Carbon and water fluxes in a cork oak woodland in Central Portugal- Data set

Sofia Cerasoli[1], Filipe Costa e Silva[1], Joana Portugal[1], Catarina Moura[2 3], João Santos Pereira[1], Jorge Soares David[1], Nuno Carvalhais[2 3], Mirco Migliavacca[2], Tarek S. El-Madany[2].

[1]CEF, Centro de Estudos Florestais, Instituto Superior de Agronomia, Universidade de Lisboa, Pt

[2]Max Planck Institute for Biogeochemistry, Jena, G

[3]DCEA, Departamento de Ciências e Engenharia do Ambiente, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Pt

Resource Title	Carbon and water fluxes in a cork oak woodland in Central Portugal
Resource Language	English
Metadata date	20.03.2020
Metadata Language	English
Keywords	Eddy Covariance, montado, ecosystem carbon exchange
Geographic extent	Lat. 39.1384, Long. -8.3327
Altitude	165m asl
Temporal extent	Start Date 2010-09-01 End Date 2017-08-31
Recommended citation	Cerasoli et al. 2020. Carbon and water fluxes in a cork oak woodland in Central Portugal. DOI:10.5281/zenodo.3727798
Responsible organization	CEF - Centro de Estudos Florestais, Instituto Superior de Agronomia, Universidade de Lisboa, PT
Character Encoding	UTF-8

Attributes

Name	Unit	Variable description
Datetime	---	date and time, in ISO 8601:2004(E) format (yyyy-mm-dd hh:mm:ss)
year	---	The four-digit year
doy	---	Ordinal day of year
hour	---	Hour of the day (0-23.5)
Tair	degC	air temperature
Tair_fqc	---	quality control flag of Tair
Tair_f	degC	gapfilled Tair
RH	%	relative Humidity
VPD	hPa	vapor pressure deficit
VPD_fqc	---	quality control of vpd
VPD_f	hPa	gap filled vpd
Rg	W m-2	global radiation
Rg_fqc	---	quality control flag of Rg
Rg_f	W m-2	gap filled Rg
PotRad	W m-2	Potential radiation
PPFD	umol m-2 s-1	Photosynthetic Photon Flux Density

Rn	W m-2	Net Radiation
NET_SW	W m-2	Net Short Wave
NET_LW	W m-2	Net Long Wave
Rain	mm	Rainfall
CO2	ppm	co2 mixing ratio
NEE	umol m-2 s-1	Net Ecosystem Exchange
NEE_fqc	---	quality control flag of NEE
NEE_f	umol m-2 s-1	gapfilled Net Ecosystem Exchange
Reco	umol m-2 s-1	Ecosystem respiration estimated after Reichstein et al. (2005)
GPP_f	umol m-2 s-1	Gross Primary Production
GPP_fqc	---	quality control flag of GPP_f
uStar	m_s-1	Friction velocity
wind_speed	m_s-1	wind speed
wind_dir	degrees	wind direction
LE	W m-2	Latent heat flux
LE_f	W m-2	gapfilled LE
LE_fqc	---	quality control flag of LE_f
H	W m-2	Sensible heat flux
H_f	W m-2	gapfilled H
H_fqc	---	quality control flag of H_f

Missing values are indicated as -9999

Site Description

The study was conducted in a 50-year-old cork oak woodland (*Quercus suber* L.) at *Herdade* da *Machoqueirado Grou*, *located* in Central Portugal (39° 08′ 20.9″ N, 9° 19′ 57.7″ W, 165-m altitude). The climate is Mediterranean, with mild, wet winters and hot, dry summers. The average annual precipitation recorded at the climate station of Santarém (39° 12′ N, 8° 44′ W) for the period 1981–2010 was 652 mm, and mean daily temperature was 17 °C (www.ipma.pt/pt/oclima/normais.clima/). The prevailing wind direction is North-West. The soil is a cambisol (FAO) with 81% sand, 5% clay and 14% silt. Tree density is 177 tree ha^{-1} and leaf area index (LAI) is 1.5 (Cerasoli et al., 2016). The mean height below the canopy and total height of trees are 3.1 and 7.9 m, respectively. The mean diameter at breast height is 24.7 cm (Correia et al., 2014). The understory is composed by a mixture of shrubs (27.6% coverage) and herbaceous (39.2% coverage) species, with litter and bare soil covering the remaining area. *Cistus salviifolius* (cistus) and *Ulex airensis* (ulex) are the most represented shrubs species, while grasses (44.5 %) and legumes (28.7 %) dominate the herbaceous layer (Cerasoli et al., 2016).

Measurements

All sensors are located at the top of a 22m tall tower. Precipitation (ARG100, Environmental Measurements Ltd., Gateshead, UK), photosynthetic active radiation (BF2, Delta-T Devices Ltd., Cambridge, UK), Net Radiation (NR2, Net Radiometer, Kipp and Zonen, Delft, NL) humidity and air temperature (CS215, Campbell Scientific, Inc., Logan, UT, US), atmospheric pressure (CS100, Campbell Scientific, Inc., Logan, UT, US) are collected at a 30-minutes time step and collected by a data logger (Campbell, CR10X) (Costa-e-Silva et al., 2015). At the same height a 3D sonic anemometer measures wind speed and direction (Model 1352, Gill Instruments Ltd., Lymington, England). CO_2 and water vapor concentrations are measured by a closed-path infrared gas analyzer (IRGA, Li 7000, Li-Cor Inc., Lincoln, NE, USA) in which the reference cell is flushed with N_2. –The inlet tube of the gas analyzer is positioned at the side of the anemometer and operated with an average flow rate of 8Lmin-1. The length of the incoming tube was approximately 8m and the diameter 5mm. Data were collected at 20 Hz and averaged at a 30 min time stamp.by a laptop using the EddyMeas software (Kolle and Rebmann, 2010).

Data processing

Data were processed with the EddyPro software (version 6.2.0, LI-COR Biosciences Inc., Lincoln, NE, USA). All raw data were despiked according to Vickers and Mahrt (1997). Time lags were determined by an automatic procedure accounting for the dependency of water vapor lags to relative humidity. Different wind coordinate rotation method was applied according to wind direction. For the main wind direction comprised between 15º and 90º and 200º-330º the planar fit method (Wilczak et al., 2001) was applied, for wind directions comprised between 90º and 200º and between 330º and 15º the double rotation procedure. This approach allowed to avoid the possible influence of an eucalypt area and an artificial rainwater harvesting lake included in the 80% iso-line of the footprint climatology (Kljun et al., 2015) (Fig.1) and to test the influence of fluxes coming from these sectors on the overall CO_2 and H_2O fluxes. Quality check of the fluxes followed the 0-1-2- system (Mauder and Foken, 2011). All meteo and flux variables were also screened for absolute limits and sensors malfunction using the MetECQC R package. The fluxes were corrected for CO_2 storage using the one point time derivative (Aubinet et al., 2001; Greco and Baldocchi, 1996). The estimate of u* threshold (Papale et al., 2006), gap filling and flux partitioning were performed using the REddyProc R package (Wutzler et al., 2018). Gap filled variables were classified using a synthetic QC (*_fqc), 1 = category A (most reliable), 2 =category B (medium), 3=category C (least reliable). 0 (zero) means that the original data was available. After correction of CO_2 fluxes for storage (Papale et al., 2006), the Net Ecosystem Exchange (NEE) was partitioned in Gross Primary Production (GPP) and ecosystem Respiration (Reco) according to Reichstein *et al.* (2005).

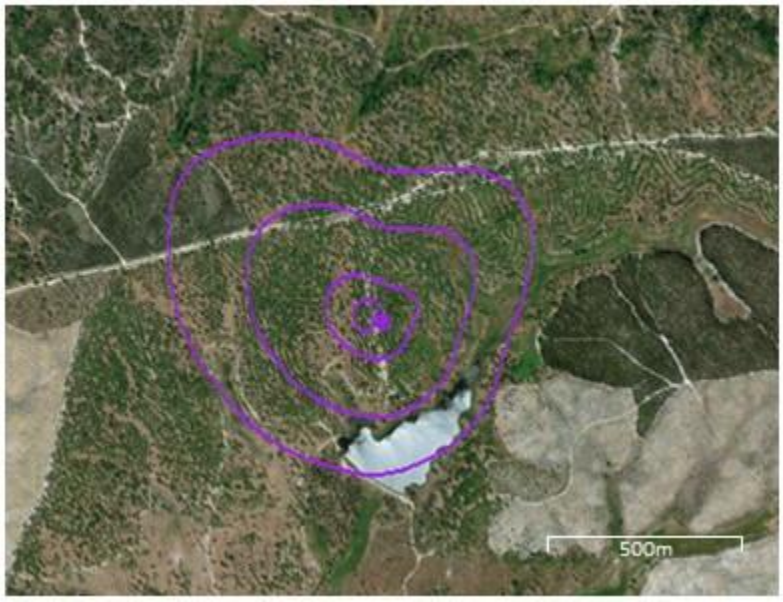

Fig. 1 10%, 40%, 70%, and 80% iso-lines of the footprint climatology for the period September 2010-August 2017.