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ENHANCING CLIMATE INFORMATION SERVICES

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SUMMARY

This report discusses available information on integrating local knowledge to transform scientific data into user-centred information. Focus of the work is the area of Western Balkan, where there is an acute need for more material to study this type of transformation. The report reviews several studies on the related topics in the selected countries of this region, as well as the results of the survey carried out in 2024 by **ClearClimate** researchers to update the available information and reduce the knowledge gap.

1. INTRODUCTION

1.1. Background and objectives

How people respond to climate information service (CIS) depends largely on how such information is designed and communicated to them. While the introduction of new information and communication technologies (ICTs) have improved the delivery of CIS, there are persistent challenges in its use. This report discusses state of the knowledge of climate change, progress and challenges in CIS development, perceptions, and use in several countries of the Southeast Europe (SEE), where reportedly CIS needs to be brought closer to the user for the efficient practical implementation. Studies demonstrate that individuals are more inclined to engage in sustainable practices to address climate change if they are confident about its existence and its primary attribution to human activities.

Relative to Western Europe, SEE and Balkan countries' residents seem to be more sceptical about climate change, and information services in general. But this observation does not take away the fact that most citizens of Balkan countries perceive, as real, the existence of climate change and the threat it poses to mankind (Cvetković and Grbić, 2021, Naydenov and Atanasova, 2024, Roshan et al., 2013, Schneiderbauer et al., 2021, Falcescu et al., 2024)

Objective of this report is, thus, to give clear picture of the current situation in the Balkan region regarding the actions to reduce the impact of climate change, the available CIS, the gaps in the information, and the current needs which will improve services delivery to users, as well as the utilization of the knowledge and advise the way forward.

1.2. Structure of the D2.2

This report is divided into 4 sections, starting with general introduction on the role of local knowledge and science-policy interface and followed by the brief information available to each of the selected countries. The third part also reports on the CIS were available and actions taken by stakeholders regarding the climate change.

The next section includes presentation of results and discussion of the questionnaire administered by ClearClimate researchers at UNSPMF in November – December 2024, to relevant organisations in the region.

The final part of the report deals with the key findings, conclusions and recommendations.

1.3. The science-policy interface and the role of local knowledge and narratives of change

According to Adamo et al., 2021, climate change is not a novel issue for scientists, since geological data indicates that the climate system has experienced both stability and variability throughout Earth's history.

Country economies have a common goal of increasing income per capita and for this reason, the EU motivates all its members to respect the Paris Agreement and to achieve EU2020 and EU2030 goals in Greenhouse Gas (GHG) emission reduction, to increase energy efficiency and energy production from renewable sources. Similarly, Comprehensive 'The Western Balkans 6 Country Climate and Development Report' (CCDR), 2024, examines Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia. It points out that adaptation to climate change is urgently required, and that the region can become climate-neutral by 2050 without compromising its growth potential if right measures are put in place. The net zero transition could decrease air pollution-related mortality by 15% by 2050, potentially saving thousands of lives. Early-warning systems will help to avoided mortality from floods and other natural disasters and nature-based solutions will benefit local economic development. In some Balkan countries, such as Croatia, policymakers consider irrigation, organic agriculture, crop crossbreeding and optimization of agrotechnical practices, and agricultural insurance as some the most important strategies to address climate change (Marić et al, 2023).

The public's view of climate change and its effects on the frequency and severity of natural disasters significantly affects the execution of climate policies, the formulation of educational initiatives, and the adoption of preventive strategies (Cvetković and Grbić, 2021; Keim, 2008; Wachinger et al., 2010). Most of the population acknowledges climate change as an important area for human existence but fails to incorporate climate change adaptation/mitigation measures into their daily lifestyle. Personal experiences with natural disasters like floods are one of the most important factors leading to the change in perception of people regarding the problem of climate change (Capstick et al., 2015). In the Balkan region, individuals mostly participate in activities within areas related to weather and climate, in the sectors such as agriculture, forestry, tourism, and ancillary services.

1.4. Brief overview of the information available in various SEE countries

Experts from the Balkan regions acknowledge the association between global warming, climate change and the increasing frequency of natural disasters as well as importance of local knowledge to mitigate effects of global change.

According to Falcescu et al (2024) in a survey of various sectors in Romania, all sectors except urban systems were found to acknowledge the need for climate information services. The study also revealed that the increasing constraints posed by climate change are the major drive for climate information services in Romania. Babai (2023) studied responses in the mountain region of Romania in the subsistence-oriented community of Valea Rece. Local observations of climate change impacts on the atmosphere primarily focus on changes in average temperature, the timing and intensity of precipitation, and shifts in seasonal patterns. Trends in observations were consistent with reports from instrumental measurements, suggesting that observations from communities in direct contact with the natural environment are reliable, providing a strong basis for adaptive responses. This empirical knowledge will support subsistence-oriented communities' coping strategies and adaptive responses to the challenges created by climate change.

Climate change research in **Albania** remains in its early stages, particularly in areas like climate science, energy efficiency, and environmental management. Furthermore, funding for environmental and climate initiatives falls short of EU standards according to study by Ghaleb, 2023. Women feel more vulnerable to extreme climate events, while men perceive the effects of climate change more on the loss of assets and money, which indicate that socially marginalized or vulnerable individuals are more affected by natural occurrences (Ghaleb, 2023).

Further research conducted in Albania revealed that the agricultural value chain is considerably negatively affected by climate change through the following processes: increased exposure to rodents, increased plant diseases occurrence, harmful insects and pests for plants and livestock, forest and pasture degradation and soil/land degradation (Zhllima et al., 2022). In that study, all respondents agreed that increased duration of droughts, frequent change of temperatures, increased incidence of pre-seasonal rainfalls and floods, frost, hail, and increased duration of rainfalls suggest climate change hazards.

Research carried out by Lippi and Sanfilippo. (2023) in Albania, indicated various changes in the atmospheric parameters which are noticeable over 15 years. In an interview with 15 farmers, over 65% of them identified the following changes: increasing frequencies of summer heatwaves, general increase in temperature, unpredictable rainfall patterns and

intensification of cold days in the winter. These, according to the respondents, negatively impact their farming activities and livelihoods. Children, adolescents, and young adults have varied knowledge and concerns about climate change in Albania, with understanding deepening with age. Problems range from unpredictable weather and health threats for children to broader climate impacts and biodiversity loss for young adults. While children value tangible activities, adolescents resonate with global activism, and young adults interweave academic lessons with external workshops. Across the spectrum, a knowledge gap exists concerning the psychological impacts of climate change (Breidy, 2023).

According to the European Commission (2023), **Bulgaria**'s green transition requires significant action on several aspects, notably the energy intensity of its economy, its heavy dependence on coal, and its relative lack of long-term climate commitments. It is perceived that the higher reliance of the Bulgarian economy on energy derived from coal increases its carbon emission profile. Administrative limitations, such as bureaucracy and corruption particularly with respect to public procurement and permit issuing procedures are the main hindrances to the adoption of green energy in Bulgaria. Consequently, Bulgaria seems inadequately equipped with the requisite effective tools and qualified administration to address the problems of fostering a low-carbon economy and generating green employment. It is perceived that the major contributor to the challenges of climate change and climate change adaptation and mitigation methods is the need for behavioural change (Mantcheva et al., 2012). Tailor-made solutions instead of one-size-fits-all solutions were recommended by ((Paparrizos et al., 2023; Naydenov and Atanasova, 2024) for climate change adaptation.

The climate change consciousness in Bulgaria is high, but slightly less than that of the EU. 85 % of respondents in a study by Simeonova and Trifonova, 2021, acknowledged and strongly believe that the warming of the planet and its consequences are detrimental to the livelihood of mankind and therefore are a problem of paramount importance, while as low as 3% are sceptical about the daily effects of global warming. According to the Eurobarometer findings (EU, 2021) about three-quarters of Bulgarians do not see the commitment of the government regarding policy to promote solutions to long-term climate-related problems. This is in line with the findings of Naydenov and Atanasova (2024) who identified the major barriers to climate adaptation to be political instability, a tenuous regulatory environment, conflicts of interest, restricted planning capacity, insufficient inter-institutional cooperation, and an absence of robust commitment. The Eurobarometer study (EU, 2021) indicates that under 10% of Bulgarian respondents consider their national government's climate initiatives adequate, in contrast to the EU average of 20% (Simeonova and Trifonova, 2021).

Bulgarians thus perceive global warming as a serious threat to their lives. The hydrological cycle of most regions is greatly affected by global warming affecting precipitation levels

(Roshan et al., 2013; Velichkova et al., 2020), resulting in less precipitation in places far from water basins and more rainfall in places near water sources (lakes, rivers, and seas). Other components of the water cycle, such as runoff and infiltration, are impacted by rain and snowfall (Velichkova et al., 2020).

A survey conducted in Bulgaria indicated that the perception of climate-related risk varies and is dependent on socio-demographic factors like the age group, gender, experience (personal experience of climate-related hazards like flood and heat waves) and to an extent the occupation of an individual (Schneiderbauer et al., 2021). The atmospheric and other hydroclimatological processes in mountainous regions are highly sensitive to climate change. Schneiderbauer et al. (2021) stated the scarcity of water, loss of biodiversity and the negative effect on mountain socioeconomic systems as some of the pressing consequences of warmer weather in the mountains and this influences the perception of the residents on climate change (Armstrong and Lazarus, 2019; Khromova et al., 2019). Cholakova and Dogramadjeva (2019) examined the relationship between climate change and the ski industry at Pamporovo resort. Their study revealed a strong consensus on the global threat posed by climate change. However, they identified divergent opinions regarding the level of vulnerability of Bulgarian ski resorts to its effects.

In **Croatia**, a study included sample of 103 employees of the Croatian Agricultural and Forestry Advisory Service to determine the opinions and attitudes of agricultural advisors on climate change. Results of the research show that the respondents are relatively aware of the anthropogenic impact on climate change, as well as wider consequences of climate change on society and the environment. Most agricultural advisors perceive climate change as dangerous for the stability of domestic farming, but as many as 92.4% of respondents believe that farmers do not have the necessary knowledge to successfully deal with the risks of climate change in their own production (Žutinić and Sušac, 2021). This seems to correspond to a study from the Adriatic part of Croatia by Oplanić et al. (2023), where (elderly and predominantly male) farmers mostly agreed that climate change presents a problem for regular activity on the farm. Nevertheless, these farmers were neutral to the statement that climate change increases risk in the farm business. In addition, more than half of the sample (57%) of farmers in the study stated that they consider themselves to be ‘climate sceptics’.

Both Bulgaria and Croatia studies consider climate-related issues to be interdisciplinary. Gender equality and women's empowerment, sustainable consumption and production, sustainable cities and human settlements, conservation and sustainable use of marine resources, oceans and seas, ecosystems and biodiversity, food security and nutrition, water and sanitation, education, health and population dynamics, energy, and sustainable agriculture are all closely related to these issues.

Public opinion poll report on the Green Agenda for the Western Balkans, carried out by the UNDP in 2023 (https://www.undp.org/serbia/publications/green-agenda-public-opinion-poll), used representative sample of 2055 citizens of **Serbia** over 18 years of age. It included 52% women and 48% men, spread among respondents aged 18 to +65 and spread among the rural and urban, educated and less educated. More than half of the respondents (51%) are aware of the dangers of climate change. However, every ninth respondent (11%) believes that climate change does not exist or does not represent a problem for humanity. The population from urban areas has shown a slightly higher level of awareness of the consequences of climate change compared to those coming from rural areas. It is also important to note that users of internet portals and websites (e.g. Twitter, and Instagram among others) believe that the danger of climate change is real and that it is necessary to introduce changes that would prevent their consequences (https://www.undp.org/serbia/publications/green-agenda-public-opinion-poll). This is consistent with findings elsewhere (e.g. Sarku, 2022) which showed that exposure of the users to ICT affects positively the usability of the CIS. Information networks have been recognized as an important element of conducted activities enabling efficient transmission and dissemination of environmental knowledge, data and up-to-date trends and ideas, especially in the urban context in the work of Stupar and Mihajlov 2016, in Serbia. Focusing on public communication of climate change, the authors state that communication, transmission and exchange of information must use both physical and digital channels of communication in order to reach all categories of users and provide a flexible, efficient and comprehensive coverage of climate related issues. In addition, according to Pantić et al, 2024 visualisation tools should be adapted to improve measures addressing climate change and the region-specific effects in spatial planning to improve these as perceived from the citizens' perspective.

A 2020 survey of 208 citizens of Belgrade and Sremska Mitrovica conducted using face-to-face interviews showed a significant variability based on the demographic and socio-economic status of the citizens which included: gender, age, marital status, education level, and employment status. According to the results of Cvetković and Grbić (2021), anthropogenic activities are the major causes of climate change and most of the respondents mentioned climate change to be the major promoter of devastating natural disasters. Findings of Krstić and Miltojević (2021) in a different study, show that women are the most vulnerable to the effects of climate change and the major cause of this trend are gender disparities. Comprehensive work by Leščešen et al. (2024), on primary school children's knowledge, attitudes, and perceptions regarding climate change highlights the importance of targeted education. It showed the value of all efforts aimed at providing accurate information about the drivers of climate change to young individuals. It emphasizes the need for targeted climate education efforts, diversified information sources, and comprehensive, multidisciplinary approaches to address awareness and interest among primary school

children in Serbia. Furthermore, it highlights the importance of encouraging young voices in climate action discussions and fostering informed and proactive responses to the pressing issue of climate change.

With poverty being the main drive, additional factors encompass gender-biased interactions within the environment, gender-biased roles in domestic and communal settings, gender inequality in access to social and physical resources, and gender differences pertaining to education, health, money, and time Krstić and Miltojević (2021). Citizens who acknowledge the reality of climate change are inclined to undertake measures to mitigate it. They also acknowledge that various anthropogenic causes, such as increased global fossil carbon dioxide (CO^2) emissions, activities and uses (ex. In agriculture), all contribute to climate change.

The perceptions and awareness of climate change by the citizens of **Montenegro**, compared to other European countries are not very advanced, according to Ćeranić et al (2023). Montenegro belongs to the countries with the highest level of public skepticism toward climate change and Montenegrian citizens are close to last place in Europe in terms of expressing pro-environmental attitudes. However, the more educated respondents were more concerned about climate change and more convinced that reducing energy consumption can lead to mitigating the consequences of climate change.

Research by Karelakis et al. (2024) in **Greece** shows positive effects of integration of resilient communities and international cooperation, as well as monitoring and evaluation of these efforts. These strategies enabled the development of a balanced and well-coordinated approach to addressing green development and climate change.

This approach also ensures that the efforts to promote sustainability and reduce emissions are mutually reinforcing, leading to long-term environmental, economic, and social benefits. In their study, Tourlioti et al. (2024) found that residents of Mytilene, a coastal city on Lesvos Island, generally trusted local institutions to take climate action but were largely unaware of their own vital role in mitigating climate change. The authors recommended that local authorities prioritize ongoing efforts to empower and actively involve residents in both climate adaptation and mitigation strategies. They also emphasized the importance of including residents in the co-creation of climate services tailored to local needs. Similarly, in the study including Axios delta in Greece and Camargue in France by Ernoul et al. (2020), the local surveyed populations have taken little action to adapt to or mitigate against climate change.

The negative impact that climate change has on human health and quality of life was addressed in the study by Velentza et al (2024) among the nursing staff in Athens. The nursing staff identified climate change, water, soil and air pollution as major health problems and appeared to be quite knowledgeable on these issues. In addition, participants seem to be particularly sensitive to actions on environmental issues and willing to contribute to them and receive training. Despite this, Lamnisos et al (2024), working in the municipalities of Messini and Alexandroupoli, found that participants in the survey, drawn from the ordinary citizens, viewed climate change as an important cause of health harm but only partially understood that climate change is caused by humans.

North Macedonia is exposed to climate change and natural hazards that pose substantial risks to public safety and public infrastructure, mainly from flooding and forest fires, according to current IMF report (2024). Climate change is thus causing natural disasters to become more frequent and with a higher economic and social impact.

1.5. Importance of Social Context for awareness of Climate Change and adaptation of CIS

Globally, several scientists have evaluated the effects of many factors such as age, level of education, employment and marital status etc., on the perception of climate change which has yielded conflicting inferences (Leiserowitz, 2006; Uddin et al., 2014).

A study (Cvetković and Grbić, 2021) investigating factors that influence public perception of climate change and its consequences, such as floods and heat waves, found a significant correlation between educational level and key variables. These variables included perceived vulnerability to climate change, perceived impact of climate change on natural disasters, as well as knowledge and fear scores.

This outcome was consistent with the results from several other research portraying education as the factor significantly associated with the awareness of the public on the impacts of climate change (Knight, 2016; Linnekamp et al, 2011; Nisbet and Myers, 2007; Monroe et al, 2019; Owusu et al., 2019). Individuals who were educated to the tertiary level were seen to have a deeper knowledge raising their awareness of climate change relative to those who had only primary education.

Relative to unmarried people, married respondents are perceived to be most vulnerable to climate extremes (Huang and Ma, 2024; Nisbet and Myers, 2007).

The perception of climate change in the study and several other studies was found to be tied to socio-demographic characteristics such as age, gender wealth, access to information, or civic engagement. The employment status of the respondents correlated more significantly with the perceived vulnerability to climate change (Semenza et al., 2008; Shi et al., 2015; Yu et al., 2013).

A study conducted in 28 European countries by Ergun et al. (2024), shows some regional as well as gender and age variabilities, which may explain some of the results. As climate change risk perception (CCRP) rises, individuals and governments are more likely to take mitigation measures and adapt to climate change.

Higher level of education, being a woman, holding egalitarian values and valuing freedom of speech are factors associated with a greater level of CCRP. However, older women tend to have lower CCRP levels than younger women. In addition, having children under 15 years of age at home has a negative effect on CCRP in females, while it does not affect males' CCRP. Additionally, it is crucial to provide education and awareness programs on climate change, targeting specific demographic groups such as individuals with lower education levels and those facing financial difficulties. These efforts should also consider the gender differences observed, aiming to engage and empower younger women in climate change initiatives.

1.6. Climate services

According to the World Meteorological Organisation (WMO), climate services are defined as the provision of climate information prepared and defined to meet users' needs, encompassing the production, translation, transfer, and application of climate information for informed decision-making. The concept of "climate services" is relatively new, having been established with the launch of the Global Framework on Climate Services (https://gfcs.wmo.int/site/global-framework-climate-services-gfcs), but has undergone significant evolution in recent decades due to the intensification of emerging climate impacts, the need to increase societal benefits, and the need to increase risk management capacity (Jacobs and Street, 2020, Paparrizos et al. 2024). Climate services platforms serve as a powerful means to raise awareness about the detrimental effects of climate change on livelihoods thereby promoting effective adaptation capacity.

Most useful CIS are those that are intuitive, accessible to diverse audiences, and applicable, based on their content. These CIS emphasises effective communication and visual presentation of information (Lemos et al., 2012). The delivery and acceptance of CIS can be viewed as a 'push-pull' process, where various conditions and institutions influence usability, with CIS providers on the push side and users on the pull side. Information providers perceive

they supply valuable information, whereas users need practical knowledge (Sarku et al., 2022). This is akin to a marketplace where information can be likened to a "good" which holds potential usefulness but transforms into usability only when it is applied into decision-making (Dilling and Lemos, 2011).

1.7. Operational Climate Services in Southeast Europe

According to the European Research and Innovation Roadmap for Climate Services (Street et al., 2015), there are five main types of organizations, which provide climate information, such as public climate service centres (not from meteorological services), universities or university networks, private businesses, and climate information management in business consulting services (Cortekar et all, 2020). Previous studies provided evidence that there are further types of organizations that provide climate services, such as public administration/policy bodies, or non-profit-organisations and non-university research performing organisations (Manez et al., Cortekar and Themessi, 2016). The mapping shows that the climate service providers are unequally distributed across EU Member States, with smaller numbers of climate service providers per country in the Eastern and South-Eastern Member States, e.g. Lithuania, Bulgaria or countries of the former Yugoslavian Republic.

2. SURVEY OF ORGANISATIONS INVOLVED IN USE AND DISTRIBUTION OF CIS – GENERAL QUESTIONS

As part of the preliminary studies for this report, the survey on relevant institutions was implemented in November and December 2024, by the UNSPMF. It can be accessed https://docs.google.com/forms/d/1m_pk3anRfeHZiZvUIkYD74s22WE37RQSCZs05qdlya0/edit. Emails were sent to more than 150 addresses. These were 81 answers from the region: Serbia, Romania, North Macedonia, Bosnia and Herzegovina, Slovenia, Greece, Croatia, Montenegro, Albania, Hungary and Italy. The survey was done in English and Serbian languages. Answers in Serbian language were translated into English and the two were combined for further statistical analysis.

2.1. Geographic coverage

Figure 1 shows the geographical coverage of the survey. The distribution of participants across countries in the study highlights varying levels of representation. **Serbia** had the largest number of participants, with 37 individuals contributing to the study, indicating the highest engagement. This was followed by **Bosnia and Herzegovina**, which had 11 participants, representing the second-highest level of involvement.

Countries such as **Romania** (8 participants), **Greece** (6 participants), **North Macedonia** (5 participants), and **Slovenia** (5 participants) demonstrated moderate levels of representation. Conversely, **Albania**, **Croatia**, and **Montenegro** exhibited relatively lower participation rates, with 3, 4, and 1 participant(s), respectively. Similarly, **Hungary** and **Italy** were minimally represented, with only 1 participant each.

This diverse regional representation underscores a broader geographical involvement while highlighting a concentration of participants from Serbia and its neighbouring countries. Such distribution is essential for understanding the regional perspectives and ensuring balanced insights into the subject under investigation.

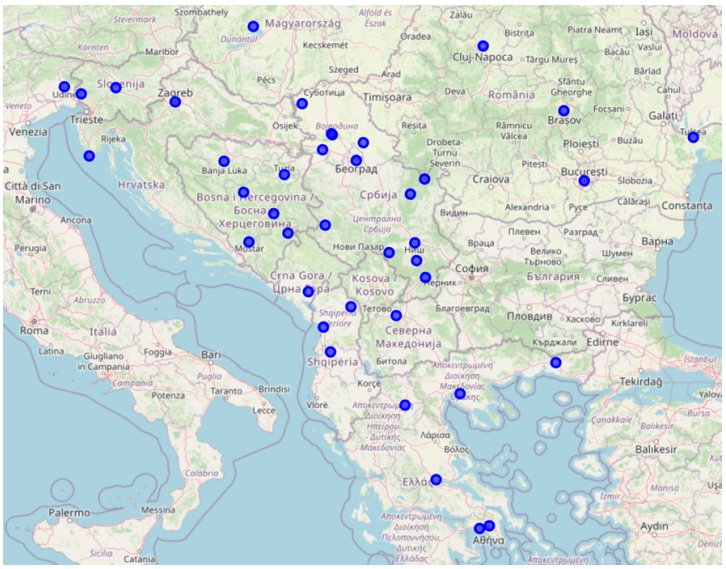

Figure 1. Geographical coverage of ClearClimate Survey

COUNTRY	NUMBER OF PARTICIPANTS
SERBIA	37
ALBANIA	3
BOSNIA AND HERZEGOVINA	11
CROATIA	4
GREECE	6
HUNGARY	1
ITALY	1
MONTENEGRO	1
NORTH MACEDONIA	5
ROMANIA	8
SLOVENIA	5

Table 1. Number of participants per country

2.2. Sectoral distribution

Main types of organisations who responded to the survey were these in public administration, research and education, socio-economic development, forestry and environmental protection, as well as agriculture and biodiversity, as presented in the Figure 2.

Public Administration and **Scientific Research and Education** were the most well-represented sectors, each accounting for the highest number of stakeholders (over 35 participants). These sectors play a pivotal role in the management and dissemination of knowledge, as well as in decision-making processes, which are crucial for addressing climate-related challenges.

Socio-Economic Development was the third most represented sector, demonstrating significant involvement (approximately 30 stakeholders). This sector's engagement reflects its critical role in balancing economic growth with sustainability goals.

Stakeholders from the **Forestry and Environmental Protection** sector were fewer in number compared to the top three but still represented a considerable portion of the sample, emphasizing their role in ecosystem management and environmental conservation. Lastly, the **Agriculture and Biodiversity** sector had the smallest representation, suggesting a potential need for greater inclusion to address agricultural resilience and biodiversity conservation in the context of climate change.

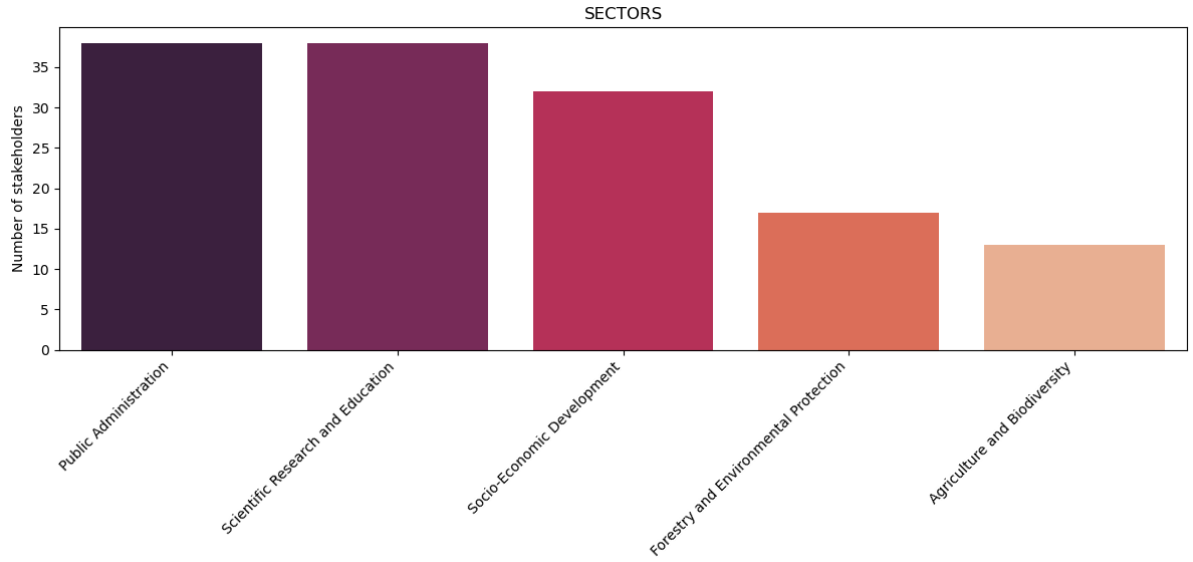

Figure 2. Main types of organisations included in the survey

2.3. Type of organisation

Organisations that responded to the questionnaire were Non-Governmental (highest number), followed by Public, Private-public, as well as Universities and Research organisations in descending order (Figure 3).

The bar chart illustrates the distribution of organizations grouped into five distinct clusters based on their type, with the x-axis representing the clusters and the y-axis showing the number of organizations in each. The largest cluster, **Non-Governmental Organizations (NGOs)**, comprises over 25 organizations, indicating their significant involvement in the analysed domain, potentially linked to advocacy, humanitarian efforts, or environmental causes. **Public Administration** forms the second-largest cluster, followed by **Private/Public Companies**, highlighting the influence of governmental and corporate entities. **Universities**

are also represented but to a lesser extent, suggesting notable but smaller academic involvement.

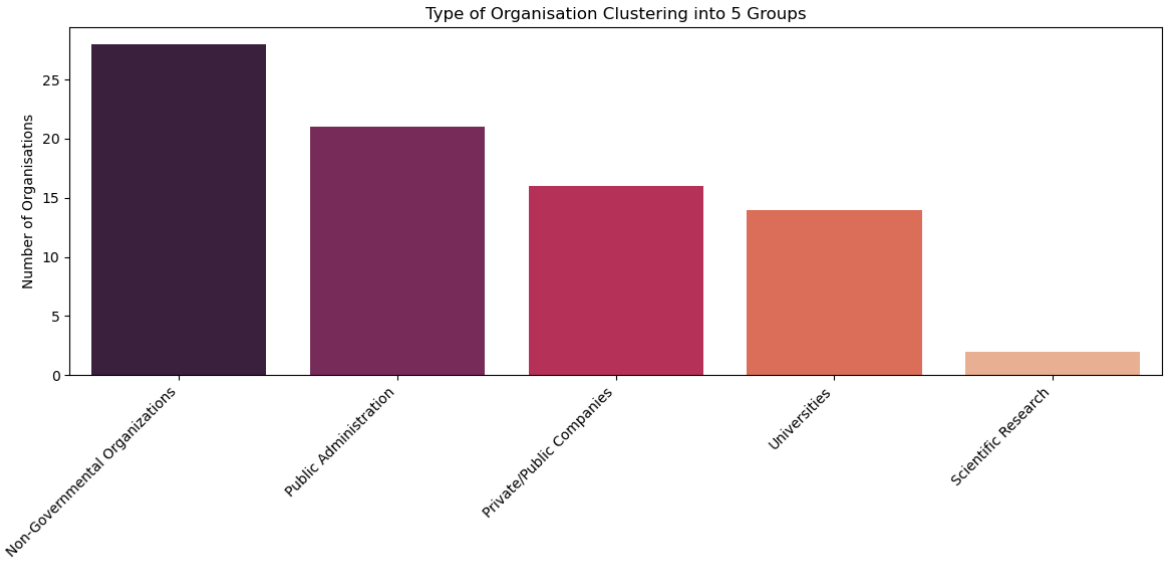

Figure 3. Organisations that responded to the questionnaire

The smallest cluster, **Scientific Research**, indicates limited representation of dedicated research entities in the dataset. These results highlight the dominant role of NGOs and the substantial participation of administrative and corporate sectors, while the lower representation of universities and scientific research organizations may point to underrepresentation or specific selection criteria. This distribution provides valuable insights into the types of organizations most actively engaged in the domain, with implications for understanding their roles and identifying potential gaps in collaboration or research contributions.

2.4. Share of organizations by the status of climate services usage.

Majority of the organisations that participated in the study (56.8%) indicated that they use climate products and services, while 43.2% did not use such products (Figure 4). Among the users, environmental organizations—such as environmental protection agencies and agencies managing protected natural areas—are prominent, alongside entities engaged climate research, public administration and tourism. The sectoral distribution of users highlights the current stage of market development, while the survey sample reveals notable differences in the size of the user base across different sectors.

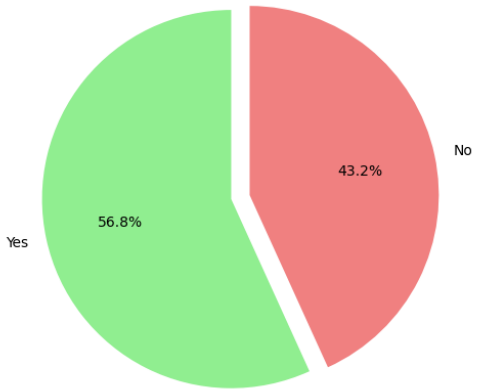

Figure 4. Use of Climate services and products in the surveyed organisations

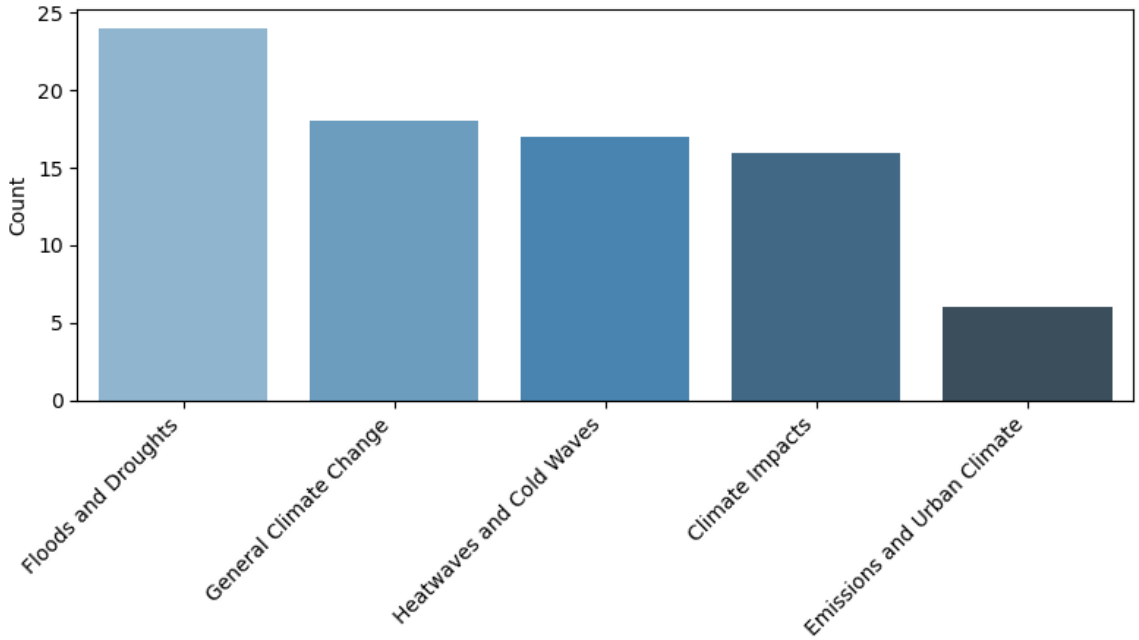

Figure 5. Frequency of various climate-related topics in everyday communication with audiences

The bar chart (Figure 5) highlights the frequency of various climate-related topics in everyday communication with audiences for the stakeholders that use climate products. "Floods and Droughts" is the most frequently discussed topic, reflecting the emphasis on immediate and impactful climate events. "General Climate Change" and "Heatwaves and Cold Waves" are also prominent, indicating a focus on both educating the public on broad climate issues and addressing temperature-related extremes. Discussions on "Climate Impacts" further underscore efforts to convey the long-term consequences of climate change. Meanwhile, "Emissions and Urban Climate" is communicated less frequently, suggesting a lower emphasis on policy, mitigation, and urban-specific climate concerns in public discourse. This distribution indicates that communicators prioritize extreme events and general awareness to engage audiences effectively.

2.5. Accessible climate information services from a human-centred perspective

In the past, the climate service sector focused on providing weather and climate predictions and overlooked important social contexts of users (Carr and Onzere, 2018). Socioeconomic and cultural barriers, which are typically inherent in society, were often not recognized in the provision of CIS, as they were socially constructed and based on societal values, gender-related restrictions, religion and power structures (Carr and Owusu-Daaku, 2016; Ingram et al., 2002; Patt et al., 2005).

Thus, conservatism, perceived risk, institutional influences, and cultural aspects all affect the usability of CIS (Kirchhoff et al., 2013; Sarku et al., 2022). Additionally, challenges from information providers, like inadequate down-scaling, limited ability to scale-up of innovations, and induce engagement, impact usability (Antwi-Adjei et al., 2021). Despite efforts to address user context challenges, there's a concern that information providers may neglect the service environment aspect in the guise of co-production in CIS provision.

The WMO initiated the Global Framework for Climate Services (GFCS) at the World Climate Conference in 2009. Recognizing the vital role of climate services in adaptation, the framework aims to transform scientific climate information into operational services, contributing to sustainability but also raising concerns about climate justice. GFCS aims to integrate climate information into decision-making globally, nationally, and locally to manage climate risks effectively (Hewitt et al., 2012). This shift recognises CIS as a tool supporting decision-making through co-production, aligning supply and demand sides (Vincent et al., 2018, del Pozo et al. 2024). Despite efforts to address user context challenges, there's a concern that information providers may neglect the service environment aspect in the guise of co-production in CIS provision.

CIS provision (Alexander and Dessai, 2019), includes the following:

- Recognizing the different groups of users, their information needs, and how they will use the information. It is also important to understand the steps users take to apply the information and when they will need the service.
- Identifying appropriate means of distributing CIS by collectively assessing the tools and improving the processes for communicating CIS.
- Following the co-production procedure of information with users and consciously building iterative co-production processes (after Paparrizos et al, 2024).

3. SURVEY RESPONSE ANALYSIS

This section is dedicated to stakeholders who use the climate services and products in their work. This part required a comprehensive approach to evaluate the effectiveness and timeliness of current climate information, products, and services, identify key future demands, and assess the need for further market development. To achieve this, we focused on the responses of current users. Specifically, we examined the types of climate data and products that are easily accessible, the categories of climate products currently in use (Section 3.1), respondents' perceptions of their usefulness services (Section 3.2), the providers of these products and as well as the source of these products (Sections 3.3). The findings discussed in these sections are derived exclusively from organizations that indicated they are active users of climate services.

3.1. Climate information

Figure 6 shows that the most organisations included in the survey used temperature-related indices, followed by precipitation and tropical days, and thermal comfort and pressure, with lesser number using general climate indices and specific indices.

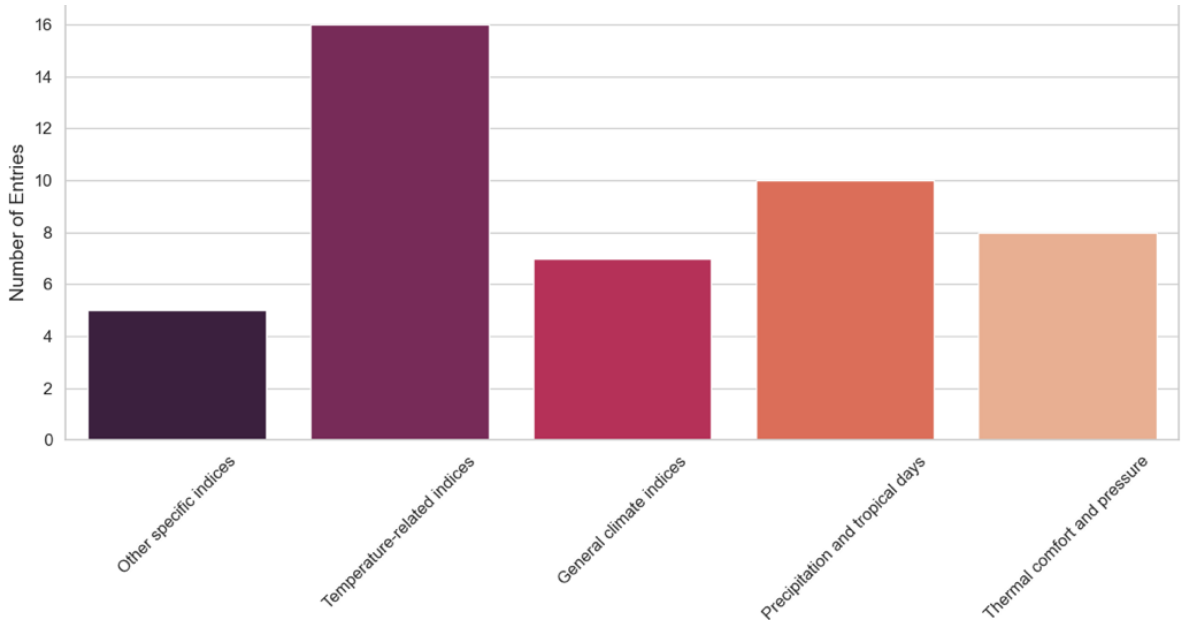

Figure 6. Climate indices and indicators currently in use

Most institutions that belong to Scientific research use temperature and precipitation related indices, while agriculture and forestry institutions focus more on precipitation, soil moisture and discharges.

Most respondents used long-term scenario, monitoring and diagnosis, followed by general climate services, weather forecasts and with few organisations using spatio-temporal analysis (Figure 7).

The institutions that belong to Agriculture and rural development mostly use climate monitoring and climate diagnosis products which is understandable due to their primary activity. Similarly, the public administration also focuses on monthly and/or seasonal weather forecasts, long-term climate scenarios and models.

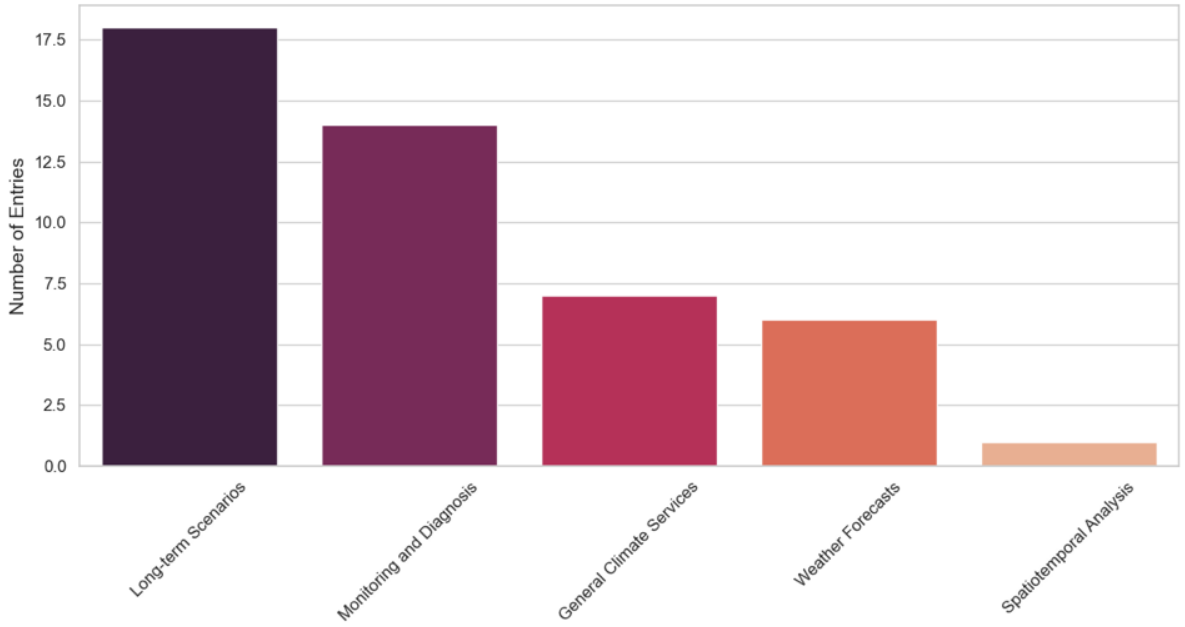

Figure 7. Climate products and services currently used

Additionally, most organisations intimated that they used daily climate service products, followed by these who use monthly, weekly, annually or occasionally, in that order.

3.2. Benefits of using climate services

Respondents identified the primary benefits of Climate Information Services (CIS) as their contributions to research, education, and monitoring activities. These were followed in importance by non-financial and educational advantages, support for decision-making processes, and assistance in developing strategies. Additionally, respondents highlighted the role of CIS in facilitating adaptation to national and EU strategies for risk management. Other notable benefits included enhanced market competitiveness and financial gains, underscoring the broad applicability and value of CIS across various sectors (Figure 8).

The identified benefits of CIS reflect their multifaceted role in addressing both immediate and long-term challenges across various domains. Contributions to research, education, and monitoring are vital for advancing scientific knowledge, raising awareness, and tracking environmental and climate-related changes, which form the foundation for informed decision-making. Non-financial and educational advantages, such as capacity building and knowledge dissemination, are essential for empowering stakeholders to understand and respond to climate risks effectively. The support provided by CIS in decision-making and strategy development is crucial for organizations and policymakers to craft resilient and adaptive approaches to climate challenges. Moreover, aligning with national and EU strategies for risk management enables organizations to meet regulatory requirements, access funding opportunities, and ensure coherence with broader climate goals. Enhanced market competitiveness and financial benefits further highlight the economic value of CIS, as they help organizations optimize operations, reduce risks, and tap into emerging green markets. Together, these benefits underscore the critical importance of CIS in fostering resilience, innovation, and sustainability across sectors.

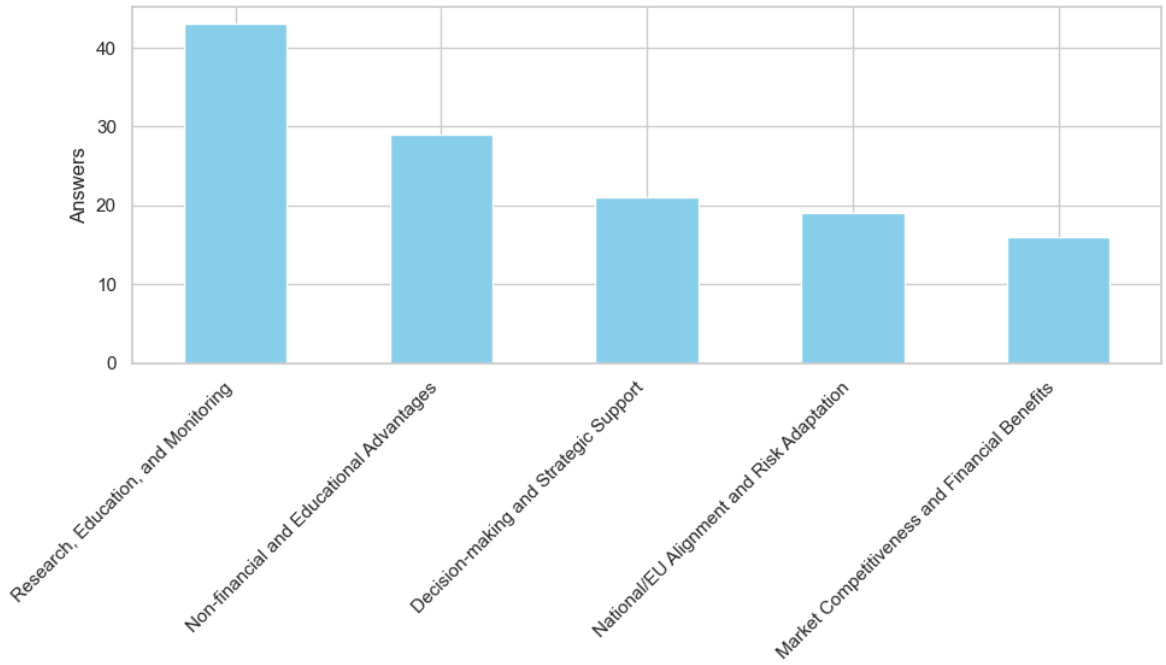

Figure 8. Benefits of using climate products and services to respondents

3.3. Characteristics of climate services used

Most of the climate products used by respondents were free (Figure 9), coming from National Meteorological Administrations. Paid products from this source are also notable but considerably fewer. Sectoral providers show a more balanced distribution of free and paid products, with moderate representation of both categories.

Consultancy agencies exhibit a significant contribution to the paid category, suggesting their specialized services are often monetized, while their free offerings are minimal. Organizations developing their own products show a moderate use of free resources, with a smaller proportion attributed to paid resources. Lastly, the "Others" category reflects contributions predominantly in the form of free products, with negligible paid options.

This visualization highlights the reliance on publicly available resources, especially from the National Meteorological Administration, while emphasizing the importance of paid services from consultancy agencies for specialized needs. It also suggests the potential role of self-reliance and innovation in generating climate products within organizations.

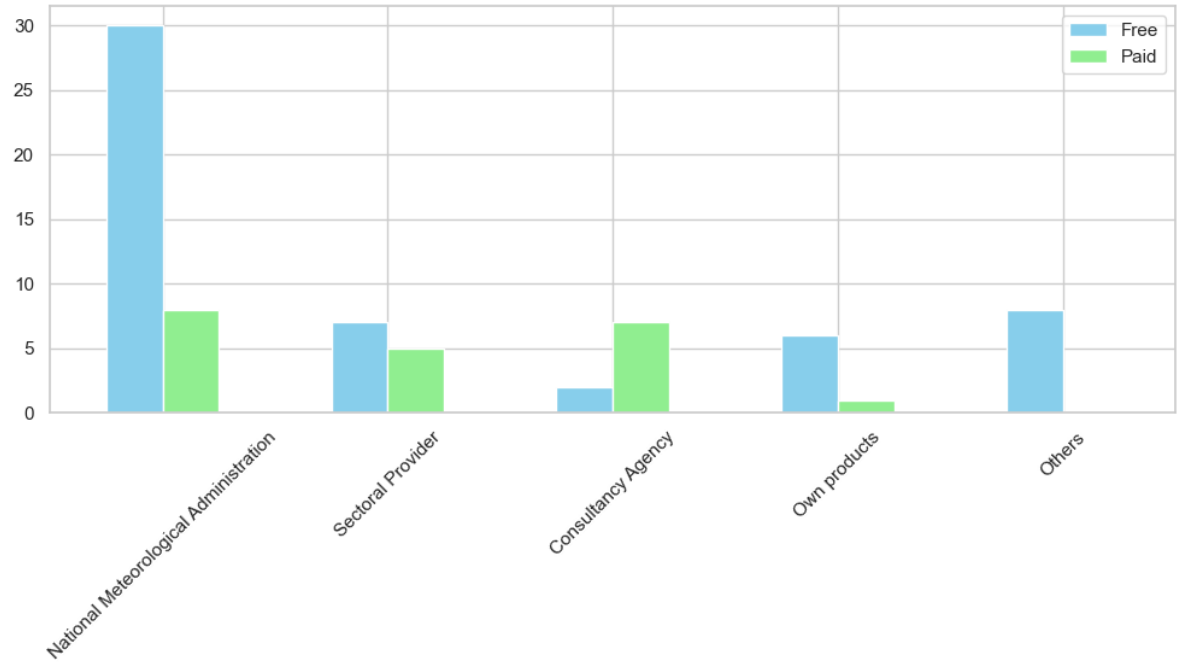

Figure 9. Share of users based on sources of climate products and services and their costs

The bar chart (Figure 10) illustrates the perceived importance of various temporal resolutions in climate services, including hourly, daily, weekly, monthly, seasonal, annual, and decennial frequencies. Hourly and daily resolutions are highly valued, particularly in the "Very Important" and "Important" categories, reflecting their critical role in applications requiring

fine temporal granularity, such as weather monitoring and immediate decision-making in agriculture and disaster response. Weekly and monthly resolutions show relatively even distributions across the importance spectrum, with a stronger emphasis on "Important" and "Very Important," indicating their utility in medium-term planning and analysis, such as water resource management and energy production. Seasonal and annual resolutions are predominantly classified as "Important" and "Very Important," emphasizing their relevance for long-term climate modelling, policy development, and strategic adaptation planning. While decennial resolution receives less emphasis overall, its significance in long-term planning and research is evident, with moderate representation in the "Important" category. These findings highlight that temporal resolution needs vary by application, emphasizing the necessity for tailored climate services to meet the temporal demands of diverse user groups and sectors.

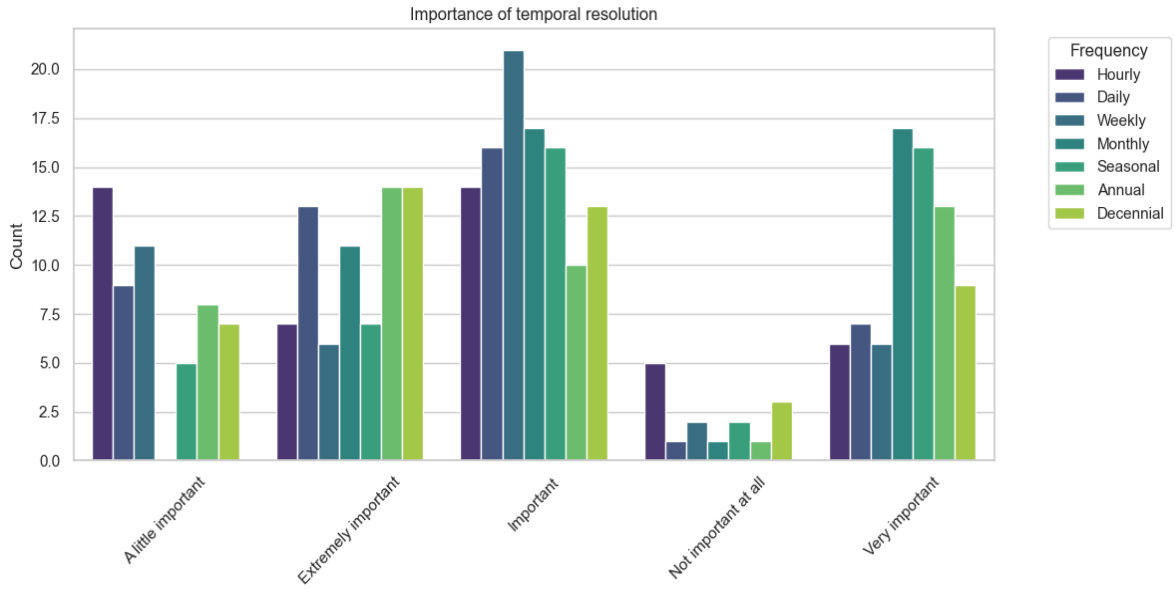

Figure 10. Temporal resolution of the products and services used by the respondents

Majority of respondents used more than 10km special resolution (over 20 respondents), second being ≤ 1km (about 20) and the last category used less than 1 km resolution (about 15 respondents). Over 35 respondents used local spatial coverage products, with about the same number using regional and national products as the second category (just above 30 each) and the smaller numbers using continental, sub-continental and global services (Figure 11).

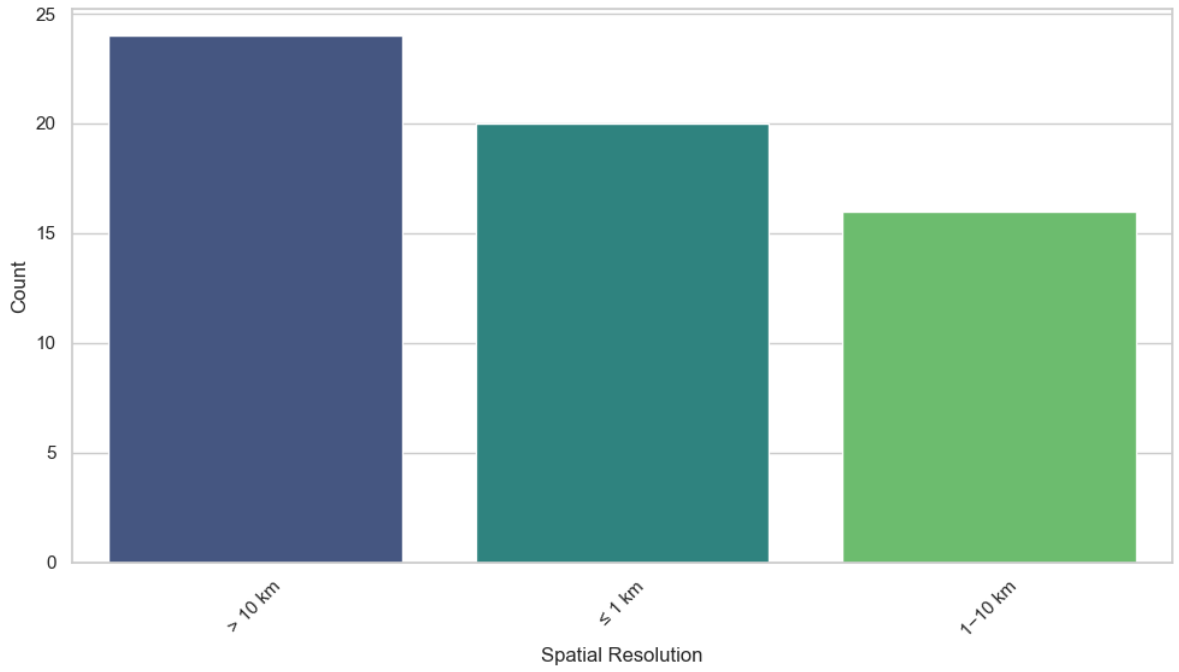

Figure 11. Relevance of spatial coverage of climate services for the users among the respondents

Figure 12 shows the views of current users of CIS in regard of improving the climate products. It shows the distribution of responses for five statements related to climate services, with each statement categorized into distinct response categories. The x-axis represents the numbered statements, while the y-axis shows the count of responses for each category. The categories, represented by different colours, include artificial intelligence integration, climate services accessibility, prioritizing a human-centred approach, clarity in communication, and integrating traditional or folk beliefs into climate services. Notably, Statement 5, which emphasizes integrating traditional or folk beliefs, received the highest response count across all categories, particularly in the associated purple category. Statement 1, focusing on artificial intelligence integration, showed consistent but comparatively lower response counts. Statements 3 and 4, highlighting the importance of human-centred approaches and clarity in communication, exhibit diverse response distributions, suggesting varying levels of emphasis among respondents. Statement 2, addressing accessibility, displayed moderate response counts, indicating steady interest in this aspect.

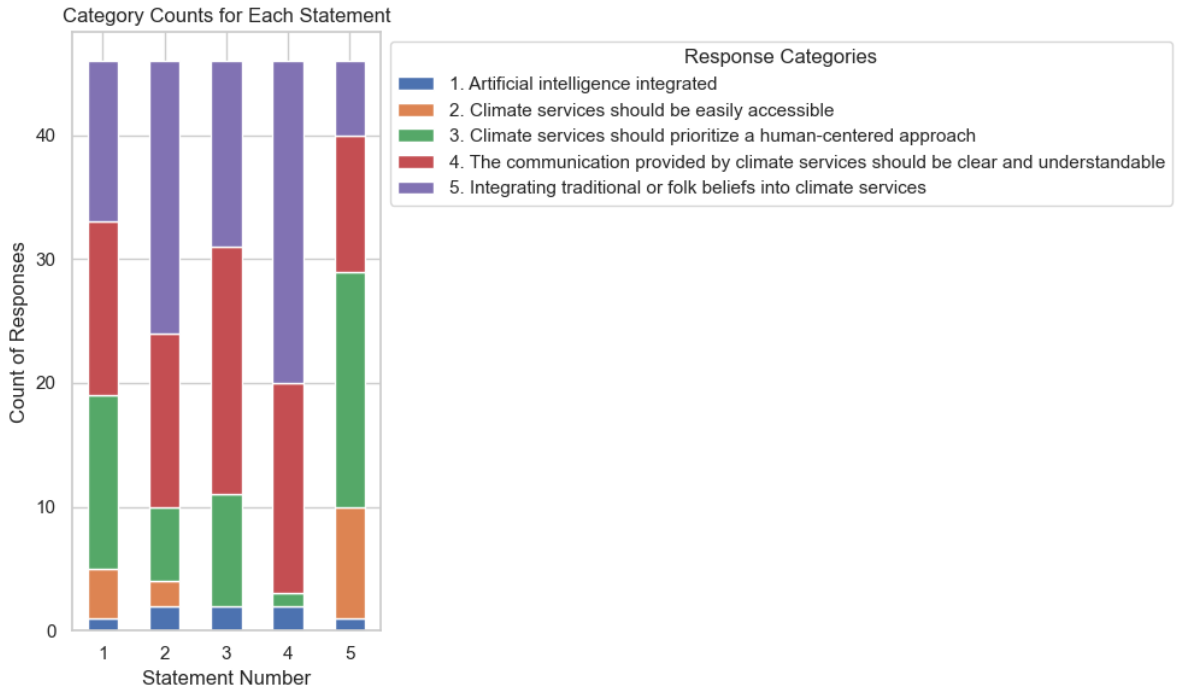

Figure 12. Need for CIS improvement stated by current users

4. NEEDS FOR CLIMATE INFORMATION

This section is dedicated to non-users of climate services. All the questions in this section were specifically designed for non-users to gather insights into their potential needs. These were multiple-choice questions, allowing respondents to select multiple options simultaneously. This approach is crucial given the higher number of non-users, as understanding their requirements is essential for addressing their needs in daily work activities.

4.1. Categories of products and services that would be useful for the organization

The most frequently selected category was "Climate Diagnosis," with 12 responses, suggesting that stakeholders see significant value in tools or services that assess and interpret climate-related issues. "Climate Models" and "Climate Analysis" were also highly regarded, receiving 8 and 9 responses respectively, indicating a strong interest in predictive tools and data-driven analyses that can inform organizational decision-making. The "Weather Forecast" category received fewer responses, with a count of 4, implying that stakeholders may perceive it as less directly relevant or potentially already accessible through other sources (Figure 13).

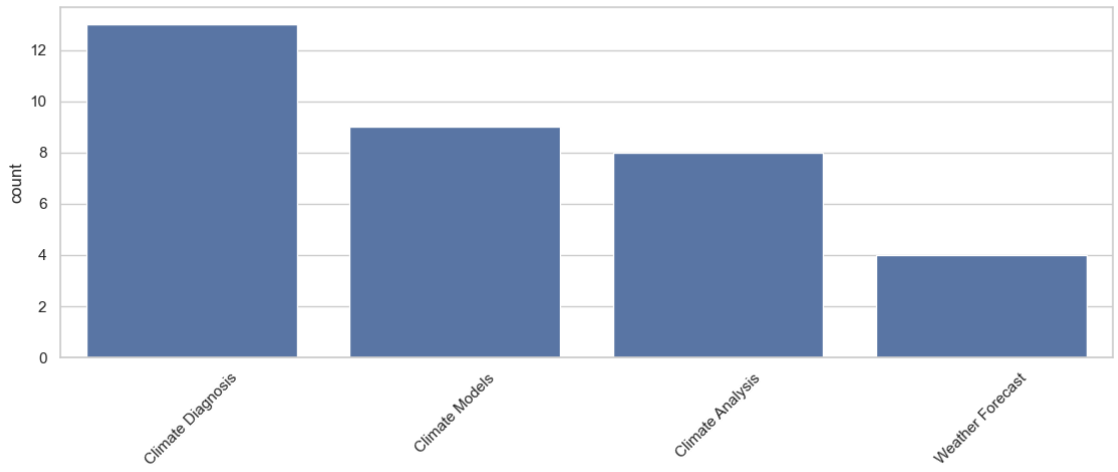

Figure 13. Perception of climate services products needed by non-users

These responses highlight a clear demand among non-users for advanced diagnostic and analytical tools, which suggests that organizations may be seeking to better understand and anticipate climate-related impacts on their operations. The results emphasize the importance of tailoring climate services to provide actionable insights, particularly in the areas of climate diagnosis, modelling, and analysis, to meet the needs of this stakeholder group.

The pie chart (Figure 14) illustrates the preferred temporal resolution of climate products and services as indicated by stakeholders who do not currently use climate services. These preferences reflect the temporal scales that non-users deem most relevant to their organizations' activities.

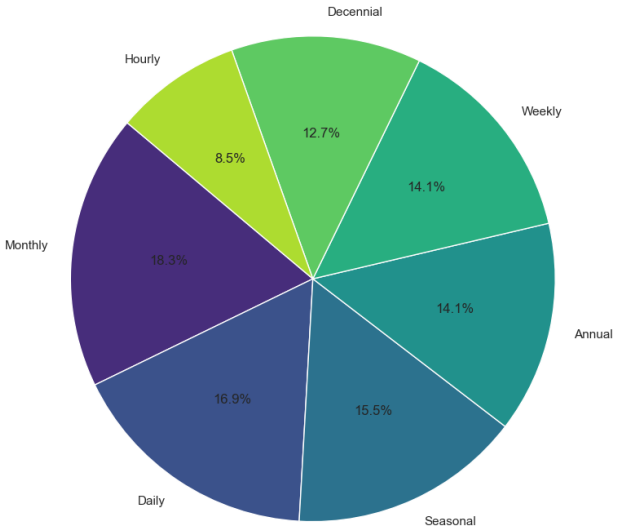

Figure 14. The preferred temporal resolution of climate products and services by respondents

The largest segment, representing 18.3% of respondents, indicates a preference for **monthly resolutions**, suggesting that many organizations prioritize data summaries or analyses that capture trends and changes on a monthly basis. This may align with reporting cycles, operational planning, or decision-making processes.

Following this, **daily resolutions** account for 16.9% of responses, indicating the importance of high-frequency data for some stakeholders, potentially for applications like short-term planning or monitoring. **Seasonal resolutions**, at 15.5%, and **annual resolutions**, at 14.1%, are also notable, highlighting a demand for longer-term insights that support strategic planning and policy development.

Weekly resolutions (14.1%) and **decennial resolutions** (12.7%) reflect a more specific subset of stakeholders interested in intermediate and long-term temporal data, respectively. Lastly, the smallest segment, **hourly resolutions** (8.5%), indicates that only a minority of respondents require highly granular, real-time data, likely for specific operational or emergency applications.

These results suggest that the temporal needs of non-users are diverse, spanning from immediate to long-term resolutions, with a particular focus on monthly, daily, and seasonal data. This emphasizes the importance of offering flexible temporal resolution options in climate services to address the varying operational and strategic requirements of different organizations.

The bar chart (Figure 15) illustrates the spatial coverage preferences for climate products and services as indicated by respondents. The most frequently selected spatial coverage was local, with a count of 20 responses, highlighting the importance of localized climate information tailored to specific areas or communities. Regional and national spatial coverages followed, with 18 and 16 responses, respectively, indicating that broader geographic scales are also relevant for organizational needs. In contrast, fewer respondents expressed a need for sub-continental, continental, and global coverages, each with significantly lower counts. This distribution suggests that organizations prioritize localized and region-specific climate products and services over larger-scale or global data, reflecting a demand for actionable insights at smaller spatial scales. These findings underline the necessity of focusing on local and regional resolutions when designing climate services to meet the practical needs of organizations.

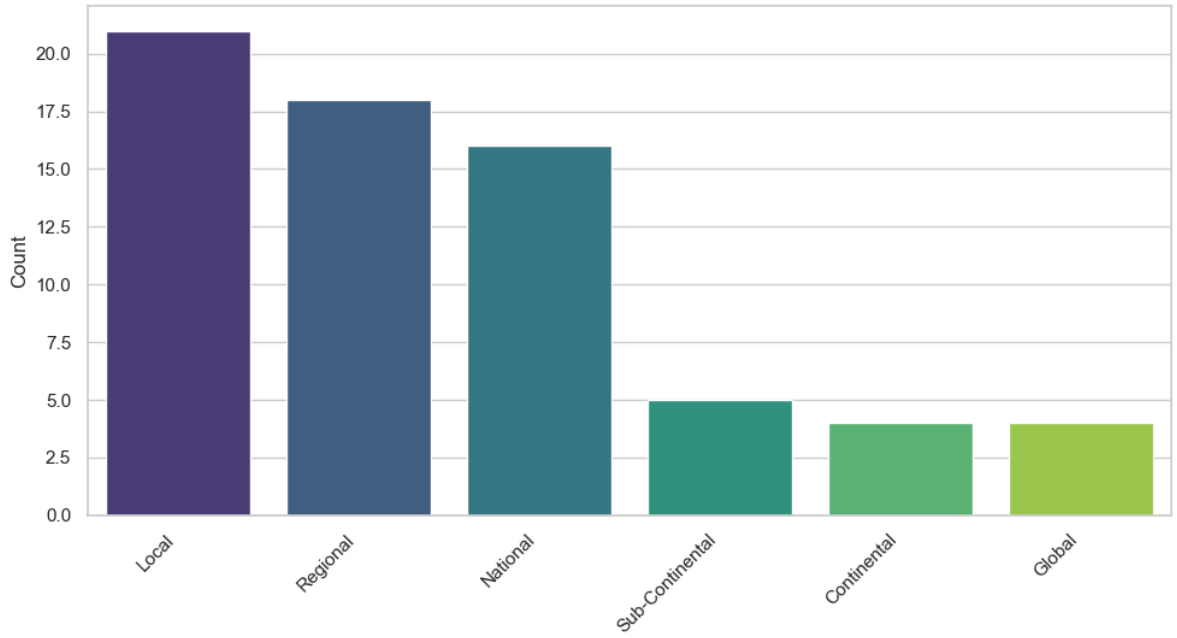

Figure 15. Spatial coverage of needed climate products and services

4.2. Desired qualities of climate services

The chart (Figure 16) highlights the predominance of responses advocating for the integration of traditional or folk beliefs into climate services (purple), suggesting a strong interest among non-users in incorporating indigenous knowledge and cultural practices into climate service products. Clear communication (red) and a human-centred approach (green) also received substantial support, reflecting the importance of providing information in a clear and understandable manner while prioritizing human needs and experiences. Although artificial intelligence integration (blue) and accessibility (orange) received fewer responses, their presence indicates an awareness of and interest in leveraging advanced technologies and ensuring climate services are accessible to a wider audience. Overall, the chart suggests that non-users of climate services prioritize a blend of traditional knowledge, clear communication, and human-centred approaches. The relatively lower emphasis on artificial intelligence and accessibility may reflect either a lack of familiarity with these features or their perceived secondary importance. These insights underscore the need for culturally inclusive, clearly communicated, and user-focused climate services to enhance adoption and utility.

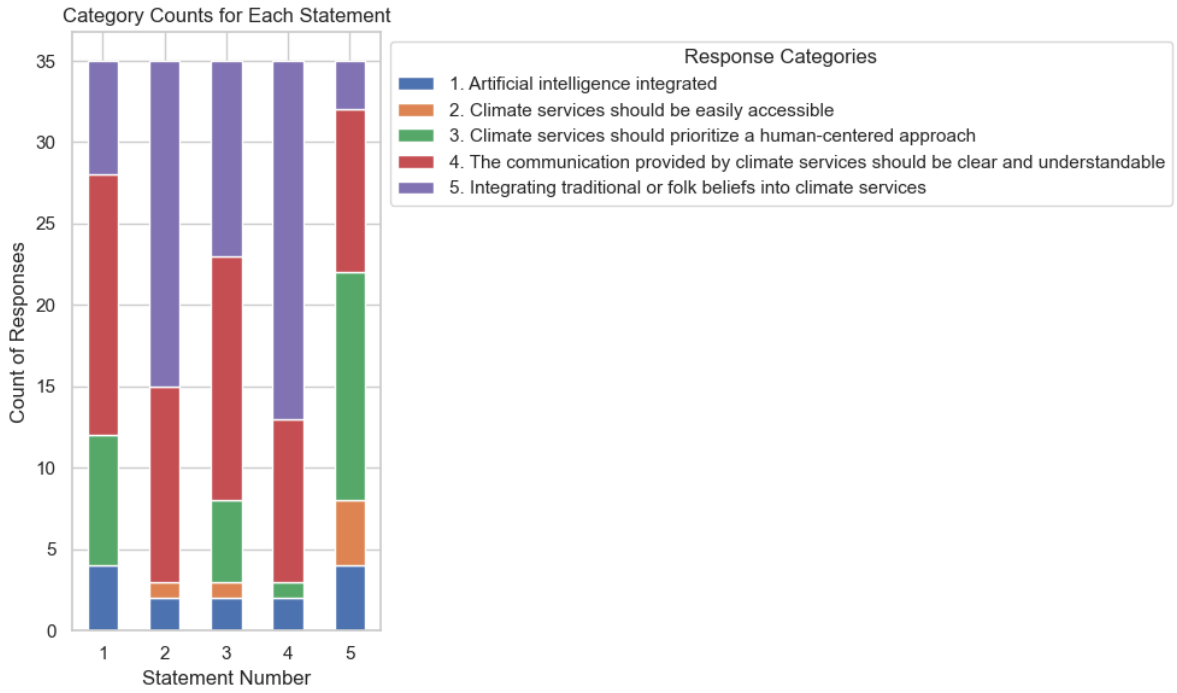

Figure 16. Need for different qualities of CIS

5. CONCLUSIONS

Key findings

- Citizens of the SEE countries are already suffering effects of climate change. This has been recognized in most areas, but frequently left to the government or big public entities to deal with, while local people wait for the solutions. In many parts of this region, local knowledge on climate adaptation is existing and it is documented, but this information, while available, is not adequately utilised to blend with scientific knowledge and provide usable solutions for local climate problems.
- Climate change disproportionately affects vulnerable and/or socially marginalized individuals. Exposure to heatwaves has a negative impact on the growth and development of children, both physically and mentally. Moreover, recent heatwaves in Europe have resulted in higher mortality rates among women than among men. Women, young people, and people with low socioeconomic status have been shown to be more vulnerable to anxiety and mood disorders related to disasters. In addition, many disorders are associated with the presence of extreme weather events, sometimes manifesting even before the event itself (Ursano et al., 2017). Having to grapple with the reality of climate change gives rise to what is called "eco-anxiety", the profound sense of discomfort and fear experienced at the recurring thought of possible disasters linked to global warming and its environmental effects (Ghaleb, 2024). The need to clearly distinguish and analyse as well as respond to the CIS needs of every group of users, but especially for vulnerable groups in society has been clearly demonstrated by the numerous studies mentioned in this report.
- To ensure the next generation copes successfully with the massive climate changes, there is the need to focus on equipping them with the necessary knowledge, skills, and attitudes. Parents play a vital role in preparing their children to face these upcoming challenges, therefore the fact that women's CCRP is lower when they have small children at home is of high relevance. It appears essential to have support groups that assist parents -especially mothers- in effectively addressing climate change. Sanson et al. (2018) state that we need initiatives that aim to help parents enhance their own and their children's abilities in social engagement, adaptation, and citizenship, all with the purpose of tackling climate change. We need to adapt communication strategies to effectively involve women and address their apprehensions regarding climate change without compromising their caregiving responsibilities. This could include highlighting the potential dangers to children's health and overall well-being. It also seems critical to understand the gender differences in CCRP, especially in young citizens, where the difference seems to be

larger (Ergun et al., 2024). School involvement to increase awareness of the students is also of essential importance, as demonstrated by Leščešen et al, 2024.

- Even with an increased use of ICTs to provide CIS, knowledge is still not sufficient to adequately show how these are best used in practice and whether they are designed meet the 'service' needs of the users. This research area is noticeably lacking from the climate service literature, as relatively less attention is focused on the services cape aspect the CIS to users, value creation and perceived service quality. This is particularly relevant in the context of the provision of CIS with ICTs for everyday use, which is important to many customers, as the previous studies show. The key question is thus whether currently used ICTs enable people to easily find, comprehend and apply relevant CIS for their actual need or is there need for considerable improvements and tailor-made options to suit different categories of users.
- Are we adapting fast enough to climate change is an important consideration, and despite the climate crisis being an unprecedented emergency, governments and corporations are largely responding not readily enough, behaving as if it were a familiar challenge we've faced before that can be resolved with a good inventions and improved technologies. The adaptation actions thus are often one-sided, driven by interests and knowledge not useful or applicable to much of the affected people. This is very clear also from the information gathered in this report and should be recognised as one of the major gaps to be addressed.

Recommendations

- To move from policy recommendations and guidelines towards more advanced comparative studies, new data needs to be collected on issues of adaptation, its leadership and processes of integration of scientific and citizen use of CIS. Collecting more customized data on adaptation and mitigation could be supported by bodies such as national funding agencies, UN and multilateral organizations, the World Bank, private funds, and donors to aid comprehensive adaptation data collection efforts. In today's world, such data collection could benefit from the use of machine learning algorithms to filter publicly available datasets (e.g., social media, or legal repositories) in search for relevant data as well as auto-coding large parts of this data (Ford et al., 2016; Kirilenko and Stepchenkova, 2014) in order to gain maximum benefits from currently available technology. In this process, community-based and local knowledge may offer valuable insights into environmental change due to climate change and complement broader-scale scientific research with local precision and nuance.
- Many of the people already confronting higher climate risks live in lower income communities, especially in the Balkan Region, or are part of the groups not sufficiently educated about climate change, older in age, etc. Even for organisations and entities

who accept that climate change is real, investing in climate resilience still seems risky, complicated, and expensive, given the unknown future ahead. It is therefore not surprising that the costs and burdens associated with climate change in the region are being disproportionately borne by the people living in the already strained community circumstances. Unless climate investments have an explicit focus and are designed for benefiting and targeting such citizens, they will add another layer of climate-based displacement and exclusion to existing inequities.

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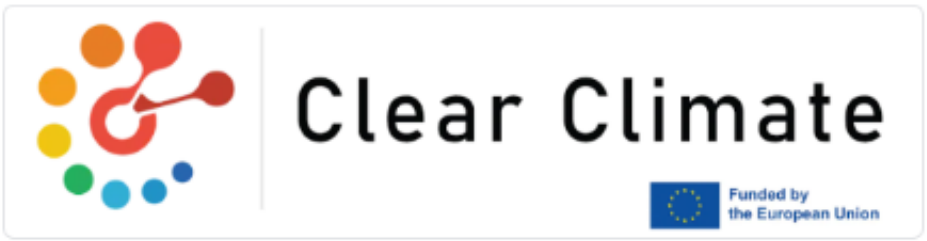
ANNEX 1. CLIMATE SERVICES USAGE AND NEED ASSESSMENT SURVEY



Climate services usage and needs assessment survey

Thank you for participating in this survey, which aims to gather insights on the use of climate services by organizations, including perceived benefits, technical characteristics, and anticipated future needs. Your responses will contribute to advancing research in the field of climate action.

Purpose
This survey is conducted as part of the project "Engaging Approaches and Services for Meaningful Climate Actions - ClearClimate," funded under the Marie Skłodowska-Curie Actions (MSCA). The project seeks to develop impactful climate services that support informed decision-making and foster sustainable practices. More information about ClearClimate is available at: clear-climate.com.

Data Privacy and confidentiality
Your privacy is important to us. The data collected in this survey will be used solely for research purposes and will be anonymized before analysis to ensure that individual responses cannot be traced back to participants. Data will be stored securely and will not be shared outside the project team without anonymization. Participation is voluntary, and you may withdraw at any time without consequence. By continuing with this survey, you consent to the use of your responses in this research.

How your data will be used
The insights gained from this survey will be used to shape future climate services tailored to organizational needs, with a focus on enhancing usability and effectiveness. Results may be published in academic and project reports, but no personally identifiable information will be included.

Thank you for contributing to this important research.

ugljesastankov@gmail.com Switch account

Not shared

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Section 1 – General questions

1. Name of organisation: *

Your answer

2. County: *

- Albania
- Bosnia and Herzegovina
- Bulgaria
- Croatia
- Greece
- Kosovo*
- Montenegro
- North Macedonia
- Romania
- Serbia
- Slovenia
- Other:

3. City

Your answer

4. Sector of activity: *

- [ ] Public administration
- [ ] Agriculture and rural development
- [ ] Biodiversity
- [ ] Air quality
- [ ] Scientific research
- [ ] Construction
- [ ] Education and awareness
- [ ] Energy
- [ ] Finance and insurance
- [ ] Industry
- [ ] Water resources management
- [ ] Public health
- [ ] Forestry
- [ ] Transport
- [ ] Tourism and recreation
- [ ] Urban planning and urban systems
- [ ] Other:

5. Type of organisation *

- ( ) Central public administration
- ( ) Local public administration
- ( ) Research institution
- ( ) Non-governmental organisation
- ( ) Private organisation
- ( ) University
- ( ) Other:

6. How many employees does your organisation have? *

- ◯ <10
- ◯ 10–49
- ◯ 50–249
- ◯ >250

7. Is there a department/person in your organisation responsible for climate and/or climate change? * *

- ◯ Yes
- ◯ No

8. Which audiences, if any, do you primarily target in your communication? *

- ☐ Climate science community
- ☐ Scientific community (beyond climate)
- ☐ Private sector professionals
- ☐ Policymakers
- ☐ Environmental and climate activists
- ☐ General public
- ☐ We don't communicate with audiences
- ☐ Other: _____

9. What topics do you communicate about most frequently in your daily work? *

- ☐ Climate change and its impacts
- ☐ Floods
- ☐ Droughts
- ☐ Heatwaves and/or coldwaves
- ☐ Emissions and greenhouse effect
- ☐ Storms and hurricanes
- ☐ Climate policy
- ☐ We don't communicate with audiences.
- ☐ Other: _____

10. Does your organisation currently use climate products and services? * *

- ◯ Yes
- ◯ No

Section 2 – This section is dedicated to users

11. What climate indices and indicators are used in your organisation's work? (for example, average temperature, atmospheric pressure, thermal comfort index, number of hot days, etc) *

Your answer

12. List the categories of climate products and services currently used by your organisation: *

- ☐ Climate diagnoses
- ☐ Climate monitoring
- ☐ Monthly and/or seasonal weather forecasts
- ☐ Long-term climate scenarios and models
- ☐ Spatio-temporal maps and analysis tools
- ☐ Statistical syntheses
- ☐ Other:

13. What is the frequency of climate products and services use in your organisation? *

- ☐ Daily
- ☐ Weekly
- ☐ Monthly
- ☐ Annual
- ☐ Occasional
- ☐ Option 6

14. What are the benefits of using climate products and services for your organisation? *

- [ ] Carrying out day-to-day activities
- [ ] Market competitiveness
- [ ] Financial benefits
- [ ] Non-financial advantages
- [ ] Decision-making support
- [ ] Strategic decision support
- [ ] Alignment with national/EU vision
- [ ] Adapting to risks in the activity sector
- [ ] Other: _____

15. Indicate the source and the cost of the climate products and services used:

	Free	Paid
National Meteorological Administration	☐	☐
Sectoral Provider	☐	☐
Consultancy Agency	☐	☐
Own products	☐	☐
Others	☐	☐

16. What is the relevant temporal resolution of the products and services used? *

	Not important at all	A little important	Important	Very important	Extremely important
Hourly	○	○	○	○	○
Daily	○	○	○	○	○
Weekly	○	○	○	○	○
Monthly	○	○	○	○	○
Seasonal	○	○	○	○	○
Annual	○	○	○	○	○
Decennial	○	○	○	○	○

17. What is the relevant timeframe for the climate products and services used?

	Not important at all	A little important	Important	Very important	Extremely important
By 2030	○	○	○	○	○
By 2050	○	○	○	○	○
After 2050	○	○	○	○	○
In the past 10 years	○	○	○	○	○
In the past 30 years	○	○	○	○	○
More than 30 years ago	○	○	○	○	○

18. What is the spatial resolution of climate products and services of interest to your organisation's work?

- [ ] ≤ 1 km
- [ ] 1–10 km
- [ ] > 10 km

19 What is the spatial coverage of climate products and services used? *

- [ ] Local (e.g., city, municipality, or specific area within a country)
- [ ] Regional (e.g., state, province, or broader area within a country)
- [ ] National (entire country coverage)
- [ ] Sub-Continental (multiple neighboring countries within a specific part of a continent)
- [ ] Continental (entire continent, e.g., Europe-wide coverage)
- [ ] Global (worldwide coverage)

20. What specific climate products and services do you think would be necessary for your organisation's work?

Your answer

21. As a current user of climate services, to what extent do you agree with the following statements about the desired qualities of climate services? *

	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
Artificial intelligence should be integrated into climate services to enhance the accuracy and relevance of climate-related insights	○	○	○	○	○
Climate services should be easily accessible to users with dissabilites and with varying levels of technical expertise and resources	○	○	○	○	○
Climate services should prioritize a human-centered approach, addressing the unique needs and contexts of different communities.	○	○	○	○	○

The communication provided by climate services should be clear and understandable, ensuring that users with different backgrounds can interpret the information effectively	○	○	○	○	○
Integrating traditional or folk beliefs into climate services can enhance the communication of weather predictions to the general public	○	○	○	○	○

If you would like to receive the results of this survey, please provide an email address where we can send them.

Your email will be used solely for the purpose of sharing survey results and will not be shared or used for any other purpose.

Your answer

Section 3 – This section is dedicated to non-users of climate services

22. Which categories of products and services would be useful in your organisation's work? *

- [ ] Climate diagnoses
- [ ] Climate monitoring
- [ ] Monthly and/or seasonal weather forecasts
- [ ] Long-term climate scenarios and models
- [ ] Spatio-temporal maps and analysis tools
- [ ] Statistical syntheses
- [ ] Other:

23. What is the temporal resolution of climate products and services of interest to your organisation's activity? *

- [ ] Hourly
- [ ] Daily
- [ ] Weekly
- [ ] Monthly
- [ ] Seasonal
- [ ] Annual
- [ ] Decennial

24. What is the spatial resolution of climate products and services of interest to your organisation's activity? *

- [ ] ≤ 1 km
- [ ] 1–10 km
- [ ] > 10 km

25. What is the spatial coverage of climate products and services required for your organisation's activity? *

- [ ] Local (e.g., city, municipality, or specific area within a country)
- [ ] Regional (e.g., state, province, or broader area within a country)
- [ ] National (entire country coverage)
- [ ] Sub-Continental (multiple neighboring countries within a specific part of a continent)
- [ ] Continental (entire continent, e.g., Europe-wide coverage)
- [ ] Global (worldwide coverage)

26. As a potential user of climate services, to what extent do you agree with the following statements about the desired qualities of climate services? *

	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
Artificial intelligence should be integrated into climate services to enhance the accuracy and relevance of climate-related insights	○	○	○	○	○
Climate services should be easily accessible to users with dissabilites and with varying levels of technical expertise and resources	○	○	○	○	○
Climate services should prioritize a human-centered approach, addressing the unique needs and contexts of different communities.	○	○	○	○	○

The communication provided by climate services should be clear and understandable, ensuring that users with different backgrounds can interpret the information effectively	○	○	○	○	○
Integrating traditional or folk beliefs into climate services can enhance the communication of weather predictions to the general public	○	○	○	○	○

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Your answer