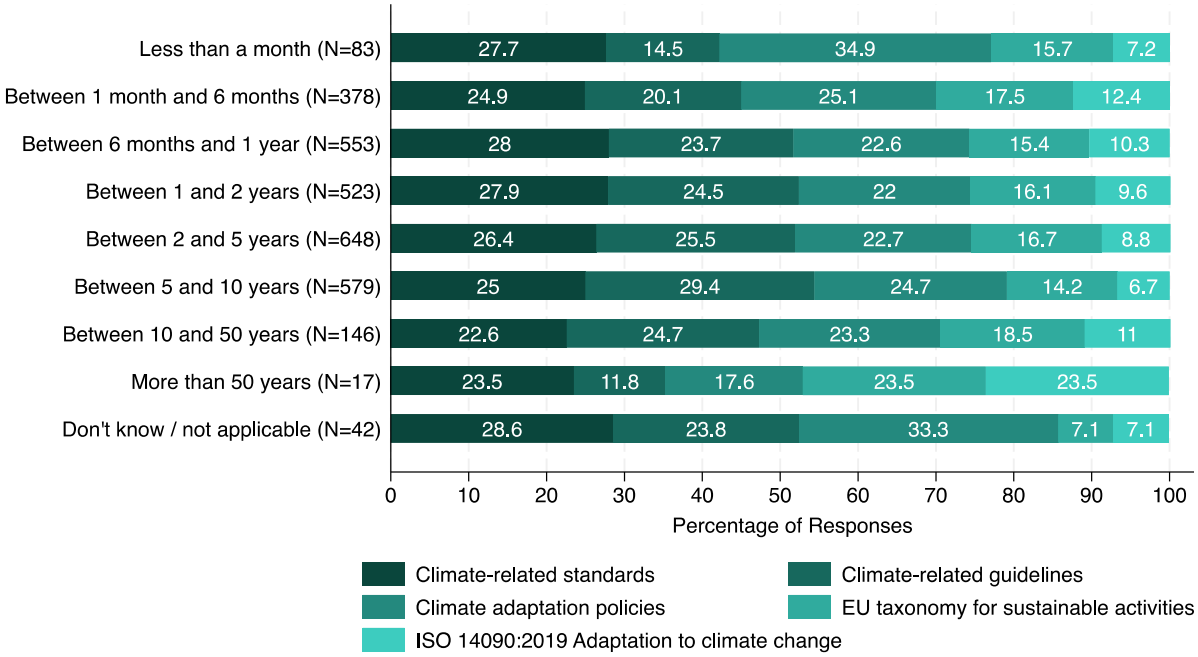


Figure 28: Distributions of climate-related policies, regulations, standards and/or guidelines within each type of planning horizons.

6.2 Organisational responses to managing events, impacts, or trends

6.2.1 Overall

Respondents were asked about their organisations' approach to managing the most significant recent event. ***Nearly half (48%) of those who answered the question followed a pre-designed plan***, while 22% took actions without a plan (Figure 29). 16% did not have a plan and did nothing to manage the impacts. Additionally, 9% took actions and then developed a plan for future events.

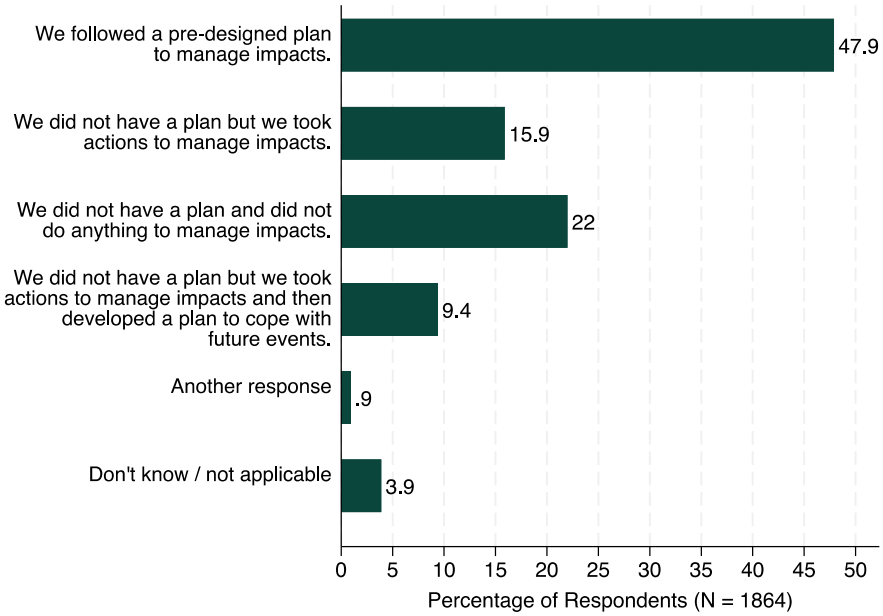
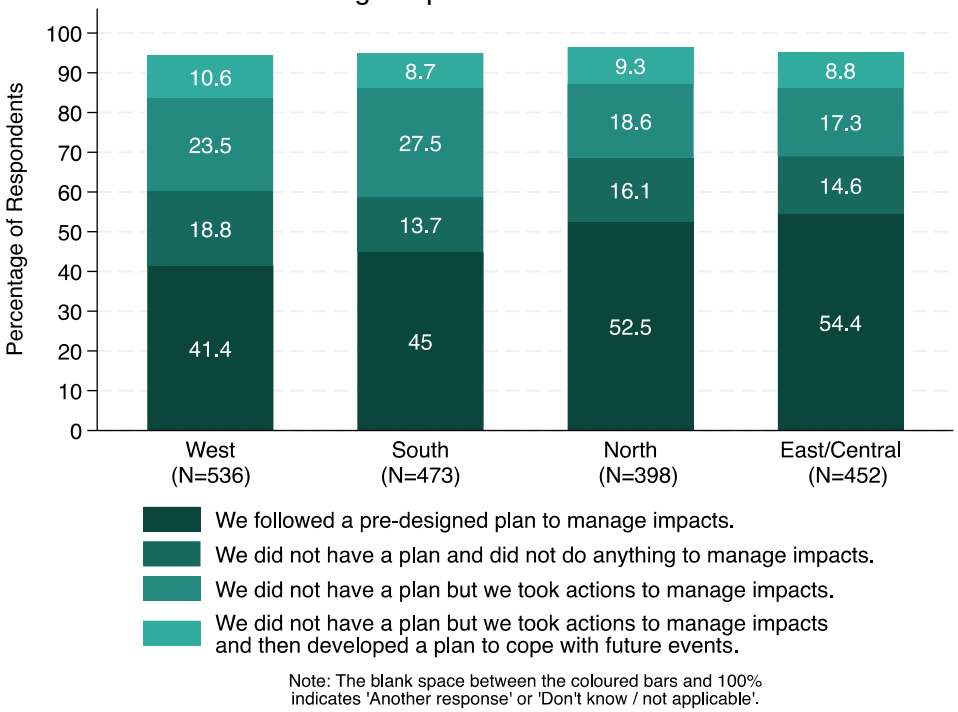


Figure 29: Organisational responses to managing events, impacts, or trends.

6.2.2 Managing approach across organisation region, size, sector, and planning horizons

Organisations located in Eastern, Central, and Northern Europe are more likely to follow a pre-designed plan to manage impacts, while those in Western and Southern Europe have a higher percentage of organisations without a plan but that have taken actions to manage impacts (Figure 30). For example, 27.5% of organisations that are located in Southern Europe didn't have a plan but took actions to manage impacts.



Note: The blank space between the coloured bars and 100% indicates 'Another response' or 'Don't know / not applicable'.

Figure 30: Distributions of managing approach within each European region.

Organisations with larger size (i.e., more employees) show significantly higher percentage of having a pre-designed plan (Figure 31). No more than 36% of small organisations with 10-49 employees already have a pre-designed plan. Nearly 30% of them took action and 7%-16% then developed a plan.

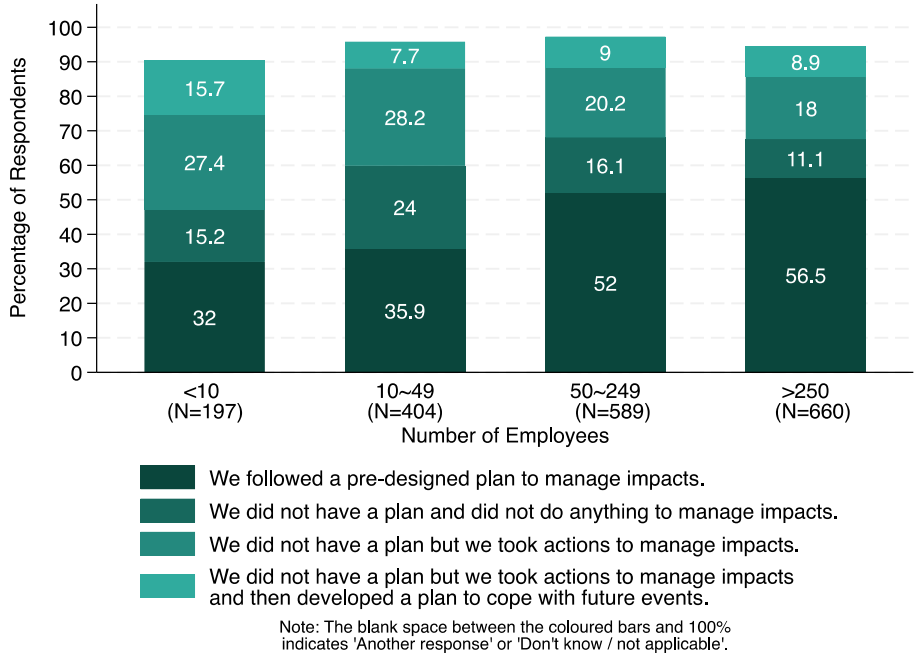


Figure 31: Distributions of managing approach within each type of organisation size.

Over 50% of the private sector organizations follow a pre-designed plan (Figure 32). This number for the public sector is 40.6%. Only 38.9% of the organisations in other sectors followed a pre-designed plan.

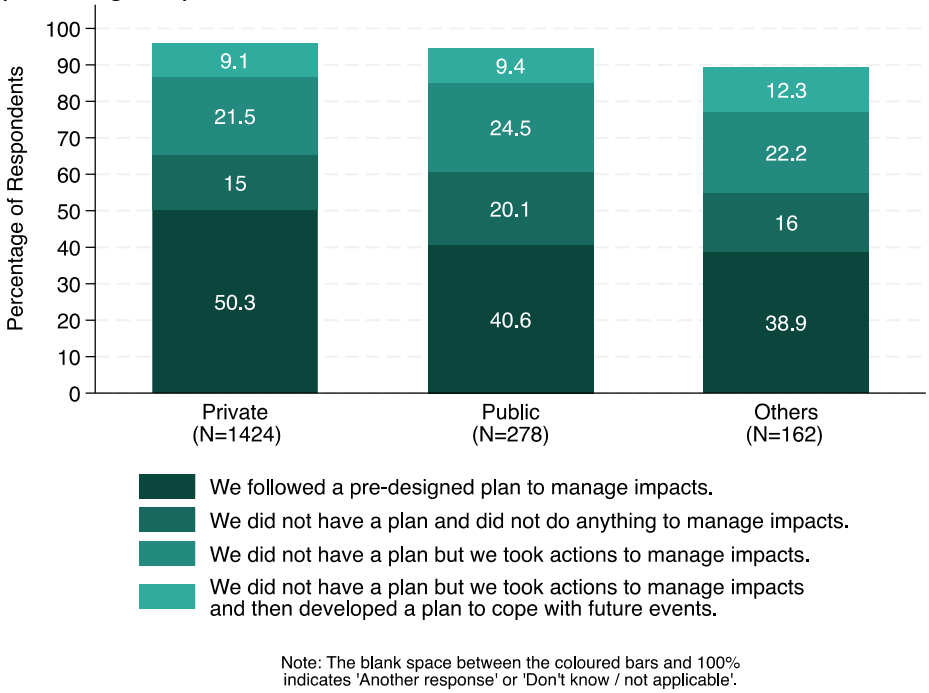


Figure 32 Distributions of managing approach within each sector.

Organisations with different planning horizons show larger variations in their current management approach (Figure 33). Among those with planning horizons between 5 and 10 years, 60.4% follow a pre-designed plan, the highest percentage across all planning horizons, with a general trend towards organisations with maximum planning horizons of over one-year indicating following a pre-designed plan than those with planning horizons of less than a year.

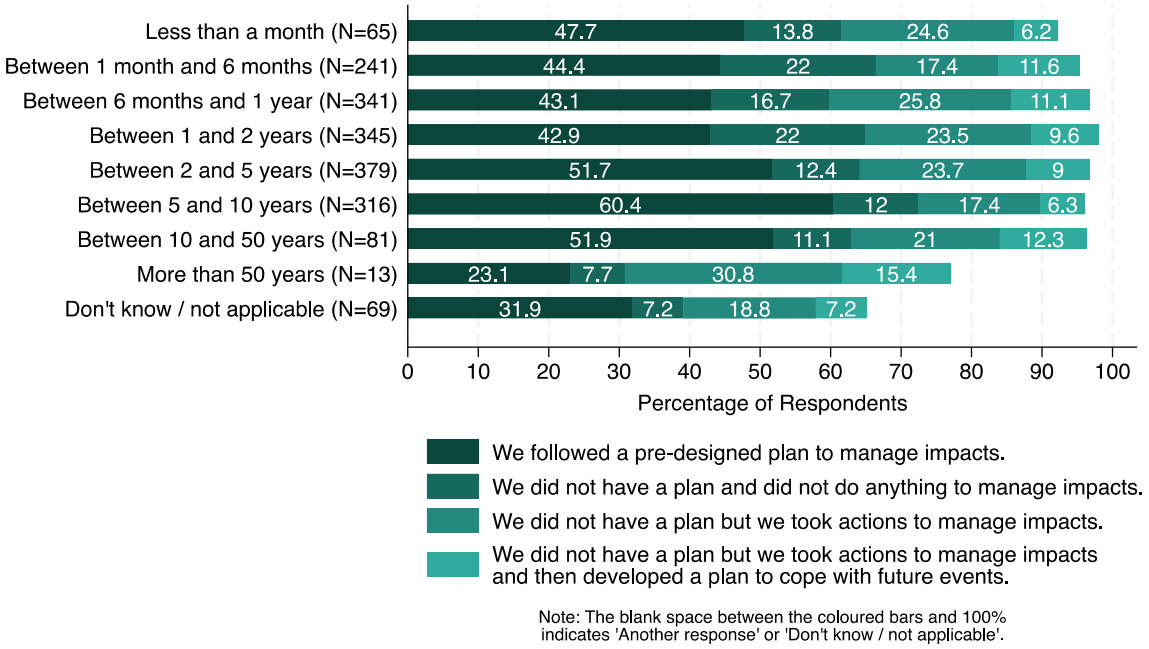


Figure 33: Distributions of managing approach within each type of planning horizons.

6.3 Active management of weather and climate risks

Respondents were asked whether their organisation was actively trying to manage weather and climate risk. The ***vast majority (80%, n=1864) reported that their organisations are actively engaged in managing these risks***. Little variation was found between regions, organisation size, sectors, and planning horizons a similar percentage is obtained. The exceptions to this were organisations with fewer than 10 employees) and respondents who didn't know the exact planning horizons, where percentage of participants selecting 'Yes' was 67% and 47% respectively.

6.4 Drivers of weather/climate risk management (adaptation) in organisations

6.4.1 Overall

Respondents that reported that their organisations actively manage risk (n=1481) were asked about the factors driving weather and climate risk management ('CRM') relating to adaptation in their organisations, with multiple answers permitted. The three ***most commonly reported drivers of risk management are experience of weather/climate-related events, impacts, or trends (36%), risk to human safety (35%),*** and ***organisational risk***

assessment/management (32%) (Figure 34). Other significant drivers are risk to public services (28%) and infrastructural durability (28%).

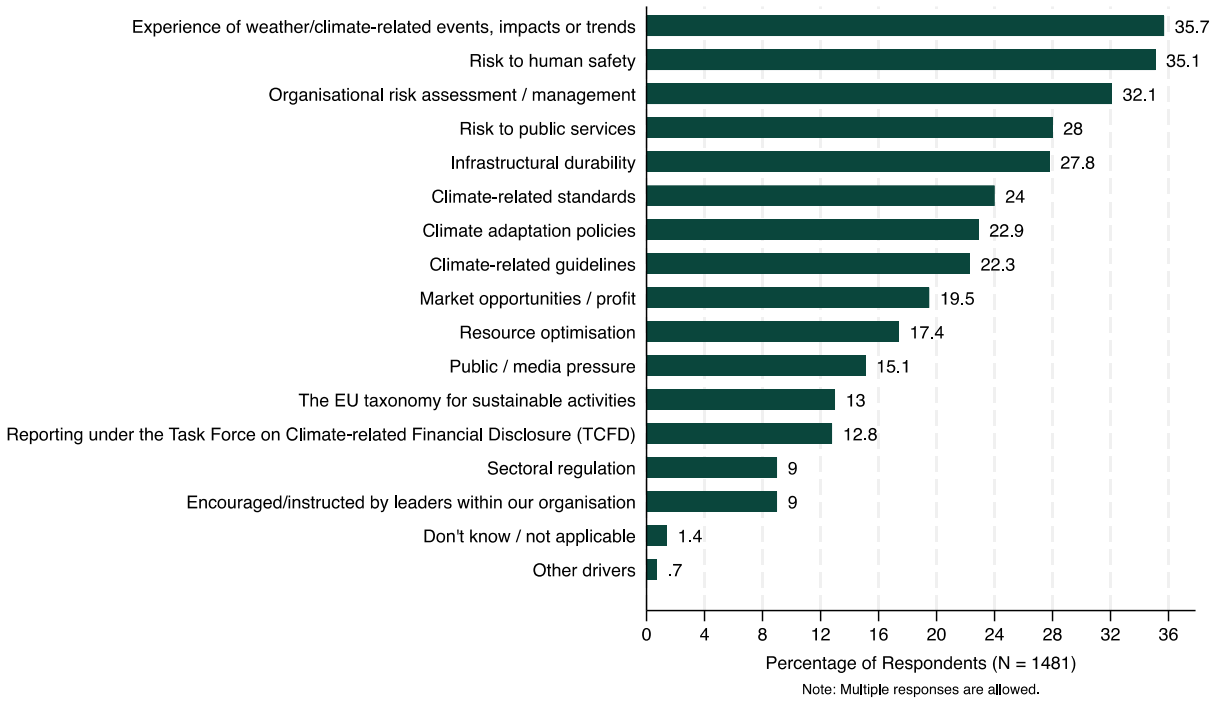


Figure 34: Drivers of weather/climate risk management (adaptation) in organisations.

6.4.2 Effect of sensitivity to specific climate events

The association between sensitivity to specific CIDs and CRM was explored using Ordered Logit regression analysis, with the odd ratios obtained from the regression analysis provided in Table 3. While sensitivity to some climate factors is positively correlated to CRM, this is not the case for others.

The likelihood of organisational engagement in climate risk management is 52% higher when the respondent's organisation is affected by hot/cold temperatures. In contrast, organisations that are sensitive to wet/dry conditions are 0.74 times or 26% less likely to engage in CRM. However, the simple correlation of the sensitivity about wet/dry conditions and the CRM is not significant. It suggests that this unexpected significant result may be led by covariance with other predictors in the model. One possible reason is that it is easier for individual organizations to respond to heat/cold locally than drought/high rain. Because the latter one is a wider challenge that is harder to adapt locally to deal with but needs more widespread and systemic adaptation. On the other hand, sensitivity towards wind, snow/ice, coastal change, and ocean change was not significantly associated with CRM.

Experience of weather/climate related events raises the likelihood of an organisation carrying out CRM by 150%. These findings underscore the critical role of past experiences in shaping proactive climate strategies within organisations.

The size of the organisation was also considered in the regression analysis - **larger organisations are 55%~81% more likely to invest in CRM**. This could be explained by the previous finding of larger organisations being more sensitive to climate risk.

Table 3: Odds ratios for the drivers of climate risk management

	Climate risk management
Hot/cold temperature	1.523***
	(0.162)
Wet/dry conditions	0.741***
	(0.080)
Wind	1.101
	(0.119)
Snow and ice	1.023
	(0.115)
Coastal change	1.013
	(0.138)
Ocean change	1.272
	(0.288)
Experience of weather/climate-related events, impacts, or trends	2.507***
	(0.289)
Between 10 and 49 employees	0.802
	(0.147)
Between 50 and 249 employees	1.553**
	(0.273)
More than 250 employees	1.814***
	(0.311)
Observations	1,440

Note: Odds ratios measure how likely the dependent variable is to occur when the value of other variables remains the same, if the independent variable changes by one unit. Robust standard errors are in parentheses. *p<0.1; **p<0.05; ***p<0.01.

6.5 Key findings

- Organisations with planning horizons of 2-50 years are more likely to report having a predefined plan than those with shorter planning horizons.
- Experience and risk to safety are the most frequently identified drivers of climate risk management.

As be expected, a greater percentage of participants (42.9% - 47.6%) indicated that their organisation followed general climate related standards, guidelines and policies than the percentage of those who specified following specific standards, guidelines and policies. A general change in having vs not having a predefined plan to deal with the impacts of a climate event or trend was evident for organisations who have an up to 2-year planning horizon point, with those organizations which have planning horizons of 2-50 years being more likely to report enacting a predefined plan than those that only have shorter planning horizons. While there was a departure from this pattern at 50+ years, this is likely due to the fact that very few respondents indicated that their organisation planned to timescales beyond 50 years.

Experience and risks to human safety were the two most frequently selected drivers of climate risk management, with climate related standards, policies and guidelines being less frequently indicated. This corresponds with the fact that ‘impacts of people’ was the most frequently selected type of impact when participants were asked to consider a recent weather or climate event and could reflect the comparative strength of regulation around health and safety. It is also in keeping with the broader risk perception and preparedness literature, where experience has been identified as a key predictor of both concern about risk and willingness to act at an organisational and individual level (e.g. Appleby-Arnold et al., 2021; Dookie et al., 2024).

7 To what extent do organisations currently use weather and/or climate information?

7.1 Current use of weather and/or climate information within climate-sensitive organisations

Respondents were asked about their current use of weather and/or climate information. We found that **77% of respondents actively use information** in their roles. Of the remaining 23%, it is possible that other employees within their organisation may use weather and climate information, but this cannot be quantified using the present dataset. The percentage of participants reporting current usage of weather and/or climate information was found to be similar across regions, sectors and sizes. However, organisations whose maximum planning horizons are between 5 and 50 years are significantly more likely to report using weather and/or climate information than those with shorter planning horizons (Figure 35).

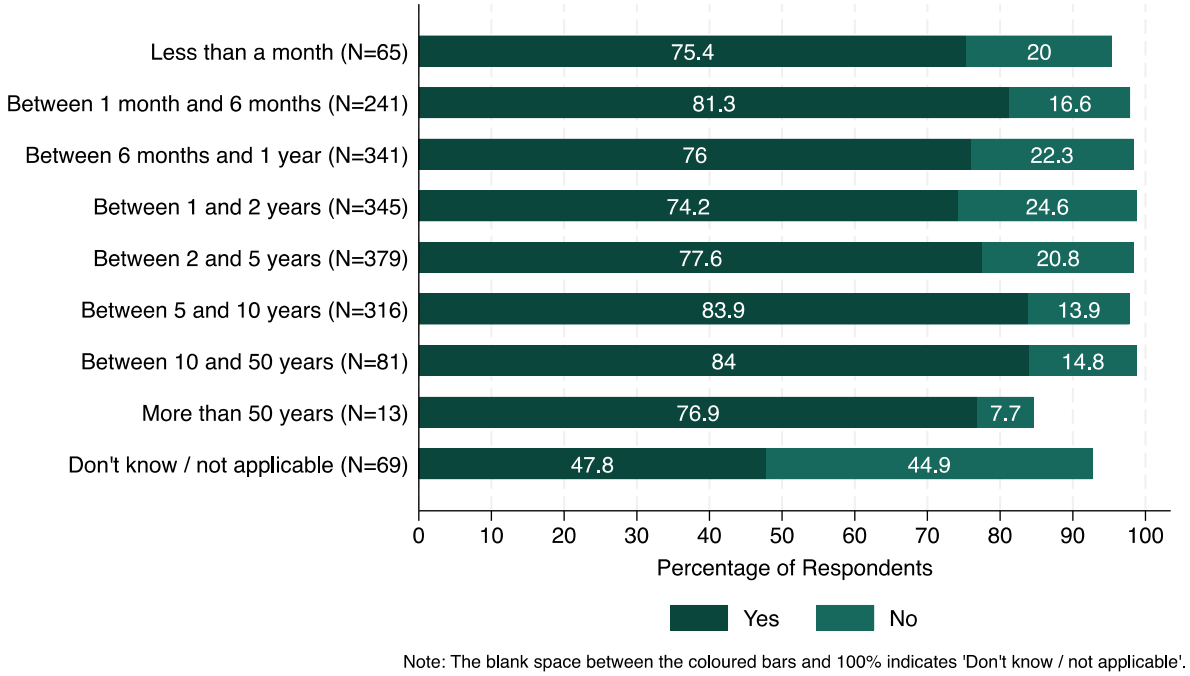


Figure 35: Distributions of current use of weather and/or climate information (Yes/No) within each type of planning horizons.

7.2 Types of weather and climate information used

Among respondents using weather and/or climate information (n=1443), t**he most commonly used is weather forecasts, selected by 62% of respondents** (Figure 36). This is followed by observations (38%), sub-seasonal forecasts (33%), and seasonal forecasts (29%). The answers indicate that **climate projections (20%) and interannual/decadal predictions**

(18%) are less commonly used. **17% of information users exclusively use weather forecast information**. Some participants may not have perfect knowledge of how the products and information that they use might be classified, such as conflating interannual/decadal predictions with climate change projections, as both pertain to 'years in the future'. Interannual and decadal prediction information is not commonly used across society and it is typically hard to access, especially in a way that meaningfully supports future decision making, limiting use to organisations with close links to research institutions or academia, or who employ climate services from organisations with decadal prediction system access. However, the top-level results from decadal predictions do now command extensive press coverage, especially as we approached a year where 1.5 C was exceeded (2024)[8] so it may also be that respondents consider accessing this press coverage as using prediction information.

After this question, exclusive weather forecast users (n=249) were directed to questions about potential interest in using other forms of climate information in the future (see Figure 1) and those who exclusively selected "Other types" (n=8) were redirected to the end of the survey.

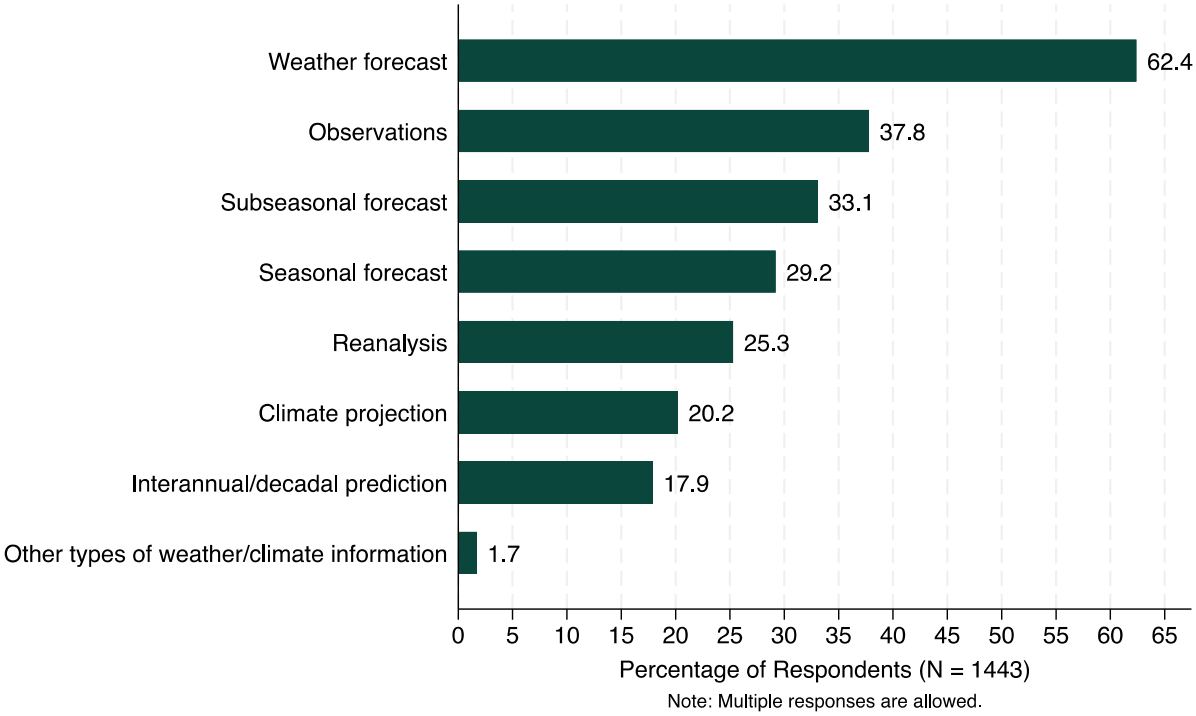


Figure 36: Types of weather and climate information used.

Given the types of weather and climate information used, respondents who reported using at least one type of climate information rather than only using weather forecast or self-reported weather / climate information are identified as current users (n=1186). For the current users, we further investigate the details of what and how they used in the following subsections.

[8] *https://www.aspect-project.eu/1-5c-warming-threshold-could-be-reached-in-2024/*

7.3 Source and Communication

7.3.1 Sources of weather and climate information

Organisations **access different types of information from diverse sources** (Figure 37). Weather forecasts (68%), observations (42%), seasonal forecasts (41%), and climate projections (43%) are primarily obtained from National Meteorological and Hydrological Services or government sources. The Copernicus Climate Change Service (C3S) (41%) is a source for reanalysis data. Private companies and consultancies are sources for sub-seasonal forecasts (37%) and interannual/decadal predictions (38%). As explained in the previous section, the results suggest that respondents may not accurately distinguish between different types of weather and climate information, and the sources from which these come.

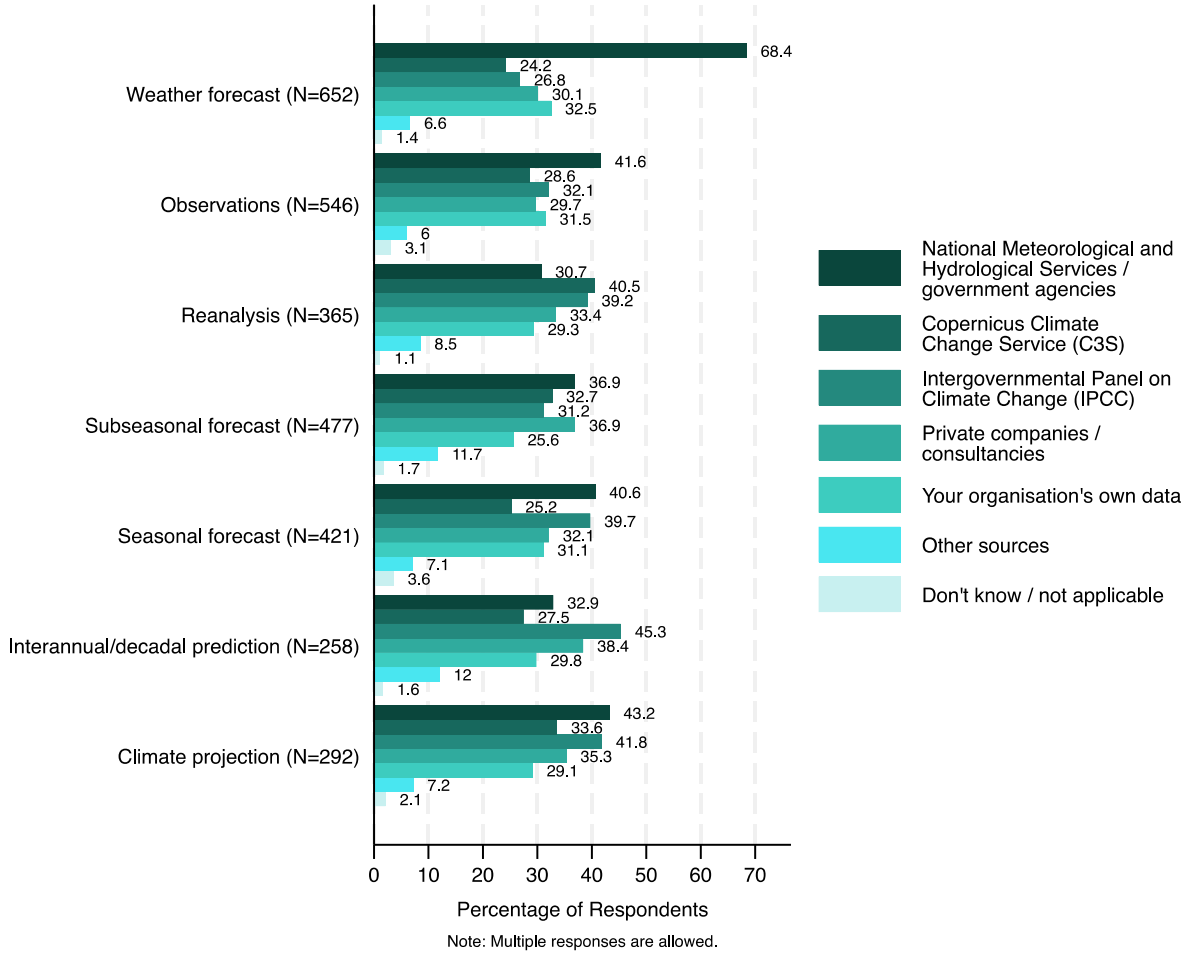


Figure 37: Sources of weather and climate information.

7.3.2 Communication of weather and climate information

We explored how different types of weather and climate information are communicated to them, allowing for multiple selections. The results show that, **while visual and written methods are the most commonly experienced across all types of information, a variety**

of communication channels are used to convey weather and climate information (Figure 38). Oral communication also plays a significant role, particularly for interannual/decadal predictions (45%), which might also include radio coverage around press releases for decadal forecasts by Decadal Prediction Centres. Additionally, raw data is relatively more common for weather forecasts (48%), climate projection and observations.

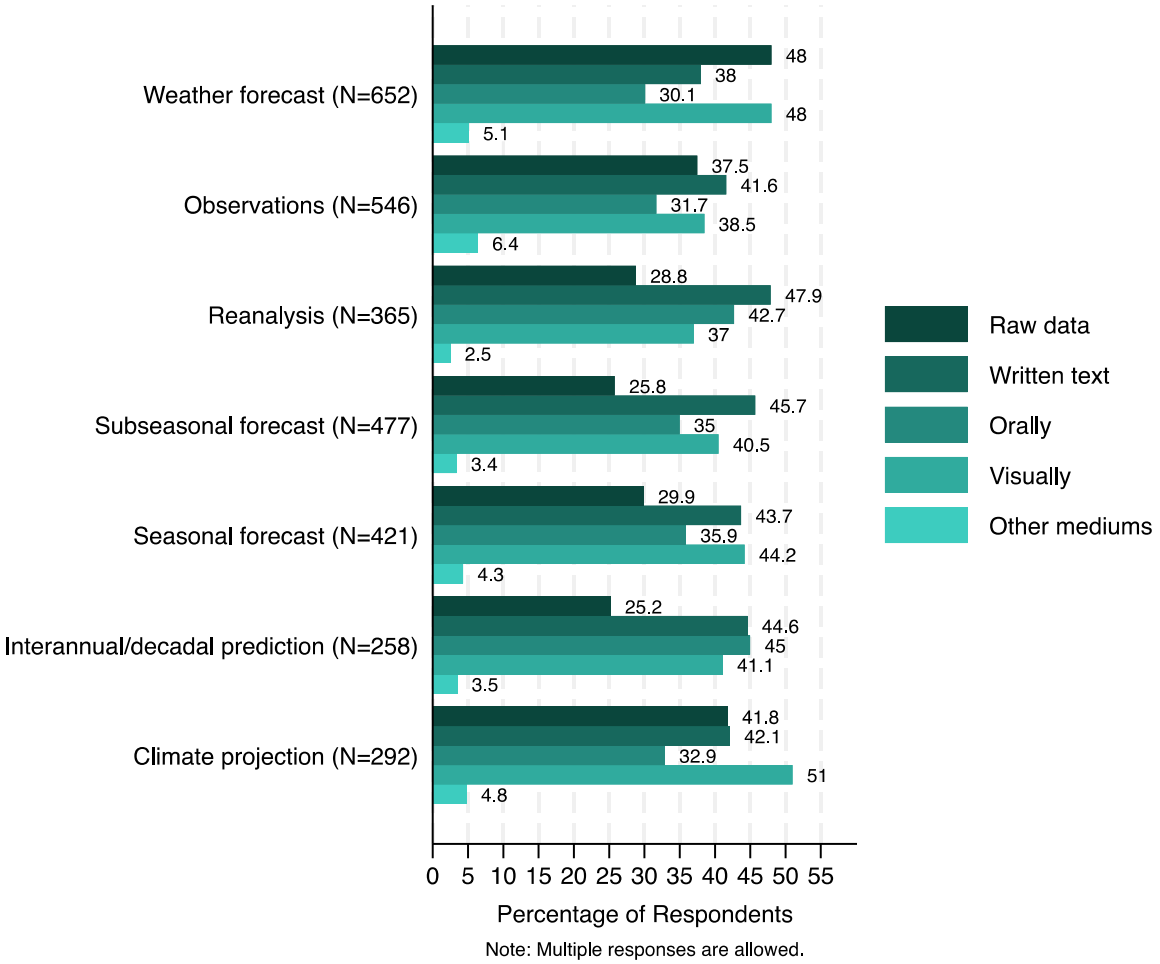


Figure 38: Communication of weather and/or climate information.

7.4 Frequency and payment

7.4.1 Frequency of use of weather and climate information

The results indicate that the majority of weather forecast users use them on a daily basis (Figure 39). Observations (weekly: 31%, monthly: 26.4%), reanalysis data (26.3%, 28.2%), and sub-seasonal forecasts (30.4%, 31.4%) are predominantly used on a weekly and monthly basis. Seasonal forecasts are most commonly used weekly (22.6%), monthly (31.8%), and every six months (23.5%). Overall, seasonal forecasts seem to be more versatile in terms of frequency of usage, indicating that they are used to inform decisions across various timescales.

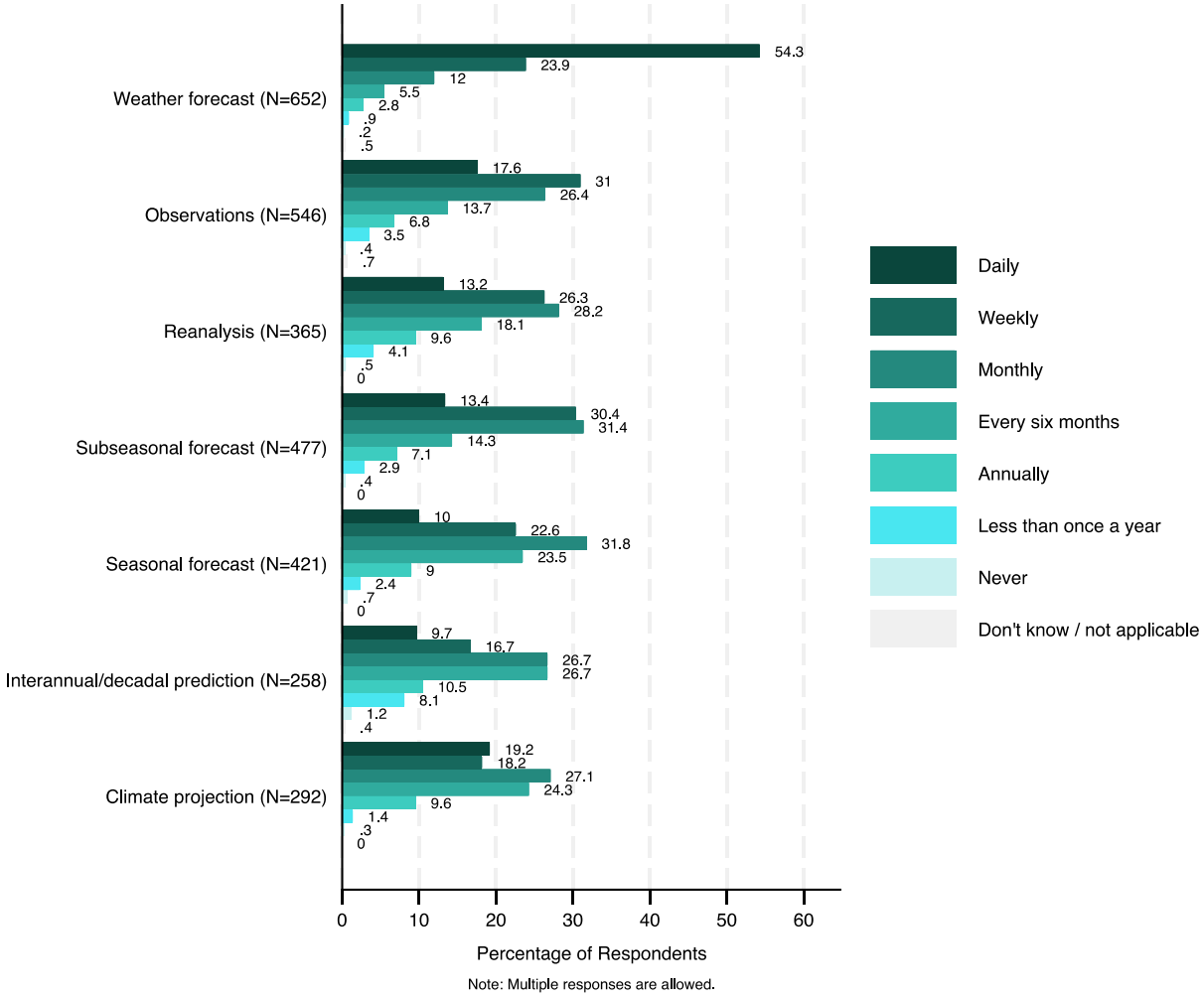


Figure 39: Frequency of use of weather and climate information.

7.4.2 Payment for weather and/or climate information

The results show that a **large majority of respondents' organisations (72%) pay for information**. Among them, 69% agree or strongly agree that the weather and/or climate information is affordable. Conversely, a quarter of respondents indicated that their organisations do not pay for weather and climate information.

7.5 Motivation to use

7.5.1 Drivers of weather and climate information use in climate-sensitive organisations

The drivers behind organisations' usage of weather and climate information were explored, allowing respondents to select multiple options. The results indicate that **respondents' organisations are most commonly driven by risks to human safety (36%) and public services** (34%) (Figure 40). Organisational risk assessment and management (31%) and experience of weather/climate-related impacts (30%) also play significant roles. Infrastructural

durability is another important driver, selected by 29% of respondents. However, all drivers were selected by at least 10% of respondents, highlighting a broad range of motivations for using weather and climate information.

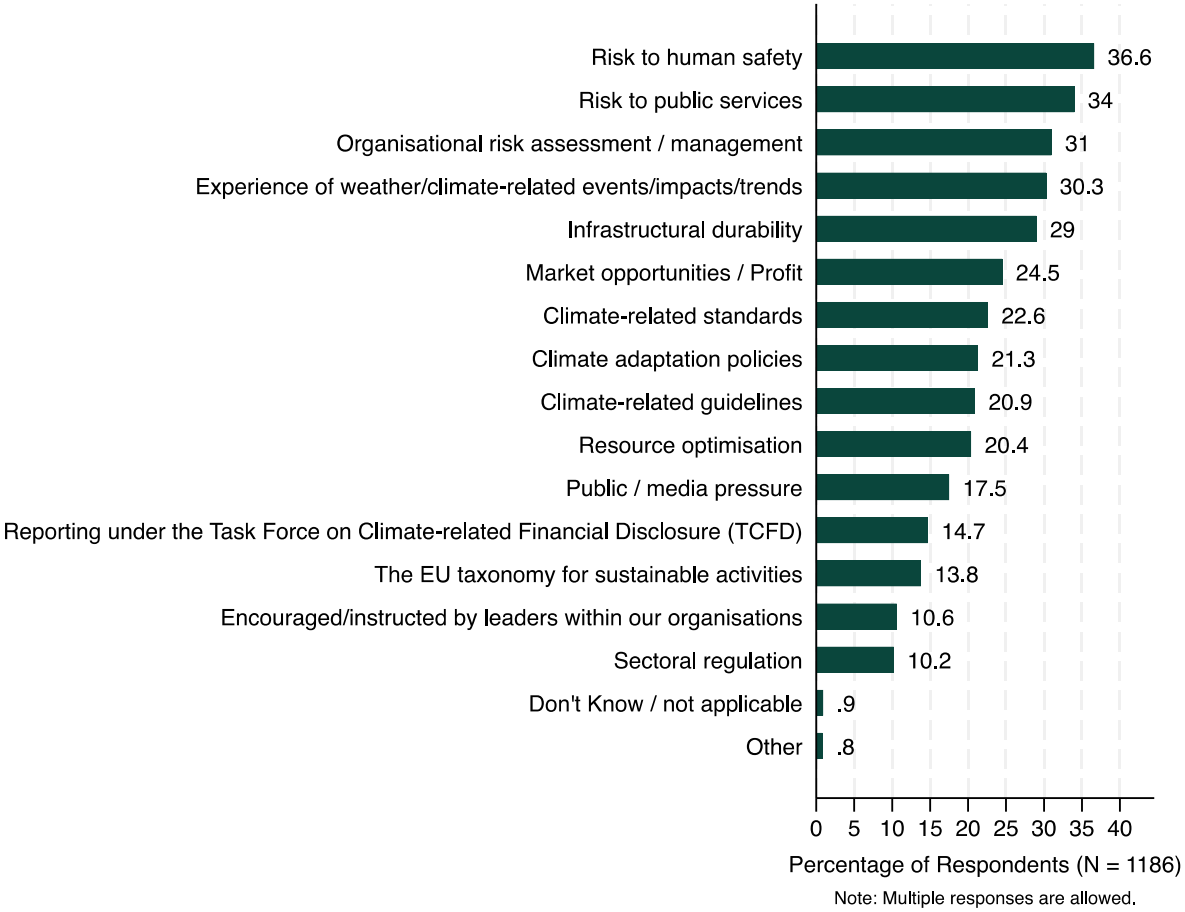


Figure 40: Drivers of weather and climate information use.

Figure 41 shows the correlation between the drivers of weather and climate information use and the drivers of CRM. The colours represent the percentage of respondents who selected the two drivers shown on the horizontal and vertical axes, relative to those who answered both questions (n=1074). For each axis, the drivers are sorted from left to right / bottom to top based on the ranking of the percentage of respondents selecting each driver. The numbers before the drivers' names indicate the ranking. For example, on the vertical axis, "01 Risk to human safety" indicates that "Risk to human safety" has the largest share of responses among all drivers of information use, as shown in Figure 40. It can be found that respondents who selected the top 5 drivers of information use are also more likely to choose the top 5 drivers of CRM. In particular, 22% of respondents agree that "Experience of weather/climate-related events/impacts/trends" is a key driver for both information use and CRM. Additionally, drivers such as climate-related guidelines, climate adaptation policies, and climate-related standards are also likely to impact the same group of respondents in both information use and CRM.

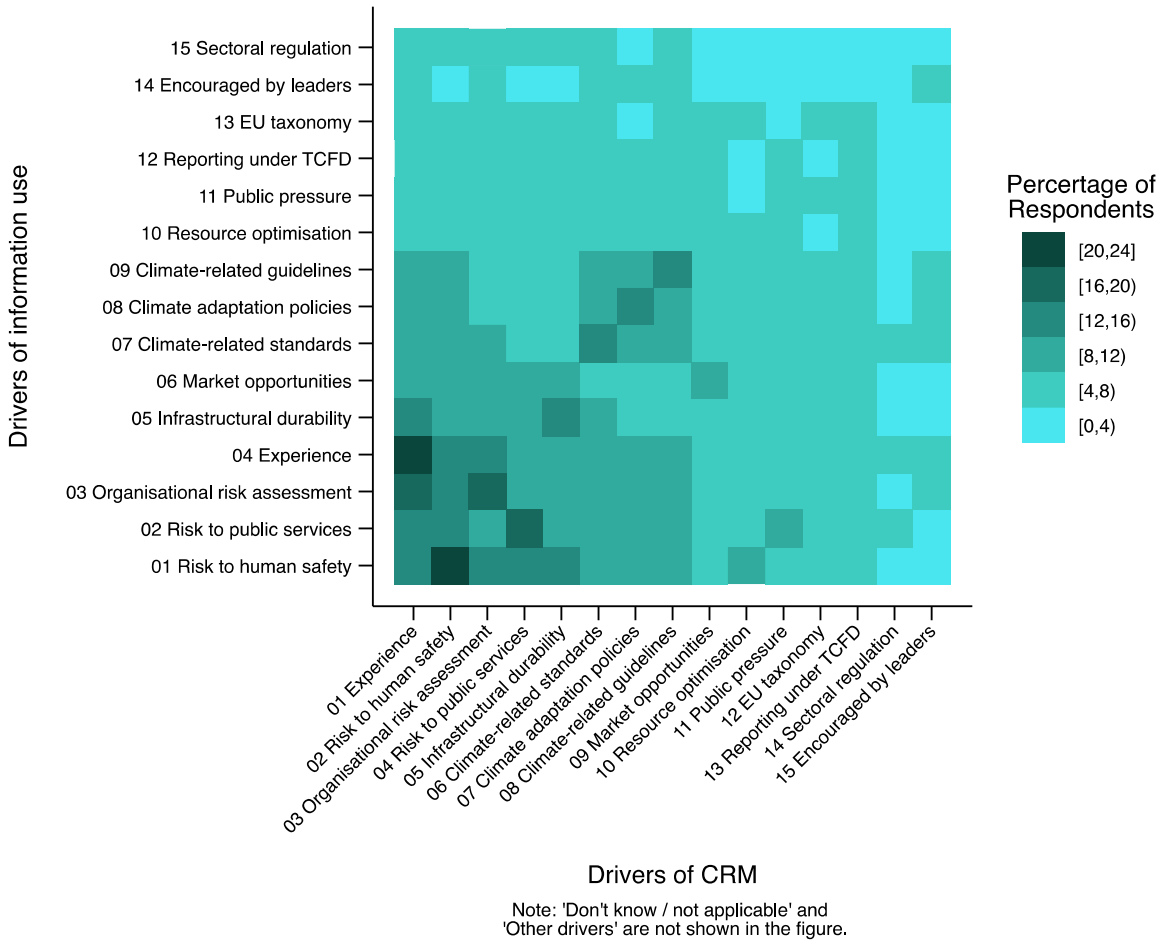


Figure 41: Correlation between drivers of weather and climate information use and drivers of CRM. For each axis, the drivers are sorted from left to right / bottom to top based on the ranking of the percentage of respondents selecting each driver. The numbers before the drivers' names indicate the ranking.

7.5.2 Organisational uses of weather and/or climate information

It was explored what respondents use this information for in their organisations, allowing for multiple selections. The results show diverse applications across various information types. Weather forecasts are predominantly used to inform risk management and day-to-day activities (Figure 42). **All other types of information, except weather forecasts, are primarily used for longer-term strategic planning.** Additionally, all seven types of information are more commonly analysed within organisations rather than by external entities.

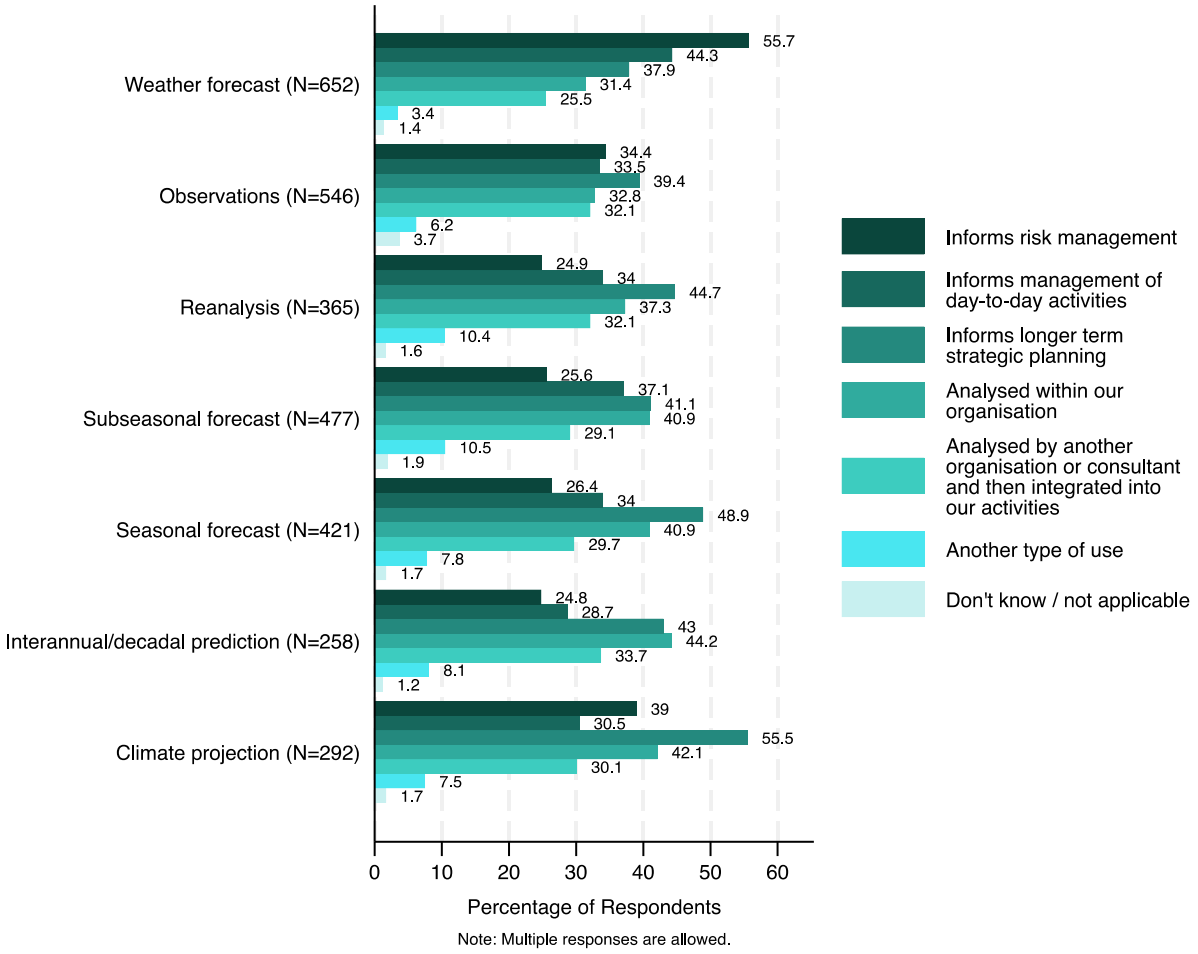


Figure 42: Use of weather and climate information in organisations.

7.5.3 Use of weather and climate information for specific events and trends

We explored respondents' usage of information for specific weather-related events, impacts, or long-term climate trends, allowing them to select multiple options. The results show that **respondents most commonly use this information for extreme heat events (28%) and heavy rainfall events (22%), indicating a strong focus on high impact events** (Figure 43). Information on long-term trends in temperature, cold spells/snaps and river floods is also widely used.

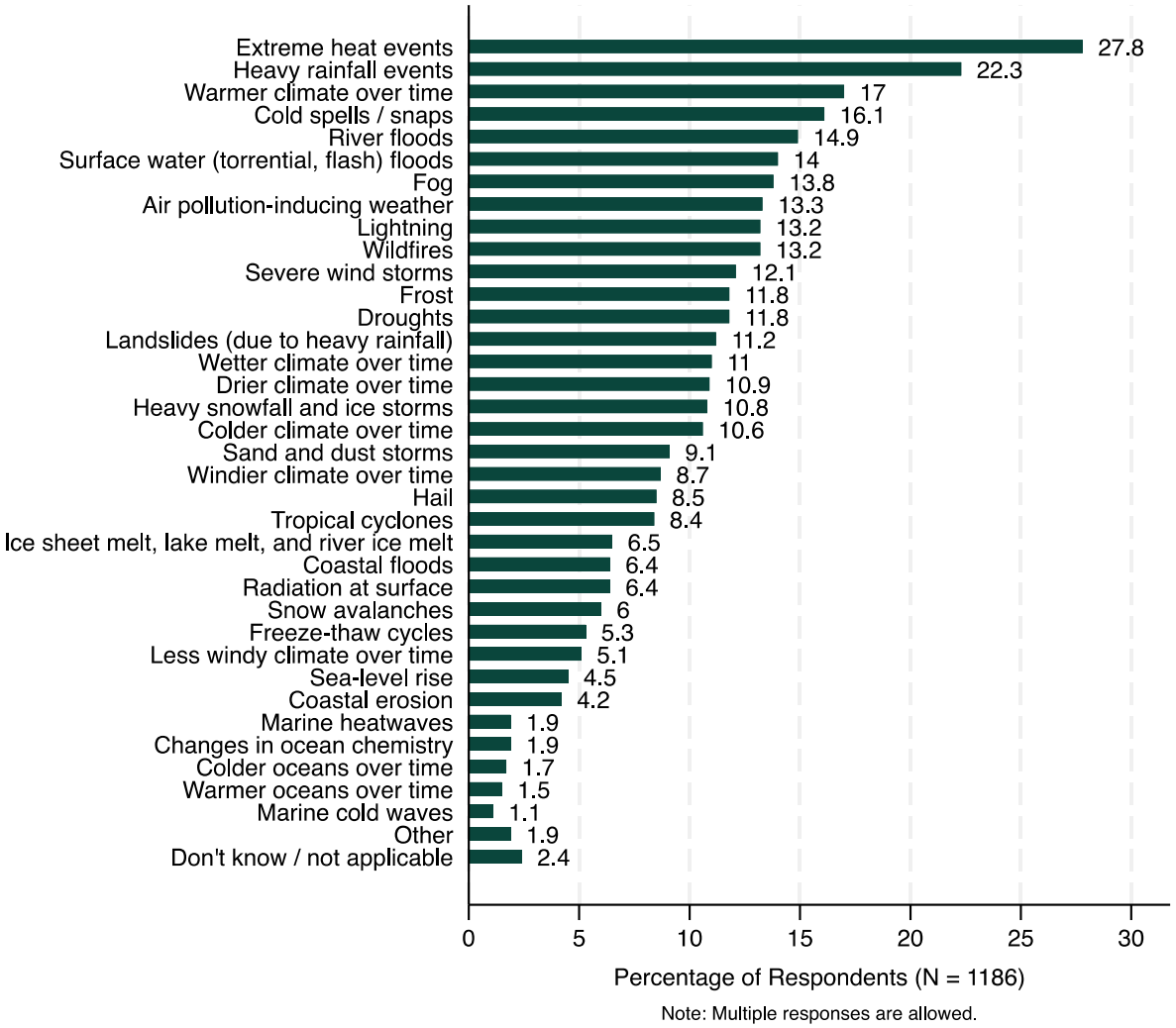


Figure 43: Use of weather and climate information for specific events and trends.

7.6 Evaluation of the information

7.6.1 Perception of weather and climate service quality

Organisations' perceptions of weather and climate service quality was explored by asking them to rate their level of agreement with 11 quality criteria on a scale of 1 to 5, where 1 represents "Strongly disagree," 3 represents "Neither agree nor disagree," and 5 represents "Strongly agree". Focusing on the share of respondents who agree or strongly agree, the results show that **a significant majority (70% or more) have a positive perception of the weather and climate information they use** across all service quality criteria. This is further supported by the low share of respondents who disagree or strongly disagree (12% or less). However, affordability stands out with relatively lower agreement and higher disagreement, indicating dissatisfaction among some respondents (Figure 44). Overall, the means and medians for all criteria were typically around 4, with a moderate level of variability (standard deviation typically between 0.9 and 1).

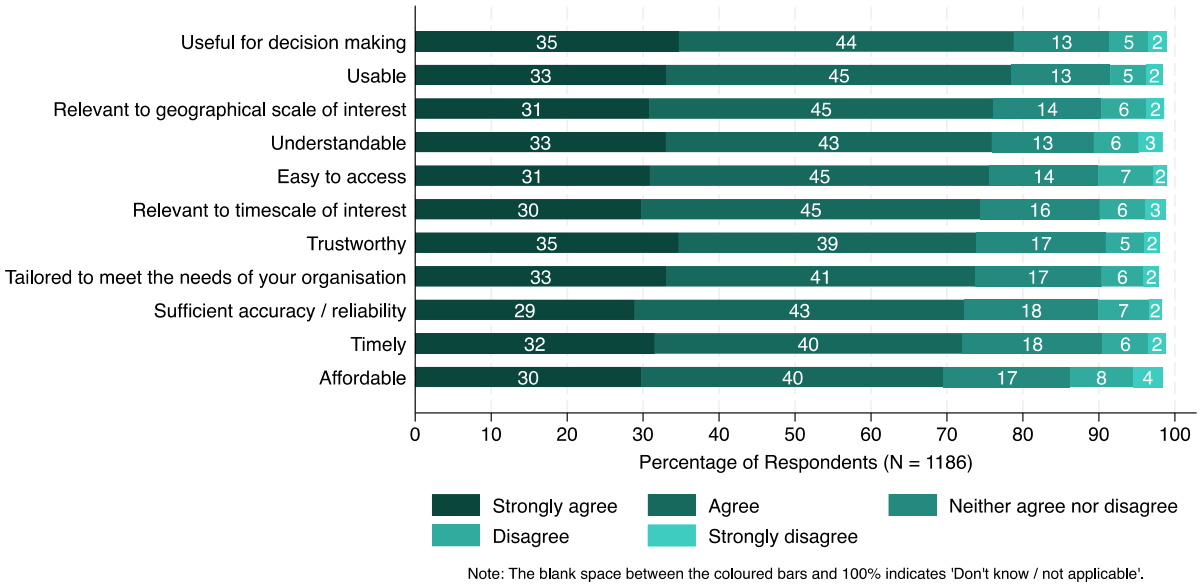


Figure 44: Perception of weather and/or climate service quality.

7.6.2 Level of confidence in the information being used

The results indicate that **the vast majority of respondents (71%) are confident or very confident in the information used by their organisation** (Figure 45). However, 23% of respondents are only somewhat confident, and 5% are not confident at all.

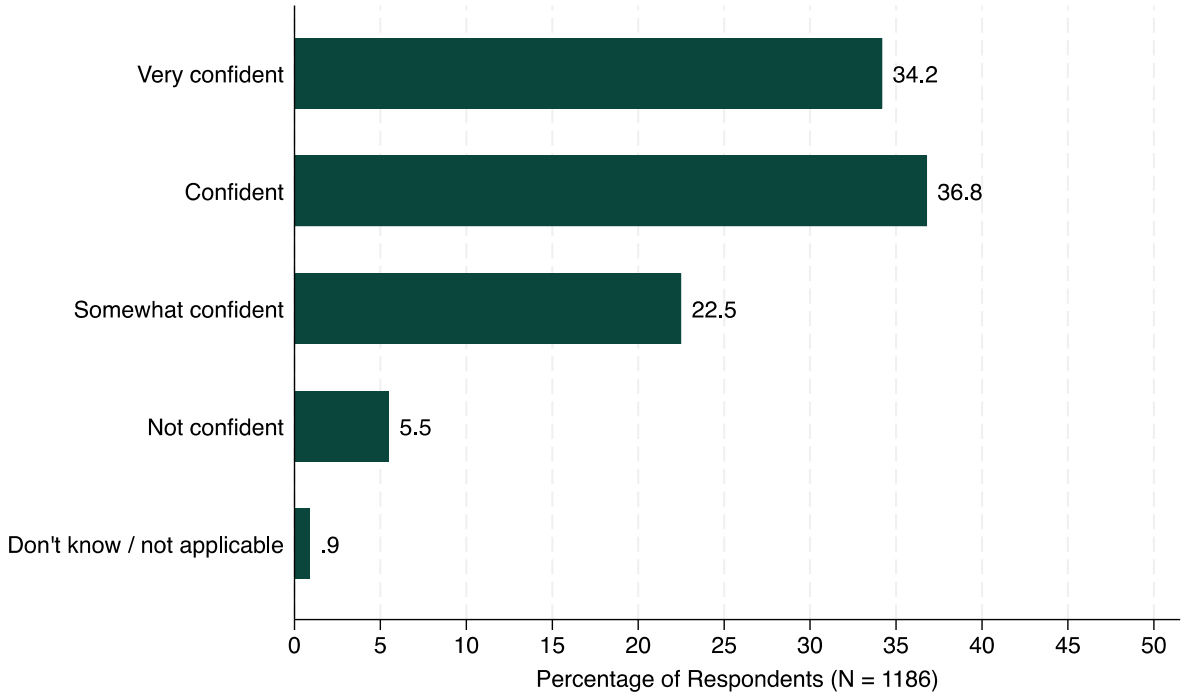


Figure 45: Level of confidence in the information being used.

7.7 Key findings

- Most participants reported using some form of weather or climate information in their work. Weather forecasts were the most frequently used followed by observations and subseasonal forecasts, with comparatively few indicating use of interannual predictions or climate projections.
- The CID's for which climate information is most commonly received are extreme heat and heavy rainfall, mirroring those to which the greatest negative sensitivity is reported.
- As with climate risk management more broadly, risk to human safety was the most frequently indicated driver of climate information usage.
- Weather information informs day-to-day activities while longer term information informs strategic planning.

The majority of participants indicated using weather information, with observations and sub-seasonal forecasts being the most frequently used forms of climate information. Meanwhile, comparatively few participants reported receiving interannual/decadal predictions or long-term climate projections. Given that interannual/decadal predictions are not as widely available, especially in climate service focussed products, as information from climate change projections, it is surmised that some participants did not distinguish between the two, viewing both as information related to years in the future. Nonetheless, it is important to note that while the uptake of interannual information is currently low, interannual timescales do align with the maximum planning horizons of a large proportion of organisations. As with the drivers of climate risk management, 'risk to human safety' was the most frequently selected driver of climate information usage, again highlighting the importance of direct risks to people in organisational decision making related to climate. There is broad consistency between the most common CIDs affecting organisations and the weather/climate information received, with high temperature and rainfall being the most frequently mentioned.

Analyses of how weather and climate information is currently used in decision-making is broadly in keeping with the findings of earlier surveys with climate information users (Bruno-Soares et al., 2018), which indicate that weather information is used to inform day-to-day operations, while longer-term climate information informs strategic planning. It is notable however that respondents in this survey reported using seasonal information in planning more often than in Bruno-Soares et al. (2018) (29.2% in this survey, while ~23% in Bruno-Soares's paper), in which the respondents were similar to ours in terms of sector of activity and geographical distribution. This may reflect the increase in accessibility to seasonal forecasting products over recent years.

8 What are unmet needs for climate information?

8.1 How do users think that current provision can be improved?

The most commonly suggested improvements include making the information easier to understand (34%) and more accurate and reliable (31%) (Figure 46). Respondents also emphasised the need for easier access, more timely availability, and tailoring the information to their organisation's geographical scale, timescale, and specific needs. Diverging from findings on affordability above, price was one of the least commonly suggested improvements.

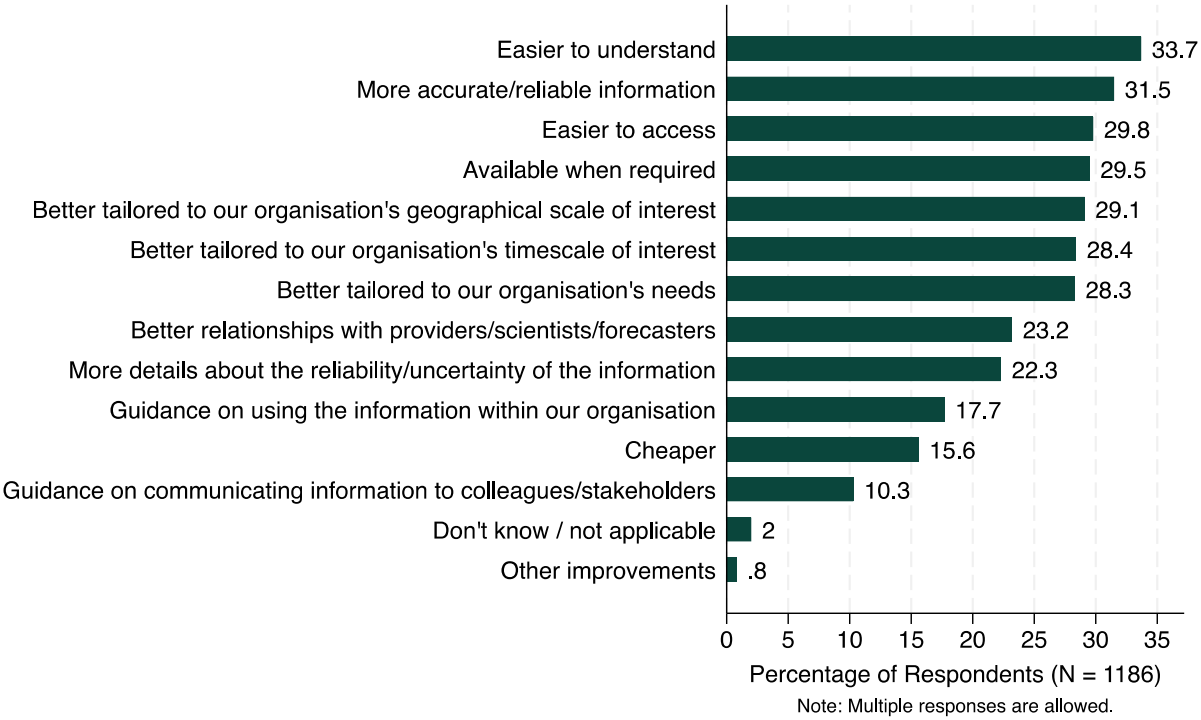


Figure 46: Areas of improvements in climate information/service.

8.2 Current non-users of weather or climate information

8.2.1 Reasons for disinterest in using weather and/or climate Information

For respondents not interested in using weather or climate information (n=127), the reasons behind their disinterest were explored, allowing for multiple options to be selected. ***The most commonly cited reason, was that the use of such information was not required in their role (55%)*** (Figure 47). Other reasons included expense (15%) followed by doubts about its usefulness (14.2%).

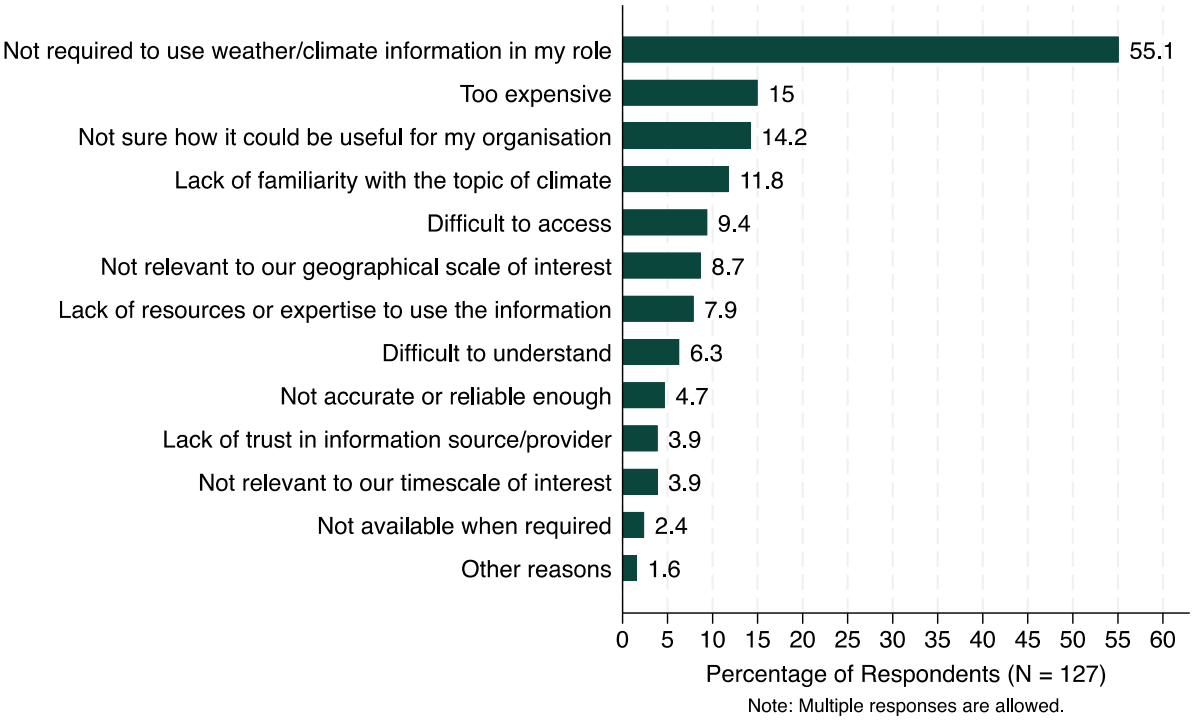


Figure 47: Reasons for disinterest in using weather or climate Information.

8.2.2 Interest in climate information among non-users and exclusive weather forecast users

Among those who do not currently use either weather or climate information (n=382), 52% indicated that they might need it in the future.

From the previous section's findings, it was also reported that ***17% of information users exclusively use weather forecast information***. These respondents (n=249) were asked a follow-up question about their interest in climate information, and 73% indicated that their organisation would be interested in this kind of information in the future.

Consequently, the vast majority (88%, including all current users, which make up 77% of the total samples, and 52% of current non-users) of survey respondents either already use or recognise the potential value of weather and/or climate information.

8.3 Current non-users who are interested in future usage

8.3.1 Interest in weather-related events and long-term climate trends

Non-users who had expressed interest in using climate information (n=379) were asked which weather-related events, impacts, or long-term climate trends they would like to receive more information about, allowing respondents to select multiple options. ***The most commonly requested topic was extreme heat events (33%)*** (Figure 48). This finding is consistent with respondents' identification of the most significant weather and climate-related event they

identified for their organisations, and also in line with the most selected event for which the weather and climate information is used among current users. Other significant areas of interest included heavy rainfall events (20%), cold spells/snaps (18%), severe wind storms (16%), air pollution-inducing weather (16%) and frost (16%).

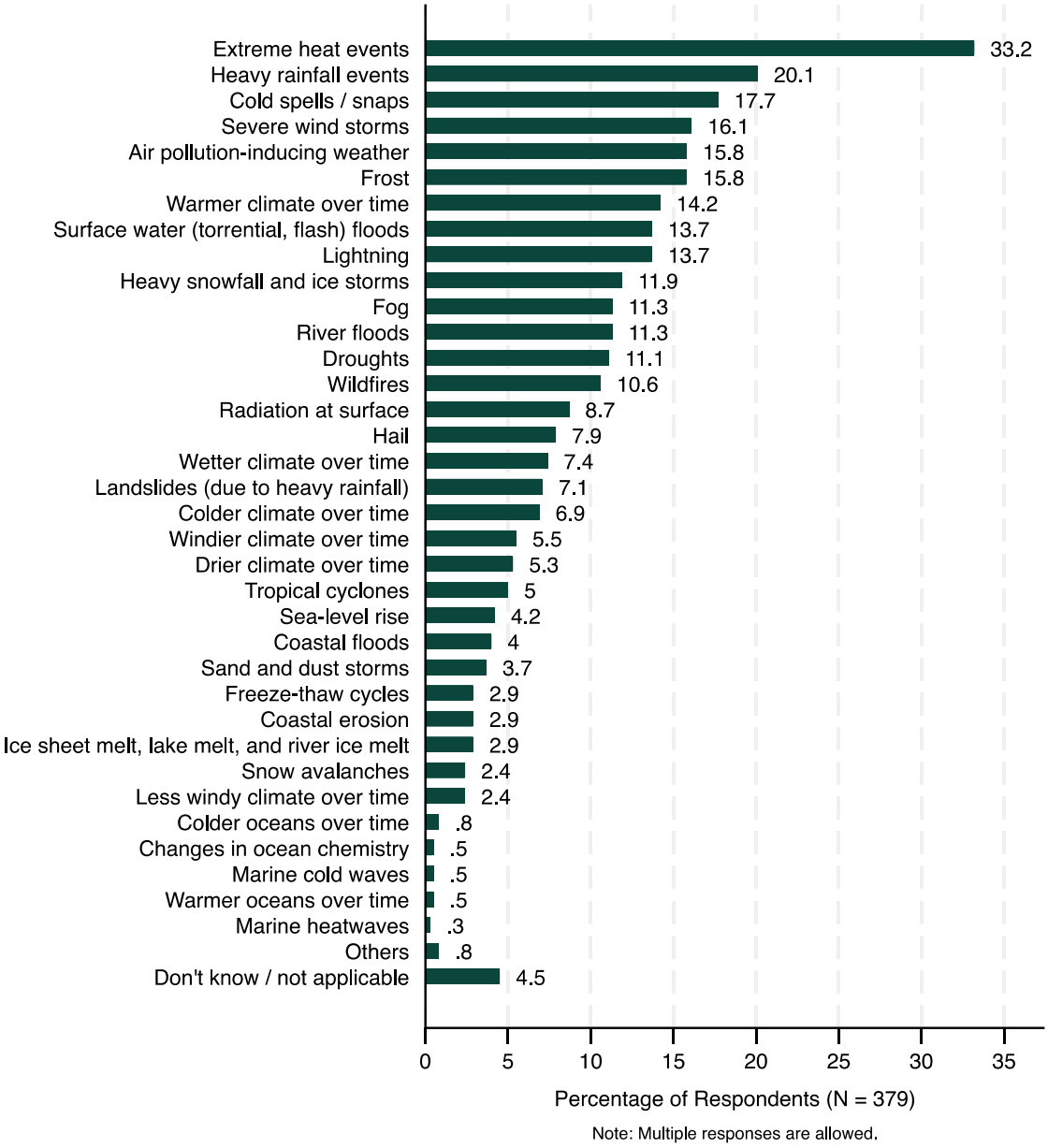


Figure 48: Interest in weather-related events and long-term climate trends.

8.3.2 Interest in climate information from current non-users within climate-sensitive organisations

Non-users of climate information who had expressed interest in using it in the future (n=379) were asked about the types of climate information their organisations would be interested in, allowing respondents to select multiple options. The most commonly cited types were

subseasonal forecasts (46%), observational data (40%) and seasonal forecasts (37%) (Figure 49). A smaller share of respondents expressed interest in climate projections (24%) and interannual/decadal predictions (17%).

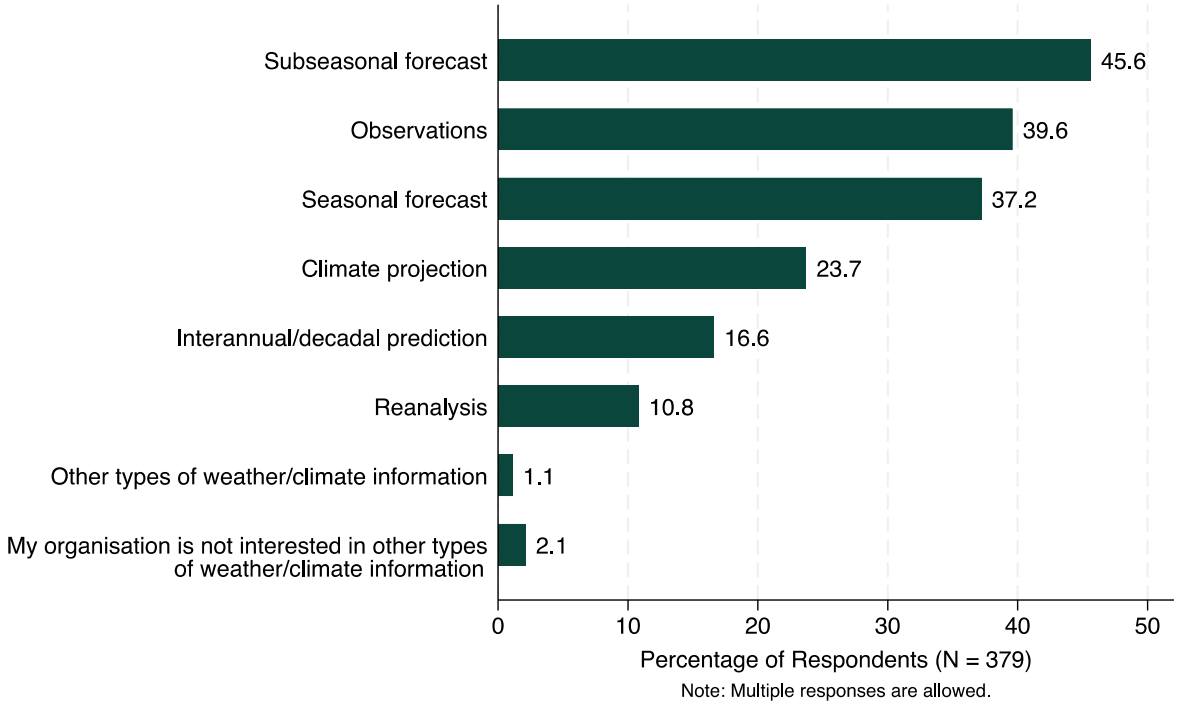


Figure 49: Interest in climate information from current non-users.

8.3.3 Preferred methods of communicating weather and climate information

Non-users who had expressed interest in using climate information (n=379) were asked how they would like weather and climate information to be communicated, allowing respondents to select multiple options. The ***most preferred method was visually (53%)***, followed by written text (45%), raw data (32%), and lastly oral communication (18%) (Figure 50).

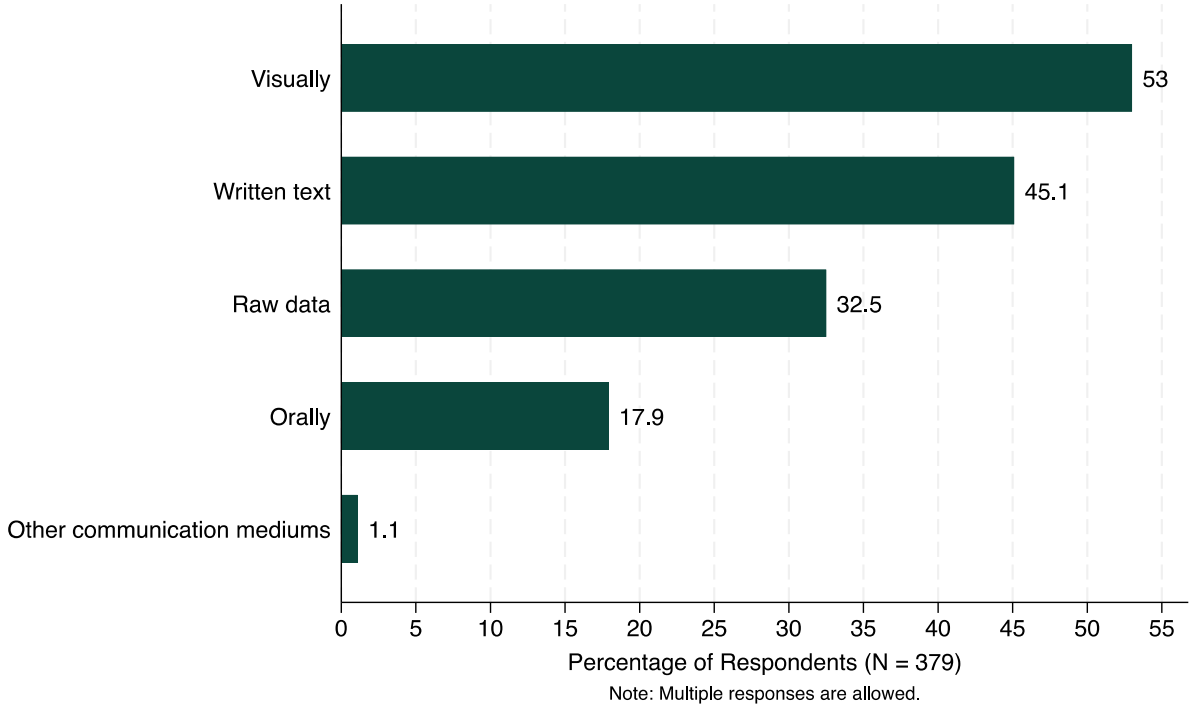


Figure 50: Preferred methods of communicating weather and climate information.

8.3.4 Barriers to using weather and climate information

Non-users who had expressed interest in using climate information (n=379) were asked to report their level of agreement with a list of potential barriers on a scale of 1 to 5, where 1 represents "Strongly disagree," 3 represents "Neither agree nor disagree," and 5 represents "Strongly agree". More than a quarter of the ***respondents agreed to some extent with all the barriers listed*** (Figure 51). While there wasn't a single predominant barrier, the most commonly agreed-upon issues included a **lack of resources or expertise to use the information** (46%) **and expense** (45%). As shown in Figure 47, "too expensive" and "not sure how it could be useful for my organisation" are the second- and third-most common reasons for respondents' lack of interest. Additionally, many respondents cited concerns about **accuracy and reliability** (43%) and a **lack of familiarity** with climate topics (42%). The reliability of information is also an important issue highlighted by current users (Figure 46). Overall, the means and medians for all criteria were typically around 3 (Neither agree nor disagree), with a moderate level of variability (standard deviation typically between 1 and 1.1).

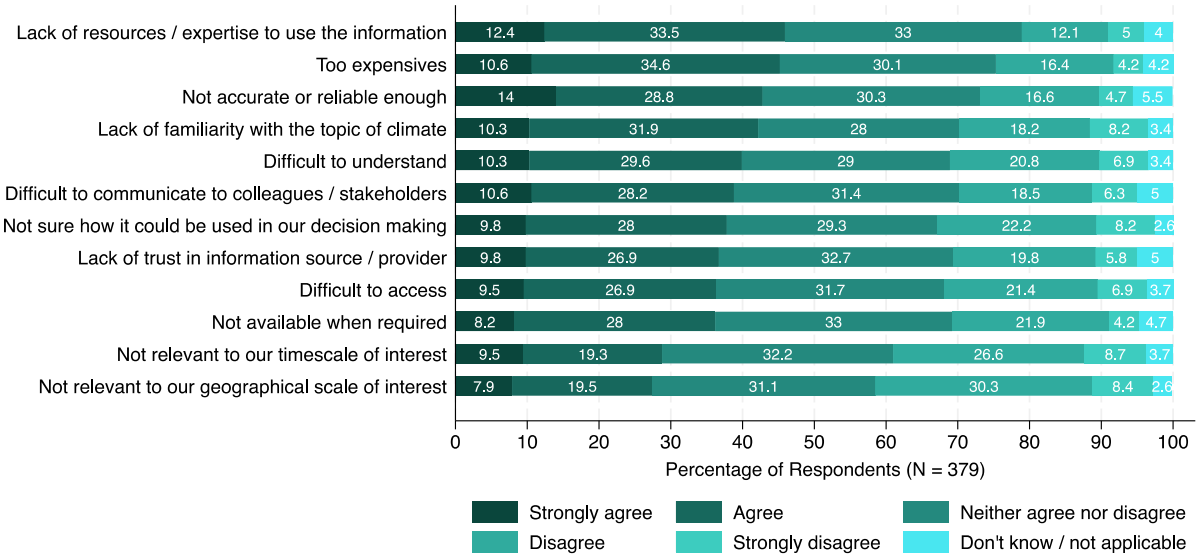


Figure 51: Barriers to using weather and climate Information.

8.4 Key findings

- Current users tend to rate the information they receive favourably, but understandability and accuracy were highlighted as key areas for improvement.
- Interested non-users commonly indicate lack of expertise, expense and concerns about accuracy/reliability as barriers to uptake.
- In considering potential future use of climate information non-users and those who currently only use weather forecasts predominantly expressed a wish to receive observations, sub-seasonal and seasonal information.
- While current users did not indicate a clear preference for specific communication formats, non-users indicate a preference for visualisations.

Although current users tend to rate the information they receive favourably, reporting relatively high confidence in interpretation, around a third indicated that they thought that it could be improved by being made easier to understand. A similar proportion also indicated a desire for more accurate/reliable information. While a dominant barrier to usage amongst interested non-users was not identified, a lack of expertise, expense and accuracy/reliability were the three barriers most commonly indicated, highlighting a potential lack of available training in how to use this information as well as concerns about quality.

With respect to unmet needs for climate information amongst non-users and those currently only receiving weather information, preferences for sub-seasonal and seasonal forecasts as well as observations are indicated, with CIDs aligning with those accessed by current users (i.e. temperature and rainfall), with windstorms being indicated slightly more often. While current users indicate information currently being received in multiple forms, interested non-users indicate a preference for visualisations.

9 Overall Discussion and Conclusions

This deliverable explores the climate sensitivity, climate risk management, climate information usage and the drivers of these amongst organisations in Europe, as well as barriers to use and unmet needs. The subsections below outline key findings and implications related to each of the five research questions.

9.1 How does concern about climate and weather risk compare with concern about other types of organisational risks?

This work highlights that physical climate and weather risks are of concern to a majority of climate sensitive organisations across Europe, though concern about climate risk tends to be interrelated with concern about other types of risk (economic, environmental, social, geopolitical, technological, transitional climate). This, along with associations between different organisational risks and sensitivity to types of CIDs, is indicative of interconnectedness of organisational risk, as well as physical climate having a compounding effect on other risks. With the interdependencies between climate, financial, geopolitical and health risks increasingly highlighted in the risk management literature (Hoffart et al., 2024, Zaitchik et al., 2022) and single hazard approaches tending to underestimate losses (Dunant et al., 2021), there is growing call for approaches for assessing complex cascading and compound events. Hence, those providing climate services to support risk assessment may wish to consider how their products might be integrated into emerging approaches for complex risk assessment (e.g. Simpson et al., 2021).

Key implications:

- Concern about physical climate risks is interlinked with concern about other types of risk, as is sensitivity to a range of CIDs.
- While climate services may principally provide information directly relevant to physical climate risks, providers should be aware of the interconnected nature of different types of organisational risk and the potential need for information to support assessments of compound and cascading risk.

9.2 How does weather and climate affect organisations in Europe?

Climatic impact drivers related to temperature and rainfall are indicated to be the most impactful overall, though amongst specific CIDs, heavy snow and air-pollution inducing weather also frequently affect organisations. This pattern is perhaps unsurprising given record-breaking heatwaves and accompanying air quality challenges in the two summers preceding the survey (Copernicus Climate Change Services, 2023), as well as regions experiencing higher than average precipitation (Copernicus Climate Change Service, 2023). Interestingly, ‘effects on people’ was the most frequently indicated organisational impact of climate and weather, followed by effects on processes. As might be anticipated however, there

were some differences in the organisational impacts of different types of climate impact driver, with 'impacts on people' being particularly strong for air-pollution inducing weather and high temperatures, while impacts on logistics featured more strongly with respect to heavy snow and ice storms. Likewise, the impact of time-bound extreme events such as heavy rainfall and snowfall, were reported to be felt at shorter timescales.

Key implications:

- Climatic impact drivers related to high temperatures and heavy rainfall identified as having the widest impact on organisations and were also most likely to be identified as a 'most impactful event', indicating potential areas of widest demand for climate information.
- Effects on people was the most frequently identified impact of climate and weather, particularly with respect to temperature and air pollution inducing weather. This suggests that decisions and planning regarding personnel management and workplace health may be under-explored when it comes to information for climate risk management.

9.3 What are the main drivers of climate risk management in organisations?

Consistent with 'effects on people' being the most identified impacts of climate and weather, 'risks to human safety' were identified as being one of the most frequently identified drivers of climate risk management. Prior experience was the most frequently cited driver of climate risk management. This is consistent with existing literature on risk perception and preparedness at an individual and organisational level (e.g. Appleby-Arnold et al., 2021, Dookie et al., 2024). Climate standards, guidelines and policy were indicated to be drivers by 20-25% of participants, with specific types such as TCFD (now replaced by IFRS S2) or the EU Taxonomy on Sustainable activities being indicated by comparatively few participants, suggesting that these are currently considered to be less important than direct effects of weather and climate on organisations and their activities.

With respect to climate risk preparedness, this analysis finds that larger organisations and those with a maximum planning horizon of more than two-years are more likely to pre-designed plan to manage climate and weather events or trends. Following a pre-designed plan for dealing with weather and climate events was also more commonly reported by respondents in eastern and northern Europe.

Key Implications:

- As experience and safety of people are the two most frequently reported drivers of climate risk management, contextualising climate services in relation to risks to human safety may, in some cases at least, be more effective in engaging with potential users than highlighting compliance with climate related standards or policy.
- Larger organisations and those with longer planning horizons are more likely to have defined climate risk management plans. Hence, climate information usage may have

more formalised integration into decision making in these organisations, but less so in smaller organisations with shorter planning horizons.

9.4 To what extent do organisations currently use weather and/or climate information?

Most respondents indicated that they used some form of climate or weather information, with weather forecast being the most frequently used. This was followed by observations, sub-seasonal and seasonal respectively, with comparatively fewer participants indicating that they received information for longer timescales. Even amongst those who reported using longer term information, it was noted that participants may not distinguish between interannual climate predictions and long-term climate projections. Reported usage of weather and climate information was broadly consistent with prior findings that weather forecasts inform day-to-day decision making while information at longer timescales is used for longer term planning (Bruno Soares et al., 2018), though in this case longer term strategic planning was emphasised for seasonal forecasts.

There was broad consistency between the types of CIDs most affecting organisations and those that they received information about, with high temperatures and rainfall/flooding events predominating. Likewise, the drivers of climate information use mirrored the drivers of climate risk management, with risks to human safety, risk to public services, risk management and experience being the most frequently identified drivers.

Key Implications:

- While longer-term climate information does not appear to be commonly used at present, it is notable that interannual information could potentially link to the planning horizons of many organisations. However, many potential users are likely unaware of the distinction between interannual predictions and climate projections.
- The drivers of climate risk management tend to correspond with the drivers of climate information usage. Hence, climate information providers should be aware that maintaining human safety is a key objective of climate information use in operations and planning. As experience is another key driver, linking information provision to past events (e.g. how conditions compare to past impactful events) may be another useful tool for engagement and communication.

9.5 What are unmet needs for climate information?

While current climate information users tended to report being satisfied with current provision and generally confident in using it, the most commonly selected ‘areas for improvement’ related to ease of understanding and greater accuracy/reliability. This was broadly reflected in perceived barriers to climate information use by interested non-users, who highlighted a lack of expertise and accuracy as key barriers. This focus on accuracy/reliability resonates with earlier work assessing barriers and enablers to the usage of climate information (Bruno-Soares and Dessai, 2016), though in this case the emphasis on capability to use is emphasised. This emphasises the need for resources, such as those to be developed through

the ASPECT project, to provide training and guidance on how to how to access and interpret climate information to be made readily accessible to those in climate sensitive organisations.

In terms of specific unmet needs, interested non-users (including those who currently use weather but not climate information) tended to express a wish for similar CIDs to current users (e.g. often related to extremes of temperature). While current users reported receiving information in a range of different formats, interested non-users expressed an overall preference for visual communication formats.

Key implications:

- Greatest demand exists for information about extreme temperatures and heavy rainfall, with observations, sub-seasonal and seasonal information receiving the strongest interest from those not currently using climate information.
- Understandability of information and perceived lack of expertise appear to be a consistent barrier to use (or usage that is as effective as possible). Development of training modules that could be deployed online, could help to address this. Likewise drawing and building on existing insights from the fields of risk communication on how to communicate information to non-experts or specialists in different fields is important for ensuring that information is understood as intended (e.g. Bruine de Bruin and Bostrom, 2013).
- Climate information providers should note a broad preference for visual formats of communication amongst interested non-users. However, it should be kept in mind that preferences for formats does not always correspond with comprehension (e.g. Lorenz et al., 2015). Hence, ensuring that graphical formats address both user preferences and comprehension is important. The extent to which infographics and interactive formats could be used alongside more traditional diagrams and maps represents an area for further exploration.

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Appendix I: Survey Protocol

Information sheet for respondents
Introduction
You have been invited to participate in a research project titled Adaptation-oriented Seamless Predictions of European ClimaTe (ASPECT).

Who is this survey for?
The survey is targeted at individuals who work in organisations that are weather- or climate-sensitive and who have either used or could potentially use weather/climate information.

What are the questions about?
This survey is interested in organisations' perceptions of weather/climate risk, decision making, information use, and unmet needs.

Why are we asking these questions?
The results from this survey will help inform climate prediction research and operations in Europe. Better provision of climate information could help your organisation and sector, and ultimately make Europe more resilient to climate variability and change.

How long will it take to complete?
It will take you approximately 15 minutes to complete.

What will we do with your data?
No personally identifiable data will be collected, and your responses will be anonymised. We believe there are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability your participation in this study will remain confidential, and only anonymised data will be published.

Thank you for taking the time to read through this information.

Contact for further information.
Research Fellow: Dr Sam Grainger, School of Earth and Environment, University of Leeds, UK. (S.Grainger@leeds.ac.uk)
Project Investigator: Prof Suraje Dessai, School of Earth and Environment, University of Leeds, UK. (S.Dessai@leeds.ac.uk)

This survey is conducted by the University of Leeds, as funded by Innovate UK and the EU Framework Programme for Research and Innovation 2021-2027 (Horizon Europe) through the ASPECT project.

- Please tick the box below if you would like to participate in the survey. If you do not want to participate in the survey, close the browser tab to exit.

Protocol (Median length - 15 mins)

Section A: Screening question

1. Are your organisation's activities sensitive to weather/climate or its impacts in some way (e.g., in your operations, supply chains, long-term planning)? [Choose one]
    a. Yes
    b. No [SURVEY ENDS]
    c. Don't know / not applicable [SURVEY ENDS]

2. Which category best describes your primary role/position in the organisation? [Choose one]
    a. Owner
    b. Director
    c. Senior Manager
    d. Junior Manager
    e. Planner
    f. Policy-maker
    g. Analyst
    h. Engineer
    i. Scientist/researcher
    j. Technician
    k. Assistant [SURVEY ENDS]
    l. Apprentice [SURVEY ENDS]
    m. Intern / volunteer [SURVEY ENDS]
    n. Other (please give details)

3. How many years of professional experience do you have in your organisation's sector? [Choose one]
    a. Less than 1 year [SURVEY ENDS]
    b. 1-5 years
    c. 6-10 years
    d. 11-15 years
    e. 16-20 years
    f. More than 20 years

Section B: Organisational background

1. Please select the European country in which your organisation is primarily located. [Choose one]

Not applicable (e.g., my organisation does not predominantly operate in one European country)	
Albania	
Andorra	
Armenia	
Austria	
Azerbaijan	
Belarus	
Belgium	
Bosnia and Herzegovina	
Bulgaria	
Croatia	
Cyprus	
Czechia	
Denmark	
Estonia	
Finland	
France	
Germany	
Georgia	
Greece	
Hungary	
Iceland	
Ireland	
Italy	
Kazakhstan	
Latvia	
Liechtenstein	

Lithuania	
Luxembourg	
Malta	
Moldova	
Monaco	
Montenegro	
Netherlands	
North Macedonia	
Norway	
Poland	
Portugal	
Romania	
Russia	
San Marino	
Serbia	
Slovakia	
Slovenia	
Spain	
Sweden	
Switzerland	
Türkiye	
Ukraine	
United Kingdom	
Vatican City	

2. What is the geographical scale of your organisation's operations? [Choose one]
    a. Local e.g., District/town/city
    b. Sub-national e.g., Region/province/county
    c. National
    d. Multiple European countries
    e. Global
    f. Other (please give details)

RESTRICTED TO THOSE ANSWERING E TO Q. B2

3. In which of the following continents does your organisation also operate? [Multiple options may be selected]
    a. Asia
    b. Africa
    c. North America
    d. South America
    e. Australasia / Oceania
    f. Antarctica

4. How would you classify your organisation? [Choose one]
    a. Private sector: Multi-national
    b. Private sector: National
    c. Private sector: Regional/local
    d. Public sector: National-level governmental organisation (e.g., directorate, agency, department)
    e. Public sector: Sub-national level governmental organisation (e.g., local government/local authority, municipality)
    f. Semi-public / Public-private partnership / Public enterprise
    g. Third Sector (e.g., non-profit making, NGOs)
    h. International organisation (e.g., United Nations agency, European Commission)
    i. Other (please give details)

5. How would you classify your organisation's main sector(s) of activity? [Multiple options may be selected]
    a. Agriculture, Forestry and Fishing
    b. Mining and Quarrying
    c. Manufacturing
    d. Electricity, Gas, Steam and Air Conditioning Supply
    e. Water Supply, Sewerage, Waste Management and Remediation Activities
    f. Construction
    g. Wholesale and Retail Trade
    h. Transportation and Storage
    i. Accommodation and Food Service Activities
    j. Information and Communication
    k. Financial and Insurance Activities

l. Real Estate Activities
m. Professional, Scientific and Technical Activities
n. Administrative and Support Service Activities
o. Public Administration and Defence; Compulsory Social Security
p. Education
q. Human Health and Social Work Activities
r. Arts, Entertainment and Recreation
s. Other Service Activities
t. Activities of Households as Employers
u. Activities of extraterritorial organisations and bodies
v. Others (please give details)

6. Please estimate how many individuals are employed in your organisation: [Choose one]
    a. Fewer than 10 employees
    b. Between 10 and 49 employees
    c. Between 50 and 249 employees
    d. More than 250 employees

7. Are you involved in any aspect of organisational planning and/or decision making? [Choose one]
    a. Yes
    b. No [SKIP TO SECTION C]

8. When needing to make **important decisions** that can't be changed easily (e.g., where to be located or build new premises, or make big new investments), how far into the future does your organisation tend to plan at most? [Choose one]
    a. Less than a month
    b. Between 1 month and 6 months
    c. Between 6 months and 1 year
    d. Between 1 and 2 years
    e. Between 2 and 5 years
    f. Between 5 and 10 years
    g. Between 10 and 50 years
    h. More than 50 years
    i. Don't know / not applicable.

9. Does your organisation follow any climate-related policies, regulations, standards and/or guidelines? [Multiple options may be selected]
    a. Climate adaptation policies
    b. Climate-related standards
    c. Climate-related guidelines
    d. EU taxonomy for sustainable activities

e. Task Force on Climate-related Financial Disclosure (TCFD)
f. ISO 14090:2019 Adaptation to climate change
g. Others (please give details)

h. No
i. Don't know / not applicable.

Section C: Wider organisational risks

1. To what extent is your organisation concerned about the following risks? [Tick one box per row]

Risks	Not concerned at all	Not very concerned	Fairly concerned	Very concerned	Don't know / not applicable
Economic (e.g., recession, inflation, supply chain disruption)					
Environmental (e.g., ecosystem collapse, resource scarcity, non-climatic natural disasters)					
Social (e.g., high living costs, involuntary migration, labour shortages, pandemics)					
Climate (e.g., extreme weather events, climate change)					
Geopolitical (e.g., trade wars/sanctions, ineffective international cooperation, interstate conflict)					
Technological (e.g., cyber insecurity, Adverse outcomes of AI)					
The effects of government policies to reduce greenhouse gas emissions (e.g., Net Zero targets)					

Section D: Weather and climate risk management / adaptation

1. Are your organisation's activities affected by any of the following? [Optional] [Multiple options may be selected]
    a. Hot and/or cold temperatures (e.g., extreme heat; cold spells; wildfires)
    b. Wet and/or dry conditions (e.g., heavy rainfall; floods; drought)
    c. Wind (e.g., storms; tropical cyclones)

d. Snow and ice (e.g., heavy snowfall; hail)
e. Coastal change (e.g., sea-level rise; coastal flooding)
f. Ocean change (e.g., marine heatwave)

If 'Hot and/or cold temperatures' selected:

A. You have indicated that your organisation is affected by [Hot and/or cold temperatures]. Please indicate the extent to which your organisation is positively or negatively affected by the following: [Tick one box per row]

Hot and cold	Completely negative	More negative than positive	Neither positively nor negatively affected	More positive than negative	Completely positive	Don't know / not applicable
Extreme heat events Cold spells / snaps Frost Wildfires Warmer climate over time Colder climate over time						

Repeat this question for each climate risk group reported as positively or negatively affected in some way in Q1 (col. 1,2,4,5)

B.

Wet and dry	Completely negative	More negative than positive	Neither positively nor negatively affected	More positive than negative	Completely positive	Don't know / not applicable
Droughts Heavy rainfall events River floods Surface water (torrential, flash) floods Landslides (due to heavy rainfall) Wetter climate over time Drier climate over time						

C.

Wind	Completely negative	More negative than positive	Neither positively nor negatively affected	More positive than negative	Completely positive	Don't know / not applicable
Severe wind storms Tropical cyclones Sand and dust storms Windier climate over time Less windy climate over time						

D.

Snow and ice	Completely negative	More negative than positive	Neither positively nor negatively affected	More positive than negative	Completely positive	Don't know / not applicable
Heavy snowfall and ice storms Hail Ice sheet melt, lake melt, and river ice melt Snow avalanches Freeze-thaw cycles						

E.

Coastal change	Completely negative	More negative than positive	Neither positively nor negatively affected	More positive than negative	Completely positive	Don't know / not applicable
Coastal floods Coastal erosion Sea-level rise						

F.

Ocean change	Completely negative	More negative than positive	Neither positively nor negatively affected	More positive than negative	Completely positive	Don't know / not applicable
Marine heatwaves Marine cold waves Warmer oceans over time Colder oceans over time Changes in ocean chemistry						

G. To what extent is your organisation positively or negatively affected by the following?

	Completely negative	More negative than positive	Neither positively nor negatively affected	More positive than negative	Completely positive	Don't know / not applicable
Fog Lightning Air pollution-inducing weather Radiation at surface						

H. Please give details of any other types of weather-related events/impacts or long-term climate trends that affect your organisation positively or negatively. [Optional]

2. Of these weather-related events/impacts or long-term climate trends, which has been the **most significant** for your organisation in the last three years? [Choose one]

Only show events/impacts/trends reported as positively or negatively affected in Q2 (col. 1,2,4,5)

a. Extreme heat events
b. Cold spells / snaps
c. Frost
d. Wildfires
e. Warmer climate over time
f. Colder climate over time

g. Droughts
h. Heavy rainfall events
i. River floods
j. Surface water (torrential, flash) floods
k. Landslides (due to heavy rainfall)
l. Wetter climate over time
m. Drier climate over time
n. Severe wind storms
o. Tropical cyclones
p. Sand and dust storms
q. Windier climate over time
r. Less windy climate over time
s. Heavy snowfall and ice storms
t. Hail
u. Ice sheet melt, lake melt, and river ice melt
v. Snow avalanches
w. Freeze-thaw cycles
x. Coastal floods
y. Coastal erosion
z. Sea-level rise
aa. Marine heatwaves
bb. Marine cold waves
cc. Warmer oceans over time
dd. Colder oceans over time
ee. Changes in ocean chemistry
ff. Fog
gg. Lightning
hh. Air pollution-inducing weather
ii. Radiation at surface
jj. Other weather-related events / impacts or long-term climate-related trends (please give details)

kk. Don't know / not applicable

3. How did this **most significant** event, impact or trend impact your organisation? [Multiple options may be selected]
    a. Logistics (e.g., own transport)
    b. External logistics (e.g., supply chains, utilities and outsourced transport)
    c. Your premises (e.g., maintenance, facilities management or buildings)
    d. People (e.g., your workforce or customers)
    e. Processes (e.g., production or service delivery)
    f. Finance (e.g., investment and stakeholder reputation)
    g. Markets (e.g., changing demand for goods and services or increase of supply prices)
    h. Insurance costs

i. Others (please give details)

j. Don't know / not applicable

4. How long did it take to feel this impact on your organisation? [Choose one]
   a. Days to weeks
   b. Months, up to a year
   c. One year or more
   d. Another time period (please give details)
   e. Don't know / not applicable

5. What did your organisation do to manage this event, impact or trend? [Choose one]
   a. We followed a pre-designed plan to manage impacts.
   b. We did not have a plan and did not do anything to manage impacts.
   c. We did not have a plan, but we took actions to manage impacts.
   d. We did not have a plan, but we took actions to manage impacts and then developed a plan to cope with future events.
   e. Another response (please give details)
   f. Don't know / not applicable

6. Is your organisation actively trying to manage weather/climate risk?[Choose one]
   a. Yes
   b. No
   c. Don't know / not applicable

Show this question only to those answering 'Yes' to Q.D6

7. What is driving weather/climate risk management (adaptation) in your organisation? [Multiple options may be selected]
   a. Experience of weather/climate-related events, impacts or trends
   b. Organisational risk assessment / management
   c. Infrastructural durability
   d. Risk to public services
   e. Risk to human safety
   f. Market opportunities / profit
   g. Public / media pressure
   h. Reporting under the Task Force on Climate-related Financial Disclosure (TCFD)
   i. Resource optimisation
   j. The EU taxonomy for sustainable activities
   k. Climate adaptation policies
   l. Climate-related standards

m. Climate-related guidelines
n. Sectoral regulation
o. Encouraged/instructed by leaders within our organisation
p. Other drivers (please give details)

q. Don't know / not applicable

Section E: Using weather/climate information

1. Do you currently use weather/climate information in your role? [Choose one]
    a. Yes
    b. No
    c. Don't know / not applicable

Show this question only to those answering 'No' or 'Don't know / not applicable' to Q.E1

2. Could you potentially use weather/climate information in your role in the future? [Choose one]
    a. Yes SKIP TO SECTION G
    b. No
    c. Don't know / not applicable END SURVEY

Show this question only to those answering 'No' to Q.E2 and then END SURVEY

3. Why are you not interested in using weather/climate information? [Multiple options may be selected]
    a. Not required to use weather/climate information in my role.
    b. Lack of familiarity with the topic of climate.
    c. Not sure how it could be useful for my organisation.
    d. Too expensive.
    e. Difficult to access.
    f. Not available when required.
    g. Difficult to understand.
    h. Not relevant to our timescale of interest.
    i. Not relevant to our geographical scale of interest.
    j. Lack of trust in information source/provider.
    k. Not accurate or reliable enough.
    l. Lack of resources or expertise to use the information.
    m. Other reasons (please give details)

4. What types of weather/climate information do you use? [Multiple options may be selected] *Note: Some of these terms may not be familiar to you.*

a. Weather forecast (Forecasts of the weather from hours up to 10 days in the future) [IF ONLY SELECTED, SKIP TO SECTION F]
b. Observations (Historical data from weather stations and/or satellites)
c. Reanalysis (Historical data combining models and observations)
d. Subseasonal forecast (Forecasts of the weather from 2 weeks to 2 months in the future)
e. Seasonal forecast (Expected climate outlook for the next season(s))
f. Interannual/decadal prediction (Expected climate outlook for the next 1-10 years)
g. Climate projection (Expected climate trends over the coming decades)
h. Other types of weather/climate information (please give details) [IF ONLY SELECTED, SKIP TO SECTION F]

5. How is weather/climate information communicated to you? [Multiple options may be selected]

Types of information	Raw data (e.g., database / spreadsheet)	Written text (e.g., reports, emails)	Orally (e.g., conversation, presentation from the provider)	Visually (e.g., data charts, maps, graphics, images)	Other communication mediums
Relate this to Q4 (only those types they use)					
If other communication mediums, please give details [Optional]					

6. To what extent would you consider the weather/climate information you use to be:

Please rate your level of agreement with the statements below

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Don't know / not applicable
Affordable						
Easy to access						
Timely						
Understandable						
Relevant to timescale of interest						
Relevant to geographical scale of interest						
Trustworthy						

Sufficient accuracy / reliability						
Usable						
Useful for decision making						
Tailored to meet the needs of your organisation						
Please provide additional details or explanations for your answers. [Optional]						

7. Could the climate information/service you use be improved in any of the following ways? [Multiple options may be selected]
    a. Cheaper.
    b. Easier to access.
    c. Available when required.
    d. Easier to understand.
    e. Better tailored to our organisation's timescale of interest.
    f. Better tailored to our organisation's geographical scale of interest.
    g. Better tailored to our organisation's needs.
    h. Better relationships with information providers/scientists/forecasters.
    i. More accurate/reliable information.
    j. More details about the reliability/uncertainty of the information.
    k. Guidance on using the information within our organisation.
    l. Guidance on communicating information to colleagues/stakeholders.
    m. Other improvements (please give details)

    n. Don't know / not applicable

8. Do you use weather/climate information about any of the following weather-related events/impacts or long-term climate trends? [Multiple options may be selected]

Only show events/impacts/trends reported as positively or negatively affected in Q. D2 (col. 1,2,4,5)

    a. Extreme heat events
    b. Cold spells / snaps
    c. Frost
    d. Wildfires
    e. Warmer climate over time
    f. Colder climate over time
    g. Droughts
    h. Heavy rainfall events
    i. River floods
    j. Surface water (torrential, flash) floods
    k. Landslides (due to heavy rainfall)

l. Wetter climate over time
m. Drier climate over time
n. Severe wind storms
o. Tropical cyclones
p. Sand and dust storms
q. Windier climate over time
r. Less windy climate over time
s. Heavy snowfall and ice storms
t. Hail
u. Ice sheet melt, lake melt, and river ice melt
v. Snow avalanches
w. Freeze-thaw cycles
x. Coastal floods
y. Coastal erosion
z. Sea-level rise
aa. Marine heatwaves
bb. Marine cold waves
cc. Warmer oceans over time
dd. Colder oceans over time
ee. Changes in ocean chemistry
ff. Fog
gg. Lightning
hh. Air pollution-inducing weather
ii. Radiation at surface
jj. Other weather-related events / impacts or long-term climate trends (please give details)

kk. Don't know / not applicable

Restricted to those answering to any option in Q. E8 apart from 'Don't know / not applicable'.

9. For the weather/climate information that your organisation receives, are you able to provide more details about the parameter(s)/variable(s)/index(ices) used. [Optional] *Note: This may not be applicable to all people taking part in the survey.*

10. How often do you use the following types of weather/climate information?

Types of information	Daily	Weekly	Monthly	Every six months	Annually	Less than once a year	Never	Don't know / not applicable
Relate this to Q4 (only those types they use)								

Questions about information use from an organisational perspective

11. Does your organisation pay for weather/climate information? [Choose one]
    a. Yes
    b. No
    c. Don't know / not applicable

12. How are the following types of weather/climate information used in your organisation? [Multiple options may be selected]

Types of information	Informs risk management	Informs management of day-to-day activities	Informs longer term strategic planning	Analysed within our organisation	Analysed by another organisation or consultant and then integrated into our activities.	Another type of use	Don't know / not applicable
Relate this to Q4 (only those types they use)							
If used in another way (please give details) [Optional]							

13. What is driving weather/climate information use in your organisation? [Multiple options may be selected]
    a. Experience of weather/climate-related events/impacts/trends
    b. Organisational risk assessment / management
    c. Infrastructural durability
    d. Risk to public services
    e. Risk to human safety
    f. Market opportunities / Profit
    g. Public / media pressure
    h. Reporting under the Task Force on Climate-related Financial Disclosure (TCFD)
    i. Resource optimisation
    j. The EU taxonomy for sustainable activities
    k. Climate adaptation policies
    l. Climate-related standards
    m. Climate-related guidelines
    n. Sectoral regulation

o. Encouraged/instructed by leaders within our organisation
p. Other drivers (please give details)

q. Don't know / not applicable

14. How confident are you that your organisation is using the best available knowledge and intelligence to improve their climate resilience?
    a. Not confident
    b. Somewhat confident
    c. Confident
    d. Very confident
    e. Don't know / not applicable

15. Where do you/your organisation get the following types of weather/climate information from?

Types of information	National Meteorological and Hydrological Services / government agencies	Copernicus Climate Change Service (C3S)	Intergovernmental Panel on Climate Change (IPCC)	Private companies / consultancies	Your organisation's own data (e.g.,observations, forecasts)	Other sources	Don't know / not applicable
Relate this to Q4 (only those types they use)							
If you obtain them from other sources, please give details. [Optional]							

Section F: Weather forecast use

1. You have indicated that you use weather forecasts for up to 10 days in the future, but not historical observations or information about weather/climate at timescales of more than 2 weeks in the future. Do you think that your organisation would be interested in using this kind of information in the future? [Choose one]
    a. Yes
    b. No END SURVEY
    c. Don't know / not applicable END SURVEY

Section G: Unmet weather/climate information needs

1. What types of weather/climate information would your organisation be interested in using (that you do not currently use)? [Multiple options may be selected]
    a. Observations (Historical data from weather stations and/or satellites)
    b. Subseasonal forecast (Forecasts of the weather from 2 weeks to 2 months in the future)
    c. Seasonal forecast (Expected climate outlook for the next season(s))
    d. Interannual/decadal prediction (Expected climate outlook for the next 1-10 years)
    e. Climate projection (Expected climate trends over the coming decades)
    f. Reanalysis (Historical data combining models and observations)
    g. Other types of weather/climate information (please give details)

    h. My organisation is not interested in other types of weather/climate information [If selected, cannot select others]

2. To what extent do you agree or disagree with the following barriers to your organisation using this type of weather/climate information?

Please rate your level of agreement with the statements below.

	Strongly disagree	Disagree	Neither agree / disagree	Agree	Strongly agree	Don't know / not applicable
Lack of familiarity with the topic of climate						
Too expensive						
Difficult to access						
Not available when required						
Difficult to understand						
Not relevant to our timescale of interest						
Not relevant to our geographical scale of interest						
Not sure how it could be used in our decision making						
Lack of trust in information source/provider						
Not accurate/reliable enough						

	Strongly disagree	Disagree	Neither agree / disagree	Agree	Strongly agree	Don't know / not applicable
Lack of familiarity with the topic of climate						
Too expensive						
Difficult to access						
Not available when required						
Difficult to understand						
Not relevant to our timescale of interest						
Not relevant to our geographical scale of interest						
Lack of resources / expertise to use the information						
Difficult to communicate to colleagues/stakeholders						
Another reason (please give details)						

3. Which weather-related events/impacts or long-term climate trends would you like to receive more information about?
    a. Extreme heat events
    b. Cold spells / snaps
    c. Frost
    d. Wildfires
    e. Warmer climate over time
    f. Colder climate over time
    g. Droughts
    h. Heavy rainfall events
    i. River floods
    j. Surface water (torrential, flash) floods
    k. Landslides (due to heavy rainfall)
    l. Wetter climate over time
    m. Drier climate over time
    n. Severe wind storms
    o. Tropical cyclones
    p. Sand and dust storms
    q. Windier climate over time
    r. Less windy climate over time
    s. Heavy snowfall and ice storms

t. Hail
u. Ice sheet melt, lake melt, and river ice melt
v. Snow avalanches
w. Freeze-thaw cycles
x. Coastal floods
y. Coastal erosion
z. Sea-level rise
aa. Marine heatwaves
bb. Marine cold waves
cc. Warmer oceans over time
dd. Colder oceans over time
ee. Changes in ocean chemistry
ff. Fog
gg. Lightning
hh. Air pollution-inducing weather
ii. Radiation at surface
jj. Other weather-related events / impacts or long-term climate trends (please give details)

[ ]

kk. Don't know / not applicable

4. How would you like weather/climate information to be communicated? [Multiple options may be selected]
   a. Raw data (e.g., database / spreadsheet)
   b. Written text (e.g., reports, emails)
   c. Orally (e.g., conversation, presentation from the provider)
   d. Visually (e.g., data charts, maps, graphics, images)
   e. Other communication mediums (please give details)

[ ]

Thank you for taking the time to complete this survey.

Future participation
We encourage you to get involved in the ASPECT project by signing up to the ASPECT mailing list which will enable you to join our annual multi-sector User Forum events. You can do this by copying and pasting the following web address into a separate window: https://bsc3.typeform.com/ASPECTproject

There is also an opportunity until 27 October for some organisations to apply to work closely with us; you can find out more on the project website by copying and pasting the following web address into a separate window: https://www.aspect-project.eu/competition-become-super-user/

Appendix II: Additional Results

A2.1 Respondents' primary role/position in the organisation

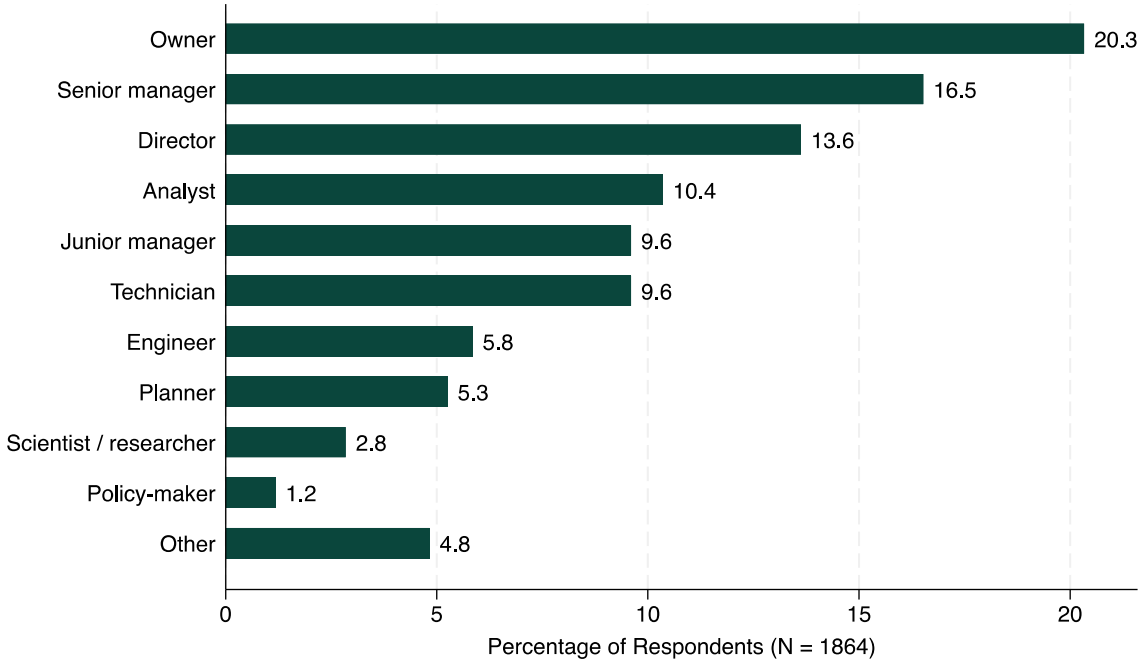

Figure A2-1: Respondents' primary role in the organisations.

In response to the question, "Which category best describes your primary role/position in the organisation?", 90 respondents (5%) selected "Other". Of these, 78 provided further explanations. The responses, originally in various languages, were translated into English using Google Translate. Synonymous responses were grouped together. The table below summarises the range of responses and their frequencies.

Table A2-1: Other responses for primary role/position

English translation of response	Frequency
Worker	25
Administrative	6
Teacher	5
Consultant	3
Senior manager	2
Expert	2
Customer service	2
Middle manager	2
Merchant	2
Technical advisor	2
Bricklayer brigadier	1
Analyst	1
Mailman	1
Director	1
Clerk	1
Waitress	1
Forklift driver	1
Nurse	1
Legal	1
Machinist	1
Public servant	1
Private security officer	1
Advisor	1
Caregiver	1
Pensioner	1
Cashier stocker	1
Supervisor	1
Team leader	1
Disabled	1
Sales	1
Farmer	1
Truck driver	1
Accountant	1
Communications advisor	1
Technical officer	1
Volunteer Ecological Guards and Volunteer Civil Protection Operators	1

A2.2 Respondents' years of professional experience in their organisations' sectors

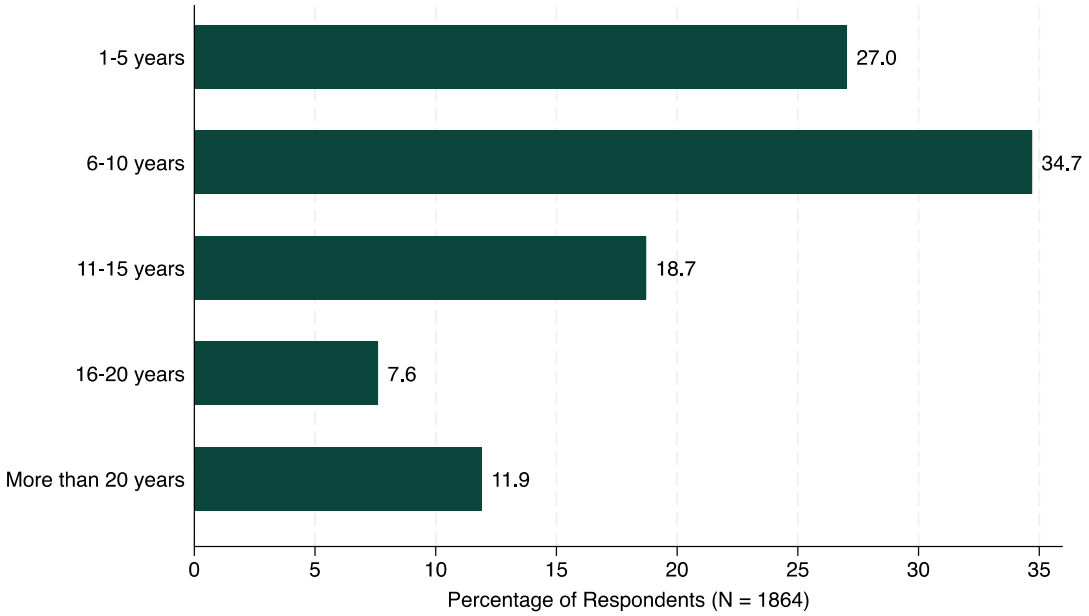

Figure A2-2: Respondents' years of professional experience in their organisations' sectors.

A2.3 Respondents' organisation's main sector(s) of activity

In response to the question, "How would you classify your organisation's main sector(s) of activity?", 69 respondents selected "Other". Of these, 61 provided further explanations. The responses, originally in various languages, were translated into English using Google Translate. Synonymous responses were grouped together. The table below summarises the range of responses and their frequencies.

Table A2-2: Other responses for organisation's main sector(s)

English translation of response	Frequency
Telecommunications	3
Automotive	3
Civil protection	3
Healthcare	2
Information technology	2
Shipping	1
Educational institute	1
Marketing	1
Entertainment	1
Hospitality Hotels	1
Sale	1
Industry	1
Energy	1
Textile	1
Manufacturer	1
Software	1
Transport and warehousing	1
Nuclear	1
Military	1
Oil Gas Construction	1
Geoinformatics (products that provide location information)	1
Transportation	1
Environmental	1
Petroleum industry	1
Forest Planting, Brush-cutting	1
Food industry	1
Pharmaceutical industry	1
Gambling	1
Supervision	1

Cargo transportation	1
Geospatial	1
Taxation	1
Railway engineering	1
Wholesale trade	1
Credit	1
Technology	1
Secure facilities services	1
Food products	1
Air and road freight transport	1
Mechanical	1
Pools and covers	1
Floristry	1
Beverages	1
Municipality related services	1
Local authority	1
Logistics	1
Heritage	1
Travel	1
Travel Management	1
Corporate Travel	1
Travel facilitator	1
Environment, climate, weather extreme	1
Production of sparkling wines and wines	1

A2.4 Other types of weather-related events/impacts or long-term climate trends that affect organisations

In response to the question, "Please give details of any other types of weather-related events/impacts or long-term climate trends that affect your organisation positively or negatively," we received 400 responses. We excluded 93 responses that provided no additional information. It should be noted that many of the events/impacts mentioned could be conceptualised within the categories given in the previous question. The remaining 307 responses, originally in various languages, were translated into English using Google Translate:

- Recently there was a severe rainstorm
- Hail
- The trains can't run
- Within construction, everything from planning to the final touch is affected by climate, weather, water, etc.
- Improved weather conditions on waterways support efficient river transport.
- Growing demand for eco-friendly products and services presents opportunities for businesses that offer sustainable solutions.
- Good air quality can reduce healthcare costs and improve the overall well-being of the population.
- Tornado
- Reduced energy consumption for de-icing and heating vehicles in milder winters leads to cost savings.
- Heat waves
- I think that overall in my country it's currently warmer than it should be
- Windy
- Lightnings, storms
- Floods
- Heavy snow
- Rain
- Rain
- Sand storm
- The rain
- Possible floods and hailstorms
- Rain wind
- Try to reduce heating ignition
- Leaf fall
- Lightnings
- Climate change... from very cold to hot, fires, floods
- Recycling policies
- Abrupt changes
- Too much heat
- Floods
- Surface radiation

- Weather conditions affect my company by impacting clients, rain for example
- The weather
- Tornado
- Power outage
- Pollen
- All negative factors affect our business because it is a transportation job
- When the sea rises, the ferries don't move
- Hot
- Global warming is affecting the earth
- Snow
- Rain negatively
- Snow
- Design of wind panels compliant with energy self-sufficiency class a++
- Many risks of great losses
- Floods
- Very negative drought
- Floods
- Cables
- Essentially, all natural events in all seasons in a year are positive and not those not foreseen or resulting from climate change
- Change the environment
- Tornadoes
- Severe frosts
- Urban fires
- Generally bad weather and rigid temperatures
- Snow
- Changes affect the organisation and forecasts
- Earthquake
- Lack of rain
- Working conditions are more affected by weather
- Fog
- Anything that affects warmth outside
- Tornado
- Road conditions
- High heat and frost affect my job
- Earthquakes
- Too much heat in old buildings making them stuffy
- Storms
- they are all covered in the questions before
- Wind is very effective
- The smell of factories
- Anything that affects our clients' insurance policies
- I have nothing to add
- Torrential rains
- Rain

- Good waste management
- Earthquakes negatively
- Climate change
- Changing conditions
- Cultures
- Volcanoes
- Climatic trends prevent merchandise availability at the point of sale
- Climate change
- Economy apple
- Drought
- The monsoons
- Cold climate
- The lack of precipitation
- Warming
- Drought
- Earthquake
- A stably moderate climate has a positive impact
- Power outage
- Intense rains
- Sleet
- The drought
- The strong extreme rain waves more than anything
- The strong cold and snow affect us in the sense that it's when we have the most work
- Earthquakes affect me negatively
- Snowfall
- Climate development
- A lot of sun
- Rain and cold play on fatigue
- Cold and humidity
- Earthquake
- When the air warms up, the weather affects us
- Heat
- Ice falling
- Heat is more positive but raining is definitely negative
- Drought
- Heat
- Ice falling
- Very strong winds
- The main problem is strong wind and rain. It always has a huge impact on the progress of work.
- Scarcity of rain
- None, only for construction health
- Storms
- For me, everything is very positive

- Due to the great climate changes, we increasingly find ourselves facing heavy downpours, strong storms, and unstable days
- Less resources due to hotter climate
- Rain, snow.
- Fire
- How the climate affects the economic and psychological well-being of our clients and company
- Excessive snow and cold halt production
- They destroy our environment
- Less cloud or rain will have a positive effect
- Hot and bad rain
- Rain
- Rain
- None
- Snow affects our organisation
- Snow
- Migration of African insects that do not harm our equipment
- Hot weather
- Global warming greatly impacts my organisation
- Too cold
- We were greatly affected by unexpected sudden rain as a society and precautions have been taken, now we are prepared
- Hurricane
- Quick changes in weather conditions (affects negatively)
- Currently only rain and wind
- Hail
- Rain
- High waste and pollution, especially if temperatures are hot
- Positive or negative weather conditions affect the quantity of products we receive during the transportation stage
- Banned winds
- Severity of weather conditions
- NVT
- Global warming is affecting me negatively
- Met-air.com
- Strong heat
- A flood
- Most of our raw materials come from foreign countries, we have had production conditioned by damaged materials during transportation and due to atmospheric conditions
- Floods
- Road washed out due to rain and overflowing sewer caps
- Manufacturing delays
- Positive = normal weather, Negative = anything that paralyzes traffic
- The heat and dryness affect our company in a negative way

- Storm
- Floods
- Co life
- Floods will create more jobs, so positive then
- Damages
- Electric spikes
- Rain
- If there's too much snow then it can be a problem
- Wind, it's so hard.
- Wind
- There is nothing else, just temperature fluctuations
- Pollution
- Nothing
- Issue for employees to get to work on time, as well as the chauffeur having a hard time getting to customers on time when there is difficult weather
- Extreme heat negative
- Glacier melting
- Strong storm
- Floods
- The heat is our biggest enemy
- Rainy
- Strong rain
- Snow and ice are bad
- We are thriving with wind
- Population during the construction of dams
- Ships must sail
- Snow
- Less heating
- Employees are partially suffering from climate change
- It deeply affects us with wind
- Good weather
- Snowstorm
- Supply or delivery problems
- Climate change is in a very bad position that we have to address
- Our company is affected by all sudden and long-term climate changes
- All the listed environmental impacts will result in selling fewer products
- Lightning
- Hail damage
- Construction work possible only in dry and beautiful weather
- Flood
- CO2 is a vital element. Keyword: photosynthesis
- Thunderstorm in Zagreb, in 2023
- Heavy rain
- Rain

- In agriculture, extreme weather changes are not easy. For proper management, the weather must be stable for several days. Not too hot, regular rain, but not too wet either.
- Fewer delegates and customers visiting our locations
- During winter, very cold snaps and during summer, extreme heat
- Cold
- Lightning can damage our router or server hardware. Our data center could be flooded because it's close to a big river
- Fluctuations in radiation intensity
- Winter frost
- Large amounts of snow, rain
- Longer winter (snow) periods
- Rain and snow
- Everything that is extremely bad adversely affects climate change
- Tornado
- There's no weather.
- Floods
- We are dependent on the warm weather
- Fog and freezing
- If the color becomes bad, cracks
- Rain
- Storms hamper trade
- Low temperatures, abundant rain
- Strong droughts, abundant snow
- Hydropower generation
- Storms
- Milder winters
- Earthquake
- Weather sometimes impacts the town
- Unforeseen accidents
- Insurance Costs: Higher frequency and severity of weather-related disasters can lead to increased insurance premiums for organisations
- Very cloudy and mostly rainy
- Heavy rain or snow
- We are in the Arctic, so extreme weather is a thing
- Floods have been destroying our parking lots and the outside walls of the building
- Stops production and distribution
- Flooding is a recent local problem
- Agriculture cannot do without the climate
- It is mainly the high heat that has a negative influence
- In the last years, our company has been flooded twice
- They have started to take over every aspect of my company's strategic management
- Buildings subsidence due to long-term drying out of land foundations
- Heavy storms, tornadoes, hurricanes, extreme cold weather, freeze
- Wind gusts

- Floods and rising sea levels in coastal cities
- Oppressive heat
- Conditions under tents
- Lightning
- More than anything, periods of drought followed by tremendous downpours that ruin our production
- Any disasters impacting the supply chain
- Too much rain
- In case of a storm, we might have fewer customers
- Negative extreme droughts
- All the claims changes can sometimes mess up what we said
- Drought's affect us mainly negatively due to more investigation
- Icy roads
- There isn't anything to add, the weather doesn't really affect us
- I produce radiator boiler control cards, the colder the weather, the better the sales
- Negative
- Natural disasters such as earthquakes and floods have a very negative impact
- Snow and freezing ice
- Sudden changes in cold or hot weather
- Climate change
- Cold snowfall reduces sales because production is in the construction sector
- All types of phenomena have already been reported
- Heavy rainfall
- Intense rains and storms earlier than usual
- Cardboard and circular garbage
- Rain
- Degrades the security nature of my organisation
- We take active protective measures
- Noise
- It is related to industrial emissions and the environment
- Bad weather can affect employees' travel
- In rainy weather, for the safety of employees, we will take a day off
- EXTREME HEATS
- Climate change could affect demand in the construction industry
- Flooding of the foundations of a construction
- Winter is getting longer and the ice slows down all activities
- Earthquake, destroyed offices
- Humid air
- The biggest problem is delays in the delivery and receipt of materials and raw materials for production
- In 2023, high temperatures prevented work
- Drought caused by climate problems makes access to water resources difficult
- Bad weather with snow and ice
- Fifty degrees below zero
- Irregular weather conditions and sudden cooling

- If there is very bad snow and rain, we will inevitably be affected in our travels
- Excessive rainfall and transportation problems
- In my opinion, the long-term effect of climate change leads to a decrease in sea ice
- Irregular distribution of precipitation leading to problems in operational protection activities, but also water supply for industrial processes
- Urban heat islands, urban flooding, forest fires
- Climate change predominantly has a negative impact on viticulture
- Accentuation of diseases and pests
- Compound weather events
- The occurrence of strong storm winds in 2017, 2019, and 2023 caused significant damage to forest ecosystems in the form of windbreaks and windfalls on a total area larger than 300 hectares in the territory of the city of Belgrade.
- Late frosts
- Torrential rains
- Increased precipitation in months with a high risk of plant diseases, making protection application more difficult.
- Heatwaves, intense precipitation, floods, and inundations
- When I say organisation, these are the areas we advise on for the heritage sector and the impact it has on the sector more broadly.
- Increased climate variability both inter-annual and intra-annual
- More frequent occurrences of extreme rainstorms, which are later followed by floods, landslides, landslide activations, leading to total traffic interruptions and significant material damage. Also, occasional extreme snowfall due to the lack of forest protective belts in the plains leads to extreme accumulation on the road and traffic interruptions. Insufficient and systematically poorly organised anti-erosion protection, which is entrusted to local self-governments in Serbia because second-order watercourses are under their jurisdiction, has led to the fact that it has hardly been done at all since 2000, and it is a prerequisite for managing torrential floods.
- Positive moderately weather events. Negative sudden and large changes in temperature
- Travel is affected, and this affects our business
- Sudden weather changes cause major disruption to travel and thus our and our clients' operations
- Long-term drought, sudden warming
- Urban heat, urban floods, urban air quality...
- We buy waste from fruit crops which are sensitive to weather - they actually need cold accumulation over winter, but a summer drought or heat wave is also bad news - so it's bad either way round!
- Heatwaves
- Global warming negatively affects the organisation

Appendix III: Robustness Check

A3.1 Figure 11

Table A3-1: Wilcoxon rank-sum test results for Figure 11

Difference between categories		Hot and/or cold temperatures	Wet and/or dry conditions	Wind	Snow and ice	Coastal change	Ocean change
<10 VS 10~49	*z*-value	1.816	0.278	-0.757	1.816	-2.107	-0.848
	p-value	0.069	0.781	0.449	0.069	0.035	0.396
10~49 VS 50~249	*z*-value	-0.609	-1.896	-0.514	-2.795	-2.278	-1.924
	p-value	0.543	0.058	0.607	0.005	0.023	0.054
50~249 VS >250	*z*-value	-3.887	-1.448	1.639	-0.539	-0.922	-1.208
	p-value	0.000	0.148	0.101	0.590	0.356	0.227

**The difference between categories is statistical significant at the confidence level of 90% if p<0.1, at the confidence level of 95% if p<0.05, and at the confidence level of 99% if p<0.01.*

A3.2 Figure 16

Table A3-2: Wilcoxon rank-sum test results for Figure 16

Difference between categories		Logistics	External logistics	Your premises	People	Processes
<10 VS 10~49	*z*-value	0.581	-2.050	-2.465	0.050	0.507
	p-value	0.561	0.040	0.014	0.960	0.612
10~49 VS 50~249	*z*-value	-4.101	-1.710	-1.674	-2.127	-0.883
	p-value	0.000	0.087	0.094	0.033	0.377
50~249 VS >250	*z*-value	-1.451	-1.008	2.424	-0.372	-1.205
	p-value	0.147	0.313	0.015	0.710	0.228

**The difference between categories is statistical significant at the confidence level of 90% if p<0.1, at the confidence level of 95% if p<0.05, and at the confidence level of 99% if p<0.01.*

A3.3 Figure 17

Table A3-3: Wilcoxon rank-sum test results for Figure 17

Difference between categories		Logistics	External logistics	Your premises	People	Processes
Public VS Private	*z*-value	-5.611	-3.111	0.239	1.162	-3.155
	p-value	0.000	0.002	0.811	0.245	0.002
Public VS Others	*z*-value	1.833	0.839	-0.235	-1.026	1.880
	p-value	0.067	0.401	0.814	0.305	0.060
Private VS Others	*z*-value	-2.565	-1.524	-0.092	-0.309	-0.346
	p-value	0.010	0.128	0.927	0.757	0.729

**The difference between categories is statistical significant at the confidence level of 90% if p<0.1, at the confidence level of 95% if p<0.05, and at the confidence level of 99% if p<0.01.*

A3.4 Figure 21

Table A3-4: Wilcoxon rank-sum test results for Figure 21

Difference between categories		Days to weeks	Months, up to a year	One year or more	Another time period	Don't know / not applicable
West VS East/Central	*z*-value	3.798	-3.769	0.193	-0.593	0.035
	p-value	0.000	0.000	0.847	0.553	0.972
South VS East/Central	*z*-value	4.592	-5.319	0.866	-0.774	0.724
	p-value	0.000	0.000	0.387	0.439	0.469
North VS East/Central	*z*-value	2.775	-1.463	-1.147	-0.971	-0.928
	p-value	0.006	0.144	0.251	0.331	0.353

**The difference between categories is statistical significant at the confidence level of 90% if p<0.1, at the confidence level of 95% if p<0.05, and at the confidence level of 99% if p<0.01.*

A3.5 Figure 28

Table A3-5: Wilcoxon rank-sum test results for Figure 28

Difference between categories		Climate adaptation policies	Climate-related standards	Climate-related guidelines	EU taxonomy for sustainable activities	ISO 14090:2019 Adaptation to climate change
Less than a month* VS *Between 1 month and 6 months	*z*-value	0.900	-0.439	-2.022	0.900	-1.904
	p-value	0.368	0.661	0.043	0.368	0.057
Between 1 month and 6 months* VS *Between 6 months and 1 year	*z*-value	0.465	-1.861	-1.969	0.504	0.736
	p-value	0.642	0.063	0.049	0.615	0.462
Between 6 months and 1 year* VS *Between 1 and 2 years	*z*-value	0.794	0.686	0.210	0.065	0.725
	p-value	0.427	0.493	0.833	0.948	0.468
Between 1 and 2 years* VS *Between 2 and 5 years	*z*-value	-1.652	-0.882	-1.920	-1.347	-0.247
	p-value	0.098	0.378	0.055	0.178	0.805
Between 2 and 5 years* VS *Between 5 and 10 years	*z*-value	-1.356	0.260	-2.340	1.073	1.232
	p-value	0.175	0.795	0.019	0.283	0.218
Between 5 and 10 years* VS *Between 10 and 50 years	*z*-value	0.988	1.296	2.068	-1.018	-1.504
	p-value	0.323	0.195	0.039	0.309	0.133
Between 10 and 50 years* VS *More than 50 years	*z*-value	0.990	0.340	1.713	-0.142	-1.197
	p-value	0.322	0.734	0.087	0.887	0.231

**The difference between categories is statistical significant at the confidence level of 90% if p<0.1, at the confidence level of 95% if p<0.05, and at the confidence level of 99% if p<0.01.*