Geo-Academy Summer School 2025

ICOS

Integrated Carbon Observation System

understanding carbon exchanges, sources and sinks

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Lund University

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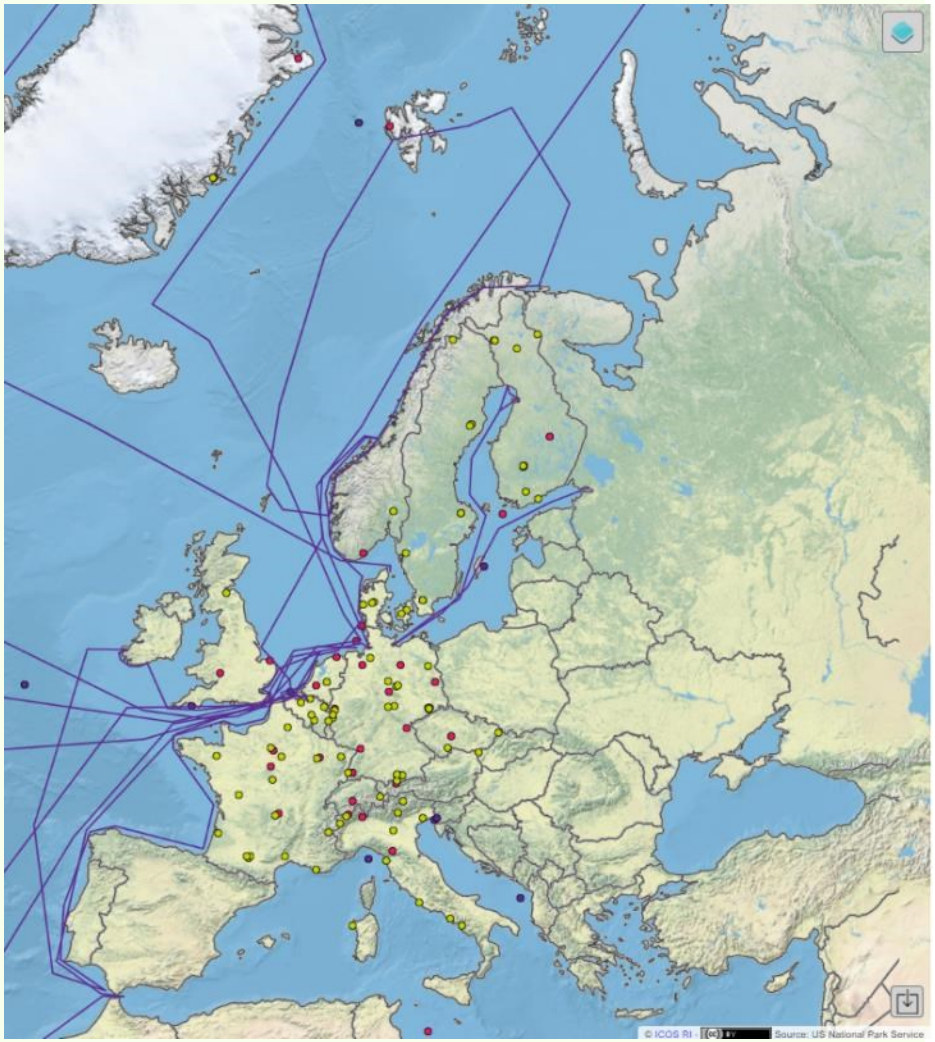
What is ICOS ?

Aim:
Comparable measurement data related to the carbon cycle to enable better science and give reliable information to decision makers.

- ICOS provides harmonized high-quality measurements of variables linked to the carbon cycle.
- Three scientific areas: atmosphere, ecosystem, ocean
- ICOS ERIC (since 2015)



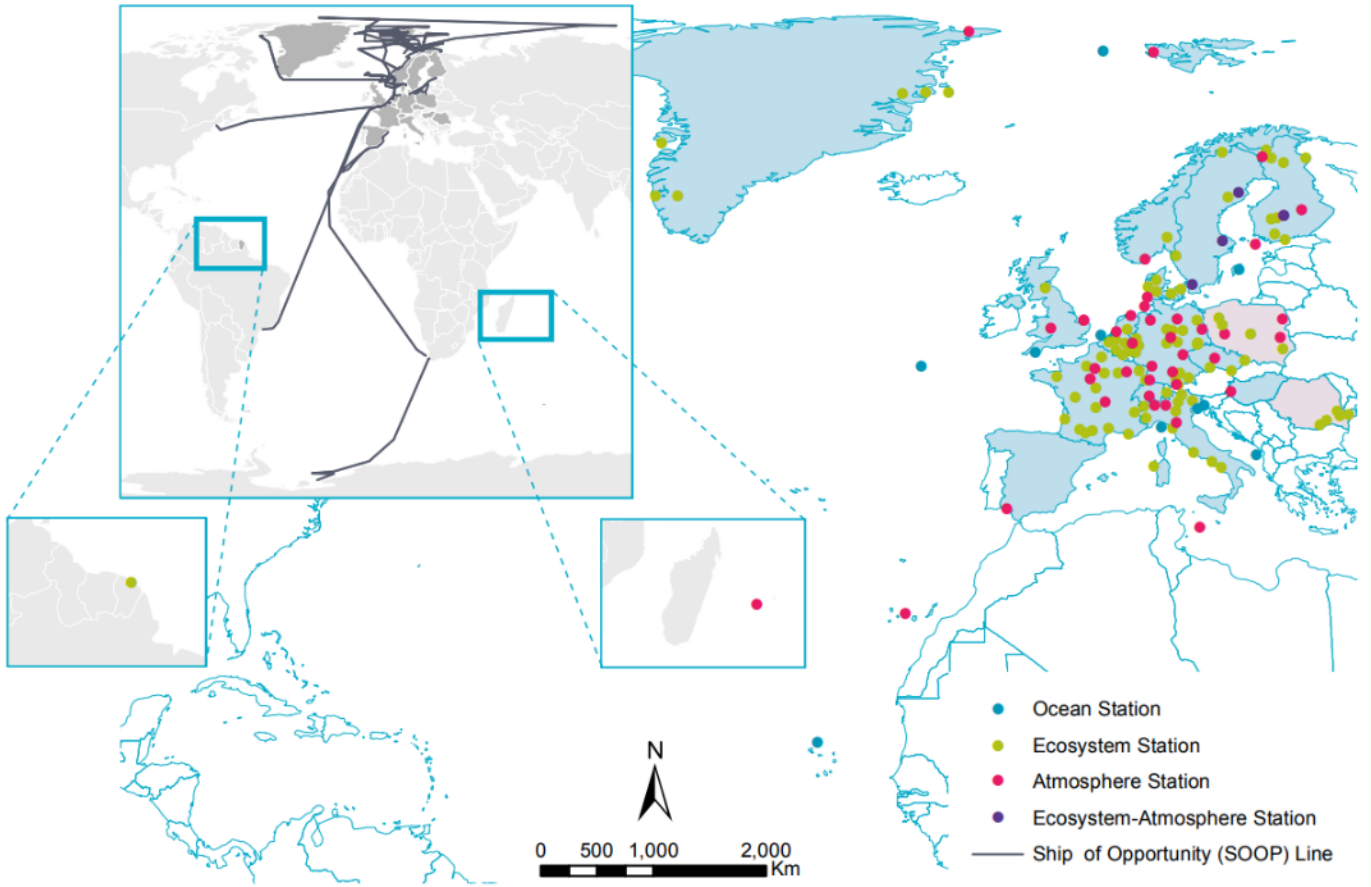
ICOS National Network Sweden

ICOS Station Network

In the map, light blue indicates current ICOS countries and light pink indicates prospective countries joining ICOS in 2023.

>170 stations in

16 member countries



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ICOS RI, 2022. https://www.icos-cp.eu/sites/default/files/2022-03/ICOS_Handbook_2022_web.pdf

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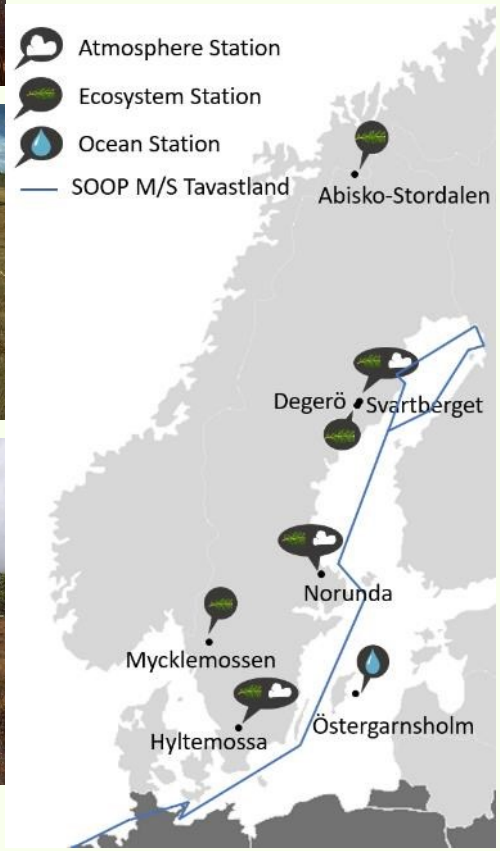
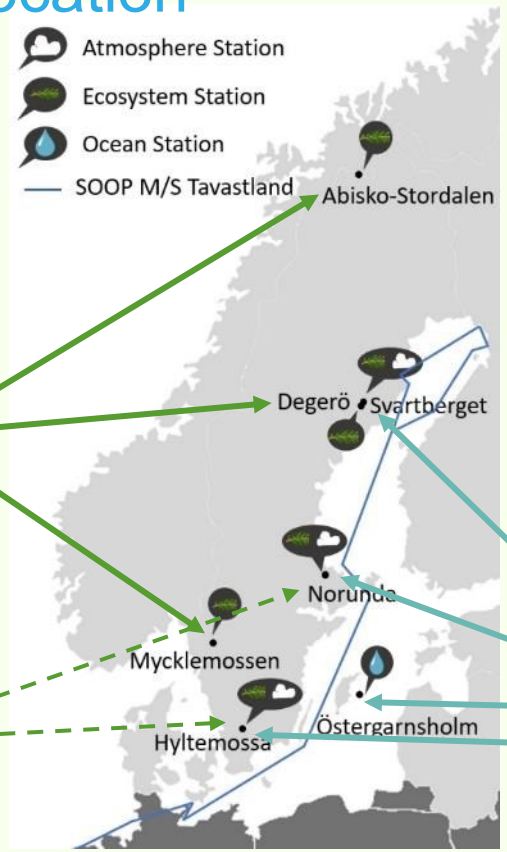
ICOS


Atmosphere Station
Ecosystem Station
Ocean Station
SOOP M/S Tavastland
Abisko-Stordalen
Degerö
Svartberget
Norunda
Mycklemossen
Hyltemossa
Östergarnsholm


TransAtlantic

Maximize information and applicability and optimize resources through co-location



SITES

Field sites to promote high quality research through long-term field measurements and field experiments

NordSpec

ACTRiS SWEDEN

Measurements of aerosols, particles and short-lived trace gases

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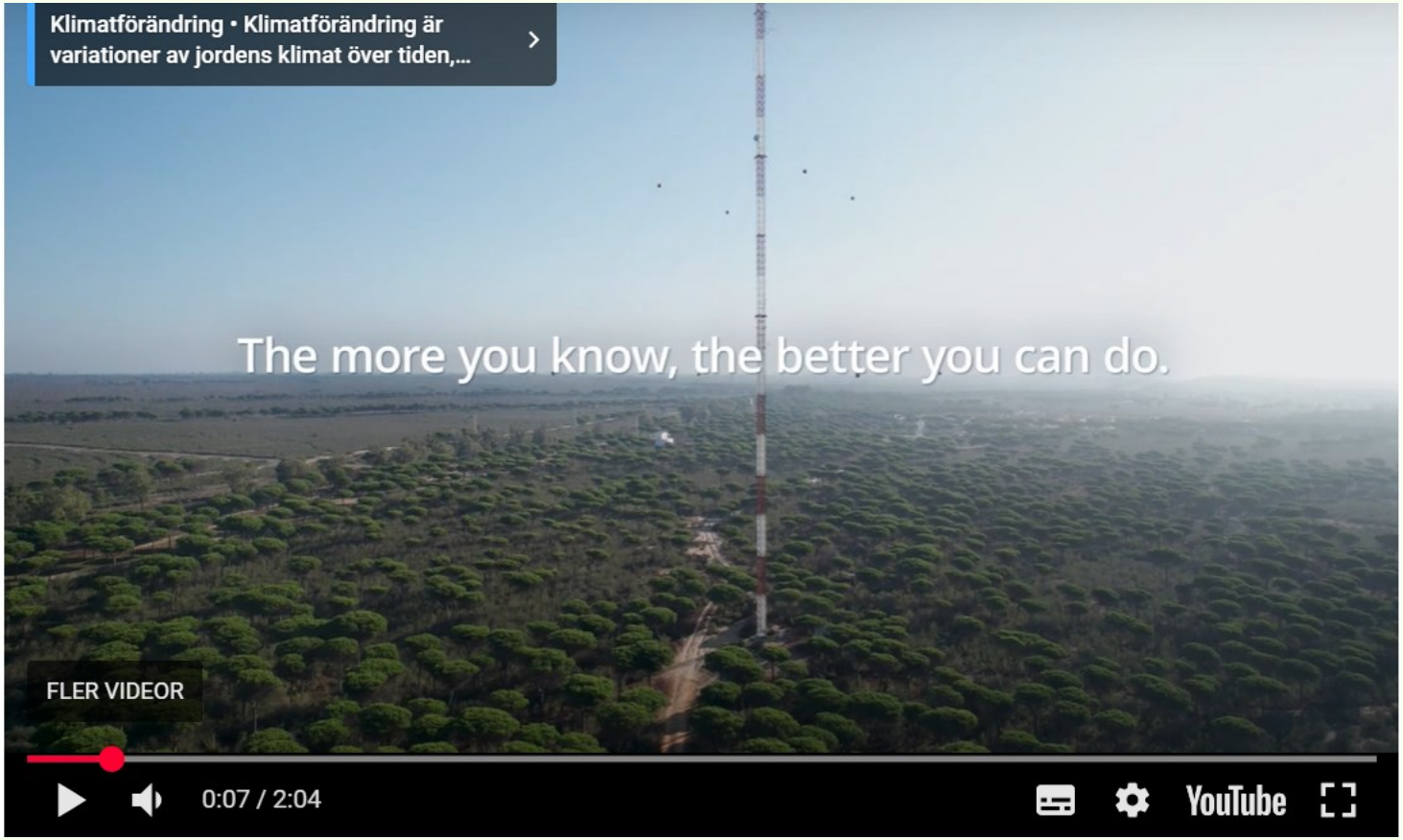
film about ICOS



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Ocean stations measure sea surface pCO_2, sea surface temperature, salinity and related variables.

The goal is to quantify the exchange of CO_2 between the atmosphere and the ocean and to assess its variability.

Short experiment

CO_2 upptake in warm and cold water

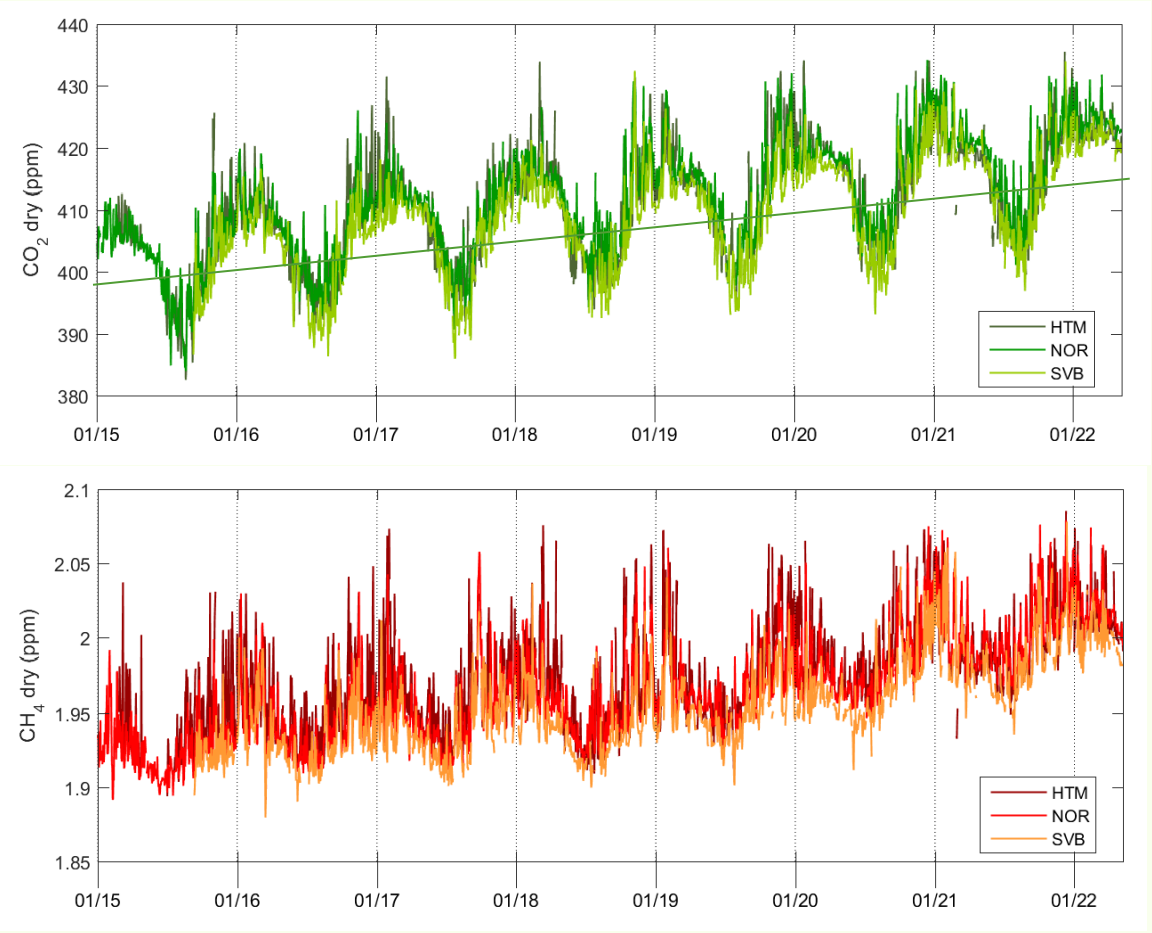
1 glass filled with warm water
1 glass filled with cold water
2 straws
BTB (pH- indicator)

Atmosphere data

Atmospheric stations continuously measure concentrations of greenhouse gases (e.g. CO_2, CH_4, N_2O), other trace gases (e.g. CO, radiocarbon-CO_2) and basic meteorological parameters.

These gas concentrations are the result of the regional and global net exchange between the Earth's surface and atmosphere and complex atmospheric transport mechanisms.

Atmosphere data from the Swedish stations



The data reflect the state of the atmosphere.

The measurements make it possible to track the effects of human activity on greenhouse gas concentrations.

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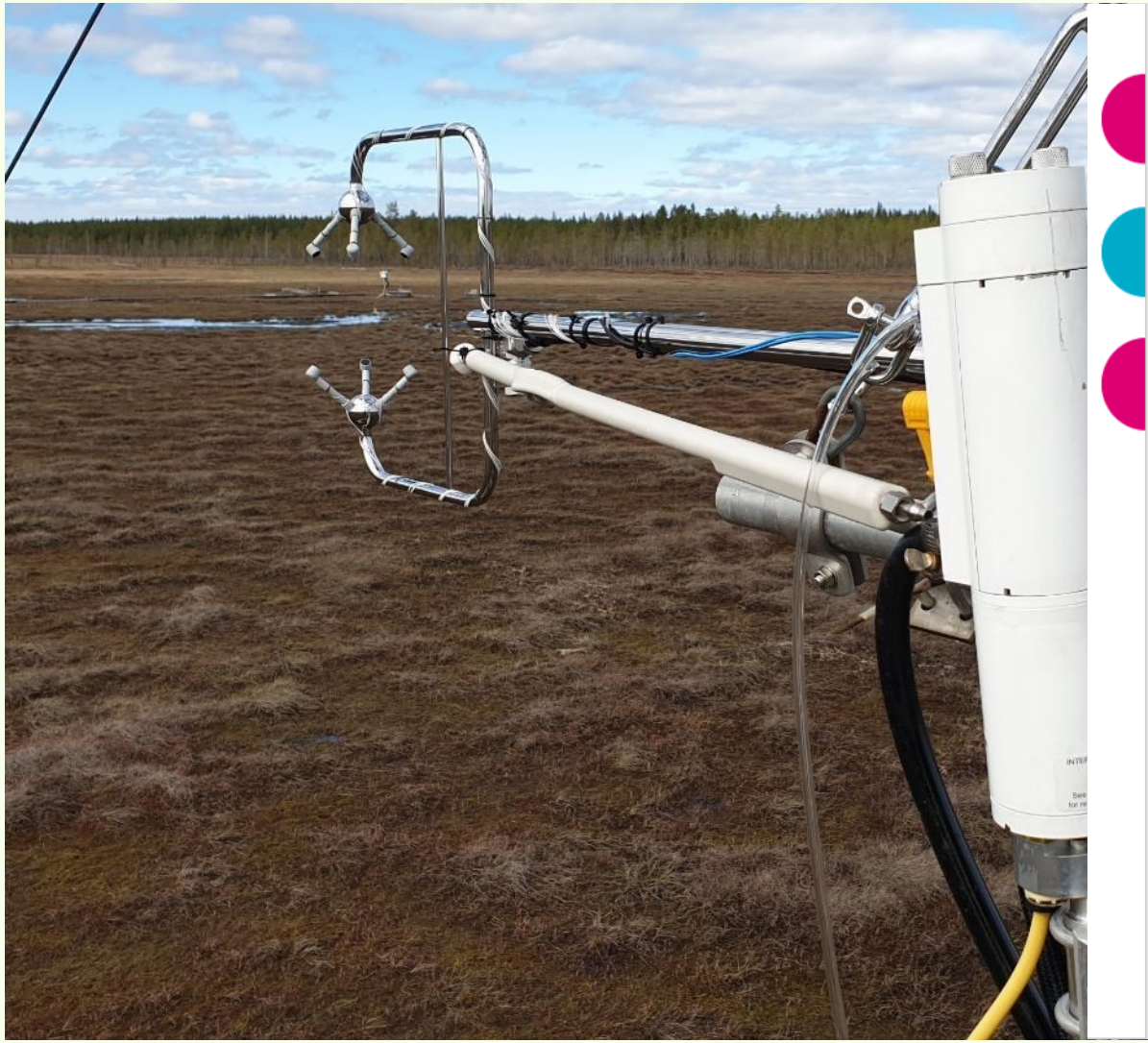
Ecosystemdata

Ecosystem stations continuously measure the exchange of relevant greenhouse gases across their respective ecosystems.



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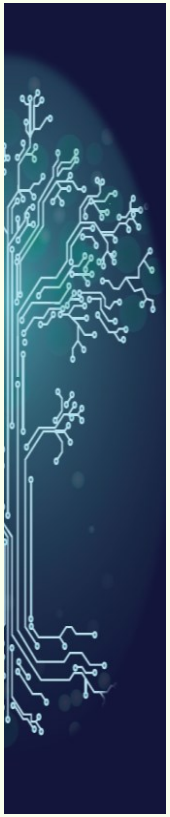
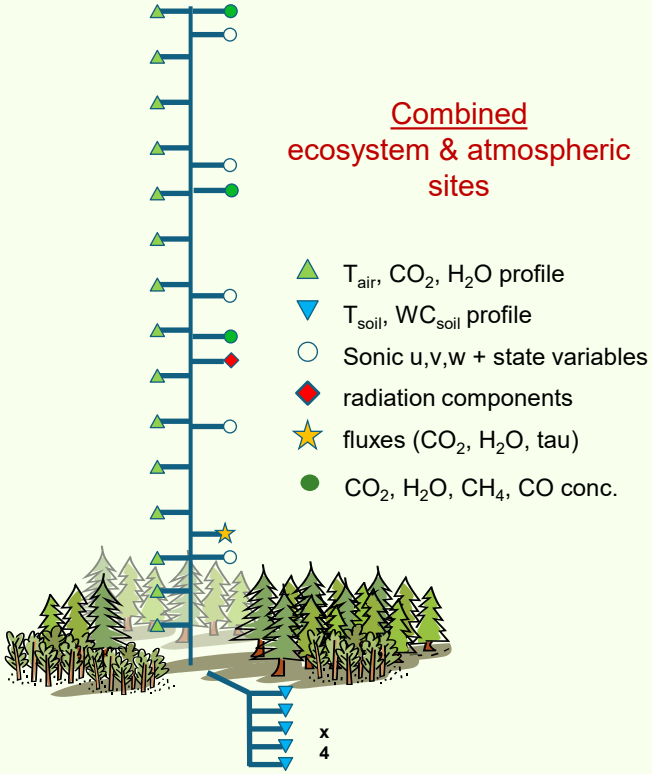


Tower instrumentation



Many more variables:
Leaf area
Biomass growth
Litterfall
Soil chemistry
Meteorological
…

Ecosystem data

- documentation management activities
- vegetation characteristics
- soil properties

aim:

- support data interpretation
- spatial upscaling
- modeling of observed ecosystem carbon and greenhouse gas dynamics

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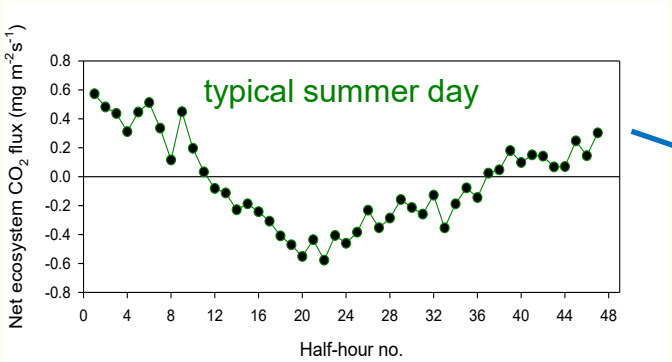
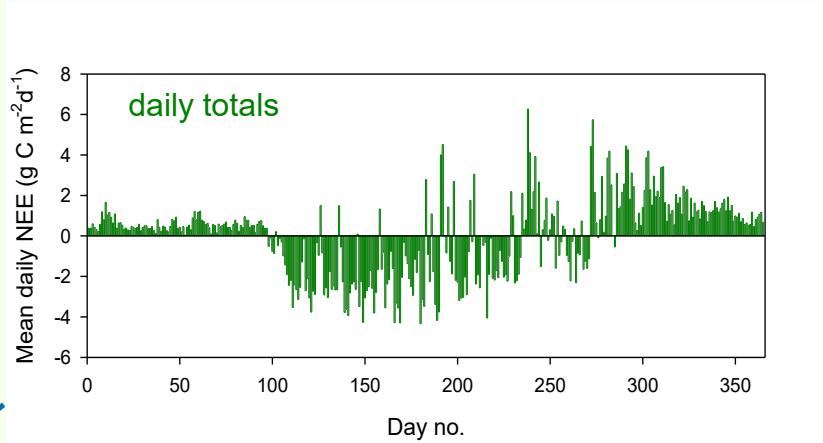
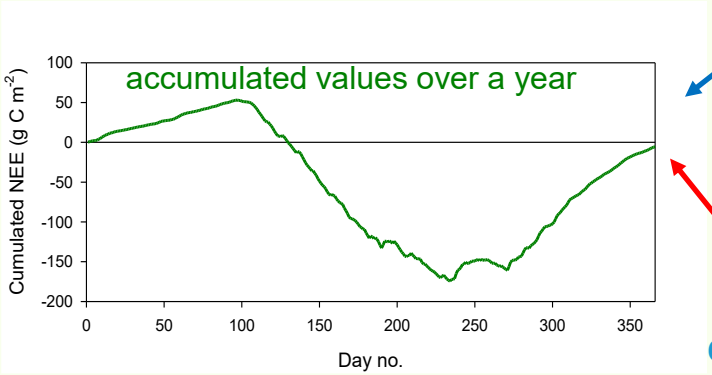
Greenhouse gas net uptake







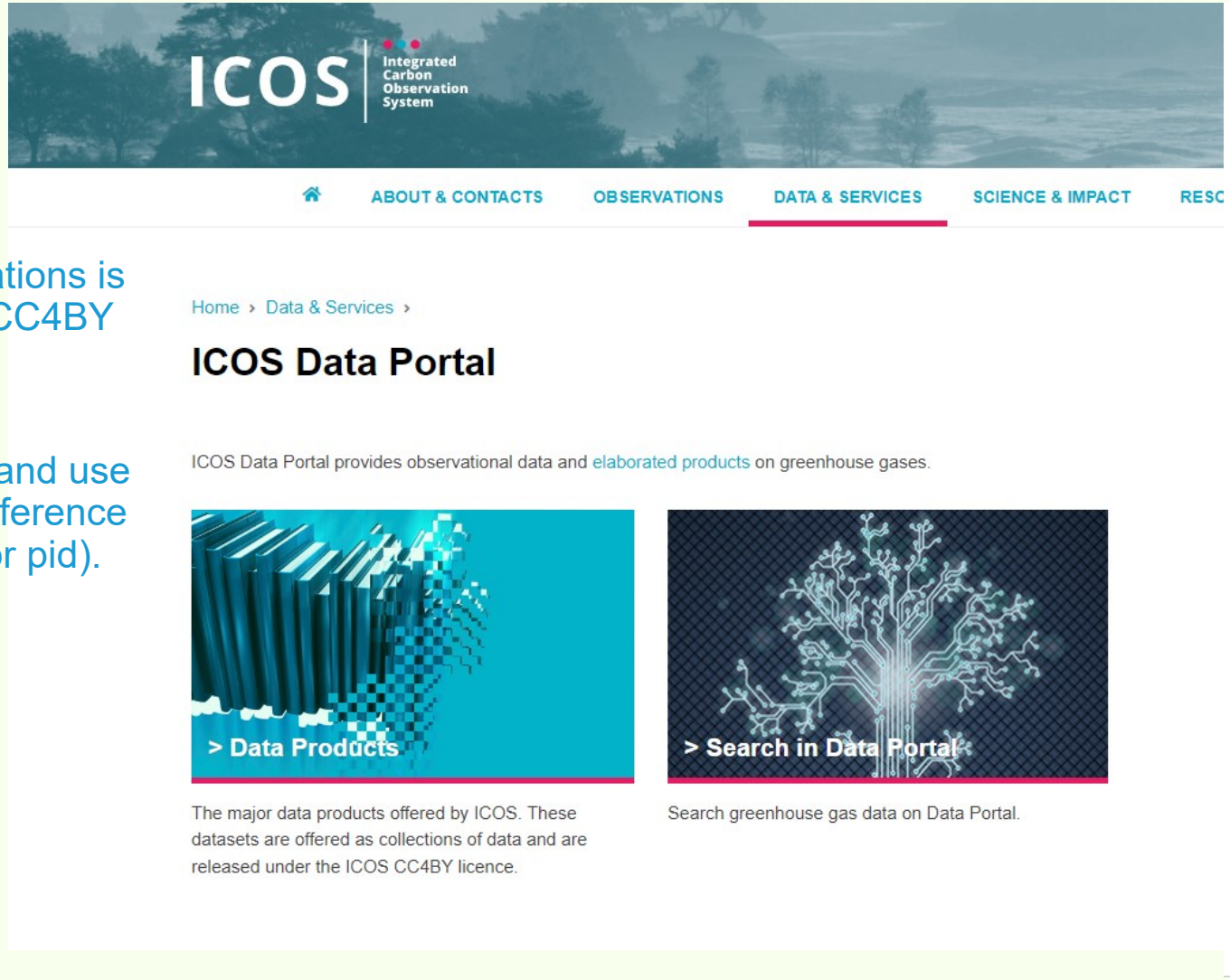
continuous measurements become one number per year

ICOS National Network Sweden

Data from the ICOS stations is open according to the CC4BY license terms:

Anyone can download and use ICOS data, but must reference and cite correctly (doi or pid).

www.icos-cp-eu



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ICOS – knowledge through observations

Thanks to:

Jutta Holst (www.icos-sweden.se)

Department for Physical Geography and Ecosystem Science
Lund University

ICOS National Network Sweden

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www.icos-sweden.se

Picture credits:

Tobias Biermann, Anders Båth, Leonie Esters, Michal Heliasz, Thomas Holst, Jutta Holst, Irene Lehner, Per Marklund, Erik Nilsson, Stefan Osterwalder, Niklas Rakos, Paul Smith, Patrik Vestin, Per Weslien, Anna Willstrand Wranne

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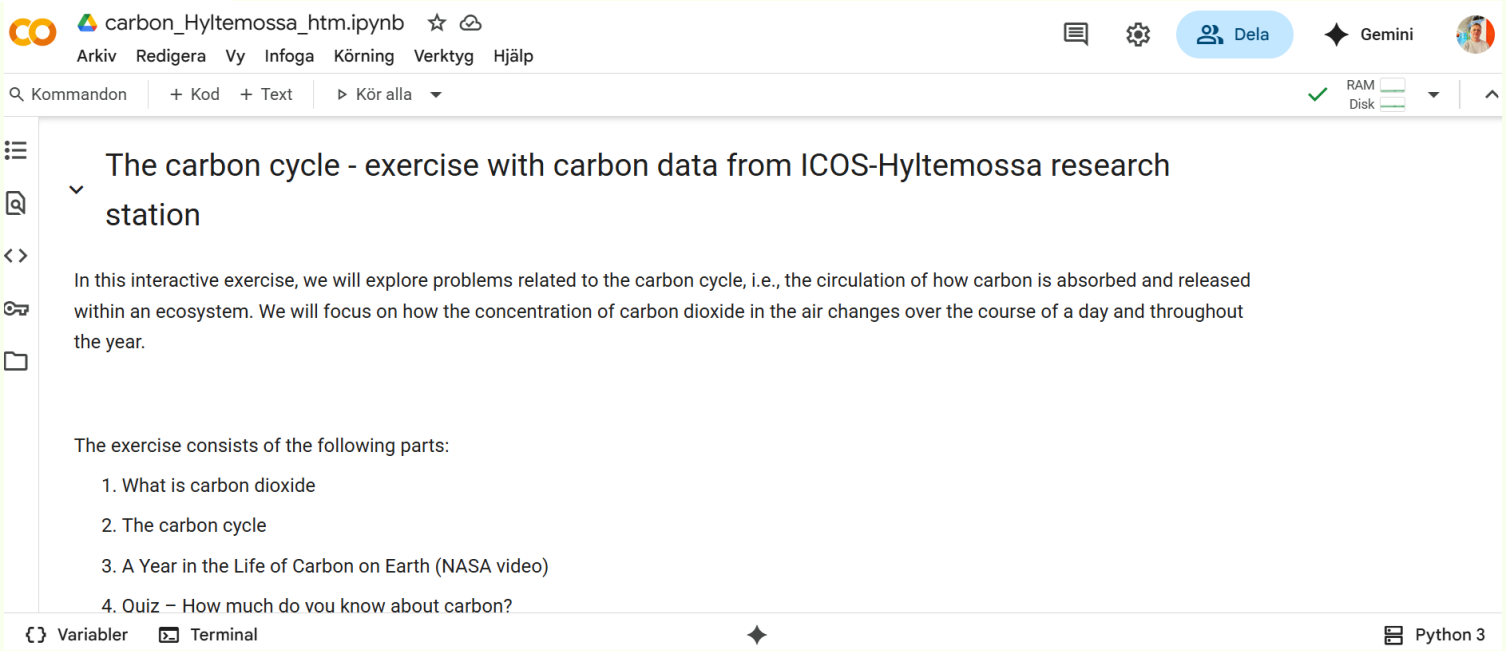
The carbon cycle – exercise with carbon data from ICOS Hyltemossa

Link to the activity:

https://colab.research.google.com/drive/1CvRLeXLRoy5nNL_x5p6j3eu_XQG9UYk7?usp=sharing



Investigate more about ICOS:

Learn about ICOS stations in Europe!

- Find some locations and discuss
- Can you find some interesting results?
- Are there a station in your country? Make contact for visiting the station

Greece:
https://www.youtube.com/watch?v=ol5O6L9Mc5Y

Italy:
https://www.youtube.com/watch?v=9qVpK189eLw

You can find the presentation and the links to the activities on our homepage:

GeoAcademy - Vattenhallen Science Center

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Thanks!

- Time for coffee break

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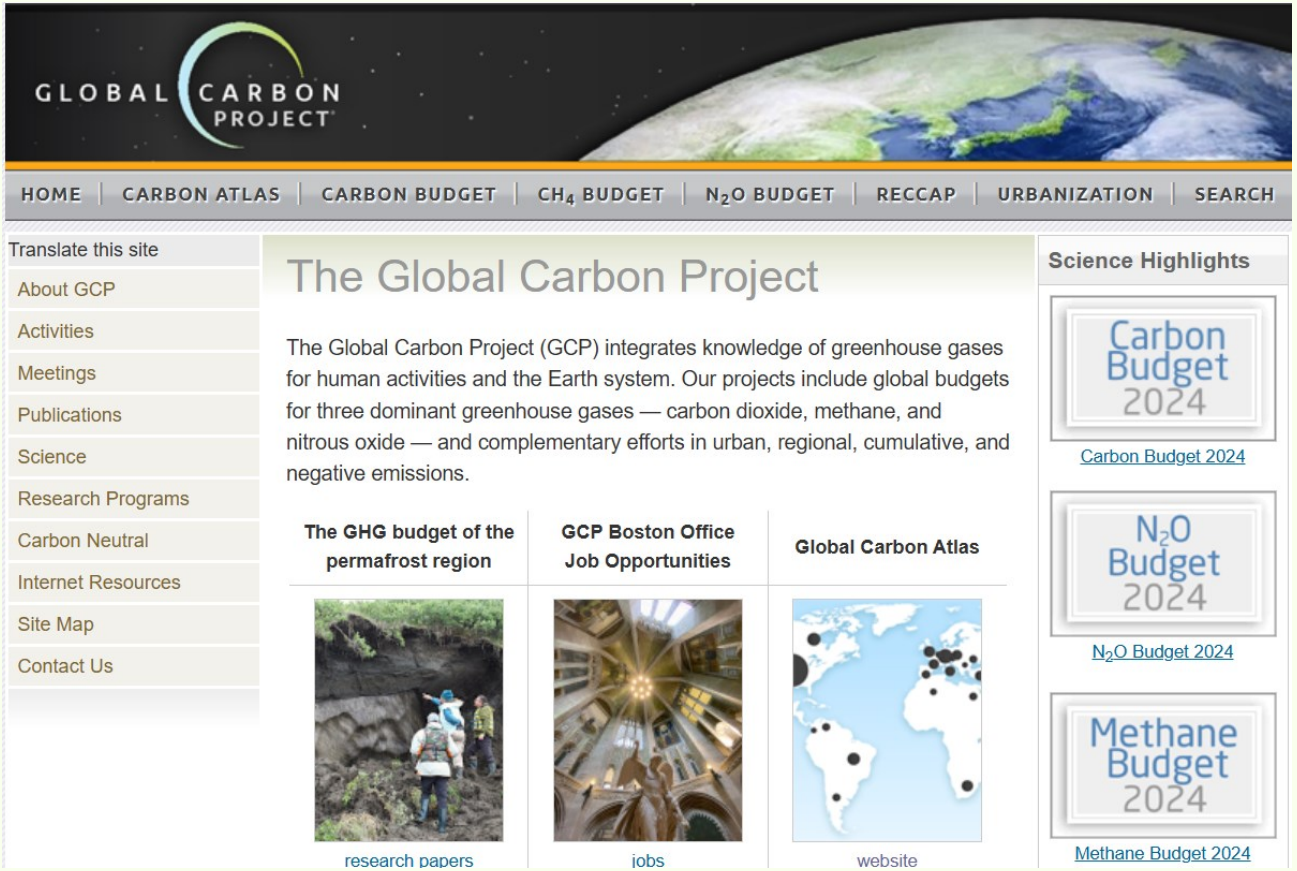
global carbon project



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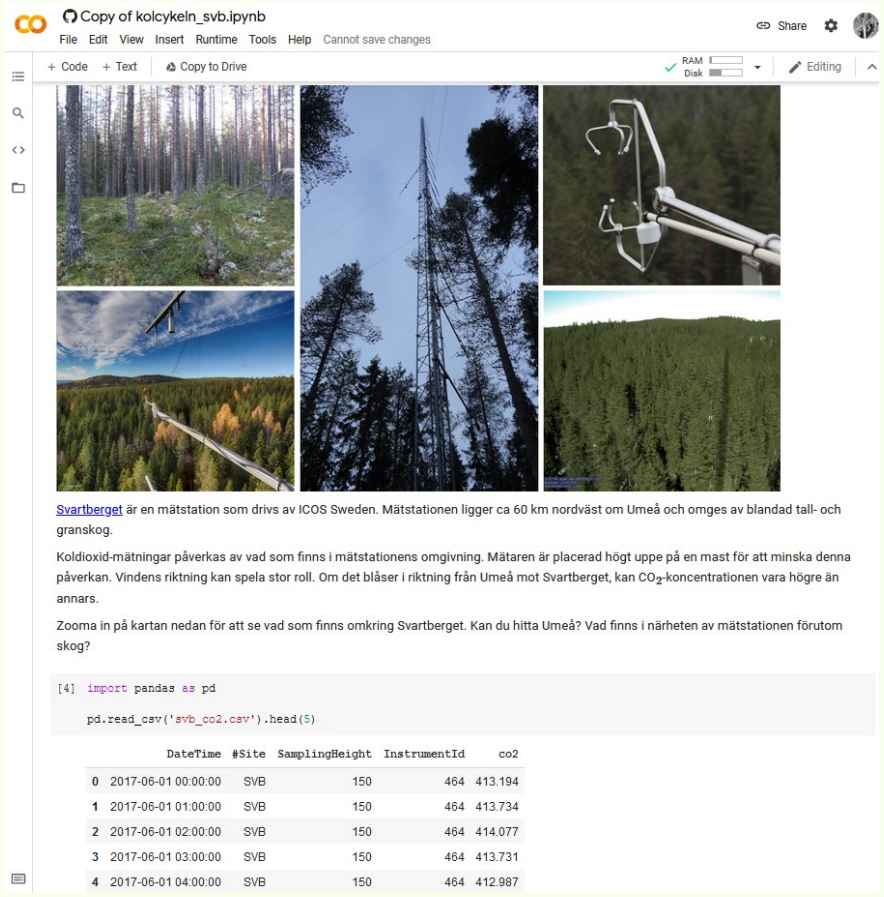
What is a notebook?

Text cell

Kod cell

Output

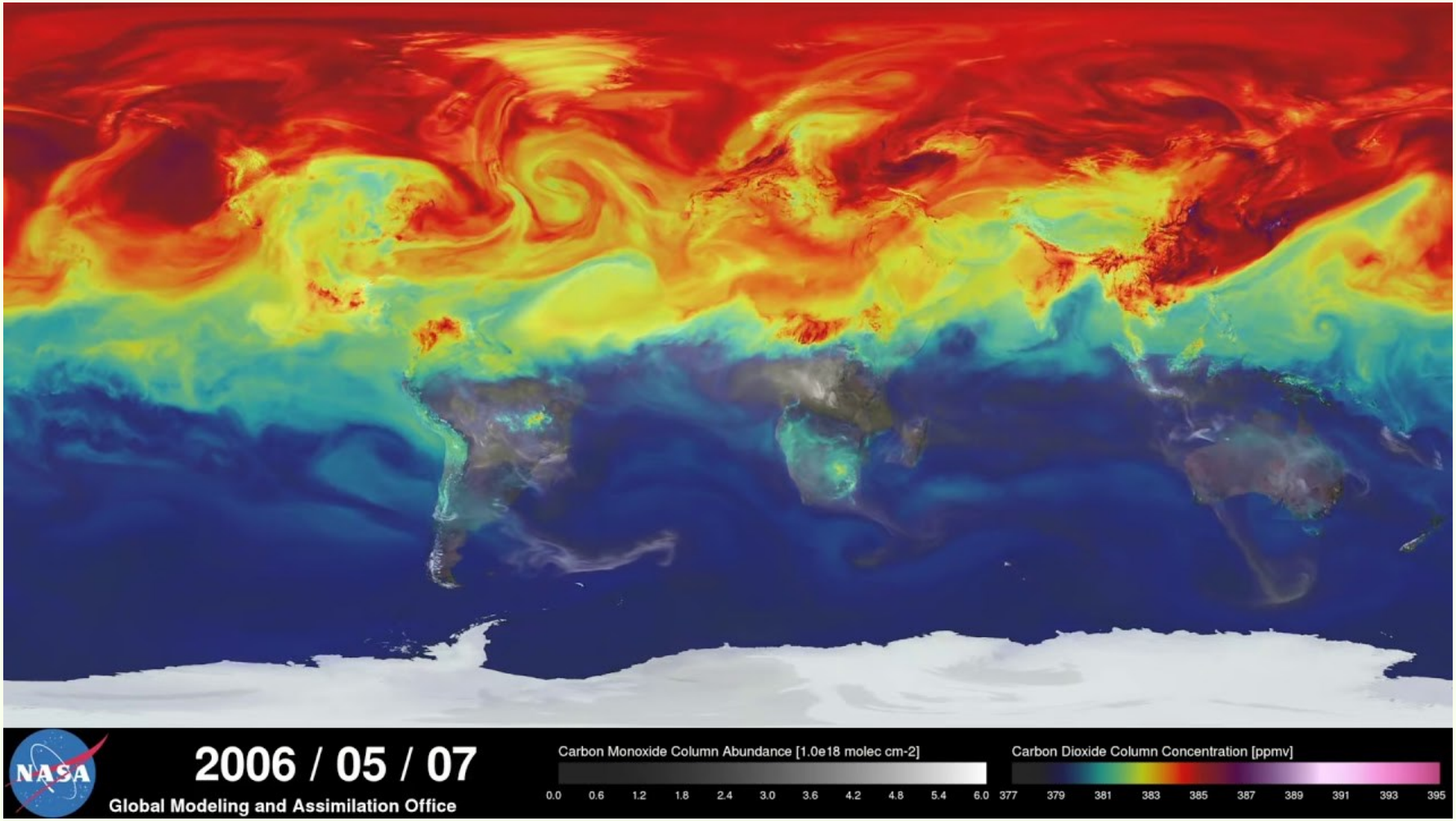


Dokumentation

- ✓ Text
  (vanlig text, HTML, Latex, …)
- ✓ Bilder
  (PNG, JPEG, …)
- ✓ Länkar
  (interna och externa)

Python kod

vektorer, tabeller, strängar, diagram, kartor, animeringar



NASA, **A Year in the Life of Earth's CO2**

https://www.youtube.com/watch?v=x1SgmFa0r04

Carbon cycle