

PILOT STUDY

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Introduction

The Eddy Covariance (EC) technique is a cornerstone method for quantifying real-time exchanges of greenhouse gases (GHGs) between ecosystems and the atmosphere. The FR-Gri ICOS station, located 40 km west of Paris, has recorded high-frequency EC measurements since 2005 in a cropland ecosystem context, using both open-path and closed-path gas analyzers.

This study processes the year 2005 as a pilot year, with the aim of establishing a standardized and reproducible data processing chain. The goal is to ensure consistency across two decades of data, prepare high-quality flux products for the ICOS Carbon Portal, and better assess uncertainties affecting long-term CO₂ flux estimates.



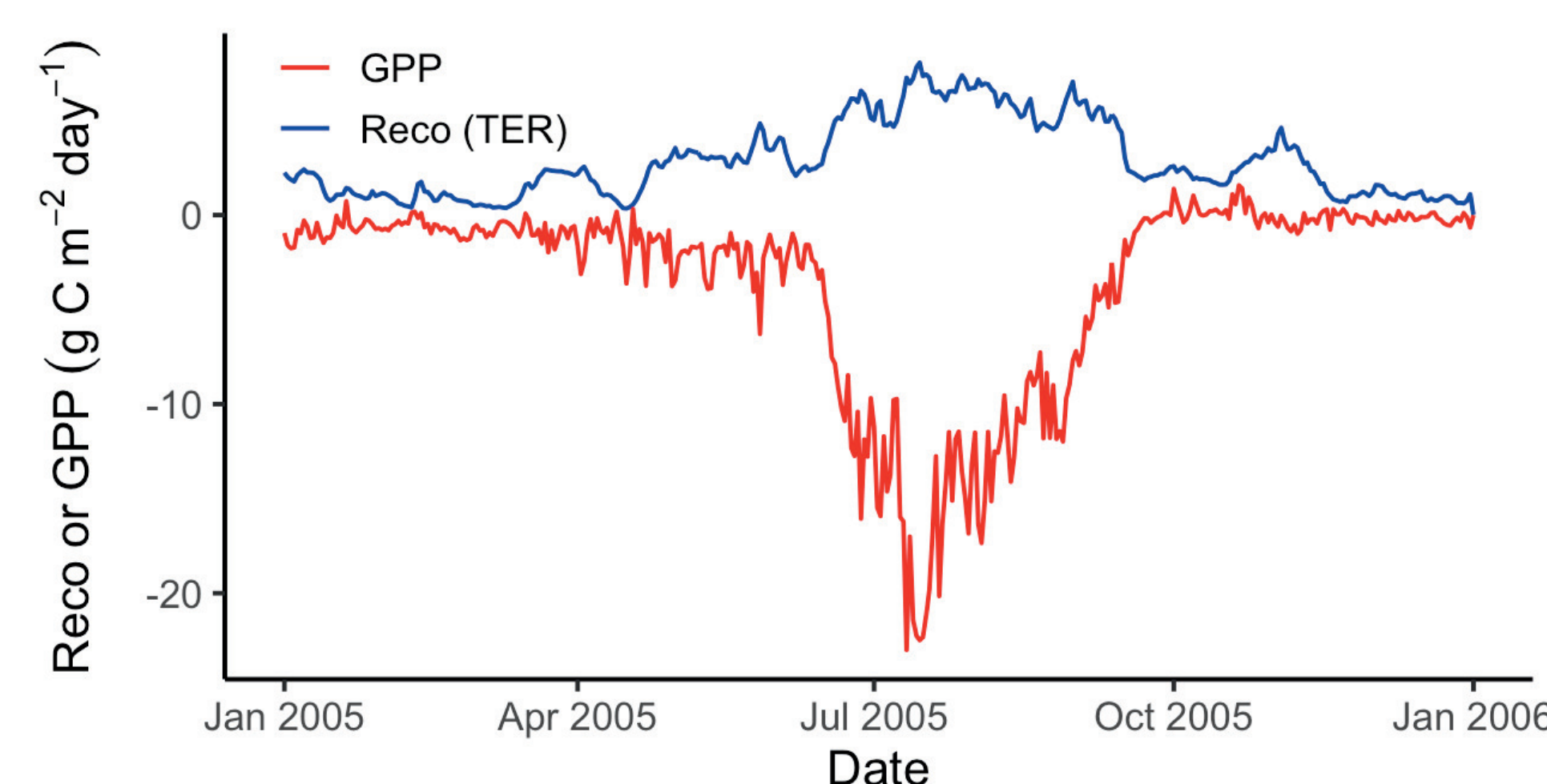
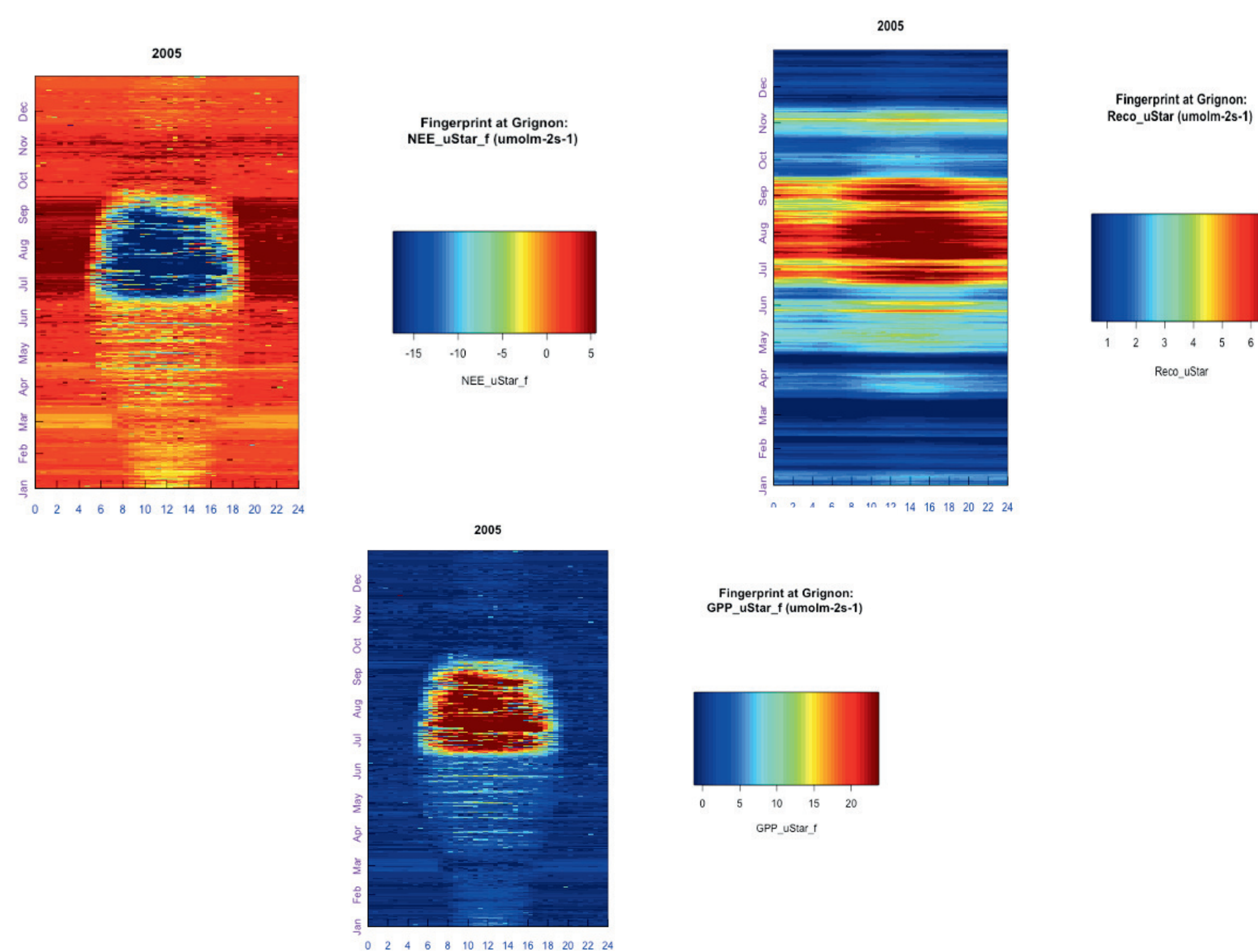
Method

Raw data from 2005 were first pre-processed in R to harmonize formats. EddyPro was then used for flux computation, including spike removal, time lag optimization, and WPL corrections. Quality checks were applied and REdyProc tool was used for gap-filling and partitioning NEE into GPP and Reco. Finally, cumulative NEE and field-based C_export and C_import were used to compute the annual carbon balance (NBP).

Gap-Filling & Partitioning (REddyProc):

Missing data were filled and NEE was partitioned into:

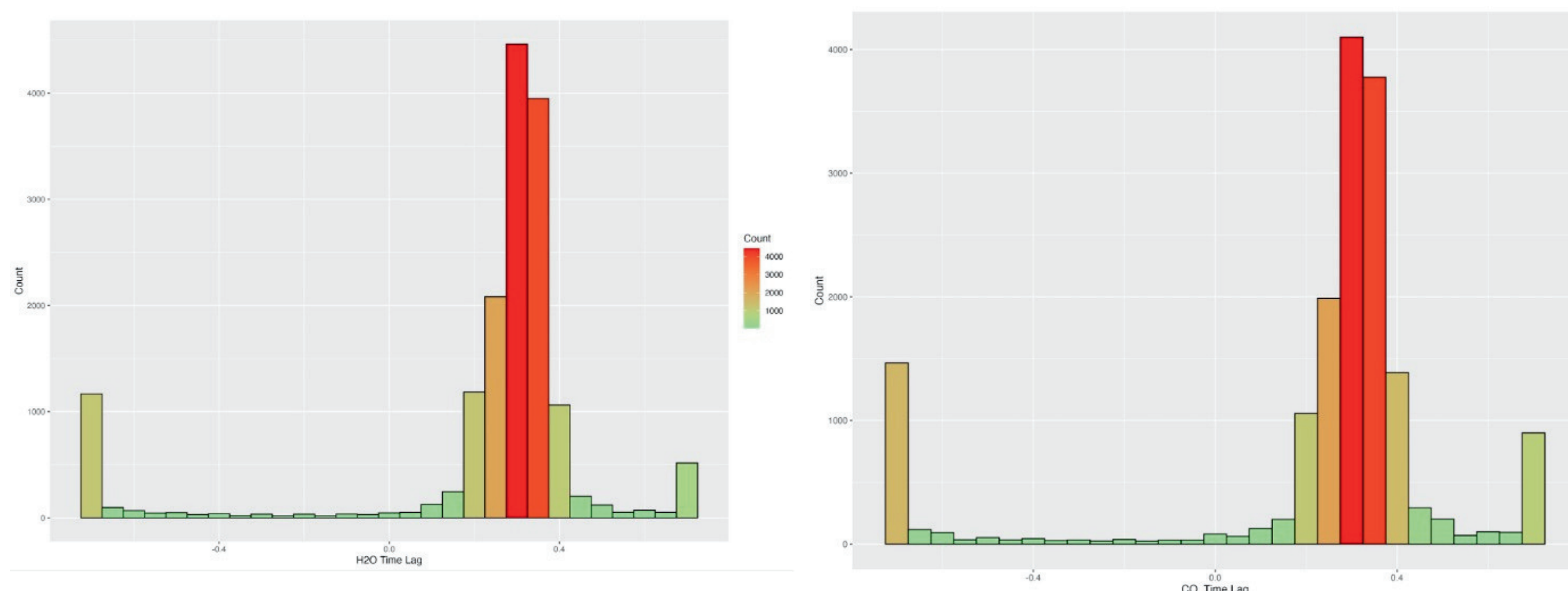
- GPP (photosynthesis)
- Reco (ecosystem respiration)



Results

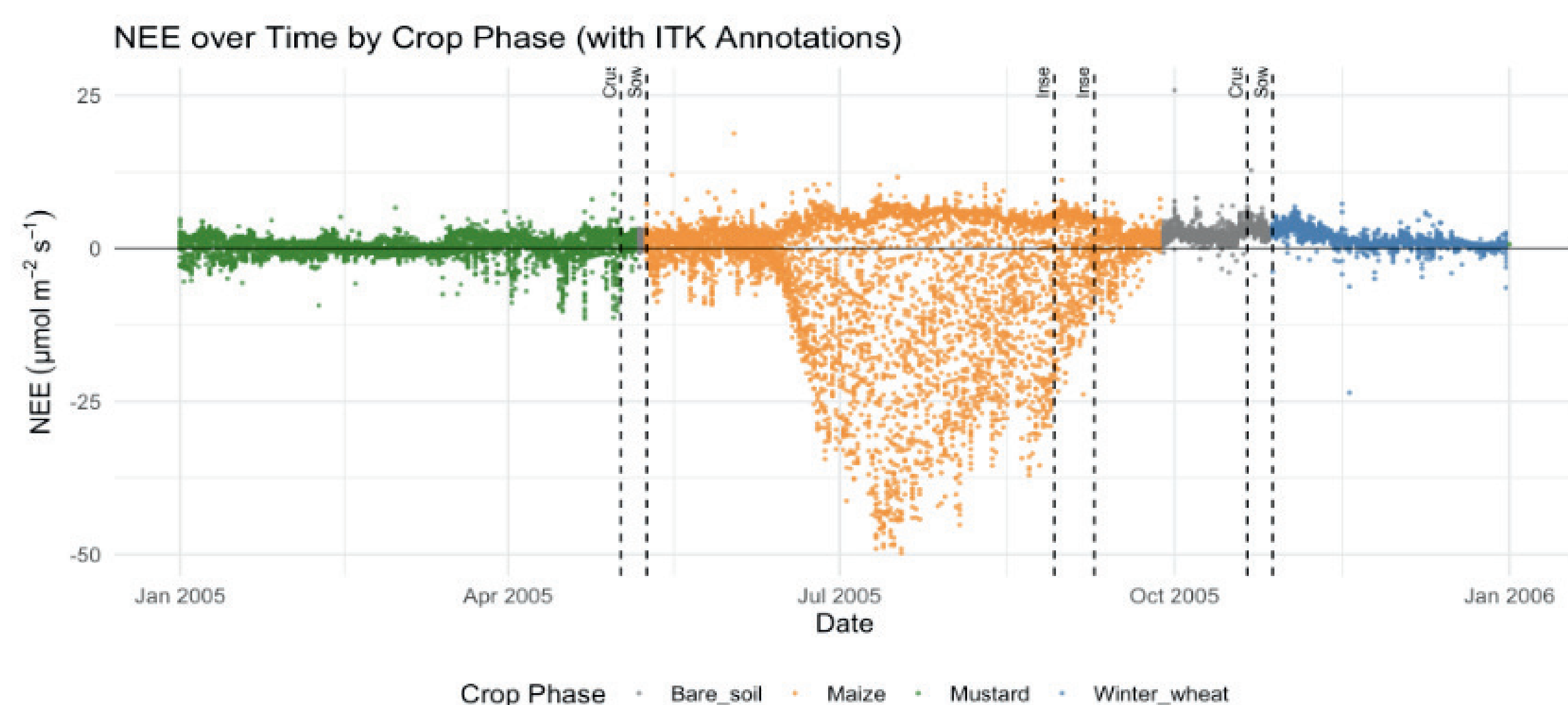
Time Lag :

Covariance maximization in EddyPro identified optimal time lags between 0.2s and 0.4s. With a maximum peak at 0.3s



Post-Processing :

Flag 2 quality data, Rain events and high wetness index periods (>30%) were filtered due to the vulnerability of the open-path sensor.



Carbon Budget Computation:

- Cumulative NEE: $-248 \text{ gC}\cdot\text{m}^{-2}$
 - C export (harvest & seeds): $+330.4 \text{ gC}\cdot\text{m}^{-2}$
 - Leaching losses: $-12.5 \text{ gC}\cdot\text{m}^{-2}$
 - C import: seeding $0.4 \text{ gC}\cdot\text{m}^{-2}$ this year
- Net Biome Production (NBP): $-94 \text{ gC}\cdot\text{m}^{-2}$

Conclusion

The year 2005 was a net source of carbon at the FR-Gri ICOS cropland site, with a Net Biome Production of $-94 \text{ gC}\cdot\text{m}^{-2}$.

The workflow developed here—from pre-processing in R to flux computation in EddyPro, filtering, partitioning, and final budgeting—will now be applied to the full 2005–2023 dataset.

Acknowledgement

This work was conducted within the framework of the Integrated Carbon Observation System (ICOS), which provided access to high-quality data and technical infrastructure at the FR-Gri site. We would like to express sincere gratitude to ICOS France for the opportunity to contribute to long-term climate observations and to INRAE for hosting this internship within the UMR ECOSYS unit. Special thanks to the FR-Gri site team for their support and dedication to maintaining continuous, high-quality flux measurements over the years.