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ICLEI Local Governments for Sustainability

CoCO2 Prototype system for a Copernicus CO_2 service

MONITORING HUMAN CARBON DIOXIDE EMISSIONS

$CoCO_2$ User activities and the Decision Support Blueprint

City Workshop: Supporting city-scale GHG inventories - opportunities and challenges

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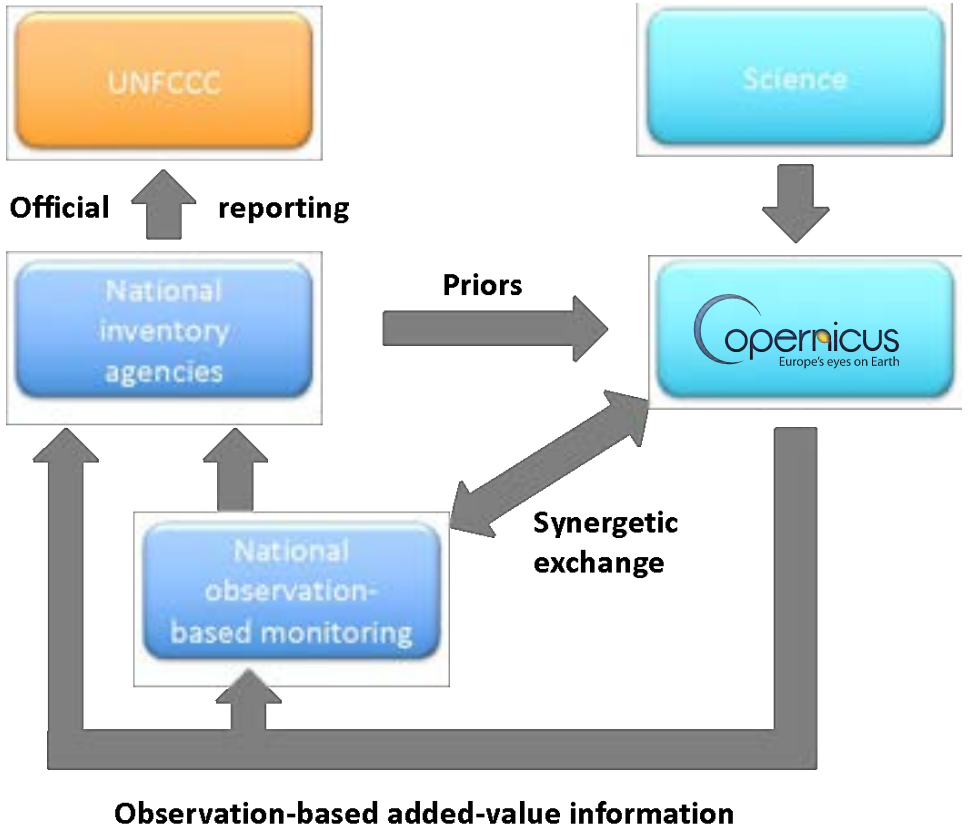
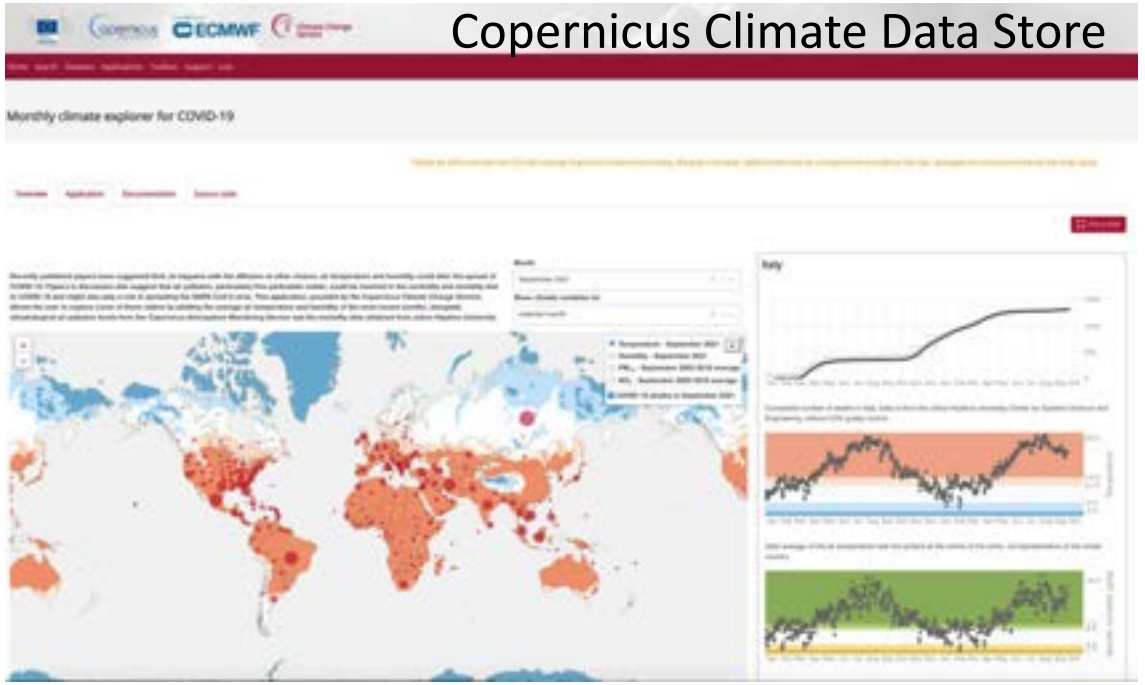
User engagement for co-designed user services



Copernicus Climate Data Store



WORLD METEOROLOGICAL ORGANIZATION

International standard for Urban GHG Monitoring and assessment

CLIMATE ACTION

ICLEI Local Governments for Sustainability

IG3IS Integrated Global Greenhouse Gas Information System

United Nations Framework Convention on Climate Change

WP8 Objectives

- Identify User Community and User Needs to serve UNFCCC national submissions, in a policy-oriented framework.
- Design a set of information products that can meet user needs and provide an outline for a **Decision Support Blueprint**.
- Produce syntheses of CO_2 and CH_4 observation-based emission estimates
- Compile a catalogue of satellite hot-spot detection studies for CO_2 and CH_4

Who are our users?

- UNFCCC, national inventory agencies, national policy makers, …
- IPCC, scientific bodies, Copernicus CAMS,…
- City authorities (local governments)
- City initiatives and stakeholders (Covenant of Mayors, C40, ICLEI)

What we do for users

For National Users

- Yearly CO_2 & CH_4 budget reports: assessing and weighing consistent evaluations of the UNFCCC-reported estimates against the observation-based evidence produced in the $CoCO_2$ project (and VERIFY)
- Multiple efforts to build competence with verification activities (Decision Support Blueprint)

Link to new EU funded project: CORSO, AVENGERS, EYE-CLIMA and PARIS

- Participation in different groups and initiatives
  - IPCC 2006 and Refinement 2019
  - IPCC Expert Meeting on Use of Atmospheric Observation Data in Emission Inventories (2022)
  - UNFCCC (COPs, SBSTAs)
  - GEO
  - WMO (IG^3IS and GHG global monitoring infrastructure)
  - ICOS Science Conference
  - RECCAP2, GEIA

For Sub-National Users: catalogue of studies, targeted workshops !

Current verification activities involving users

- The **verification** ensures reliability of the inventory estimates, for their intended purpose
- In the IPCC Guidelines, verification includes both **inventory-based comparisons** and **observation-based comparisons**
- Independent verification can **complement** inventories and **support** the improvement of both models and inventories
- A careful comparison across independent inventory-based approaches can reveal causes of differences (Andrew 2020; Deng et al. 2022) and identify errors (e.g., $CoCO_2$ D8.1 on EIA estimate of oil).

Current challenges: to understand differences between observation-based and inventory-based emission estimates for the different GHGs.

Fossil CO_2 – quite certain with low uncertainties
Land CO_2 – highly uncertain inventories – system boundaries challenges – progress possible due to multiple approaches
CH_4 – uncertain inversions but still possible for verification – uncertain inventories

Ongoing work

Now:

- Identify, quantify and explain possible divergences between global inventories, atmospheric inversions, process-based models, and national inventories submitted to the UNFCCC.

- Building on and improving the methodological approach developed previously in the EU-funded VERIFY project's GHG syntheses (Petrescu et al., 2020, 2021a, 2021b, 2023 and McGrath et al., 2023).

- Focus on EU27 and few individual Member States (CO_2) and on EU27 and top global emitters (e.g., Brazil, China, DR Congo, Indonesia, Russia and the USA) for CH_4.

Next:

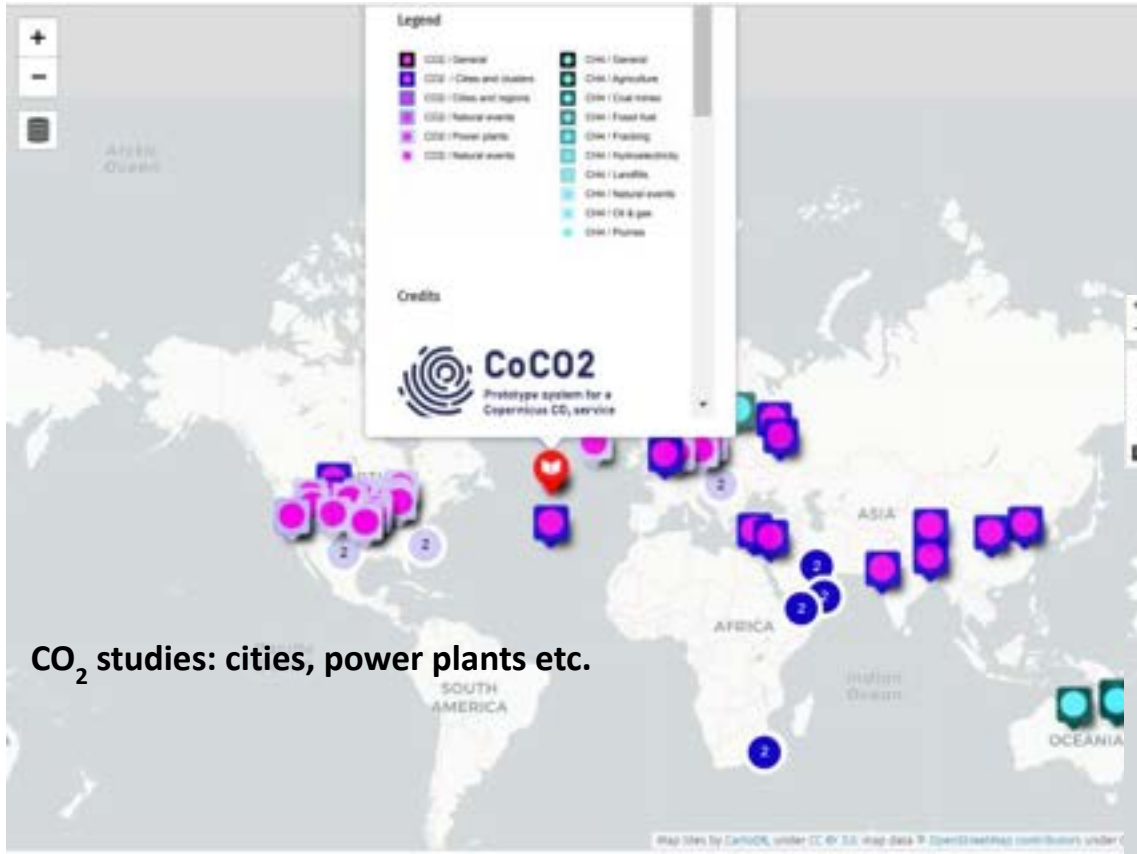
- Top-down, observation-based estimates are required by multiple stakeholders and at multiple scales to verify bottom-up emission estimates - set-up a yearly reconciliation exercise to support monitoring and verification activities.

- Systematic reconciliation and comparison often requires a close dialogue between analysts, data providers, and modelers – the Decision Support Blueprint, will outline potential mechanisms and tools to provide diverse, but targeted, information to the relevant users.

User engagement activities in $CoCO_2$

What we do for sub-national users

- For cities, regions:Hot spot emission detection studies | CoCO2: Prototype system for a Copernicus CO2 service (coco2-project.eu)



CO_2 studies: cities, power plants etc.

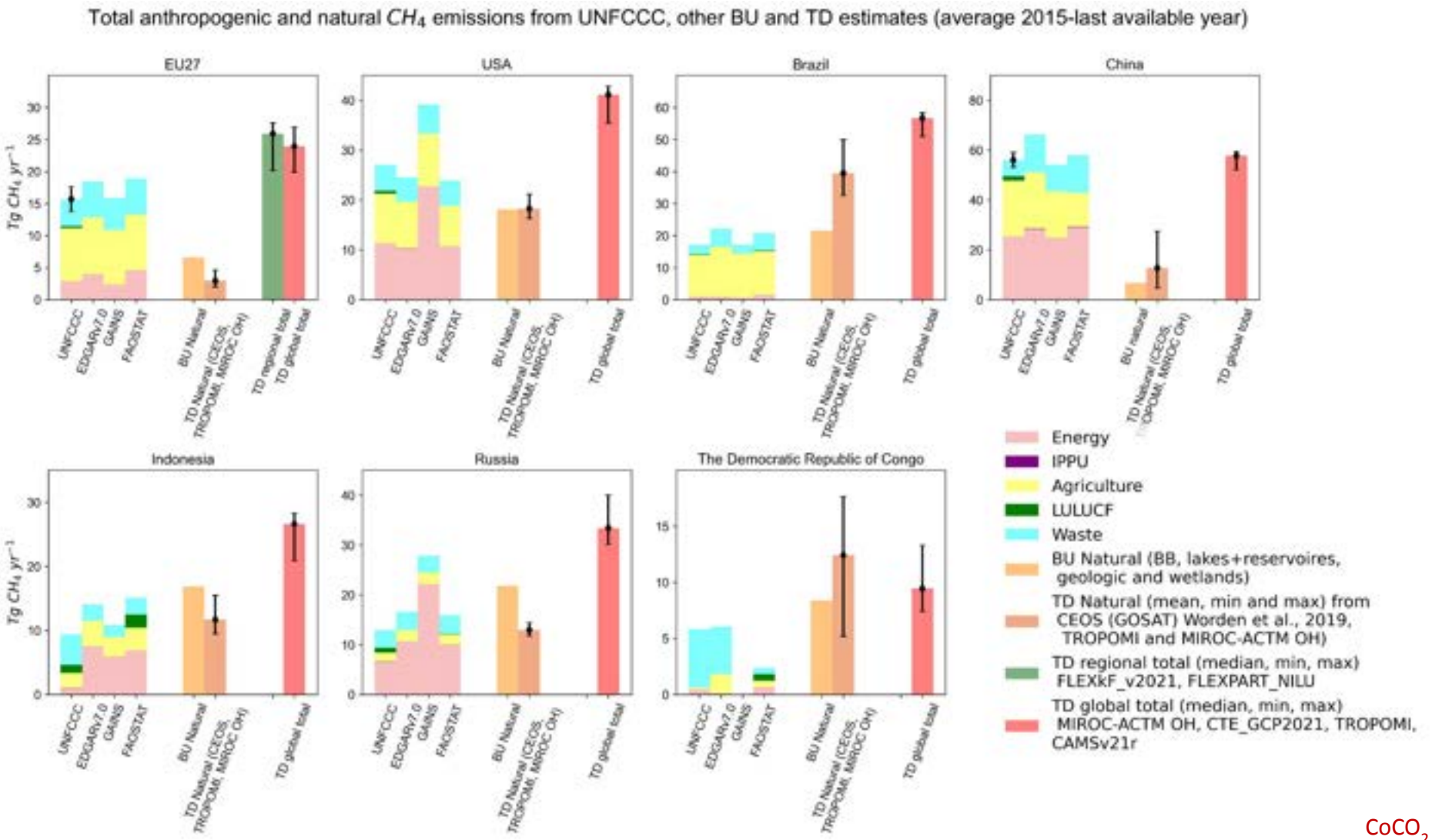
CH_4 oil & gas studies:

Please use it and send us your feedback!

CH_4 budget comparisons

UNFCCC, TD and BU – preliminary results

What we do for national users



$CoCO_2$ CH_4 current work by A.M.R. Petrescu et al., (VU Amsterdam)

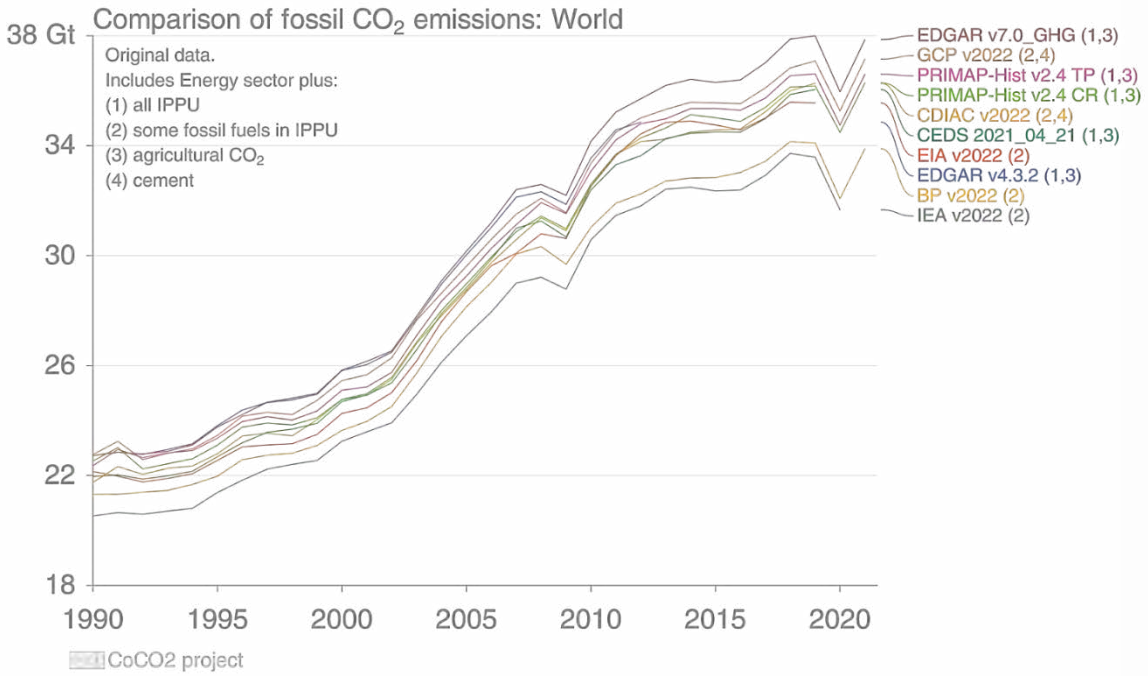
CO_2 budget comparisons – CO_2 fossil

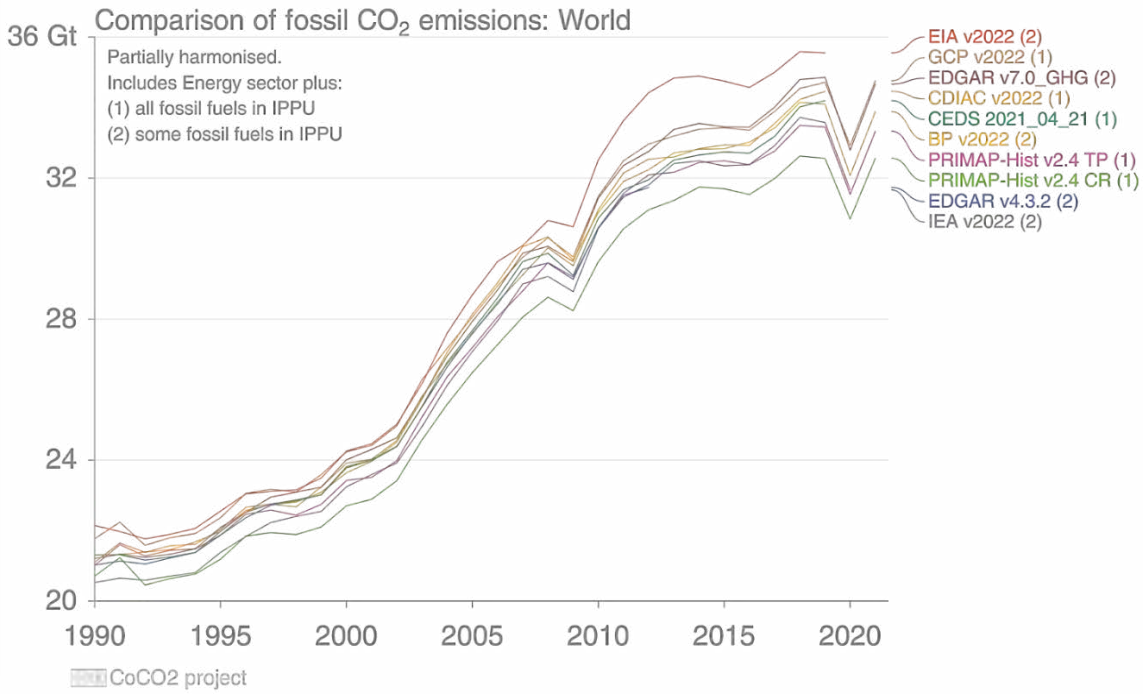
- **Left**: 'Raw' totals from these datasets have differing system boundaries, they don't all include the same set of emissions sources.

- **Right**: harmonized data as much as possible, but harmonization is limited by the disaggregated information presented by each dataset**.**

- Most datasets agree well within expected system boundary differences (Andrew, 2020).

- This exercise discovered that EIA's estimates were high, and investigation showed errors leading to double-counting. Globally. their correction led to a drop in EIA's estimates of fossil CO_2 emissions by about 1 Gt CO_2.

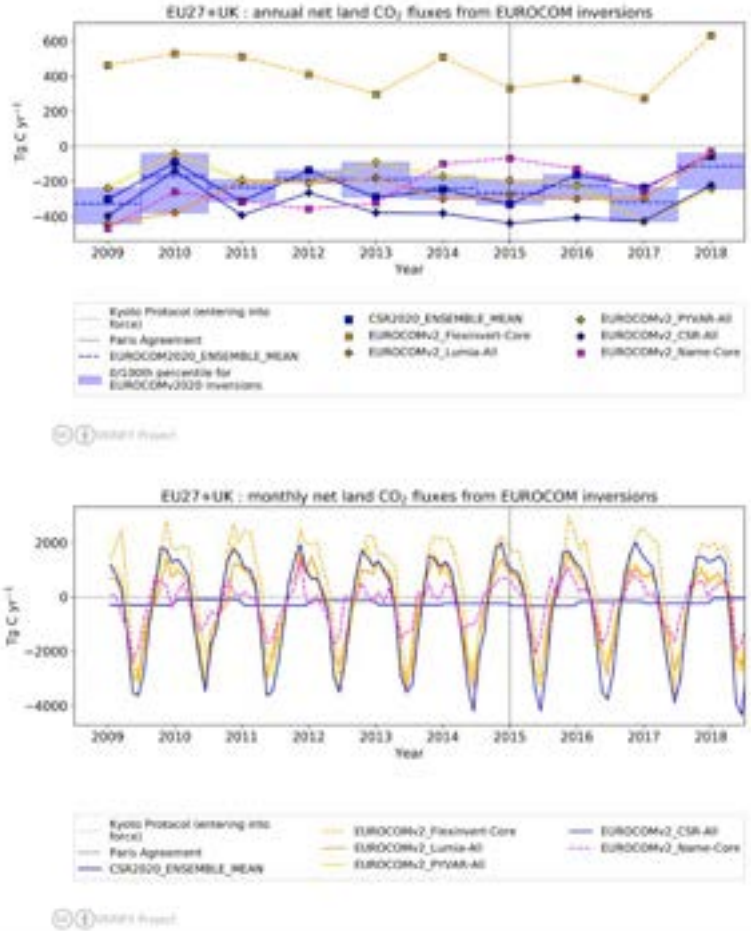




$CoCO_2$ CO2 current work by Robbie Andrew (CICERO)

CO_2 budget comparisons – CO_2 Land

Comparisons between different versions of model ensembles and products continue…to compare we need similar system boundaries



EUROCOM

Comparison of different ensemble members help identify those which might need further investigation

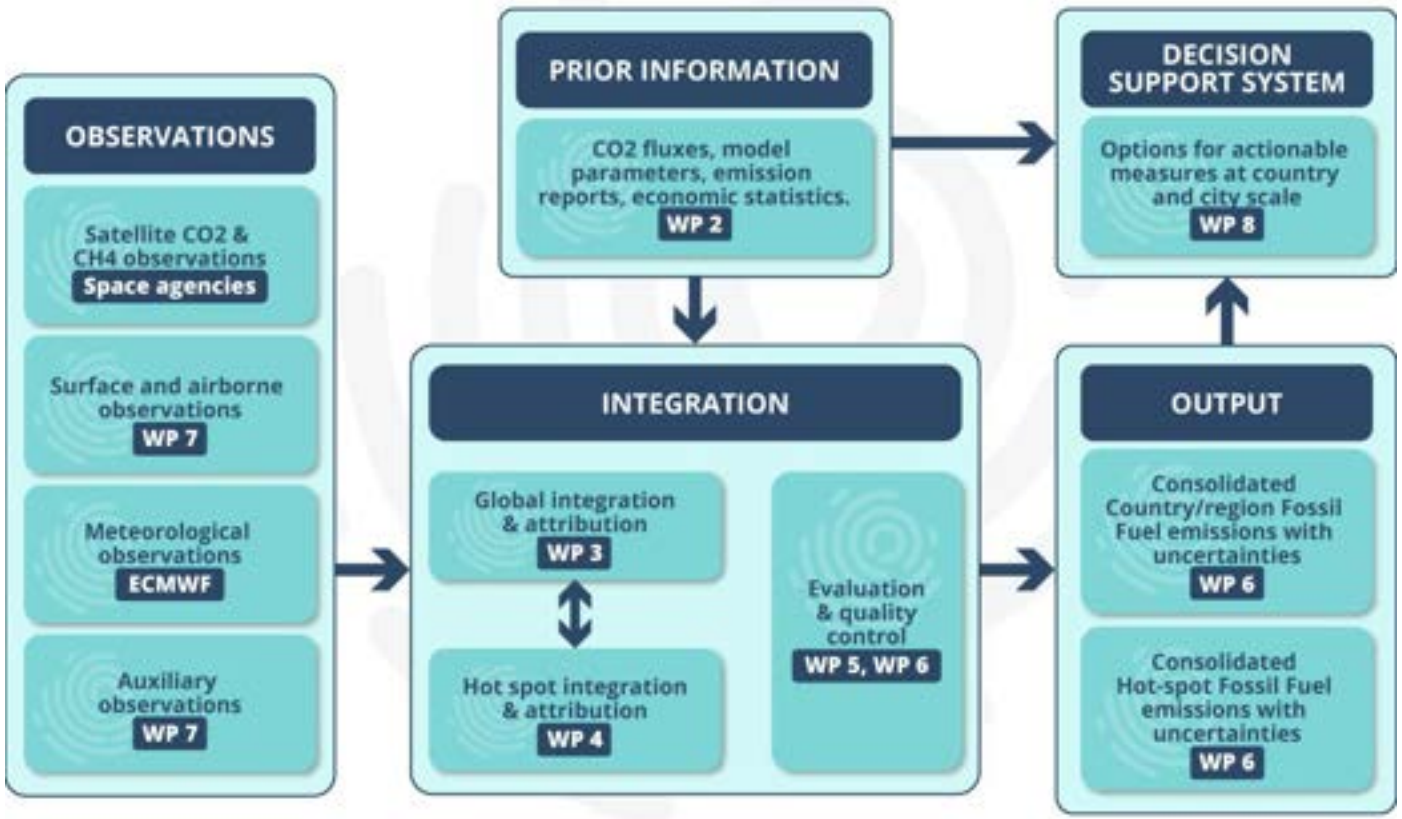
Top-down CO_2 land

Adjustment of components (e.g., lateral fluxes) will enhance comparability between estimates

Orange CAMS with adjusted lateral fluxes

$CoCO_2$ CO2 current work by Glen P. Peters (CICERO), Frederic Chevallier and Matthew J. McGrath (LSCE)

Decision Support System (DSS) blueprint



Background

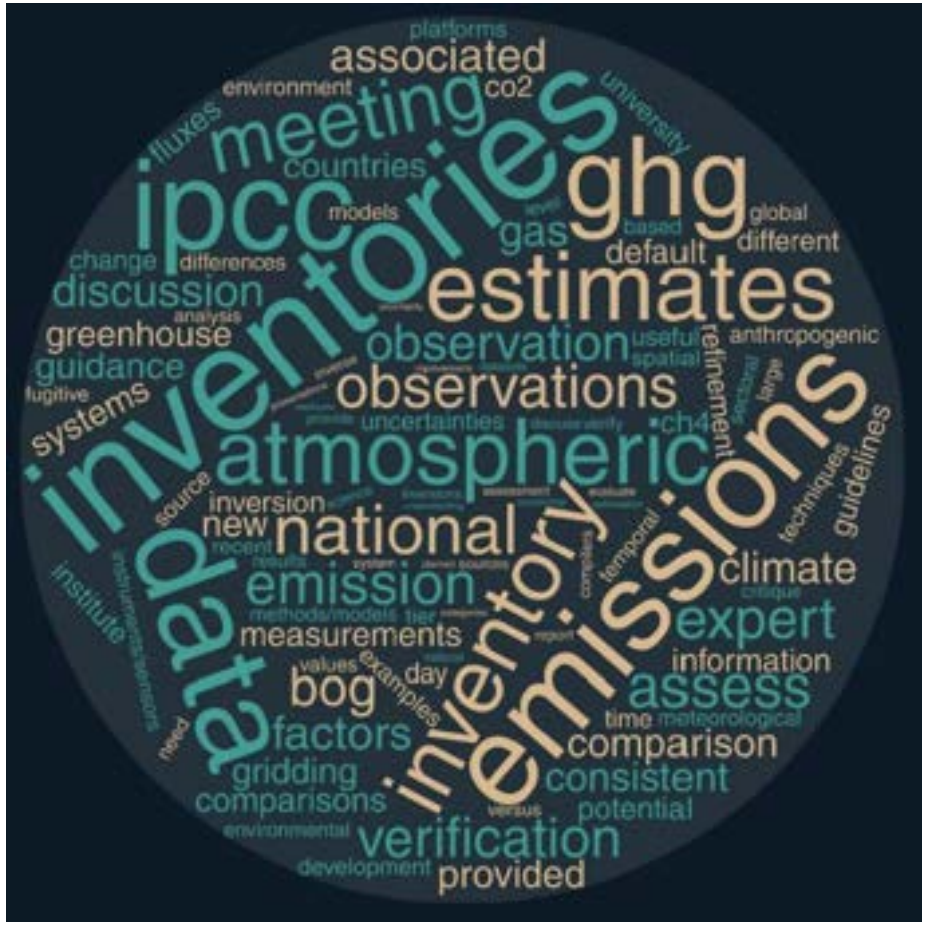
What is and why do we need a CO_2MVS?

- A tool to help support user's verification activities, particularly with the influx of new space-based observations (such as through CO_2M).
- Components: **prior information** (e.g., initial emission estimates) and **observations** (e.g., meteorology, satellites - **inventory-based approach and inversion-based approaches**) that require **integration** (e.g., via models) to produce **outputs** (e.g., revised emission estimates), that are then condensed into a **decision support system** (e.g., user functions).

Decision Support System (DSS) blueprint

Current status

- IPCC Guidelines / Guidance
  - Already applied in UK and Switzerland, also elements in Australia, Germany, NZ, US, etc
- User processes in research projects
  - Past projects: CHE, VERIFY
  - Ongoing: CoCO2, EYE-CLIMA, AVENGERS, PARIS
  - US-based initiatives
- VERIFY Fact Sheets
  - Put all data on a common platform
- IPCC Expert Meeting on Verification
- Dialogues with national experts and domain experts



Decision Support System (DSS) blueprint

Preliminary recommendations

- Building a common knowledge base
  - What are the opportunities? What are the expectations? What are the limits?
- Communication
  - Very few know what we are talking about (even in expert communities)!
- Case studies
  - "Try by doing" – we will see this in the new EU projects (EYE-CLIMA, AVENGERS, PARIS, ICOS Cities, …)
  - Country (or city) level activities (preparing for the influx of new data and methods)
- Further development of inversion modelling
- Graphical material and analysis tools
  - Example: Copernicus Atmosphere Monitoring Service (CAMS) https://atmosphere.copernicus.eu/
  - Access data to perform own analysis
  - Tools to (partially) perform certain types of analysis
- Collaboration
  - Across research projects, user communities, etc

Feedback

The CO_2,CH_4 studies map is available here:
A Catalogue of published studies on hotspot detection of emissions for CO2 and CH4 | CoCO2: Prototype system for a Copernicus CO2 service (coco2-project.eu)

The DSS is available here:
Decision Support Blueprint (preliminary) WP8 | CoCO2: Prototype system for a Copernicus CO2 service (coco2-project.eu)

The second CO_2 and CH_4 budgets report is available here:
https://coco2-project.eu/node/360

Please send us your feedback at:
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a.m.r.petrescu@vu.nl

CoCO2

Prototype system for a Copernicus CO_2 service

THANK YOU!

This presentation reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

coco2-project.eu

@CoCO2_project

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