



Observations for GHG inventories and reporting

Room 1 Earth Information Day COP30

Clement Albergel (ESA) & Thais M Rosan (University of Exeter)

clement.albergel@esa.int

t.rosan@exeter.ac.uk

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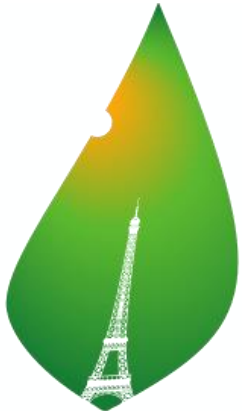
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→ THE EUROPEAN SPACE AGENCY



United Nations Framework
Convention on Climate Change



PARIS2015

Different approaches can be used to monitor GHG budgets,

- (i) **top-down estimates** from atmospheric inversions based on atmospheric GHG measurements from in-situ monitoring networks or satellites with atmospheric transport models,
- (ii) **bottom-up approaches** based on book-keeping or process-based models constrained with satellite EOs for natural and anthropogenic fluxes,
- (iii) **bottom-up approaches** using activity statistics combined with emission factors, empirical or process-based modelling

IPCC encourages Parties to “verify reported emissions against independent measurements, to promote transparency and align emissions reporting with real-world conditions”

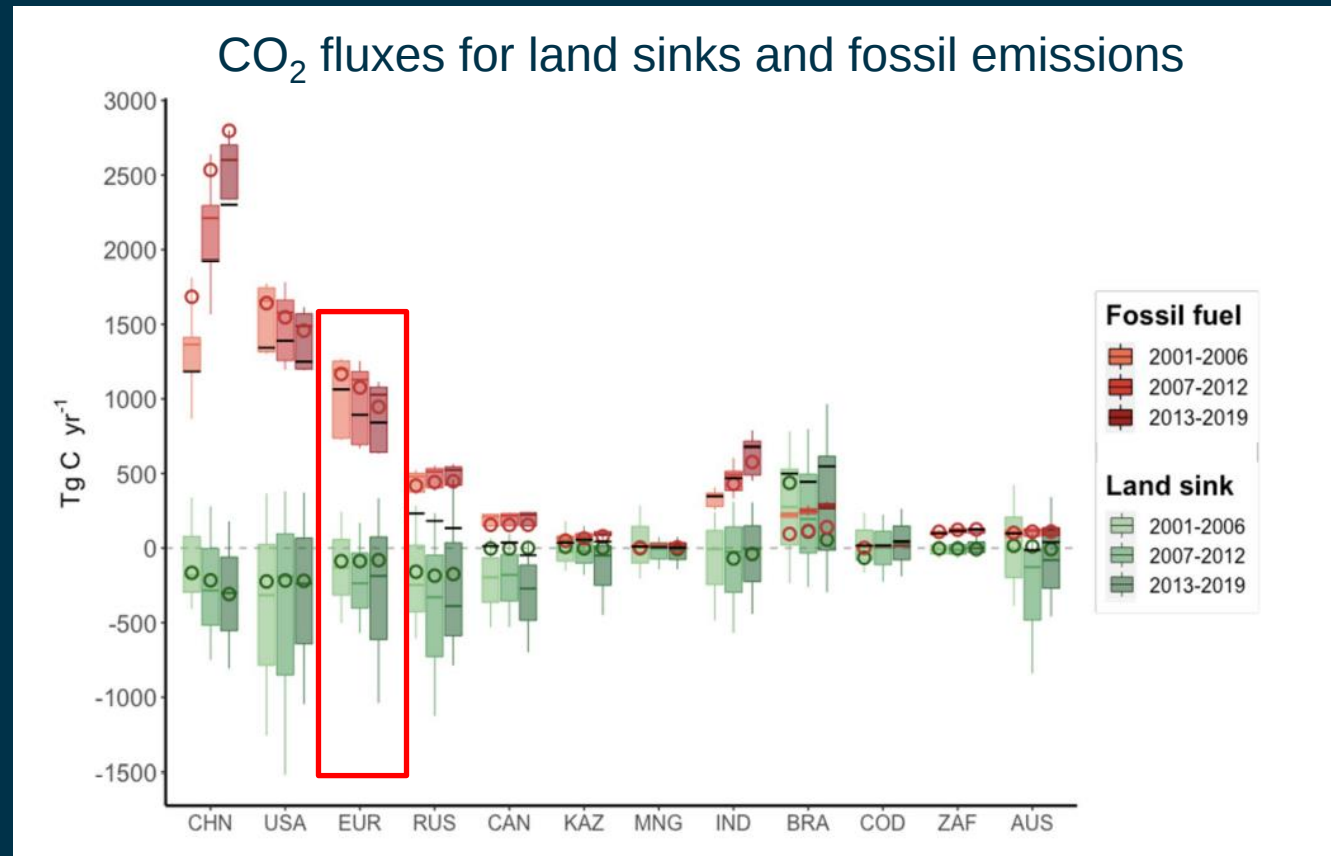
→ Satellites provide **systematic, global & continuous** coverage

Reconciling UNFCCC National GHG inventory & atmospheric inversions

A comprehensive framework to process the results of atmospheric inversions to make them suitable for evaluating the estimates of anthropogenic emissions and removals of GHGs made by UNFCCC national inventories (Deng et al., [2022](#) & [2025](#))

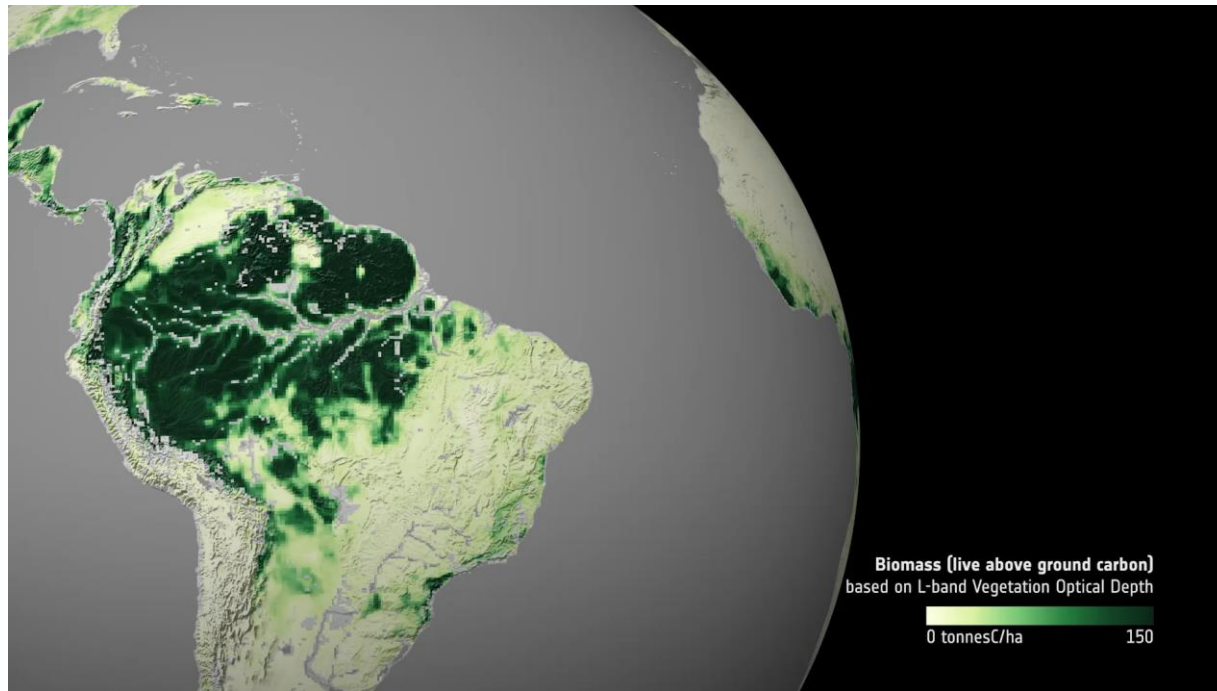
- *Boxplots: inversions for different time periods*
- *Black horizontal lines: net CO₂ fluxes for inversions (fossil fuel and cement emissions + land flux)*
- *Circles: mean of UNFCCC NGHGI data*
- *Consistency between means for each period of NGHGI land carbon sinks and inversions, for all major emitters*

→ Improves transparency in the accounting process & facilitates the effectiveness of mitigation policy and progress by individual countries



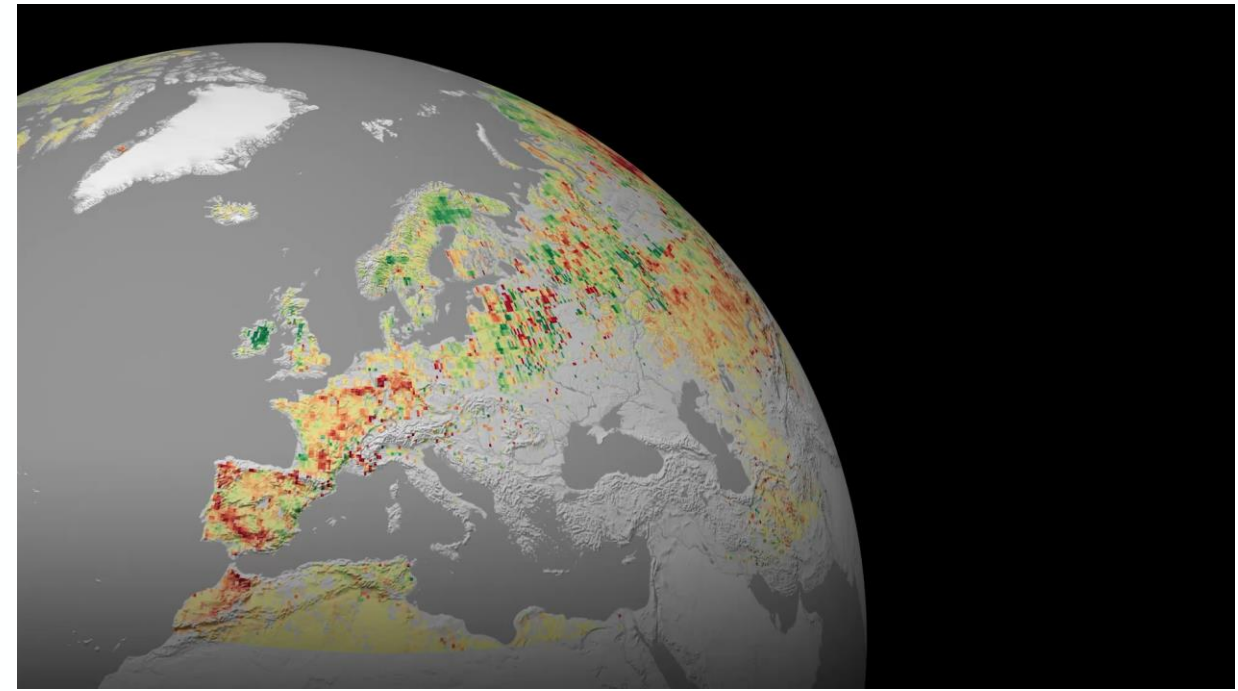
[ESSD - Comparing national greenhouse gas budgets reported in UNFCCC inventories against atmospheric inversions \(copernicus.org\)](#)
& [ESSD Global greenhouse gas reconciliation 2022](#)

Amazon



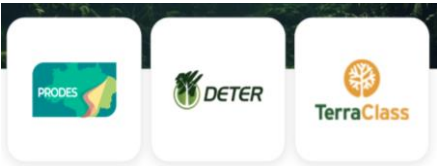
The Amazon region lost 370 million tonnes of carbon 2010-2020 decade. The south-eastern area is now a net source.

Europe



European forests' ability to absorb carbon has weakened over the past decade, posing a risk to achieving future European climate goals.

Advances and opportunities in systematic observation and cooperation to support work under the Convention and the Paris Agreement

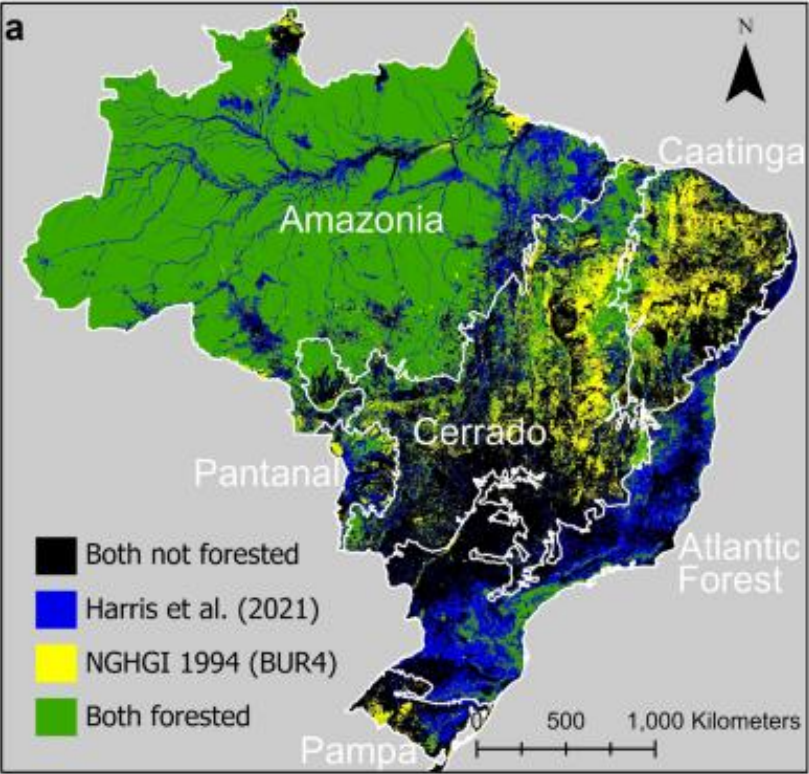


How gaps, and knowledge and capacity needs for advancing Earth observations for climate action, are being addressed at regional and global levels

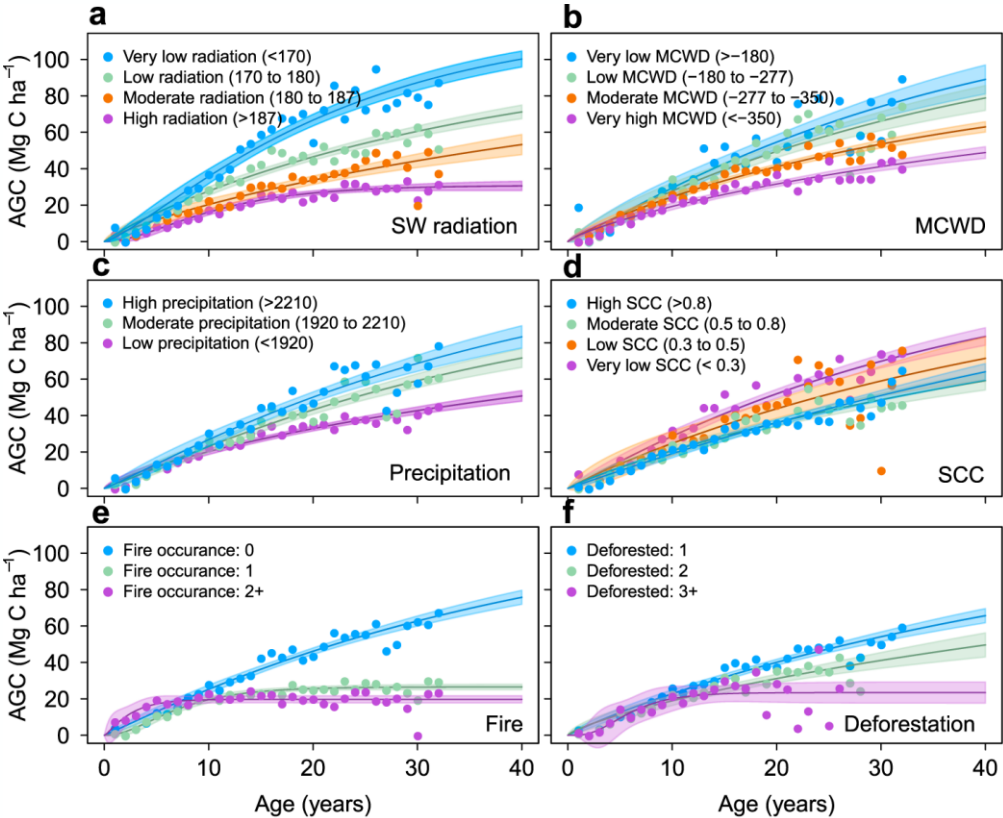


“Differences in the forest area definition and removal factors used by different datasets as an important discrepancy.”

(Heinrich *et al*, 2023)



Advances in understanding removal factors



Source: Heinrich *et al*, 2021

- National GHG inventories are used to track progress under the PA for climate
 - ➔ National reports are the official data
- Little use of satellite EOs, they are developed using activity statistics combined with emission factors, empirical or process-based modelling
 - ➔ RELIABILITY, TRANSPARENCY and ACCOUNTABILITY
- Atmospheric inversions help for the quality control of national reports
- Need to carefully separate managed land and natural / anthropogenic emissions
- New satellite missions will provide a much denser sampling of atmospheric carbon dioxide and methane, MicroCarb, CO2M

Questions



Clement Albergel (ESA)
clement.albergel@esa.int



ESA RECCAP-2



Amazon Rainforest experiment
ESA/INPE/UFOPA

Thais M Rosan (University of Exeter)
t.rosan@exeter.ac.uk

