Funded by the European Union

Co-ordinated by ECMWF

CORSO
CO2MVS Research on Supplementary Observations

INTRODUCTION

Kick-off Meeting

Richard Engelen
ECMWF
23/01/2023

The CORSO project (grant agreement No 101082194) is funded by the European Union.

Welcome to CORSO

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

ECMWF

AGH

Lund University

The University of Edinburgh

Empa
Materials Science and Technology

iLab

CORSO
CO2MVS Research on Supplementary Observations

university of groningen

Wageningen University & Research

Météo France

TNO innovation for life

cea

Université Paul Sabatier Toulouse III

University of Bristol

Universität Heidelberg Zukunft seit 1386

ETH zürich

Call requirements

1. New and innovative methodologies to improve the definition of the correlations between emissions of co-emitted species (CO_2, NO_2, CO, CH_4) in support of CO_2 fossil fuel emission estimation

2. New and innovative methods to better use auxiliary observations such as ^{14}C (radiocarbon), SIF (Solar Induced Fluorescence), and APO (Atmospheric Potential Oxygen) to separate anthropogenic CO_2 emissions from the natural variability of CO_2

Greenhouse gas emissions monitoring capacity

Atmosphere Monitoring Service
atmosphere.copernicus.eu

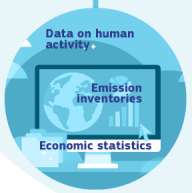
Sentinel 5P

Sentinel 5

Sentinel CO2M

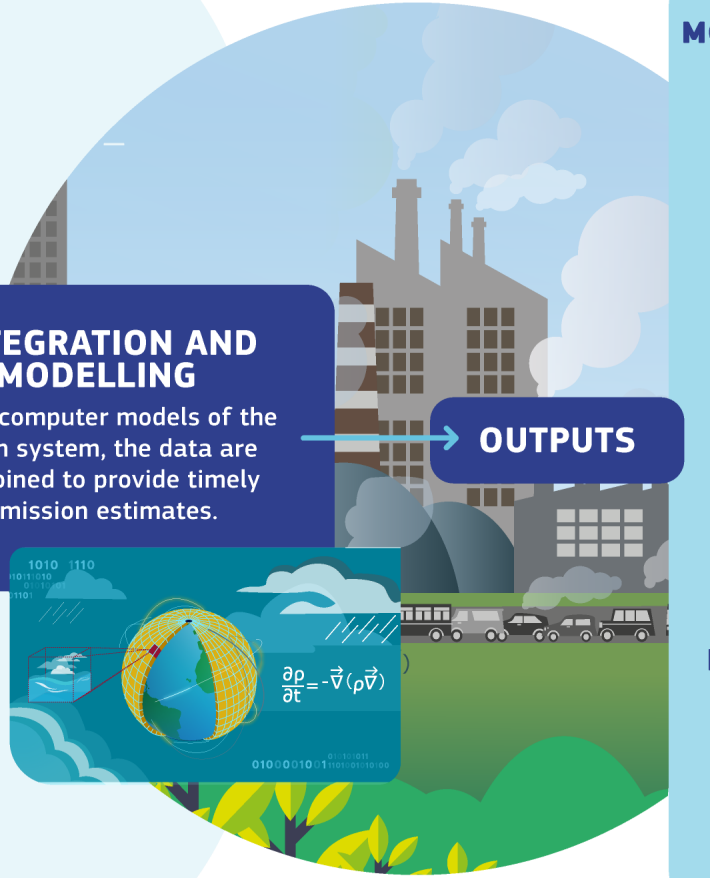
OBSERVATIONS OF ATMOSPHERIC CO_2 AND CH_4

WHAT WE ALREADY KNOW



INTEGRATION AND MODELLING

Using computer models of the Earth system, the data are combined to provide timely emission estimates.



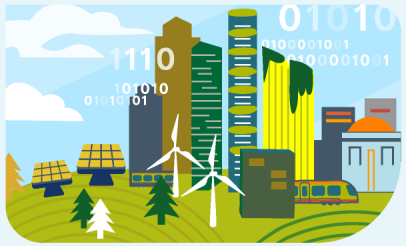
OUTPUTS

EMISSION MONITORING DATA

USER SUPPORT

POLICY TOOLS

GLOBAL
Supporting the Paris Agreement



LOCAL
Supporting green cities

USERS
Consistent, reliable information

Supports policy and decision-making processes

INDUSTRY

GOVERNMENTS AND POLICYMAKERS

SCIENTIFIC COMMUNITY

THE PUBLIC

PROGRAMME OF THE EUROPEAN UNION

Copernicus Europe's eyes on Earth

IMPLEMENTED BY ECMWF

EUMETSAT

esa

EU Climate Law as part of EU Green Deal

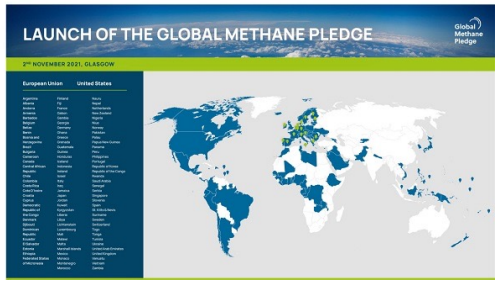
Set the long-term direction of travel for meeting the 2050 climate neutrality objective through all policies, in a socially fair and cost-efficient manner

Set a more ambitious EU 2030 target, to set Europe on a responsible path to becoming climate-neutral by 2050

Create a system for **monitoring progress** and take further action if needed

EU Methane Strategy

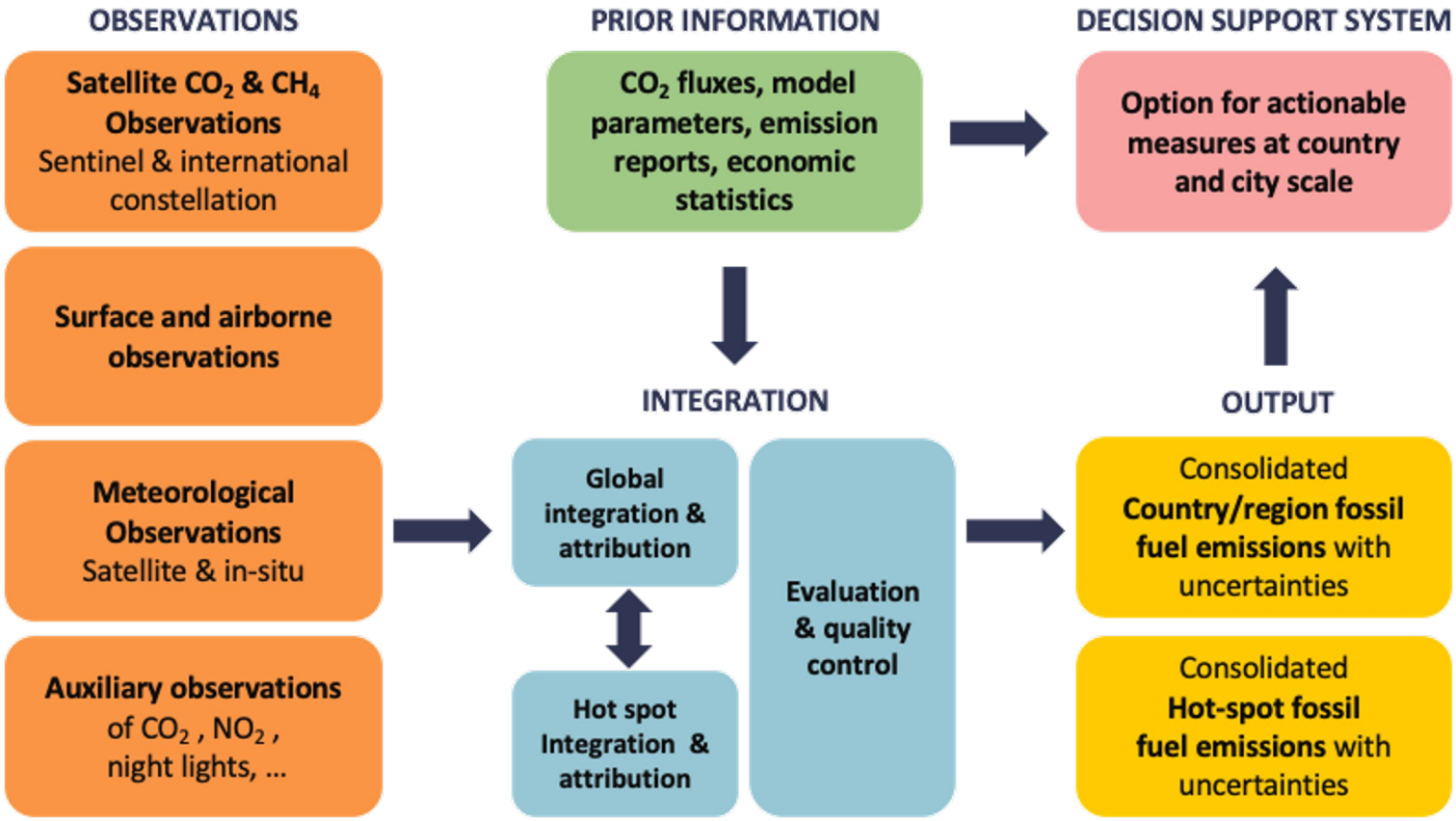
The EU's Copernicus programme for Earth observation is contributing to improved indirect air surveillance and the monitoring of methane emissions. Copernicus can contribute to an EU-coordinated **capability for detecting and monitoring global super-emitters**, principally via its Copernicus Atmosphere Monitoring Service (CAMS)



UNITED NATIONS PARIS CLIMATE AGREEMENT

Copernicus
Europe's eyes on Earth

High-level blueprint



Atmosphere Monitoring Service

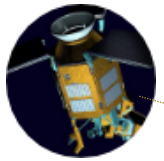
atmosphere.copernicus.eu

An integrated system approach based on experience in NWP and air quality monitoring & forecasting.

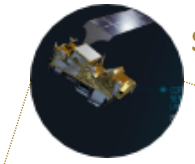
Same system (in potentially different configurations) for greenhouse gases and atmospheric pollutants.

Towards a Copernicus emission monitoring service

ECMWF esa EUMETSAT



Sentinel 5p



Sentinel 5

Sentinel 4

CO_2 Mission

SATELLITE MISSIONS

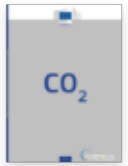
Air Quality emissions
2025

Operational
ramp-up in CAMS

SERVICE COMPONENTS

2026
CO_2 Monitoring & Verification Support (CO_2MVS)

CO2 TASK FORCE GUIDANCE DOCUMENTS



2015

2017

2019

2017

CO_2 Human Emissions

2018

VERIFY

2021

CoCO2
Prototype system for a Copernicus CO_2 service

ICOS Cities

2022

horizon europe

RESEARCH AND PREPARATORY PROJECTS

CORSO
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OBSERVATIONS	PRIOR INFORMATION	DECISION SUPPORT
Satellite CO_2 & CH_4 Observations Sentinel & international constellation	**CO_2 fluxes, model parameters, emission reports, economic statistics**	**Option for actionable measures at country and city scale**
Surface and airborne observations	INTEGRATION	OUTPUT
Meteorological Observations Satellite & in-situ	**Global integration & attribution** ↕ **Hot spot Integration & attribution** → **Evaluation & quality control**	Consolidated **Country/region fossil fuel emissions** with uncertainties
Auxiliary observations of CO_2 , NO_2 , night lights, …		Consolidated **Hot-spot fossil fuel emissions** with uncertainties

Related projects within H2020 and Horizon Europe

Horizon 2020

CO_2 Human Emissions

CoCO2 Prototype system for a Copernicus CO_2 service

VERIFY

ICOS Cities

Greenhouse gases

SEEDS Sentinel EO-based Emission and Deposition Service

Atmospheric pollutants

Horizon Europe

CORSO CO2MVS Research on Supplementary Observations

AVENGERS

PARIS

EYE-CLIMA

Greenhouse gases

AMEO

Atmospheric pollutants

CORSO project aims

1. Deliver improved estimates of emission factors/ratios and their uncertainties.

2. Deliver the capabilities at global and local scale to optimally use observations of co-emitted species to better estimate anthropogenic CO_2 emissions.

3. Provide clear recommendations to CAMS, ICOS, and WMO about the potential added-value of high-temporal resolution $^{14}CO_2$ and APO observations as tracers for anthropogenic emissions in both global and regional scale inversions.

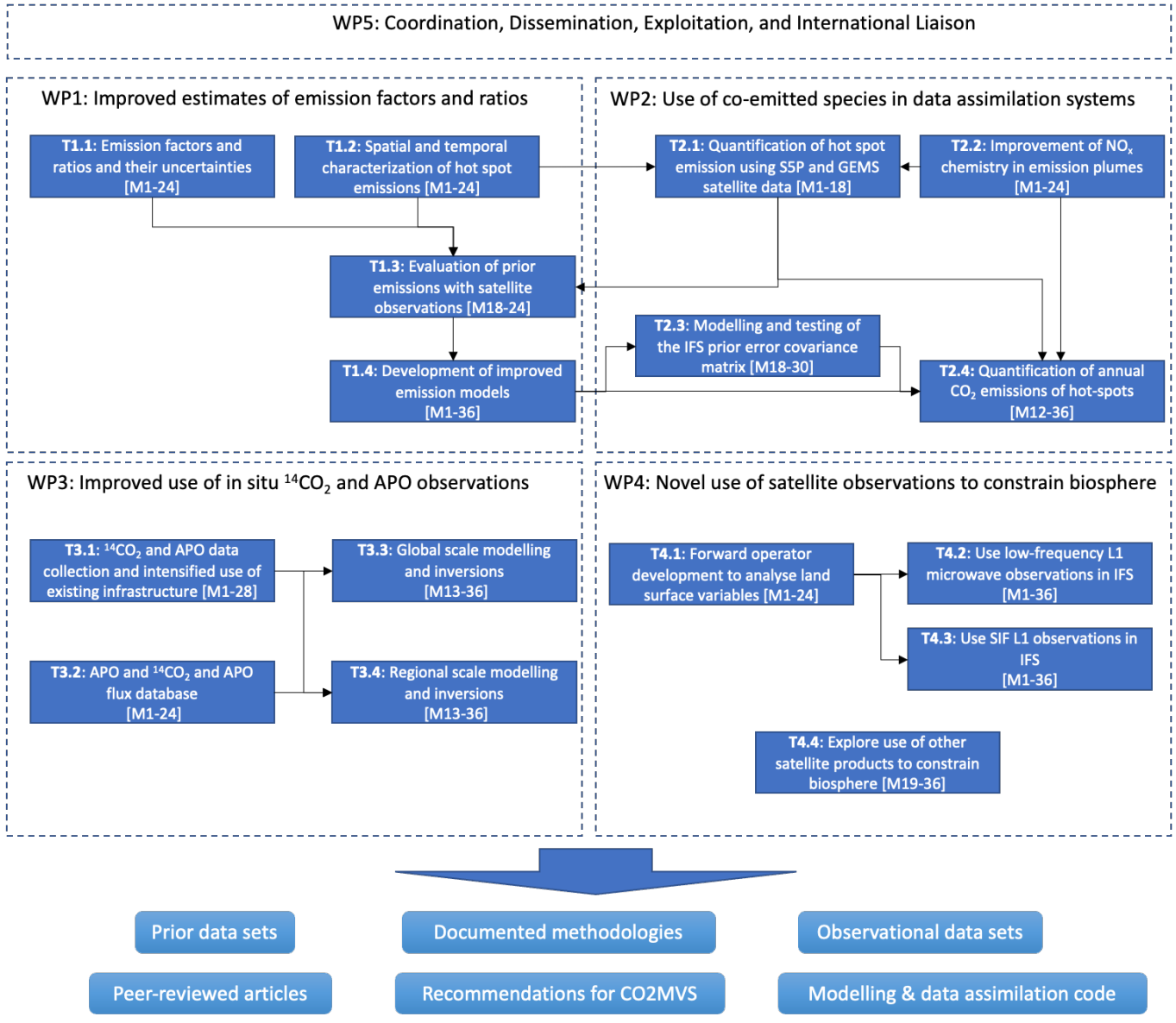
4. Develop coupled land-atmosphere data assimilation in the global CO2MVS system constraining carbon cycle variables with satellite observations of soil moisture, LAI, SIF, and Biomass.

5. Provide specific recommendations for the topics above for the operational implementation of the CO2MVS within the Copernicus programme.

CORSO structure

4 main science work packages:

- Improved estimates of emission factors and ratios
- Use of co-emitted species in data assimilation
- Improved use of $^{14}CO_2$ and APO observations
- Constraining the land biosphere with satellite observations



Some remarks

- CORSO is not a stand-alone project; it supports the long-term development of a Copernicus monitoring system that will last for many years to come.

- The Copernicus programme itself works with competitive Invitation To Tenders (ITTs) to procure services and service development contracts. This makes the development of specific future systems more complicated.

- CORSO therefore aims to:
  - Improve directly the CAMS global monitoring and forecasting system
  - Improve the expertise within the European GHG monitoring community to prepare for response to future CAMS implementation
  - Make specific recommendations to main Copernicus stakeholders about the most viable approaches
  - Document all developments for uptake in wider community

Agenda

23 January 2023

Plenary session

- 09:30 - 09:50: Welcome and introduction - Richard Engelen (ECMWF)
- 09:50 - 10:20: Horizon Europe context & implementation guidelines – Lukas Lanneau (HaDEA)
- 10:20 - 10:40: WP1 – Marc Guevara (BSC) & Claire Granier (UT3)
- 10:40 - 11:00: WP2 – Gerrit Kuhlmann (EMPA) and Nicolas Bousserez (ECMWF)
- *11:00 – 11:20 Coffee break*
- 11:20 - 11:40: WP3 – Ingrid Luijkx (WU) & Gregoire Broquet (LSCE)
- 11:40 - 12:00: WP4 – Patricia de Rosnay (ECMWF) & Jean-Christophe Calvet (MF)
- 12:00 - 12:20: Project management – Tanya Warnaars (ECMWF)

WP discussion breakouts

- 13:30 - 16:00: **WP1** (*Improved estimates of emission factors/ratios and their uncertainties*) discussion meeting
- 13:30 - 16:00: **WP3** (*Improved use of in-situ $^{14}CO_2$ and APO observations to separate the impact of fossil fuel emissions from observed CO_2 variability*) discussion meeting

24 January 2023

WP discussion breakouts

- 09:30 - 12:00: **WP2** (*Use of co-emitted species (correlations, improved emission ratios, uncertainties*) in data assimilation systems) discussion meeting
- 09:30 - 12:00: **WP4** (*Novel use of satellite observations to constrain the natural biosphere*) discussion meeting

Plenary session

- 13:00 - 13:30: Reporting back from **WP1** including plenary discussion
- 13:30 - 14:00: Reporting back from **WP2** including plenary discussion
- 14:00 - 14:30: **WP1** & **WP2** connections
- *14:30 - 15:00: Break*
- 15:00 - 15:30: Reporting back from **WP3** including plenary discussion
- 15:30 - 16:00: Reporting back from **WP4** including plenary discussion
- 16:00: Closure

Questions in chat or raise hand during Q&A

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THANK YOU

TBC

TBC

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