Co-ordinated by ECMWF

CoCO2
Prototype system for a Copernicus $CO_2$ service

# UPDATE ON COCO2 & CAMS

## VERIFY General Assembly

Richard Engelen
ECMWF
29/04/2021

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958927.

**Period: January 2021 – December 2023**

# CoCO2

## Prototype system for a Copernicus $CO_2$ service

**With support from:**

**CO2 Monitoring Task Force**

**External Expert Group**

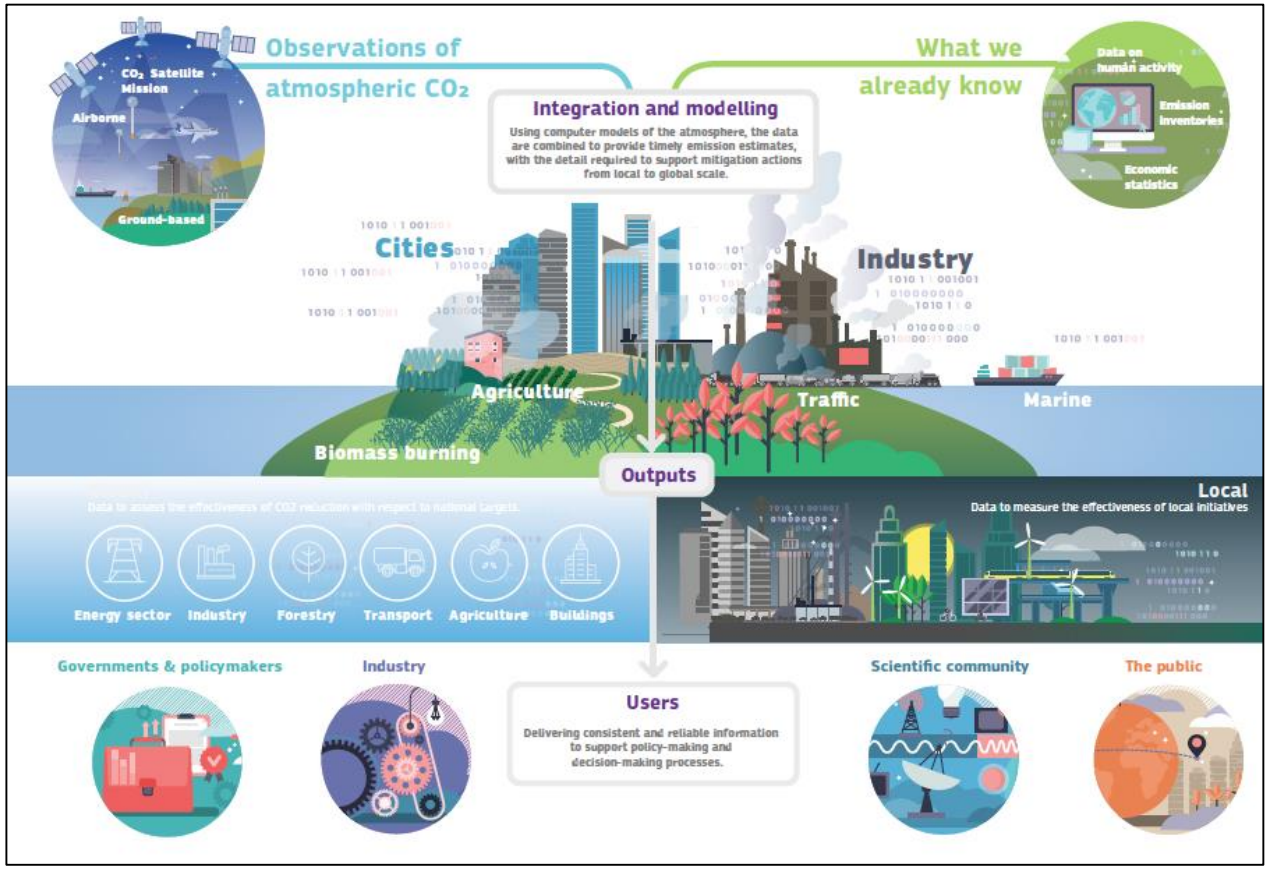
**Inventory Agency Advisory Board**

**CoCO2 reviewers**

**REA**

# Aims of the project

**Deliver the prototype systems for a new European anthropogenic $CO_2$ emissions monitoring & verification support (MVS) capacity that can be implemented within the Copernicus programme as a new operational service element.**




Atmosphere Monitoring Service

atmosphere.copernicus.eu

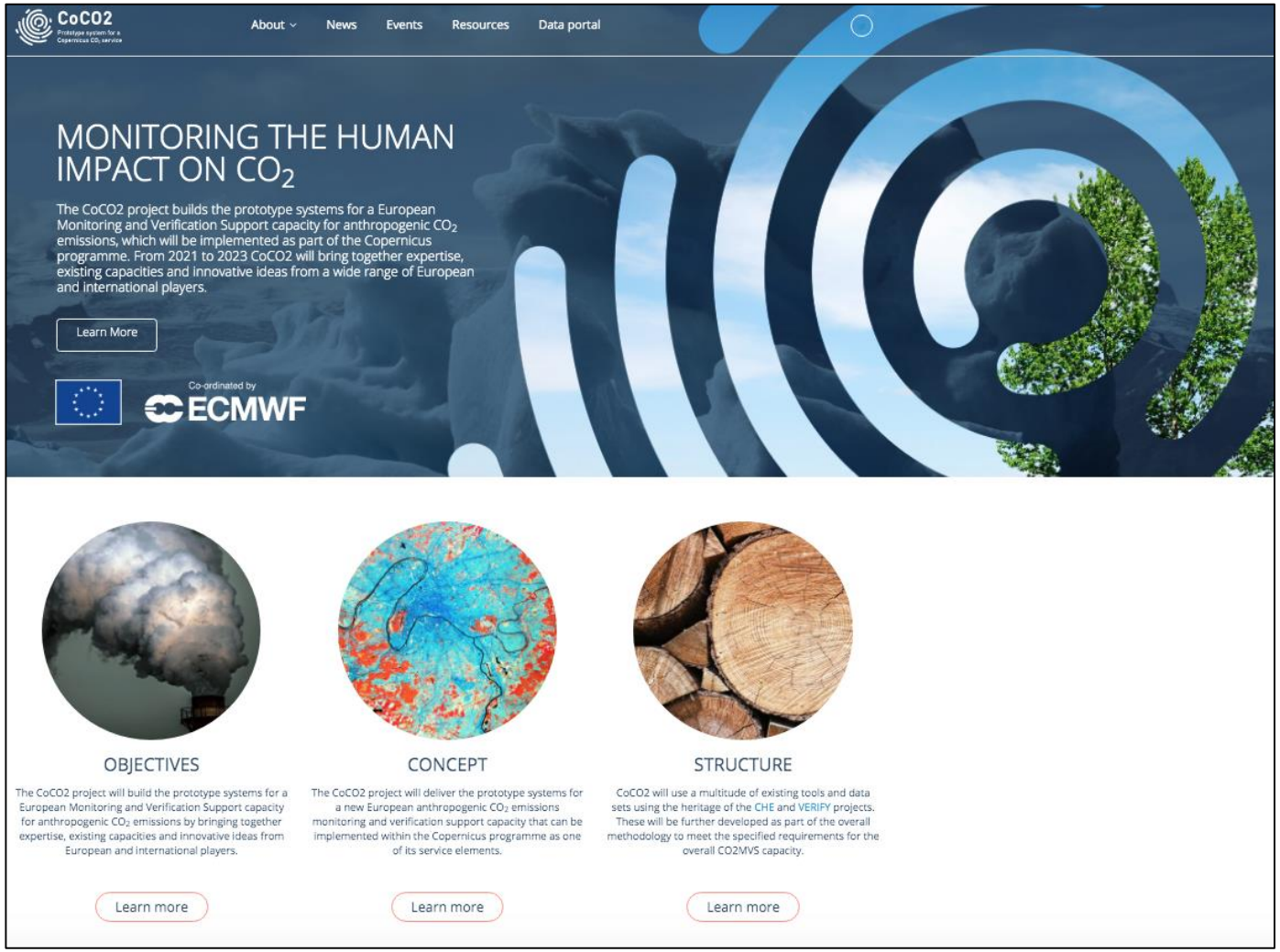
European Commission

esa

ECMWF

EUMETSAT

# CoCO2 website & social media

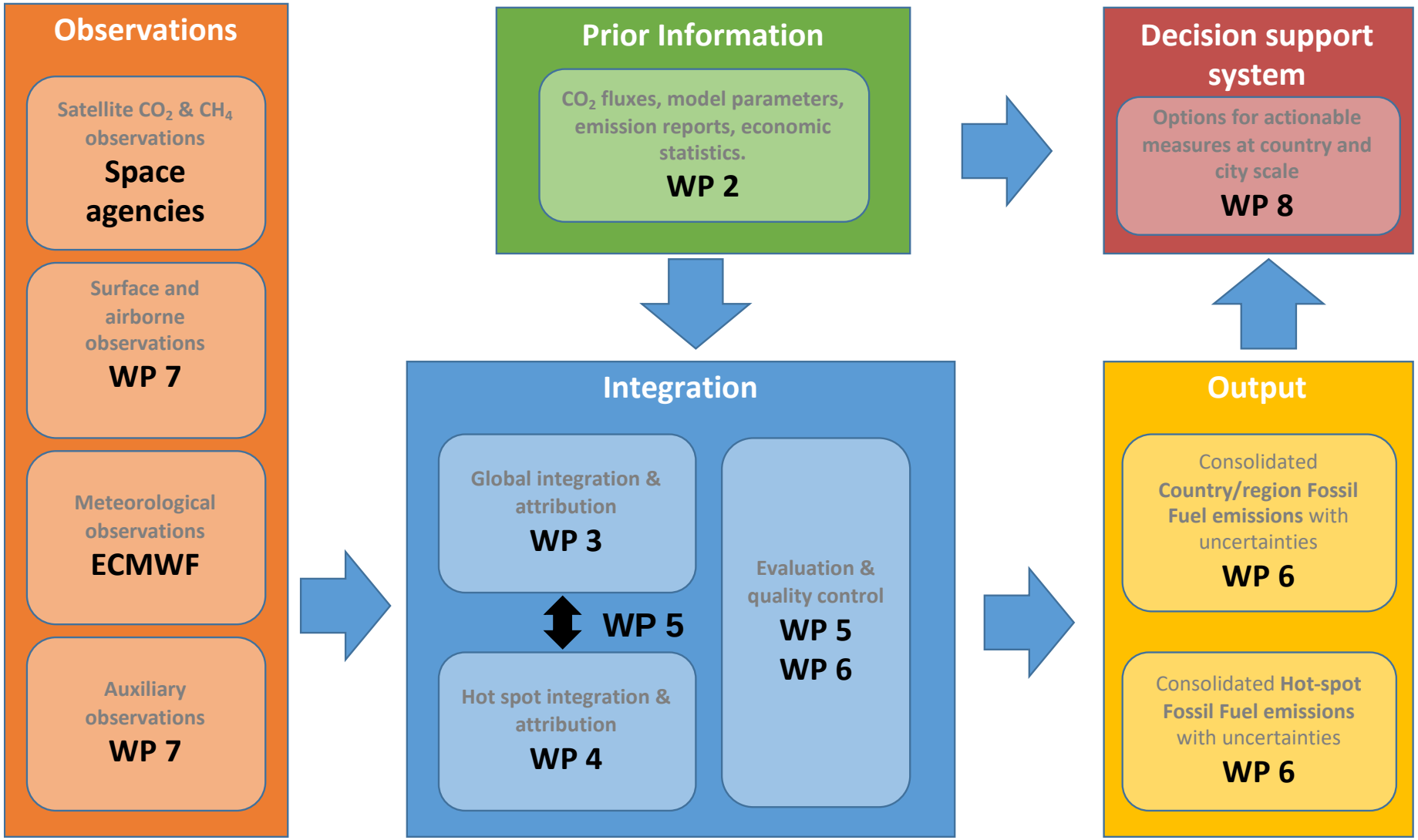




@CoCO2_project

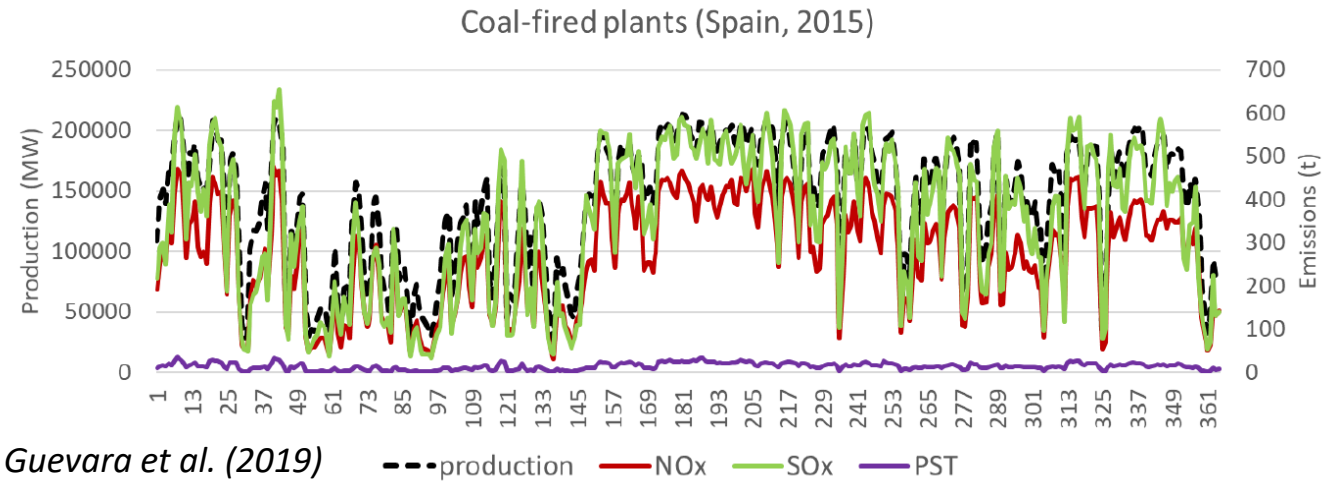
coco2-project.eu

# CoCO2 mapping onto CO2MVS structure

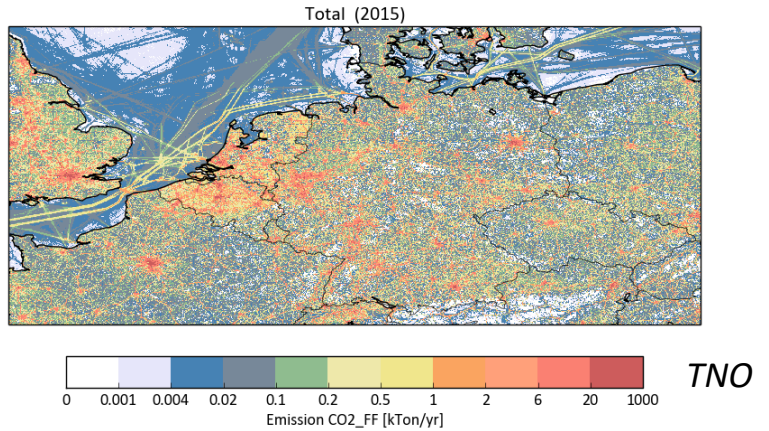
Data flow

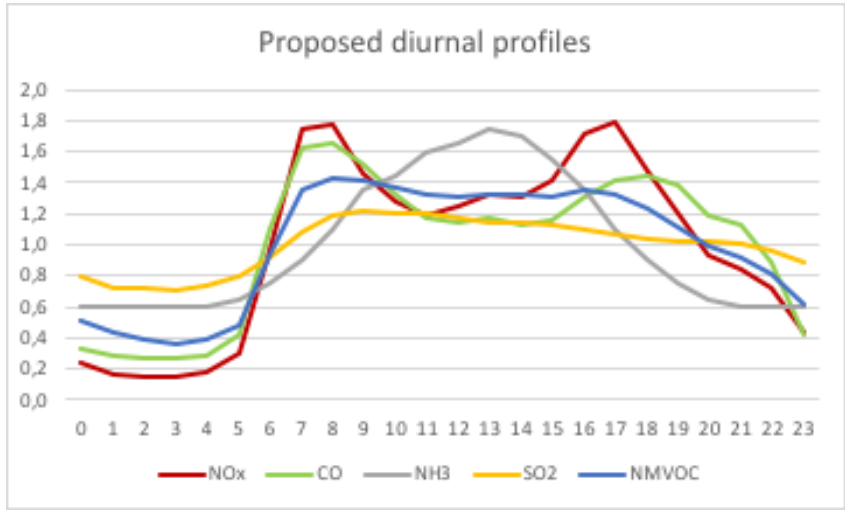


# WP 2 - (Offline) Prior and Ancillary Information

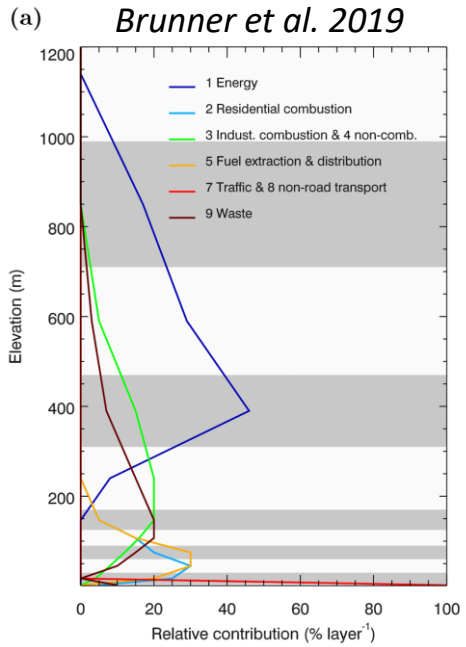



*Guevara et al. (2019)*




*Brunner et al. 2019*

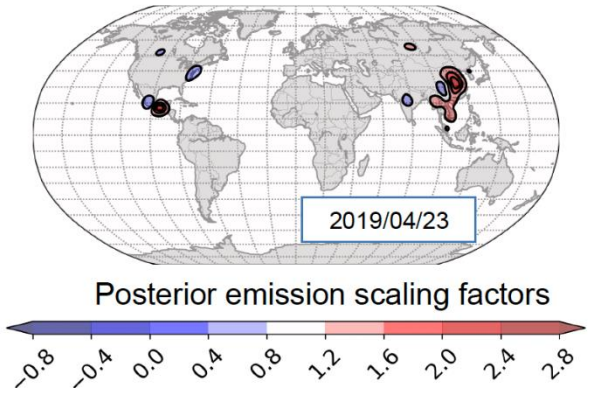


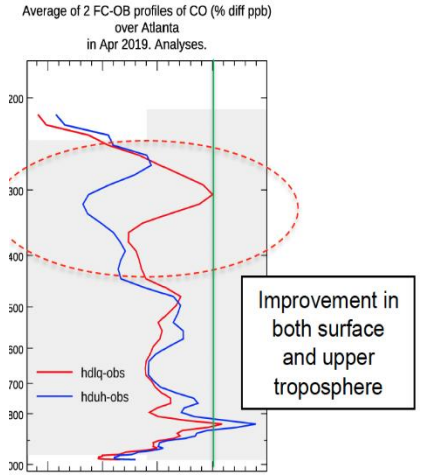

- Regional and global emissions
- Develop a mosaic emission data set
- Improvement of temporal and spatial profiles
- Development of emission models
- Uncertainties and correlations

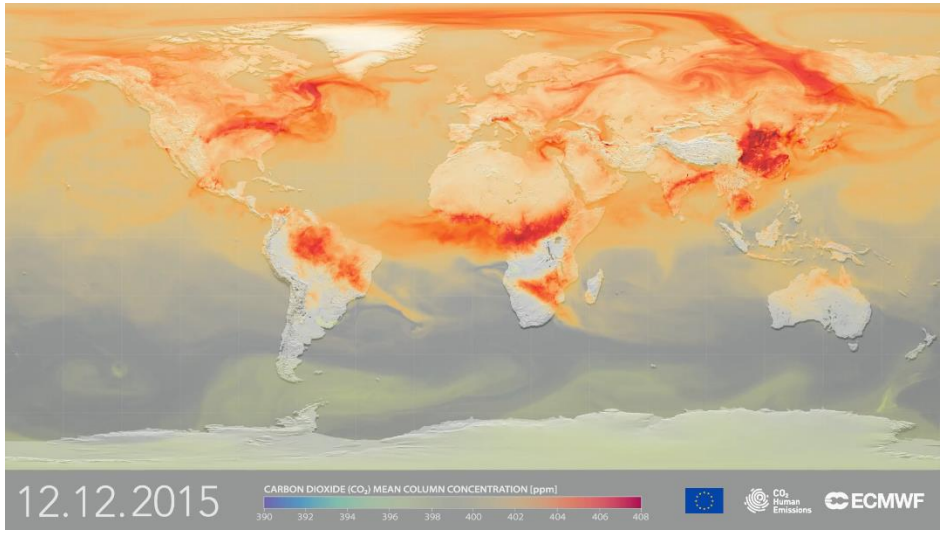


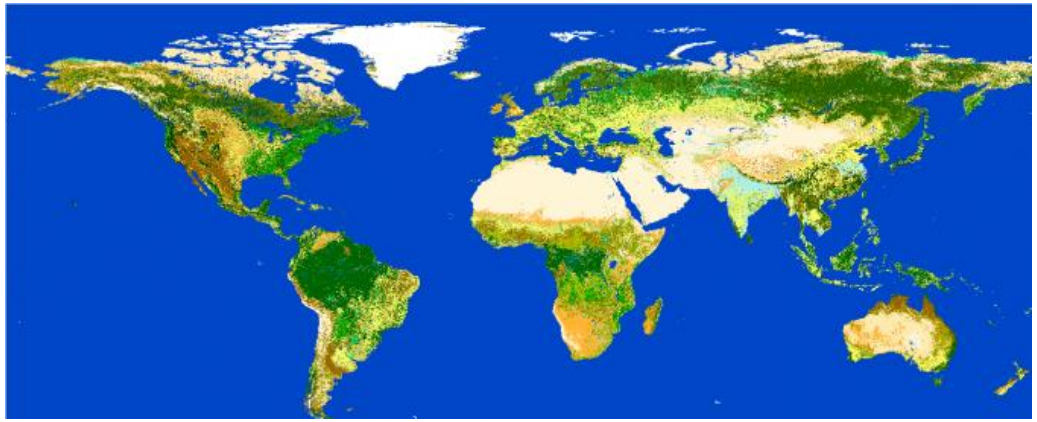
Lead: Hugo Denier van der Gon (TNO) & Greet Janssens-Maenhout (JRC)

# WP 3 - Development of global modelling and data assimilation capacity in an MVS



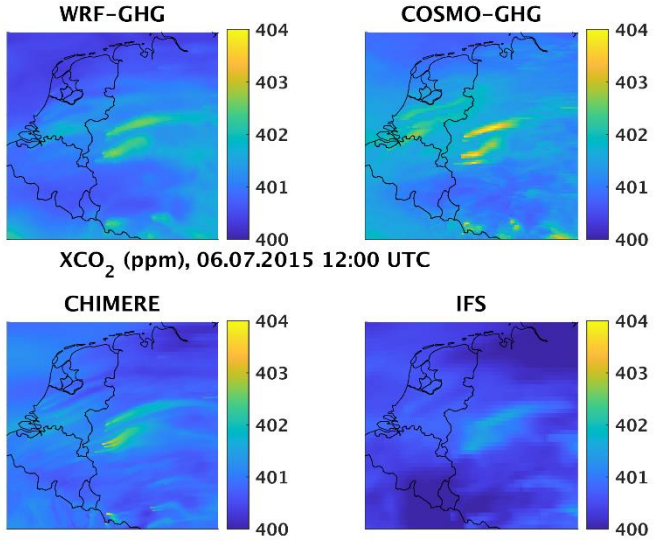



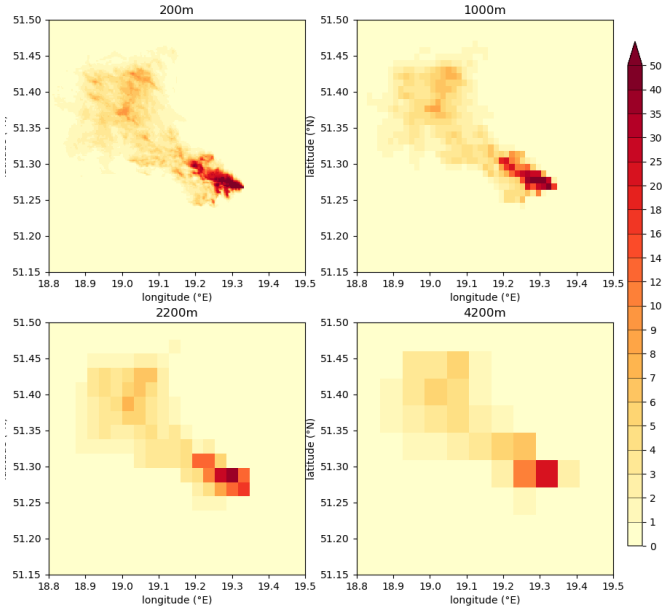
- Further develop global data assimilation system
- Further develop global transport modelling and produce new nature runs
- Further develop global land surface and emission modelling based on expertise in CoCO2 modelling groups

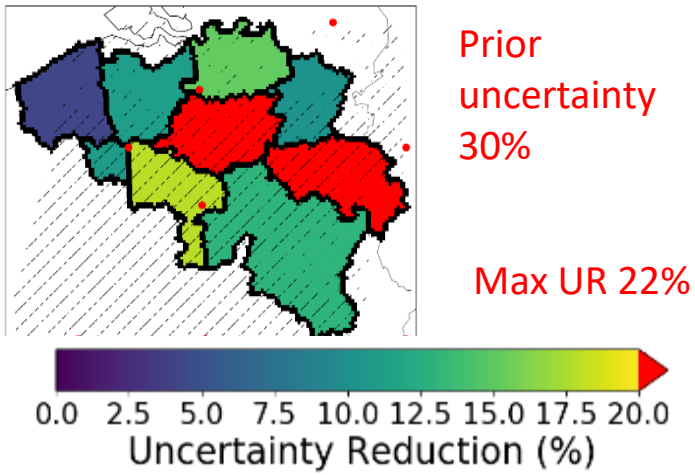


Lead: Wouter Peters (Wageningen University) & Anna Agusti-Panareda (ECMWF)

# WP 4 - Local and regional modelling and data assimilation




Prior uncertainty 30%

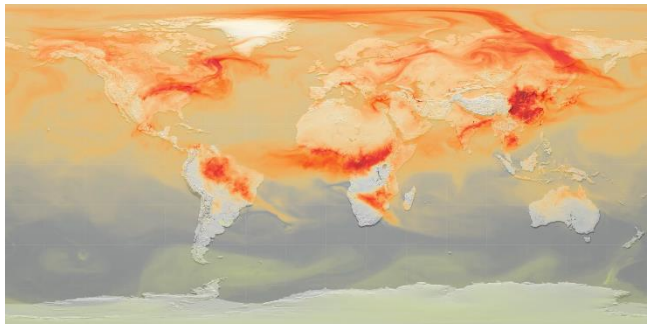
Max UR 22%

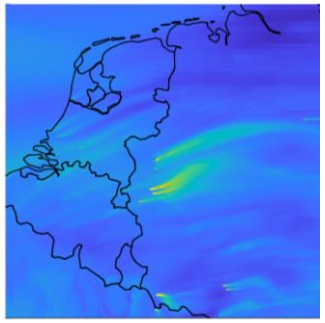
- Further develop local and regional transport modelling and produce library of plumes
- Further develop local inversion approaches (full transport and simplified)
- National-scale inversions and consistency with local inversions



Lead: Dominik Brunner (EMPA) & Gregoire Broquet (CEA)

# WP 5 - Connecting scales and uncertainties

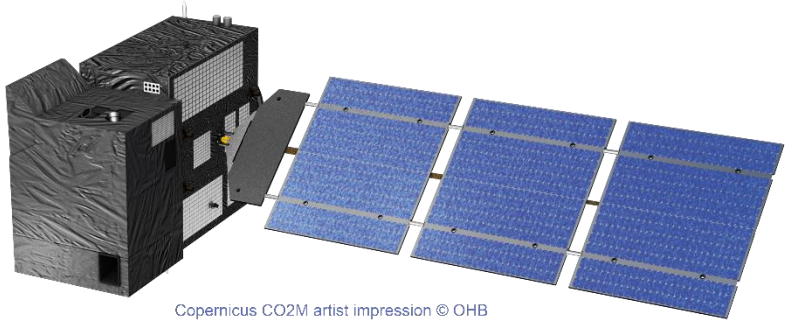




VPRM, CTESSEL, SDBM3, ORCHIDEE, ISBA

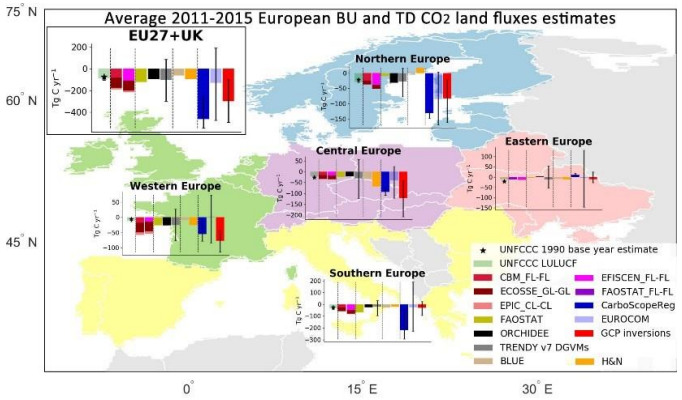
- transfer of information from global to local scales and vice versa
- Uncertainties in biogenic fluxes
- Uncertainties in inversion models
- Representation of observation uncertainty in inversions
- Test network design options in terms of output uncertainty
- Benchmarking of inversion performance

VERIFY CIF

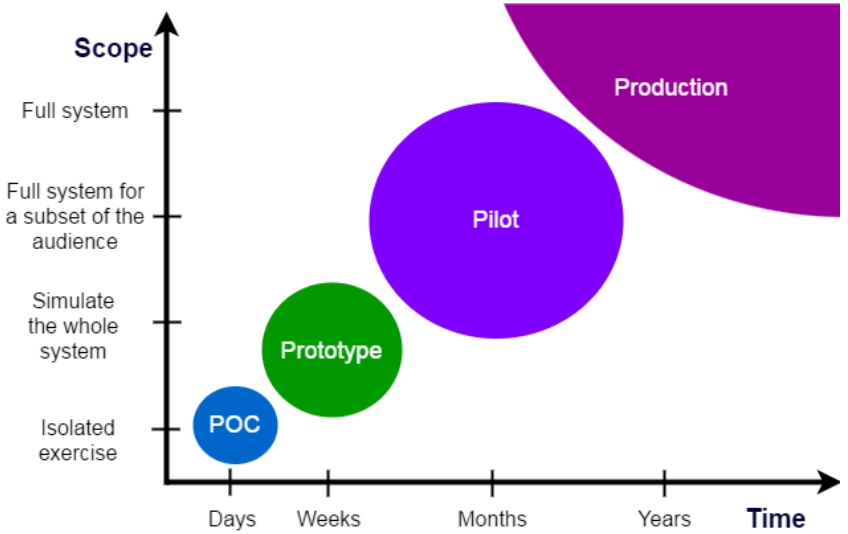


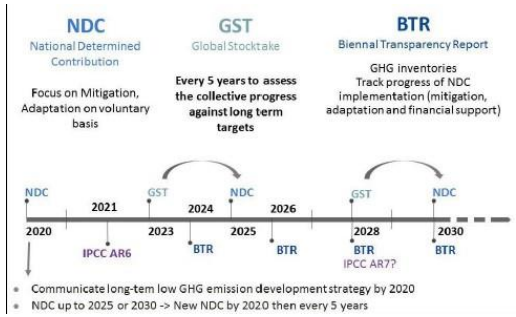
Copernicus CO2M artist impression © OHB

# WP 6 - Integration, testing, application and initial validation of prototype systems







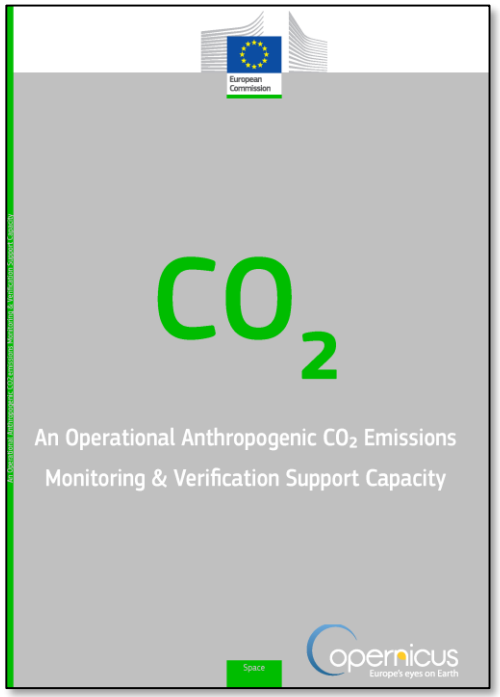




The Global Stocktake Under the Paris Agreement

Opportunities and challenges

- Continue VERIFY synthesis for 2021
- Continue VERIFY User Requirement Document
- Contribute to 1st Global Stocktake with sufficiently mature prototype systems
- Build pre-operational global multi-scale system
- Design EQC framework

# WP 7 - Observations

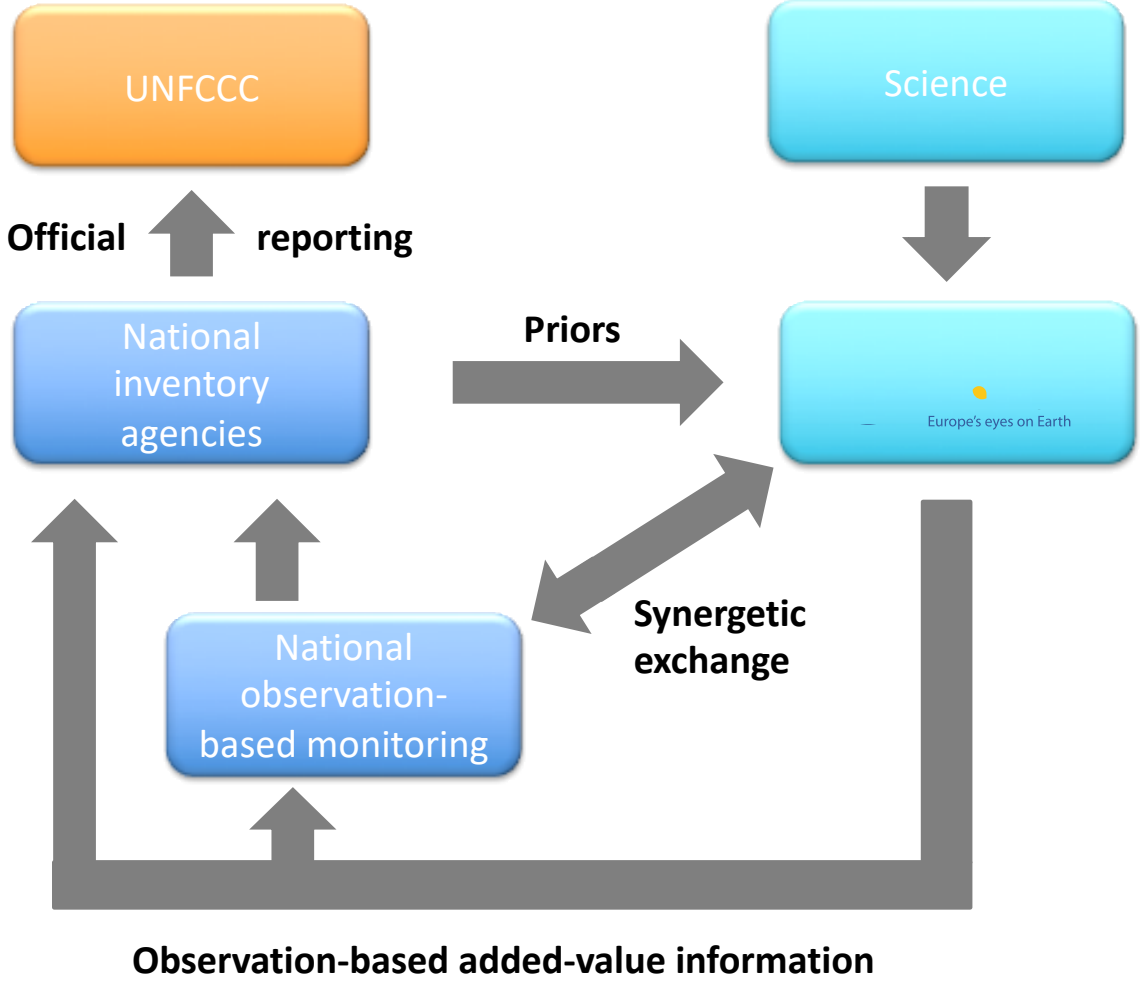


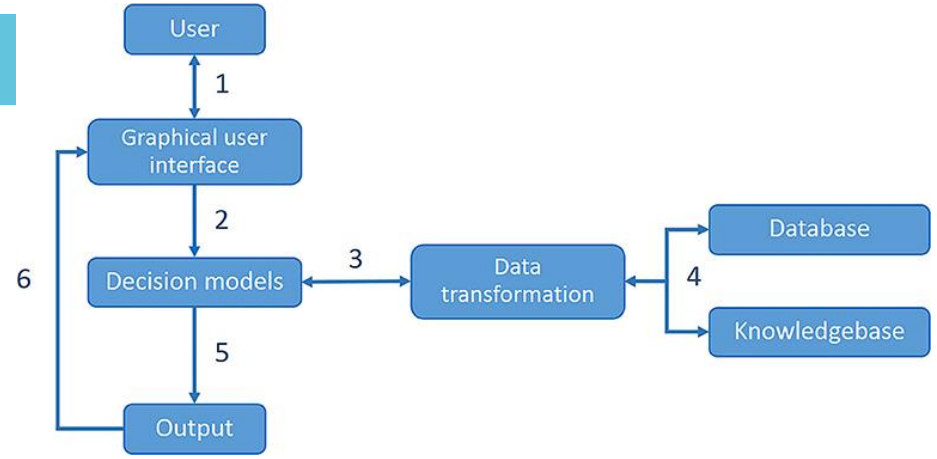

ICOS Integrated Carbon Observation System

IG3IS Integrated Global Greenhouse Gas Information System

- Living book of in situ requirements
- Identify and work with data providers to set discuss the metadata, data quality, and timeliness following WMO guidance
- Gap analysis
- Data pipeline for CO2MVS
- New measurement techniques and instruments

# WP 8 - User engagement




- Blueprint for Decision Support system
- Provide synthesis results as showcase
- Interact with user communities about fit-for-purpose prototype

IG3IS Integrated Global Greenhouse Gas Information System

United Nations Framework Convention on Climate Change

ICLEI Local Governments for Sustainability

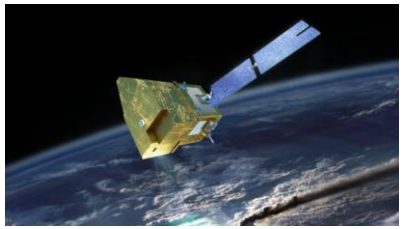
**CoCO2 Inventory Agency Advisory Board**



Lead: Han Dolman (Vrije Universiteit Amsterdam) & Glen Peters (CICERO)

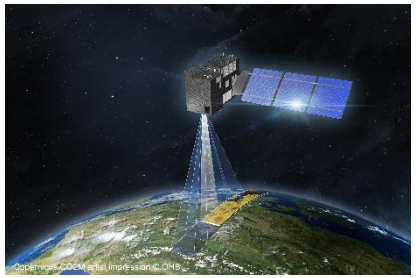
# Roadmap – gradual implementation of CO2MVS

Sentinel-5p, OCO-2, GOSAT

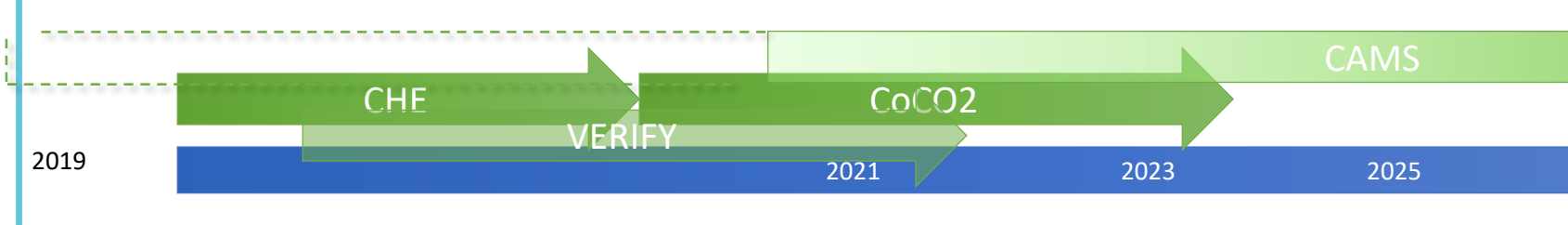


MicroCarb, Merlin, GHGSat, …

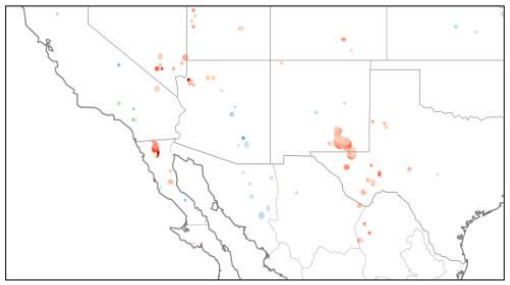
Sentinel-4 & Sentinel-5



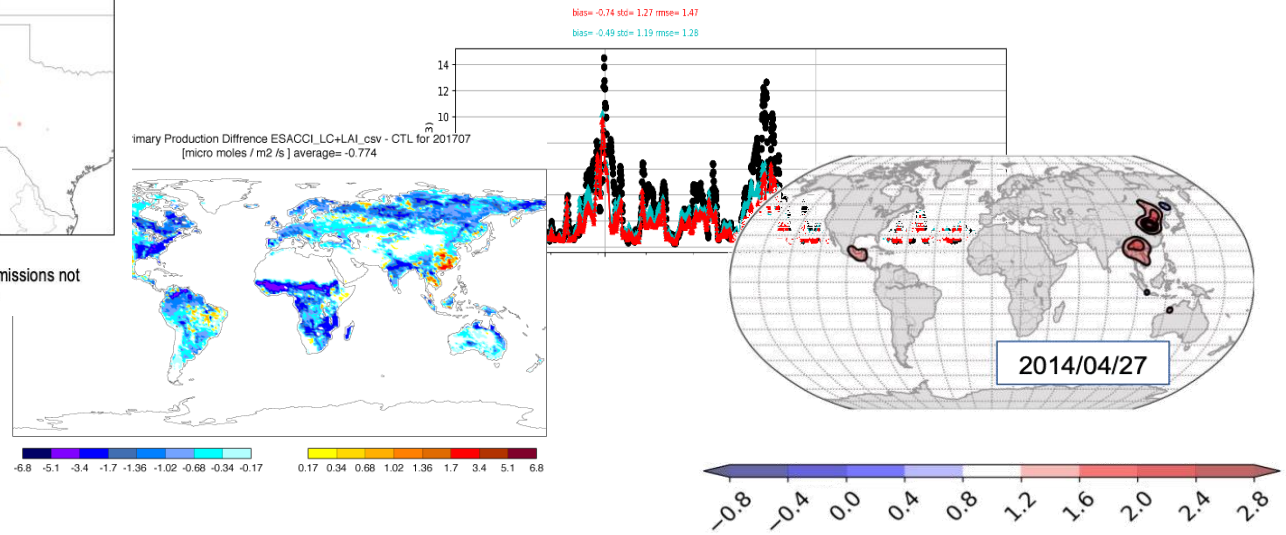
**CO2M**




Improved prior emissions, modelling & data assimilation



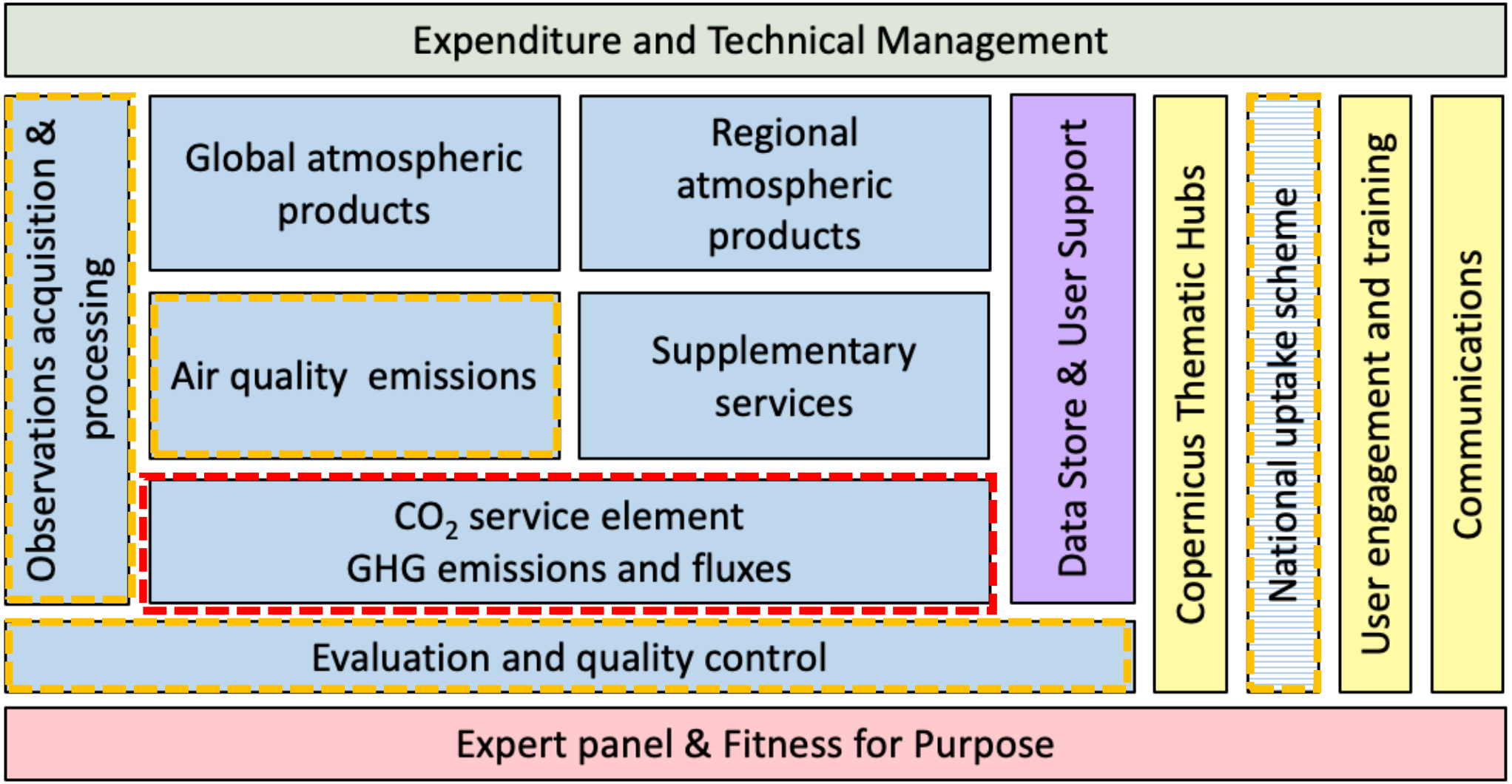
CH4 anomaly monitoring




$CO_2$ & $CH_4$ developments will be integrated in operational CAMS systems as they mature.

This will gradually build up the full $CO_2$ prototype system, for operational implementation and testing between 2024 and 2025, in readiness for the launch of the CO2M mission.

# CAMS_2.0 (1 July 2021 – 30 June 2028)

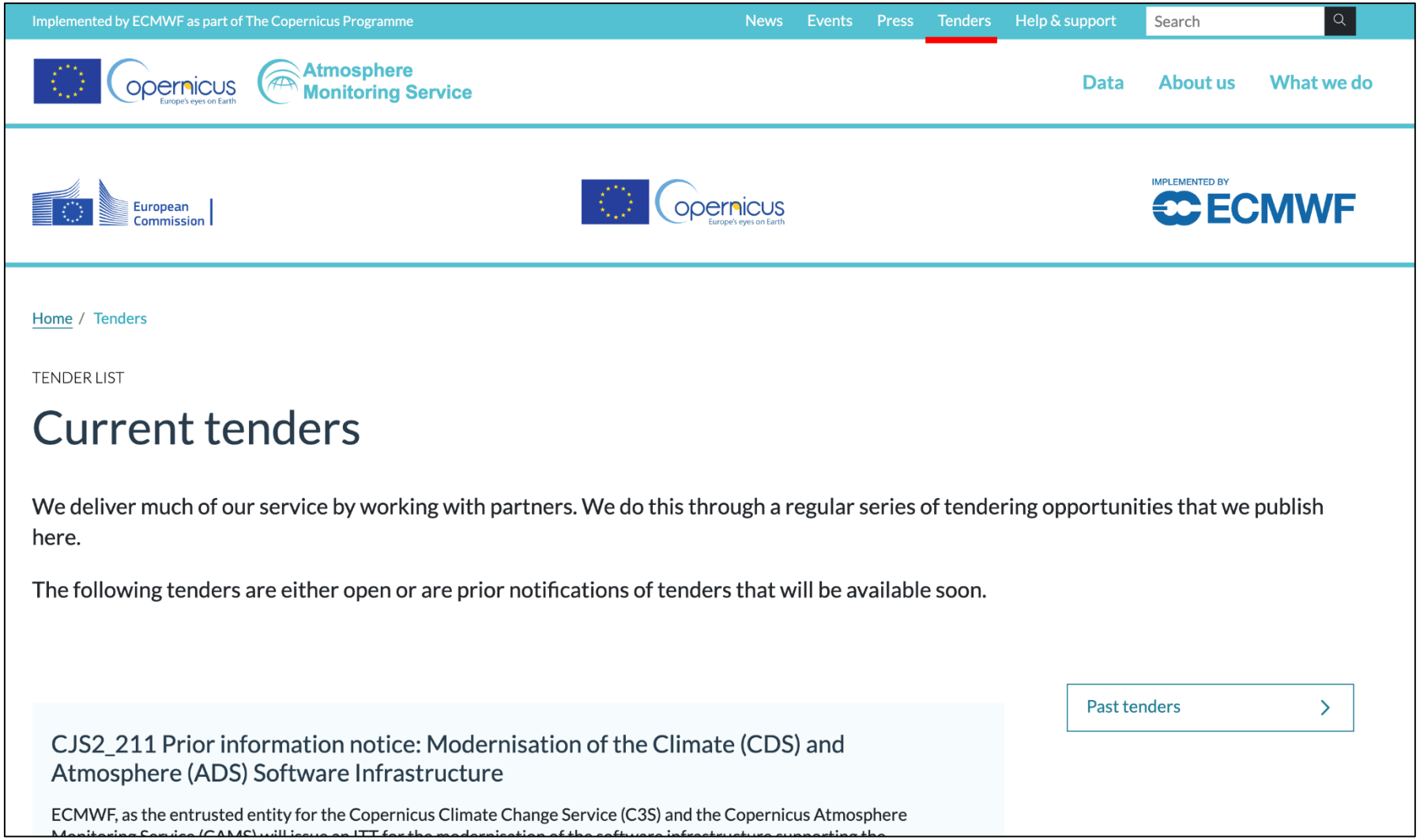


# CAMS Technical Annex – CO2MVS related topics

| | |
|---|---|
| CAM2_5000: CO2 and other greenhouse gas emissions and fluxes | CAM2_5100: Emission inventories of greenhouse gases |
| | CAM2_5200: Development and provision of global observation-based emissions and fluxes |
| | CAM2_5300: Development and provision of hot-spot observation-based emissions |
| | CAM2_5400: Co-design of specific user services |
| | CAM2_5500: Provision of supplementary greenhouse gas services |
| CAM2_6000: Air quality emissions | CAM2_6100: Global emission inventories of reactive gases and aerosols |
| | CAM2_6200: Regional emission inventories of reactive gases and aerosol |
| | CAM2_6300: Observation-based emissions of reactive gases and aerosol |
| | CAM2_6400: Observation-based emissions from wildfires |
| CAM2_2000: Decentralised activities on atmospheric composition In-Situ observations | CAM2_2100: Acquisition of ACTRIS data |
| | CAM2_2200: Acquisition of EEA/EIONET data |
| | CAM2_2300: Acquisition of EAN European Pollen Information data |
| | CAM2_2400: Acquisition of GAW data |
| | CAM2_2500: Acquisition of IAGOS data |
| | CAM2_2600: Acquisition of ICOS data |
| | CAM2_2700: Acquisition of NDACC data |
| | CAM2_2800: Acquisition of in situ data from international networks |
| CAM2_7200: National collaboration | |
| CAM2_8400: EQC of emission and surface fluxes products | |

Subject to signature of Contribution Agreement

# CAMS distributes through ITTs



# THANK YOU

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Prototype system for a Copernicus $CO_2$ service

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958927.