



# Summary report on the communication, dissemination and engagement activities

## *Deliverable 4.9*

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This project received funding from the Horizon 2020 programme under the grant agreement No. 821003.

## Document Information

GRANT AGREEMENT	821003
PROJECT TITLE	Climate Carbon Interactions in the Current Century
PROJECT ACRONYM	4C
PROJECT START DATE	01/06/2019
RELATED WORK PACKAGE	WP7
RELATED TASK(S)	T4.4.3
LEAD ORGANIZATION	BSC
AUTHORS	Andria Nicodemou, Ilaria Vigo (BSC), Glen Peters, Miriam Stackpole (CICERO), Pierre Friedlingstein (University of Exeter)
SUBMISSION DATE	31/11/2023
DISSEMINATION LEVEL	PU

## History

DATE	SUBMITTED BY	REVIEWED BY
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Final version submitted 30/11/23		

**Please cite this report as:** Nicodemou A., Vigo I., Peters G., Stackpole M., and Friedlingstein P. (2023). Summary report on the communication, dissemination, and engagement Activities, D4.9 of the 4C project.

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# 1 About

**4C**, or **Climate-Carbon Interactions in the Current Century**, is an EU-funded project that aims to fill the crucial knowledge gap on carbon dioxide (CO<sub>2</sub>) emissions, by reducing the uncertainties in our quantitative understanding of climate-carbon interactions and feedbacks. The objectives of the 4C project are to:

1. Better understand the processes controlling the global carbon cycle.
2. Develop new tools and methods to predict, for the first time, the evolution of global carbon cycle variability over the coming decade, including atmospheric CO<sub>2</sub>, land and ocean carbon sinks, and climate response to track the overall progress towards the goals of the Paris Agreement.
3. Reduce uncertainties in climate projections over the 21<sup>st</sup> century.
4. Ensure the usability of the knowledge generated by scientific research and engage in bilateral interactions among scientists and policymakers, while also fostering the understanding of the findings for the broad society.

4C achieved its objectives through the innovative integration of new models and a wide range of observations. It developed systems for new climate predictions and projections from annual to centennial timescales that are informed by observations, and provided key knowledge to underpin IPCC assessments and support policymakers.

The project originally ran for 48 months, from June 2019 to May 2023, receiving an extension until November 2023.

## 2 WP4 Objectives

Communication, dissemination, engagement and policy dialogue have been the core activities of Work Package 4 (WP4) within the 4C project. These activities aimed to synthesise and disseminate the 4C scientific findings to foster a broader understanding of climate-carbon interactions and accurate interpretation in support of scientific assessments and policymaking.

The key objectives of the communication, dissemination and policy dialogue activities included the following:

- increase the visibility of 4C and its outcomes in Europe and beyond, supporting Europe's leadership in climate science
- maximise the impact and reach of the project, by facilitating knowledge transfer to the target audiences (e.g. policymakers, scientific community)
- support international scientific assessments, such as IPCC, Global Carbon Project, and similar assessments
- ensure accurate interpretation by policymakers of scientific findings in the context of the UNFCCC Paris Agreement
- broaden the public understanding of the carbon cycle and of the risks of climate-carbon interactions for enhancing climate change.

The activities carried out as part of WP4 were led by the Barcelona Supercomputing Center, supported by CICERO, University of Exeter, and University of East Anglia, with contributions by all partners.

### 2.1 Definitions

In the context of this H2020 project, the differentiation among the communication, dissemination and engagement strategies is described below, although in practice these actions are closely linked.

**Communication strategy:** The project's communication strategy aimed to raise awareness, create visibility, and support dissemination and exploitation by providing a strong visual identity, media tools and channels, as well as fostering linkages with other related projects and programmes. The communication strategy targets multiple audiences beyond the project's own community, including the media and general public in order to show how society can benefit from the research.

**Dissemination strategy:** The dissemination strategy aims to position the scientific results, tools and knowledge from the project to be usable by a range of stakeholders within the scientific community and society, contributing to the development of relevant national, European, and international policies. The dissemination strategy targets specialist audiences that may use the results in their own work, including peer groups, policymakers, industry, and professional organisations.

**Engagement strategy:** The engagement strategy aimed to maximise the project impact and knowledge exchange by proactively engaging with groups of interest within and outside the EU, and elicit feedback from relevant actors. Engagement activities imply a multilateral conversation where the project hears, reacts and co-produces results together with engaged stakeholders.

## 2.2 Tasks

All the activities listed in the plan are related to the WP4 work plan found in the Description of Action of 4C. These activities are framed within one of the following four tasks in the WP, each aimed at a specific audience:

### Task 4.1: Knowledge transfer to support major international scientific assessments (led by UEA)

This task intends to provide direct support to international assessments, in particular the IPCC AR6.

- Supporting IPCC AR6 (T4.1.1)
- Improving ScienceBrief user experience and reach (T4.1.2)
- Supporting post-AR6 and other international assessments (T4.1.3)

### Task 4.2: Provide added value to decision- and policymakers (led by CICERO)

This task engages with decision- and policymakers to add value by translating the emerging scientific consensus.

- Fact sheets and knowledge base contents (T4.2.1)
- Policy brief and executive summaries (T4.2.2)
- Carbon Outlooks (T4.2.3)
- Events organised by 4C (T4.2.4)

### Task 4.3: Climate-carbon interactions for broad audiences (led by BSC)

This task aims to adapt materials from Tasks 4.1 and 4.2 for a general audience, create outreach material and social media actions, communicate the results to the target audience and support media coverage.

- Media Coverage (T4.3.1)
- Communication content for platforms (T4.3.2)
- Animated infographic about the carbon cycle (T4.3.3)
- Web based explorable explanation of the outcomes of the project (T4.3.4)

### Task 4.4: Communication and dissemination management (led by BSC)

This task involves the management of the general communication tasks (e.g. creation of the CDEP). It also aims to create visibility for the project to the general public and media, design the project website and visual identity, and produce online and printed PR materials.

- Visual identity (T4.4.1)
- Website (T4.4.2)

- Communication, Dissemination and Engagement Plan (T4.4.3)
- Communication and PR materials (T4.4.4)

## 3 Communication, dissemination, engagement and policy dialogue in 4C

### 3.1 Plan

The Communication, Dissemination & Engagement Plan (CDEP) of 4C project was developed early on in the project (M9 - D4.6), and updated twice during the project (M18 - D4.7 and M36 - D4.8).

The plan describes the strategies and activities planned during the lifetime of the 4C project, including a comprehensive table with all planned actions and status. It also provides information on the project's key messages, target audiences and channels to reach these audiences. The CDEP also details the Key Performance Indicators (KPIs) used to assess the progress of the WP4 activities, and a risk assessment. The activities listed in the CDEP were regularly assessed and adapted according to the project needs.

In brief, the target audiences included the scientific community (including climate-carbon researchers, early career researchers, ScienceBrief users), scientific assessments (e.g. IPCC), EU decision- and policy makers, related projects and initiatives (e.g. ESM2025, CRESCENDO, VERIFY, Global Carbon Project), media outlets (in particular focusing on climate research, e.g. CarbonBrief), and the general public. The main communication channels included the project website, social media, mailing lists, scientific publications, as well as participation in conferences, workshops, and other relevant events.

In the next section, a table is shown with a summary of all the communication, dissemination and engagement actions carried out, their target audiences, and their final updates. KPIs for the website, social media, and other parameters are described in more detail in the related sections later on.

### 3.2 Summary of activities

Details on the communication, dissemination and engagement activities carried out in 4C are presented below in Table 1. The table lists each of the subtasks of the project, defines the target audience and aims, and provides details of the actions carried out.



**Table 1. Detailed Communication (C), Dissemination (D) and Engagement (E) plan.** Each task is labelled according to the type of action.

Please note that some of these actions may have mixed objectives and overlap.

	Task / Partners	Target group	Aim	Actions	Status / deadline	Comments
E	<b>4.1.1</b> (UNEXE, UEA, MPG, ETHZ, BSC, UBREMEN, CICERO, DLR, UOXF)	4C IPCC lead authors	Support IPCC AR6 (address issues of AR6 drafts, and identify key remaining issues that can be resolved by 4C) ( <i>milestone 9 - UNEXE</i> )	<ul style="list-style-type: none"> <li>Kick-off <u>workshop</u></li> </ul>	<b>COMPLETED</b> (June 2019)	Minutes published on website (including key issues to address in 4C)
E	<b>4.1.2-A</b> (UNEXE, UEA, UBERN)	ScienceBrief users and platform contributors (particularly policymakers and media users)	Improve ScienceBrief user experience and reach ( <i>milestone 10 - UEA</i> )	<u>Deploy</u> recommendations from the analysis of User Experience advice received in July 2019 (survey and interviews), and <u>re-evaluate</u> the usage of the ScienceBrief Carbon Cycle pilot after COP26	<b>COMPLETED</b> (May 2021)	Milestone 10 report summarised the key findings
D	<b>4.1.2-B</b> (UNEXE, UEA, UBERN)	IPCC authors, 4C consortium	Ensure ScienceBrief platform is up-to-date ( <i>D4.1; UEA</i> )	<ul style="list-style-type: none"> <li>Work with IPCC authors to <u>update the carbon cycle statements</u> posted on ScienceBrief</li> <li><u>Include all 4C results</u> on platform</li> </ul>	<b>COMPLETED</b>	Deliverable 4.1 summarises information on ScienceBrief
D	<b>4.1.3-A</b> (UNEXE, UEA, BSC, CICERO)	Scientific community	Support post-AR6 and other international assessments	Present 4C results at <u>conferences</u> and <u>workshops</u> (e.g. European Geophysical Union)	<b>COMPLETED</b>	The 4C Team has actively participated in remote and in-person events.
E	<b>4.1.3-B</b> (UNEXE, UEA, BSC, CICERO)	Scientific community, particularly early career researchers	Engage the broad community (particularly early career researchers) to contribute to ScienceBrief	<ul style="list-style-type: none"> <li><u>Training</u> session at next annual meeting</li> </ul>	<b>COMPLETED</b> (June 2020)	The training session was held during the General Assembly online meeting (due to COVID-19 restrictions).

D	<b>4.2.1</b> (UNEXE, UEA, BSC, CICERO)	Decision- and policymakers, scientists	Build knowledge base of project users; present the main concepts of 4C to help understand the project outcomes	Prepare at least 3 <u>factsheets</u>	<b>COMPLETED</b>	Three factsheets were prepared
D	<b>4.2.2-A</b> (UNEXE, UEA, BSC, CICERO)	Decision- and policymakers, intergovernmental organisations (IGOs)	Highlight all relevant results and adapt them for use by decision- and policymakers: 1. Most relevant results of project on emissions and climate-carbon interactions 2. Overview of current policies on emissions and climate implications 3. Policy recommendations	<ul style="list-style-type: none"> <li>Prepare a <u>policy brief</u></li> <li>At least 3 <u>science summaries</u> of results</li> </ul>	<b>COMPLETED</b> (Nov 2023)  <b>COMPLETED</b>	Policy brief and three science summaries were prepared and can be found in <a href="#">Policy Publications</a> on the 4C website.
D	<b>4.2.3</b> (UNEXE, UEA, BSC, CICERO)	Decision- and policymakers	Carbon outlooks focused on carbon budget for recent years (T1.4) and forecast for coming years (T2.4); collaboration with the Global Carbon Budget project	<ul style="list-style-type: none"> <li>Publish annual <u>carbon outlooks</u></li> <li>Related <u>news story</u> published on the project website each year</li> </ul>	<b>COMPLETED</b> (2020, 2021, 2022)	Three <a href="#">Carbon Outlooks</a> were published, along with related news articles and social media campaigns
E	<b>4.2.4-A</b> (UNEXE, UEA, BSC, CICERO)	EU policymakers	Communicate key findings to policymakers and discuss their perspective and goals	<u>Participate in events</u> to present key 4C findings: <ul style="list-style-type: none"> <li>UNFCCC intersessional meeting (Bonn), or</li> <li>COP each year</li> <li>Other relevant events</li> </ul>	<b>COMPLETED</b>  May/June  Nov/Dec	Participation in COP25 (Nov 2019), COP26 (Nov 2021), COP27 (Nov 2022) and UNFCCC intersessional meetings, taking place online or in-person
E	<b>4.2.4-B</b> (UNEXE, UEA, BSC, CICERO)	EU and national policymakers	Briefings around emerging topics from 4C (T4.2.1 and 4.2.2); help the interaction between scientists and stakeholders, exchange ideas	<ul style="list-style-type: none"> <li><u>Workshop</u> in Brussels (<i>milestone 11</i>)</li> <li>Publish workshop <u>minutes</u></li> <li>Organise or co-organise other <u>briefings</u></li> <li><u>Summary report</u> on engagement with policy makers (<i>D4.2</i>)</li> </ul>	<b>COMPLETED</b> (Nov 2023)	Workshop was held in Brussels in November 2023, in collaboration with other EU projects (ESM2025, CONSTRAIN, and PROVIDE).  D4.2 submitted

C	4.3.1 (UNEXE, UEA, BSC, CICERO)	Media outlets and journalists	Identify emerging news stories and encourage their media coverage	<ul style="list-style-type: none"> <li>Press releases and direct contact with journalists</li> </ul>	COMPLETED (throughout the project)	Press releases were published by project partners, showcasing important project findings and scientific papers.
				<ul style="list-style-type: none"> <li>Rapid Response Review report, and statement added to ScienceBrief "Critical Issues in Climate Change Science"</li> </ul>	COMPLETED	8 ScienceBrief <a href="#">reviews</a> were released
C	4.3.2 (UNEXE, UEA, BSC, CICERO)	General public, all target audiences, related projects	Materials adapted for a general audience (T4.1, T4.2) to promote 4C and knowledge on climate-carbon interactions; produce communication content in collaboration with other WP partners	<ul style="list-style-type: none"> <li>Prepare outreach materials (e.g. videos, opinion articles, interviews, infographics etc.)</li> <li>Social media actions (Twitter posts and campaigns)</li> </ul>	COMPLETED	Regular ongoing actions, including: <ul style="list-style-type: none"> <li>Weekly Twitter posts; campaigns to promote publications etc.</li> <li>Website articles</li> <li>Newsletter</li> <li>Videos on insights from 4C</li> </ul>
C	T4.3.3 (BSC)	General public, media, scientific community	Animated infographics about carbon cycle (D4.3): Poster to be used in press releases, reports, presentations, conferences; video for Youtube, website and live presentations	<ul style="list-style-type: none"> <li>Create a short <u>animated video</u> on carbon cycle (30 sec to 1 min)</li> <li>Create a static <u>poster</u> on carbon cycle</li> </ul>	COMPLETED (Nov 2020 - Animated infographic)	Animated infographic video available <a href="#">online</a> - a campaign was carried out to maximise its reach (website + social media), and is still regularly promoted.  Creation of a <u>poster</u> was deemed unnecessary, since 4C due to limited in-person events during the pandemic. Some flyers were produced for COP26.
D	T4.3.4 (BSC)	EU decision- and policymakers, general public, media, IGOs	Provide context to understand the project's challenges, motivations and outcomes (D4.4)	Develop a web-based explorable explanation of project results and simulations (interactive application)	COMPLETED	Explorable available at <a href="https://explorable.4c-carbon.eu">explorable.4c-carbon.eu</a>

c	<b>T4.4.1</b> (BSC)	4C consortium	Develop a visual identity for consistency of all project materials ( <i>D4.5</i> )	<ul style="list-style-type: none"> <li>Design <u>visual identity</u> of project (logo, colours, design elements, fonts)</li> <li>Design <u>templates</u> for letters, presentations, reports and newsletters</li> </ul>	<b>COMPLETED</b> (March 2020)  <b>COMPLETED</b> (March 2020)	The visual identity and templates were used throughout the project in all material produced.
c	<b>T4.4.2</b> (BSC)	All target audiences	Website containing the project description and its various outputs, such as public reports, general information, dissemination materials and news ( <i>D4.5</i> )	Develop project <u>website</u>	<b>COMPLETED</b> (March 2020)	Project website can be accessed at <a href="http://4c-carbon.eu">4c-carbon.eu</a>
c	<b>T4.4.3</b> (UNEXE, BSC, CICERO)	WP4 partners and all 4C partners	CDEP to maximise the project impact; provide detailed information about planned activities, key messages, target audiences, communication platforms and activities, practical branding info (logo etc.), engagement actions ( <i>D4.6-4.9</i> )	<ul style="list-style-type: none"> <li>Prepare <u>CDEP</u> (including two revisions)</li> <li><u>Summary report</u> on the communication, dissemination and engagement activities</li> </ul>	<b>COMPLETED</b>	CDEP - Feb 2020 First Update - Nov 2020 Second Update - May 2022 Summary - Nov 2023 (this document)
c	<b>4.4.4</b> (UNEXE, BSC)	Related projects, EU decision- and policymakers	Produce communication and PR materials to give visibility to the project	<ul style="list-style-type: none"> <li><u>Communication material</u></li> <li>Roll-up / Poster / Project brochure (online material to reduce the use of paper)</li> </ul>	<b>COMPLETED</b>	<p>We focused on producing online communication material with informational or educational purposes, such as the Climate Classrooms and videos.</p> <p>Production of promotional material, such as roll-ups, was deemed unnecessary as most events took place online during the COVID-19 pandemic.</p>

## 4 Project website

The purpose of the 4C website ([www.4c-carbon.eu](http://www.4c-carbon.eu)) was to make available information about the project, including details on the scientific background, the project objectives and the research conducted. It aimed to increase the visibility of the project and its results, reaching a wide range of target audiences.

The website was designed, hosted and maintained by the Barcelona Supercomputing Center (BSC), offering easy navigation to project material. More information can be found in D4.5.

The 4C site consists of several pages accessed through the main menu at the top, some of which are described in more detail below:

- **4C project:** Within this menu, different sections provided general information on the project (*About*), scientific background behind the research (*Background*) and the project aims (*Objectives*). It also provided information on the partners (*Consortium*) and researchers (*Team*) involved in the project.
- **Research:** These pages described the main research lines of 4C, based on the different project work packages, including: *Current Carbon Cycle* (WP1), *Near-term Prediction* (WP2), *Climate Projections* (WP3), and *Dissemination* (WP4).
- **Resources:** This section includes the main project outputs and resources, including the web-based explorable explanation, open-access scientific publications, policy-related publications (including science summaries, factsheets and the policy brief), the annual carbon outlooks, datasets, public deliverables and outreach resources (material aimed at a general audience, such as videos and climate classrooms).
- **Latest news:** Articles with important project news were published in this section, covering topics such as participation in events, recent scientific papers and more. A total of 28 news articles were published on the website during the project.

As of November 2023, there were more than **10,387 users** visiting the project website, with **14,415 sessions** (being actively engaged with the page) and **26,054 pages viewed** (*KPI target: >2,500 views*). Some of the most visited pages included the carbon outlooks (1,009+ views), the About page (786+ views), and policy publications (744+ views). Most visitors were located in the United Kingdom, United States, China, Spain, Germany, France, and other countries. These data were recorded via Google Analytics. It should be noted that the views and other visitor information was only collected in the case that the visitor accepted the cookies notice, thus these numbers are likely to be much higher.

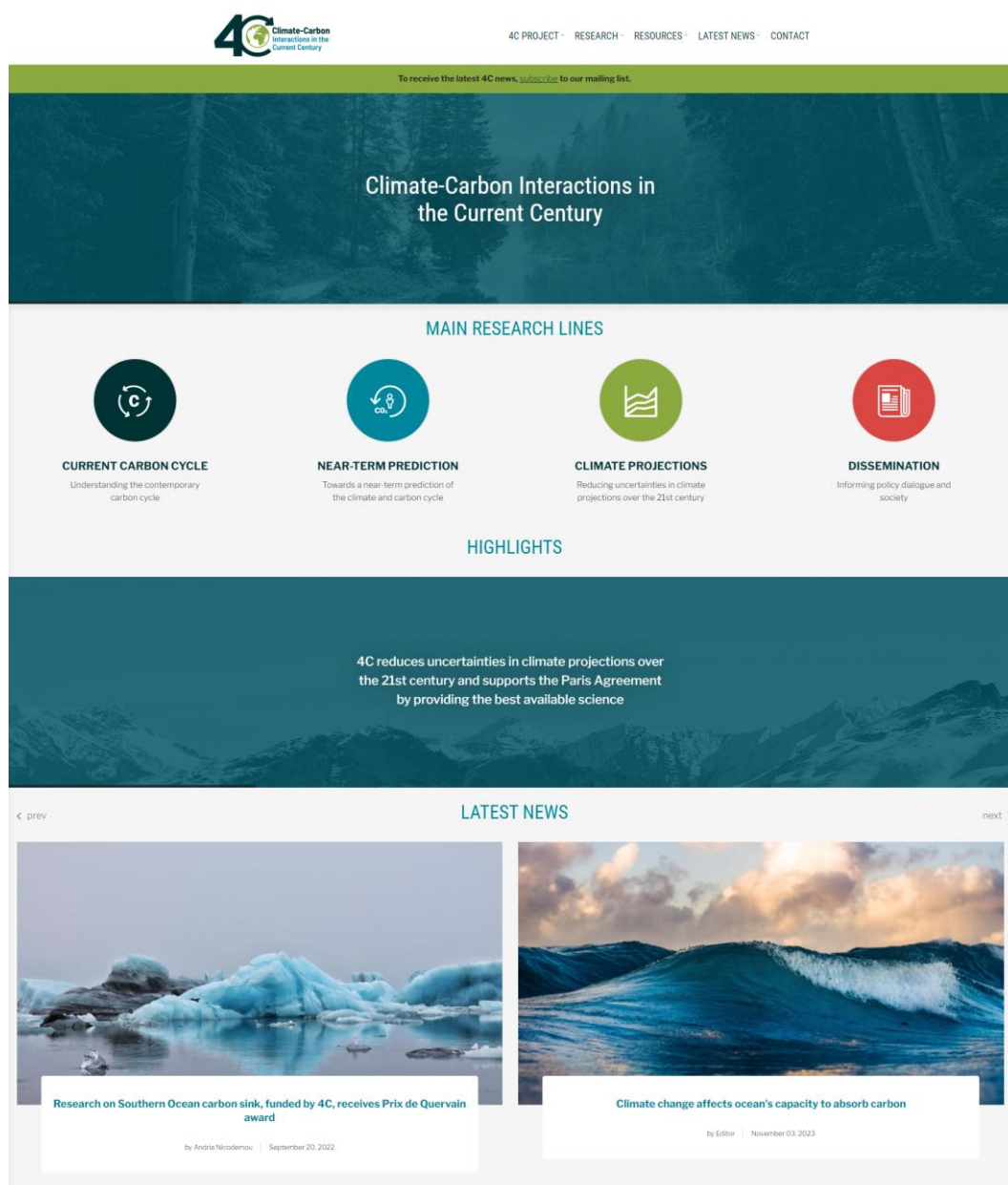


Figure 1. Homepage of 4C website.

## 5 Social media

While social media accounts were not initially planned for in the 4C project, a **Twitter account** (@4C\_H2020) was established in January 2020 and was extensively used during the project. The aim of the account was to communicate and disseminate the project research and findings to the target audiences, increase the project impact and reach, engage with the other researchers, projects and relevant networks, as well as share related content on climate and carbon topics.



**Figure 2. Profile page of 4C Twitter Account.**

A Twitter Strategy was prepared by the BSC team early on in the project to define the frequency and type of posts, ideas for content, future actions, hashtags and accounts to tag. The account is maintained by the BSC, while all project partners were encouraged to post through their personal profiles mentioning the project, or share the project's Twitter posts.

The content published on the project's account include the following, among others:

- Project news, findings, scientific publications and material
- Information on ongoing and future project research
- Visuals based on project results
- Rapid response reviews, posted in ScienceBrief
- Policy-related content (e.g. related to IPCC, Paris Agreement, and Global Stocktake)
- Findings of other relevant projects and initiatives on the carbon budget, climate-carbon interactions and CO<sub>2</sub>, such as other H2020 projects, the Global Carbon Project etc.
- Events organised by 4C, relevant events where 4C partners are participating, or news on other relevant events and conferences taking place (e.g. COP26)
- Retweets of relevant external news and posts by 4C partners





**Figure 3. Examples of visuals shared on social media.**

Since the launch of the Twitter account in January 2020 until November 2023, the 4C Twitter account has obtained **1,630+ followers** (KPI target: >500 followers), creating a large community of people interested in the feedback between carbon emissions and climate, including researchers, policymakers, journalists, and the general public. The average number of new followers per month was >35, which is a considerable number for a scientific specialised account.

As of November 2023, a total of **715 tweets** were posted, with an average of 15 posts per month. In 2023 alone, the 4C posts received about **56,000 impressions** and **>2,160 engagements** (e.g. likes, retweets, link clicks, detail expands, follows). Similarly, in 2022, the project received >14,100 impressions and >1,440 engagements. These numbers were obtained through Twitter Analytics (it should be noted that these numbers do not include retweets posted by the 4C account).

The community of followers of the 4C Twitter profile includes recognised climate influencers (such as Greta Thunberg and Vanessa Nakate), institutions (such as the EU Commission's Directorate-General for Climate Action - DG CLIMA and for Environment - DG ENV), and specialised media (such as Carbon Brief).

Besides the 4C Twitter account, key researchers involved in the project are using their personal accounts to share content related to 4C (with some including the handle @4C\_H2020 in their personal bios).

- Glen Peters (@Peters\_Glen): >50,400 followers
- Pierre Friedlingstein (@PFriedling): >6,470 followers
- Corinne Le Quéré (@clequere): >13,600 followers
- Robbie Andrew (@robbie\_andrew): >7,520 followers
- Tatiana Ilyina (@ilitat): >2,260 followers

Since some of these researchers have a huge community of followers, the reach of 4C-related content on Twitter goes far beyond the official account.

Finally, the project created and maintained a **YouTube channel** (@@CCClimateCarbonH), where several relevant videos were published. The channel has a total of 16 subscribers.



## 6 Project publications

### 6.1 Scientific publications

Throughout the project's lifetime, 4C researchers have published **>156 open-access scientific publications** in top tier journals in the field of climate research (e.g. Nature journals). Papers can be found in the dedicated [Scientific Publications](#) page under *Resources* on the project website.

WP4 ensured that the project research was promoted through the project platforms in order to reach the target audiences and was clear to a wider audience. This aimed to maximise the impact of the project's research and ensure the transfer of knowledge to the audiences that can best make use of it. It was achieved by promoting new papers on the project's social media channels, as well as preparing [news articles](#) for the project website for selected papers of interest to a wider audience. In addition, partners were encouraged to post about new publications through their personal Twitter accounts, tagging the project.



NOVEMBER 03, 2023

#### Climate change affects ocean's capacity to absorb carbon

*A new study shows that the ocean recently absorbed a decreasing proportion of the CO<sub>2</sub> emissions we produce. This trend could persist as climate change intensifies.*

[READ MORE »](#)

Figure 4. Example of a news article discussing a 4C funded study on the project website.

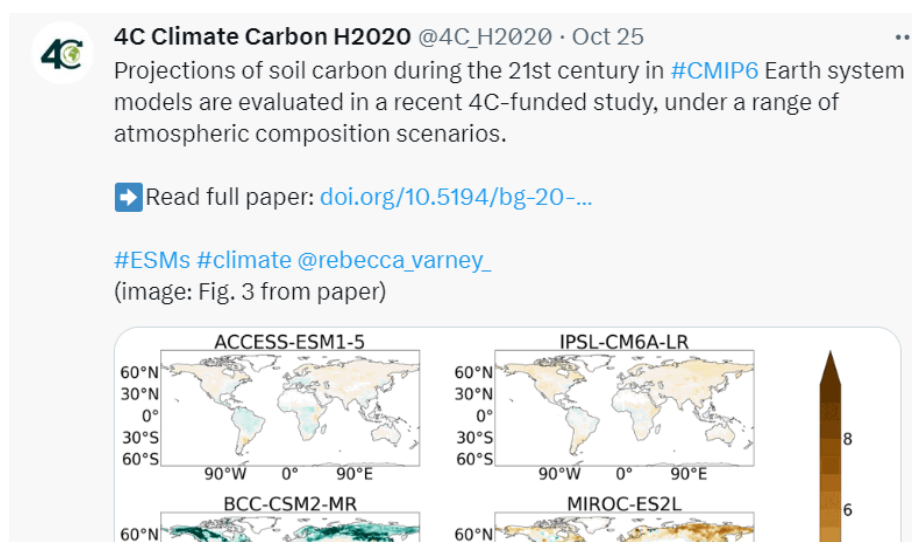


Figure 5. Example of Twitter post about a 4C-funded paper.

## 6.2 Policy publications

Several publications were prepared in the 4C project aiming to inform policymakers about important climate concepts, using insights from 4C research. These can be grouped into three main categories:

- **Factsheets**, which present the main concepts to understand the outcomes of 4C science. This type of material addresses policy makers, as well as fellow scientists.
- **Science summaries**, which highlight relevant results and translate them for use by decision and policy makers. They are based on project publications and public deliverables.
- **Policy briefs**, which present project results, similarly to the science summaries, but combined with an overview of current policies offering a set of policy recommendations.

A total of three factsheets, three science summaries and one policy brief were prepared during the project. Details of these publications can be seen in **Table 2**. These publications ranged from 2-6 pages, and are available on the project website in the “Policy Publications” page found under the “Resources” menu (<https://4c-carbon.eu/resources/policy-publications>). Extensive communication was carried out to promote the policy-related publications on social media.

**Table 2. List of policy publications.**

Publication type	Topic	Date (tentative)
Science summary 1	Effect of COVID-19 confinement on daily global CO <sub>2</sub> emissions ( <a href="#">link</a> )	July 2020
Science summary 2	The increase in CO <sub>2</sub> -induced global warming will only stop when humans stop adding CO <sub>2</sub> to the atmosphere ( <a href="#">link</a> )	August 2021
Science summary 3	Summary of project findings	<i>December 2023 (to be released)</i>
Factsheet 1	Near-term Predictions ( <a href="#">link</a> )	August 2022
Factsheet 2	Emergent Constraints ( <a href="#">link</a> )	September 2022
Factsheet 3	Carbon Budget ( <a href="#">link</a> )	September 2023
Policy brief	Policy brief: Science needs to help reduce persistent uncertainties in climate projections ( <a href="#">link</a> )	November 2023



Figure 6. First page of factsheet on near-term predictions.



Figure 7. Example of a social media post promoting one of the factsheets (impressions and engagement shown).

## 6.3 Carbon outlooks

Carbon Outlooks were prepared annually, with a total of three outlooks released during the 4C project: the 2020 Outlook, released in December 2020; the 2021 outlook, released in November 2021; and the 2022 outlook, released in February 2023.

These documents described changes in the atmospheric concentration of CO<sub>2</sub>, as well as an update on the state of the carbon sinks. Each outlook integrated the latest science in an easy-to-read format.

The outlooks were prepared in collaboration with the high-profile annual [Global Carbon Budget](#), which has major releases in November / December each year, generally in line with the UNFCCC Conference of the Parties (COP). Many 4C researchers are also involved in the Global Carbon Budget.

These outlooks were promoted through news articles published on the 4C website and through extensive social media campaigns.

In addition, the final 4C Carbon Outlook for 2022 was launched during a webinar held in February 2023, which attracted a large audience of at least 100 participants (216 registrations), including researchers, policymakers, and private sector. The webinar addressed how emissions evolved in the last decade and what is expected for

2023, while also focusing on the world's top emitters, and the drivers for emission recovery in 2023. 4C researchers participated in the webinar, as well as Yan Qin, a carbon analyst and expert in the field, who was an invited speaker.

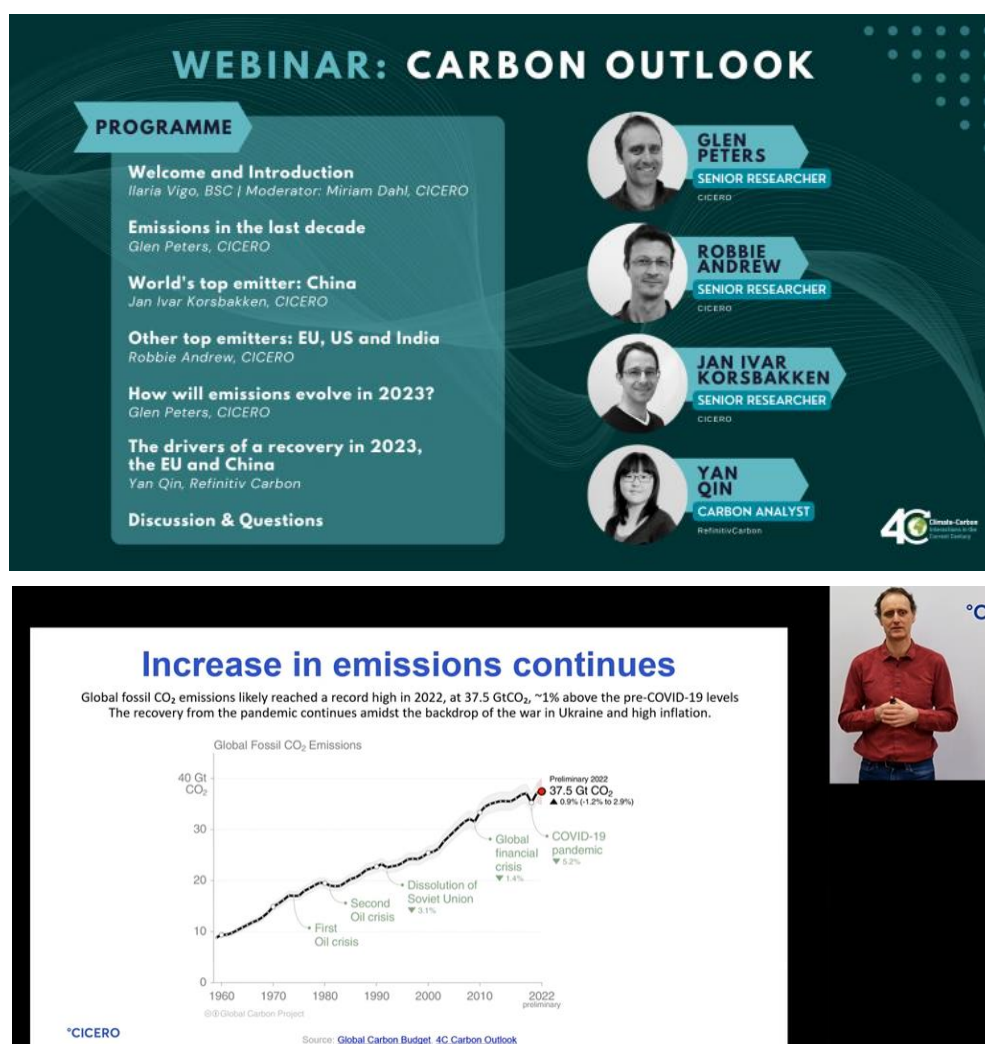


Figure 8. Agenda and speakers of webinar for the launch of the 2022 Carbon Outlook, and image from the presentation by Glen Peters (CICERO).

## 7 Outreach activities

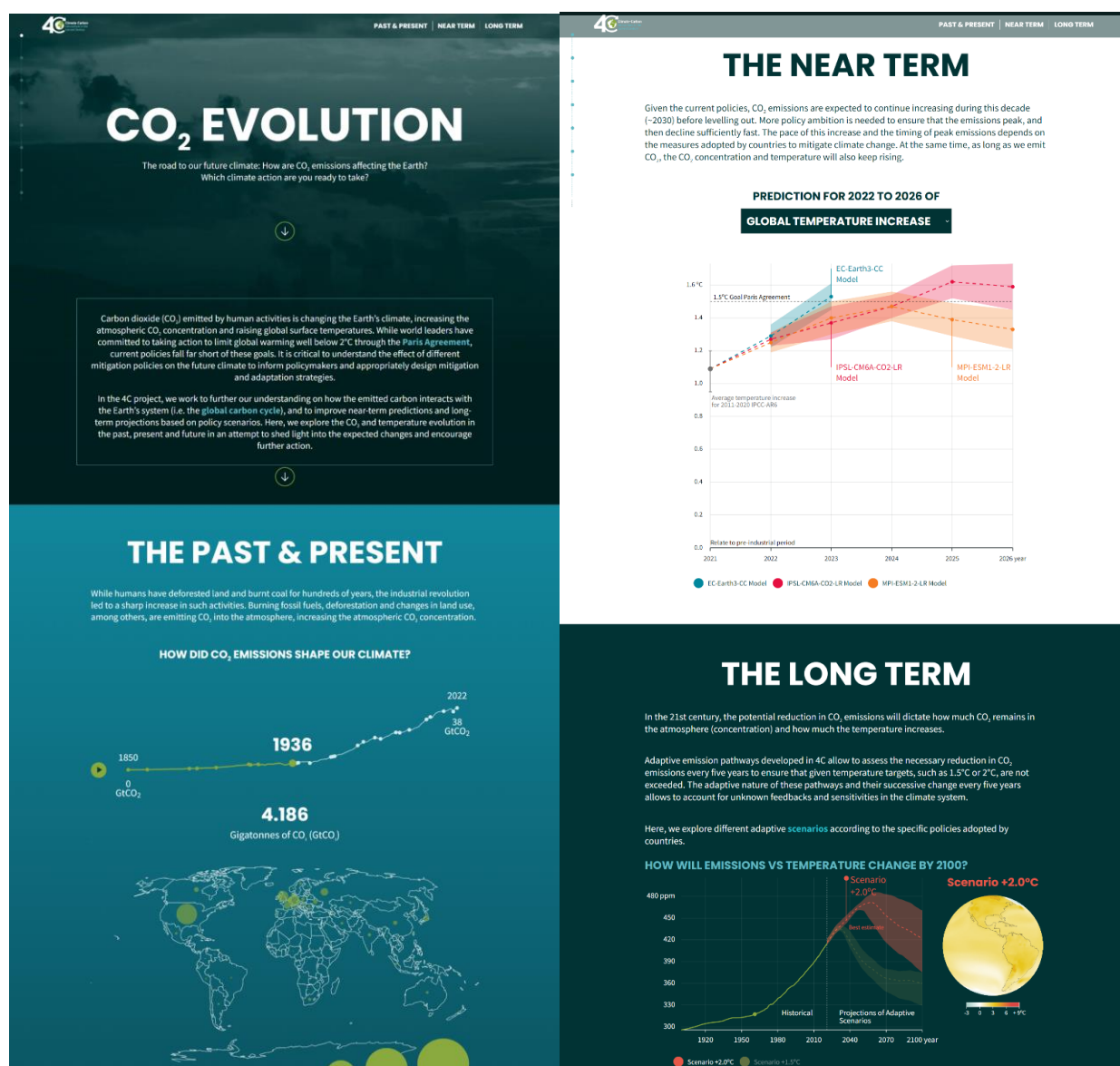
### 7.1 Web-based Explorable Explanation

The 4C Explorable Explanation is an interactive webpage that explores the CO<sub>2</sub> and temperature evolution in the **past**, **present** and **future** through visualisations, in an attempt to shed light on the expected changes and encourage further action. It includes a general introduction, followed by three sections: Past & Present (WP1



research), Near Term (WP2 research), and Long Term (WP3 research), which can be navigated from the top right of the page. The main aim of the explorable explanation is to facilitate the understanding of scientific concepts investigated in the project for non-technical audiences, such as policymakers and the interested public.

It can be found at [explorable.4c-carbon.eu/](https://explorable.4c-carbon.eu/), and is accessible through the 4C website under the “Resources” menu.



**Figure 9. Some of the visualisations included in the three sections (Past & Present, Near Term and Long Term) of the 4C explorable explanation.**

The 4C Explorable Explanation was designed and developed through the collaborative effort of user experience, data visualisation and communication experts at the Barcelona Supercomputing Center, with contributions from the project researchers who provided data and feedback.

Deliverable 4.4 provides further information on the development of the explorable explanation, as well as a summary of the Explorable Explanation content and visualisations.

The explorable explanation webpage was made available on the project website in May 2023, with a final version released in November 2023, which included updates of several visualisations to include 2022 data points. The explorable was promoted on social media (Twitter), with posts reaching over 6,650 impressions and over 220 post engagements (e.g. link visits, likes, retweets).

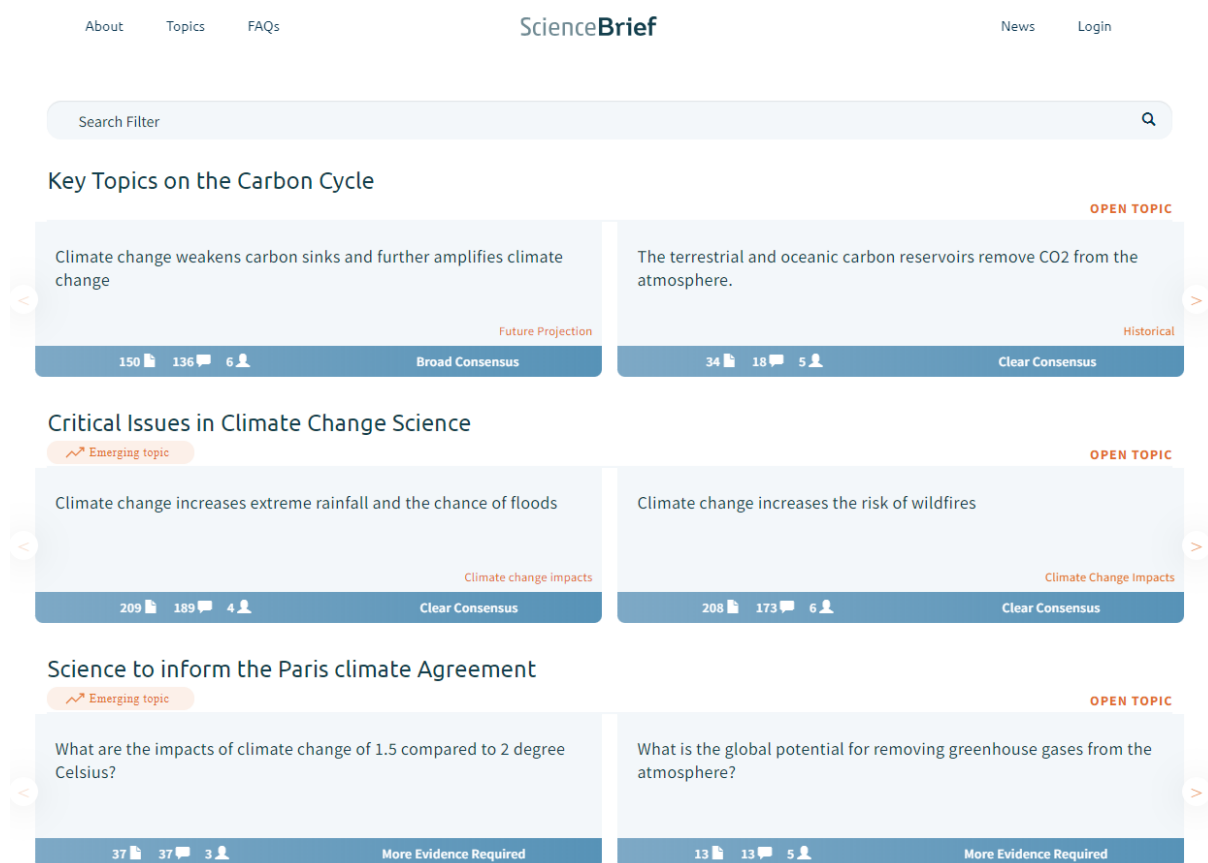


**Figure 10. Example of Twitter post on Explorable Explanation, with impressions (views) and engagements shown.**

## 7.2 Science brief

4C, in collaboration with the European project CRESCENDO (grant no. 641816), financially supported the ScienceBrief initiative (<https://sciencebrief.org>), which was set up by researchers at the University of East Anglia's Tyndall Centre for Climate Change Research.

ScienceBrief is a web application for reviewing scientific publications that shows the status and strength of scientific consensus in critical areas, such as climate change. It was designed to help keep up with science by providing scientists with a means to show (not just tell) the scientific consensus on key topics in the carbon cycle and climate change science. The platform aimed to support major scientific assessments, such as IPCC, by streamlining workflows and maximising collaboration.



**Figure 11. Some of the topics assessed in the ScienceBrief platform.**

ScienceBrief also published several rapid response reviews on pressing topics (available at: [news.sciencebrief.org/reviews](https://news.sciencebrief.org/reviews)). For instance, a strong consensus was shown about the link between climate change and wildfire risk in a review published in 2020. This review, which collates over 115 articles, has been discussed in a [news article](#) published on the 4C website.

In total, the topics included in the Science Brief platform received **>31,000 page views**, while the reviews received **>25,000 views** and **>1,000 downloads**. The platform is discussed in more detail in Deliverable 4.1 (submitted in February 2023).



Figure 12. ScienceBrief Review example.

## ScienceBrief Reviews

At a time when society needs to tackle critical issues like climate change and biodiversity loss, sound and accessible scientific evidence is critical. ScienceBrief Reviews outline the latest science on climate change impacts, climate understanding, and possible solutions, in the form of short briefing notes.

Read the ScienceBrief Reviews published in the collection 'Critical Issues in Climate Change Science':

- Climate change increases the risk of **wildfires** (January 2020)
- Climate change increases the risk of **wildfires** (September 2020 update)
- Climate change is probably increasing the intensity of **tropical cyclones**
- Independent **expert advisory bodies** facilitate ambitious national climate policy responses
- Climate change increases **extreme rainfall** and the chance of floods
- Climate change will weaken **carbon sinks** and further amplify climate change
- **Arctic warming** amplifies climate change and its impacts
- Climate change increases **marine heatwaves** harming marine ecosystems

Figure 13. ScienceBrief Reviews webpage.

## 7.3 Other outreach material

Outreach materials were prepared during the project that were aimed mainly at a less technical / non-scientific audience, including decision- and policy makers, and a general audience interested in climate research topics.

An **animated infographic** was prepared and released in November 2020, which provides a brief introduction into the 4C project and its main objectives. The infographic involves a 1.5-minute video that was made available on the project's [YouTube channel](#) (receiving 527 views until November 2023), and on the 4C website (under [Outreach Resources](#)). The infographic was promoted on social media throughout the project duration.



Figure 14. Screenshot from the 4C infographic video.



Other outreach **videos** were also published, providing insights from 4C researchers, such as a presentation on the uncertainties of carbon sources and sinks given by a 4C researcher during an internal seminar, and the policy relevance of 4C results by the project coordinator. These videos can be found in the project YouTube channel and in Outreach Resources.

**Climate Classrooms** are another type of outreach material developed in 4C. These are articles providing an easy-to-understand explanation of the main scientific concepts behind the 4C project. Three Climate Classrooms were published, covering topics including the carbon cycle, short-term variations in CO<sub>2</sub>, and the shared socioeconomic pathways. These were posted as downloadable PDF documents in [Outreach Resources](#), as well as news articles under “Project News”.



**Figure 15. Part of a climate classroom document.**

In addition to these actions, several **newsletters** were sent out to the 4C mailing list (total subscribers: 112), promoting project news and results.



**Figure 16. Example of newsletter sent to the project mailing list.**

# 8 Engagement with different stakeholders

## 8.1 Policymakers: Establishing a policy dialogue

One of the main objectives of WP4 was to enable dialogue between the project and policymakers to ensure that scientific findings are accurately interpreted and utilised in the context of the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. This aimed to maximise the project impact and knowledge exchange by proactively engaging with groups of interest within and outside the EU and elicit feedback from relevant actors.

The main targeted decision and policymakers were at the European level, covering various Departments of the European Commission (CLIMA, R&I, EASME), Joint Research Centre (JRC), European Parliament, European Scientific Advisory Board, and various other non-governmental groups (e.g., IPCC, WMO, Bruegel, Global Carbon Project, Science Media Centre, Carbon Brief, etc).

A more detailed summary on the engagement with policymakers carried out in 4C can be found in D4.2, while some of the activities are discussed below.

A number of **publications targeting a policy audience** were published during the project, including a factsheets, science summaries, carbon outlooks, and a policy brief (see more in Section 6 of this document). These provided insights from the 4C project into pressing issues in climate policy, providing a simplified explanation of important scientific concepts and importance in policy, such as the carbon budget concept.

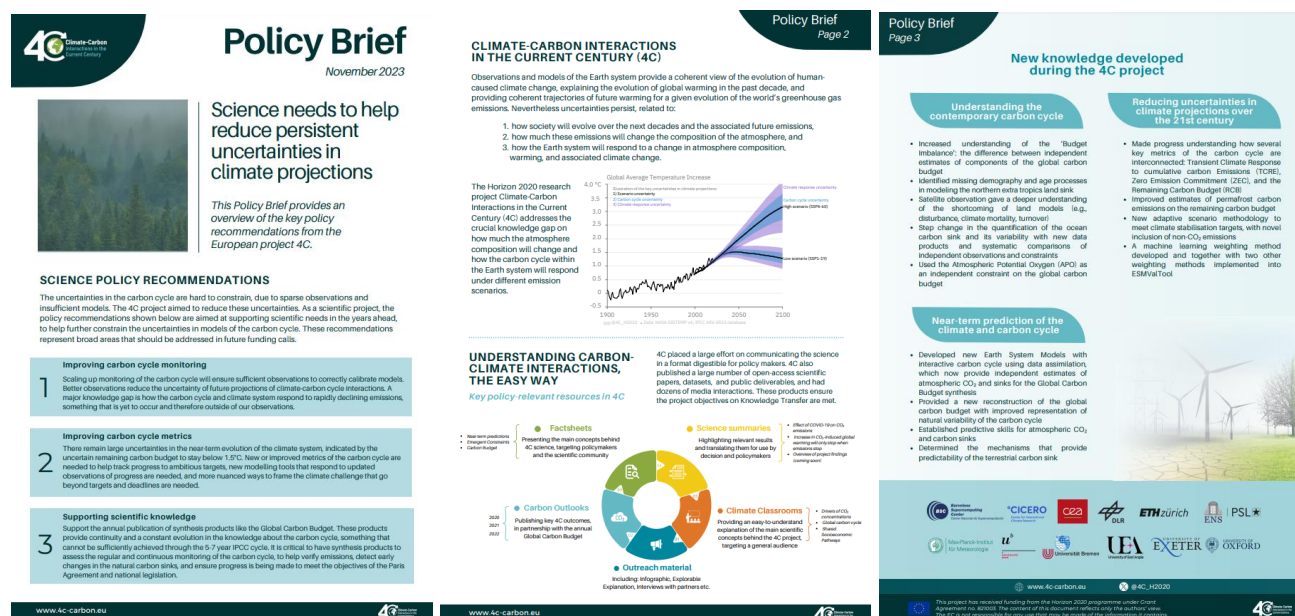


Figure 17. Policy brief, listing recommendations based on project research and presenting the most important results and new knowledge developed in the project.

In addition, a **science-to-policy workshop** was held in Brussels, Belgium, in November 2023, which was organised in collaboration with other European projects funded at the same time: ESM2025, CONSTRAIN, and PROVIDE. The workshop invited important policy contacts, and was held in a hybrid format, presenting insights and advances in climate science and Earth system research. The 4C policy brief “Science needs to help reduce persistent uncertainties in climate projections” (Nov 2023) was published to coincide with this policy event.



Figure 18. Hybrid science-to-policy workshop held in Brussels.

4C also took part or organised in a large number of **policy-related events**, such as participation at the UNFCCC Conference of the Parties (COP25, COP26, and COP27), and the organisation of a webinar for the release of the 2022 Carbon Outlook. In addition, 4C researchers participated in the Global Carbon Budget and the IPCC Sixth Assessment Report (AR6) as authors, which provide important insights for climate policy. Finally, partners were involved in other activities such as press conferences, webinars, and engagement with media.



Figure 19. 4C researchers at COP27.

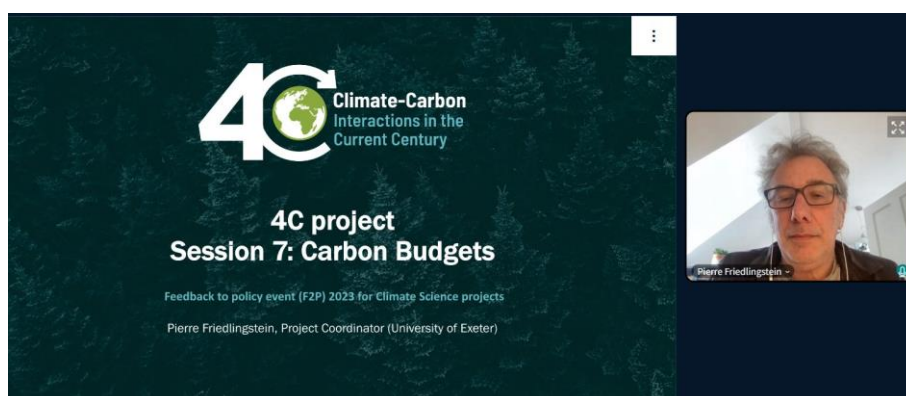
## 8.2 Scientific community: sharing knowledge

Engagement with the scientific community, major scientific assessments (e.g. IPCC), and relevant projects and initiatives formed an integral part of the 4C activities, with the aim to share knowledge and maximise the impact of 4C research.

Notably, 4C researchers contributed as authors to the IPCC AR6 process, which ran in parallel to the 4C project, and held a 4C workshop on IPCC AR6 key issues on climate-carbon interactions early on in the project (June 2019).

4C researchers also led the publications of the Global Carbon Budget annual reports released in 2019, 2020, 2021, 2022, and 2023, always aligned with UNFCCC Conferences of Parties (COP). The 2023 launch is on the 5th December, while the project formally finishes on the 30th November, but the vast majority of the preparation occurred while the project was still formally running. The Global Carbon Budget publication involves more than 100 authors and is the reference on the subject for the scientific community.

Interactions with other European projects and initiatives on relevant climate and carbon topics were established throughout the project by participating in joined activities. For instance, as mentioned earlier, a policy workshop was held in collaboration with the projects ESM2025, CONSTRAIN and PROVIDE, while side events at COP were also held in collaboration with these projects, as well as CRESCENDO. Another example is the participation of 4C at a clustering workshop held by MAIA project on 'Climate sciences and responses for the transformation towards climate neutrality' in March 2023, where >70 European projects were present. Other projects with which 4C has interacted include COMFORT, OptimESM, nextGEMS, and many more.



**Figure 20. Pierre Friedlingstein, the 4C project coordinator, presenting at the MAIA clustering event.**

Furthermore, 4C has had a strong presence in scientific conferences, where project results were presented, such as the European Geosciences Union (EGU) annual General Assembly.





MAY 18, 2022

### Bringing policy-relevant, cutting-edge climate research to EGU 2022

The latest project findings are presented at the 2022 EGU General Assembly by 4C researchers.

[READ MORE »](#)



NOVEMBER 03, 2021

### Supporting policymaking at COP26: 4C brings policy-relevant climate research to the summit

4C researchers present the latest climate research at the 26th Conference of the Parties (COP26) in support of the need for urgent climate action.

*Figure. Examples of news articles on the project website, providing details on the sessions at EGU and COP where 4C researchers participated.*

## 8.3 Media: increasing visibility

4C researchers had numerous interactions with the media, in particular for the annual releases of the Global Carbon Budget papers, but also for the high-profile publications from 4C researchers. Across the different 4C researchers who are also authors of the Global Carbon Budget, there is intensive media activity during each of the UNFCCC COPs. There are usually several press conferences, hundreds of direct media interactions and thousands of hits on Google News, in addition to TV and radio appearances, with some variations across the years depending on media interest.

## 8.4 Consortium: improving internal communication

To improve communication and foster regular interaction among the consortium researchers, several **internal seminars** were organised by the 4C project, which involved 1-hour online meetings attended by consortium members. During each talk, one or more researchers present a topic to the whole consortium and then engage in a discussion with the team. For instance, as part of this initiative, a 3-hour workshop / tutorial on the ESMValTool was held by WP3 researchers in March 2022, to help partners improve their knowledge on this tool.

# 9 Deviations

As a result of the COVID-19 pandemic, all related events (such as conferences, workshops, project meetings etc.) in 2020 were held online, cancelled or postponed. For instance, the 4C General Assembly meeting was held online on 23-24th June 2020, while COP26 (originally scheduled for November 2020) was held in November 2021.

Due to this shift to online events, the 4C project focused on producing online communication and dissemination materials, resources and campaigns, while the creation of materials like posters and roll-ups was deemed unnecessary. Furthermore, the 4C communication team planned various alternative online actions to promote the research and findings of 4C, such as producing short videos with 4C researchers explaining key concepts and a number of Twitter actions. To strengthen internal communication among partners, internal seminars were also organised, during which partners presented their latest research or methods, and engaged in a discussion with other researchers.

Another deviation from the original plans was the 6-month extension of the project. Due to this, the communication and dissemination plans were adapted and carried out until November 2023 (e.g. later release of policy publications and explorable explanation).

## 10 Conclusions

This deliverable provides a summary of the communication, dissemination, engagement and policy dialogue activities conducted in the 4.5 years of the 4C project.

Successful and extensive communication and dissemination of the project research, results and outputs was carried out, reaching the scientific community, policymakers, other projects in the climate research field, the wider public and other audiences. 4C had an important presence in social media, reaching a large number of followers (>1,630) and impressions on Twitter. Also, a great number of resources were developed, including policy publications, outreach and communication material, videos, an explorable explanation and an animated infographic, among others. These are complemented by the significant number (150+) of open-access publications by 4C researchers, having an important contribution to the scientific community. Finally, the project successfully established a policy dialogue through its participation in COP and other key conferences, its contributions to IPCC AR6, the organisation of a policy workshop and release of a policy brief, along with other policy-relevant reports (e.g. factsheets).

Overall, the dissemination, engagement and policy dialogue activities of 4C, as well as the resources prepared, can serve as a guide for other projects to successfully communicate climate research, reach diverse audiences and inform climate policy, impacting future action.