



Copernicus for methane monitoring

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Relevant EU Policies

- European Climate Law
 - Economy-wide climate neutrality by 2050 and reduction commitment of net greenhouse gas emissions of at least 55% below 1990 levels by 2030
- EU's 2030 Climate Target Plan
 - Roadmap to achieve climate goals. Highlights the need to step-up reductions in methane emissions.
- The European Green Deal
 - The Methane Strategy: setting out measures to cut methane emissions in the EU, including in the energy sector, and internationally

EU Methane Legislative Proposal

- Part of the hydrogen and gas market decarbonisation package
- Proposal for a regulation on methane emissions reduction in the energy sector
- Will make use of both Copernicus and IMEO
- Super emitter monitoring tool
 - “(...) the Commission shall establish a global methane monitoring tool based on satellite data and input from several certified data providers and services, including the Copernicus component of the EU Space Programme.”

Observations

- Satellite remote-sensing
- In situ and ground-based remote-sensing
- Concentrations are not emissions

Numerical modelling

- Based on weather modelling approaches
 - Forecasts and “what if?” questions

What are the actual emissions of CH₄? Are policies effective?

Emissions inventories / “bottom-up”

- Official reporting by countries, commitment
- Often lagging by 2-4 years
- Uncertainties due to unknowns (and unknown unknowns)

Observations based emissions / “top-down”

- Use of models as transfer between “bottom-up” emissions and observations

Copernicus

- Earth Observation component of the EU Space Programme
- Partnership between the EC, ESA and EUMETSAT
- 8 satellites in orbit, the Sentinels
- 6 services: Land, Marine, Climate, Atmosphere, Emergency, Security, plus in-situ
- ~ 16 Terabytes per day
- Free and open data policy



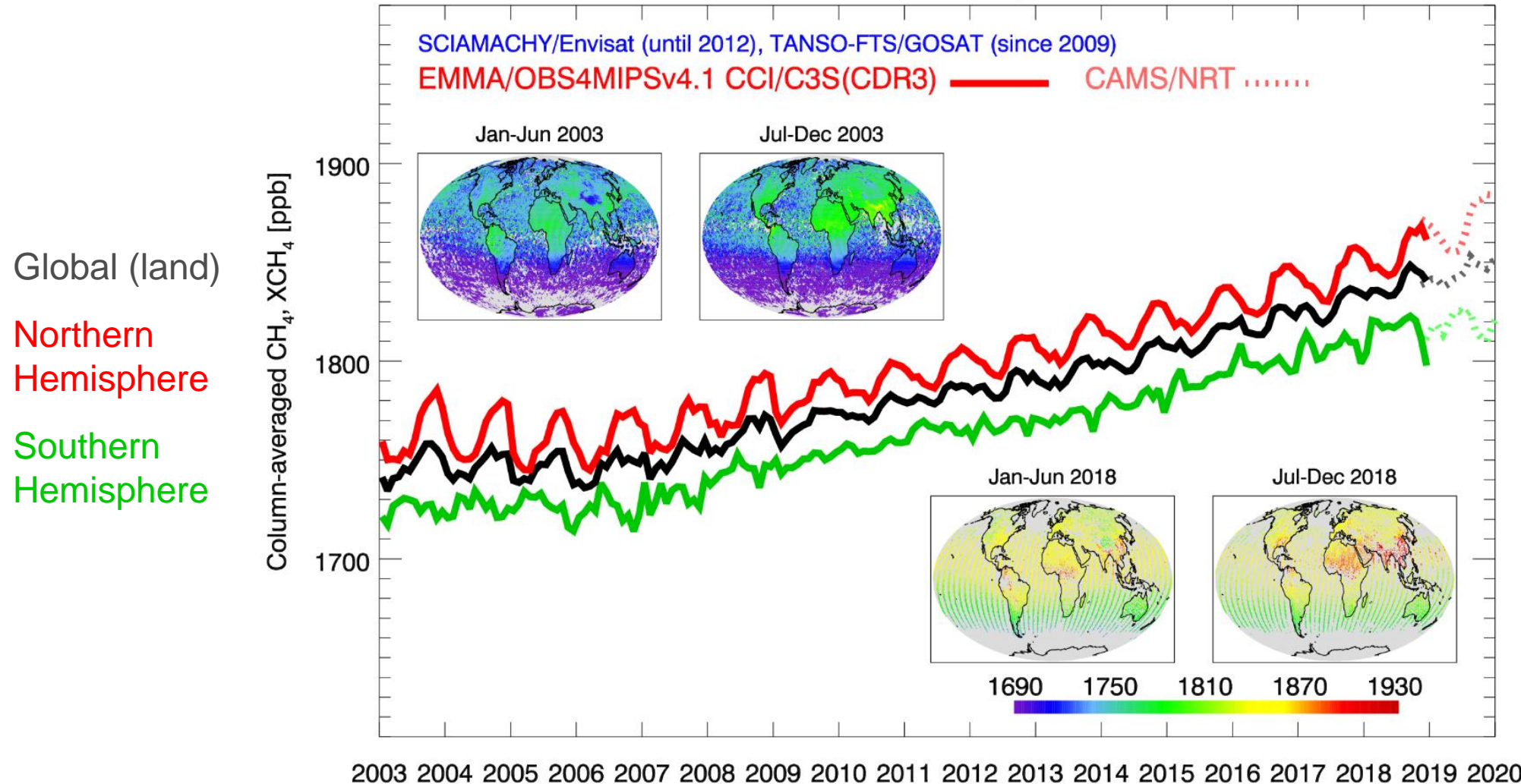
Copernicus Atmosphere Monitoring Service

- Implemented by the European Centre for Medium-Range Weather Forecasts (ECMWF)
- Consistent and quality-controlled information related to air pollution and health, solar energy, greenhouse gases and climate forcing, everywhere in the world
- Forecasts, observations, tools



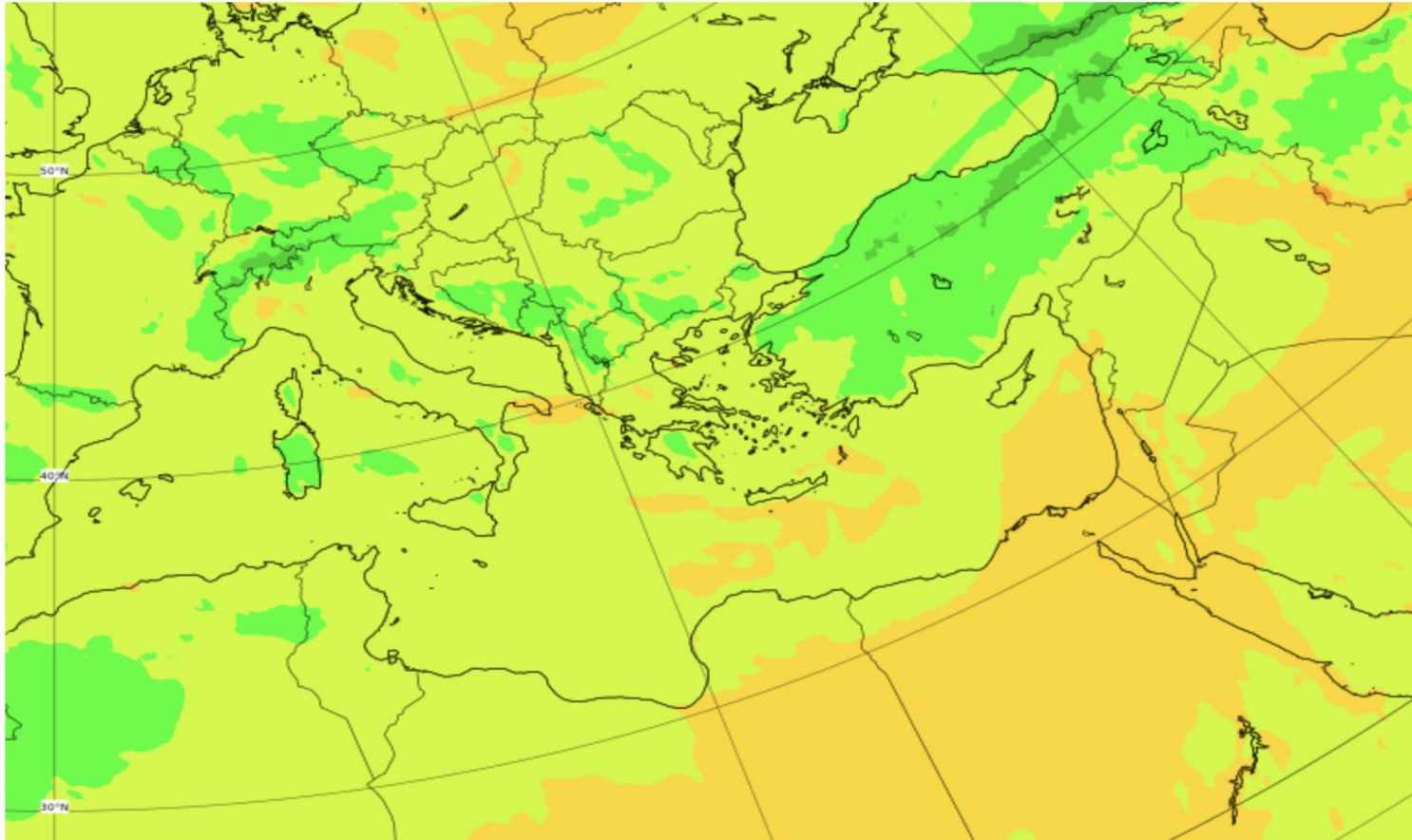
C3S-CAMS monitoring of atmospheric CH₄

Atmospheric Methane (CH₄) from Satellites



Available: CAMS worldwide CH₄ forecasts

Total column of methane [ppbv] (provided by CAMS, the Copernicus Atmosphere Monitoring Service)
Sunday 28 Feb, 00 UTC T+60 Valid: Tuesday 2 Mar, 12 UTC



0 1660 1700 1740 1780 1820 1860 1900 2320



Column averaged CH₄
(ppbv)

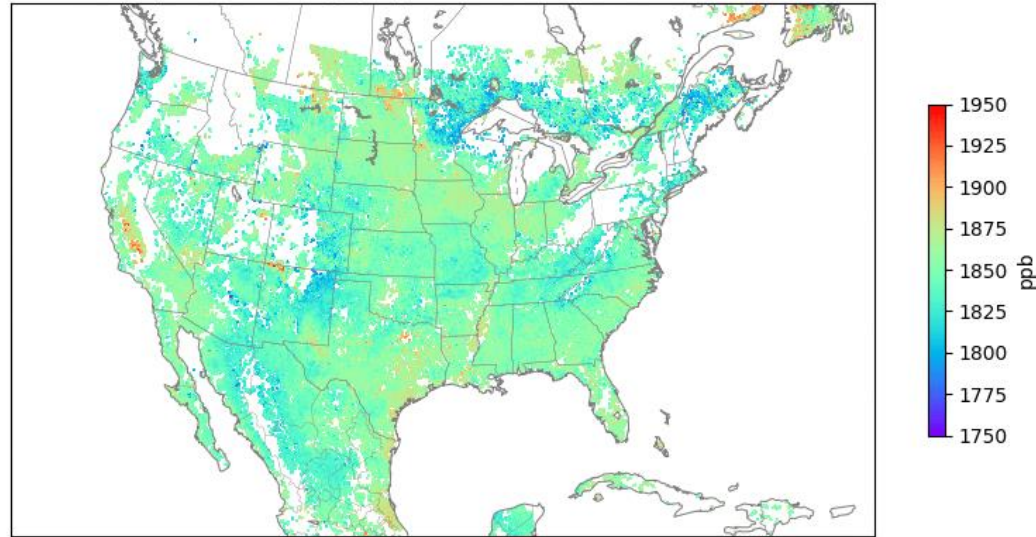
What are the expected concentrations of methane in the world over the next five days?

Depends on emissions and weather.

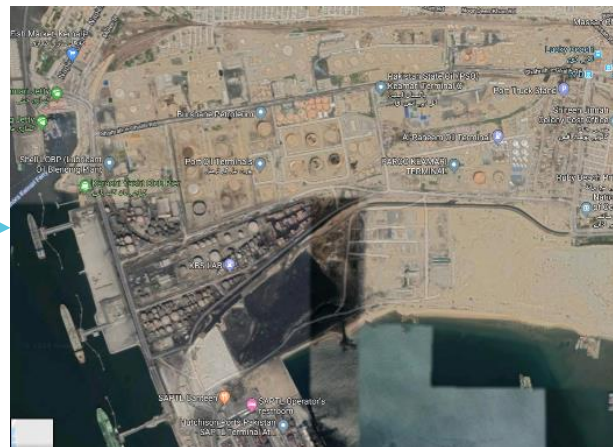
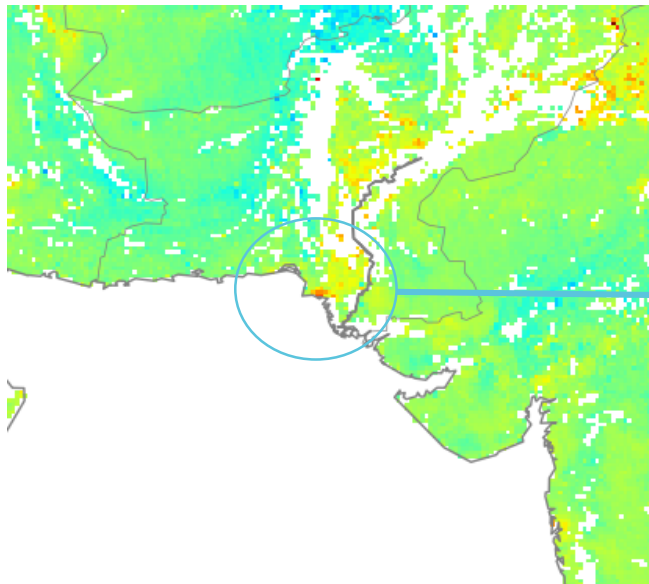
High-resolution satellite observations of CH₄

USA

TropOMI Monitoring Jan_2019 Mean Observation values



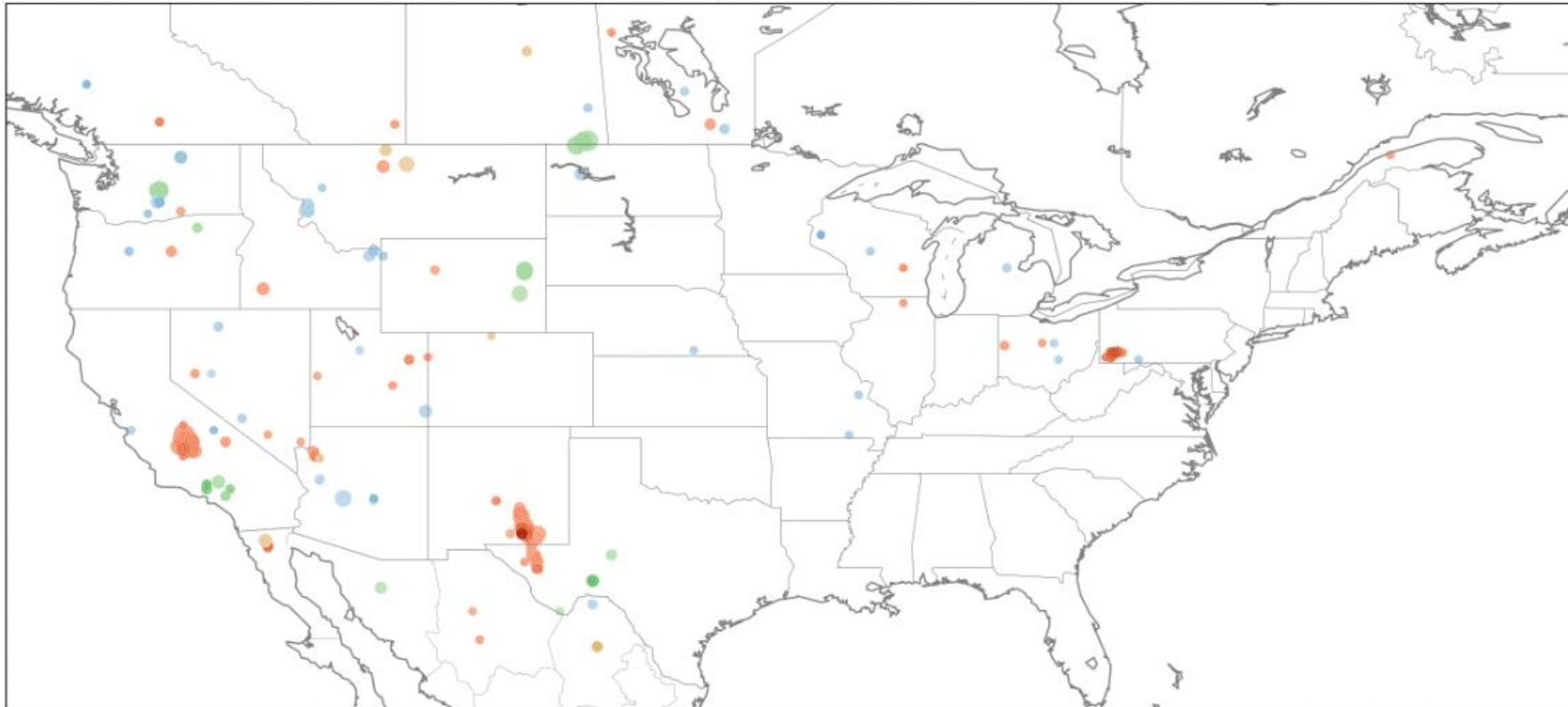
- Sentinel-5P TropOMI CH₄ product (worldwide) produced by ESA and SRON
- Unprecedented pixel size (**5 km** x 3.5 km) and processing algorithms still relatively new
- Monitoring against CAMS forecasts pivotal to improve the processing: **biases** (due to clouds, surface temperature, surface reflectance...) depend upon location, season



Karachi

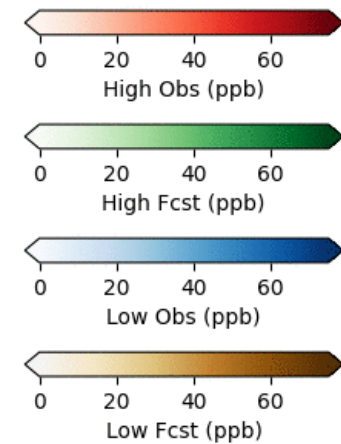
Available: CAMS CH₄ “anomalies” monitoring

End of 30 day window date: 2020-08-26



Do model “expected” CH₄ concentrations and incoming Sentinel-5P observations differ?

Are there potential anomalies?



Future plans

- New satellites: Sentinel-5 (2024), CO2M (2025, ...)
- Hybrid constellations
- Global monitoring and verification support capacity of anthropogenic CO₂ and CH₄ emissions (CO2MVS) in CAMS

Thank you!

The EU Space Programme

EU SPACE PROGRAMME OVERVIEW



COPERNICUS

Earth Observation (EO) and monitoring based on satellite and non-space data

Nr.1 world provider of space data and information



GALILEO

Global satellite navigation and positioning system (GNSS)

10% of the EU GDP enabled by satellite navigation



EGNOS

Reliable navigation signals for safety of life use

Operational in 360+ airports & helipads in 23 countries



SSA

Space situational awareness monitoring and protecting space assets

Providing surveillance and tracking services to 210+ satellites

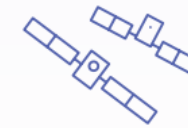


GOVSATCOM

Secure satellite communications for EU security actors

Delivering rapid support over crisis areas

AN INVESTMENT IN A FUTURE READY EUROPE



Competitive edge

Completing current satellite constellations, developing and launching the next-generation of satellites



Research innovation

Ambitious research and innovation programme benefiting from Horizon Europe



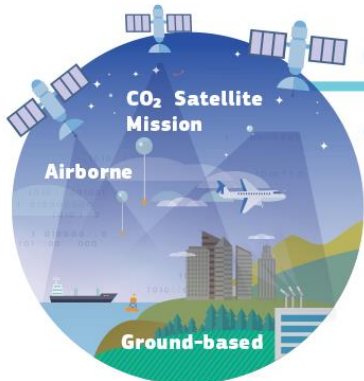
Fighting Climate Change

Monitoring biodiversity, environmental compliance and CO2 emissions (Paris Agreement)



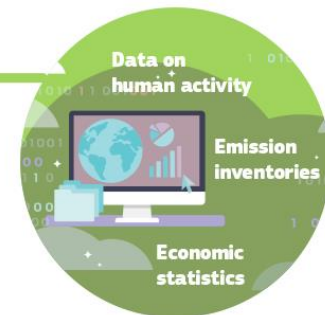
EU as a global actor

Supporting disaster relief, humanitarian assistance and security operations



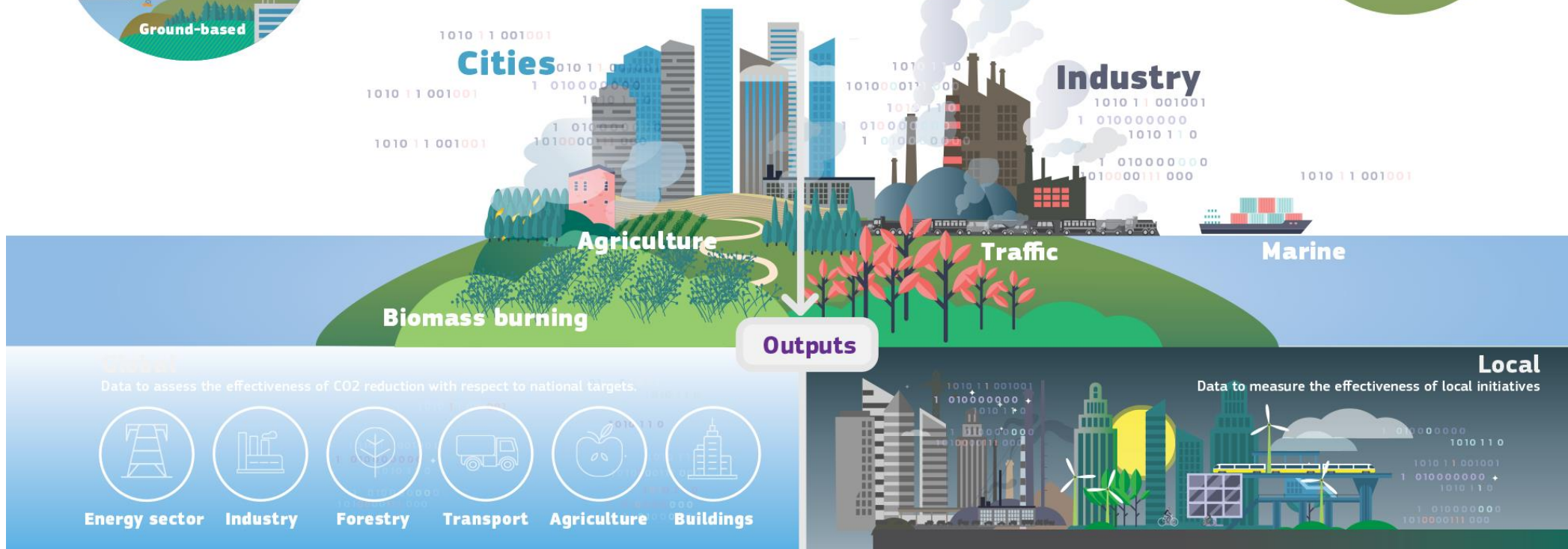
Observations of atmospheric CO₂

What we already know



Integration and modelling

Using computer models of the atmosphere, the data are combined to provide timely emission estimates, with the detail required to support mitigation actions from local to global scale.



Outputs

Global

Data to assess the effectiveness of CO₂ reduction with respect to national targets.



Energy sector Industry Forestry Transport Agriculture Buildings

Local

Data to measure the effectiveness of local initiatives



Governments & policymakers



Industry



Users

Delivering consistent and reliable information to support policy-making and decision-making processes.

Scientific community



The public

