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INTEGRATED CARBON OBSERVATION SYSTEM

# INTEGRATED CARBON OBSERVATION SYSTEM'S CONTRIBUTION TO SDGS

Dr. habil Werner L Kutsch Director General, ICOS RI International Conference on Research Infrastructures Brno, 19.10.2022 Side event: Research Infrastructures' Contribution to SDGs



INTEGRATED CARBON OBSERVATION SYSTEM



## **ICOS' contributions to the SDGs**



A focus on SDG 13: by providing harmonised, high quality greenhouse gas (GHG) measurements across Europe, ICOS contributes directly to SDG 13 'Climate Action'. Monitoring GHG emissions and removals is vital to achieve carbon neutrality. Our data along with excellence climate science and active international dialogue enable informed decision-making for global climate strategies.

In addition, ICOS ERIC contributes to several other SDGs in two key impact areas :

#### **Scientific excellence**

ICOS provides FAIR data for scientists, students, citizens and policy makers. They support research and innovation to adapt agriculture, water management, energy provision and city planning to the challenges related to climate change and its impacts.



### **Societal impact**

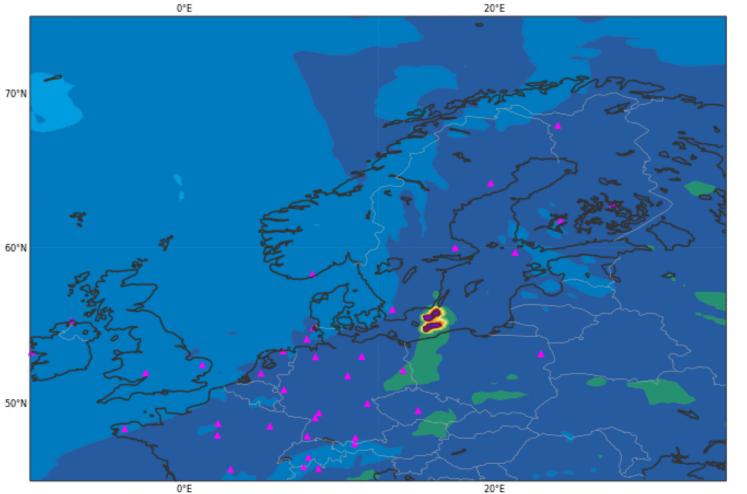
Reliable data on GHG fluxes support evidence-based policy making around climate adaptation and mitigation. Direct cooperation with UN organisations such as WMO and UNFCCC and science partnerships around the world support education and strong institutions.

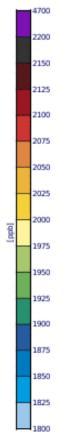
Science generates more societal impact



Foto: Danish Defence / UPI Photo / IMAGO

#### Monday 26 September 2022 00 UTC ecmf t+3 VT:Monday 26 September 2022 03 UTC surface CH4 column-mean molar fraction

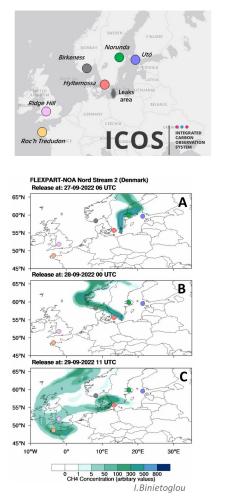


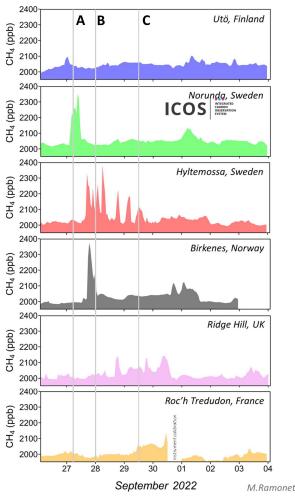


## Ingredients for more than 1200 media hits

- A permanent online network is ready to detect surprises
- A well organised data life cycle enables near-real time data provision
- A well connected scientific community that uses the data immediately

#### Tracking the dispersion of the CH<sub>4</sub> plume over Europe

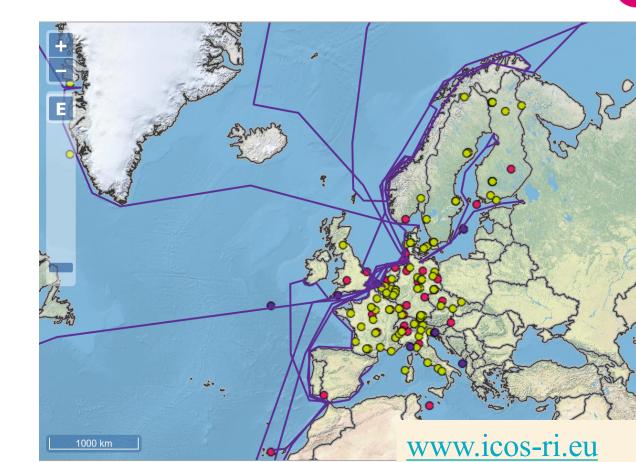


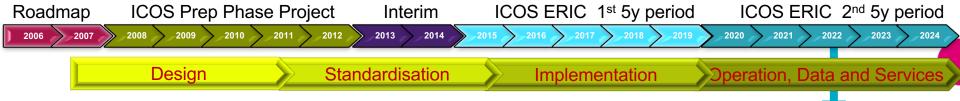




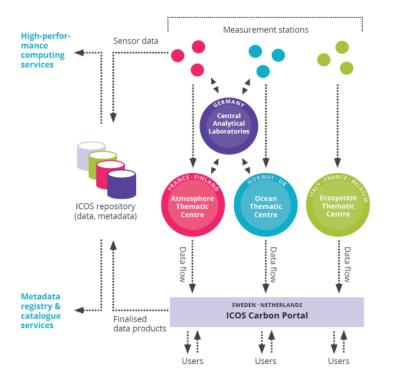
## **Integrated Carbon Observation System (ICOS)**

- Distributed
- In-situ observations of greenhouse gases and the carbon cycle
- >>100 Mio € Investment
- currently 160 stations
- Thematic Centres (Hubs) on atmosphere, ecosystem and ocean observations
- Central Laboratories
- Central data portal
- High scientific excellence
- High societal impact





## A well-designed reliable data life cycle



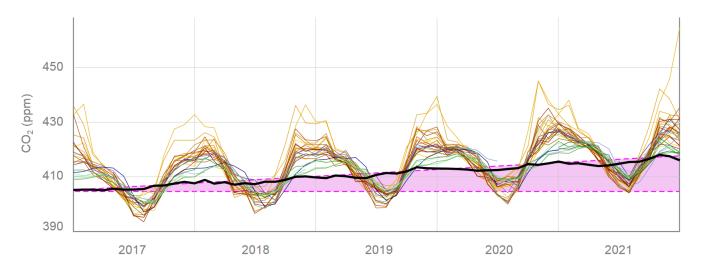
- ✓ Standardized measurements
- $\checkmark$  Standardized data processing
- ✓ Centralized quality control
- $\checkmark$  Data provenance, curation and archiving
- ✓ Clear open data license
- $\checkmark$  Data citation

"The **ESFRI Landmark ICOS ERIC** is of paramount importance to reach the goal of climate neutrality." ESFRI Roadmap 2021

#### However, there is more...

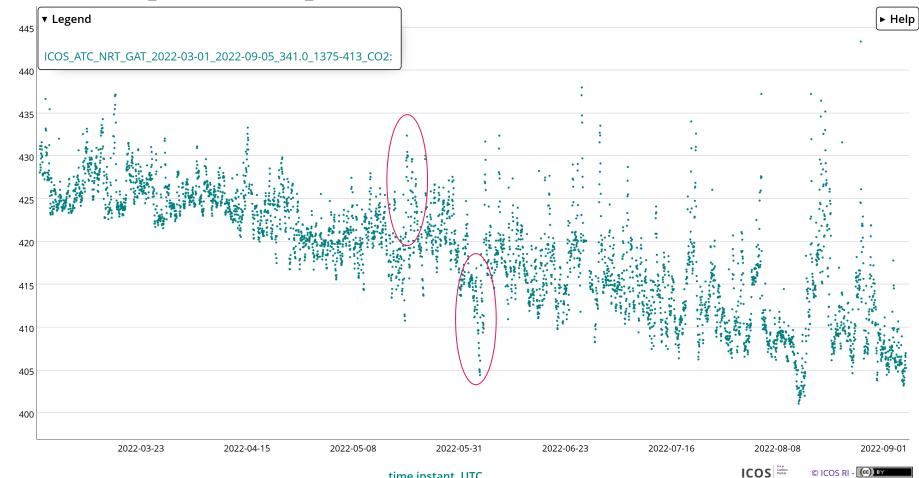
## Figure 2 Monthly average CO<sub>2</sub> concentrations measured at 36 ICOS stations between 2017 and 2021.

The legend indicates the station's code, and the sampling height in meters above ground. The black line corresponds to the station on the island of Réunion, in the Indian Ocean, the only ICOS site in the southern hemisphere. This station was not exposed either to biogenic nor anthropogenic fluxes, taking place mostly on the northern hemisphere, resulting in a very weak seasonal cycle. Thus, it shows the overall global trend (highlighted by the pink area).



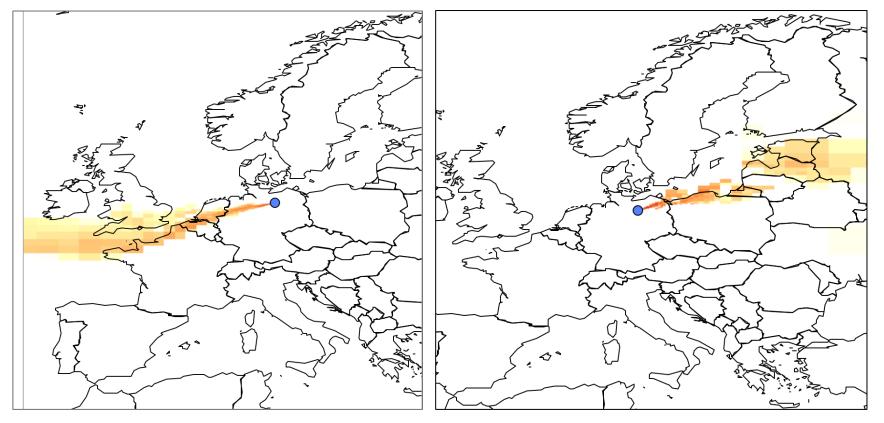


#### The atmosphere transports a lot of information...



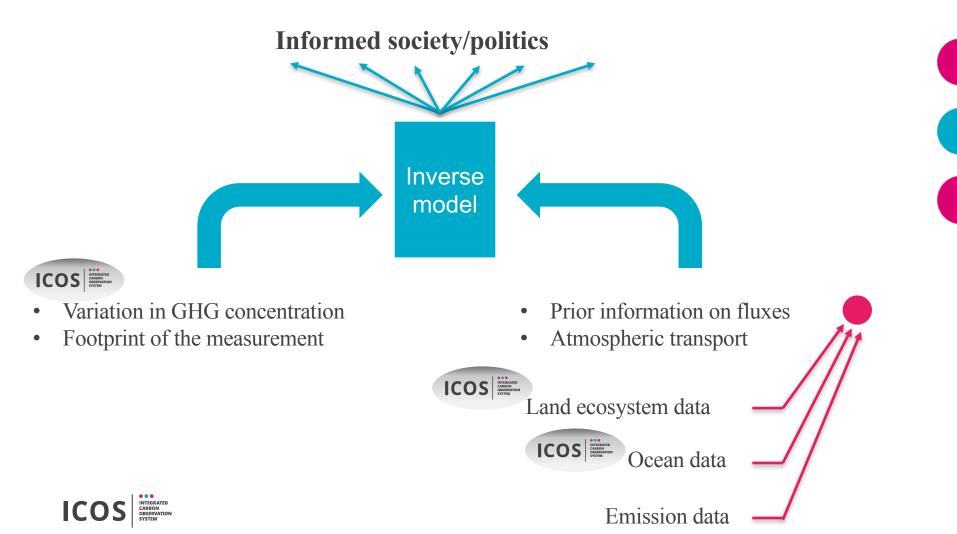
time instant. UTC

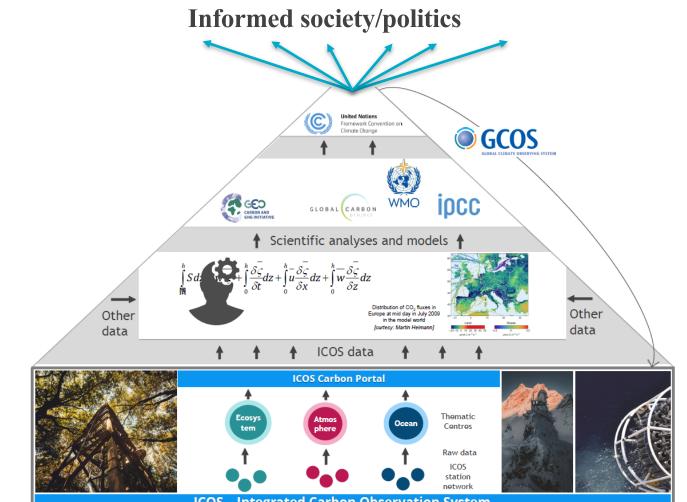
#### ...and we can calculate where it comes from.



ICOS

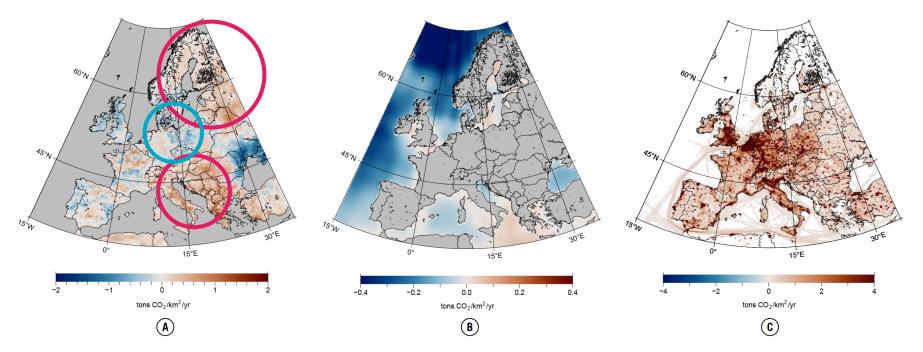
https://stilt.icos-cp.eu/viewer/





ICOS INTEGRATED CARBON OSSERVATION SYSTEM

ICOS – Integrated Carbon Observation System



#### Figure 1 The three major CO, fluxes for Europe and adjacent ocean areas in 2021: (A) Biogenic fluxes of land ecosystems, (B) Ocean fluxes, (C) Human emissions of fossil fuels.

(A) Biogenic fluxes of land ecosystems. This map shows the complex pattern of land ecosystem fluxes over Europe. Blue areas symbolise net carbon uptake during the year, reducing the CO<sub>2</sub> load of the atmosphere. Red areas symbolise net carbon loss adding additional CO<sub>2</sub> to the atmosphere. Italy, most of the Balkan States, Scandinavia and the Baltic countries showed carbon losses mainly due to hot and dry summer conditions. (B) Ocean fluxes. This map shows a strong carbon sink in the open ocean while coastal areas as well as the Baltic and the Mediterranean seas show a more complex pattern of both sources and sinks. (C) Human emissions of fossil fuels. This map shows the spatial distribution of fossil fuel emissions. Highest emissions are located in industrial and highly populated areas (cities). Emissions from marine transport can be seen on the major shipping routes.

These maps are highly-integrated products based on observations, inventory data and models. Note that the flux scales of the maps are different: the same colour is twice as high in fossil fuel emissions than land ecosystem fluxes, and ten times higher than ocean fluxes.



## Scientific and societal impact



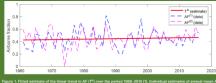
#### No. 17 | 25 October 2021

Roughly half of the carbon dioxide (CQ) emitted by uptake to human activities to day remains in the antrosystem. The rest is absorbed by oceans and land ecoxystems. The service of emissions remaining in the atmosphere. The also be called almorms fraction (AP) is an important indicator of the balance between sources and lanks. AF varias is corrars a lost from year to year, and over the past 60 years determined the relatively uncertain annual averages have varias.

between 0.2 (20%) and 0.8 (80%), However, statistical analysis shows that there is no significant trend in the average AF value of 0.42 over the long term (about 60 years) (ase Figure 1). This means that only 42% of human CO<sub>2</sub> emissions remain in the strosphere. Land and occasin CO<sub>2</sub> sinds have continued to increase proportionally with the increasing emissions. It is uncertain how AF will change in the future because the uptake processes are sensitive to climate and land use choses.

Changes in AF will have strong implications for reaching the goal of the Paris Agreement, namely to limit global warming to well below 2° C, and will require adjustments in the timing and/or size of the emission reduction commitments. Ongoing climate

emission reduction commitments. Orgoing climate change and related feedbacks, such as more frequent Based on this direct observations of CO, levels for the expected emission and intensification of wildlines (2), might reduce CO, scenarios can be provided, allowing for improved



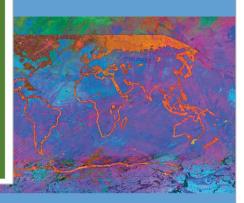
rigure 1, ritice estimate or the linear trend in Art 11° over the period isour 2016 (1), individual estimates of annual me are depicted by the dashed linea using two methods with zero (AF<sup>0</sup>) and a non-zero (AF<sup>0</sup>) and a non-zero

# 13 CLIMATE

INTERGOVERNMENTAL PANEL ON Climate change

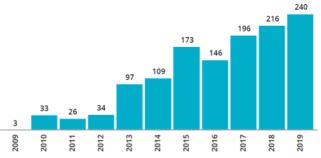
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#### Climate Change 2021 The Physical Science Basis

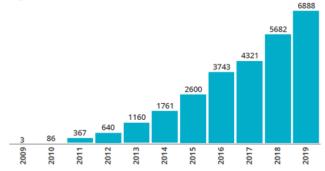


#### Between 2010 and 2019, altogether 1273 scientific ICOS-related publications and 27 251 citations of these ICOS-related publications have been counted. The yearly numbers are steadily increasing.

Figure 5. ICOS related publications 2009-2019.



#### Figure 6. Number of ICOS related citations in publications.



Link to full list of references on ICOS website: https://www.icos-cp.eu/science-and-impact/society-impact/references







king Group I contribution to the ixth Assessment Report of the ernmental Panel on Climate Change 

# Thank you for your attention!

