



Atmosphere Monitoring

# Nature runs for AQ and GHG in CAMS and CHE

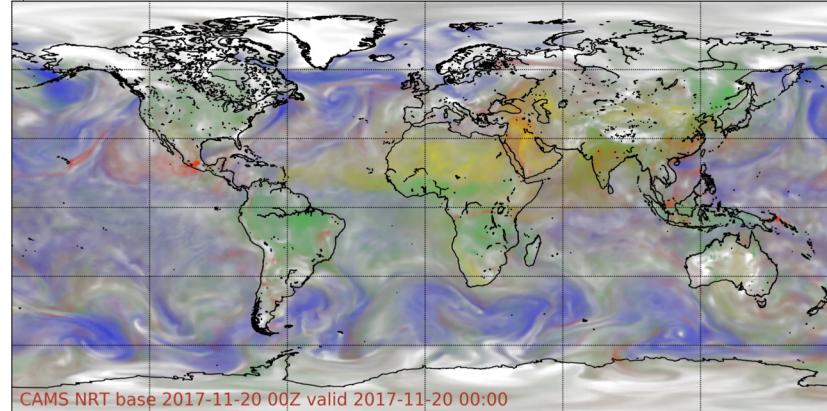
Richard Engelen, Anna Agusti-Panareda





# Copernicus Atmosphere Monitoring Service

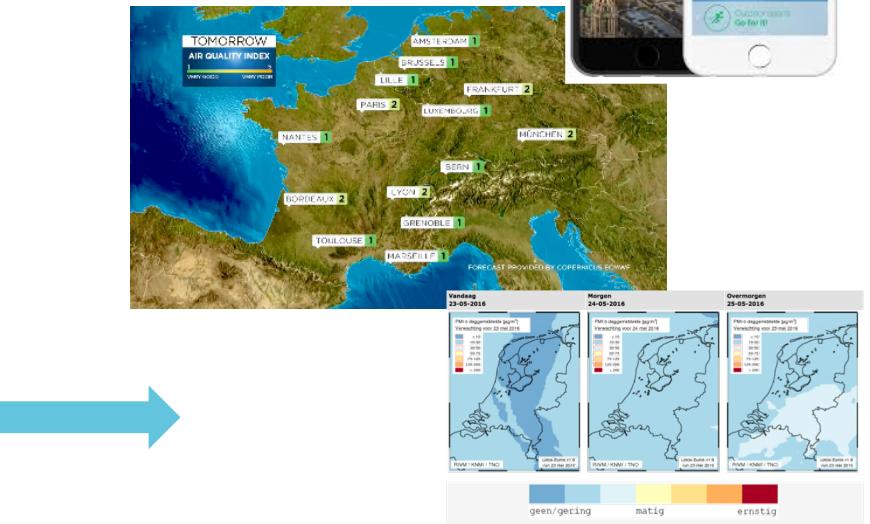
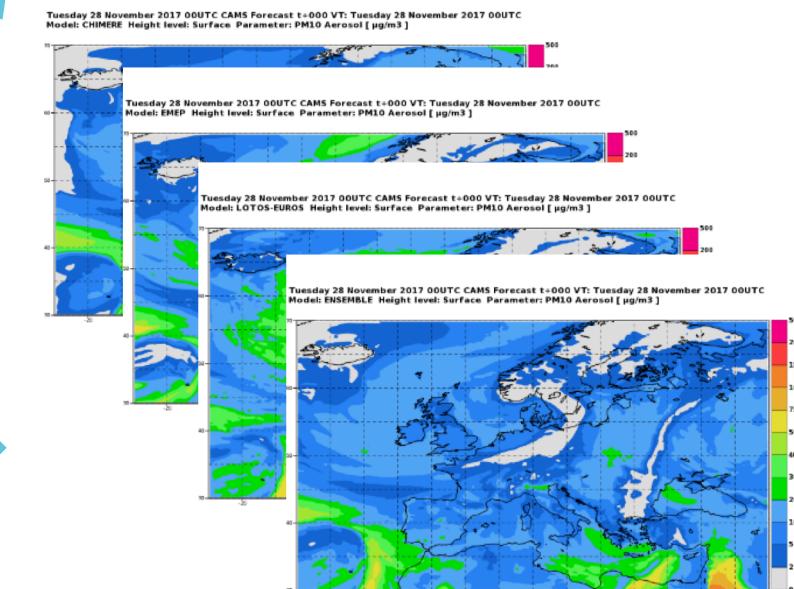
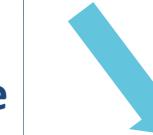
Atmosphere  
Monitoring



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Transforming satellite  
observations into user-  
driven services.



IMPLEMENTED BY  
ECMWF

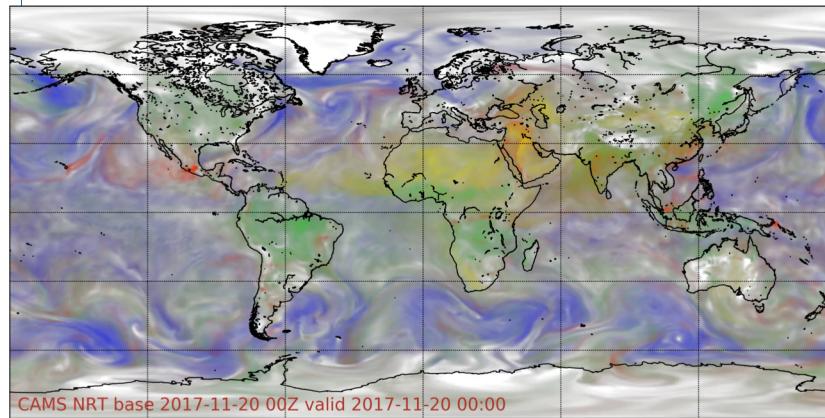
Copernicus  
Europe's eyes on Earth

European  
Commission

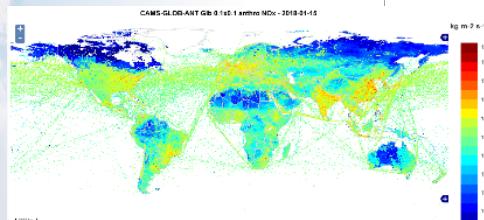
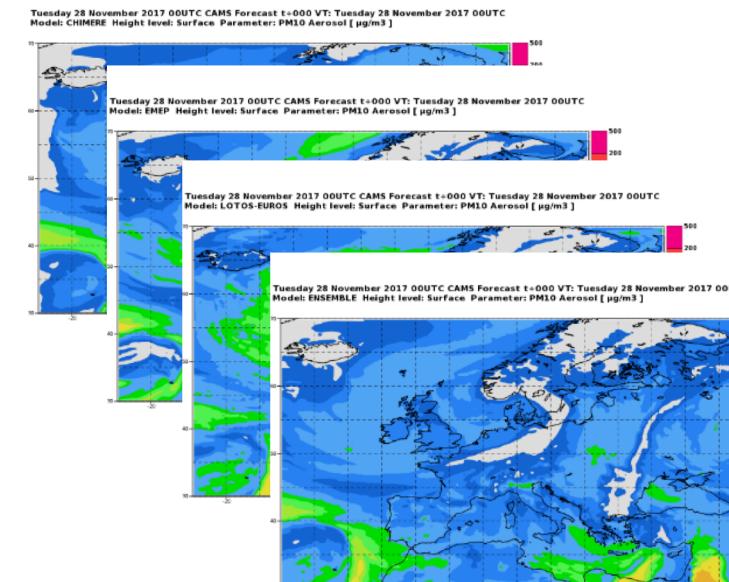
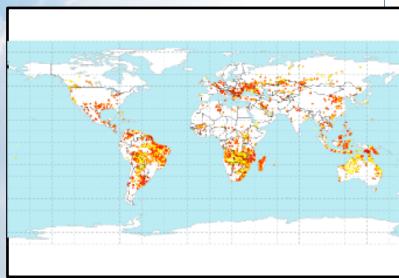


# Copernicus Atmosphere Monitoring Service

Atmosphere  
Monitoring

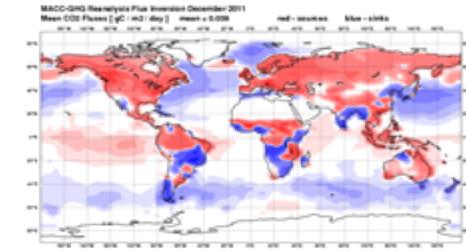


## Fire emissions

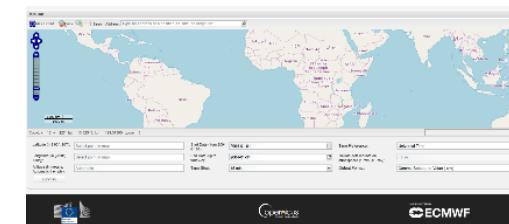
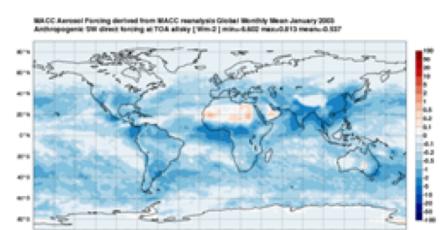


## Emissions

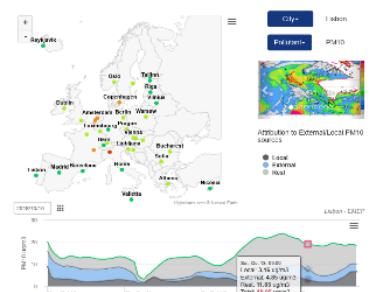
## Greenhouse gas fluxes



## Radiative forcing



## Solar radiation



## Policy tools

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ECMWF

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Europe's eyes on Earth

European  
Commission



# CAMS data sets

Atmosphere  
Monitoring

## CAMS global reanalysis

- chemical and aerosol species
- 2003 – 2018
- 80 km; 60 levels

## CAMS global GHG reanalysis

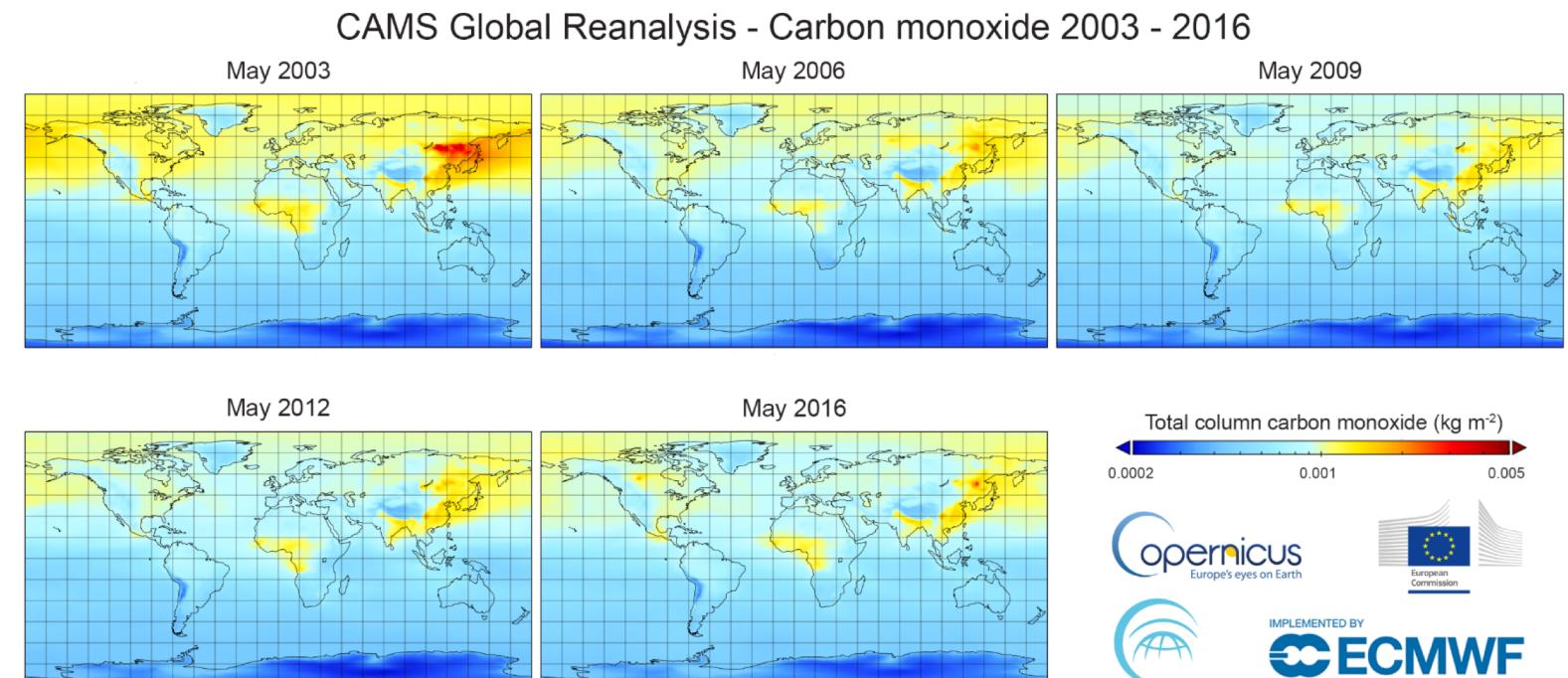
- CO<sub>2</sub> & CH<sub>4</sub>
- 2003 – 2018 (in progress)
- 80 km; 60 levels

## Control runs for reanalysis

- Details as reanalysis

## Flux inversions with corresponding atmospheric concentrations

- CO<sub>2</sub>, 1979 – 2018, 3.75° x 1.9°, 39 levels, 3-hourly
- CH<sub>4</sub>, 1900 (2009) – 2017, 6° x 4°, 25 levels, 6-hourly
- NO<sub>2</sub>, 1995 – 2017, 3.75° x 1.9°, 39 levels, 3-hourly



# CHE-CO<sub>2</sub> Human Emission Project (& its numbers)

## Aim:

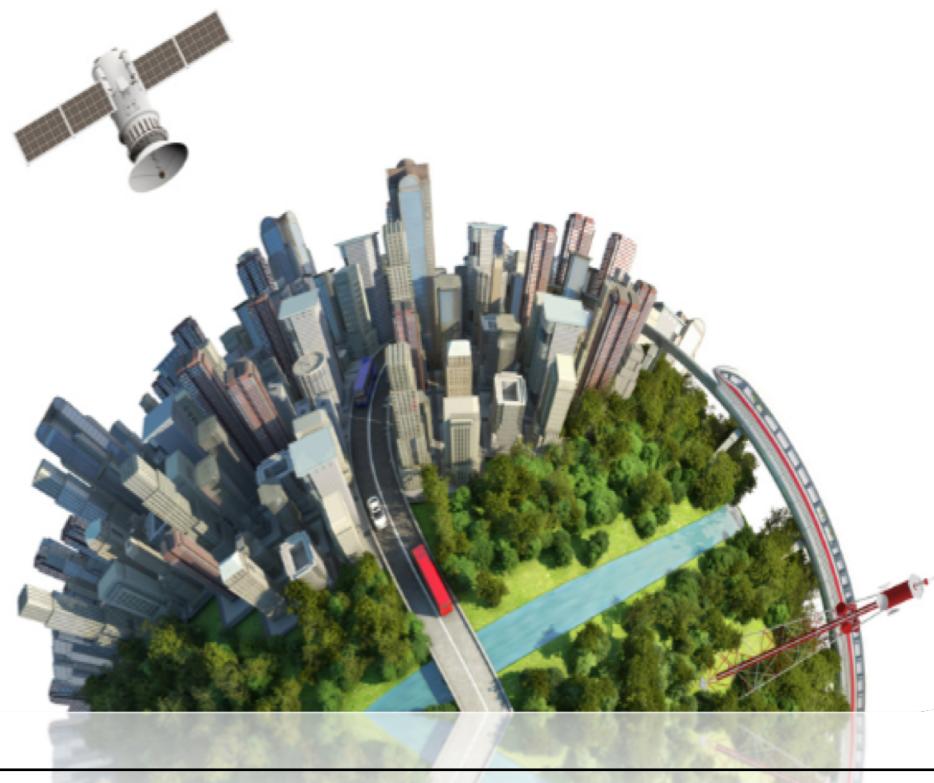
Build European monitoring capacity for anthropogenic CO<sub>2</sub> emissions

## How:

CO<sub>2</sub> emission estimation system driven by Earth observations (remote sensing and in situ) combined with enhanced modelling system

## Why:

To support the Paris Climate Agreement and its implementation



## Project Duration:

**39 month**

## Project Funding:

**3.75 ME** (1.25 ME/year)

## Consortium Numbers

**22 partners** Institutes

## Work Content Numbers

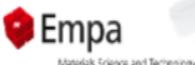
**7 work-packages:**

5-Science development,  
1-International liaison,  
1-Management & Coms

**7 Milestones**

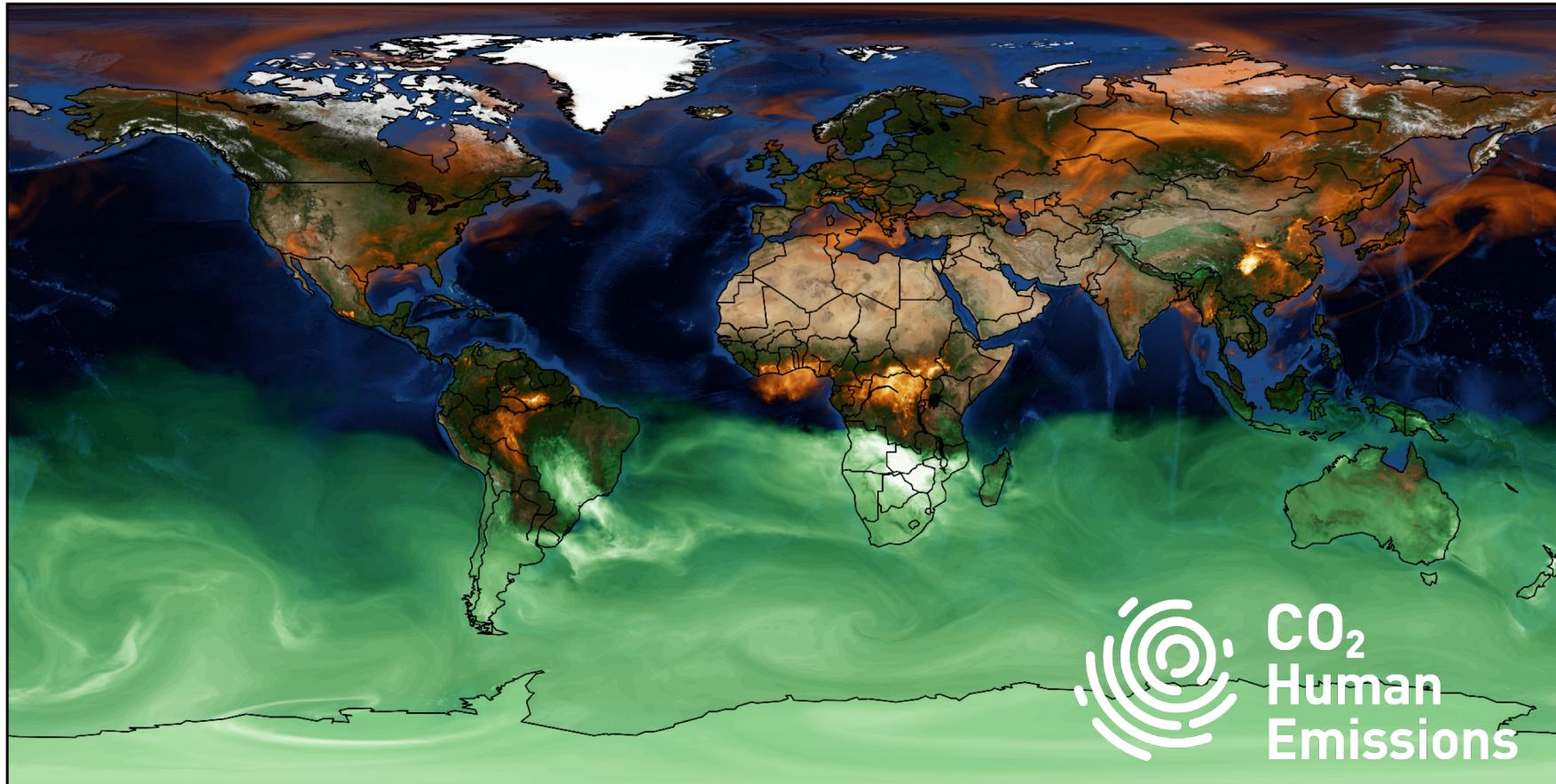
**45 Deliverables**

**344.25 Person Month**  
**(Eq 8.8 FTE)**



# Global nature run

20150101 12 UTC XCO<sub>2</sub>



CO<sub>2</sub> HUMAN EMISSIONS

<https://www.che-project.eu/news/che-tier-1-co2-global-nature-run>

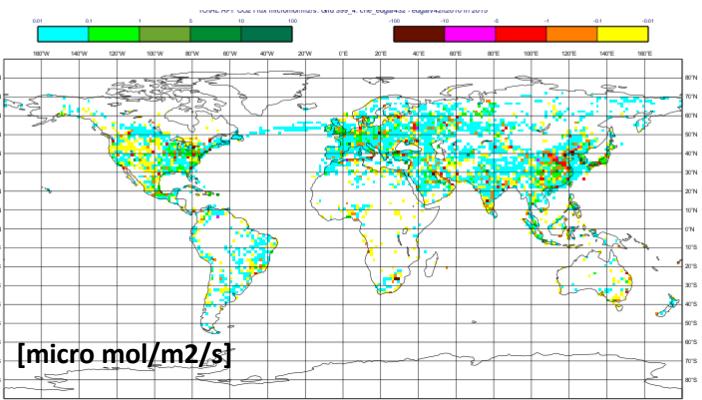
CO<sub>2</sub>, CH<sub>4</sub>, linCO, tagged  
tracers at Tco1279  
(~9km) L137  
(Agusti-Panareda et al.,  
2019, ACP)

- CTESSEL NEE (BFAS correction Agusti-Panareda et al. ACP 2016)
- EDGARv4.2FT2010
- Takahashi et al. (2009)
- GFAS biomas burning
- IFS transport
- Bermejo & Conde mass fixer (Agusti-Panareda et al. 2017, GMD)

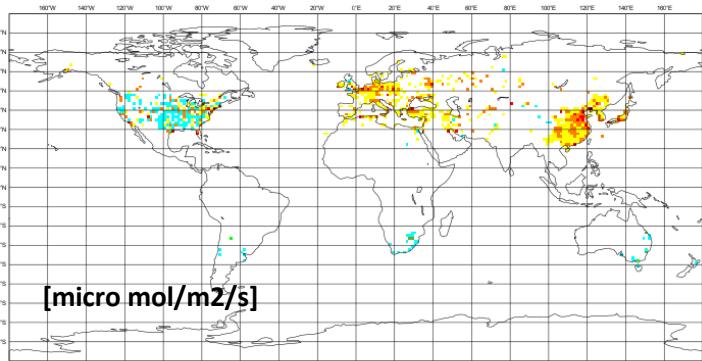
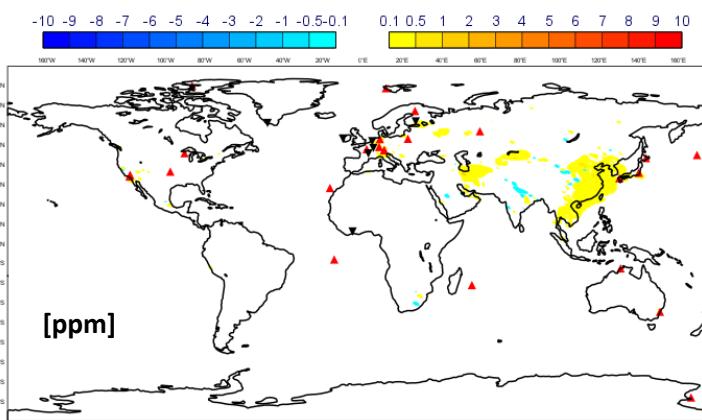
# ECMWF progress on CO<sub>2</sub>/CH<sub>4</sub> global nature runs

- Tier1 nature run (available now)
  - IFS CY43R1
  - Annual EDGARv4.2FT2014
  - Monthly ocean fluxes from Takahashi et al. (2009)
  - Tagged CO<sub>2</sub> tracers with anthropogenic, biogenic, ocean, biomass burning emissions
- Tier2 nature run (December 2019)
  - IFS CY46R1
  - EDGARv4.3.2 with monthly profiles (EDGARv4.2FT2010)
  - New ocean fluxes from SOCAT (Roedenbeck v16)
  - New tagged CO<sub>2</sub> tracers with ECMWF emission groups (energy, manufacturing, transport, settlements, other)
  - Update of NEE bias correction (BFAS, Agusti-Panareda et al. 2016)

CO<sub>2</sub> HUMAN EMISSIONS

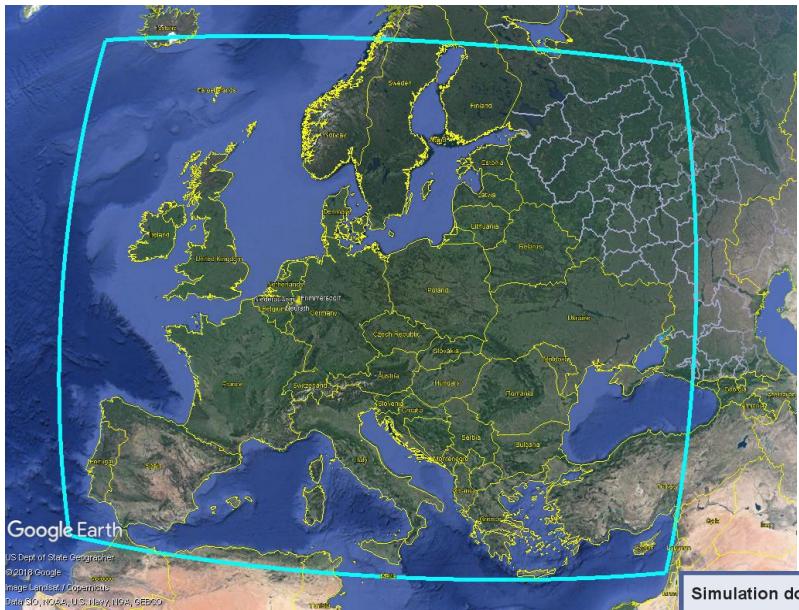


CO2 FF EMISSIONS: CHE EDGARv4.2.3 January – Annual mean

XCO<sub>2</sub> January: CHE EDGARv4.2.3 monthly - EDGAR v4.2FT2010 ANNUAL MEAN

# Series of regional simulations

COSMO  
WRF  
LOTOS-EUROS



More details on request.  
Data will become  
available on CHE website.

CO<sub>2</sub> HUMAN EMISSIONS

