

The ICOS Ecosystem network and Thematic Center: an infrastructure to monitor and better understand the ecosystem GHGs exchanges

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The ICOS Ecosystem network and Thematic Center: an infrastructure to monitor and better understand the ecosystem GHGs exchanges GC51C–1209 D. Papale¹⁻², R. Ceulemans³, I. Janssens³, D. Loustau⁴, R. Valentini¹⁻²

What is ICOS

ICOS (Integrated Carbon Observation System) is a Eur infrastructure of high precision long-term network of s measuring greenhouse gas fluxes from ecosystems and the and greenhouse gas concentrations in the atmosphere, de around a set of central facilities.

The ICOS structure and measurements are designed to permi

- The detection of systematic changes in regional greenhou fluxes despite their high level of internal variability;
- The reduction of uncertainties in Earth System models;
- Early warning of negative developments;
- The timely introduction of mitigation and adaptation me and the evaluation of their successes.

ICOS ETC – Data processing Unit

The Data processing Unit of the ETC is responsible f centralized and standardized processing of the ICOS ecos sites measurements that involves different QAQC, calculation correction steps, all implemented at the central facility.

Uncertainty estimation



Multiple constrain quality checks

To additionally evaluate the measurements quality, better characterize the uncertainty and identify potential problems, a suite of advanced quality controls involving different variables are under preparation. These quality checks will test the consistency of related quantities or similar variables measured using different approaches. Examples are the test of the water, energy and biomass balances closure using fluxes and ancillary data, or the analysis of the consistency between groups of connected variables such radiation components or LAI and FAPAR.

aropean stations oceans, esigned	The ICOS Ecosystem Thematic Center (ETC) o
easures	network activities through a number of services: and distribution of the data measured at the development of new methods and sensors; assis with training and support activities. The main ETC lab is located in Italy (Viterbo) offices/labs in France and Belgium.
for the osystem ion and	ICOS ETC – links and connections with
s analy) s d)	Meta-information Worldwide CO, Water and Energy FLUXNET ORNL
cessing valid. nultiple allow ertainty	ICOS ETC – Test and Development Instruments and methods are evolving continuousl solutions are proposed by the scientific comm companies. A robust and top quality infrastructur able to conjugate development and stability. The Development Unit is responsible for the laboratory

ly and new nunity and re must be e Test and y and field test of new systems and the development of new methodologies also in collaboration with private companies.

The ETC field test sites

New systems and methods test and comparison, in addition to long-term parallel running of different sensors, is done in three test sites along a latitudinal transect.

The ETC test sites are also open to external groups and private companies interested in techniques development and new sensor prototypes evaluation.

nd ETC



dinates the ecosystem collection, processing ICOS sites; test and stance to the network

with two additional

other initiatives



ICOS ETC - Measurements

The ICOS ecosystem network will use highly standardized methodologies to collect data. The meteorological and biological variables will follow existing international protocols (e.g. WMO) while for the eddy covariance measurements it has been decided to standardize the instruments to avoid potential biases. The sensors selection is still ongoing but LI7200 IRGA and Gill-HS anemometer have been preselected.

There are two different possible ecosystem site levels: Level_1 sites where all the ICOS ecosystem variables are measured and Level_2 sites where a subset of the variables are requested but measured with the same high quality standard.

Variable	Level
CO ₂ , H ₂ O and sensible heat fluxes (eddy covariance)	1 & 2
Eddy covariance CH_4 and N_2O	
CO ₂ vertical profile	
H_2O vertical profile + RH	
LW_in, LW_out, SW_in, SW_out	
SW incoming radiation	
PAR/PPFD incident	
PAR/PPFD below canopy	
PAR/PPFD reflected	
Diffuse SW radiation	
Canopy temperature	
Spectral reflectance	
Soil Heat flux	1 & 2
Temperature and Rh profile	1 & 2
Precipitation	1 & 2
Snow precipitation	1 & 2
Soil temperature profiles	1 & 2
Trunk and branches temerature	
Soil Water Content profile	
Air Pressure	
Trhoughfall	
Stemflow	
Groundwater level	
Snow heigt	
Soil profile CO ₂	1
trees diameter	1
Phenology-Camera	1 & 2
Sap flow	1
Soil CO ₂ , CH ₄ and N ₂ O fluxes by automatic chambers	1
LAI	1 & 2
Biomass	1 & 2
Soil carbon content	
Litterfall	
N deposition	
Leaf N content	
Soil water N content	
C and N import/export by management	

t Unit



The ETC field test site in Roccarespampani (Italy)



Data distribution and references

Portal for data distribution is under preparation and will be operative from March 2013. Currently a temporary webpage developed during the ICOS preparatory phase online at: <u>www.europe-fluxdata.eu/icos</u>

Data access and use policy ICOS data will be openly and freely accessible and usable by all the interested users, including private companies. All the datasets will be identified by a d.o.i. number that it is requested to be cited. . DIBAF, University of Tuscia, Viterbo, Italy. 2. CMCC, Euro-Mediterranean Center for Climate Change, Viterbo,

To ensure comparability all the chemical analysis of biological and soil samples will be done centrally at an INRA (France) laboratory that will be also responsible for the samples archiving and maintenance for 20 years.

Protocols preparation

- The development of high quality protocols for measurements and data treatment needs the contribution of the whole global scientific community. For this reason eight thematic Working Groups have been created to prepare and publish the protocols in peer-reviewed journals.
- Join at www.europe-fluxdata.eu/icos/working-groups
- WG1: Eddy covariance fluxes and storage measurements WG2: Chambers measurements
- WG3: Soil and vegetation sampling
- WG4: Ancillary data measurements
- WG5: Continuous meteorological data measurements
- WG6: Lateral fluxes, disturbances and management
- WG7: Data processing
- WG8: QAQC and multiple constraints



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