D4.3 – First report on Communication and Dissemination activities

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CLIMOP Consortium

CLIMOP Consortium consists of a well-balanced set of partners that cover all the needed competencies and the whole value chain from research to operations. The ClimOP Consortium includes representatives from the aviation industry (IATA, SEA), academic and research institutes (NLR, DLR, TU-Delft, ITU) and SMEs (DBL, AMIGO).

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Executive summary

Dissemination represents one of the core activities of the ClimOP project. Our dissemination strategy is based on the identification of groups of stakeholders who may be interested in the project findings, and on the personalization of the communication message for the different stakeholders in terms of content, style, and information support.

According to the Dissemination Plan [1], this document aims at reporting the different communication and dissemination actions carried out along the first year of the ClimOP project, specifically the period January 2020 – August 2021. The main communication and dissemination actions carried out for that period are the following:

- Dissemination towards the H2020 and SESAR programs, leading to a close collaboration with other European research projects, resulting in the elaboration of a coordinated poster and in the joint application for third-party events;
- Dissemination towards the general public, through the ClimOP project website, social networks and general press articles;
- Dissemination towards the scientific community, through the publication and the presentation of the research work elaborated by the ClimOP Consortium;
- Dissemination towards the Advisory Board (AB), with the organization of the first AB workshop and the preparation of the related material.

1. Introduction

1.1 ClimOP Overview

The aviation industry contributes to human-made emissions mostly by releasing carbon dioxide (CO_2), water vapour (H_2O), nitrogen oxides (NO_x), sulphur oxides (SO_x), soot, and sulphate aerosols. As a consequence, it is responsible of the alteration of the radiative balance of the planet of about 5% of the overall effect of human activities [2]. Currently, the Covid-19 crisis has caused an abrupt contraction of the activities in the aviation sector, which are still far from recovery and are not likely to return to 2019 levels before 2024 at the earliest [3]. However, once the current pandemic is overcome, air traffic is expected to resume its growth by 3 –4% per year. This suggests that the aviation impact on climate will significantly increase over the next decades unless effective counter-actions are planned and implemented. ClimOP aims to lay the foundation for a greener aviation by identifying and assessing the most promising operational improvements to reduce the aviation climate impact.

In the first year of the project, ClimOP made an inventory of the currently known operational improvements (OIs) and the available key performance indicators (KPIs) to quantify the effect of these OIs. Alternative sets of compatible OIs will subsequently be determined, and their impact on the climate will be assessed, by taking CO_2 and non-CO_2 effects into account. In addition, in collaboration with the stakeholders in the consortium and the Advisory Board, ClimOP will evaluate the impact of these OIs on airports, airlines, air navigation service providers (ANSP), manufacturers, and passengers. As a result, ClimOP will develop a body of harmonized, most-promising mitigation strategies based on the alternative sets of OIs and will provide recommendations for target stakeholders on policy actions and supporting measures to implement the alternative sets of OIs.

1.2 Relationship with other deliverables

Although this deliverable is part of a work package (WP4) concerning communication, dissemination and exploitation activities, its contents are lined with all the other technical WPs, such as WP1 “Operational improvements and KPIs/Metrics”, WP2 “Climate impact assessment including non-CO2 effects” and WP3 “Selection and recommendation for the implementation of mitigation strategies”. Indeed, the present document reports all different communication and dissemination actions, carried out in the first 20 months of the ClimOP project, which support and feed these WPs. But most importantly, this document relates closely to the ClimOP D4.1 “Communication, Dissemination and Exploitation plan”.

1.3 Structure

The rest of the document is structured as follows:

- Chapter 2 describes the dissemination towards SESAR and H2020 projects: it details the close collaboration with other European research projects and the activities performed.
- Chapter 3 reports all the dissemination towards the general public describing the project website and its social networks.
- Chapter 4 describes the dissemination towards the scientific community, providing an overview of the different scientific events attended by the project and the paper published.
- Chapter 5 explains the dissemination towards the aviation industry.

- Chapter 6 summarizes the activities described in the text and illustrates the next dissemination activities.

2. Dissemination towards the general public

The ClimOP project deals with many different stakeholders. For this reason, the communication of project results to a broader community of users is one of the project inherent objectives.

Strategic communication relies on the clarification of targets, audience and message before deciding which media to use to convey the message. Therefore, in the D4.1 Communication, Dissemination and Exploitation Plan, ClimOP matched the messages to communicate with the target audience, and then with the means to use them. This was fundamental to increase the possibility of achieving awareness across the multi-layered community to which ClimOP refers.

ClimOP identified the general public as one target audience. This cluster includes people and groups interested in the topic in general, such as policymakers which aim to reduce aviation emissions. An audience that broad and with such a level of interest recognizes the importance of the project research and the benefits that may derive from it.

Therefore, this audience looks for clear, useful, non-technical information. In fact, the main source of information for this group are the website, social networks, flyers and brochures, and online articles as well as printed ones.

2.1 ClimOP Project Website

The project website[1] has an essential role in the dissemination as the principal means of communication of the ClimOP objectives, activities and results. The website promotes communication and interaction within ClimOP by improving dissemination directed to specialists, potential users, politicians and public funding authorities, as well as the general public. Deep Blue regularly updated it with public information about ClimOP progress, news and any other relevant information. The website and the social profiles create a network that connects the broader possible group of stakeholders.

No major changes were made to the structure and graphical aspects of the website, illustrated in Deliverable 4.2 [4]. However, in this first period several products were uploaded on the ClimOP website and on a monthly basis the Consortium members updated the blog with articles that focused on topic related to the project itself[2]. As a result, some articles focus on research work carried out in the context of the project, while others describe part of a partner's contribution towards a project deliverable.

Figure 1. Screen capture of the ClimOP website

[1] https://www.ClimOP-h2020.eu/
[2] https://www.climop-h2020.eu/tag/partners-articles/

2.1.1 Search Engine Optimization

The position of the ClimOP website on some keywords in well-known search engines is one of the parameters to monitor in order to assess the success of the dissemination. This is an indication of whether ClimOP is associated with keywords that are relevant to the project.

The following table presents the ClimOP website ranking for specific words (keyword column). For each keyword, it indicates in which position is the website (rank column) and the page of the results (results page column).

Keyword	Rank	Results page
Greener aviation operations	1	1°
Innovative operational improvements in aviation	1	1°
ClimOP	1	1°
Greener aviation	4	1°
Operational improvements in aviation	4	2°

Table 1. ClimOP positions on Search Engines

For the keyword “greener aviation operations”, in the first 20 months of activity our website climbed up to the first position as a result of the communication activities. Similarly, the website rank 1st for the keyword “innovative operational improvements in aviation”, winning the competition against the ICAO website. Then, even if a bit less relevant for SEO purposes, another keyword that shows our website as the first result is “ClimOP”.

For “Greener aviation”, ClimOP results in the 4th position thanks to the article published in April on the Open Access Government, a digital magazine providing news on key public policy areas from all around the world. The article also appears on the first page of other less relevant keywords, hence amplifying the visibility of the project.

Finally, the keyword “Operational improvements in aviation” shows a blog posted on the website with the results obtained in the first six months of activities. The blog appears as the 4th result on the second page. These results highlight the value of partners’ articles and all the other content published on the websites for increasing the overall visibility of the project.

2.1.2 Website Analytics

As the website was launched, an analysis tool, Google Analytics, was linked to it to monitor the access and usage of the webpages. Google Analytics provides different kinds of information regarding the number and behaviors of visitors, helping identify possible problems, and increase the website performance by evaluating the impact and effectiveness of its contents. Data provided cover the period spanning between the 27th of March 2020 and the 20th of August 2021.

2.1.2.1 Audience overview

Figure 2 provides a snapshot of different metrics regarding the quantitative and qualitative aspects of the website's visits.

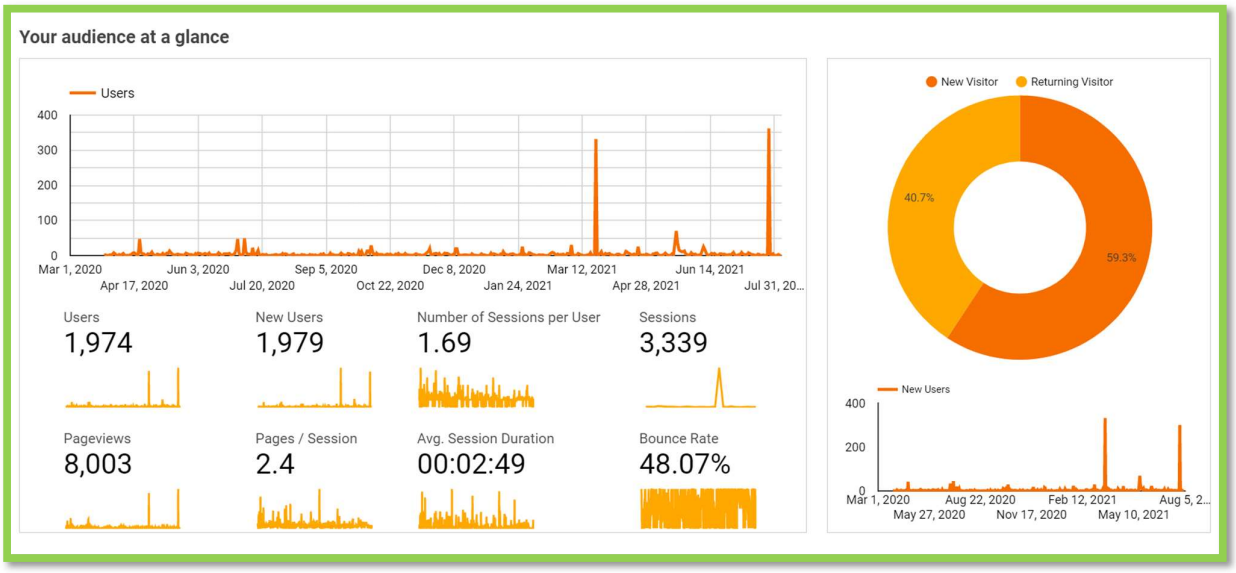

Figure 2. Website analytics: audience overview

The Consortium employs the following metrics to analyze the website visitors' behaviors and understand the users' interest in the content of the ClimOP website:

- **Users** is the number of single (counted only once) visitors over the course of a period.
- **Sessions** is the number of visits to the website.
- **Page Views** is the number of pages viewed (repeated views of a single page are counted).
- **New visitors** is the percentage of visits that were first-time visits (from people who had never visited the website before).
- **Pages/Session** is the average number of pages viewed during a visit by a single user.
- **Avg. Session Duration** is the average duration of a visit.
- **Number of public materials downloads** is the count of downloads recorded for all materials published on the ClimOP website.
- **Bounce Rate** is the percentage of single-page visits (meaning that the person left the website from the entrance page).

All these metrics show that the website performance is in line with similar sites, i.e., websites of EU research projects around the same size as ClimOP. The metrics reported in *Table 2* are above average if compared to those websites.

Parameter	March 2020 – August 2021
Users	1,974
Sessions	3,339
Pageviews	8,003
New visitors	40,7%
Page/session	2,4
Avg. session duration	00:02:49
Multimedia material downloads	173
Bounce rate	48,7%

Table 2. ClimOP website metrics

In the first period, the website activity has overachieved the key performance indicators (KPIs) presented in the D4.1 to monitor the progress of the Communication and Dissemination activities (*see Table 6*).

The number of users outperformed the goal set for the following reporting period and got beyond the ultimate target of 1500 unique visitors. The same has happened for the number of multimedia downloads that has got more than ten-times beyond the planned value. These results may depend on the wide use of the website as a first means of communication and the increase of time spent online by every individual, which occurred due to the spreading of the Covid19 pandemic.

A positive insight is provided by the balance between new and returning users, and the bounce rate. The audience of the ClimOP website is composed by 40,7% from new visitors and for the remaining part of returning visitors, while the bounce rate is rather good for a content website, as it is lower than 50-60%.

These data suggest that the website contents are appealing both for new users, that are interested in exploring other sections beyond the landing page, and for old visitors, that return to read the ClimOP updates. Furthermore, the high numbers of multimedia material downloads indicate how the project stakeholders have already started engaging with ClimOP.

2.1.2.2 Pages viewed

The **top ten visited pages** are:

1. Homepage
2. News
3. Resources
4. Partners
5. [*News*] Reducing airports emissions: the new gas turbine from SEA
6. [*Hosting page*] First Advisory Board Meeting
7. [*News*] ClimOP identified a preliminary list of Operational Improvements and Key Performance Indicators
8. [*News*] TU Delft and climate neutral aviation: now boarding!
9. [*News*] A human-centered approach: ClimOP Stakeholder Engagement
10. [*News*] Sustainable airports pave the way to a greener future

Overall, visitors tend to browse the most significant pages in the main menu, i.e. the ones providing crucial information on ClimOP. However, the News section and several single news items are in the highest positions. This means that recurring visitors, representing more than half of the visitors to ClimOP website, have already browsed the other sections of the website and are now interested in reading the news related to the project. This may also be explained considering that 15,6% of the visits come from social networks and 22% from other websites (*see Section 2.1.2.4*), where links to the ClimOP website are shared.

Overall, it seems that the ClimOP strategy of publishing at least one news article per month or even more to keep the website dynamic and to provide visitors with timely information is appreciated by users. Indeed, the blogposts account alone for more than 1200 views. This suggests that several visitors keep coming back to our website specifically to stay updated with the latest news.

2.1.2.3 Geo-localization

Not surprisingly, the biggest number of visits comes from Italy, as three out of 8 members of the

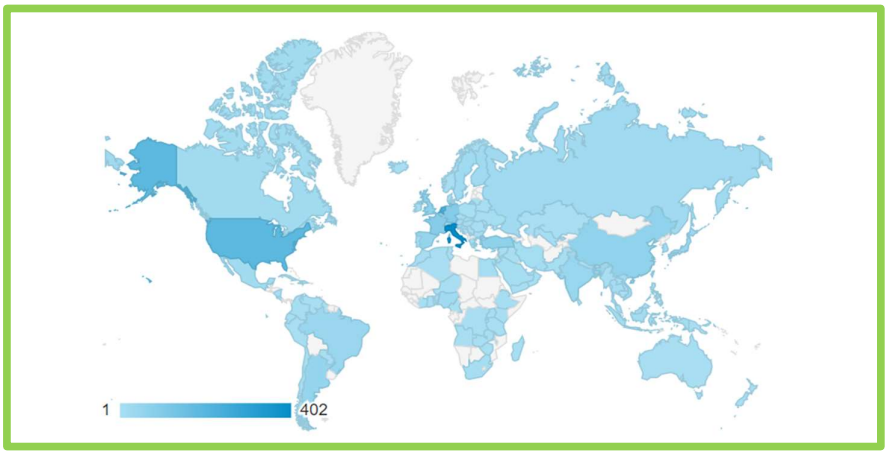

Figure 3. ClimOP website visits by geo-location

Consortium are Italian. Likewise, the Netherlands, Germany and Turkey are also in the top-ten

countries, thus reflecting the composition of the Consortium. But many visits come from the US and from other countries worldwide as well. This demonstrates the effectiveness of the communication strategy at creating content of interest for a wide and diversified audience.

2.1.2.4 Referrals

The following table presents the **traffic channels**.

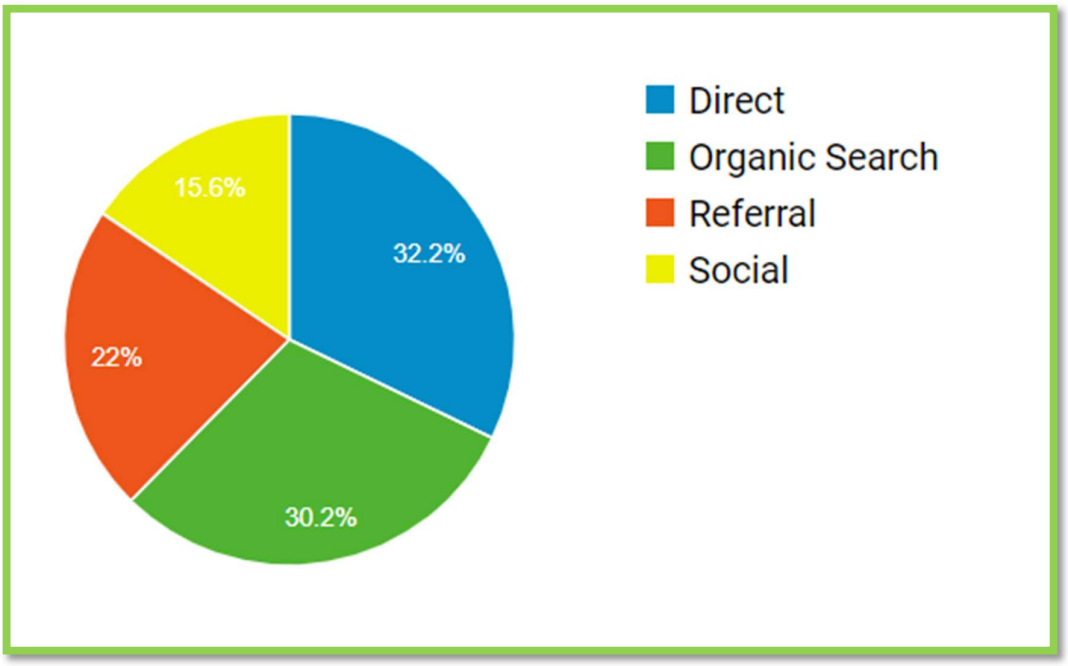

Figure 4. ClimOP website traffic channel

Direct traffic comes from people that type the ClimOP website URL directly into their browser. It also includes visitors who clicked on links from their bookmarks/favorites, within emails, or in documents that do not include tracking variables (e.g. PDFs or Word documents).

Organic traffic is generated as an unpaid search engine result. It is the second source of traffic towards the ClimOP website, and relies on the list of keywords presented in Section 3.1.1.

Referral traffic comes through links on other websites (13 so far), like cordis.europa.eu, dblue.it, explore.openaire.eu, amigoclimate.com, flyatm4e.eu, dlr.de, openaccessgovernment.org, youmanist.it, ecats-network.eu, ferpress.it, aeon-project.eu and ambientum.com.

Social traffic generates from social networks links. The website received visits mainly from LinkedIn (473), Twitter (212) and only a minority from Facebook.

The number of links that produce the referral traffic is a good indicator of the website's wealth as it is also used by Google algorithms to rank ClimOP trustworthiness against websites that deal with similar topics. This is bolstered by the traffic generated by organic research, the second major source of visits to the website.

The direct traffic is the first way for visitors to find ClimOP. This is in line with the general stats showing that many visitors already know its URL and directly type it in their browsers: this probably refers to returning visitors who keep coming back on our website.

2.2 Social Networks

ClimOP makes use of two social media, LinkedIn and Twitter, to enhance the impact of the communication, dissemination, and exploitation activities. These channels have been chosen due to their ability to target a diversified audience. Through LinkedIn, the Consortium aims at reaching a more professional and specialized audience, while Twitter has been chosen mainly to reach the general public. These channels help open up discussion around the project and engage the target audience accordingly to the communication goals described in the D4.1.

2.2.1 Twitter

Twitter supports short and focused communication and is very useful to follow actors relevant to the project and when participating in external events, offering the possibility of live tweeting, interacting with people taking part in the same event, or entering a previously started discussion.

The table below reports ClimOP activities on Twitter[3] in the period March 2020 – August 2021.

Month	Tweets	Impressions	Profile Visits	Mentions	New Followers
Mar	0	0	69	0	3
Apr	10	2,446	215	4	21
May	15	5,793	153	2	17
Jun	19	4,367	111	5	11
Jul	14	3,270	49	3	2
Aug	5	1,540	16	0	4
Sep	12	2,837	63	0	2
Oct	8	2,336	133	1	4

[3] ClimOP on Twitter: https://twitter.com/ClimOP_EU

Nov	11	3,526	79	2	3
Dec	6	2,032	36	0	3
Jan	6	2,479	122	1	8
Feb	7	2,435	155	0	8
Mar	7	2,474	602	3	2
Apr	8	1,710	339	9	3
May	7	2,059	497	0	3
Jun	7	1,410	315	2	0
July	3	919	330	2	2
Aug	7	1,391	485	0	3
Tot.	**150**[3]	**43,024**	**3,769**	**34**	**99**

Table 3.ClimOP Activity on Twitter

Compared to the previous year, ClimOP published fewer tweets but with more visibility. This is due to the increased number of followers the profile reached in the third semester (98), and to the fact that ClimOP started to publish more focused news targeting a very specialized audience, e.g. partners' blogposts and other profiles' tweets mentioning the project. As a result, the total amount of tweets reached 150[4].

[4] The total amount of tweets is 170, considering also ClimOP's retweet from other profiles.

2.2.2 LinkedIn

LinkedIn, as a professional social network, helps attract a specialized public that can exchange information and discuss the project and its findings (this may also involve the partners of the Consortium).

In the period March 2020 – August 2021, ClimOP published 31 updates that reached 147 followers on LinkedIn[5]. ClimOP succeeded in expanding its network of connections and keeping followers informed about upcoming events involving ClimOP and news on the project's results.

Parameter	March 2020 – August 2021
Posts	31
Followers	147
Views (Unique impressions)	6,294
Clicks	198
Reactions	251
Comments	4
Shares	26

Table 4. ClimOP activity on LinkedIn

[5] ClimOP on LinkedIn: https://www.linkedin.com/company/ClimOP-project

2.3 Press Releases

In June 2021, ClimOP issued its first press release to share updates on the first 18 months of activities. The press release was distributed to members of the national news media by each partner of the Consortium in order to target the general public on a European level and generate awareness about the ClimOP project. Each partner translated the press release in their language and distributed it through their contacts in local and national newspapers. The press release has been uploaded on the ClimOP website to make it available to everyone.

favoring a continuous climb and descent operations could save more than one million tons of CO2 and 150 million euros in costs; flying slow and low is estimated to cut up to 10% aircraft emissions (non-CO2 emissions are disposed of more quickly in the lower atmosphere) with only an increase of 1% in operating costs, mainly fuel; scheduling intermediate stops on long-haul flights could lead to potential fuel savings varying from 5% to 25%. Other mitigation actions focused on regulations such as providing national or international incentives to promote more climate-friendly operations.

...rements had already been taken into account by the aviation ... different methodologies and in different scenarios, so cannot ...e a common air traffic scenario to assess the climate impact of ...ational and technological conditions. That is quantifying the ...e simulated flight space modeled with flights, air traffic, aircraft ...holders. They are actively involved in the modeling process and ...ility of each Operational Improvements in working groups. The ...s year and produce mature results by mid-2022. Then the ...onal Improvements via several validation activities conducted ...y Board.

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PRESS RELEASE

First results of ClimOp published. The European project, led by Deep Blue, aims to reduce the aviation pollutant emissions

Driving electric vehicles in airports, optimizing flight routes, flying slow and low: these are some mitigation actions chosen to test their impact on climate

Now it is time for the operational phase: the selected mitigation strategies will be evaluated in a common air traffic scenario to compare their effectiveness and feasibility

Rome, 28/06/2021 - Flying causes pollution. The aeronautics sector is responsible for 1.9% of global greenhouse gas emissions and 2.5% of global carbon dioxide emissions, contributing to global warming by 5% (Anthropogenic Radiative Forcing)[1]. Despite the setback due to the pandemic, EUROCONTROL estimates a 53% increase in flights between now and 2040[2]. Pollution will increase too if no mitigation actions are taken: before the Covid-19 crisis, ICAO estimated that in 2040 the pollutant emissions from the aviation sector will be three times as many as in 2015[3]. And yet, if Europe wants to reach the goal of climate neutrality by 2050, as required by the European Green Deal, aviation will have to reduce its "climate footprint".

ClimOp (Climate assessment of Innovative Mitigation strategies towards Operational improvements in aviation) is an EU-funded project seeking a series of mitigation strategies to decrease the climate impact of the aviation sector (flights and airport operations, air traffic control and management). The objective is in line with the European Union's FlighPath 2050 goals related to the 75% reduction in CO2 emissions, and the 90% reduction in NOx emissions. Launched in 2020, the project is led by Deep Blue. The Consortium is composed of partners from different backgrounds: AMIGO (experts into climate risk management); SEA Group (who manages the airports of Milano Linate and Milano Malpensa); the International Air Transport Association (IATA); the Royal Netherlands Aerospace Center (Royal NLR); the Germany research centre for Aerospace, Energy and Transportation (DLR); the Delft University of Technology and the Istanbul Technical University.

In its first year, the project Consortium had identified the 11 most promising Operational Improvements (www.climop-h2020.eu/tackling-climate-change-with-greener-aviation-operations/) for cutting the aviation pollutant emissions. They were selected from the literature on the basis of criteria such as availability and robustness of the scientific data; the maturity of the technologies needed to implement them; a good cost / benefit ratio; a positive feedback from the stakeholders of the project Advisory Board (airlines, air traffic controllers, airports, air navigation service providers, policy makers, the European Passengers' Federation).

Many shall take effect immediately and would bring long and medium-term benefits since required no technological innovations or new regulations. So, for example, single-engine taxiing, E-taxi, hybrid taxi or converting the entire land fleet to electric. These mitigation actions cover ground operations, but most of the selected Operational Improvements are aimed at reducing emissions during Terminal Maneuvering Area, Network and in-flight operations. Here are some examples:

1 D. S. Lee et al., "Transport impacts on atmosphere and climate: Aviation," Atmos. Environ., vol. 44, no. 37, pp. 4678 – 4734, Dec. 2010, doi: 10.1016/j.atmosenv.2009.06.005.
2 EUROCONTROL, "Five-Year Forecast 2020-2024 European Flight Movements and Service Units Three Scenarios for Recovery from COVID-19." 2020. Accessed: Nov. 18, 2020. [Online]. Available: https://www.eurocontrol.int/sites/default/files/2020-11/eurocontrol-five-year-forecast-europe-2020-2024.pdf.
3 https://ec.europa.eu/clima/policies/transport/aviation_en

Figure 5. 1st ClimOP press release

2.4 Press coverage

The press coverage directly results from the communication activities and indicates whether the project topics are communicated effectively or not. The more effective the project's communication is, the more ClimOP is expected to appear in journals and newspapers. In the first reporting period,

the ClimOP project appeared in three Italian digital magazines: FerPress, Youmanist, and SEA Medium.

The first is a magazine delivering news on public transportation and railways. The second Italian magazine is a project of BNP Paribas committed to raising awareness about cultural values such as social responsibility, environmental sustainability, and diversity management. The latter magazine belongs to one of the partners, SEA Milan, which described ClimOP in one of its posts, illustrating their effort at creating a greener connection from and to its two airports of Milan Malpensa and Linate.

2.5 Public Materials

In the first reporting period, the Consortium developed several public materials to convey the information to the general audience on the ClimOP goals and progress. This material consists of three posters presented in third-party events and the report on the First Advisory Board meeting. Each material has been created in line with the audience to which it was going to be presented by focusing on different aspects of the project.

The first poster gives an overview of ClimOP, the objectives, methodologies, and examples of the measures taken into account by the project. It further includes the project concept image (*Appendix A)*, which supported the project presentation at the 3rd ECATS Conference (*Figure 6*).

The second poster (*Appendix B*) has been developed together with ClimOP's sister projects for the 10th EASN Conference, in which a common session was organized to present the cluster of projects and their common purpose.

The third poster was created to present the analysis of TU Delft on the NOx-O3 effects from optimized air traffic in the 10th Annual EMAC Symposium (*Appendix C)*.

The report on the first Advisory Board meeting (*Figure 6*) was released to inform the project audience about the results produced by the consultation of the aviation stakeholders. The document also describes the activities and methodology employed throughout the meeting.

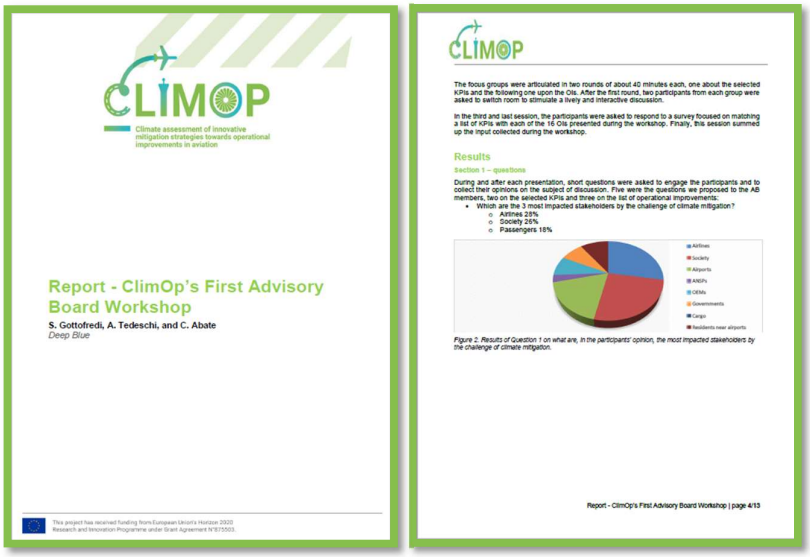


Figure 6. Excerpts from the First Advisory Board Meeting

All these documents have been shared through ClimOP social media profiles and are downloadable on the project website. In this way, all the interested audience that could not attend the events has the chance to get updated on the project activities.

3. Dissemination towards the scientific community

3.1 Third-party events

Third-party events include conferences, workshops, and meetings organized by stakeholders who are not directly involved in ClimOP. Participation in public events is a relevant opportunity to spread information about the purpose, results, and benefits of ClimOP.

3.1.1 EASN

The ClimOP project member, Carlo Abate (DBL), presented the project in the common session organized together with the sister projects for the 10th EASN Conference, held online on the 2-4th of September 2020. About 400 remote participants from all over Europe took part in the conference, including researchers, professors and university students as well as industrial practitioners and policymakers.

During the common session, each sister project presented the work done during the first 9 month of activities. Then, the poster entitled “ACGA cluster for aviation operations impact on climate change” (*Appendix B*) was presented to the audience. The presentation of the common poster aimed at illustrating the common strategy of the four projects that are investigating different ways to counteract aviation impact on climate change. The poster and sister projects’ presentations were well received, and in particular, some attendees were curious about the different applications of each project.

In September 2021, the ClimOP Consortium plan to attend the EASN Conference for the second time. At the 11th EASN Conference, some ClimOP members will present the lasted updates from project activities.

3.1.2 ECATS

The 3rd ECATS Conference, initially organized in March 2020 in Gothenburg, was forced to be held remotely on the 13-15th of October 2020 because of the Covid19 outbreak. The ECATS conference takes place every 4 years and mobilizes a vast international audience.

The Consortium took part in the event by presenting a poster designed for the occasion (see Figure 6) and illustrating the overall project, providing information on its goals, the methodology employed, and the most promising greener aviation OIs identified during the state-of-the-art analysis completed in the first six months of research. Furthermore, ClimOP presented an abstract that has been published in June 2020 in the 3rd ECATS Book of Abstract (see Section 3.2).

3.1.3 EGU General Assembly

The European Geophysics Union (EGU) General Assembly brings together a community of 22.000 geoscientists, researchers, and industry representatives from all over the world to one meeting covering all disciplines of the Earth, planetary, and space sciences. The EGU aims to provide a forum where scientists, especially early career researchers, can present their work and discuss their ideas with experts in all fields of geoscience.

The ClimOP members Giacomo Caria and Sara Dal Gesso (Amigo) presented the work “An assessment of the likelihood of contrail formation” in the vPICO presentation on the 28th of April,

2021. Their seminar was part of the session that discussed the research on the “Dynamics and chemistry of the upper troposphere and stratosphere”. The study is part of the ClimOP effort to assess the climate impact of aviation, including non-CO_2 effects. During the discussion time after the presentation, two attendees asked for further information.

3.1.4 InterFAB Expert Talk

The InterFAB Expert Talks consist of a series of meetings organized by FABEC (The Functional Airspace Block Europe Central), aiming to provide a platform to share experiences and views from experts on key issues related to data and performance in ATM.

Sigrun Matthes (DLR), presented the ClimOP project in the 4th InterFAB Expert Talk held online on the 11th of May, 2021. Our partner illustrated the role of ATM in fighting climate change by presenting the work done to understand the CO_2 impact on climate and the opportunity to mitigate CO_2 and non-CO_2 effects, carried out in ClimOP WP2.

3.1.5 EMAC

At the beginning of June, ClimOP took part in the 10th Annual EMAC Symposium, where our colleagues from TU Delft presented their work on the analysis of NOx-O_3 effects from optimised air traffic using algorithmic climate change functions (aCCFs).

The EMAC Symposium is an annual gathering that aims to intensify the collaboration between the groups of experts that employ the MESSy (Modular Earth Submodel System) modelling system in their daily work. The software provides a standardized bottom-up implementation of Earth System Models, such as atmospheric chemistry and the model physics-related submodels.

Our partners from TUD employ these submodels to verify the effectiveness of aCCFs in generating green trajectories that avoid climate-sensitive regions. With their work, they want to understand the extent to which the algorithmic climate change functions are useful in predicting NOx-O_3 impact from aviation re-routing procedures and to define whether the radiative forcing of Ozone from climate-optimised air traffic is lower than for cost-optimised traffic.

The presentation and poster (*Appendix C*) were well received by the attendees. Five climate researchers show interest in the work illustrated by Pratick Rao, asking for further details, and giving valuable feedback to the work TU Delft is carrying out in the ClimOP project.

3.2 Scientific Publications

In the first 20 months, the ClimOP Consortium published five papers in peer-reviewed journals, open access, and international conferences.

Event/Journal	Title	Author(s)	Typology
Aerospace Europe Conference (AEC), 25 – 28 Feb 2020, Bordeaux	Mitigation potential of climate-optimized routing: concept	Sigrun Matthes (1), Benjamin Lührs (2), Florian Linke (2), Volker	International conference

	study for europe	Grewe (1,3), Katrin Dahlmann (1), Feijia Yin (3), Keith Shine (4)	
3rd ECATS Conference Book of Abstracts, Vol. 1, June 2020, Gothenburg	ClimOP: Climate Assessment of Innovative Mitigation Strategies Towards Operational Improvements in Aviation	A. Tedeschi & the ClimOP Project Team.	Open access
3rd ECATS Conference Book of Abstracts, Vol. 1, June 2020, Gothenburg	Robustness of climate-optimized trajectories and mitigation potential: flying atm4e	S. Matthes, B. Lührs, K. Dahlmann, F. Linke, V. Grewe, F. Yin & K.P. Shine	Open access
Aerospace 2020 https://doi.org/10.3390/aerospace7110156 https://www.mdpi.com/2226-4310/7/11/156	Climate-Optimized Trajectories and Robust Mitigation Potential: Flying ATM4E	Matthes, S.; Lührs, B.; Dahlmann, K.; Grewe, V.; Linke, F.; Yin, F.; Klingaman, E.; Shine, K.P.	Peer-reviewed aviation journals
The April Edition of Open Access Government, April 2021, Online	Tackling climate change through greener aviation operations	S. Gottofredi, C. Abate, A. Tedeschi, V. Ferraiuolo	Open access

Table 5. List of Scientific Publications made by ClimOP from M1-M20.

4. Dissemination towards SESAR and H2020 programs

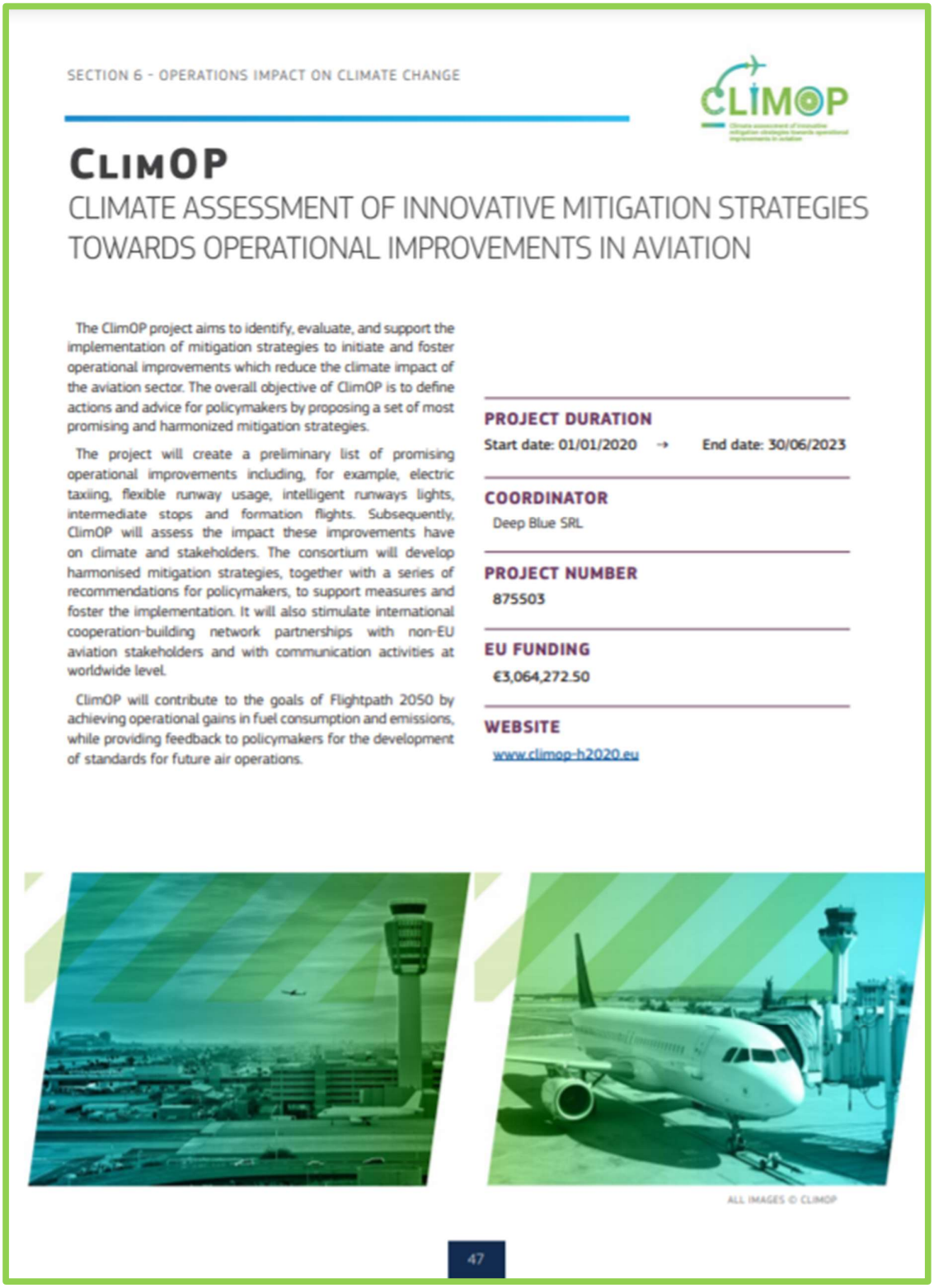
The following sections describe the communication and dissemination activities targeting European funding organizations and research projects similar to ClimOP. The activities performed towards this audience help share the ClimOp lessons-learned and findings in similar or complementary research areas. The goal of these activities is to contribute to a better and efficient organisation of the research activity.

4.1 INEA Booklet

The INEA Booklets consist of a series of publications that bring together a set of EU-funded research projects that share a common aim. INEA was an Executive Agency established by the European Commission to implement parts of EU funding programmes for transport, energy, telecommunications, and climate action. INEA ceased operations on 31 March 2021. The European Climate, Infrastructure and Environment Executive Agency (CINEA) was established on 1 April 2021 to take over its legacy portfolio as well as additional EU funding programmes.

At the end of September, the ClimOP project was included in the Booklet “Towards Climate-Neutral Aviation”[6]. The participation of ClimOP in this publication is part of the attempt to reach the specialized audience and raise awareness by giving an overall description of the project and its goals. A link to the website is included in order to connect the publication to the major means of communication used by the ClimOP Consortium. Furthermore, the INEA Booklet has been incorporated also in the ClimOP website in Section “press coverage” under the product page. This was to make it easier for readers to remain updated with the latest project publications.

[6] https://ec.europa.eu/inea/sites/default/files/towardsclimate-neutralaviation-2020_metadata.pdf



SECTION 6 - OPERATIONS IMPACT ON CLIMATE CHANGE

CLIMOP

CLIMATE ASSESSMENT OF INNOVATIVE MITIGATION STRATEGIES TOWARDS OPERATIONAL IMPROVEMENTS IN AVIATION

The ClimOP project aims to identify, evaluate, and support the implementation of mitigation strategies to initiate and foster operational improvements which reduce the climate impact of the aviation sector. The overall objective of ClimOP is to define actions and advice for policymakers by proposing a set of most promising and harmonized mitigation strategies.

The project will create a preliminary list of promising operational improvements including, for example, electric taxiing, flexible runway usage, intelligent runways lights, intermediate stops and formation flights. Subsequently, ClimOP will assess the impact these improvements have on climate and stakeholders. The consortium will develop harmonised mitigation strategies, together with a series of recommendations for policymakers, to support measures and foster the implementation. It will also stimulate international cooperation-building network partnerships with non-EU aviation stakeholders and with communication activities at worldwide level.

ClimOP will contribute to the goals of Flightpath 2050 by achieving operational gains in fuel consumption and emissions, while providing feedback to policymakers for the development of standards for future air operations.

PROJECT DURATION

Start date: 01/01/2020 → End date: 30/06/2023

COORDINATOR

Deep Blue SRL

PROJECT NUMBER

875503

EU FUNDING

€3,064,272.50

WEBSITE

www.climop-h2020.eu

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Figure 7. ClimOP page on the INEA Booklet "Towards a climate-neutral aviation"

4.2 SESAR Webinars

The SESAR Joint Undertaking (SJU) is a non-profit organization that coordinates all EU research and development (R&D) activities in ATM. With its “Digital Academy webinars”, the SJU aims at spreading the knowledge produced by the projects to the funding institutions, industry, policymakers, and the research community.

On the 19th of November 2020, ClimOP was presented by the project member Sigrun Matthes in the webinar “Smart and sustainable solutions for greener ATM - Airport domain”. This event was the first of a series of seminars focusing on SESAR solutions that aim to provide Europe’s airports with a greener, cleaner, and quieter operating environment. The goals and methods of ClimOP were described in front of approximately 150 people with the support of a graphic presentation. The project was presented as part of a broad European initiative aiming to understand and reduce the climate impact of aviation. At the end of the presentation, the attendees were invited to visit the ClimOP website, and six of them asked for further details.

4.3 Links with other EU funded research projects

Under the coordination of the Air Transport Action Group (ATAG), the aviation sector has long committed to cut its emissions and implement mitigation strategies to reduce its impact on the environment and climate [5]. This commitment has been recently restated despite the current crisis [6]. At institutional level, the European Commission is supporting these efforts by promoting the research of innovative methods and technologies aimed at reducing the impact of aviation on climate.

4.3.1 ACACIA, AEON, ALTERNATE, GREAT, RENAISSANCE

ClimOP is one of the four projects selected by the Innovation and Networks Executive Agency (INEA) within the action “Aviation operations impact on climate change” that pursue this purpose. These four projects, namely GreAT (Greener Air-Traffic Operations), ACACIA (Advancing the Science for Aviation and Climate), ALTERNATE (Assessment on alternative aviation fuels development), and ClimOP, focus on complementary aspects:

- **GreAT:** innovative methods for a more climate-friendly air traffic management;
- **ACACIA:** a scientifically sound understanding of the aviation contribution to climate change;
- **ALTERNATE:** new fuels less dependent on fossil sources;
- **ClimOP:** the identification and assessment of the most promising operational improvements to reduce the aviation climate impact and the evaluation of their impact on all the aviation stakeholders.

The ClimOP Consortium meets its sister projects on a regular basis. In September 2020, ClimOP took part in a cluster session at the 10th EASN Conference, held virtually. During the session each project gave a presentation of its goals and the results produced in the first nine month of activities. Moreover, ClimOP and its sister projects presented a common poster at the 3rd ECATS Conference, held online in mid-October 2020.

In 2021, the ACGA cluster is organizing a second common session for the 11th EASN Conference, where each project will have the opportunity to present the results of the second year of activities.

In addition to the ACGA cluster, ClimOP established synergies with two other EU-funded research projects: the AEON and Renaissance projects. AEON (Advanced Engine-off Navigation) is a SESAR JU funded project that aims at innovating airport ground operations with more environmental friendly taxiing techniques. Renaissance is an H2020 funded project that aims to deliver a community-driven scalable and replicable approach to implement new business models and technologies supporting clean production and shared distribution of energy in local communities.

Figure 8. Logos of the ClimOP-related projects

ClimOP and AEON started collaborating on two levels: by sharing knowledge on more efficient ground operations and through joint communication initiatives. As a result, AEON presented ClimOP in its first newsletter, while ClimOP invited them to attend the 2nd Advisory Board Workshop planned for mid-November 2021. In that occasion, the AEON Consortium will give a presentation of an preliminary concept of operations which integrates a number of novel engine-off taxiing technologies that are coming onto the market to decarbonizing the operations at the ground level.

The collaboration of ClimOP with Renaissance is similarly organized. On the technical level, ClimOP aims to scale up the methodology applied by the energy community of the Renaissance project by deploying it inside airports to make their energy supply more efficient. In the short term, both the project are working on a common post to share through their communication channels.

5. Dissemination towards the industry

Active contribution and participation from a large set of stakeholders are pivotal for the achievement of the objectives of ClimOP and, particularly, for the success of WP4. Thus, at the beginning of projects, an Advisory Board was constituted to support the methodological work of the project, provide reviews, recommendations and feedback on project activities and findings; and bring an external view into the project. Nevertheless, the Consortium carried out several activities to establish connections with aviation industry members even beyond the AB. This brought the Consortium to a set of bilateral exchanges of information that benefited both parties.

5.1 Meetings with representatives of the industry

During the first 20 months of activities, the Consortium has had 5 meetings with representatives of the industry outside the Advisory Board meetings. In most of the consultations, the Consortium gave a detailed presentation of the project and the results produced until that point.

The discussions focused on the mitigation and adaptation measures in the domain in which the participants were operating. On July 23, 2020, ClimOP met in two separate meetings 2 Air National Service Providers (ANSP) from CANSO and one airport manager from the Aeropuertos Españoles y Navegación Aérea (AENA). All the participants expressed their interest in the future developments of the ClimOP project, asking to receive periodic updates after the call.

The 21st of October 2020, ClimOP met with Sky-Echo, a start-up dealing with high-definition urban rainfall and storm monitoring software. The ClimOP members Alessandra Tedeschi and Sara Dal Gesso presented the project to two representatives of the consulting firm, which expressed their interest in future joint consultancy activities.

Finally, in March 2021 ClimOP had two meetings with representatives of the industry. The first was with a consultancy firm, the FLT-Consulting, and the second was with the European Organization for the Safety of Air Navigation (EUROCONTROL). Five representatives of the aviation industry took part in the meeting with the FLT-Consulting and one representative of the ATM EU Agency took part in the second meeting. The Consulting firm shows interest in new potential collaborations. On the other hand, EUROCONTROL asked to receive further information and periodic updates about ClimOP results.

5.2 Dissemination towards the AB

The collaboration with the Advisory Board members takes the form of ‘ad-hoc’ meeting reviews where they provide feedback to project results, steering the overall work of the project. For the description of the designed plan for the validation activities with details on the expected contributions of the Advisory Board to specific WPs, we refer to the D4.1 (*see Chapter 5*). No major deviances were seen from the plan, with the exception of the number of the meetings initially planned that a decrease in favor of a smaller number of more fruitful meetings.

The following section illustrates the contribution that the AB workshops brought to the dissemination towards the decision-makers and specialized audiences.

5.2.1 First AB meeting

On the 2nd of July 2020, the Consortium held the first workshop with the Advisory Board members online, aimed at collecting feedback on the preliminary results produced in the first four months of project activities.

Figure 9. Screenshot from a room of the first Advisory Board meeting

These results have been described in two deliverables, which identify the first list of operational improvements (OIs) to mitigate the CO_2 and non-CO_2 emissions from aviation (D1.2 - Inventory of operational improvement options) and a set of Key Performance Indicators (KPIs) to assess the feasibility of the OIs by taking in account seven performance aspects: operational, environmental, financial, technical, safety, human performance and social acceptance (D1.1 - Definition of climate and performance metrics). These deliverables have been finalized and uploaded on the EC portal at the end of April 2020.

Deep Blue, as project coordinator and leader of the dissemination activities, took care of the organization of the workshop sessions, including the creation of a dedicated webpage. Representatives of each member of the ClimOP consortium moderated and took notes during the workshop activities. Eight representatives of the following organizations took part in the workshop: AENA, Airbus, ACI Europe, CANSO, BULATSA, MTU Engine and the Dutch Ministry of Infrastructure and Water.

Feedback given by the Advisory Board was included in the project deliverables D1.3 “Report on the assessment of operational improvements against identified KPIs” and in a dedicated report uploaded on the ClimOP website and shared through social media profiles.

In July 2021, some Advisory Board members have taken part to the first project Review Meeting where the Consortium updated the representatives of the European Commission and the Horizon 2020 about the ClimOP advancements. All the attendees were very positive about the project status and the AB members provided encouraging feedback as well.

6. Conclusion

6.1 Analysis of the dissemination audience and objectives

The D4.1 dissemination plan defined a list of four main objectives for the dissemination in ClimOP: raising awareness about the project objectives and goals, generating understanding about the project contents and progress, fostering interaction and exchange among the target audience, and getting key messages to decision-makers to ensure the impact of the project.

During the first reporting period of the project, ClimOP focused on achieving the first two objectives and, in particular, showing the relevance of the project objectives and maximizing its diffusion through the general and specialized audience.

The objective of informing and raising awareness among the target audience on the ClimOP project and objectives has been achieved. The results produced so far by the communication and dissemination activities show that an audience of almost 50,000 has been reached through social media, and another 2,000 visitors visited the ClimOP website. As the project started to publish the first relevant results, the project stakeholders started downloading them from the website and increasingly interacting with the content posted on social networks. Even though the dissemination in the first period has particularly suffered from the Covid19 pandemic, the events attended by ClimOP can be considered very successful when looking at the number of attendees and requests for further information received.

The D4.1 also identified three different target audiences to reach, which use the information received about ClimOP in different ways. The **general public** makes conceptual use of the information (i.e., affecting knowledge or attitude towards the topic). The **specialised audience**, uses it in an instrumental way (i.e., influencing behaviour and practice). Finally, **decision makers** use the communication in a strategic way, affecting the definition of policies and broad research themes in order to align the researchers and end users.

In the second phase, the communication and dissemination activities of ClimOP will target the second and third audiences in order to foster the adoption of ClimOP findings. All the activities carried out in the second period of reporting will be reported in the D4.4 – “Final Report on the Communication, Dissemination and Exploitation activities”.

6.2 Status of the communication and dissemination activities

Overall, the KPIs presented in the D4.1 have been achieved. A deviation from the actual plan only occurred for the number of scientific publications in international conferences and workshops, fulfilled for half of the expected value. This result can be attributed to two contingencies. Firstly, the impact that the spreading of the pandemic has had on the organization of public events. Secondly, the schedule of the work, which concentrates most of the technical results in the second part of the project. As mitigation action, the Consortium is preparing the publication of one paper on the work that TUD will present during the EASN Conference in September 2021.

Other indicators for the WP4 performance have been included among those selected at the beginning of the project (*see Section 2.1.2.1.*). These indicators mainly deal with digital communication, which has been largely used during the month in which most of the world was blocked at home.

The table below reports the updated list of communication and dissemination KPIs where it is possible to see the status of the indicators against the expected values. The last column shows the mitigation actions the Consortium will adopt to fulfill the KPIs that missed their goal.

KPI for Dissemination and Communication	(Planned) M1-M20	Actual	Status	Mitigation actions/notes
N° of events organized for external audiences	1	**1**		
N° of events attended representing the project	2	**6**		
Meetings (incl. remote) with representatives of industry	2	**5**		
N° of scientific publications in peer-reviewed journals	1	**1**		
N° of scientific publication in international conferences and workshops	2	**1**		Considering the publication of one paper under the EASN 2021 issue
N° of general press/magazine articles published also at the local/National level	2	**4**		
N° of press releases delivered to traditional media	1	**1**		
Total number of unique visitors to the Website (based on Google Analytics)	500	**1974**		
Social media contacts (LinkedIn and Twitter)	100	**245 (147,98)**		
N° of references of ClimOP in other websites	3	**13**		
N° of multimedia material downloads (website)	15	**173**		

Scientific publications as Open Access	2	**3**		
N° of global social media visualisations	-	**48,140**	-	
N° of Twitter profile view	-	**3,348**	-	
N° of LinkedIn profile view	-	**390**	-	
N° of blog posts published	-	**22**	-	
N° of blog posts reads	-	**1272**	-	
N° of EU-funded projects we regularly link with	-	**5**	-	
Average time on page	-	**02:49 min**	-	

Table 6. Updated list of Dissemination and Communication KPIs

6.3 Next Events

ClimOP is planning to participate in the following events, both internal and external.

Name of the Event	Location	Date	Description
11th EASN International Virtual Conference	Online	1st-3rd of Sept 2021	Presentation of two studies from partners of the ClimOP consortium and publication of one scientific paper under the special issue with the EASN conference. News on the website insertions through the social media profiles.
1st Advisory Board workshop of the AEON project	Online	21st September 2022	The AEON Advisory Board meeting aims at presenting the initial version of the concept of green taxiing operations and collects experts' opinions. ClimOP will attend the meeting to provide feedback on the operational improvements at the ground level
2nd Advisory Board	Online/in presence	mid-November 2021 (date to be	The meeting aims at sharing the results produced by the modelling

workshop	(depending on the Covid-pandemic progress)	confirmed)	activities in the second year of research and gathering feedback from the Advisory Board and the related projects.
ICAO working groups	Online/in presence (depending on the Covid-pandemic progress)	//	Through the ClimOP partner DLR, the Consortium is considering presenting the project, its status and the main results to the participants at the ICAO working groups.

Table 7. Next events planned

6.4 Next Activities

The ClimOP project will be completed at the end of Jun 2023. As this deliverable only covers the project activities performed until the 20th of August 2021, some activities already planned are not included in this document, as they will be performed in a later period.

6.4.1 Clustering communication activities with ClimOP-related projects

In the following months, ClimOP will organize a number of communication activities with the related projects. The first one consists of a joint publication that illustrates how the local energy community model of Renaissance can be applied to airports and make their energy supply more efficient. ClimOP and Renaissance are working on an article to publish on the websites of each project and share on the respective social media in order to increase the visibility of both the H2020 projects beyond their field of application.

The ACGA cluster is organizing a workshop to foster the exchange of scientific findings developed during the first half of project research. The exchanges will be open to all consortium members but also include high-level presentations. A specific session will be dedicated to brainstorming in smaller groups on cross-fertilization activities like ways of structuring common communication initiatives and supports (as per the common poster, or other materials like leaflets, videos, etc.).

6.4.2 Papers in preparation

ClimOP is planning to submit or discuss the following papers:

Event/Journal	Lead author	Co-author(s)	Working title	Date
MDPI Aerospace special issue on Aircraft Emissions and	Pratik Rao (TUD)	Feijia Yin, Volker Grewe, Hiroshi Yamashita and Patrick Jöckel	The verification of NOx-ozone algorithmic climate change functions from the	Submission due date: October 31st 2021

Climate Impact			sub model ACCF 1.0 of EMAC 2.54 for optimising flight trajectories.	

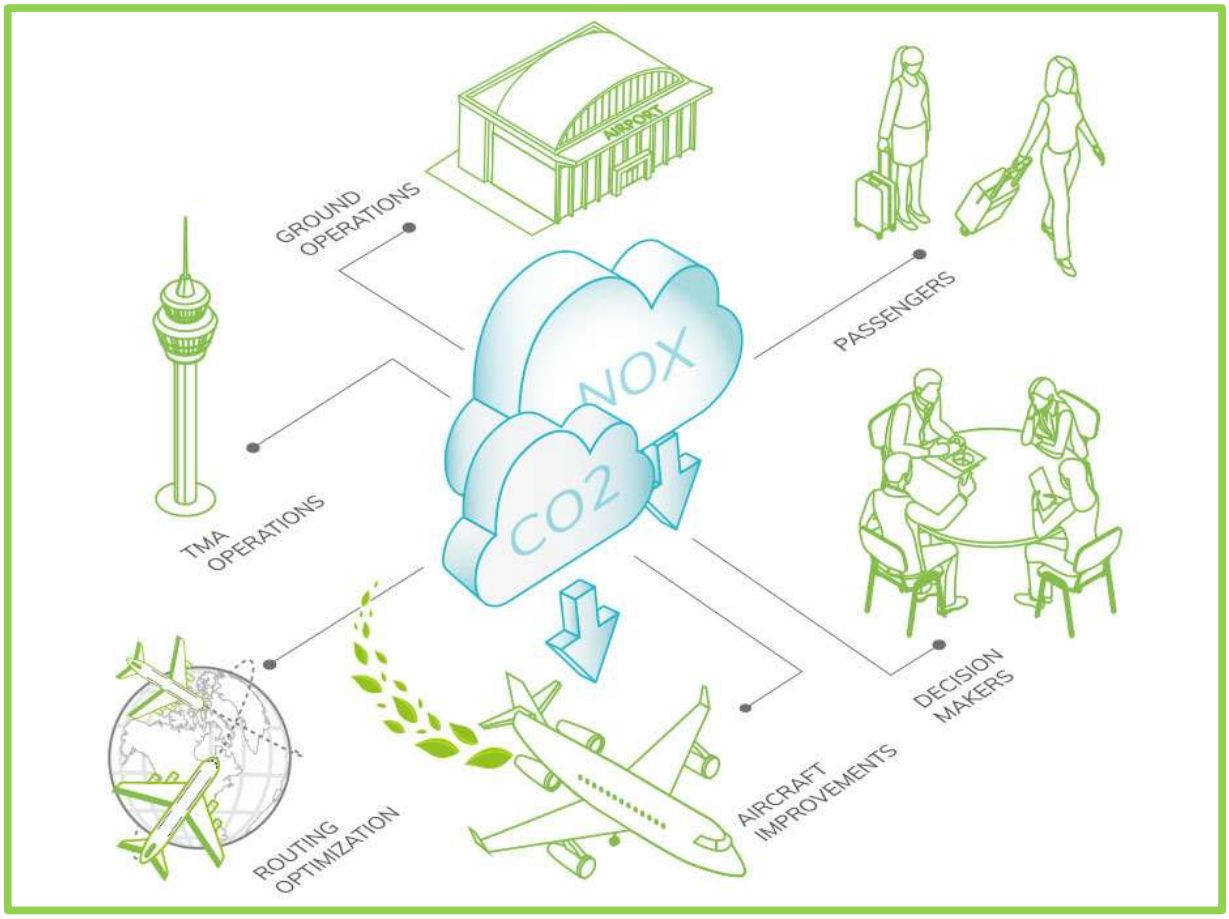
Table 8. Next papers planned

References

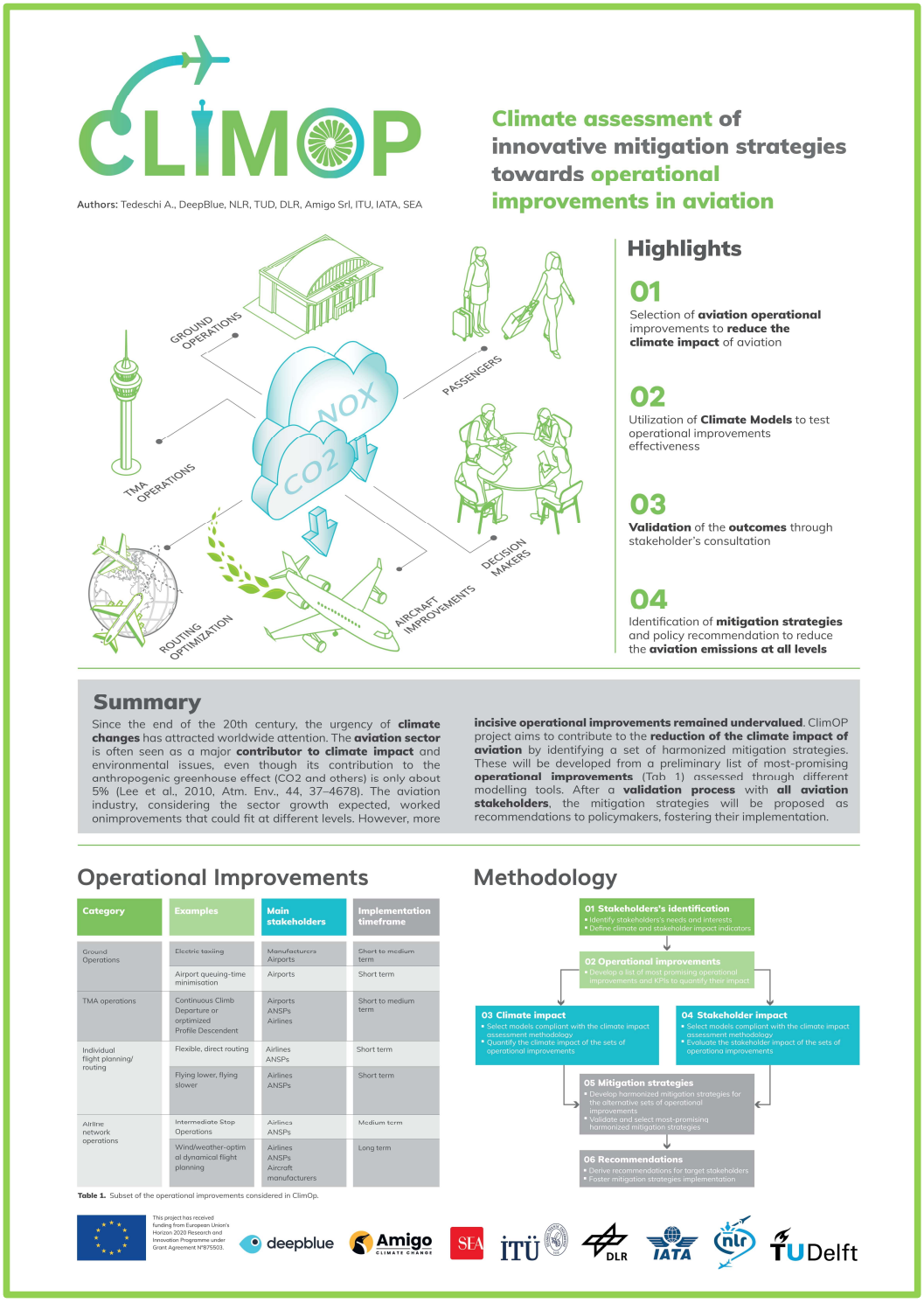
[1] ClimOP Consortium. (2020) *D4.1 Communication, Dissemination and Exploitation plan.*
[2] D. S. Lee et al., "Transport impacts on atmosphere and climate: Aviation," Atmos. Environ., vol. 44, no. 37, pp. 4678–4734, Dec. 2010, doi: 10.1016/j.atmosenv.2009.06.005.
[3] EUROCONTROL, "Five-Year Forecast 2020-2024 European Flight Movements and Service Units Three Scenarios for Recovery from COVID-19," 2020. Accessed: Nov. 18, 2020. [Online]. Available: https://www.eurocontrol.int/sites/default/files/2020-11/eurocontrol-five-year-forecast-europe-2020-2024.pdf.
[4] ClimOP Consortium. (2020) *D4.2 ClimOP Website.*
[5] ATAG, "Climate change." https://www.atag.org/our-activities/climate-change.html (accessed Apr. 29, 2020).
[6] ATAG, "Green recovery of air transport a priority for industry leaders," Press release, 2020. https://www.atag.org/component/news/?view=pressrelease&id=121 (accessed Nov. 18, 2020).

Appendix

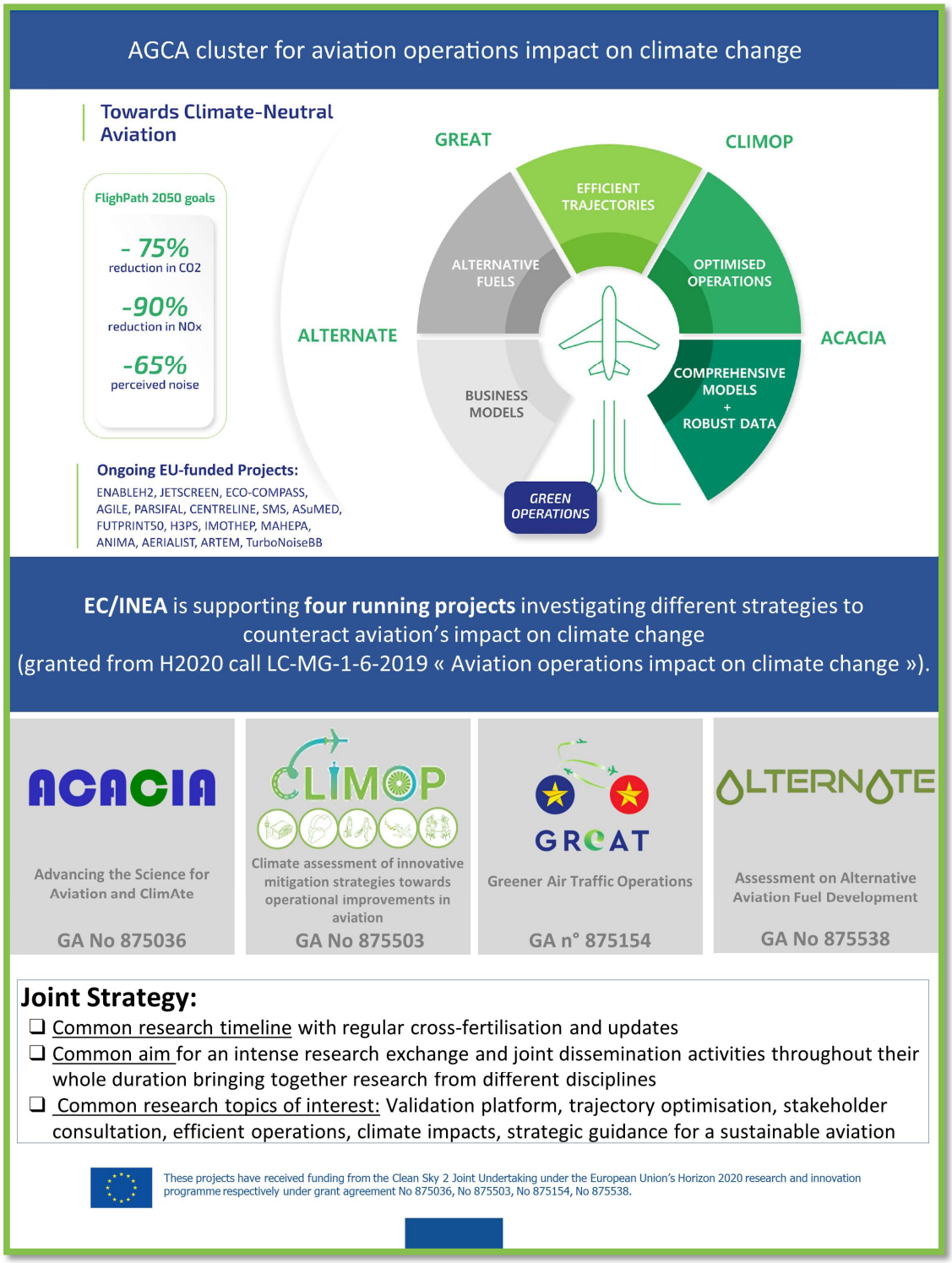
A. Concept image



B. ClimOP Poster for the 3rd ECATS Conference



C. Poster of the ACGA Cluster session in the 10th EASN Conference



D. Poster for the 10th Annual EMAC Symposium

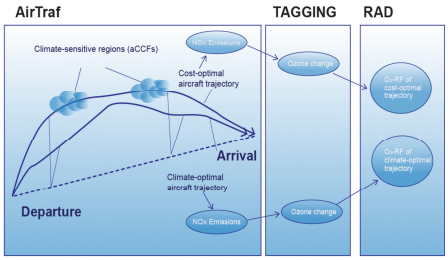
The analysis of NO_x-O_3 effects from optimised air traffic using algorithmic climate change functions (aCCFs)

Pratik Rao[1], Feijia Yin[1], Volker Grewe[1,2], Hiroshi Yamashita[2], Patrick Jöckel[2]

[1]Delft University of Technology, Aircraft Noise and Climate Effects (ANCE)
[2]German Aerospace Center (DLR), Institute of Atmospheric Physics

Motivation

- Aviation induced warming includes CO_2 (<35%) and non-CO_2 effects (>65%) from NO_x, H_2O, contrails and direct aerosols [1].
- The climate impact of non-CO_2 emissions are characterised by the meteorology, emission location and time [2].
- Algorithmic Climate Change Functions (aCCFs) [3] are response models that use meteorological data to estimate the climate impact of emissions at a given location and time.
- We need to **verify the effectiveness of aCCFs in generating green trajectories** that avoid climate sensitive regions.
- The focus here is specifically on **verifying O_3 aCCFs** which are expected to predict NO_x impact on Ozone.



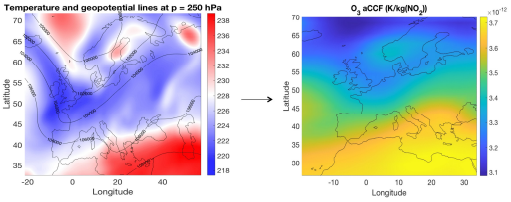
Simulation setup

Ozone aCCFs

- O_3 aCCFs are dependent on temperature and geopotential:

$$\mathrm{aCCF}_{\mathbf{O_3}}(\mathrm{T}, \mathbf{\Phi}) = \beta_0 + \beta_1 \mathrm{T} + \beta_2 \mathbf{\Phi} + \beta_3 \mathrm{T}\mathbf{\Phi}$$

- The verification process will provide insight on the capability of O_3 aCCFs in predicting NO_x effects on Ozone from optimised air traffic.



Weather situation (T, Φ) *Climate impact of NOx on* O_3

Verification Approach

- Optimise EU air traffic on days characterised by high variability of NO_x-O_3 aCCFs.
- Both horizontal and vertical re-routing is considered.
- The flight traffic emissions are tracked and used in a 4-month chemistry simulation.
- A direct climate impact comparison is made with cost-optimised air traffic.

Expected results

At the end of the project, the following is expected:

- The extent to which O_3 aCCFs are useful in predicting NO_x-O_3 impact from aviation re-routing procedures.
- Radiative forcing of Ozone from climate-optimised air traffic is lower than for cost-optimised traffic at the end of the simulation.

Air traffic optimised on:	Cost optimal	Climate optimal	Difference
Winter day	10.67	10.64	0.03
Summer day	8.85	8.73	0.12

Mean-adjusted O_3 *RF (mW/m²) from optimised air traffic*

References

1. Lee et al., 2020. The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018.
2. Grewe et al., 2014. Aircraft routing with minimal climate impact: the REACT4C climate cost function modelling approach (V1.0).
3. van Manen et al., 2019. Algorithmic climate change functions for the use in eco-efficient flight planning.

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TU Delft Delft University of Technology

Challenge the future