Methane Action for People & Planet Conference

Poster Abstract Book

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Quantifying location-specific methane removal efficiency and health impacts of H_2O_2 and Cl_2 injections

Presenter: Amir Hakami (Carleton University)

Co-authors: Burak Oztaner, Shunliu Zhao, Scott Bell

Abstract

We employ the hemispheric version of the U.S. EPA's Community Multiscale Air Quality (CMAQ) model and its adjoint model (CMAQ-ADJ, v5.0) to examine the methane removal efficiencies of H_2O_2 and Cl_2 dispersal and the associated health impacts. We conduct year-long CMAQ simulations for the Northern hemisphere to initialize the CMAQ-ADJ model for summer and winter methane loss and health impacts in 2016. Adjoint cost functions are defined for hemispheric methane chemical loss and for premature mortality associated with O_3 and $PM_{2.5}$ exposure. The adjoint model provides location-specific impacts from oxidant injection on methane removal and mortality across the northern hemisphere.

Our results indicate that removal efficiencies range from -18 to 735 kg CH_4 per ton H_2O_2 and from -57 to 1,280 kg CH_4 per ton Cl_2. Efficiencies increase with altitude, particularly for H_2O_2. Health impacts associated with H_2O_2 and Cl_2 injections range from -0.75 to 15 deaths per kiloton H_2O_2 and up to 920 deaths per kiloton Cl_2, with the largest burden near the surface. Monetizing health benefits and applying CO_2 equivalency ratios results in benefits ranging from -500 to 6,000 USD per ton H_2O_2 and -4,000 to 9,000 USD per ton Cl_2, indicating net positive outcomes concentrated at higher altitudes. Techno-economic viability is likely to hinge upon the choice of CO_2 equivalency metric for methane. We find that techno-economic viability is likely to hinge upon the choice of CO_2 equivalency metric for methane as well as other assumptions.

Towards High-Resolution Methane Waste Detection in African Oil & Gas Fields Using Open Satellite Data

Presenter: Assala Benmalek (Africa Space Works)

Co-authors: Edward Boamah

Abstract

Methane (CH_4) is a potent greenhouse gas with a global warming potential more than 25 times that of carbon dioxide (CO_2) over a 100-year period. Despite Africa hosting major oil and gas production regions, methane emissions remain poorly characterized due to limited in situ measurements and the lack of region-specific labeled satellite datasets. This work presents a systematic data collection protocol for building a methane plume dataset over African oil and gas regions using open-access Sentinel-2 and Landsat multispectral imagery. The protocol focuses on the identification of candidate super-emitter sites, spatiotemporal filtering of cloud-free acquisitions, and standardized preprocessing of short-wave infrared (SWIR) bands sensitive to methane absorption. Two primarily representative regions are targeted: Hassi Messaoud (onshore Algeria) and the Niger Delta (offshore Nigeria). The collected imagery is intended to support manual plume annotation, downstream machine learning model training, and integration with methane quantification methods. This protocol aims to address current data gaps and enable scalable methane monitoring in data-scarce regions and supports the call for expanded methane monitoring in the Global South using open-access satellite data.

Unearthing Rhizosphere Controls on Methane Emissions from Northern Peatlands

Presenter: Avni Malhotra (University of Zurich)

Abstract

Northern peatlands are anoxic, carbon-rich ecosystems that contribute significantly to global CH_4 emissions. As in other wetland types, fine-scale process heterogeneity in northern peatlands propagates into broad-scale uncertainty in regional and global CH_4 estimates. Plant traits are often used as predictors of fine-scale spatial heterogeneity in peatland CH_4, but the role of root traits and rhizosphere processes remains elusive. I will present: (1) a conceptual framework of rhizosphere controls on wetland CH_4, (2) empirical rhizosphere predictors of CH_4 across different peatland types, and (3) ongoing and future efforts to incorporate these controls into process models.

Microbial driver of 2006–2023 CH_4 growth indicated by trends in atmospheric δD–CH_4 and δ13C–CH_4

Presenter: Ben Riddell-Young (Cooperative Institute for Research in Environmental Science (CIRES); NOAA Global Monitoring Laboratory)

Co-authors: Sylvia Englund Michel, Xin Lan, Pieter Tans, Thomas Röckmann, Bibhasvata Dasgupta, Youmi Oh, Lori MP Bruhwiler, Ryo Fujita, Taku Umezawa, Shinji Morimoto, John B Miller

Abstract

Methane (CH_4) is the second most important greenhouse gas and has been rising following a brief period of stabilization from 1999 to 2006. Determining the cause of this rise is critical for reducing emissions and predicting future climate sensitivity. The carbon and hydrogen stable isotopic composition of atmospheric CH_4 is controlled by variability in isotopically distinguishable emission categories and fractionating sink processes. While most studies using atmospheric δ13C–CH_4 data suggest a dominantly microbial source for recent CH_4 growth, this understanding is not uniform, and uncertainties remain. Here, we present a harmonized global measurement record of atmospheric δD–CH_4 and estimate emissions from 1999 to 2022 with global isotope mass balance calculations using both carbon and hydrogen isotopic ratios. We conduct thorough uncertainty analyses to separate absolute magnitude and emission trend uncertainties and find with high confidence that trends in δ13C–CH_4 and δD–CH_4 observations are both consistent with an entirely microbial emission driver of the post-2006 CH_4 rise, while fossil fuel emissions have remained relatively stable.

Warming-induced ecosystem CH_4 and CO_2 emissions reduce time substantially towards the Paris targets: Policy-relevant data are needed for better quantification, stronger ambitions, and potential mitigation

Presenter: Brian Buma (Environmental Defense Fund)

Co-authors: Peter C. Frumhoff, Brendan M. Rogers, Stephane Sartzetakis, Carly A. Phillips, Christina Schädel, Rachael Treharne, Susan M. Natali, Alice Alpert, Matti Goldberg, John P. Holdren, Josep G. Canadell, Kate Dooley, Werner A. Kurz, Carlos Nobre, Emily Ury, Steven P. Hamburg

Abstract

Warming induced emissions, or bioclimatic feedbacks, are indirectly human-caused emissions that are emerging as a significant force in climate change through increased CH_4 and CO_2 fluxes. However, they are neither well quantified nor incorporated into climate models, international policy frameworks, or mitigation planning. This discrepancy threatens climate ambitions. Under two scenarios (SSP 1-1.9, roughly aligned with Paris Agreement goals and SSP 2-4.5, roughly current trajectory), thawing permafrost, increasing circumboreal fires, and warming tropical wetlands increase CH_4 by ~17 to ~50 Tg C yr−1 and CO_2 emissions by ~15 to ~300 Tg C yr−1 above 2015 levels by 2050, reducing the time to the Paris thresholds by ~21%–25%. Ensuring that we collect the right data to drive action, including increased direct emission mitigation to lower the feedback and deliberate management of warming induced emissions where appropriate, requires strategic science, careful needs assessment, and utilizing existing policy and quantification frameworks.

Warming-induced greenhouse gas emissions could substantially amplify global warming

Presenter: Danielle Potocek (Spark Climate Solutions)

Co-authors: Sam Abernethy, Christina Schädel, Brian Buma, Ilissa Ocko, Philip Duffy, Benjamin Poulter

Abstract

Warming-induced emissions (WIE) of greenhouse gases from natural sources, including permafrost, wetlands, freshwaters, and wildfires, are major climate feedbacks inadequately captured in most climate models. We synthesize emission feedback data from recent literature to derive linear relationships between temperature and WIE across three emissions scenarios (SSP1-2.6, SSP2-4.5, and SSP4-6.0). Warming-induced methane (CH_4) emissions from wetlands, permafrost, freshwaters, and wildfire increase linearly with temperature at 99 ± 6 Tg CH_4 yr-1 °C-1 across all scenarios. Warming-induced carbon dioxide (CO_2) emissions from permafrost and wildfire increase linearly at 9 ± 1 Pg CO_2 yr-1 °C-1 in SSP2-4.5 and SSP4-6.0. Using the reduced-complexity climate model MAGICC, we project that these WIE feedbacks will add 0.20–0.47°C (± ~0.2°C) of warming by 2100, amplifying global warming by 24–36% across scenarios (± 12–31% due to feedback uncertainty). Until Earth system models incorporate these feedbacks, climate projections will underestimate warming, and the interactions between feedback sources will remain difficult to constrain.

Modelling Methane-Hydrogen interactions in the atmosphere

Presenter: David Stevenson (The University of Edinburgh)

Co-authors: Hannah Bryant

Abstract

We present results from new simulations of a version of the global UKCA model, which uses methane and hydrogen emissions. A base simulation is compared to a perturbation simulation with a pulse of extra hydrogen emissions. The pulse perturbs hydroxyl radical concentrations and a cascade of effects through atmospheric chemistry, perturbing most species, including methane and ozone. We quantify these interactions and hence the components of the methane and ozone climate forcings related to hydrogen emissions.

Measurement of Methane Emissions from Household Gas Stoves

Presenter: Donglai Xie (Environmental Defense Fund)

Co-authors: Xiangang Xu, Xinyue Zhong, Jiankai Dong

Abstract

A total of 62 residential gas stoves were sampled for this study between January and October 2024. Methane emissions were quantified using the flux chamber method. The experimental setup involved isolating a kitchen with a sealed plastic partition and employing a fan to ensure air mixing. Methane concentrations in the kitchen were recorded using a methane–ethane analyzer. Each stove was tested at three heat settings: high, medium, and low. Emissions were categorized into five stages: steady-off (not in operation), pulse-on (ignition), steady-on (in operation), pulse-PS (power switch), and pulse-off (extinction).

The results indicate an average emission factor of 0.20 kg of methane per stove per year (95% confidence interval: 0.18–0.22), with 63% of emissions arising from incomplete combustion during stove operation. Emission rates measured at high power were positively correlated with both stove age and historical usage frequency. Nationally, household stoves are projected to emit 66 Gg of methane annually by 2025 (95% CI: 59–74).

The opening of the stove inlet valve (SIV) is the primary source of methane emissions when stoves are turned off. Closing the SIV during inactive periods could reduce emissions by one-third, potentially avoiding up to 0.13 Tg of methane (95% CI: 0.09–0.18) between 2026 and 2030. These findings refine the emission profile of household stoves and highlight practical strategies for mitigating methane emissions.

Trends and seasonality of 2019–2023 global methane emissions inferred from TROPOMI satellite observations

Presenter: Drew Pendergrass (Duke University)

Abstract

We use 2019–2023 TROPOMI satellite observations of atmospheric methane to quantify global methane emissions at monthly 2° × 2.5° resolution with a localized ensemble transform Kalman filter (LETKF) inversion, deriving monthly posterior estimates of emissions and year-to-year evolution. Our best posterior estimate of global emissions shows a surge from 560 Tg a−1 in 2019 to 587–592 Tg a−1 in 2020–2021 before declining to 572–570 Tg a−1 in 2022–2023. Posterior emissions reproduce the observed 2019–2023 trends in methane concentrations at NOAA surface sites and from TROPOMI with minimal regional bias. Consistent with previous studies, we attribute the 2020–2021 methane surge to a 14 Tg a−1 increase in emissions from sub-Saharan Africa but find that previous attribution of this surge to anthropogenic sources (livestock) reflects errors in the assumed wetland spatial distribution. Correlation with GRACE-FO inundation data suggests that wetlands in South Sudan played a major role in the 2020–2021 surge but are poorly represented in wetland models. We find that the global seasonality of methane emissions is driven by northern tropical wetlands and peaks in September, later than the July wetland model peak and consistent with GRACE-FO. We present preliminary work jointly constraining methane emissions and the OH sink via joint assimilation CH_4 and CO observations, as well as preliminary work on reactive nitrogen emissions and the information such data may offer for agricultural CH_4.

Atmospheric methane research in Italy, 250 years later: introducing stable carbon measurements in a cross-country network

Presenter: Francesco D'Amico (National Research Council of Italy - Institute of Atmospheric Sciences and Climate)

Co-authors: Ivano Ammoscato, Alcide G. di Sarra, Tatiana Di Iorio, Salvatore Piacentino, Damiano M. Sferlazzo, Paolo Cristofanelli, Simonetta Montaguti, Isabella Zaccardo, Antonella Buono, Lucia Mona, Giulia Zazzeri, David Lowry, Rebecca E. Fisher, Thomas Röckmann, Carina van der Veen and Claudia R. Calidonna

Abstract

250 years after the discovery of methane, the study of CH_4 in Italy is aiming for advanced techniques. Thanks to project ITINERIS, four atmospheric observatories have recently introduced stable carbon isotope measurements of δ13C-CH_4, performed via Picarro G2201-i CRDS analyzers. The Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) operates the Lampedusa (LMP) site on a small island south of the Strait of Sicily, while the National Research Council of Italy – Institute of Atmospheric Sciences and Climate (CNR-ISAC) operates the observation sites of Lamezia Terme (LMT), in a coastal area of the Calabria region, and Mt. Cimone (CMN), which is a mountain site (2150 m asl) in Emilia-Romagna. Finally, the National Research Council of Italy – Institute of Methodologies for Environmental Analysis (CNR-IMAA) operates the new tall tower atmospheric station, POT, nearby Potenza (Apennines, 760 m asl) in Basilicata.
The national network is now working closely with foreign institutions in order to optimize measurements and introduce efficient calibration procedures. Instrumental intercomparisons, training sessions, and ongoing collaborations are among the key factors contributing to the development of a well-organized network. Full calibration procedures on a network-wide scale will be fully introduced in 2026, thus allowing the network to fill a gap in the Mediterranean. Once fully implemented, the calibration chain will enable the network to produce high-quality, comparable δ13C-CH_4 data, improving regional source apportionment and reducing uncertainties in CH_4 budgets. This enhanced observational capacity will support more informed mitigation strategies in a highly climate-sensitive region.

Mobilising Sustainable Finance for Methane Abatement

Presenter: Gabriela Constantin (Climate Bonds Initiative)

Abstract

The Fastest Path to Slowing Global Warming:

- Methane abatement offers one of the fastest opportunities for climate action and a major opportunity for investment.
- Reducing methane emissions requires credible investment frameworks that enable capital to flow to ambitious mitigation projects.

Why focus on Methane Abatement?

- Methane (CH_4) is responsible for around 30% of global warming since pre-industrial times, and emissions are still rising.
- Because methane is short-lived in the atmosphere, rapid and substantial reductions can deliver meaningful near-term climate benefits. Cutting methane emissions also brings wider co-benefits, including improved public health and increased agricultural productivity through reduced air pollution.
- Key sectors for abatement include fossil fuel energy (37% of human-caused methane emissions), agriculture (42%), and waste (21%).
- Yet, these opportunities remain significantly underfunded. Mobilising finance to support methane mitigation in these sectors can deliver immediate, measurable climate impact. It aims to boost stakeholder engagement and finance flows, while highlighting gaps, policy levers, and opportunities to scale action.

Climate Bonds develops sustainable finance tools, guidance, and frameworks that integrate methane abatement into sustainable finance markets. Find all our tools and guidance at https://www.climatebonds.net/expertise/mobilising-sustainable-finance-methane-abatement.

Ice sheets and glaciers as missing components of the methane budget

Presenter: Guillaume Lamarche-Gagnon (iC3 - Centre for ice, Cryosphere, Carbon and Climate, Dept. of Geosciences, UiT The Arctic University of Norway)

Co-authors: Gabrielle Emma Kleber, Philip Pikka, Emeric Babut du Marès

Abstract

Mounting evidence indicates that glaciers and ice sheets can no longer be excluded from today's global methane budget. Ice caps overlay hidden wetlands, where ancient organic matter is continuously being converted to methane, and can also sit on geological deposits rich in natural gas. This subglacial methane does not only accumulate beneath the ice but can be expelled to the atmosphere by glacial meltwaters, or escape through geological fractures and cracks created by glacial motion. This is now supported from observations from across the Arctic and sub-Arctic regions. Moreover, present-day ice sheets are also thought to overlay large reserves of methane hydrates, with evidence from the paleo record of abrupt hydrate destabilisation during periods of rapid deglaciation. Taken together, it is clear that glaciers likely imprint on a range of natural methane pools today (e.g. inland waters, permafrost, seeps, etc.), and that large reserves of glacial methane could be highly vulnerable to future warming. However, the contribution of glacial methane to global budgets remains very difficult to quantify. Logistical challenges in direct measurements preclude traditional bottom-up upscaling, and top-down assessments are currently non-existent. Here, we summarise the current state of knowledge on glacial methane pools, sources and sinks, and stress that there is a clear gap in monitoring efforts when it comes to glacial environments. Given the extreme sensitivity of glacial systems to ongoing and future warming, the call for enhanced and concerted actions through both top-down and bottom-up approaches is urgent.

Assessing the climate footprint of LNG as a marine fuel: evidence from a high-resolution AIS-based emission model for Spain

Presenter: Ivan Lombardich (Barcelona Supercomputing Center)

Co-authors: Paula Castesana, Oliver Legarreta, Carles Tena Medina, Carmen Piñero-Megías, Artur Viñas Ferran, Johanna Gehlen, Luca Rizza, Carlos Pérez García-Pando, and Marc Guevara Vilardell

Abstract

LNG adoption in shipping is often presented as a route to lower air-pollutant emissions and meet tighter sulphur limits under IMO 2020 and EU in-port requirements. The climate side is trickier: LNG-related methane (CH_4) emissions depend heavily on CH_4 slip. This matters even more under the new FuelEU Maritime policies that apply well-to-wake GHG-intensity targets. Also, from January 2026, CH_4 emissions from maritime transport also fall under the EU Emissions Trading System.

We present results on shipping CH_4 emissions over Spain derived from a near-real-time, high-resolution Automatic Identification System (AIS)-based emission model developed within the RESPIRE-CLIMATE national project, which received formal endorsement from the WMO-IG3IS initiative. Using 2019–2025 AIS trajectories, we quantify CH_4 slip from LNG-fuelled ships using engine-type- and load-dependent emission factors. The system is fully operational and generates daily outputs per ship type on a 0.01°×0.01° grid.

Across Spanish waters, we detect a marked increase in LNG-related activity after 2022, consistent with Europe's rapid shift in gas supply chains following the war in Ukraine. Spain is indeed a major LNG gateway in Europe, with roughly one-third of Europe's regasification capacity.

A Barcelona case study shows how this trend intersects with intensified LNG operations. Results highlight where and when CH_4 slips concentrate near ports and in traffic lanes and which ship types are driving emission peaks. They also show how, for major cruise and cargo ships, CH_4 slip can substantially change the CO_2-equivalent balance of LNG-fuelled ships under certain operating profiles.

Worldwide inference of national methane emissions by inversion of satellite observations with UNFCCC prior estimates

Presenter: James D. East (Harvard University; UNEP International Methane Emissions Observatory (IMEO))

Co-authors: Daniel J. Jacob, Dylan Jervis, Nicholas Balasus, Lucas A. Estrada, Sarah E. Hancock, Melissa P. Sulprizio, John Thomas, Xiaolin Wang, Zichong Chen, Daniel J. Varon, John Worden

Abstract

Meeting climate policy goals to reduce methane emissions under the Paris Agreement and the Global Methane Pledge requires nations to set targets and quantify reductions. Individual countries report emissions by sector to the United Nations Framework Convention on Climate Change (UNFCCC) but there are large uncertainties. Here we optimize 2023 national emissions at up to 25 km grid resolution for 161 countries with a globally consistent open-source framework for inverse analysis of Tropospheric Monitoring Instrument (TROPOMI) satellite observations, using UNFCCC reports for prior estimates together with point source information from GHGSat and other satellites. We find global anthropogenic emissions to be 15% higher than UNFCCC reporting (32% for oil-gas), with national emissions more than 50% higher than reporting for a quarter of the countries. Oil-gas emission intensities vary by two orders of magnitude between countries. Sub-Saharan Africa has the highest livestock emission intensity of any region. Hydroelectric reservoirs, generally not included in UNFCCC reporting, contribute 6% of anthropogenic emissions globally. The framework allows updates for subsequent years, enabling monitoring of emission trends and support for improved reporting.

Results from the AVENGERS intercomparison of regional European CH_4 inversions

Presenter: Marko Scholze (Lund University, Lund, Sweden)

Co-authors: D. Brunner, I. Cheliotis, S. Houweling, V. T. Manaparambil, R. Petrescu, J. Thanwerdas, Y. Villalobos

Abstract

The reporting of national greenhouse gas emission inventories is a crucial element in the Paris Agreement. However, the reported emissions carry substantial uncertainties and are lacking independent verification using the atmospheric records. The AVENGERS project brings together European experts to establish top-down techniques in support of the verification of national greenhouse gas (GHG) inventories. AVENGERS makes use of atmospheric inverse modelling and data assimilation, remote sensing, environmental monitoring and observation, terrestrial ecosystem modelling, policy and stakeholder interaction together with national inventory compilers in order to improve consistency of the inventory-based GHG emission reports with top-down approaches. We performed regional atmospheric inversions over Europe with three different inversion systems (WRF-CTDAS, CIF-ICON-ART and LUMIA) over the period 2010 to 2021. Preliminary results show that atmospheric inversions infer larger CH_4 emissions over the Benelux area indicating a significant underestimation from the emissions inventory for Benelux. In contrary, emission over Italy a largely reduced compared to prior suggesting an overestimation of the geological sources in that region. Overall, we see a noteworthy decrease of the CH_4 fluxes of approx. 1 to 3 Tgr/year in the ensemble of the European Union countries from the year 2010 compared to 2021.

Exploring the Viability of Atmospheric Methane Removal

Presenter: Martin Wolf (Spark Climate Solutions)

Co-authors: Megan Melamed, Katrine A. Gorham, Sam Abernethy, Meg Thurlow

Abstract

Spark Climate Solutions is a science-driven, philanthropically funded nonprofit that accelerates progress on unsolved climate challenges. One such challenge is reducing climate risk of a high-methane future. While reducing methane emissions should be the top priority, emissions abatement alone may not be enough. Spark's methane removal program supports scientific research, drives engagement, fosters governance, and advances practical viability and decision making to accelerate assessment of the field. Our program supports a diverse portfolio of research pathways, including atmospheric oxidation enhancement, biological methane removal, engineered reactors, and catalytic surface treatments. To date, Spark has awarded $8 million to 27 projects across 25 institutions. Ultimately, these efforts aim to generate the rigorous evidence required to inform an effective and comprehensive climate solution portfolio.

Mobile and isotopic measurement for quantification and attribution of agricultural sources of methane

Presenter: Rebecca Fisher (Royal Holloway University of London)

Co-authors: Dave Lowry, James France, Mackenzie LeVernois, Ceres Woolley Maisch, Victoria Rafflin, Aliah Alshalan, Mathias Lanoisellé

Abstract

Inventories for 2024 indicate that agriculture (enteric fermentation, manure, and rice cultivation) accounts for approximately 46% of global anthropogenic methane emissions (EDGAR, 2026). This sector must therefore be targeted to achieve Net-Zero ambitions.

As new technologies and management practices are introduced to reduce methane emissions, in-field atmospheric measurements are required to quantify improvements. Methane emission measurements from cattle in field or barn environments are more representative than emission factors derived from artificial environments such as chambers.

Over the past decade, mobile measurement and modelling techniques for methane emission quantification have been developed for the oil and gas and waste sectors, leading to improved emissions estimates and more targeted mitigation strategies. However, applying these methods to agricultural sources, such as grazing cattle, is more challenging because emissions are spatially dispersed.

We are developing techniques to quantify emissions from grazing cattle using mobile measurements of methane concentrations along transects downwind of the herd, combined with meteorological measurements and drone imagery to determine cattle locations, followed by atmospheric dispersion modelling. Within a farm, isotopic signatures and CH_4/CO_2 ratios from different sources (e.g. cattle eructation, manure, slurry) can be used to characterise emissions, while mobile measurements enable spatial mapping of emission sources. These measurements are improving our understanding of the distribution and variability of methane emissions across farms.

Inefficient Consumption of Natural Gas Drives Methane Emissions from New York City

Presenter: Roisin Commane (Columbia University)

Co-authors: Raghav Dhall, Andrew Hallward-Driemeier, Luke Schiferl, Yuwei Zhao

Abstract

Reducing methane emissions offers a significant near-term opportunity for climate mitigation if the dominant sources are effectively targeted. Despite extensive natural gas pipeline upgrades in cities, methane reductions remain far smaller than expected, suggesting missing emission pathways. Using long-term tower observations in a U.S. megacity, we found a strong seasonal cycle in methane emissions peaking during the winter heating and summer cooling seasons. Natural gas methane emissions dominated both seasons and were strongly correlated with consumption, yielding a loss rate of 1.7±0.6%, equivalent to $300M USD/yr of unused natural gas. Landfill and wastewater methane emissions were underestimated, but the incomplete combustion was the primary natural gas signal observed, indicating future mitigation planning should prioritize inefficient natural gas consumption.

IMM4CA: Investigating Methane for Climate Action

Presenter: Sander Houweling (Vrije Universiteit Amsterdam)

Co-authors: The IM4CA team

Abstract

2026 started with the first anniversary of the Horizon Europe project IM4CA, aimed at enhancing the quantification and understanding of methane emissions and sinks. In IM4CA, 26 partners join forces to investigate pressing questions about the evolution atmospheric methane levels in recent decades, to reduce the uncertainty in future projections, and design efficient solutions for monitoring and mitigating emissions in and outside of Europe. The project builds new measurement and modelling infrastructure for improved monitoring of the progress toward short- and long-term emission reduction targets, with a prominent role for existing and upcoming satellite missions for measuring atmospheric composition and land surface processes.
The changing European methane emissions are an important focus of the project. IM4CA supports the quantification of emission trends with eastward extensions of the ICOS monitoring network in Poland and Romania. In June 2026 an intensive measurement campaign will be conducted in Romania combining surface, aircraft, and total column measurements to improve the accuracy of emission quantification techniques using satellite data. The world-wide applicability of satellite data processing techniques will extend the impact of our campaign in Romania far beyond European borders.

Besides changing anthropogenic emissions, climate impacts on natural sources and sinks of methane are an important focus of IM4CA also. The four-year research program is initiating new measurement infrastructure in Congo to help characterize emissions from tropical wetlands in Africa. Besides the Tropics, climate feedbacks on natural methane emissions in high latitudes are investigated also. Last summer, a first measurement campaign was organized in Northern Scandinavia to investigate the spatial covariance between vegetation parameters, soil moisture, and methane emissions using drones. The aim is to support the quantification of Arctic methane emissions using advanced measurements of vegetation cover from hyperspectral satellite missions. This poster will provide an overview of the activities and plans in IM4CA. The project offers a great opportunity to learn about methane in a cooperative spirit, reaching out and supporting those who can turn knowledge about methane into climate action.

Recycle Organics Program

Presenter: Santiago Uribe Cuentas (Center for Clean Air Policy)

Co-authors: CCAP, ImplementaSur

Abstract

In 2021, around 100 countries pledged to take actions to reduce global methane emissions by at least 30% by 2030, according to their 2020 levels. This commitment, known as the “Global Methane Pledge,” seeks to avoid a warming of more than 2 °C by 2050. With the aim of contributing to this goal, the Recycle Organics program was born. Funded by the Global Methane Hub (GMH), Environment and Climate Change Canada (ECCC) and the Climate and Clean Air Coalition (CCAC) and implemented by the Center for Clean Air Policy (CCAP), ImplementaSur and LEDS LAC, the program currently supports 21 countries around the globe (Latin America and the Caribbean, Africa and Asia region).

This program aims to accelerate the implementation of methane mitigation projects in the waste sector and create enabling conditions for a sustained expansion of organic waste management technologies that provide significant environmental, economic and social benefits. In addition, it seeks to create a community of practice, raise awareness about concrete actions that can reduce methane emissions, and build capacities in developing countries around the world.

Community of Practice on Methane Emissions Reduction from Organic Sources in Latin America and the Caribbean (CoP MetLAC)

Presenter: Santiago Uribe Cuentas (Center for Clean Air Policy - CCAP)

Co-authors: CCAP, implementaSur, LEDS LAC

Abstract

The Community of Practice on Methane Reduction from Organic Sources in Latin America and the Caribbean (CoP MetLAC) is a regional collaborative platform launched in October 2023 to accelerate methane mitigation through practical action and cooperation.
Led by the Center for Clean Air Policy (CCAP), ImplementaSur, and the LEDS LAC Regional Platform, with financial support from the Global Methane Hub (GMH), the CoP promotes the development of public policies, business models, and investment-ready projects targeting methane emissions from organic waste.

MetLAC addresses persistent regional barriers such as fragmented stakeholder engagement and limited technical and financial capacities by connecting governments, private sector actors, practitioners, and experts through peer learning, technical assistance, and strategic dialogue.

Operating bilingually in English and Spanish, the Community transforms knowledge exchange into implementation by supporting project design, policy development, and access to financing. Through capacity building, technical acceleration, and knowledge sharing, MetLAC functions as a regional catalyst that links collaboration with measurable methane mitigation outcomes across countries and sectors.

Sparking methanotrophy into action: 120 years of history and a formula for microbial methane mitigation from the Global South

Presenter: Simon Guerrero-Cruz (Asian Institute of Technology, Environmental Engineering and Management program)

Co-authors: Nannaphat & Niyomsri; Eleazar Jr. Quiero & Gatela,

Abstract

2026 marks the 250th anniversary of Methane's discovery, and the 120th anniversary of the discovery of a globally relevant process: biological methane oxidation, i.e., methanotrophy, first described in 1906.

Rice paddy fields as an important methane source, harbor methanotrophs and methanogens. Thailand dedicates 22% of its area to rice cultivation, an area as big as Iceland or Virginia in the US. My work takes place in Isaan region, having 13 out of the 16 poorest Thai provinces (GDPp.c. < 2,000 USD y-1). Millions of farmers grow rice without mitigation, capacity building, awareness, or implementation if sustainable soil practices. Continuous flooding (8 months y-1) is the dominant practice for 50-100 years of intensive cultivation, resulting in documented soil metal micronutrient depletion and a methanogenesis-dominated ecosystem.

In the projects MicroGRICE and MicroSPARK, we focus on the study and enhancement of methanotrophs currently outcompeted by methanogens. In soils from Surin province, we detected copper depletion and low range concentrations of cerium, both crucial methanotrophic cofactors (Cu, Ce). In addition, methanotrophic activity in-vitro shows to be outdone by methanogenic activity. With Cu and Ce additions, we documented a 2- and 3-fold increase of methane oxidation, respectively. Furthermore, in greenhouse experiments with plants, we observed methane reduction ranging from 50-75%, and in-vitro experiments showed 65%,50%, and 40% higher methane consumption with a mix of metals, Ce, and Cu respectively; compared to the control.

This evidence suggest that micronutrient amendments when deficient, and methanotrophic supplementation could aid in methane reduction in rice paddies in SE Asia. Although skepticism exist, farmers overload Synthetic fertilizers every season, a culture hard to change. Methane mitigation strategies can be included under such culture. The root of GHG Emissions equals the Methanotroph and Micronutrient Management for the Mitigation of Climate Change.

Droughts Dampen Methane Emissions: Implications for an Important Negative Feedback to Global Change

Presenter: Sparkle Malone (Yale School of the Environment and Yale Center for Natural Carbon Capture)

Co-authors: Youmi Oh; Licheng Liu; Gavin McNicol; Qing Zhu; Avni Malhotra; Shuo Chen; Kevin Rozmiarek; Kyle Arndt; Lori Bruhwiler; Fa Li; Danielle Potocek; Benjamin Riddell; Yiming Sun; Ammara Talib; Eric Ward; Qing Ying; Kunxiaoji Yuan; Jianqiu Zheng

Abstract

Extreme meteorological events are intensifying globally, yet their influence on natural methane (CH_4) fluxes remains poorly constrained. Methane dynamics are jointly regulated by temperature and moisture, which are tightly coupled through land–atmosphere energy and water balances. Because warming often coincides with drying, particularly during drought, the net effect on CH_4 emissions depends on shifts between anaerobic methanogenesis and aerobic oxidation. Here, we test the hypothesis that extreme drought dampens methane emissions by suppressing production and enhancing oxidation, thereby weakening temperature sensitivity under moisture limitation. Using eddy-covariance observations from 49 natural FLUXNET-CH_4 sites distributed globally, we quantified ecosystem-scale responses to hydroclimatic extremes defined by the Standardized Precipitation–Evapotranspiration Index (SPEI). Fluxes were normalized to site-specific "normal" conditions and evaluated across gradients of drought severity, duration, vegetation type, and climate. Sites spanned wetlands ($n = 27$), grasslands, forests, shrublands, and other ecosystems, with 24 sites experiencing drought ($SPEI < -1$) during measurement periods. A Random Forest analysis explained 90% of the variance in flux deviations, identifying drought duration, elevation, month, SPEI, air temperature, and vapor pressure deficit as key predictors. Across ecosystems, drought conditions were associated with significant reductions in CH_4 emissions relative to normal moisture regimes, indicating a widespread negative feedback to climate warming. We identify thresholds at which methane is dampened or enhanced and assess how current process-based models represent coupled temperature–moisture controls. These findings highlight the importance of explicitly incorporating hydroclimatic extremes into methane budget assessments and improving representation of drought-driven feedbacks in Earth system models.

Methane Inventories, Solutions, and Scenarios

Presenter: Steven Smith (Center for Global Sustainability, University of Maryland)

Co-authors: Steven Smith, Mengye Zhu, Ryna Yiyun Cui, Rachel Hoesly, Christoph Bertram

Abstract

This poster will present an overview of methane related research at the Center for Global Sustainability (CGS) at the University of Maryland. Methane emission analysis ranges from detailed inventory work for key countries to global methane emission, mitigation, and policy databases. We preview a new open-source methane emissions tool that allows the community to compare top down and bottom-up emission estimates by country and sector. Country-specific work (China, Indonesia, United States) includes emission estimates, mitigation potential, and policy frameworks. CGS hosts the Global Methane Abatement Solutions Tracker (G-MAST) is a publicly available database that compiles detailed information on mitigation measures from major anthropogenic methane-emitting sectors. Work on future scenarios includes contributions to global scenarios (including CMIP7) and work focused on the potential for fast track comprehensive mitigation, where near-term methane mitigation plays a key role, for limiting future climate change.

50 shades of methane

Presenter: Thomas Röckmann (Utrecht University)

Co-authors: Jacoline van Es, Carina van der Veen, Malika Menoud, Hugo Denier van der Gon, Stephan Henne, Francesco D'Amico, Paolo Christofanelli, Mihaly Molnar, Jia Chen, Huilin Chen, Jaroslaw Necki, Calin Baciu

Abstract

We will show how isotope measurements with high temporal resolution and precision can help characterise the mixture of regional methane sources in different regions of Europe.

Monitoring Methane (GHG) in Île-de-France using Sentinel 5P

Presenter: Venkata Sri Varshini (International Space University)

Abstract

Methane (CH_4) is a short-lived but extremely powerful greenhouse gas that has a 20-year global warming potential that is much higher compared to carbon dioxide. Urban and suburban regions are becoming recognized as major contributors to atmospheric methane emissions due to the coexistence of several anthropogenic sources, such as wastewater infrastructure, landfills, household heating systems, and natural gas distribution networks. However, measuring methane emissions at the city and regional levels remains to be challenging due to temporal fluctuation, geographical dispersion, and limitations in ground-based monitoring networks. The current study examines atmospheric methane concentrations over the Île-de-France region between January 2019 and December 2025 using cloud-based analysis in Google Earth Engine (GEE) and Sentinel-5P satellite imagery. Using small satellite observations, we investigate long-term temporal trends, urban-rural variations, seasonal variability, methane persistence patterns, and weather effects. The results indicate persistent methane enhancements over the Paris metropolitan area, increased concentrations during warm seasons, and a clear urban excess relative to neighboring rural areas. This demonstrates how small satellites can help monitor greenhouse gas emissions in urban areas and provide valuable data for emission reductions and climate policy.

Systems Change for Methane Mitigation: Case Studies and Crowdsourcing for Data to Action

Presenter: Will Atkinson (Rocky Mountain Institute (RMI))

Abstract

Methane awareness is rising fast, but so are emissions and their impact on our planet, health, and food system. It is crucial to learn from concrete examples of data to action – and to discuss how we can accelerate them to cut methane quickly. This interactive poster aims to spark conversation based on systems change research, project case studies, and input opportunities for conference participants.

First, we will share systems frameworks that have implications for methane action opportunities across businesses, policymakers, and civil society – based on current adoption phases of sectoral solutions. Second, we will highlight barriers to action based on recent surveys and focus groups, as well as case studies where transparency tools have overcome those barriers to enable progress in policy and market activation – from WasteMAP with Lagos and IDB, to OCI+ with the EU and Chubb. Finally, we will use the poster session conversations to compile other examples of barriers and case studies, to help identify positive tipping points for methane mitigation. Discussions could inform the event's Angera Declaration and other post-conference efforts to link science, policy, and innovation.

Distinct Efficacy of Regional Methane Emissions in Affecting Global Concentrations: A Modeling Study with Interactive Chemistry and Emission Tags

Presenter: Yangyang Xu (Texas A&M University)

Co-authors: Chuan Feng

Abstract

The newly developed emission-driven capability of CESM2 allows methane concentrations to be more realistically simulated based on emissions, transport, and atmospheric chemistry, rather than being prescribed as lower boundary conditions as in most previous global Earth system modeling studies. This new capability enables flexibility in investigating the role of spatially resolved methane sources and sinks. In this study, we conduct a suite of emission-driven simulations for 2014–2019, with the full coupling of methane and other short-lived species and with a novel tagging scheme to track the regionally resolved emissions from three representative regions in the Northern Hemisphere (Asia, Europe, and North America). Our simulations show that methane emissions from different regions exhibit distinct efficacy in increasing global and regional methane concentrations. Specifically, methane emitted at higher latitudes (e.g., Europe) is more effective in increasing global methane levels because it tends to be transported over regions with a much longer local lifetime due to the latitudinally varying distribution of OH. Moreover, despite methane's decade-long lifetime, its concentrations close to the source regions respond much faster than the global mean, especially in the first few years after the emission changes. Our findings highlight the importance of accounting for distinctions in local chemical sinks and methane lifetimes when assessing the climate responses to methane emissions and mitigation measures.

Understanding global methane emissions during 2010-2022 using GOSAT methane and in-situ carbon isotopic composition

Presenter: Zhen Qu (North Carolina State University)

Co-authors: Daniel J. Jacob, Kevin Luo, Yuqin Song, Robert J. Parker, Anthony Bloom, John Worden

Abstract

Atmospheric methane concentrations rose rapidly over the past decade and surged in 2020-2022 but the causes have been unclear. We find from inverse analysis of GOSAT satellite observations that emissions from the wet tropics drove the 2010-2019 increase and the subsequent 2020-2022 surge, while emissions from northern mid-latitudes decreased. The 2020-2022 surge is principally contributed by emissions in Equatorial Asia (43%) and Africa (30%). Wetlands are the major drivers of the 2020-2022 emission increases in Africa and Equatorial Asia because of tropical inundation associated with La Niña conditions, consistent with trends in the GRACE terrestrial water storage data. In contrast, emissions from major anthropogenic emitters such as the US, Russia, and China are relatively flat over 2010-2022. Concentrations of tropospheric OH (the main methane sink) show no long-term trend over 2010-2022, but a decrease over 2020-2022 that contributed to the methane surge. We further include in-situ methane and its stable isotope δ13C-CH_4 measurements to constrain regional emissions from six sectors: (1) oil, gas, and coal; (2) waste management and termites; (3) livestock; (4) rice; (5) biomass burning; and (6) wetlands. Our state vector consists of annual mean non-wetland methane emissions for five sectors across 15 land-containing regions (75 elements) and monthly wetland methane emissions for 14 sub-continental regions (168 elements). Using constraints from GOSAT and in-situ measurements, we found different emission adjustments in high-latitude Northern Hemisphere regions, which can be explained by variations in measured variables and sampling coverage.