Associated ICOS Ecosystem Station Labelling Report

Station: FI-Var (Varrio)

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 September 28th 2017 and completed the data and metadata submission on September 4th 2018. Here below a summary of the submitted data and metadata is reported.

Station Description

The Värriö Subarctic Research Station and the Station for Measuring Ecosystem-Atmosphere Relationship (SMEAR I, established in 1991) of the University of Helsinki (UH) are located in Värriö strict nature reserve, Salla, Finnish Laplandon. The flux tower is located at SMEAR I station at the arctic-alpine timberline on the top plateau of the hill of Kotovaara, at 395 m a.s.l, and surrounded by a homogeneous and relative open 10m tall Scots Pine (*Pinus sylvestris* L.).

Its coordinates are Lat. 67.7549 N, Long. 29.6100 E, the UTC offset is UTC+2.

The site is characterized by a typically subarctic climate with the following climate averages:

Average annual temperature: -0.5 C°

Average total annual precipitation: 601 mm

Fig. 1 - the FI-Var tower

Team description

The staff of the site has been defined and communicated in January. It includes in addition to the PI, the scientific expert and the affiliated. 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
Pasi Kolari	University of Helsinki, Finland	PI	
Liisa Kulmala		SCI-ANC	
Tuukka Petäjä	University of Helsinki, Finland	AFFILIATED	

Metadata about the sensors

The metadata were sent in March 2018 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 7200 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-7200	72H-0317	16.6	0	0
SA-Metek USA-1 Fast	VAR_EDDY_metektow	16.6	0	0

A set of instruments are located near the tower: radiation, precipitation, 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 Class1	300	15	-1.3	4	SW_IN_1_1_1
RAD-Net radiometer	VAR_META_NET	15	0	-1	NETRAD_1_1_1
RAD-PAR Quantum	Q20593	15	-1	4	PPFD_IN_1_1_1
RAD-PAR Quantum	VAR_META_RPAR	15	-1.1	4	PPFD_OUT_1_1_1
RAD-Other	VAR_META_	15	-1.2	4	PPFD_DIF_1_1_1

	diffPAR				
PREC-OpticGauge	VAR_META_Precipacc	2	-5	5	P_1_1_1
PREC-WeightGauge	VAR_FMI_Precip2	1.5	0	-600	P_2_1_1
RAIN-TipBucGauge	VAR_META_RMM	2	-12	12	P_RAIN_1_1_1
SNOW-Other	VAR_META_SNOWDEPTH	1.5	-10	10	D_SNOW_1_1_1
TEMP-ElectResis	VAR_META_TDRY0	15	-2	4	TA_1_1_1
TEMP-ElectResis	VAR_META_TDRY1	9	-2	4	TA_1_2_1
TEMP-ElectResis	VAR_META_TDRY2	6.6	-2	4	TA_1_3_1
TEMP-ElectResis	VAR_META_TDRY3	4.4	-2	4	TA_1_4_1
TEMP-ElectResis	VAR_META_TDRY4	2.2	-2	4	TA_1_5_1
RH-Capac	71717332	15	-2	4	RH_1_1_1
RH-Capac	VAR_META_HUM_RH	2	-2	4	RH_1_2_1
PRES-ElectBar	VAR_META_P	2	-2	4	PA_1_1_1
SA-Metek USA-1 Fast	VAR_EDDY_metektow	16.6	0	0	WD_1_1_1
					WS_1_1_1
WIND-2DSA	VAR_META_Wx0	16	-2	4	WD_1_2_1
					WS_1_2_1
SOIL_H-Plate	VAR_META_G1	-0.05	0	-5	G_1_1_1
SOIL_H-Plate	VAR_META_G2	-0.05	1	-4	G_2_1_1
SOIL_H-Plate	VAR_META_G3	-0.05	-1	-4	G_3_1_1
SWC-FDR	VAR_META_wsoil1	-0.02	2	1	SWC_1_1_1
SWC-FDR	VAR_META_wsoil2	-0.02	1	2	SWC_2_1_1
SWC-FDR	VAR_META_wsoil3	-0.02	3	2	SWC_3_1_1

SWC-FDR	VAR_META_wsoil4	-0.02	2	3	SWC_4_1_1
SWC-FDR	VAR_META_wsoil51	-0.15	-2	23	SWC_5_1_1
SWC-FDR	VAR_META_wsoil251	-0.35	-2	23	SWC_5_2_1
SWC-FDR	VAR_META_wsoil52	-0.1	-6	25	SWC_6_1_1
SWC-FDR	VAR_META_wsoil252	-0.3	-6	25	SWC_6_2_1
TEMP-Thermis	VAR_META_Tsoil1	-0.02	2	1	TS_1_1_1
TEMP-Thermis	VAR_META_Tsoil2	-0.02	1	2	TS_2_1_1
TEMP-Thermis	VAR_META_Tsoil3	-0.02	3	2	TS_3_1_1
TEMP-Thermis	VAR_META_Tsoil4	-0.02	2	3	TS_4_1_1
TEMP-Thermis	VAR_META_Tsoil01	-0.1	-2	23	TS_5_1_1
TEMP-Thermis	VAR_META_Tsoil51	-0.15	-2	23	TS_5_2_1
TEMP-Thermis	VAR_META_Tsoil251	-0.35	-2	23	TS_5_3_1
TEMP-Thermis	VAR_META_Tsoil02	-0.05	-6	25	TS_6_1_1
TEMP-Thermis	VAR_META_Tsoil52	-0.1	-6	25	TS_6_2_1
TEMP-Thermis	VAR_META_Tsoil252	-0.3	-6	25	TS_6_3_1
TEMP-Thermis	VAR_META_Tsoil03	-0.05	-4	27	TS_7_1_1
TEMP-Thermis	VAR_META_Tsoil53	-0.1	-4	27	TS_7_2_1

Ancillary data

To describe the site, the climatic annual averages of temperature and precipitation have been sent on March 2018 (see the Station Description paragraph). The only disturbance highlighted is a nature induced burn that involved about 60% of the footprint on 1951.

The soil data were sent on March specifying in detail the pH, the organic carbon stock, the data of texture.

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

- **LAI of overstory canopy**: 1.6 (mean)

- **Biomass**: foliage 0.321 KgDM m^{-2}, total above ground 3.68 KgDM m^{-2}, total below ground 0.872 KgDM m^{-2} (mean)

- **Canopy height**: 8.61 m (mean), 11.4 m (90th percentile)

- **Stand age**: 61 years (mean), 155 years (maximum)

- **DBH distribution**: 13.96 cm (mean), 21 cm (90th percentile)

- **Basal area**: 13.3 m^2 ha^{-1} (mean)

- **Number of trees**: 748 trees ha^{-1} (mean)

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 May 2018 and it includes 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. The uploaded meteo and soil variables are listed in Table 4. In the following figures plots of some of the key variables are presented as example in order to evaluate the data continuity and coverage.
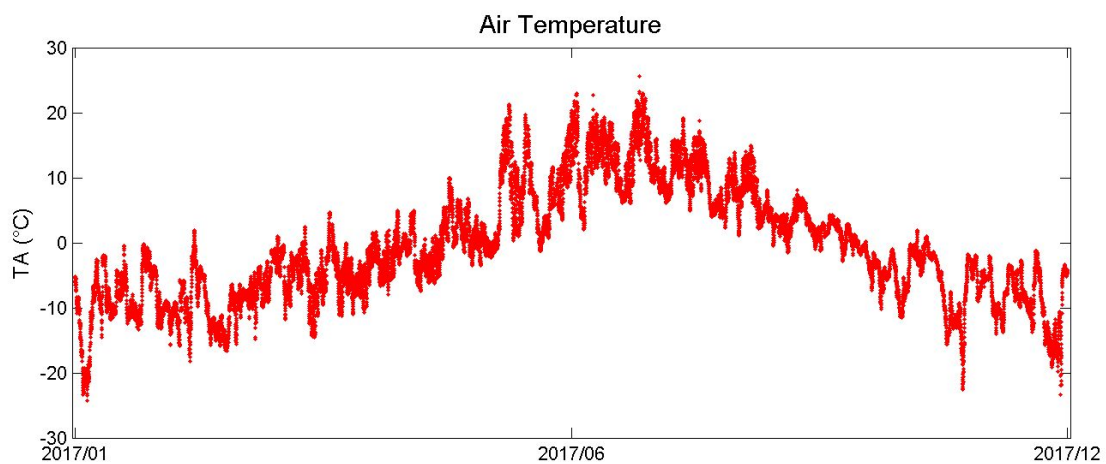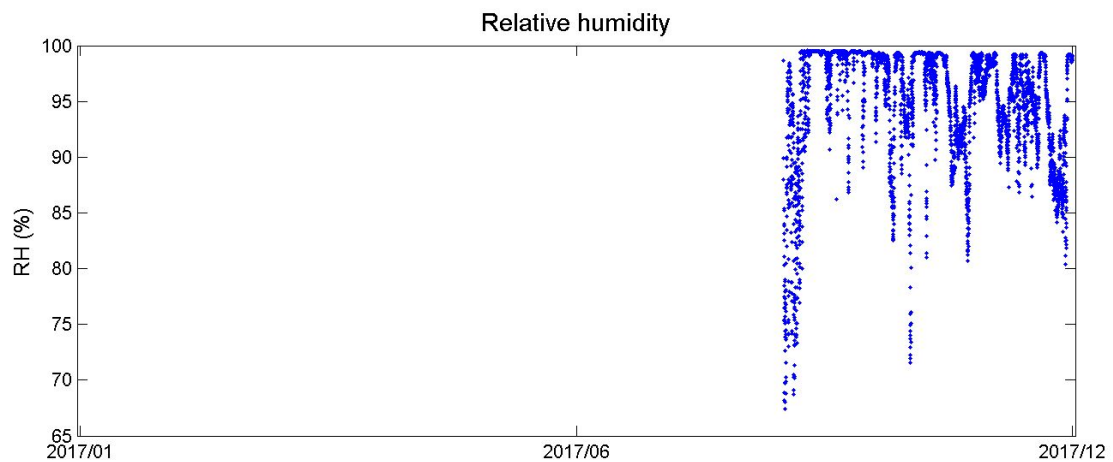
CO$_2$ fluxes measured with eddy covariance
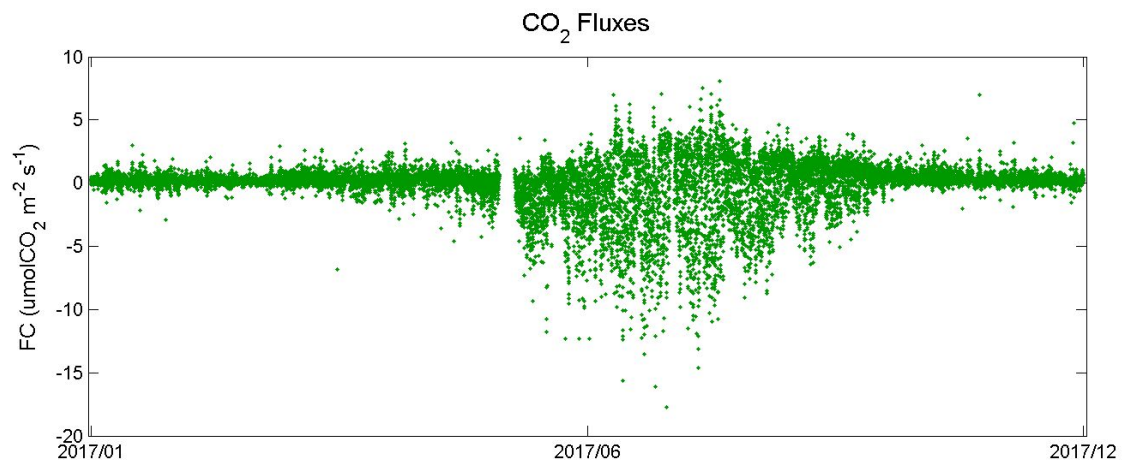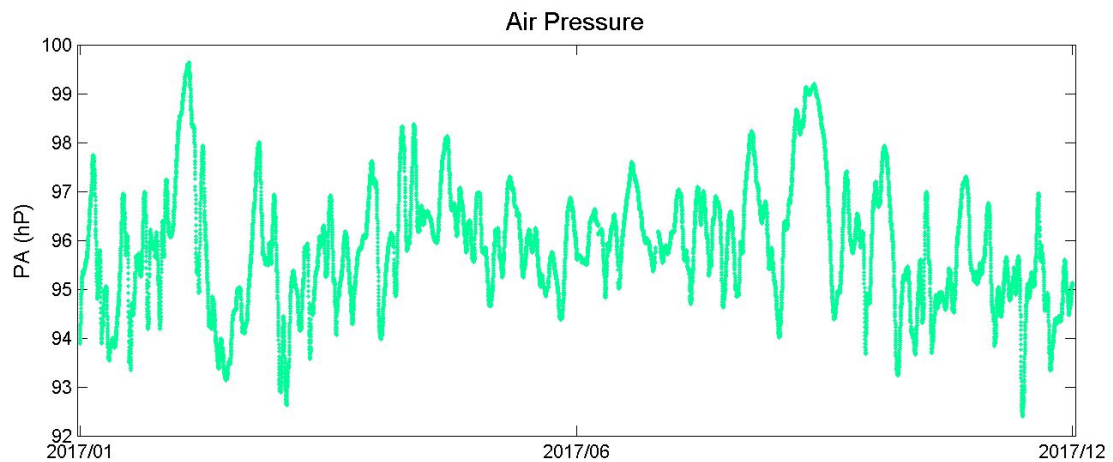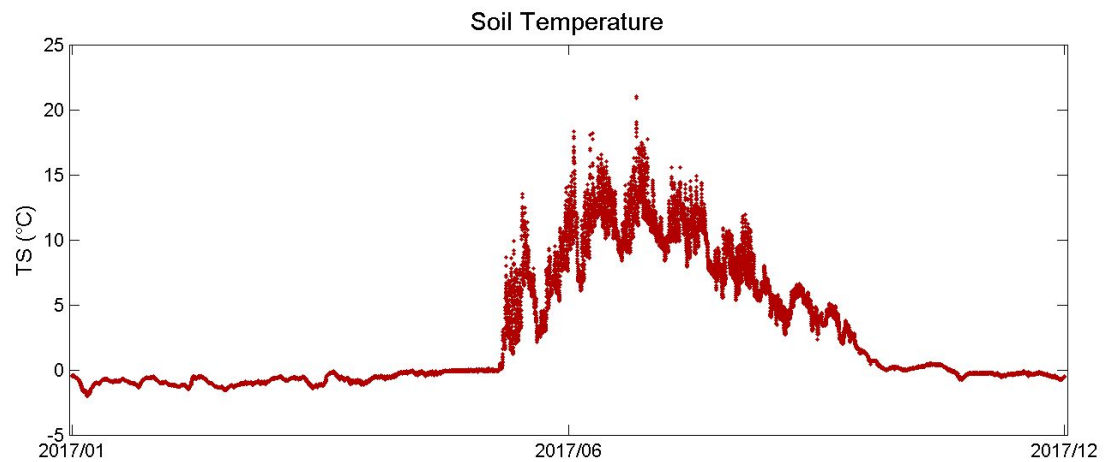

Incoming shortwave radiation
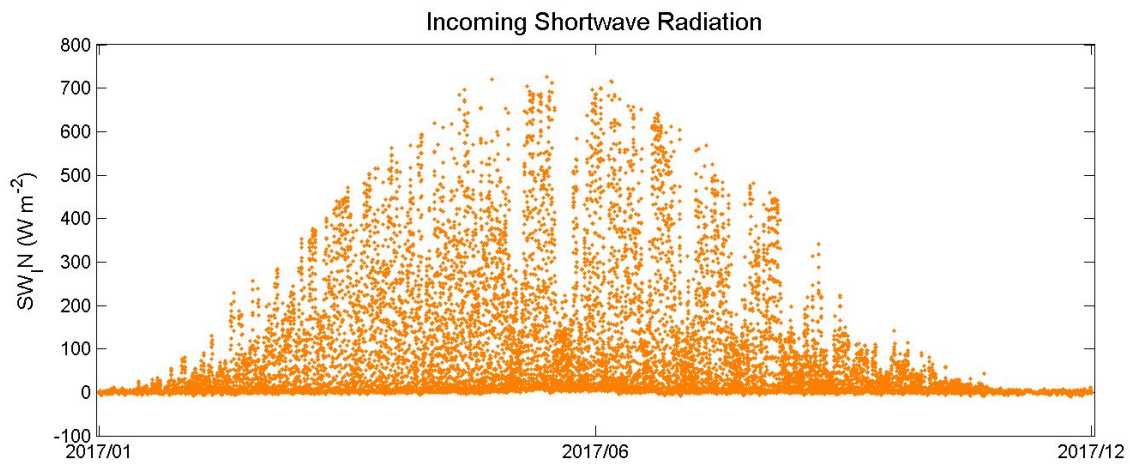
Air temperature

Relative humidity

Relative humidity

Air pressure

Air Pressure

Soil temperature

Soil Temperature

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 Varrio (FI-Var) is labelled as ICOS Associated Ecosystem station.

Dario Papale, ETC Director

November 6th 2018