

°CICERO

Newsletter

Dissemination of CICERO researchers' scientific publications, reports and other outputs.

Featured



Journal of Cleaner Production

[Sharing for wellbeing and sustainability. Lending sports equipment and the role of libraries in Norway](#)

[Monica Guillen-Royo](#), [Emil Dæhlin](#), [Tom Erik Julsrud](#) and [Borgar Aamaas](#)

This paper builds on the four-year UPSCALE research project investigating how public libraries can take a lead role as hubs for sharing material

consumer goods such as sports equipment, tools and clothing. It explores the extent to which borrowing downhill ski equipment contributes to wellbeing and reduces CO2 emissions across three contexts characterized by varying prevalence of sharing practices. [Read more.](#)

Sustainability: Science, Practice and Policy

[Has international business travel reached a turning point? Exploring the long-term effects of COVID-19 on air-travel practices in knowledge intensive organizations](#)

[Tom Erik Julsrud](#) and [Steffen Kallbekken](#)

This article presents findings from a study of travel-behavior changes in three knowledge-intensive organizations conducted one year after the elimination of travel restrictions. The results show that most employees have reduced their intercontinental air travel after the pandemic, and many expect further reductions in the future. The findings suggest that mobility crises and external shocks represent opportunities for change and the development of low-carbon travel practices in knowledge-intensive organizations. [Read more.](#)

Publications



Nature Climate Change

[Energy and socioeconomic system transformation through a decade of IPCC-assessed scenarios](#)

D. J. van den Ven, [Shivika Mittal](#), A. Nikas et. al. including [Ida Sognnæs](#) and [Glen Peters](#) from CICERO

While emissions have grown and climate targets become more ambitious over the last decade, the investments needed to limit global warming to below 1.5-2°C have not increased, thanks to faster-than-expected reduction in costs of clean technologies such as solar, wind and battery storage. [Read press release.](#) [Read the article.](#)

International Journal of Hydrogen Energy

[Renewable hydrogen trade in a globale decarbonised energy system](#)

Khalidi Alanazi, [Shivika Mittal](#), Adam Hawkes and Nilay Shah

Renewable hydrogen has emerged as a potentially critical energy carrier for achieving climate change mitigation goals. International trade could play a key role in meeting hydrogen demand in a globally decarbonized energy system. To better understand this role, we have developed a modelling framework that incorporates hydrogen supply and demand curves and a market equilibrium model to maximize social welfare. The results offer key insights for policymakers and investors for shaping future hydrogen trade policies and investment decisions. [Read more.](#)

Environmental Health

[From inequalities to vulnerability paradoxes: juxtaposing older adults' heat mortality risk and heat experiences](#)

Małgorzata Wrotek, [Iulia Marginean](#), Zofia Boni et. al.

Increasing temperatures across the globe pose one of the biggest threats to human health and wellbeing. Different kinds of inequalities, determined by age, sex/gender, isolation, socio-economic status, occupation, living in the city, and health situation, create vulnerability factors influencing people's heat-related mortality risk and their daily experiences during summer. This study uses an interdisciplinary approach to research how intersecting inequalities generate vulnerabilities to heat stress among older adults (65+) in two European cities: Warsaw and Madrid. [Read more.](#)

Environmental Research Letters

[Plant and soil characteristics as key predictors for future agricultural drought](#)

A Kumar Samantaray, [N J Steinert](#) and P A Mooney

Drought is one of the most complex and multidimensional types of extreme events, with meteorological and agricultural droughts being two of the most widely studied types. Here, the researchers analyze agricultural drought with a crop water stress index (CSI) that incorporates plant and soil characteristics and soil moisture. The results emphasize the importance of combining plant and soil information with standardized indices in the assessment of drought-driven crop stress under climate change aiding effective policy formulation. [Read more.](#)

Annual Review of Environment and Resources

[Overshoot: A Conceptual Review of Exceeding and Returning to Global Warming of 1.5°C](#)

Andy Reisinger, [Jan S. Fuglestedt](#), Anna Pirani et. al.

Limited progress with mitigation makes it almost inevitable that global warming of 1.5°C will be exceeded. This realization confronts Parties to the UNFCCC with a choice either to stabilize warming above but as close as possible to 1.5°C or to reverse global warming back to this level. This article reviews core concepts and current knowledge relating to overshoot: an exceedance and subsequent decline back below a specified global warming level. [Read more.](#)

Urban, Planning and Transport Research

[A social justice perspective on protests against urban transport measures](#)

Tom Rye, [Anders Tønnesen](#) og Lisa Hansson

This paper examines one category of contentious transport measure: that which reallocates parking space from cars to other modes of transport. Such restrictive measures are regarded as essential within the broader mix of policies needed to create more climate-friendly cities. The study analyses three Norwegian cases: two involving the removal of curb-side parking to make way for cycle lanes on urban streets, and one involving the removal of parking to pedestrianise three central-city squares. [Read more.](#)

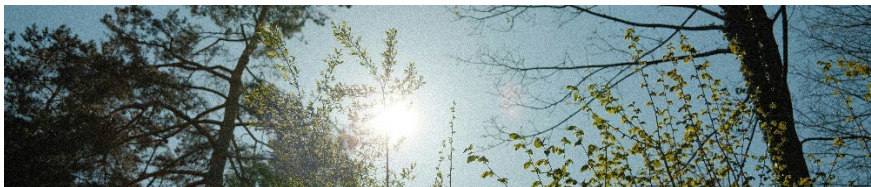
Communications Earth & Environment

[Anthropogenic sulfate-climate interactions suppress dust activity over East Asia](#)

Xiaoning Xie, [Gunnar Myhre](#), Huizheng Che, et. al.

Observational evidences indicate a significant decline in dust storm frequencies over the East Asian arid-semiarid region during recent decades, which creates a strong contrast with a great increase in sulfate emissions over monsoonal Asia. However, the causes for decline of dust activities are still controversial. Through conducting a set of idealized sensitivity experiments of regional aerosol perturbations, here the researchers show that anthropogenic sulfate aerosols over monsoonal Asia remarkably suppress the regional dust activities over East Asia. [Read more](#)

[Sign up to receive the next newsletter](#)



Environmental Research Letters

[The strategic and governance implications of solar radiation modification: perspectives from delegates of international climate negotiations](#)

Todd L Cherry, [Steffen Kallbekken](#), David M McEvoy and Wai Yan Siu

The lack of progress in addressing climate change has led to increased interest in solar radiation modification (SRM) — a collection of large-scale interventions that cool the planet by managing the amount of solar radiation that reaches the earth. SRM complicates climate change governance. This article presents a survey of international climate policy experts for their assessments of the potential for effective global

governance of SRM and the likelihood of possible international responses to unilateral SRM scenarios. [Read more.](#)

Earth's Future

[Change in Wind Renewable Energy Potential Under Stratospheric Aerosol Injections](#)

Susanne Baur, [Benjamin M. Sanderson](#) , Roland Séférian, Laurent Terray

In this study, the researchers explore the potential effect of one type of Solar Radiation Modification, Stratospheric Aerosol Injections (SAI), on Wind renewable energy (WRE). Using hourly output from the Earth System Model CNRM-ESM2-1, they compare WRE potential under a medium emission scenario (SSP245) and a high emission scenario (SSP585) with an SRM scenario that has SSP585 baseline conditions and uses SAI to offset warming to approximately SSP245 global warming levels. [Read more.](#)

Earth's Future

[Limited Effect of Future Land-Use Changes on Human Heat Stress and Labor Capacity](#)

Steven J. De Hertog, [Anton Orlov](#), Felix Havermann et. al.

To achieve the 1.5°C target of the Paris agreement, rapid, sustained, and deep emission reductions are required, which often includes negative emissions through land-based mitigation. However, the effects of future land-use change on climate are often not considered when quantifying the climate-induced impacts on human heat stress and labor capacity. Here, the researchers project the effects of land-use change on heat stress and

outdoor labor capacity for two contrasting future land-use scenarios under high-ambition mitigation. [Read more.](#)

Environmental Research Letters

[Linking regional economic impacts of temperature-related disasters to underlying climatic hazards](#)

Vidur Mithal, [Jana Sillmann](#) and Jakob Zscheischler

Temperature-induced disasters lead to major human and economic damage, but the relationship between their climatic drivers and impacts is difficult to quantify. Using a regression-based approach, researchers find that the regional economic impacts of heat-related disasters are most strongly linked to the daily maximum temperature (TXx) index. They also highlight the role of compound climatic hazards in worsening impacts, showing that in the agriculture sector, compound hot-and-dry conditions amplify the impacts of heat-related disasters on growth rates by a factor of two. [Read more.](#)

Nature Geoscience

[Reversal of the impact chain for actionable climate information](#)

Peter Pfleiderer et. al. including [Benjamin M. Sanderson](#) and [Jana Sillmann](#) from CICERO

Escalating impacts of climate change underscore the risks posed by crossing potentially irreversible Earth and socioecological system thresholds and adaptation limits. However, limitations in the provision of actionable climate information may hinder an anticipatory response. Here

the researchers suggest a reversal of the traditional impact chain methodology as an end-user focused approach linking specific climate risk thresholds, including at the local level, to emissions pathways. [Read more. Read our web article related to this paper.](#)

Nature Communications

[Using human observations with instrument-based metrics to understand changing rainfall patterns](#)

V. Savo, K.E. Kohfeld, [Jana Sillmann](#) et al.

Shifting precipitation regimes are a well-documented and pervasive consequence of climate change. Subsistence-oriented communities worldwide can identify changes in rainfall patterns that most affect their lives. Here the researchers scrutinize the importance of human-based rainfall observations as climate metrics and the relevance of instrument-based precipitation indices to subsistence activities. [Read more.](#)

Environmental Science & Technology

[Combining Fleetwide AviTeam Aviation Emission Modeling with LCA Perspectives for an Alternative Fuel Impact Assessment](#)

Jan Klenner, [Marianne T. Lund](#), Helene Muri and Anders H. Strømman

The use of alternative fuels could be one way for the aviation sector to reduce its emissions. This study of fuel use in domestic flights in Norway shows some mitigation potential for alternative fuels, but warns that these alternatives are neither emission-free nor climate-neutral. [Read the paper. Read our web article.](#)



Communications Earth & Environment

[No constraint on long-term tropical land carbon-climate feedback uncertainties from interannual variability](#)

Laibao Liu, [Rosie A. Fisher](#), Hervé Douville et. al.

Unraveling drivers of the interannual variability of tropical land carbon cycle is critical for understanding land carbon-climate feedbacks. The results of this study highlight the limited implication of interannual variability for long-term tropical land carbon-climate feedbacks and help isolate remaining uncertainties with respect to water limitations on tropical land carbon sink in Earth system models. [Read more.](#)

Geoscientific Model Development

[Dynamic ecosystem assembly and escaping the “fire trap” in the tropics: insights from FATES_15.0.0](#)

Jacquelyn K. Shuman, [Rosie A. Fisher](#), Charles Koven et. al.

Fire is a fundamental part of the Earth system, with impacts on vegetation structure, biomass, and community composition, the latter mediated in part via key fire-tolerance traits, such as bark thickness. Due to anthropogenic climate change and land use pressure, fire regimes are changing across the world, and fire risk has already increased across much of the tropics. The ability of FATES to capture the connection between fire disturbance and plant fire-tolerance strategies in determining biogeography provides a useful tool for assessing the vulnerability and

resilience of these critical carbon storage areas under changing conditions across the tropics. [Read more.](#)

Earth Systems Science Data

[Comparison of observation- and inventory-based methane emissions for eight large global emitters](#)

Ana Maria Roxana Petrescu, [Glen Peters](#) , Richard Engelen et. al.
including [Robbie Andrew](#) from CICERO

Monitoring the spatial distribution and trends in surface greenhouse gas (GHG) fluxes, as well as flux attribution to natural and anthropogenic processes, is essential to track progress under the Paris Agreement and to inform its global stocktake. This study updates earlier syntheses, provides a consolidated synthesis of CH₄ emissions using bottom-up and top-down approaches for the European Union (EU), and is expanded to include seven additional countries with large anthropogenic and/or natural emissions. [Read more.](#)

Cleaner Environmental Systems

[A comprehensive analysis of process-related CO₂ emissions from Iran's cement industry](#)

Bahman Massoumi Nejad, Sara Enferadi and [Robbie Andrew](#)

Direct emissions from the cement industry account for 7%–8% of global anthropogenic CO₂ emissions. Iran ranks among the world's top ten cement producers and is the seventh-largest CO₂ emitter globally. Despite its significant contribution to global emissions, Iran's process-related CO₂

emissions remain underreported in international datasets. This study addresses this gap by analyzing CO₂ emissions from carbonate decomposition in 77 Iranian cement plants from 2013 to 2023, highlighting regional and plant-specific emission factors. [Read more.](#)

Earth System Dynamics

[Exploration of diverse solutions for the calibration of imperfect climate models](#)

Saloua Peatier, [Benjamin M. Sanderson](#) and Laurent Terray

In this study, the researchers lay out a formalism for making different assumptions about how ensemble variability in a perturbed physics ensemble relates to model error, proposing an empirical but practical solution for finding diverse near-optimal solutions. [Read more.](#)

Atmospheric Chemistry and Physics

[Surface temperature effects of recent reductions in shipping SO₂ emissions are within internal variability](#)

Duncan Watson-Parris, Laura J. Wilcox, [Camilla W. Stjern](#) et. al. including [Carley E. Iles](#), [Marianne T. Lund](#) and [Bjørn H. Samset](#) from CICERO

In 2020, the International Maritime Organization (IMO) implemented strict new regulations on the emissions of sulfate aerosol from the world's shipping fleet. This can be expected to lead to a reduction in aerosol-driven cooling, unmasking a portion of greenhouse gas warming. The magnitude of the effect is uncertain, however, due to the large remaining uncertainties

in the climate response to aerosols. This paper shows that, while there is a clear physical response of the climate system to the IMO regulations, including a surface temperature increase, we do not find global mean temperature influence that is significantly different from zero. [Read more.](#)

Atmospheric Chemistry and Physics

[Evaluation of biases in mid-to-high-latitude surface snowfall and cloud phase in ERA5 and CMIP6 using satellite observations](#)

Franziska Hellmuth, Tim Carlsen, [Anne Sophie Daloz](#) et. al.

Evaluating state-of-the-art climate models with respect to their ability to simulate the frequency of occurrence of supercooled liquid-containing clouds (sLCCs) and the frequency with which they produce snow is critically important. Here, researchers compare these quantities as derived from satellite observations, reanalysis datasets, and Earth system models from Phase 6 of the Coupled Model Intercomparison Project (CMIP6) and find significant discrepancies between the datasets for mid- and high latitudes in both hemispheres. [Read more.](#)

Atmospheric Chemistry and Physics

[Climate variability can outweigh the influence of climate mean changes for extreme precipitation under global warming](#)

Kalle Nordling, Nora L. S. Fahrenbach and [Bjørn H. Samset](#)

As global warming progresses, weather conditions like daily temperature and precipitation are changing due to changes in their means and distributions of day-to-day variability. In this study, researchers show that

changes in variability have a stronger influence on the number of extreme precipitation days than the change in the mean state in many locations. [Read more.](#)

Atmospheric Chemistry and Physics

[Biomass burning emission analysis based on MODIS aerosol optical depth and AeroCom multi-model simulations: implications for model constraints and emission inventories](#)

Mariya Petrenko et. al. incl. CICERO researchers [Gunnar Myhre](#) and [Ragnhild B. Skeie](#)

Researchers assessed the biomass burning (BB) smoke aerosol optical depth (AOD) simulations of 11 global models that participated in the AeroCom phase III BB emission experiment. By comparing multi-model simulations and satellite observations in the vicinity of fires over 13 regions globally, they (1) assess model-simulated BB AOD performance as an indication of smoke source–strength, (2) identify regions where the common emission dataset used by the models might underestimate or overestimate smoke sources, and (3) assess model diversity and identify underlying causes as much as possible. [Read more.](#)



Nature Medicine

[Estimating future heat-related and cold-related mortality under climate change, demographic and adaptation scenarios in 854 European cities](#)

Pierre Masselot et. al. including [Kristin Aunan](#) from CICERO

Previous health impact assessments of temperature-related mortality in Europe indicated that the mortality burden attributable to cold is much larger than for heat. In this study, researchers estimated how climate change could affect future heat-related and cold-related mortality in 854 European urban areas, under several climate, demographic and adaptation scenarios. They showed that, with no adaptation to heat, the increase in heat-related deaths consistently exceeds any decrease in cold-related deaths across all considered scenarios in Europe. [Read more.](#)

Science Advances

[Continued permafrost ecosystem carbon loss under net-zero and negative emissions](#)

So-Won Park et. al. including [Norman J. Steinert](#) from CICERO

The loss of ecosystem carbon (the sum of vegetation, litter, and soil carbon) may occur in a permafrost region under mitigation pathways, which could reduce the efficiency of carbon dioxide removal. Here, the researchers investigate changes in permafrost under net-zero and negative emissions, based on idealized emission-driven simulations using a state-of-the-art Earth system model. [Read more.](#)

Nature Communications

[Impacts of irrigation expansion on moist-heat stress based on IRRMIP results](#)

Yi Yao et. al. including [Kjetil Schanke Aas](#) from CICERO

Irrigation rapidly expanded during the 20th century, affecting climate via water, energy, and biogeochemical changes. Previous assessments of these effects predominantly relied on a single Earth System Model, and therefore suffered from structural model uncertainties. Here we quantify the impacts of historical irrigation expansion on climate by analysing simulation results from six Earth system models participating in the Irrigation Model Intercomparison Project (IRRMIP). [Read more.](#)

Nature Energy

[Reducing the cost of capital to finance the energy transition in developing countries](#)

M Calcaterra et. al. including CICERO researcher [Shivika Mittal](#)

In this study, the researchers incorporated the empirically estimated cost of capital differentiated by country and technology into an ensemble of five climate–energy–economy models. The study highlights the importance of fair finance for energy availability, affordability and sustainability, as well as the need to include financial considerations in model-based assessments. [Read more.](#)

Nature Communications

[Atmospheric health burden across the century and the accelerating impact of temperature compared to pollution](#)

Andrea Pozzer et. al. including CICERO researcher [Sourangsu Chowdhury](#)

This study assesses future changes in mortality attributable to long-term exposure to both non-optimal temperature and air pollution simultaneously. The researchers show that under a realistic scenario, end-of-century mortality could quadruple from present-day values to around 30 million people/year. [Read more.](#)

The Lancet Regional Health Europe

[Heat and cause-specific cardiopulmonary mortality in Germany: a case-crossover study using small-area assessment](#)

Siqi Zhang et. al. including [Kristin Aunan](#) from CICERO

High temperatures have been associated with increased mortality, with evidence reported predominately in large cities and for total cardiovascular or respiratory deaths. This case-crossover study examined heat-related cause-specific cardiopulmonary mortality and vulnerability factors using small-area data from Germany. [Read more.](#)

National Science Review

[From global to national GHG budgets: the REgional Carbon Cycle Assessment and Processes-3 \(RECCAP3\)](#)

Josep G. Canadell et. al. including [Robbie Andrew](#), [Glen Peters](#) from CICERO

As human-induced climate change intensifies, there is a growing demand for more comprehensive greenhouse gas (GHG) intelligence to support the development and implementation of mitigation policies. The Global Carbon

Project (GCP) is developing and seeking involvement in the Regional Carbon Cycle Assessment and Processes-3 (RECCAP3) to support the development of comprehensive national-scale GHG budgets, including natural and anthropogenic sources and sinks of the three most important GHGs: carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). [Read more.](#)

Earth Systems Science Data

[Global Carbon Budget 2024](#)

Pierre Friedlingstein et. al. including CICERO researchers [Robbie Andrew](#), [Glen Peters](#) and [Jan Ivar Korsbakken](#)

Accurate assessment of anthropogenic carbon dioxide (CO₂) emissions and their redistribution among the atmosphere, ocean, and terrestrial biosphere in a changing climate is critical to better understand the global carbon cycle, support the development of climate policies, and project future climate change. Here we describe and synthesize datasets and methodologies to quantify the five major components of the global carbon budget and their uncertainties. [Read more.](#)

[Sign up to receive the next newsletter](#)

Other material



Report

[Policy Options for Reducing Consumption-Based Emissions](#)

Eskil Engström, Markus Larsson, Karin Bradley and [Merethe Dotterud Leiren](#)

Consumption-based greenhouse gas emissions (GHGs) and other air pollutants must decrease substantially across the Nordics. This report published by the Nordic Council of Ministers gathers around 100 possible policy options to this end. The researchers also asked a panel of Nordic experts to rank and analyze 21 policy options, identifying particularly promising policies. [Read more.](#)

Report

[Adapting homes to a changing](#)

[climate: Assessing the sustainability of measures to prevent damage from extreme precipitation](#)

[Sofie Waage Skjeflo](#), [Emil Dæhlin](#) and [Nina Bruvik Westberg](#) from CICERO and Rasmus Andersson, Greta Gustafsson, Sevda Jusufavska, Nelli Melolinna, Johan Holmqvist and Hugo Settergren from IVL

In this report, CICERO and IVL assess the sustainability of measures for protecting homes in Nordic urban areas from extreme precipitation. Extreme rain and flooding drive a growing share of insurance payouts, making these measures increasingly relevant. [Read more.](#)

CICERO Report

[The Burning Issues of Punjab: Exploring the Different Futures on Offer when Managing Residue in Punjab's Rice-Wheat Cropping System](#)

Anders Delebekk

The annual rotation from rice to wheat across Punjab leaves millions of tons of straw residue. The preferred method for handling residue has been incineration. This contributes to the winter smog that covers the mega-city of New Delhi. In 2019, the Supreme Court deemed stubble burning illegal. This brought forth alternative means to handle residue. This thesis is based on fieldwork conducted in Punjab and uses a Science and Technology Studies (STS) lens to explore how the ways of handling residue affect the local and global environment and how more-than-human actors are excluded or included, depending on how performing actors frame and understand the problems and solutions. [Read more.](#)

[CICERO Center for international climate research](#)

Gaustadalléen 21, 0349 OSLO

[Would you rather not hear from us?](#)

