

Supplementary evidence from Professor Matt Rigby (MET0001)

Further to my oral evidence, I am providing additional details on a) the discrepancy between top-down and bottom-up methane emissions; b) some international efforts to better understand methane sources (including recent announcements from the USA).

a) Discrepancy between top-down and bottom-up methane emissions

The discrepancy between top-down and bottom-up UK methane emissions is presented in an Annex to the UK's National Inventory Report (Figure 1, from Brown et al., 2023). In the 1990s, the inventory was consistently higher than the top-down estimates, with a difference of approximately 40 to 80 Tg yr⁻¹ CO₂-eq, depending on the year. Since 2012, the two estimates are not statistically different.

The cause of the historical difference between the two methods is not known and remains under investigation.

A further investigation of the post-2012 trend, including a discussion of the level of agreement between the top-down and bottom-up estimates was presented in Lunt et al. (2021). Consistent top-down emissions estimates were found for a range of measurement techniques (e.g., tall tower, aircraft and ship-based measurements), models and inverse methods.

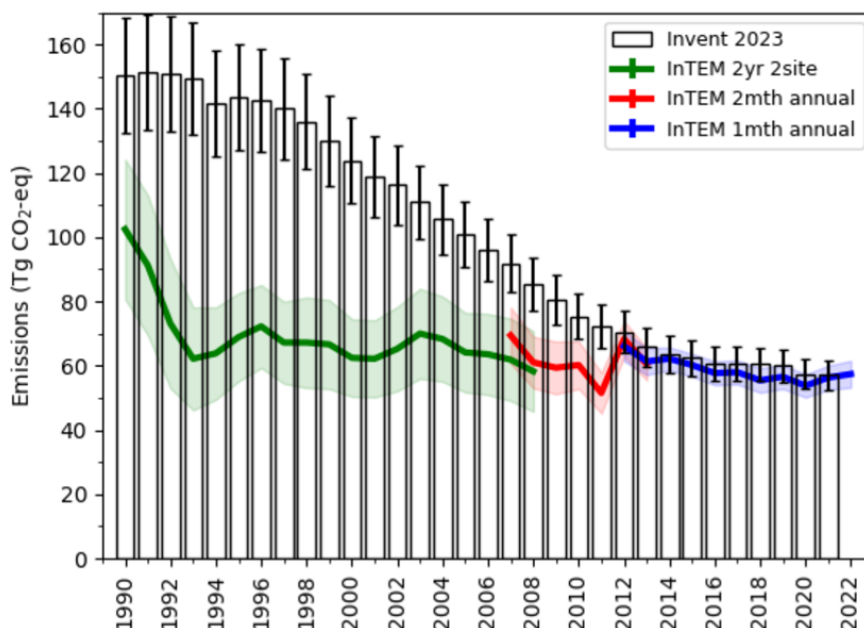


Figure 1. UK methane emissions as CO₂-equivalent. Lines and shading are top-down estimates, based on two sites (green, Mace Head, Ireland and Cabauw, Netherlands), or the UK DECC network with Cabauw (blue). The bars are the 2023 inventory. From Annex 6, Figure A6.2 of Brown et al., 2023.

To better understand any future disagreement between the inventory and top-down estimates, current research is focused on improving spatial resolution and sector-level attribution, primarily by:

- adding new sites and incorporating remote sensing data (see, for example, the [GEMMA](#) and National Centre for Earth Observation GEMINI projects)
- using observations of methane isotopologues, which are emitted from different sectors with characteristic signatures (e.g., Rennick et al., 2021)

- using observations of ethane, which is co-emitted with fossil fuel methane, but not from other sources (e.g., Ramsden et al., 2022)

b) International efforts to understand methane emissions

There are a variety of international activities that are aiming to improve national monitoring and reporting of methane emissions. Detailed here is a selection, which is not exhaustive:

- The US recently announced the US Greenhouse Gas Center (<https://earth.gov/ghgcenter/>), which brings together data from various US government agencies (NASA, NIST, NOAA, EPA)
- The World Meteorological Organisation (WMO) Global Greenhouse Gas Watch programme is aiming to support members (meteorological centres) in developing greenhouse gas emissions evaluation capabilities: <https://wmo.int/activities/global-greenhouse-gas-watch-g3w>
- The WMO Integrated Global Greenhouse Gas Information System (IG3IS, <https://ig3is.wmo.int>) aims to promote the expansion of greenhouse gas emissions evaluation activities, and has been developing best practice guidelines (e.g., guidelines on national emissions evaluation system design, which have been informed by UK teams: <https://ig3is.wmo.int/en/about/what-we-do/objective-1/project-guidelines-objective-1>)
- The European Centre for Medium Range Weather Forecasting (ECMWF) Copernicus Atmosphere Monitoring Service (CAMS, <https://atmosphere.copernicus.eu>) is aiming to provide global estimates of CO₂ and CH₄ flux using atmospheric observations.
- The Horizon Europe PARIS project (<https://horizoneurope-paris.eu>) is developing top-down emissions estimates for a range of European countries and will support the development of draft annexes to inventory reports.
- The European Integrated Carbon Observing System (ICOS, <https://www.icos-cp.eu>) provides measurement infrastructure from which member countries can develop emissions evaluation methodologies. Some stations from the UK networks are also ICOS stations.

References

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