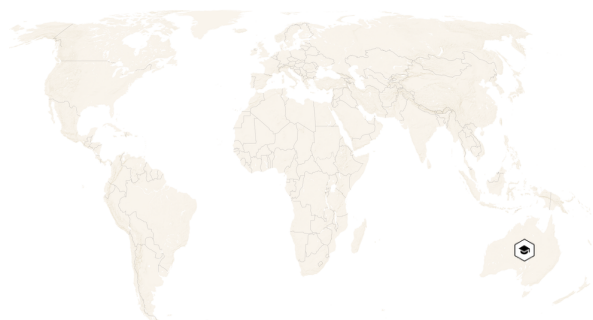


VALIDATION OF COAL MINE METHANE EMISSIONS WITH TOP-DOWN DATA IN AUSTRALIA'S BOWEN BASIN

Provides the first comprehensive methane emission data set enabling reconciliation between airborne and operator-reported emission estimates from coal mines in Australia's Bowen Basin



DONOR:
European Commission



**BENEFITTING COUNTRIES
OR REGIONS:**
Australia



SECTOR:
Coal



Subsector, if applicable:
—

STATUS:
Published

TIMELINE:
Measurements 2023



**IMEO SCIENCE
OBJECTIVE:**

→ **Advance reconciliation and data integration approaches for multi-scale emissions data.**



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KEY FINDINGS

In progress

RATIONALE

Australia is the world's fifth-largest producer and second-largest exporter of coal. Understanding the magnitude of its coal sector emissions is critical to assess climate impact and target mitigation opportunities. This study deployed two independent airborne methods to characterize methane emissions from underground and open-cut surface mines in the Bowen Basin, Queensland, Australia. Established, state-of-the-art airborne approaches were deployed to supply the high-quality empirical data needed to independently validate coal methane emission estimates from both satellites and inventories. Prior research using TROPOMI satellite flux estimates suggested that methane fluxes in the Bowen Basin are higher than inventories report. The study provided data to evaluate if current reporting methods are representative of measured emission rates.



RELATED PUBLICATIONS

Evaluation of coal mine methane inventory methods
(Harris et al., 2026)

Elevated methane emissions from an Australian open-cut coal mine (Borchardt et al., 2025)



SIGNIFICANCE FOR DECISIONMAKERS

For Policymakers

Inventories provide foundational information for designing mitigation policies and actions. Accurate inventories, backed by empirical data, are needed to define the magnitude of emissions by sector, track emission trends over time and verify success in meeting reduction targets. Comparing emission inventory data with state-of-the-art empirical measurement methods is an important validation approach. Australia uses a blend of IPCC Tier 2 and 3 bottom-up approaches to estimate and report its fugitive coal mine methane emissions. To date, Tier 3 reporting for underground coal mines, which largely relies on direct measurements of ventilated air, has not been systematically assessed against top-down atmospheric measurements. Tier 2 coal core-based emission factors and Tier 3 model guidelines for surface (open-cut) mine emissions also lack verification.

For Industry

This study introduces a unique data set reconciling precise, airborne methane emission estimates with reported inventory data. Accurate, reliable methane emission reporting is important for mine operators, coal buyers and importers who need to understand their emissions and develop strategies to reduce their climate impact. These insights are particularly relevant in the context of iron and steel industries, which use metallurgical coal extracted from Australia's open-cut mines.



STUDY APPROACH/ACTIVITIES

Using two aircraft, each deploying different in-situ and remote-sensing technologies, the team acquired and quantified individual emission rates from 17 coal mines over a 31-day campaign. In total, these yielded average emission rate estimates across multiple mine types: 10 open-cut, eight underground, two mine complex and four multi-facility groupings.

Some mines contribute more than one estimate where both aircraft were deployed. The team also collected discrete air samples during the flights. The isotopic composition of the methane in these samples are consistent with a coal mine methane source. The measurement-based emission estimates were then compared to reported emissions from inventory data.



CATALYZING ACTION

This study has shown the need for further evaluating both reporting methods and atmospheric quantification methodologies. In 2026, IMEO will implement a world-first controlled release study (SIMFLEX Coal Australia) designed for open-cut coal mines in Australia, bringing together academics, the Australian coal industry, and Australia's Department of Climate Change, Energy, the Environment and Water (DCCEEW). The study also informs the work of an expert panel established by DCCEEW in 2025 to review how top-down approaches could enhance Australia's methane emissions reporting.

OTHER SUPPORTERS/STAKEHOLDERS

Principal Investigator: **University of Bremen, supported by Airborne Research Australia**

The UN Environment Programme's International Methane Emissions Observatory (IMEO) exists to provide open, reliable, and actionable data to the individuals with the agency to reduce methane emissions. IMEO does this by integrating and reconciling data across sources, including its global methane science studies. IMEO supports measurement and research studies around the world to close the knowledge gap on methane emissions and provide policy-relevant insights to decisionmakers.