



# BOG Report

## BOG 2 – Fugitive CH<sub>4</sub>

# IPCC TFI Expert Meeting on Use of Atmospheric Observation Data in Emission Inventories

5-7 September 2022  
WMO HQ, Geneva - Switzerland

IPCC TFI TSU

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INTERGOVERNMENTAL PANEL ON climate change



# Discussion Question #1 - i

- ✓ Assess and critique recent estimation techniques that utilise atmospheric observations as well as operational systems, platforms, instruments/sensors and methods/models for their potential to be used for the verification of national inventory sectoral emission estimates, consistent with the guidance provided in the 2019 Refinement
- A lot of potential for use of these techniques for assessment of GHG inventories for CH<sub>4</sub> fugitive emissions
- Rapidly maturing science
- **Ongoing dialogue** and development of capacity between GHG inventory compilers and researchers is critical (design of studies and appropriate interpretation of results)
- Appropriate technique **depends on question being asked**:
  - particular target: verification of the national inventory for fugitive CH<sub>4</sub> **or** development of Tier 3 EFs **or** conduction of Tier 3 measurement for inventory reporting
  - specific source in question: level of detail required
  - **scale: time and space** (source level, facility level, basin level, national), (e.g., snap shot through long-term measurements) versus annual inventories and time series considerations
  - approach to upscaling/downscaling of measurements (representativeness)
  - relevance of single technique or to use the combination of techniques

# Discussion Question #1 - ii

- ✓ Assess and critique recent estimation techniques that utilise atmospheric observations as well as operational systems, platforms, instruments/sensors and methods/models for their potential to be used for the verification of national inventory sectoral emission estimates, consistent with the guidance provided in the 2019 Refinement
- Idea from the group: to develop a matrix (set of matrixes) for use in collaboration between inventory compilers and atm. researchers to assess available different techniques **for different scales and different purposes (e.g., level versus trend)** (Table 6.2, Volume 1)

QUESTION (inventory-relevant) ↔ TECHNIQUES (atmospheric-based)  
↔ IMPLEMENTATION

- could include mass balance, spectroscopy, long-term observation, simple inversion, modelling, etc. and different vehicles: cars, towers, aircrafts, satellites
- “living” list of techniques – to be updated periodically taking into account rapid developments in that science, including information on uncertainty
- Is possible to develop, but time is needed
  - **Recommendation for future work of TFI**

# Discussion Question #2 - i

- ✓ Assess and evaluate successful examples of:
  - comparisons between atmospheric observations and national inventories that are consistent with good practice provided in the 2019 Refinement that have led to implemented or planned improvements in national inventories;

## Examples discussed from Annex I (lack for non-Annex I):

- **Canada:**
  - aircraft used to compare emissions totals and source-level breakdown for the area
  - planned to measure EFs for specific provinces
- **Australia:** aircraft QA process for CH<sub>4</sub> inventory in total and for coal seam gas particularly
- **US:** satellite (e.g. TROPOMI datasets) and aircraft used for comparison for production and distribution (oil/gas)
- **China:** in situ comparison for coal CH<sub>4</sub> emissions
- **Poland and Romania:** aircraft spectrotechnics, large subnational scale – fugitive emissions for coal mines (Poland) oil and gas (Romania)

# Discussion Question #2 - ii

- ✓ Assess and evaluate successful examples of:
  - available examples where emission factors derived from atmospheric observations have been incorporated into a bottom-up inventory framework
- A lot of examples of EFs however subnational scale: California, Canada
- Improvements in the industrial reporting
- Idea from the group: encourage submission of new developed EFs in the IPCC EFDB

# Discussion Question #3

- ✓ Assess the possibility that emerging datasets from atmospheric observations could be used to test and verify particular IPCC default values (emission factors) and associated uncertainties
- Opinion of the group: testing and verification of Tier 1 default EFs **may not be worth** the effort due to variability (geographically, practices, etc), complexity of measurements, costs, level of disaggregation of data obtained
  - Other potential uses include informing decision by country to use or not use tier 1 EF, development of tier 2 EF
- New default EFs from atmospheric observation **would not necessarily lower the associated uncertainties** compared to 2019 Refinement: different features\specific of different individual sources
- Uncertainties of measurements and inventory estimates are different (sampling size, equipment, modelling versus IPCC uncertainties of estimates)

# Discussion Question #4 - i

- ✓ Discuss the use of gridding (spatial and temporal) of NGHGs to allow comparison with atmospheric observation data
- Gridding is **critically important** step
  - Gridded versions of national GHG inventories (consistent with sectors, sources in GHG inventories) improve our ability to compare GHG inventory results with atmospheric observations to identify areas of improvement
  - Note that uncertainty is impacted with spatial, temporal, allocations etc.
- **Space** resolution needed:
  - depends on the individual sources and could be different, depends on types of observation
- **Temporal** gridding:
  - for fugitive emissions is difficult to obtain
  - fugitive emissions can vary greatly over time
  - limited data to grid temporal variability for fugitives
- Additional value of gridding:
  - Information to local communities (including environmental justice information, mitigation)
  - Improved priors for atmospheric studies

# Discussion Question #4 - ii

- ✓ Discuss the use of gridding (spatial and temporal) of NGHGs to allow comparison with atmospheric observation data
- **Connected to the question of capacity of inventory teams in different countries**
  - is **a barrier** to wide use atmospheric observation across reporting countries under the Paris Agreement (only few countries have a such experience)
- **Some countries could resist of doing gridding**
  - E.g. confidential (or lack of) information
- **Idea of the group: to develop recommendations on the gridding of the national GHG inventory data**
  - **further work for TFI**



# Discussion Question #5 - i

- ✓ Discuss terminology and classifications of sources/sinks and associated natural and anthropogenic GHG fluxes to find a common understanding of consistency and differences in atmospheric observation data and GHG inventory estimates
- **constrain** - atm. “what we have information on” ↔ inv. “not be able”
- **scale** - how different scales are matching inventory
- **fugitive** - atm. general understanding ↔ inv. IPCC definition
- **validation/verification** - validation of models versus defined verification in IPCC GLs
- **natural versus anthropogenic** - provide list of sources from IPCC GLs to atm. obs. community
- **biogenic and thermogenic and pyrogenic** - and how it does and does not relate to natural versus anthropogenic

# Discussion Question #5 - ii

- ✓ Discuss terminology and classifications of sources/sinks and associated natural and anthropogenic GHG fluxes to find a common understanding of consistency and differences in atmospheric observation data and GHG inventory estimates
- ***uncertainty*** - scientific interpretation of measurements conducted ↔ IPCC methodology related to the total calculated emission
- ***concentrations versus emissions (fluxes)*** - measured atmospheric concentrations versus emissions in inventories
- ***upscaling/downscaling*** - how national totals are obtained from measurements
- ***time frames*** – how annual data are obtained for the inventory

# Discussion Question #5 - iii

- ✓ Discuss terminology and classifications of sources/sinks and associated natural and anthropogenic GHG fluxes to find a common understanding of consistency and differences in atmospheric observation data and GHG inventory estimates
- ***completeness*** - all sources covered in measurements ↔ IPCC definitions
- ***individual source versus source category*** - measured individual source versus defined source categories in inventories
- ***time series consistency*** - how possible to ensure using atm. obs. in line with IPCC GLs
- Inventory development ***requirements*** versus research needs to get a result

# Thanks to the team

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# Thank you

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