Evaluating the Role of Subcanopy Cover in the Net Ecosystem CO2 Exchange in an Olive Orchard of SE Spain

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Abstract

In the last decades, the Eddy Covariance (EC) technique has become a standard method to measure net ecosystem CO2 exchange (NEE), but it doesn't let to distinguish between Gross Primary Production (GPP) and Ecosystem Respiration (Reco). Olive (Olea europea L.) is one of the most important agrosystems on the Mediterranean basin, covering 9.5Mha and accounting for 98% of olive groves global surface. In this study we analyze the EC fluxes from an olive orchard of SE Spain with two soil treatments: 1) leaving spontaneous weed cover (WC) growing on the soil, and 2) inhibiting this growth with a glyphosate-based herbicide (WF). These two different treatments provide high differences in NEE, but the contribution of each component (trees, weed and soil) in the NEE require a better understanding. In this study, we analyze Eddy Covariance fluxes from an olive orchard in SE Spain at different altitudes (above and below the olive trees). To study carbon fluxes contribution of weed in the olive orchard 4 EC towers were installed, placing them on two different areas: one area in WC treatment and the other in WF treatment. On each area, a canopy tower and a subcanopy tower were installed. After a data-filtering during the growth season in which only wind directions coming from olive orchard alleys were accepted, preliminary results from the subcanopy towers show that there are prevailing CO2 emission values from the soil in the WF area and CO2 fixation from the weed in the WC area. On the other hand, during senescence period, CO2 emission fluxes were obtained from both subcanopy towers. These results layout the relevant place of subcanopy towers to understand the role in carbon cycle of the different components in an ecosystem.

EVALUATING THE ROLE OF SUBCANOPY COVER IN THE NET ECOSYSTEM CO2 EXCHANGE IN AN IRRIGATED OLIVE ORCHARD OF SE SPAIN

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13/12/2021

AGU FALL MEETING

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INTRODUCTION AND BACKGROUND

- Conventional agriculture management → alteration of Biogeochemical cycles
- SOC and soil fertility loss
- Monitoring GHG in agriculture ecosystems with differentiated management
- Olive orchards in Spain

OBJECTIVES

- Quantify CO2 fluxes at a subcanopy level
- Evaluate differences in CO2 fluxes for the two different soil treatments
- Relate variations of CO2 fluxes to climatic conditions and ecosystem physiology over the year

METHODOLOGY

- Eddy Covariance site

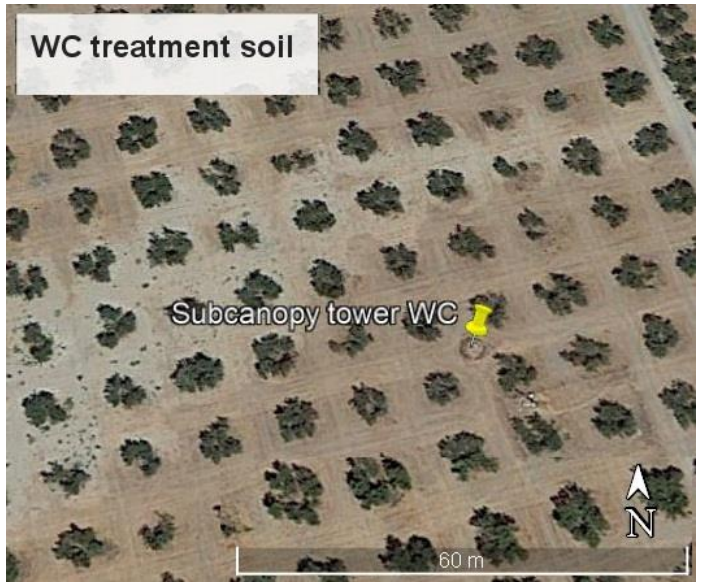
- Two different soil treatments:
  - **Weed Cover** (WC)
  - **Weed Free** (WF) – application of herbicide

- **Subcanopy towers** → EC technique
  - Data selection based on wind direction

METHODOLOGY

Data treatment

- Rotate coordinates
- Take data coming just from the olive orchard alleys



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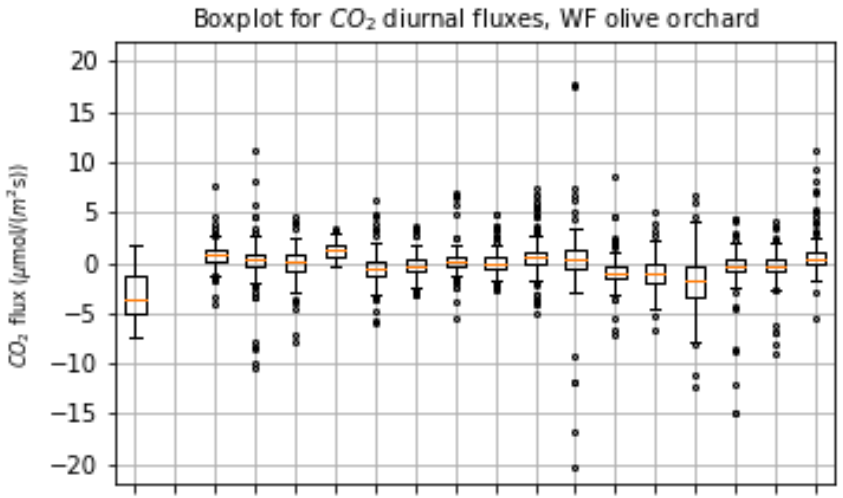
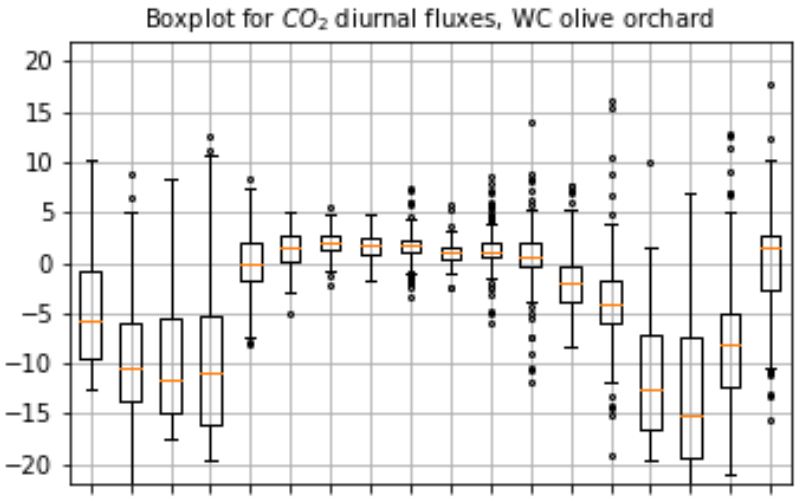
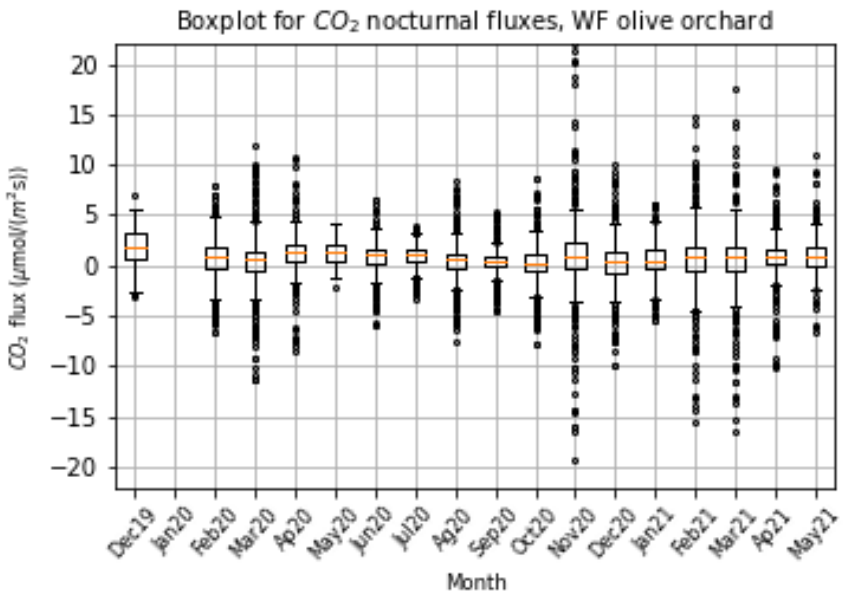
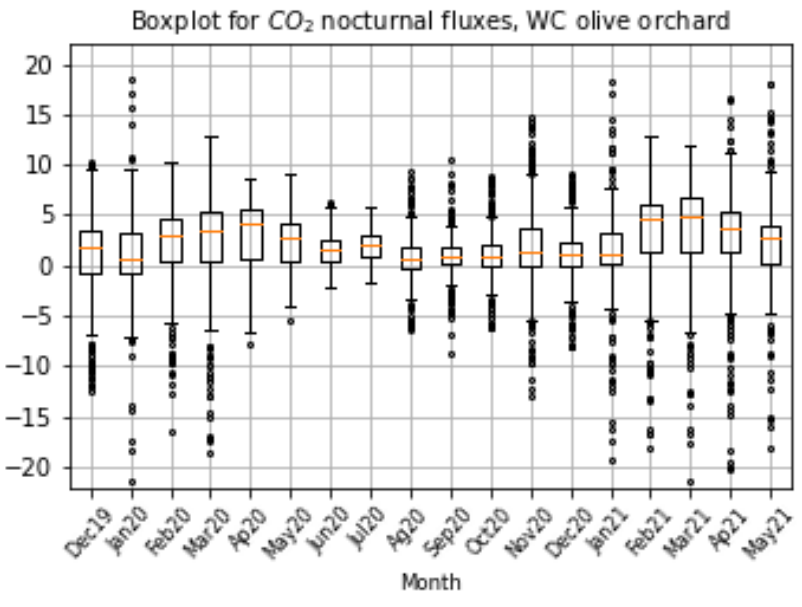
Diurnal and nocturnal CO_2 fluxes boxplots over the whole measurement period.









RESULTS

C uptake:

-Day in WC during weed growth season

C release:

-Day and night in WF

-Night in WC

-Day in WC after weed cut

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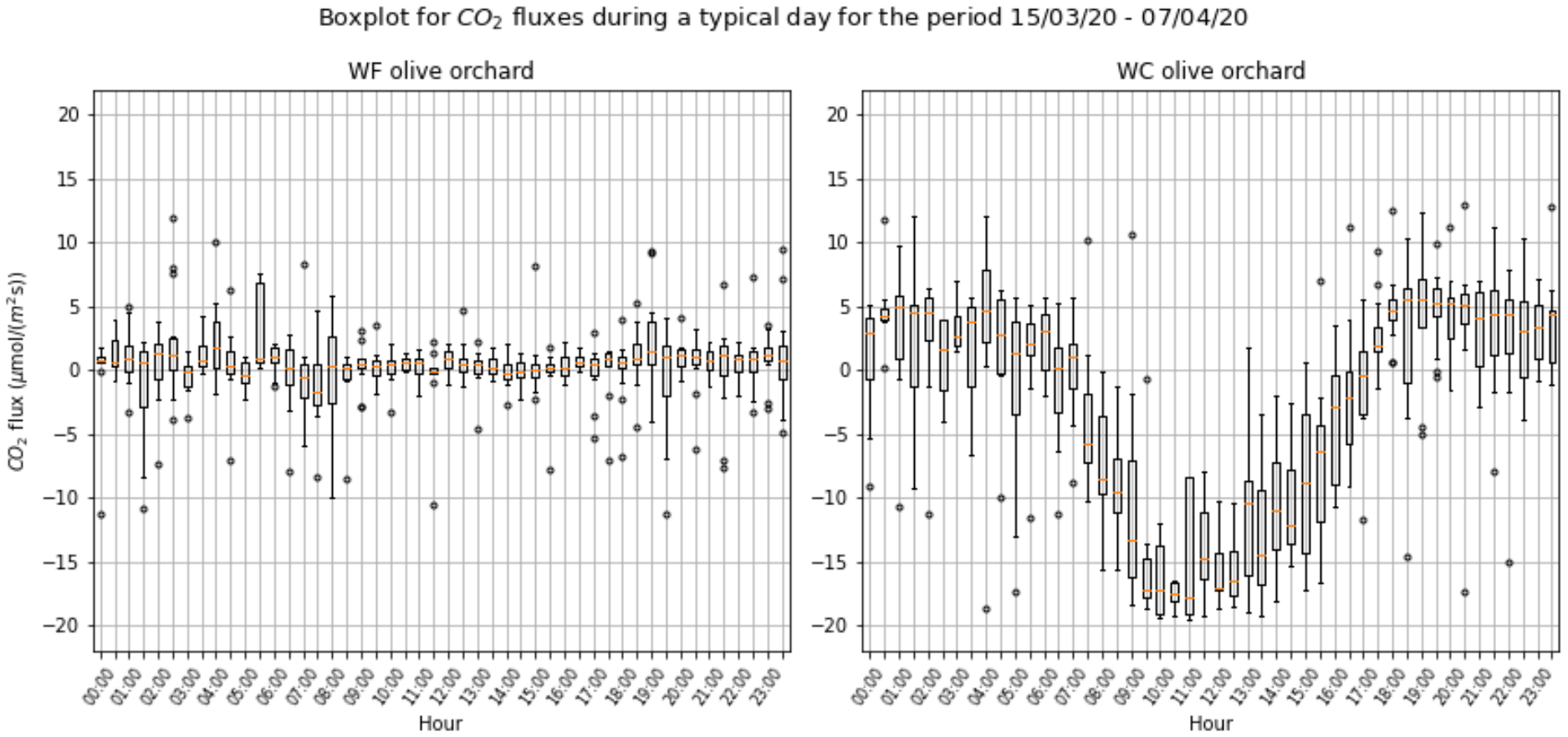
RESULTS

Before mowing 2020



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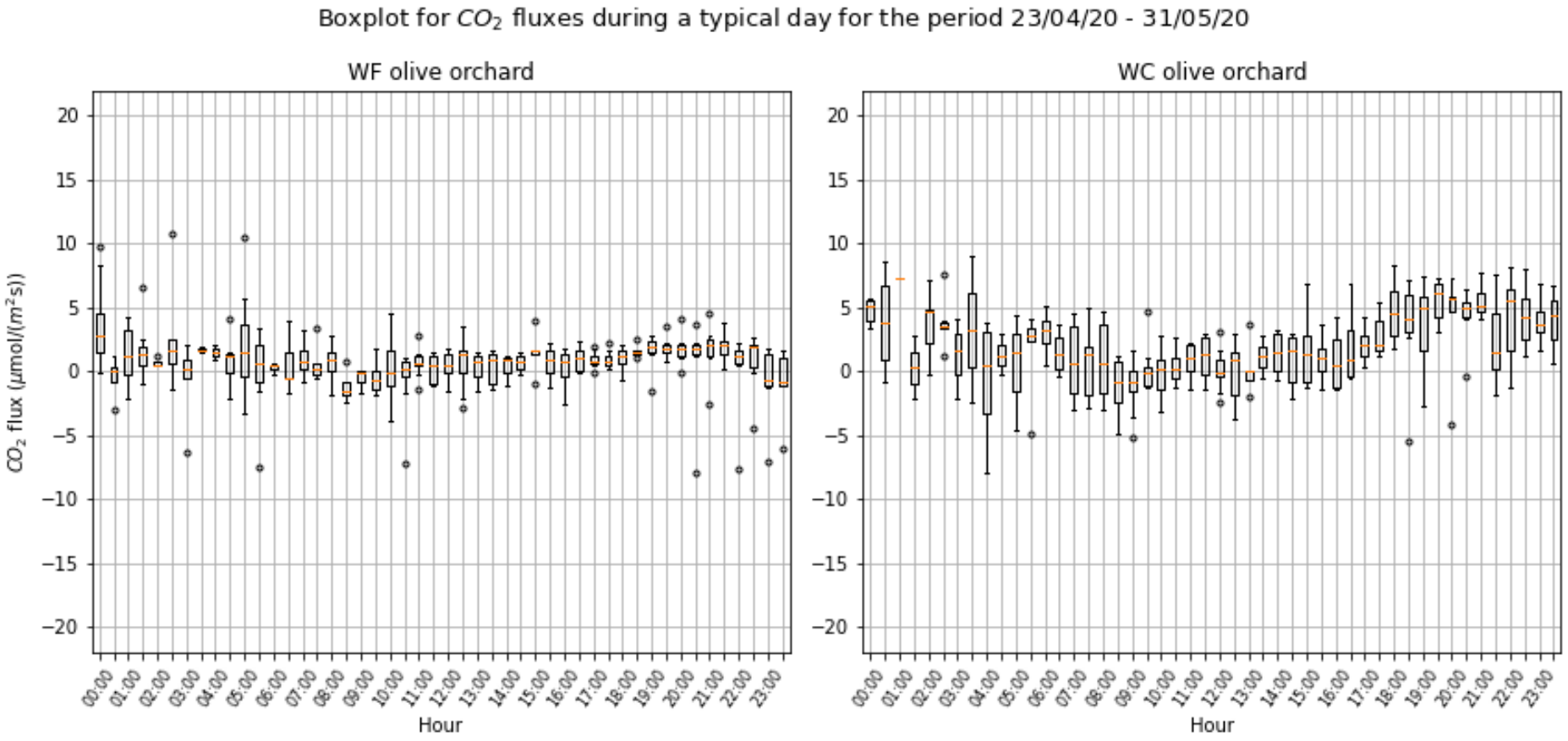
RESULTS

After mowing 2020



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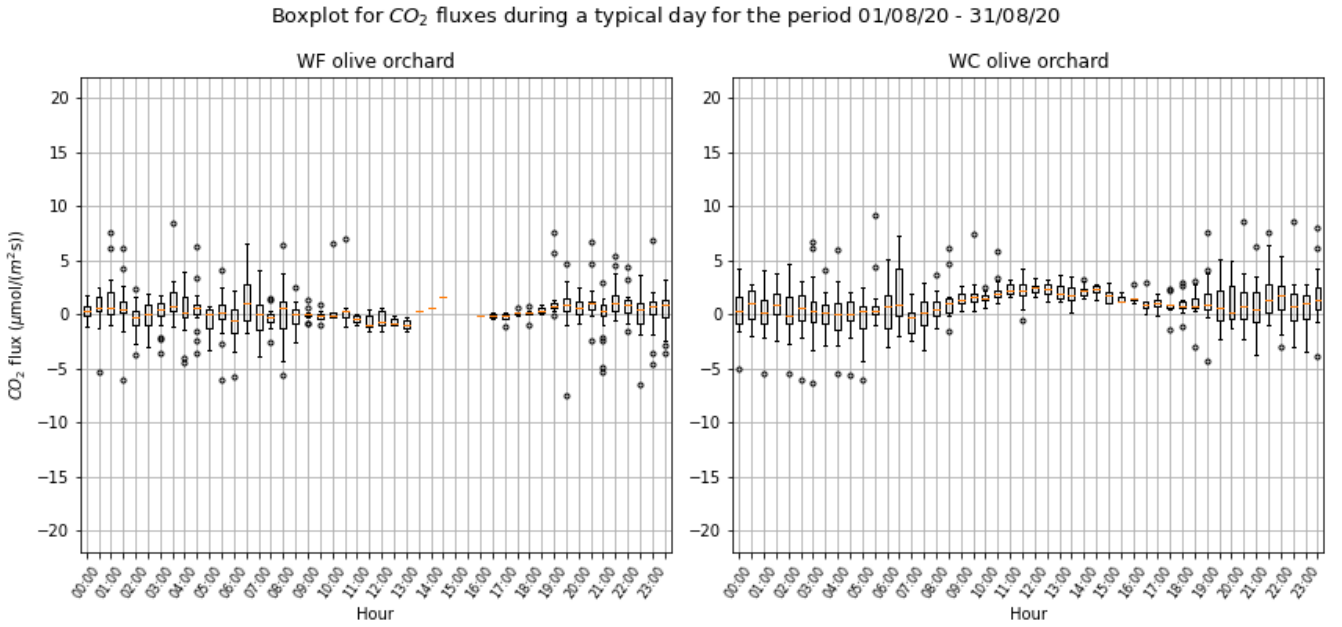
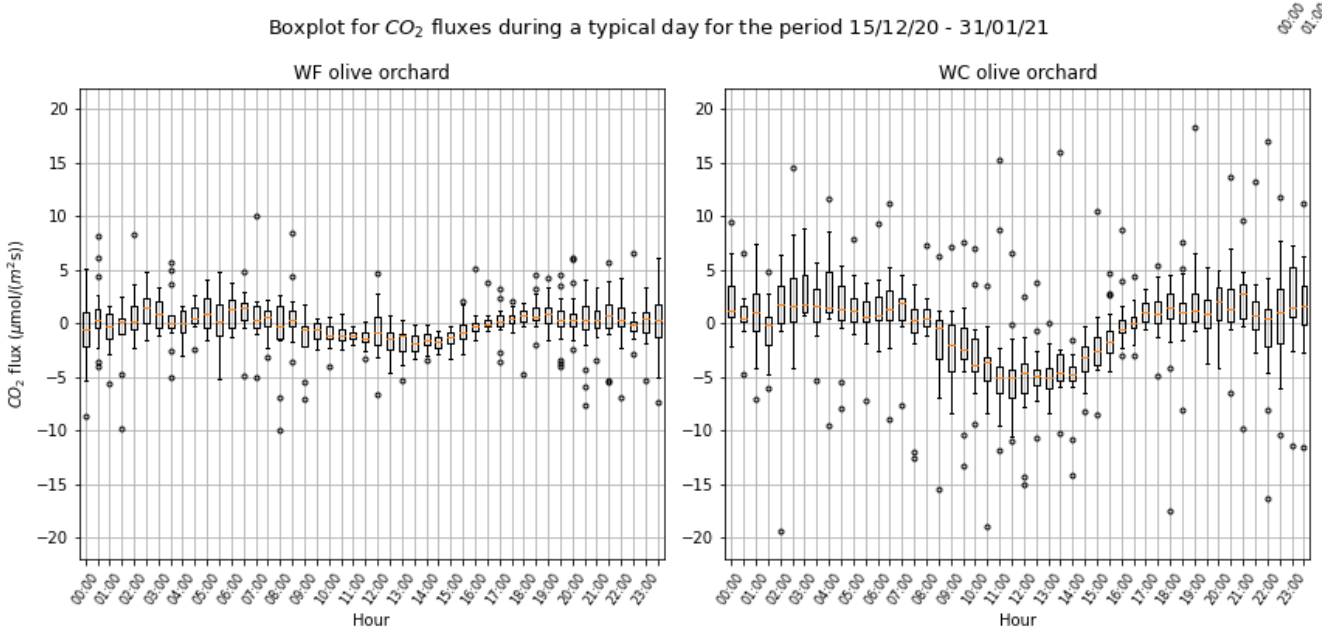
RESULTS

August 2020





Dec20 - Jan21

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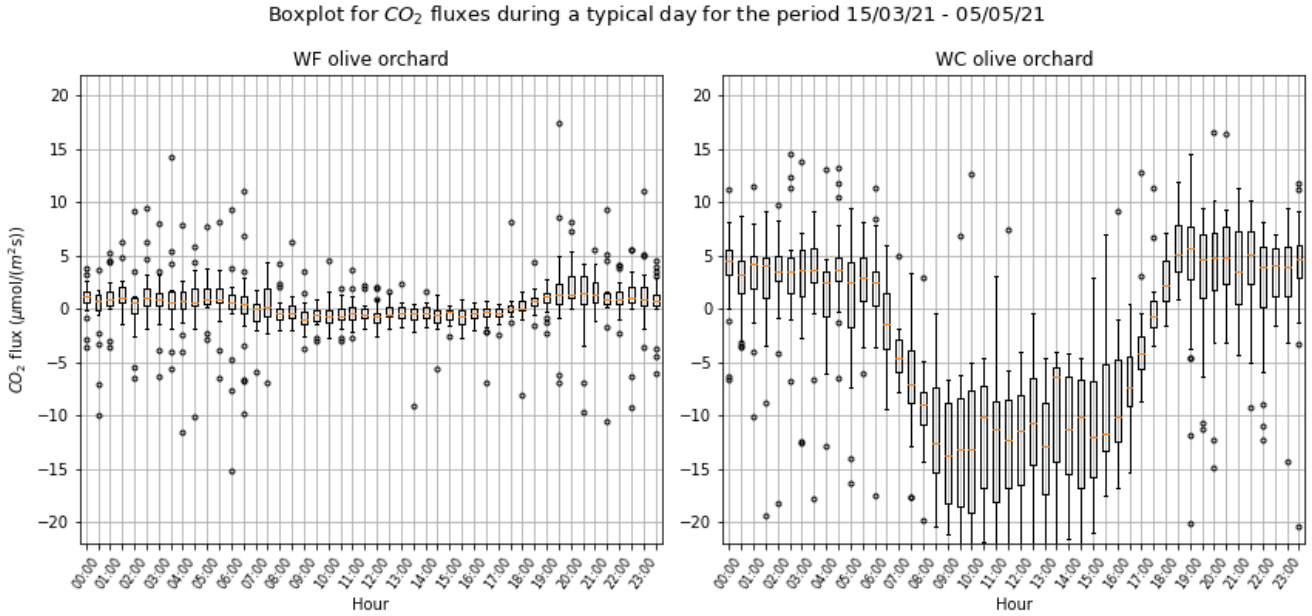
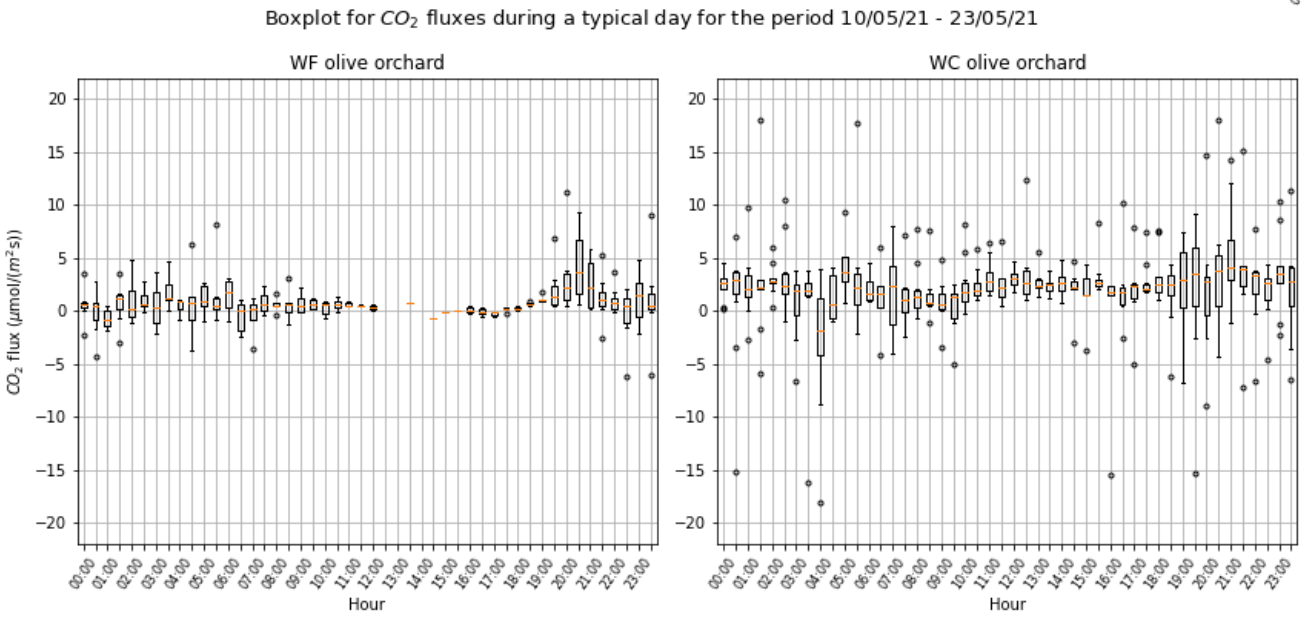
RESULTS

Before mowing 2021





After mowing 2021

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DISCUSSION AND FUTURE WORK

- C uptake during growth season in WC soil
- C release during all period in WF soil
- After mowing, respiration from WC soil is higher than resp. from WF soil
- Global subcanopy balances cannot be estimated with these data
- Future work should consider data from soil chambers and improve data selection methods

THANK YOU

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