

DARE-UK Annual Meeting 2022

Summary of discussion session

1) Operational emissions evaluation

What is needed to develop an operational emissions evaluation system for the UK?

a. Who would be the customers?

ONS

Government/Policy makers: DEFRA/BEIS

Other scientists

Industry/businesses/energy providers

Public

IPCC

Local authorities who make own net zero goals/decisions

b. What equipment, infrastructure, and services would be required?

Infrastructure: New measurement sites are needed, likely in the north of England/Wales/Scotland/N. Ireland. However, sensitivity analysis is needed to determine an optimal configuration and number of sites required. There will be diminishing returns as new data are added, but the feeling is that we are far from data saturation.

Number of new sites will depend on the resolution and type of deliverable being aimed for (e.g., sector-level emissions). Mobile systems may help to test if and how valuable a new site would be if it was established permanently.

Services: A new, more responsive system may be needed to update emission factors, etc. in the inventory. It was noted that the inventory needs to comply with IPCC guidelines, so there may need to be different approaches for reporting versus “best estimate” emissions. To achieve this, closer coordination will be needed between inventory and “top-down” teams. A wider range of activity data need to be included to provide more accurate estimates and help with higher temporal/spatial resolution.

It was noted that NISC already discusses improvements based on top-down information. A pre-meeting is needed to discuss developments in advance of the NISC.

c. What would you deliver?

Near real-time (sub-annual) emission estimates are a priority.

Robust uncertainties are needed, as are sector-level estimates, and estimates of emission factors.

Estimates need to be disseminated to UNFCCC separately from other stakeholders.

2) Stakeholder needs and monitoring transition to net-zero

a. Who are the stakeholders who would be interested in top-down estimates?

Regulators

Policy makers

NGO's / UNFCCC

Companies with emission reporting duties

Academic community

Carbon accounting and carbon finance initiatives

Governments / EU commission

b. What are their requirements?

- Need for methodology verification / certification
- Result reporting transferability / standardisation
- Verifiable baseline to allow measurement of progress and performance. Critical for measures such as carbon pricing for methane or requirements for climate responsible financing.
- Methodologies need to be appropriate for the purpose. i.e. costs for multinational oil and gas companies will be different to reporting requirements for single farm.
- Methods need to be developed for all scales, be easy to follow and understand, be robust and cost appropriate. E.g., For the farming community, it would need to be an emission factor-based system rather than regular costly measurement program

Questions were raised on where the onus of emission reporting will ultimately fall. Will programmes such as the Oil and Gas Methane Partnership (<https://www.ccacoalition.org/en/resources/oil-and-gas-methane-partnership-ogmp-20-framework>) be made compulsory in the near future? Can the academic community become part of the independent verification system?

c. As we transition to net zero how do emissions estimation systems (inventory and top-down) need to change as national GHG emissions profiles change?

- Systems need to be agile and responsive with near real-time data outputs.
- Requirement to consider global equity and global integration – e.g. the need for Australia to continue mining for global needs, but emissions can't only count for Australia.
- Requirements for offsetting and net negative for some countries.
- Inclusion of new gases as required, especially important for consideration of hydrogen economy.

3) Measurements

What are the priorities for UK measurement infrastructure in the next 5 years?

- a. Are there measurement systems that are “missing” from the UK at present?
- b. Are there techniques from DARE-UK or other projects that should be more widely rolled out

Remote Sensors - Bring in commercial satellite, use to pick out point sources that would not be picked up by measurement towers.

Offshore oil and gas: Priority for BEIS. Large albedo would make this challenging for remote sensing. Could be a place for future high-res. Instruments.

Long term Measurements: Sector-specific measurements are a priority. Need to tailor measurements to answer inventory specific challenges. Biogenic fluxes are a challenge due to variability. Need more autonomy than currently available at Arqiva sites.

Isotope measurements: Still need to determine added value. Needs to be co-located with other long-term measurements. Background needs characterizing over longer timescales. Scalable?

DOPLAR-LIDAR measurements:

Needed to better understanding of the physics of the atmosphere. Can be used to check how well models are performing. Need more meteorological measurements co-located with GHG observations.

4) Inverse modelling

How could top-down modelling systems be improved (Excluding more measurements)?

- a. What are the current limitations?
 - b. How could these be overcome?
- Important to develop methods of evaluating transport model performance. Deliberate release tracer experiments are now very old and based on short campaigns. Trial halocarbon tracer release recently attempted in the Netherlands: DARE-UK team will follow up and determine whether possible in the UK. Tracers of opportunity should be investigated, e.g., xenon from hospitals?
 - Use high resolution models – temporal resolution has not kept up with spatial resolution
 - Spatial resolution depends on surface cover, resolution of processes
 - Use of weather model ensembles, different models of transport, city flows even more detailed, Met Office 100m model
 - Boundary layer venting improvements to NAME, vertical resolution, exploring alternative input variables to NAME to make UM and NAME more consistent. Is the representation of stable boundary layers correct?
 - Improved turbulence data/representation in models.
 - Using different models, different met data, ensembles to capture transport uncertainty
 - Sector-based estimates, but under-constrained and potentially biased. Perhaps for large, national-level regions.
 - Use of co-emitted tracers needed to separate sectors and natural vs anthropogenic

5) Bottom-Up modelling

What improvements are needed for bottom-up models and inventory systems?

- A priority is access to better spatial (sub-SNAP) data – underlying data is not open for general use at present
- Measurements and Emission factors – targeted measurements needed of key sources
- Spatial maps of where carbon is located to account for the carbon in the longer term. No long-term measurements of carbon stock at present.
- Better understanding of sectors and uncertainties. CH₄ in freshwater systems might be overestimated (on the global scale) – drone measurements (bag sampling?).
- Uncertainties need to be propagated all the way through from the activity data. This uncertainty is not required for stakeholders but is required for scientific use.
- High resolution maps for city scale modelling. Digital-twinning – down to household resolution. E.g. Hestia in the USA.
- What is going on in our Peatlands – this is a BEIS priority area. Inventory has included some wetland fluxes (speculative). Carbon sink – net warming – depends on time horizons – it is a balance.
- Ventilation from caves – CO₂ acts as a carrier for Rn (for example) – what about old coal mines?
- Project based things are going on – bottom-up work going on at Aberdeen
- Industrial sources are important but getting hold of information is tricky due to confidentiality issues
- New ideas should be fed through to NISC to help them prioritise improvements.
- DUKEMS (UK-EMS) historical and forecast data, continuously updated, temporal profile information can be used. All gases and all sectors going back to 2005.
- Can request activity data from BEIS
- UK is accepted as world leading from external sources.