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Miro Demol and many others...
What is ICOS

www.icos-ri.eu

European ESFRI Research Infrastructure dedicated to greenhouse gases monitoring.

Network of distributed stations in Europe (and outside EU).

Open access and long term funding.

High standardization
The ICOS Ecosystem Network

Class 1 and Class 2 are the high quality sites (currently 40 in the network)

<table>
<thead>
<tr>
<th>Site</th>
<th>Setup</th>
<th>Metadata</th>
<th>Processing</th>
<th>Data</th>
<th>Variables</th>
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</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>Standard</td>
<td>Mandatory</td>
<td>Centralized</td>
<td>Raw data, NRT</td>
<td>CO₂, CH₄ and N₂O, full set of meteo</td>
</tr>
<tr>
<td>Class 2</td>
<td>Standard</td>
<td>Mandatory</td>
<td>Centralized</td>
<td>Raw data, NRT</td>
<td>CO₂, large set of meteo</td>
</tr>
<tr>
<td>Associated</td>
<td>Free</td>
<td>Basic</td>
<td>Postprocess</td>
<td>HH, every 6 months</td>
<td>One flux and basic meteo</td>
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</tbody>
</table>

Standardized, full metadata, data in Near Real Time. All data processed centrally at the ICOS Ecosystem Thematic Centre (ETC)

Standard protocols applied are available here:
www.icos-etc.eu/documents/instructions
Monitoring strategy summary

Target area

SP-I every 5-10 years
- Tree parameters
- GAI
- Soil C and N

EC tower and air meteo

CP every year (multiple)
- Tree parameters
- GAI
- SWC, TS (continuous)
- Leaves nutrients
- Litter production
Among the different meteorological parameters in the ICOS stations there are continuous measurements of:

• Shortwave Longwave Incoming and Outgoing (and so Net Radiation and Albedo)
• PAR (Incoming, in some cases Outgoing, in some site below canopy)
• Diffuse radiation
• Soil water content and Soil temperature
• All the main meteorological parameters (humidity, temperature, precip.)

Data (collected at 20 seconds resolution) and full metadata (sensor model, position, calibration etc.)

All processed at the ETC, output halfhourly
Vegetation characteristics

Measured at the 20 SP-I location every 7-10 years and every year at the Continuous Plots (CP) (2,000 m² circular)

- Tree diameters and heights
- Tree healthy status
- Green Area Index
- Litterfall (Class 1 only)
- Nutrients in the leaves
Green Area Index measurement

Green Area Index is measured with one of these two methods:

- DHP (if LAI<6)
- Ceptometer (LAI>6)

Processing is centralized at the ETC with a tool shared in GitHub:

https://github.com/ETC-UA/LeafAreaIndex.jl
Green Area Index and below canopy PAR

Below Canopy PAR measurements for GAI estimation under test. Mainly due to difficulties to find optimal conditions for DHP.

Cross-calibrated sensors with strict specifications

Five sensors per plot in representative locations selected after campaign

Comparison with DHP estimations
Phenology measurements

Phenocam (same standard used in the US Phenocam network) for the analysis of the phenology and greenness under implementation.
Above-ground Biomass measurement

Tree position, DBH, height, species, healthy status and allometric relations using the FieldMap.

Test with TLS scanning the CP of the forest stations (same operator, same instrument, centralized processing)
TLS in ICOS

TLS scanning funded by a project, currently not foreseen for the other ICOS stations.
Data available (raw and results)
Data availability

Official ICOS data (FAIR) available in the ICOS Carbon Portal under CC-BY: 
https://data.icos-cp.eu/portal/

ICOS has as **main target the monitoring of GHGs** and for this reason the data products released are optimized for this main topic (aggregation, format, resolution, processing etc.).

It is **possible** (and relatively easy) to **implement specific processing and format** to meet the user communities needs. This is better than a parallel re-processing...
Adapting/Adjusting protocols

The ICOS community and ETC are available and happy to evaluate all the possible changes and adaptations of the protocols.

For the ICOS characteristics (long term, standardization etc.), changes that add costs must be evaluated and approved.

Some measurements could be proposed as facultative to the stations. In this case however we still need a clear protocol and to build the structure to handle these data.

Possible to install on the stations third parties sensors for specific measurements. Procedure not defined but will be possible and easy.
Why LPV should consider ICOS

ICOS is a stable, long term and sustained European ESFRI Research Infrastructure that ensures timely, high quality and open access data to the scientific communities.

These stations and system to manage them are expensive (in particular Person Months). Duplicating a network is a waste of resources.

ICOS is available to discuss new products, adaptation of the protocols and new sensors to meet the requirements.

Additional sensors developed by the LPV community (spectral reflectance, SIF etc.) can be proposed and added. Will be managed by the ICOS Station Teams.
Thanks for the attention

for questions and feedbacks:

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