Associated ICOS Ecosystem Station Labelling Report

Station: FI-Let (Lettosuo)

Viterbo (Italy), Antwerp (Belgium), Bordeaux (France), November 6th 2018

Description of the Labelling procedure

Associated stations have a simplified, one step labelling procedure. After a first general evaluation of the station to ensure the compatibility with the ICOS aims and standard, proposed stations must submit data and metadata. There is a list of mandatory variables and related metadata that must be measured and submitted by an Associated station in order to get and maintain their status and it is reported in Table 1. Calculated fluxes and processed data at the final time resolution must be submitted

Table 1. List of variables and metadata that Associated stations must submit

Variable	**Specifications**	**Metadata**
GHG flux	At least one GHG flux + concentration (30 minutes resolution) among CO_2, CH_4 and N_2O measured with eddy covariance. In case of forest storage flux measured using a vertical profile.	Description of the system (sensors and setup), description of the processing applied to calculate the fluxes.
Incoming radiation	At least one between SW_IN and PPFD_IN, representative of the target area	Description of the system (sensors and setup)
Air Temperature	Representative of the target area	Description of the system (sensors and setup)
Relative Humidity	Representative of the target area	Description of the system (sensors and setup)
Precipitation	Representative of the target area	Description of the system (sensors and setup)
Horizontal wind speed/direction	Representative of the target area	Description of the system (sensors and setup)
Maximum LAI	LAI or GAI measured at its maximum in the year. Method not prescribed.	Description of the method used.
Above Ground Biomass	Above ground biomass, for annual vegetation the biomass at the maximum in the year	Description of method used.
Soil texture	Average soil texture at the site	Description of method used.
Management and disturbances	Info on the disturbances occurring at the site and management practices	-----

In addition to the mandatory variables, the Associated stations can and are invited to submit other micrometeorological and ancillary data collected at the site that can help to better interpret and analyze the flux variables.

The station must be active, submit at least one year of data and continue to submit the data at least yearly by end of February of the year after the acquisition.

Labelling report

The station started the labelling on January 24th 2018 and completed the data and metadata submission on October 3th 2018. Here below a summary of the submitted data and metadata is reported.

Station Description

The Lettosuo station (ICOS code FI-Let) is a nutrient-rich peatland forest (originally a fen–type peatland), located in southern Finland, few kilometers from highway 2. The site was drained for forestry in 1969 and partially harvested in March 2016. After drainage, the stand has developed to a mixture of Scots pine (*Pinus sylvestris* L.) and pubescent birch (*Betula pubescens* Ehrh.) in the dominant canopy layer, with an understorey of Norway spruce (*Picea abies* (L.) H.Karst.) with some scattered small-sized pubescent birch.

Its coordinates are Lat. 60.64183 N, Long. 23.95952 E, the UTC offset is UTC+02.

The climate at the site has both continental and maritime influences and the following climate averages:

Average annual temperature: 4.6 C°

Average total annual precipitation: 627 mm

Fig. 1 -FI-Let instrumentation

Team description

The staff of the site has been defined and communicated in June. It includes in addition to the PI, the CO-PI, the manager and the scientific and technician experts. Below the summary table of the Team members is reported.

Tab. 2 - Team members of site

MEMBER_NAME	MEMBER_INSTITUTION	MEMBER_ROLE	MEMBER_MAIN_EXPERT
Mika Korkiakoski	Finnish Meteorological Institute	PI	MICROMET
Tuomas Laurila	Finnish Meteorological Institute	CO-PI	MICROMET
Annalea Lohila	Finnish Meteorological Institute	MANAGER	PLANT
Mika Aurela	Finnish Meteorological Institute	SCI-FLX	MICROMET
Juha-Pekka Tuovinen	Finnish Meteorological Institute	SCI-FLX	MICROMET
Juha Hatakka	Finnish Meteorological Institute	DATA	MICROMET
Juuso Rainne	Finnish Meteorological Institute	TEC-ANC	DATAPROC

Metadata about the sensors

The metadata were sent in October and for each of the measured variables the sensor has been described, communicant the model, the serial number, its position (height, eastward and northward distances). The Eddy station is characterized by one analyzer LI-COR 7000 and one anemometer Metek as reported in the underlying Table 3:

Tab. 3 - The Eddy Covariance system

MODEL	SN	HEIGHT (m)	EASTWARD_DIST (m)	NORTHWARD_DIST (m)
GA_CP-LI-COR LI-7000	IRG4-0820	25.7	0	0
SA-Metek USA-1 Fast	2006 10002/01	25.7	0	0

A set of instruments are located near the tower: precipitation, radiation, air meteorology and soil climate. Table 4 summarizes the installed sensors and the measured variables.

Tab. 4: The installed sensors and relative codes for the measured meteo and soil variables

MODEL	SN	HEIGHT (m)	EASTWARD_DIST (m)	NORTHWARD_DIST (m)	VARIABLE_H_V_R
RAD-SW Pyran Class2	91391	25.7	0	0	SW_IN_1_1_1
RAD-PAR Quantum	90286	25.7	0	0	PPFD_IN_1_1_1
RAD-PAR Quantum	90285	25.7	0	0	PPFD_OUT_1_1_1
RAD-Net radiometer	20947	25.7	0	0	NETRAD_1_1_1
TEMP-ElectResis/RH-Capac	663088	25.7	0	0	TA_1_1_1
					RH_1_1_1
PRES-ElectBar	F1840065	25.7	0	0	PA_1_1_1
PREC-TipBucGauge	30203	5	0	0	P_1_1_1
SA-Metek USA-1 Fast	2006 10002/01	25.7	0	0	WD_1_1_1
					WS_1_1_1
SOIL_H-Plate	00565	-0.07	-2	-2	G_1_1_1
TEMP-ElectResis	LET_IKES30	-0.05	-2	-2	TS_1_1_1
TEMP-ElectResis	LET_IKES29	-0.15	-2	-2	TS_1_2_1
TEMP-ElectResis	LET_IKES28	-0.3	-2	-2	TS_1_3_1
TEMP-ElectResis	LET_IKES27	-0.4	-2	-2	TS_1_4_1
WTD-Press	LET_E80_1	0	80	0	WTD_1_1_1
WTD-Press	LET_SE60_1	0	42	-42	WTD_2_1_1
WTD-Press	LET_SE100_1	0	71	-71	WTD_3_1_1
WTD-Press	LET_SE140_1	0	99	-99	WTD_4_1_1
WTD-Press	LET_S120_1	0	0	-120	WTD_5_1_1
WTD-Press	LET_S160_1	0	0	-160	WTD_6_1_1
WTD-Press	LET_S200_1	0	0	-200	WTD_7_1_1
WTD-Press	LET_SW100_1	0	-71	-71	WTD_8_1_1
WTD-Press	LET_SW140_1	0	-99	-99	WTD_9_1_1
WTD-Press	LET_W80_1	0	-80	0	WTD_10_1_1
WTD-Press	LET_W160_1	0	-160	0	WTD_11_1_1

Ancillary data

To describe the site, the climatic annual averages of temperature, precipitation and radiation (shortwave) have been submitted on July (see the Station Description paragraph). A thinning and pruning is reported, carried out between February and March 2016, that involved about 100% of the footprint. No other disturbances are reported.

The soil data were sent on July specifying in detail the chemical composition (carbon, nitrogen, ammonium, nitrate, potassium, phosphorus and ratios), the bulk density, detailed stocks data (carbon, nitrogen, potassium, phosphorus), the soil group according the Soil World Reference Base for Soil Resources. Furthermore detailed data of Water retention (pF) curve matric potential have been provided.

Further and detailed ancillary data have been provided, and in particular:

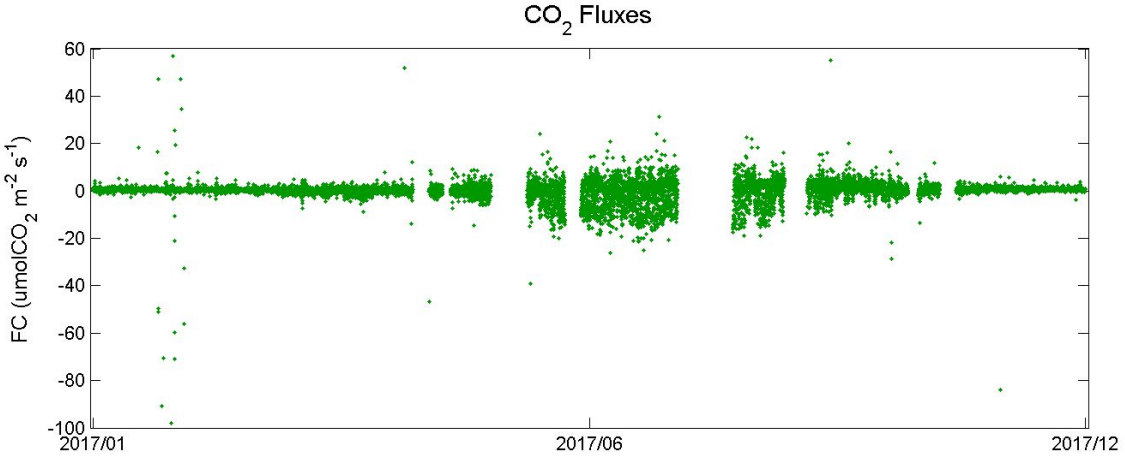
- **PAI of understory canopy** measured in 10 different location on 4 different vegetation types: Herb/Forb, Grass/Graminoid, Non-vascular, and Shrub
- **Biomass**: measured in 10 different location on 4 different vegetation types: Herb/Forb, Grass/Graminoid, Non-vascular, and Shrub
- **Canopy height**: 12.5 ± 8.7 m (Deciduous trees), 10.2 ± 3.0 m (*P. abies*)
- **DBH distribution**: 15.0±8.3 cm (Deciduous trees), 11.8 ± 4.0 cm (*P. abies*)
- **Basal area**: 5.3±4.2 m^2 ha^{-1} (Deciduous trees), 5.5±4.3 m^2 ha^{-1} (*P. abies*)
- **Number of trees**: 398±291 trees ha^{-1} (Deciduous trees), 763±494 trees ha^{-1} (*P. abies*)

All data are calculated with the spatial standard deviation.

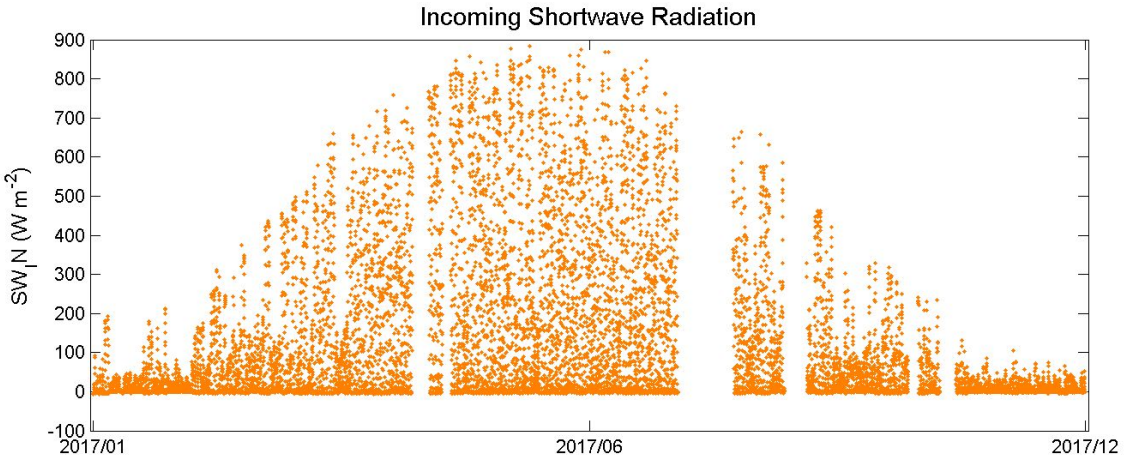
Submitted data

As requested in the labelling procedure, continuous data have been submitted for the period January-December 2017. The file has been uploaded in October 2018 and it include eddy covariance fluxes, meteo measurements and soil measurements. The flux variables (CO_2 flux, sensible heat and Latent heat flux) report also the Steady State and Integral Turbulence Characteristics tests results according to Foken et al. 2004. In the following figures plots of some of the key variables are presented as example in order to evaluate the data continuity and coverage.

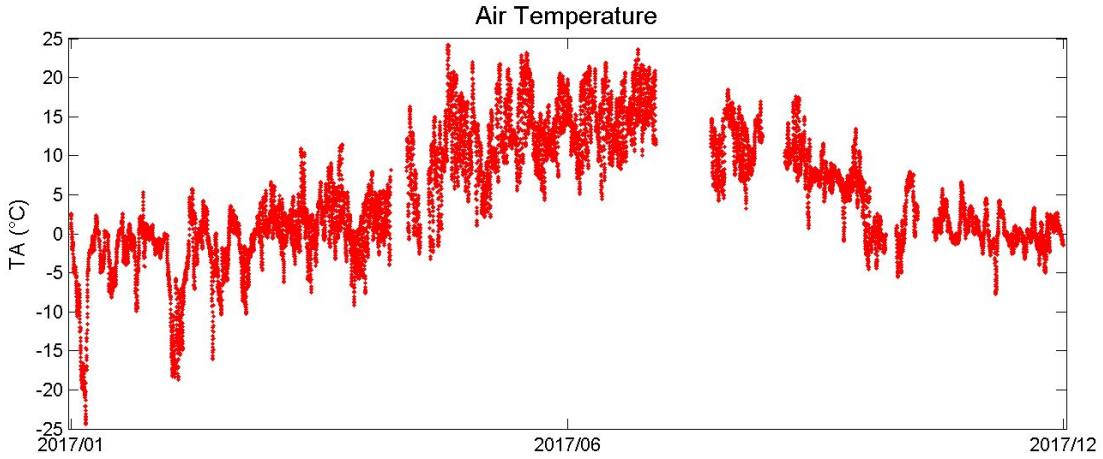
CO_2 fluxes measured with eddy covariance



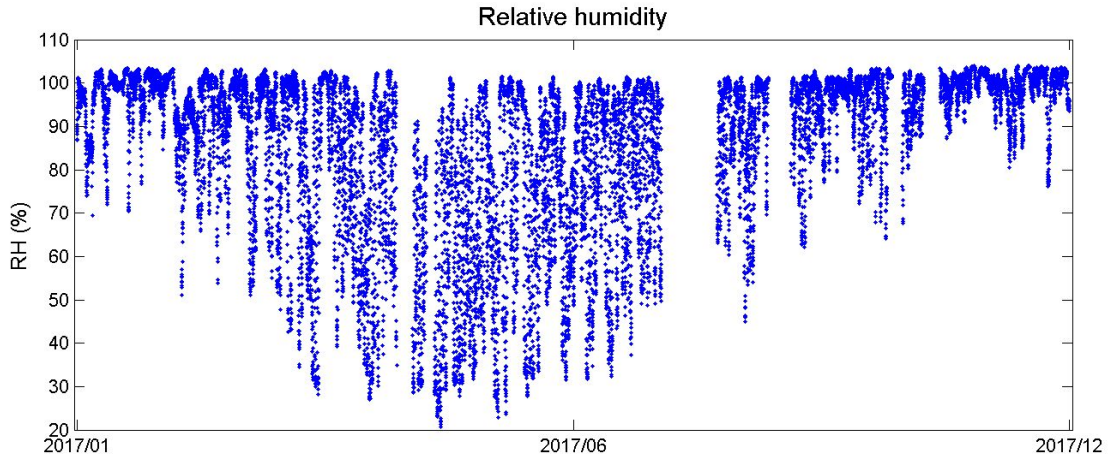
Incoming shortwave radiation



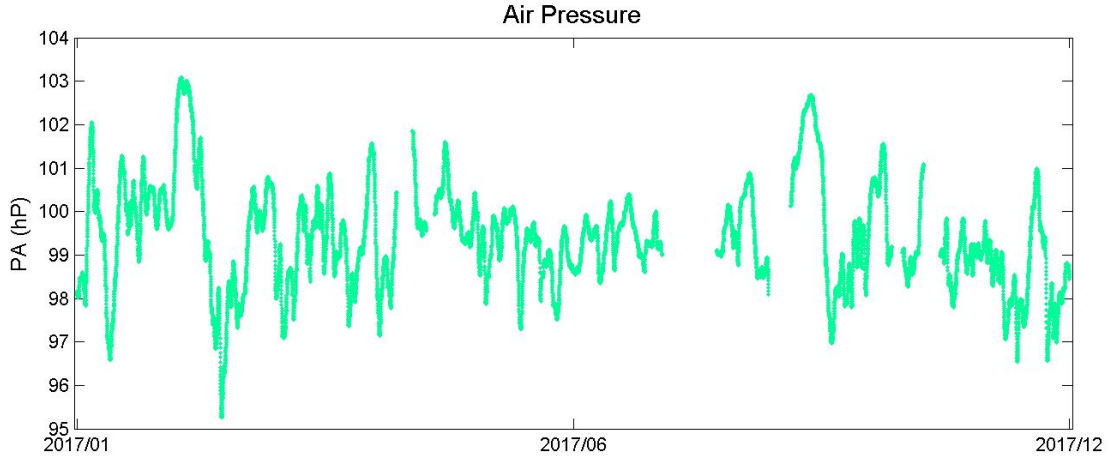
Air temperature



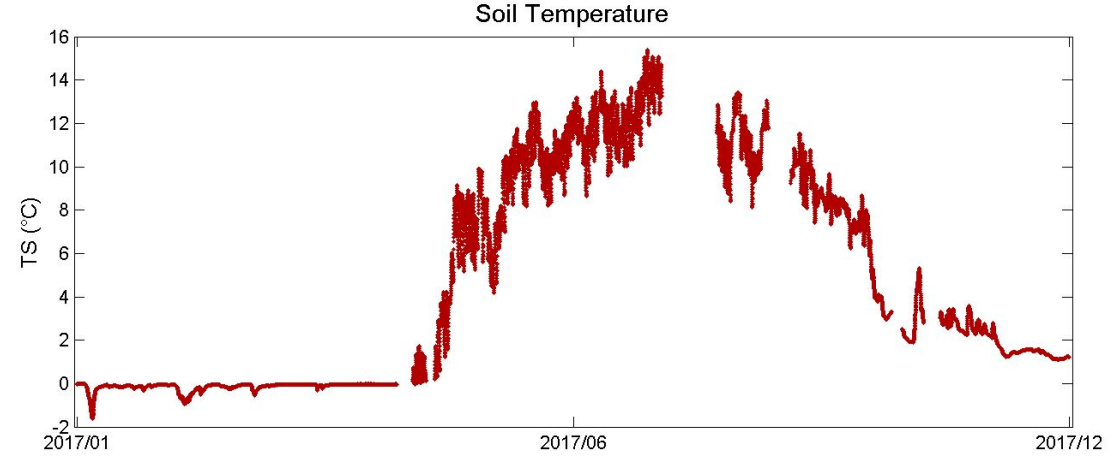
Relative humidity



Air pressure



Soil temperature



Next steps

Data on soil texture are under preparation and will be submitted in the next weeks. For the overstory GAI the station team asked to use the standard ICOS procedure with DHP and Continuous plots. ETC agreed to process these data and the acquisition is ongoing.

Labelling summary and proposal

On the basis of the activities performed and data submitted and after the evaluation of the team capacity to be compliant with the ICOS requirements for Associated Ecosystem Stations we recommend that the station Lettosuo (FI-Let) is labelled as ICOS Associated Ecosystem station.

Dario Papale, ETC Director

November 6th 2018