Open letter: Addressing contrails is a no-regrets decision that will help slow climate change

There is no denying it: we find ourselves in a climate emergency. The World Meteorological Organisation confirmed that 2023 was the warmest year on record, with the global average near-surface temperature at 1.45°C above the pre-industrial baseline[1]. Earlier in 2023, the IPCC assessed that by the mid-2030s there would be a 50% chance of the world reaching a rise of at least 1.5°C.

Certain sectors of the economy are drivers of the climate emergency. Transport is one of them. And within that, aviation. That problem needs only a few facts and figures to underline its seriousness. Global aviation traffic doubled between 2005 and 2019 and its CO_2 emissions grew by 40%. And that just covers part of the problem. Planes cause much more warming than just through their CO_2 emissions

Non-CO_2 effects of aviation, such as nitrogen oxides and contrails, warm the planet at least as much as aviation's CO_2. The climate impact of these effects has been known for more than 25 years.

Contrails - created by aircraft flying through cold and humid air - are the most significant of aviation's non-CO_2 effects. Most contrails dissolve within a few minutes, but in certain conditions, they can persist in the atmosphere, spread out, and become artificial cirrus clouds with a net warming effect. A landmark study estimated that the effective radiative forcing (ERF) from contrails in the year 2018 was larger than the ERF from the CO2 present in the atmosphere from aviation emissions since 1940.

Nonetheless, little effort has been made in the last decades to mitigate the warming effects of contrails. To date, the aviation industry has not been proactive in dealing with the problem.

Crucially, if decisive action is taken, these effects may be partly mitigated in a faster and more cost-effective way than other climate issues, thanks to slightly rerouting a small number of targeted flights. This would entail minimum impact on the aviation industry and passengers, and a negligible risk of doing more climate harm than good.

Moreover, the effects of contrails on the climate are short lived, so addressing them would deliver short term climate benefits, very much needed in the race to meet the goals set out in the Paris agreement.

Recognising the impact of non-CO_2 effects, particularly contrails, on our warming climate and the urgent need for action, we, aviation and climate scientists, call upon global decision makers to implement solutions to tackle non-CO_2 effects of aviation on top of decarbonisation efforts. This starts by better awareness-raising of the general public on their climate impact. Airline passengers

[1] With a margin of uncertainty of ± 0.12 °C

should be informed of the full climate impact of flying when booking a flight and companies performing business flights should include non-CO_2 in their corporate reporting. Performing large scale contrail-avoidance trials, supported by applied research, will also be pivotal. Finally, and most importantly, we recognise the importance of a policy framework, underpinned by a robust monitoring system, to reduce warming contrails and other non-CO_2 effects. This will ensure that mitigation measures are quickly adopted, as soon as they are ready.

This is a no regrets approach that will help to slow climate change by a significant margin. Delaying action would be a critical error.

Signatories of the letter include (in alphabetical order):

Professor Jillian Anable, *Institute for Transport Studies, University of Leeds*
Professor Alexander Archibald, *University of Cambridge*
Dr Mona Bachmann, *University of Copenhagen*
Dr Magnus Bengtsson, *Hot or Cool Institute gGmbH*
Dr Peter Berrill, *Institute of Environmental Sciences, Leiden University*
Katharina Bohnenberger, *Institute for Socio-Economics, University of Duisburg-Essen*
Dr Kobe Boussauw*, Associate Professor of Spatial Planning and Mobility, VUB Brussels*
Dr Olivier Boucher, *IPSL, Sorbonne Université / CNRS*
Professor Christian Brand, *Emeritus Professor of Transport, Energy and Climate Change , University of Oxford*
Dr Cameron Brick, *University of Amsterdam*
Professor Federico Butera, PhD h.c., *Professor Emeritus of Technical Environmental Physics, Politecnico di Milano*
Dr Sven Buyle, *Principal research fellow, University of Antwerp*
Stefano Caserini, *University of Parma, Department of Engineering and Architecture*
Pierpaolo Cazzola
Dr Alex Chapman, *Senior Economist, New Economics Foundation*
Dr Ying Chen, *Assistant Professor in Atmospheric Science, University of Birmingham*
Dr Nicolas Clerbaux*, Royal Meteorological Institute of Belgium, Remote Sensing from Space*
Professor An Cliquet*, UGent*
Professor Wolfgang Cramer, *Professor and Director of Research CNRS, Medit. Institute for Biodiversity and Ecology, Aix-en-Provence, France*
Professor Edouard Davin, *Professor of Climate Scenarios for Sustainable Development, University of Bern*
Professor Cesare Hall, *Professor of Aerothermal Engineering, University of Cambridge*
Karl-Martin Hentschel, *Mathematician and author of „Handbuch Klimaschutz“*
Dr Charlie Gardner, *Associate Senior Lecturer, Durrell Institute of Conservation and Ecology, University of Kent*
Professor Dr Xavier Fettweis, *Department of Geography, University of Liège*
Chris Kesteloot, *Emeritus Professor, Division of Geography and Tourism, Department of Earth and Environmental Sciences, KU Leuven*
Patrick Le Clercq, *Head of department, multiphase flows and alternatives fuels, German Aerospace Center (DLR)*
Dr Kristian Nielsen*, Copenhagen Business School*
Professor Dr Pao-Yu Oei*, Professor for Economics of Sustainable Energy Transition, Head of Research Group FossilExit, Europa-Universität Flensburg (EUF)*
Professor George Papadakis*, Professor of Aerodynamics, Department of Aeronautics, Faculty of Engineering, Imperial College London*
Professor Anthony Patt, *Professor of Climate Policy, Department of Environmental Systems Science, ETH Zürich*
Pauline Petereit, PhD
Dr Robert Pietzcker, *Head of National Energy Transitions Team, Energy Systems Group, Potsdam Institute for*

Climate Impact Research
Joachim Piret, *Department of Water and Climate, VUB*
Professor Hans-O Poertner, *Alfred-Wegener-Institut*
Dr Philippe Quirion, *Director of Research, CNRS*
Professor Edward Richardson, *Professor of Applied Thermodynamics, University of Southampton*
Dr María Victoria Román, *Basque Centre for Climate Change*
Professor Sandra Rousseau, *Center of Economics and Corporate Sustainability, KU Leuven*
Dr Kevin Sartor*, Département d'aérospatiale et mécanique, University of Liège*
Gianni Silvestrini, *Scientific Director Kyoto Club, QualEnergia, KeyEnergy, Responsible Master Ridef Politecnico Milano, President Exalto*
Professor Steven Sleutel, *Faculty of Bioscience Engineering, Department Environment, Ghent University*
Dr Chris Smith, *VUB*
Dr Sophie Szopa, *Senior scientist in atmospheric chemistry, Laboratoire des Sciences du Climat et de l'Environnement, LSCE-IPSL*
Professor Wim Thiery, *Professor of Climate Science, VUB*
Professor Jean Pascal van Ypersele, *Professor of climate sciences, UCLouvain and Uliège, former IPCC Vice-Chair*
Professor Kwinten van Weverberg, *Professor in Climate Science, Ghent University, Royal Meteorological Institute of Belgium*
Professor Frank Venmans, *Assistant Professor, London School of Economics*
Professor Sara Vicca, *Associate Professor, University of Antwerp*
Professor Christiane Voigt*, Professor of Atmospheric Physics, University Mainz*
Professor Tommy Wiedmann, *Professor of Sustainability Research, Sustainability Assessment Program, School of Civil and Environmental Engineering, UNSW Sydney*