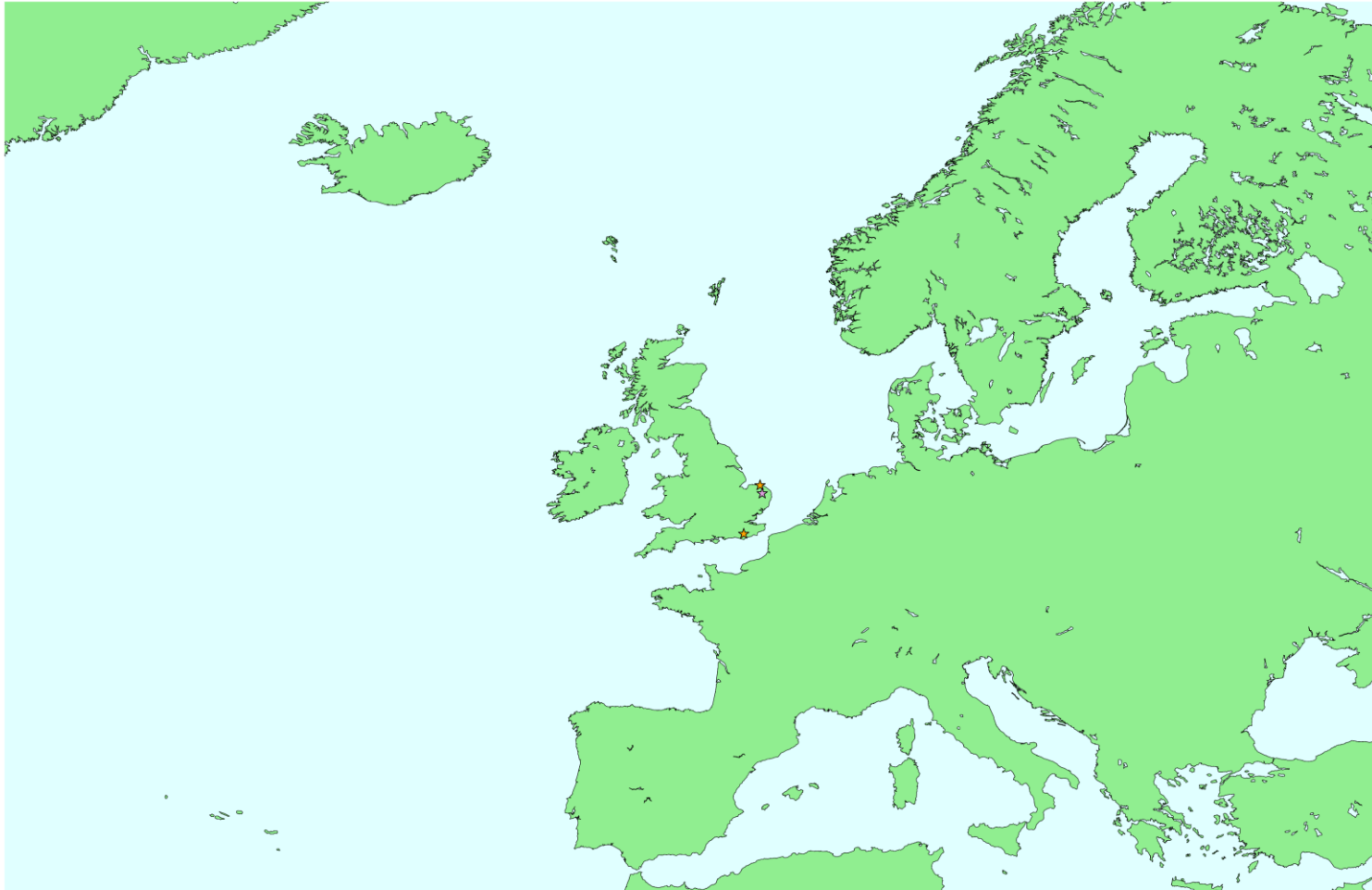


4th Workshop on Atmospheric Oxygen

Continuous measurements of atmospheric oxygen in the United Kingdom

Karina E. Adcock, Penelope A. Pickers, Andrew C. Manning, Grant L. Forster, Leigh S. Fleming, and Tim Arnold

Measurement sites

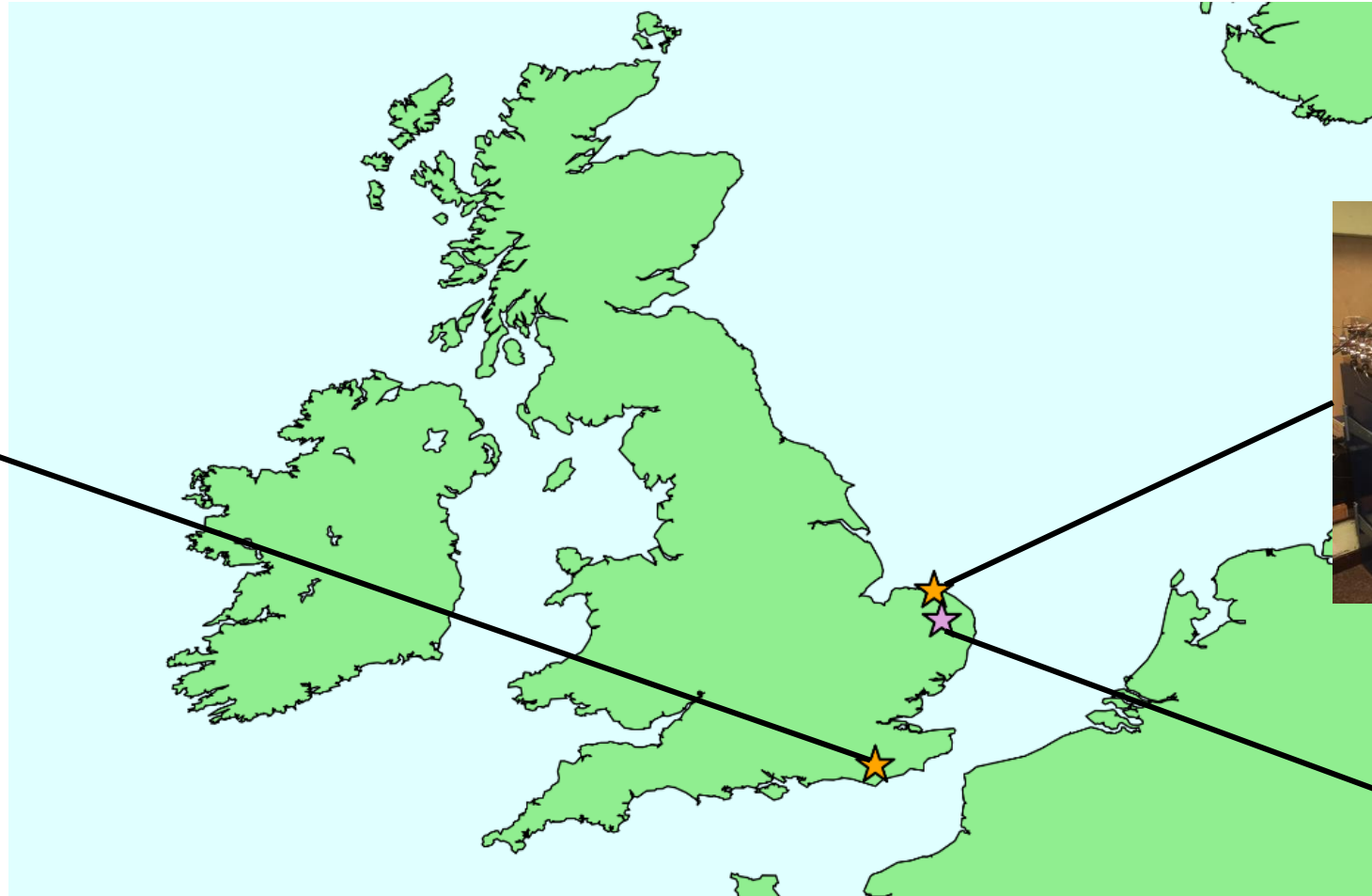


Measurement sites

**Heathfield
Tall Tower
(HFD)**



Inlet: 100 m



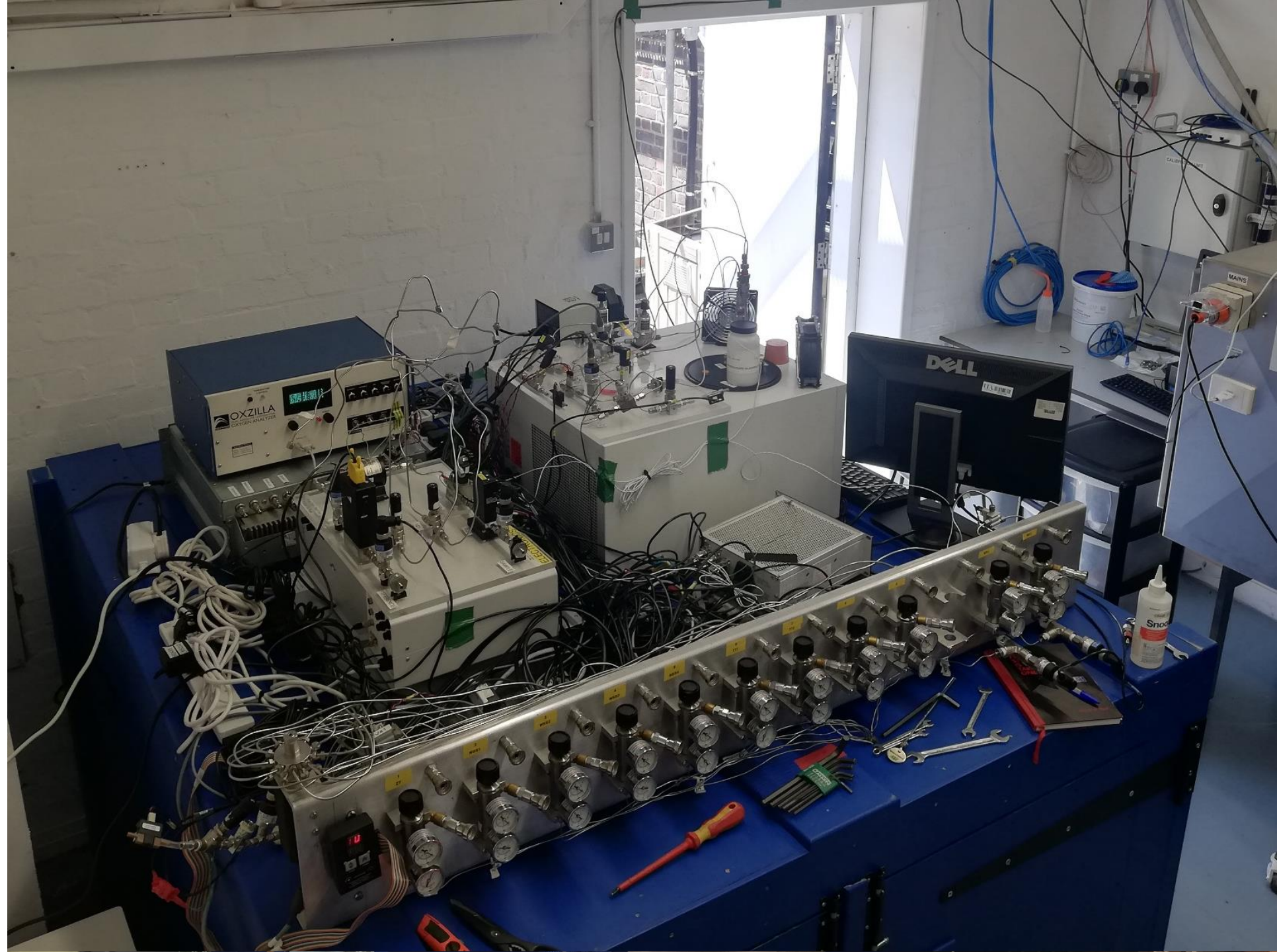
**Weybourne
Atmospheric
Observatory
(WAO)**



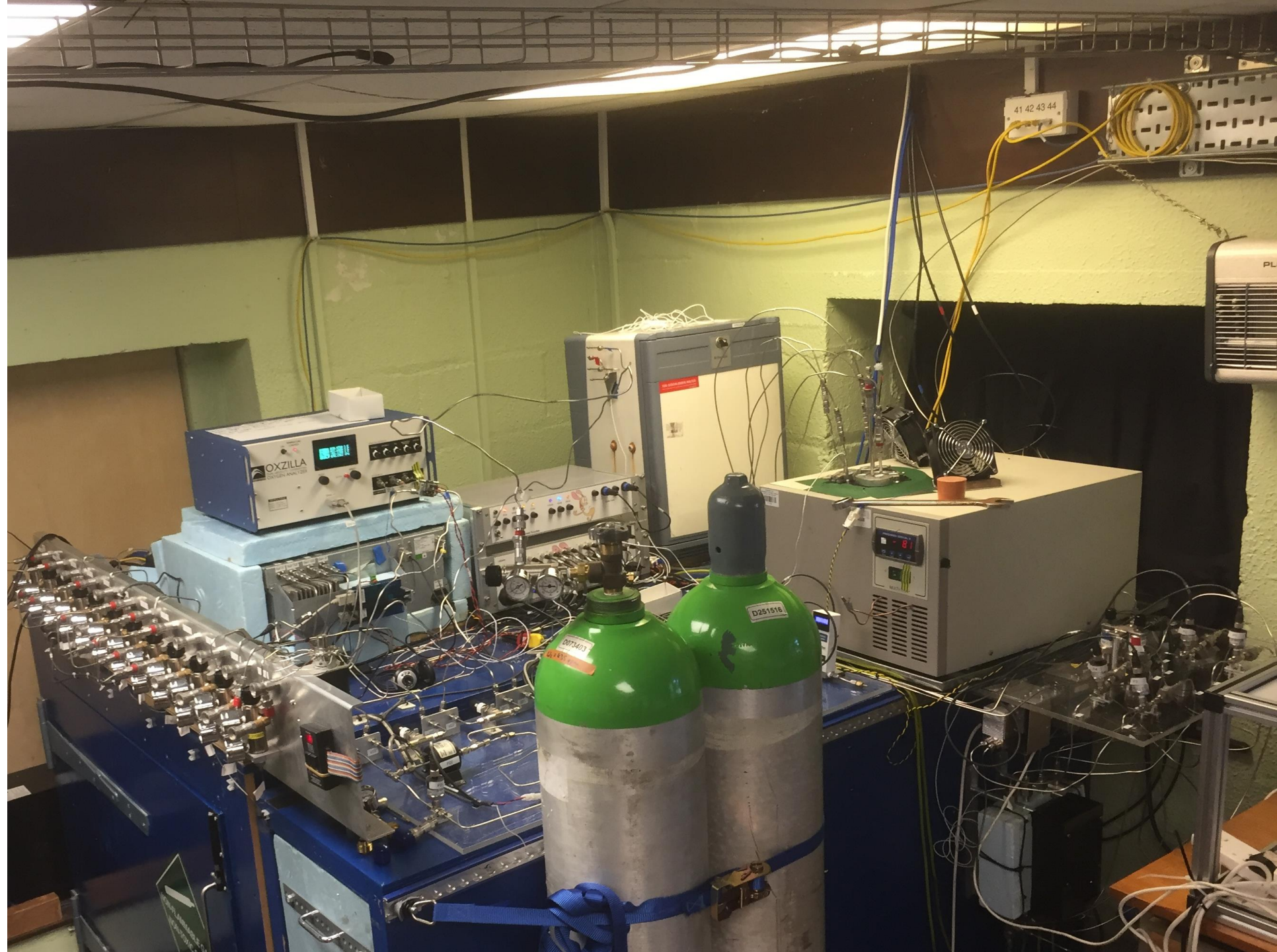
Inlet: 10 m

UEA

Measurement system



Measurement system

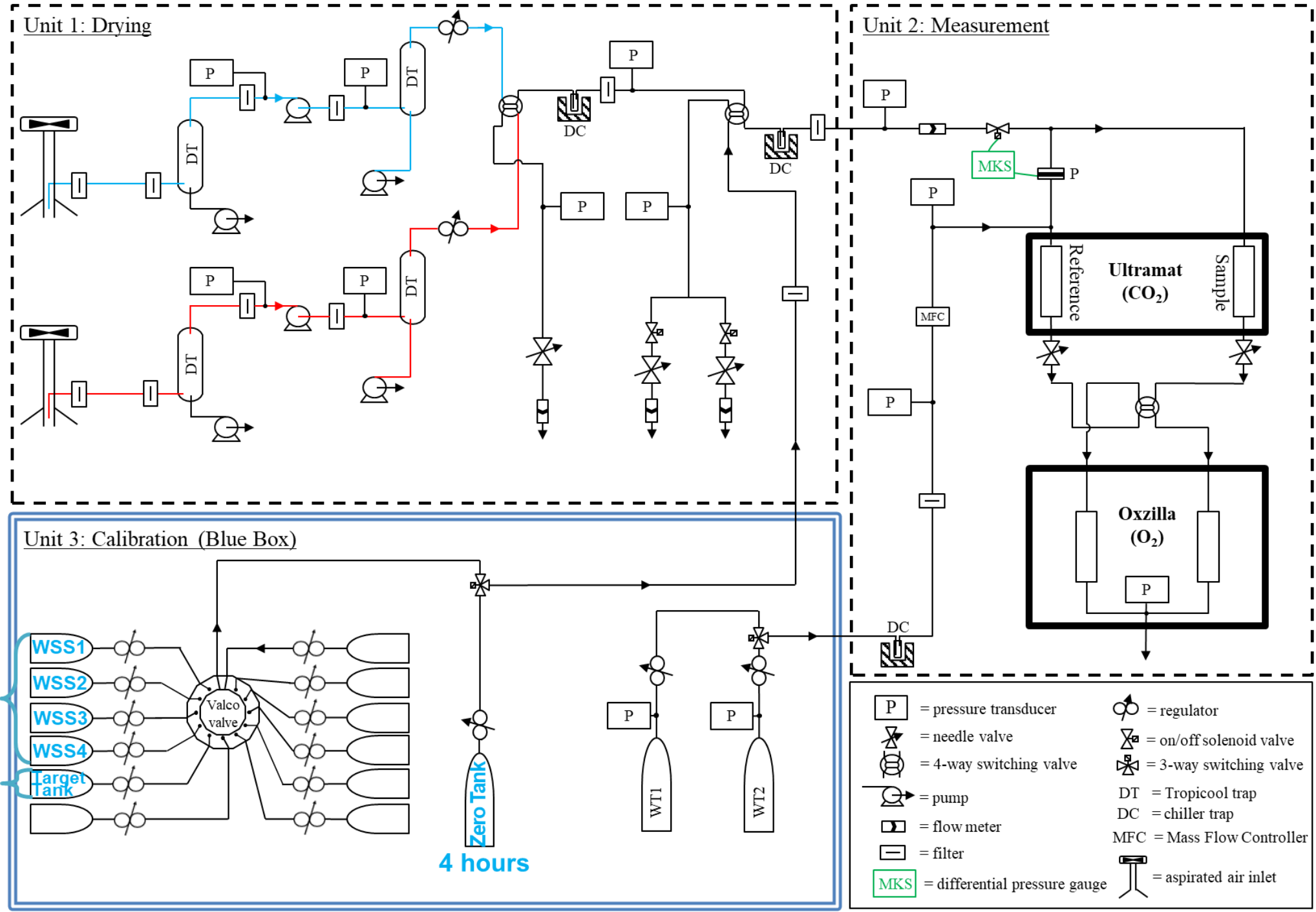


Gas Handling Diagram

Measurement every 2 minutes

47 hours
11 hours

4 hours

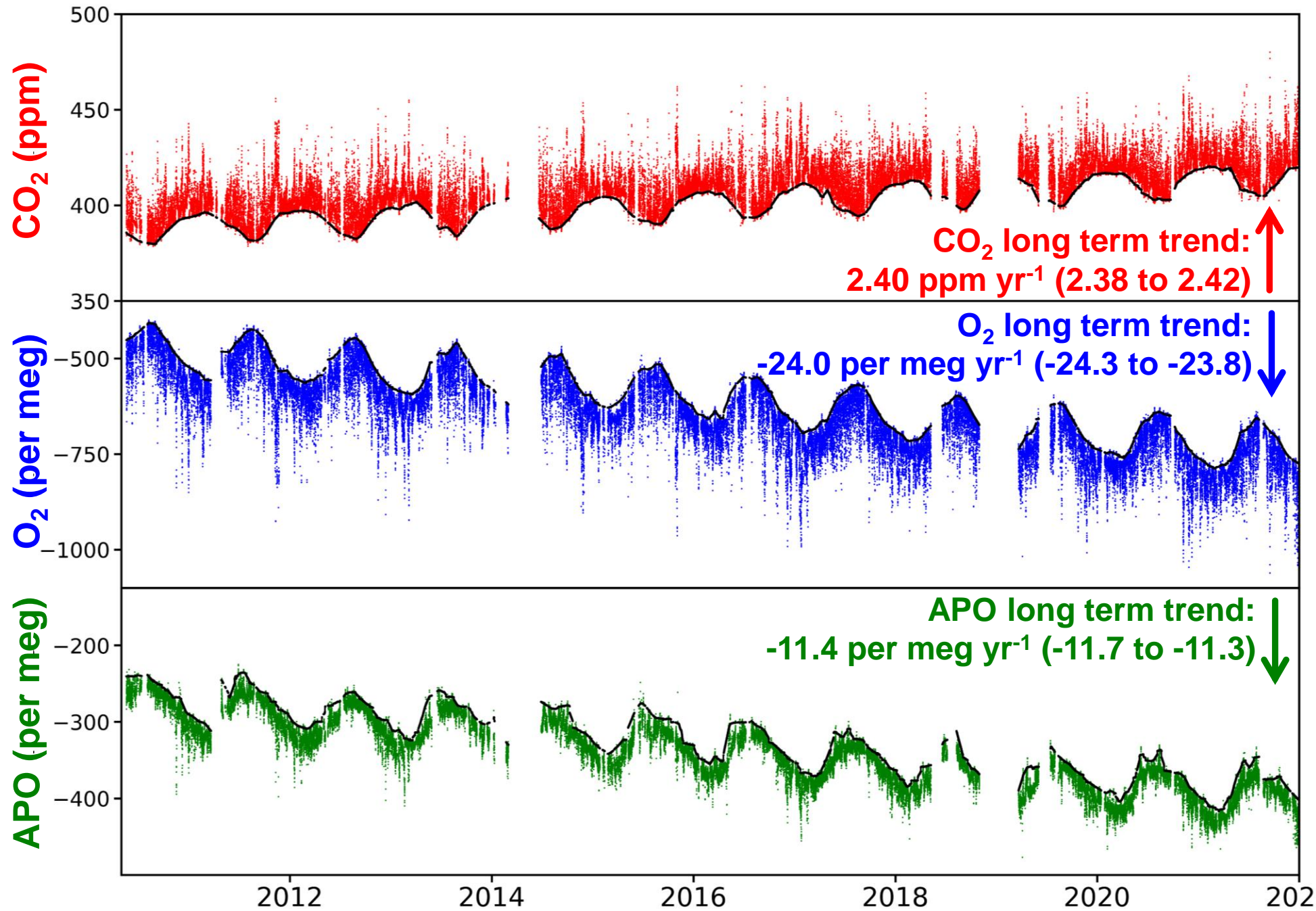


Weybourne – CO₂, O₂ & APO

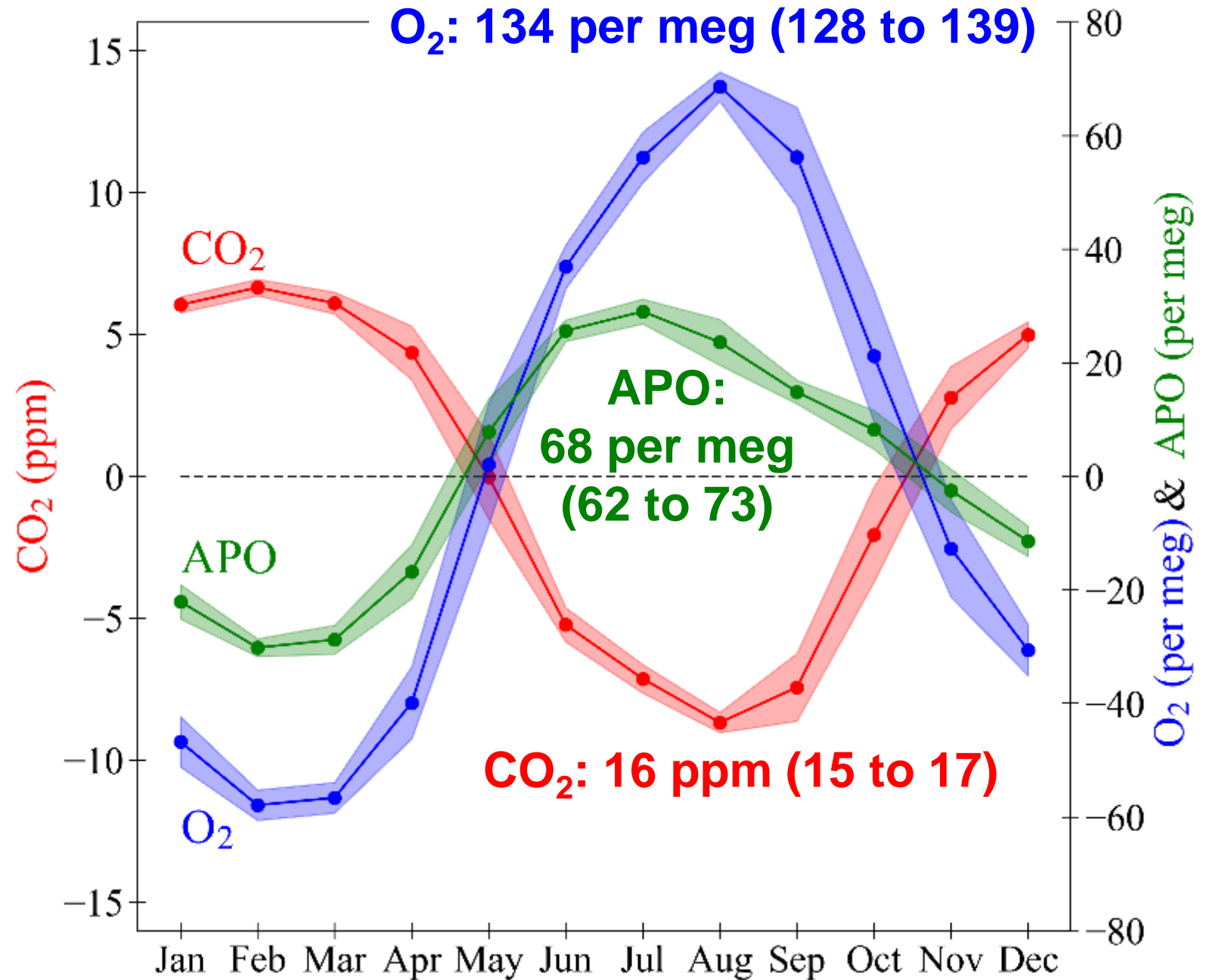
From Global
Carbon Budget
 2.4 ± 0.1 ppm
2012-2022

(Friedlingstein et al., 2022)

Note: CO₂ & O₂ y-axes are
visually comparable, APO
y-axis is half the O₂ y-axis

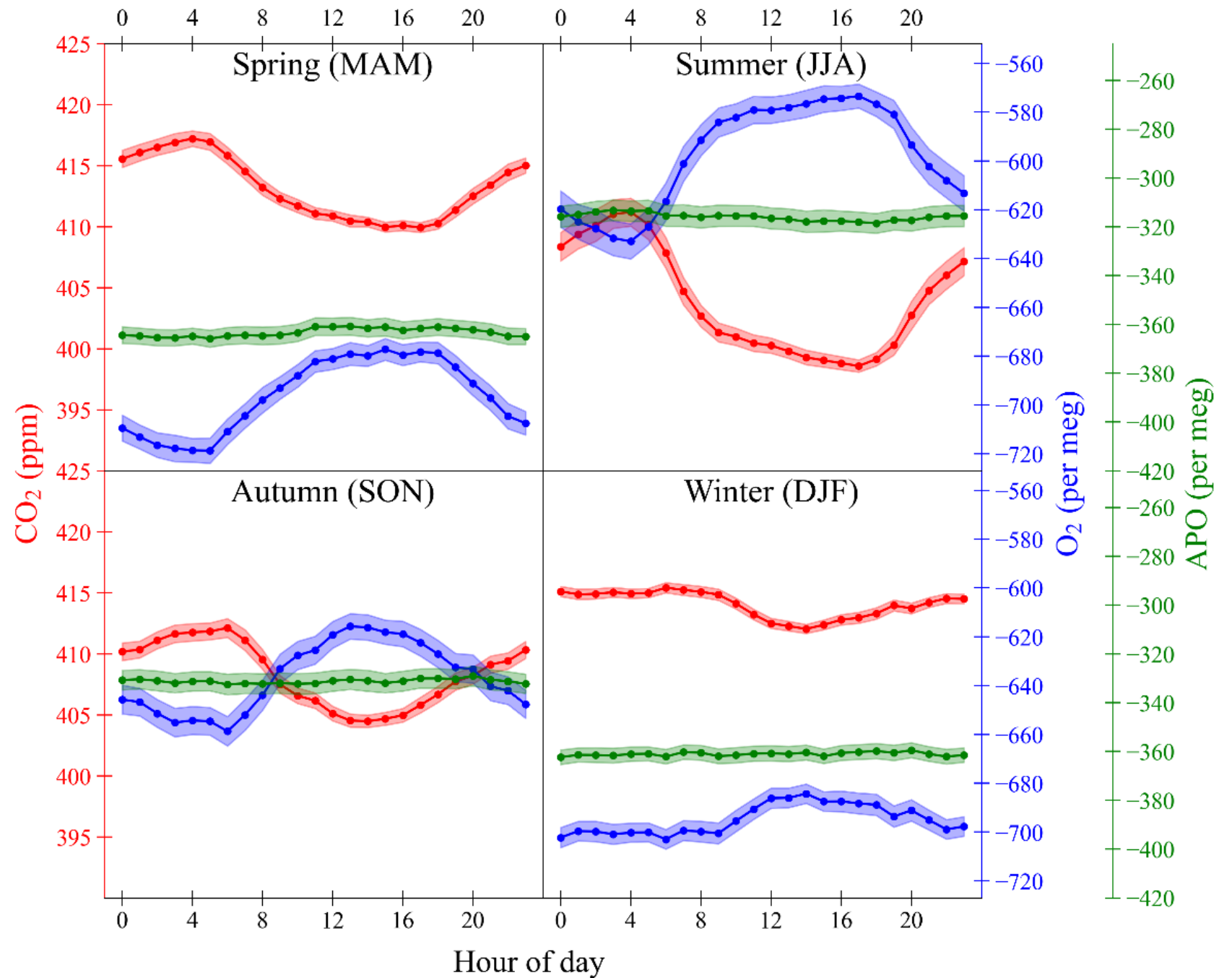


Average Seasonal cycles



Note: y-axes are
visually comparable

Average Diurnal cycles



Note: y-axes are visually comparable

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Abstract

Assets

Discussion

Metrics

12 May 2023



Status: this preprint is currently under review for the journal ESDD.

12 years of continuous atmospheric O₂, CO₂ and APO data from Weybourne Atmospheric Observatory in the United Kingdom

Karina E. Adcock [✉](#), Penelope A. Pickers, Andrew C. Manning, Grant L. Forster, Leigh S. Fleming, Thomas Barningham, Philip A. Wilson, Elena A. Kozlova, Marica Hewitt, Alex J. Etchells, and Andy J. Macdonald

Abstract. We present analyses of a 12-year time series of continuous atmospheric measurements of O₂ and CO₂ at the Weybourne Atmospheric Observatory in the United Kingdom. These measurements are combined into the term Atmospheric Potential Oxygen (APO), a tracer that is conservative with respect to terrestrial biosphere processes. The CO₂, O₂ and APO datasets discussed are hourly averages between May 2010 and December 2021. We include details of our measurement system and calibration procedures, and describe the main long-term and seasonal features of the time series. The 2-minute repeatability of

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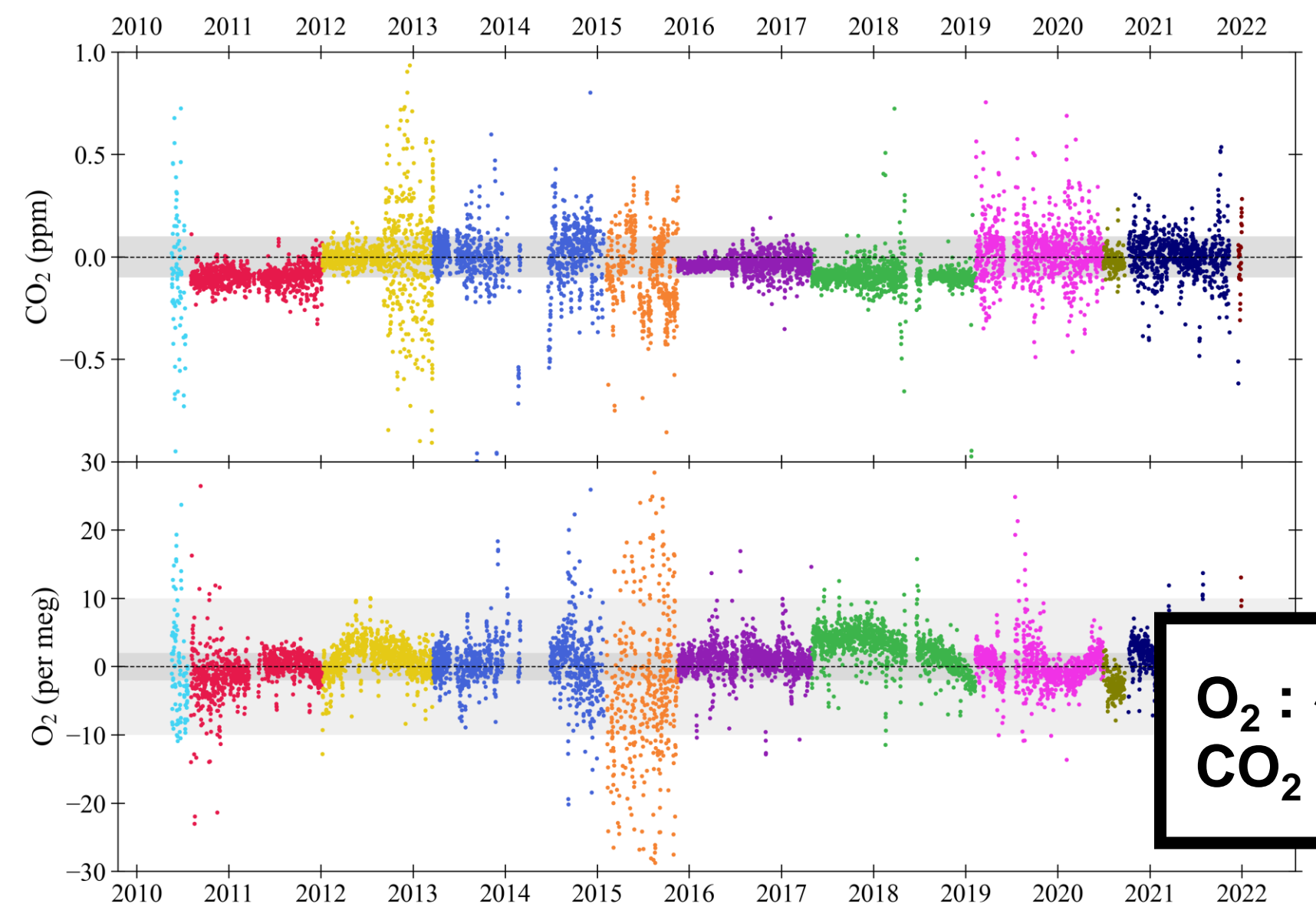
Short summary

We present a 12-year time series of continuous atmospheric measurements of O₂ and CO₂ at the...
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Short summary

We present a 12 year

O₂ : ~ ±3 per meg
CO₂ : ~ ±0.005 ppm

Earth System Science Data

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Status: this preprint is currently under review for the journal ESSD.

**May 2010 – December 2021
CO₂: 1.9 million data points
O₂: 1.5 million data points**

12 years of continuous atmospheric O₂, CO₂ and APO at the Weybourne Atmospheric Observatory in the United Kingdom

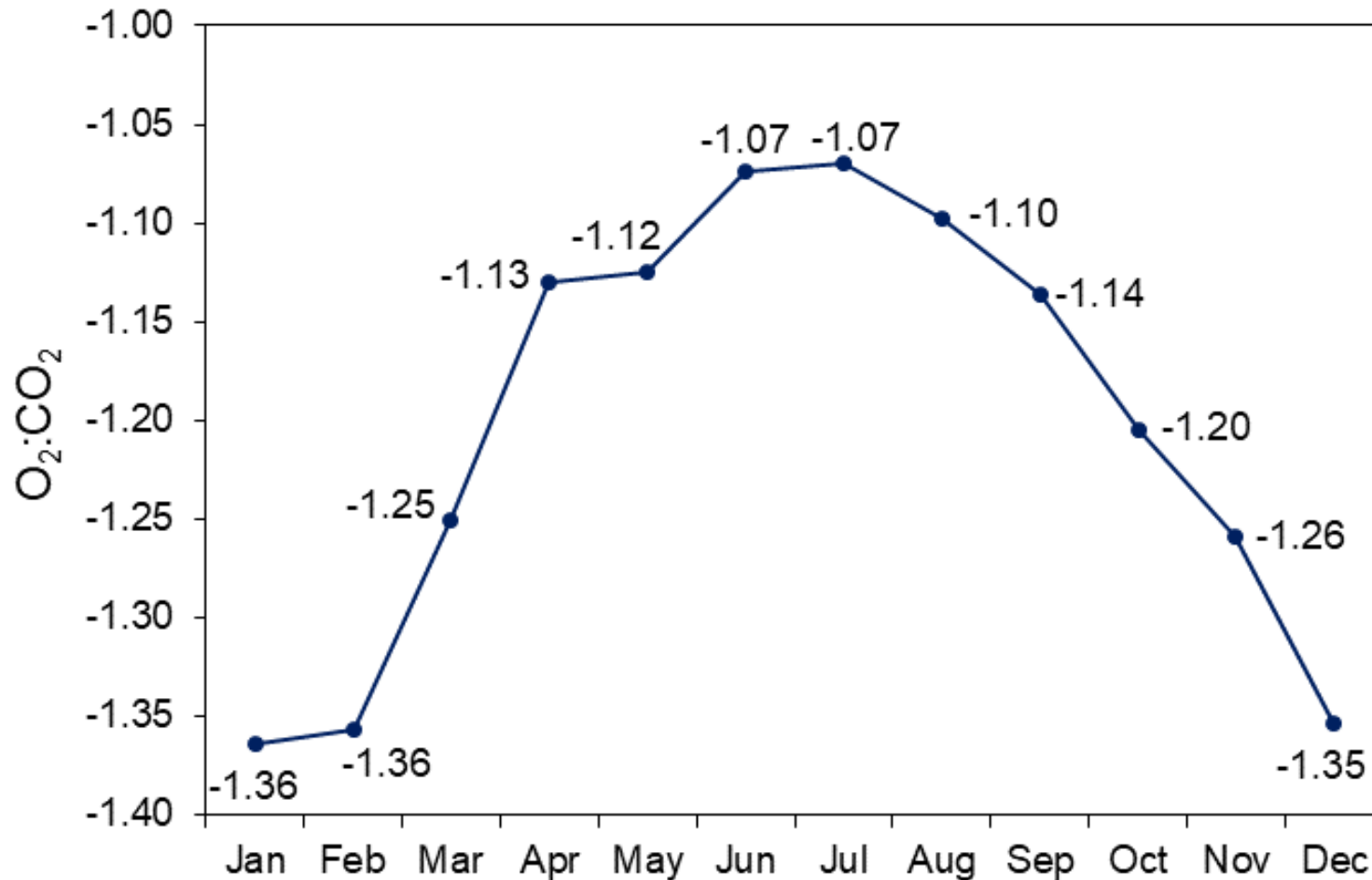
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time series of continuous atmospheric measurements of O₂ and CO₂ at the...
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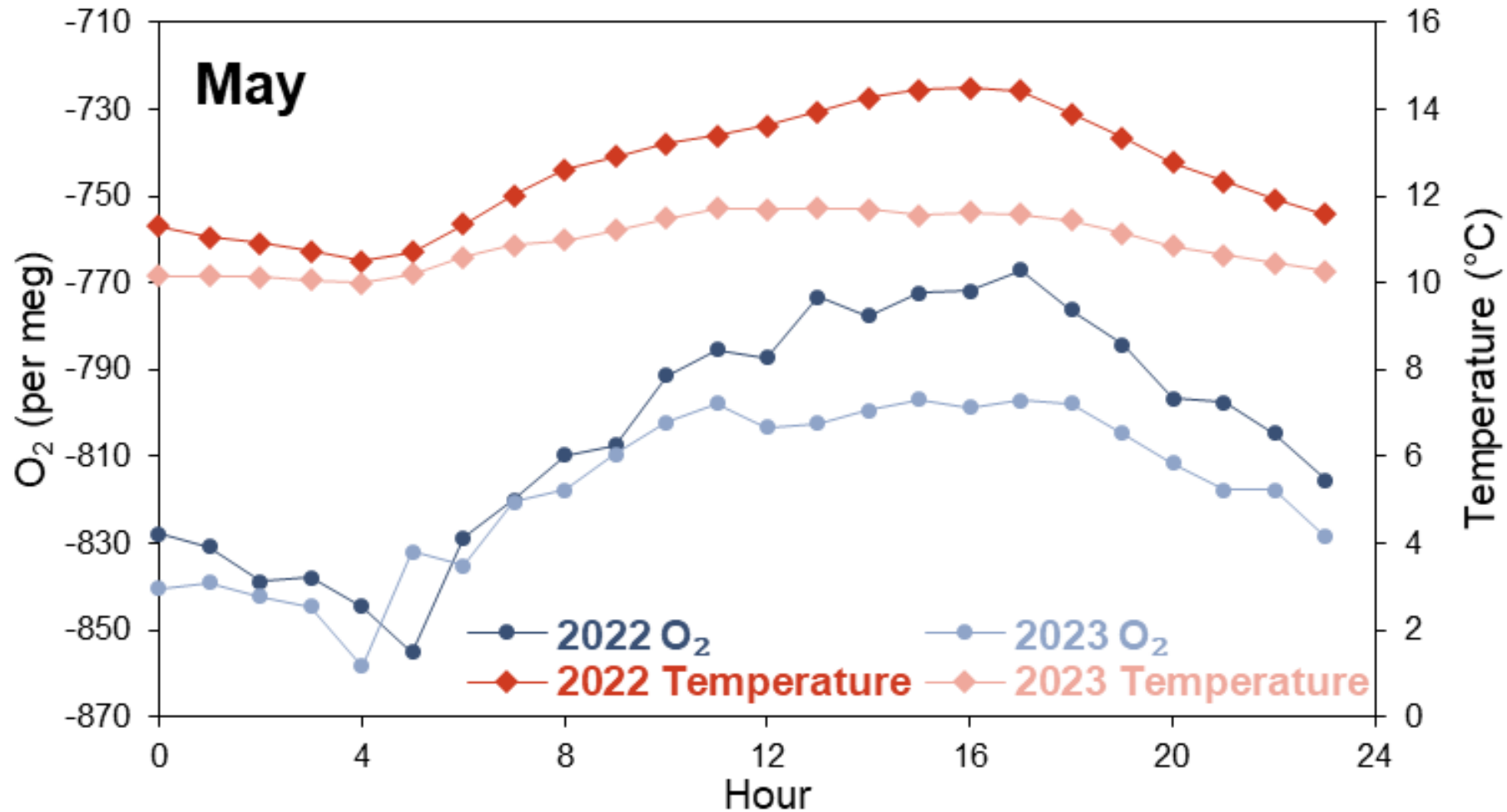
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O₂:CO₂ ratios

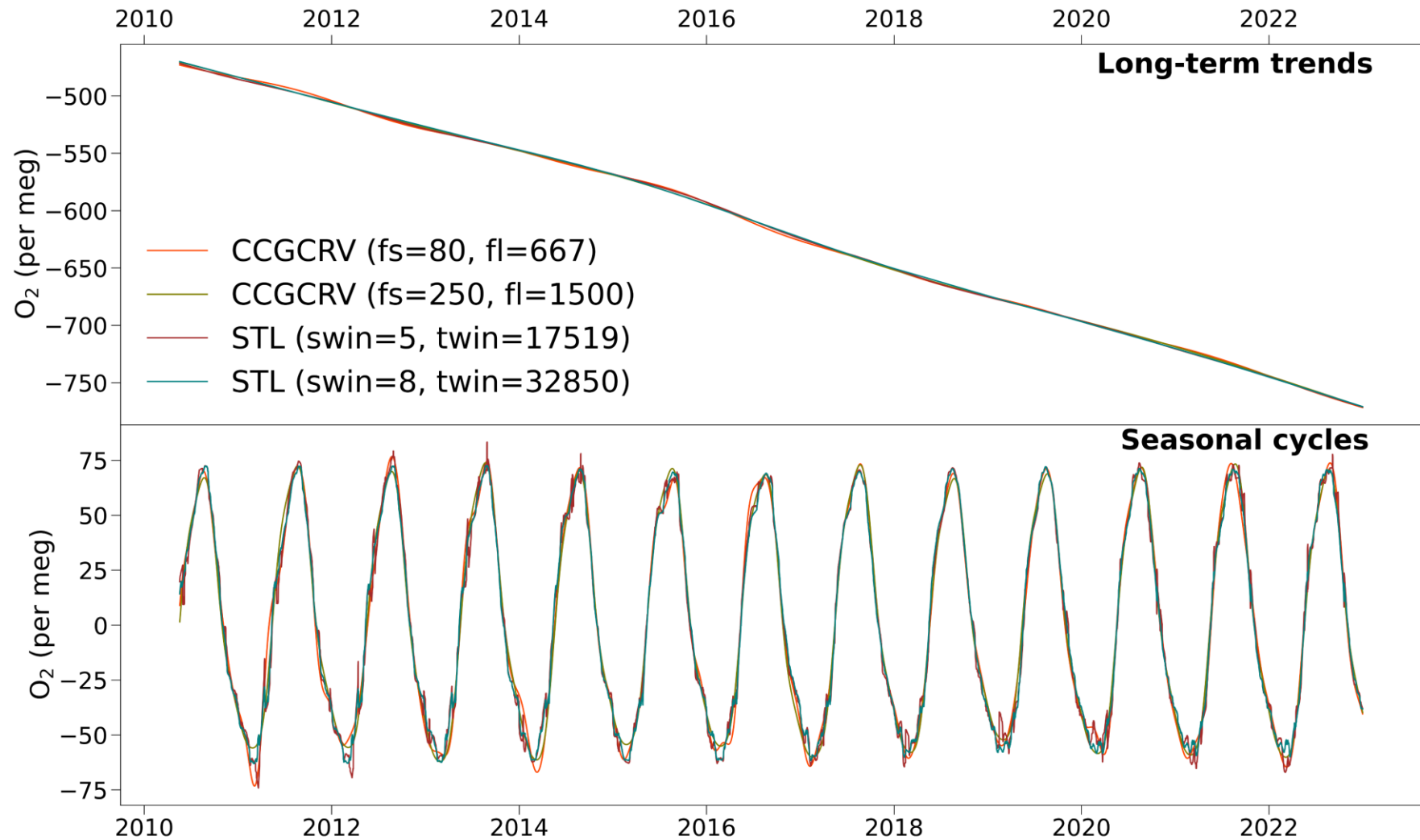


Terrestrial biosphere	-1.10±0.05
Coal	-1.17
Oil and petroleum	-1.44
Natural gas	-1.95
Fossil fuel average	-1.39

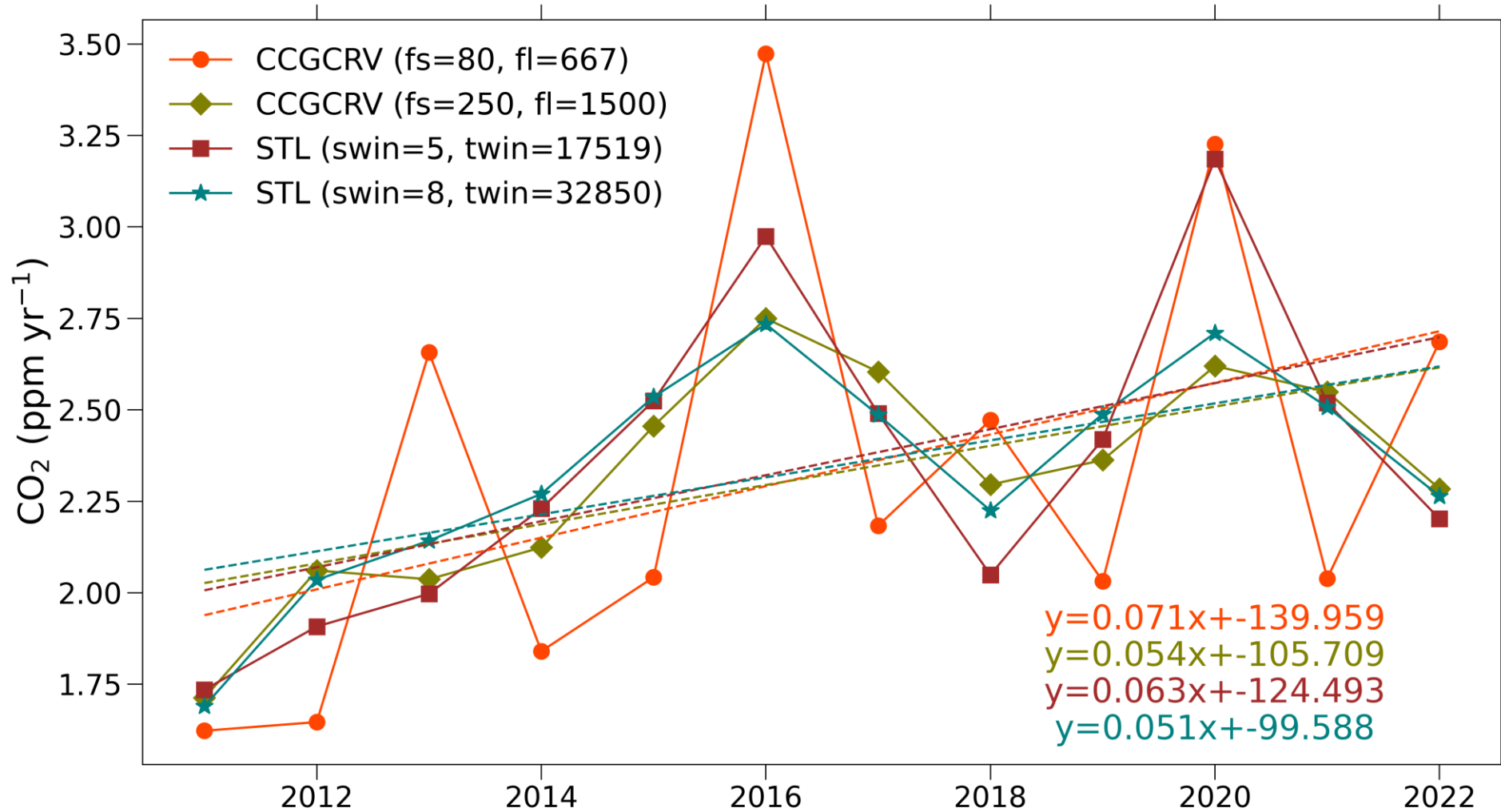
Temperature & Diurnal cycles



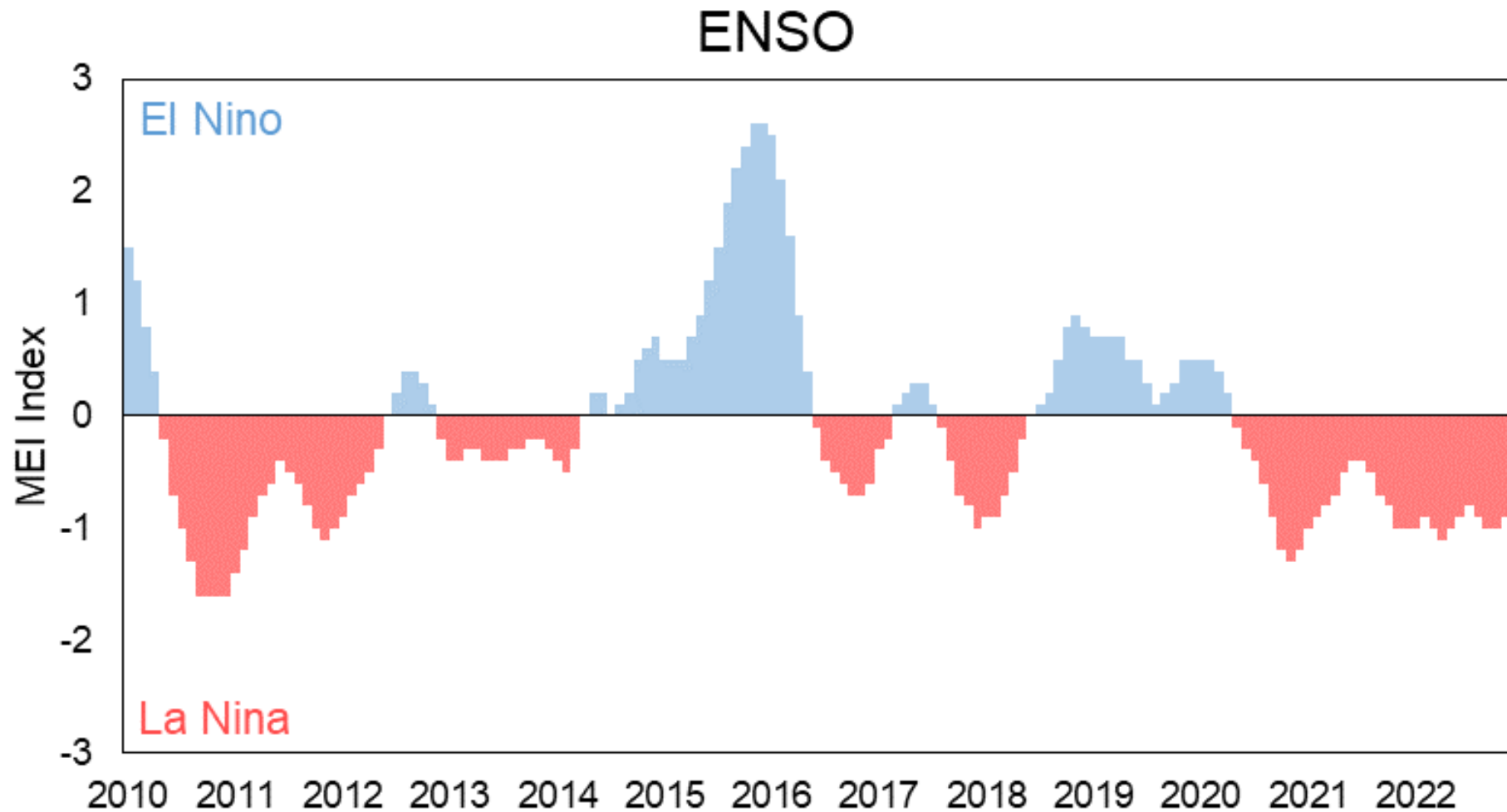
O₂ long-term trend & seasonal cycle



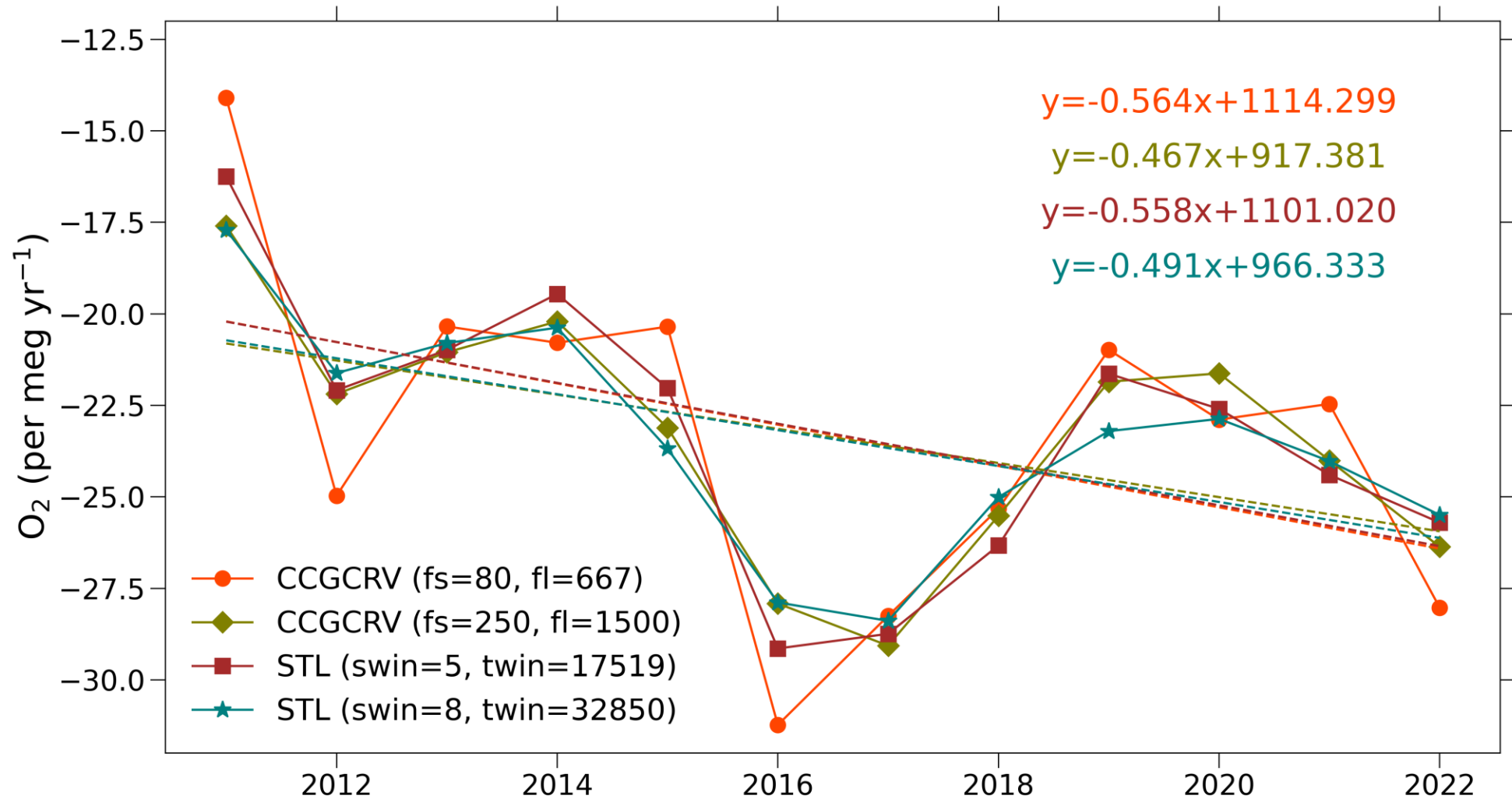
Interannual variability of CO₂ long-term trend



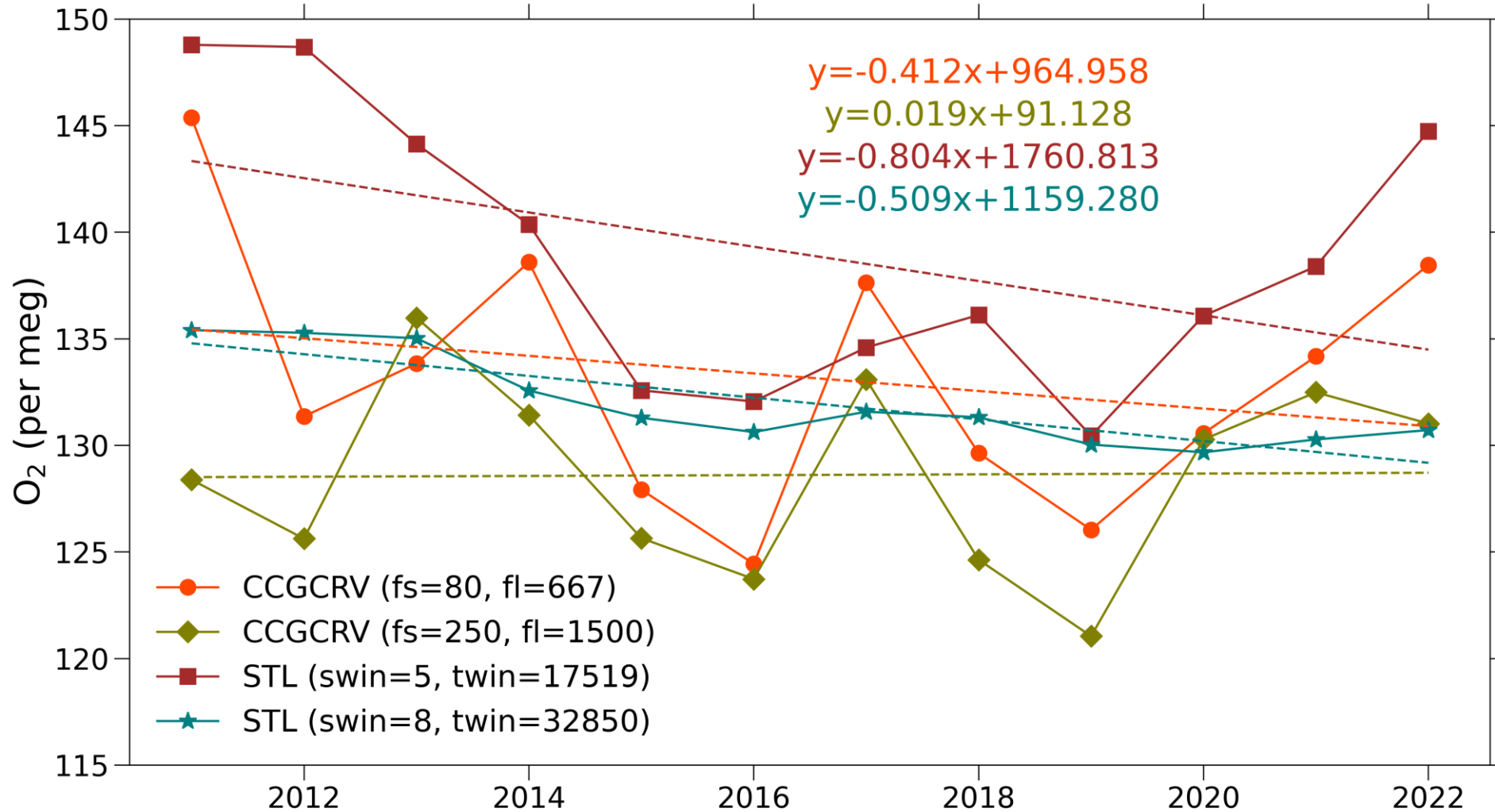
Interannual variability of CO₂ long-term trend



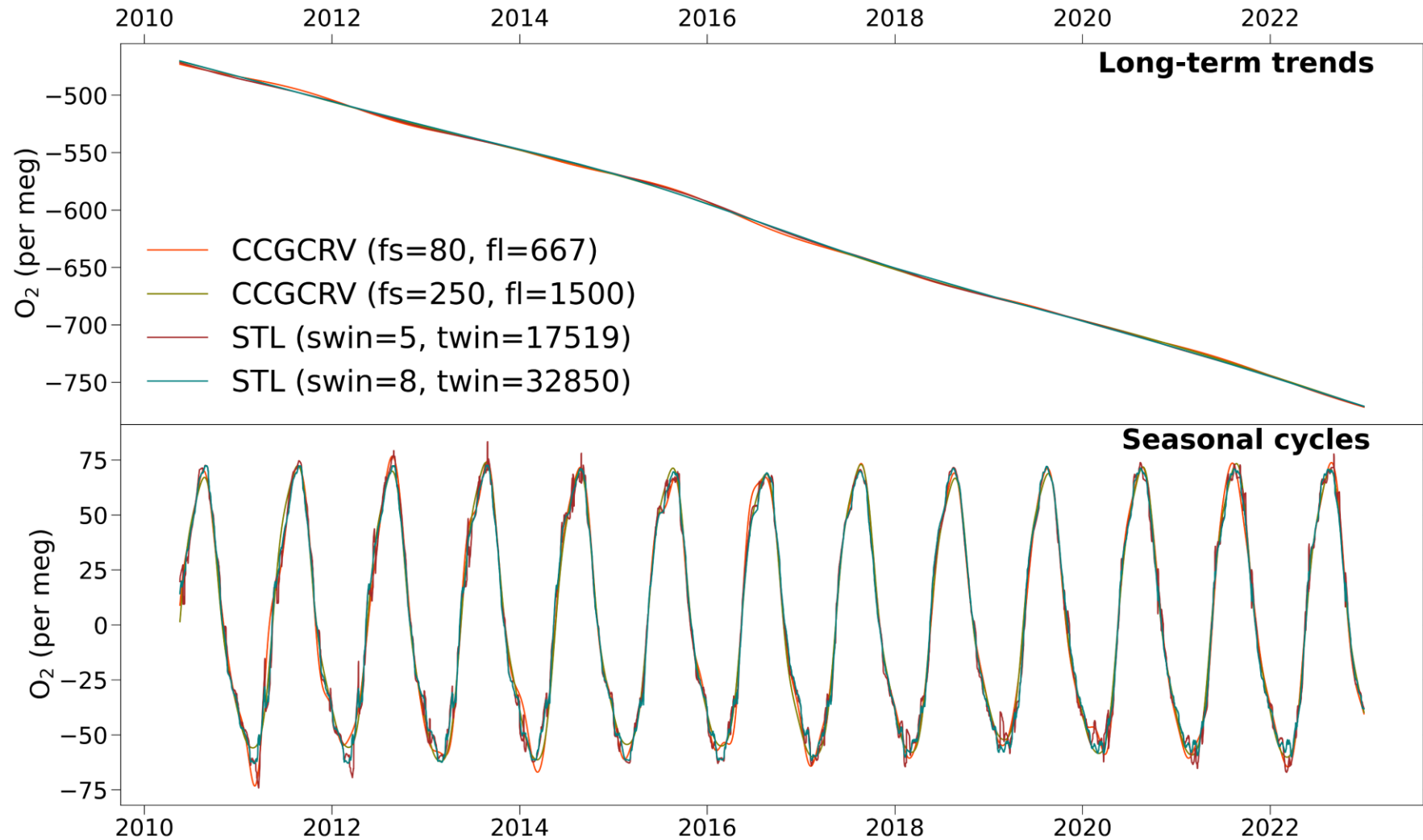
Interannual variability of O₂ long-term trend



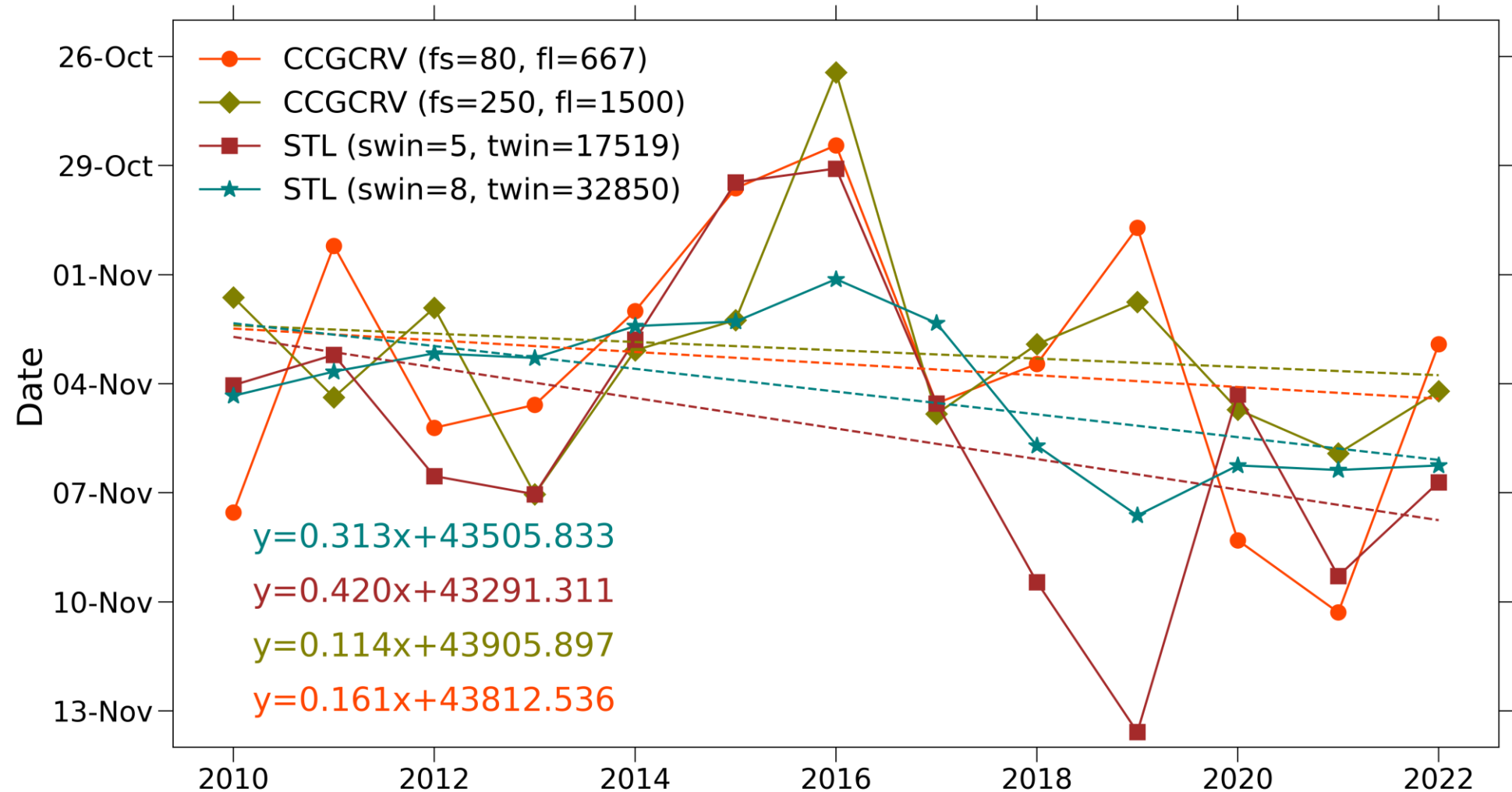
Interannual variability of O₂ seasonal amplitude



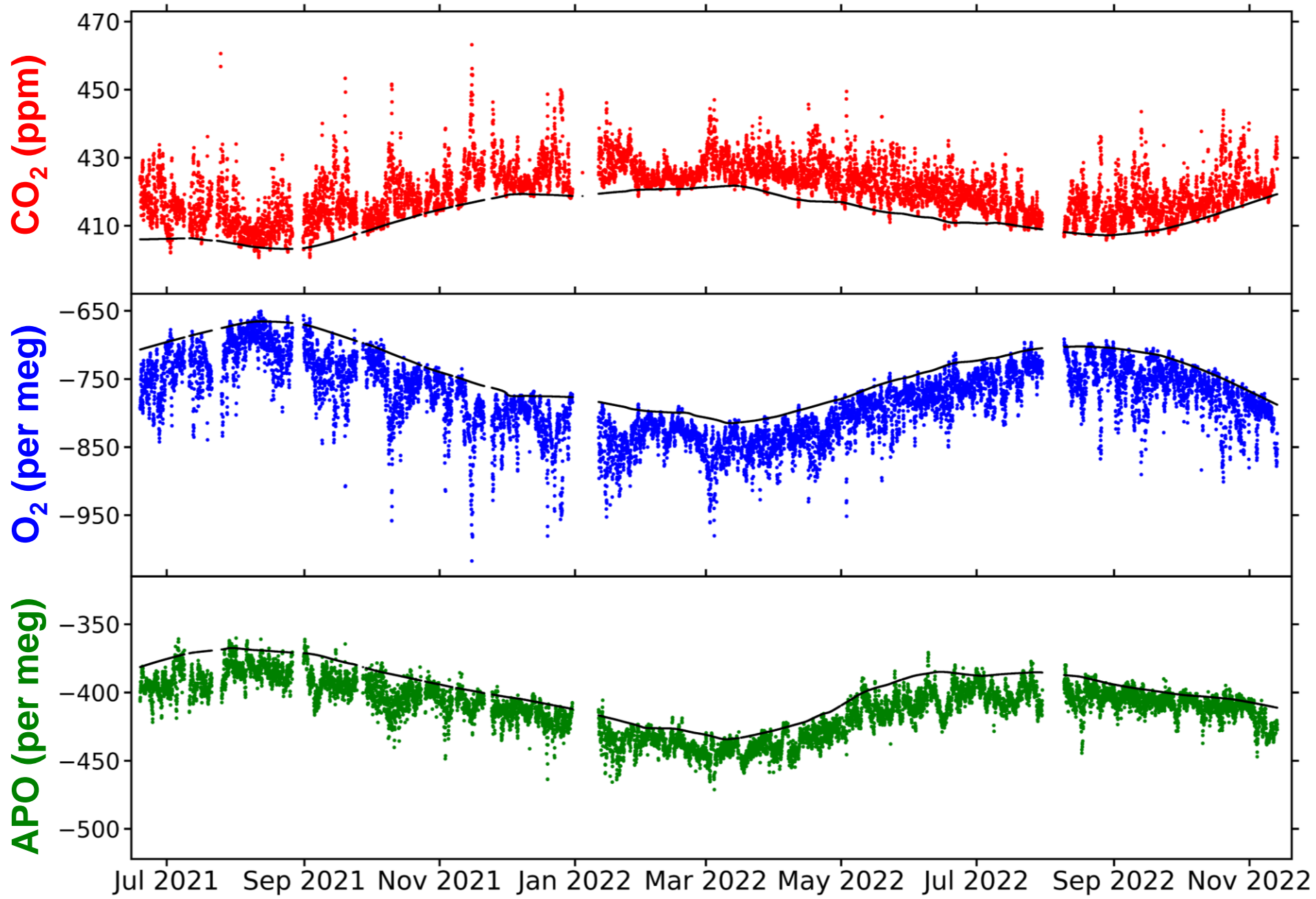
Interannual variability of O₂ seasonal amplitude



Interannual variability of O₂ Autumn Zero Crossing

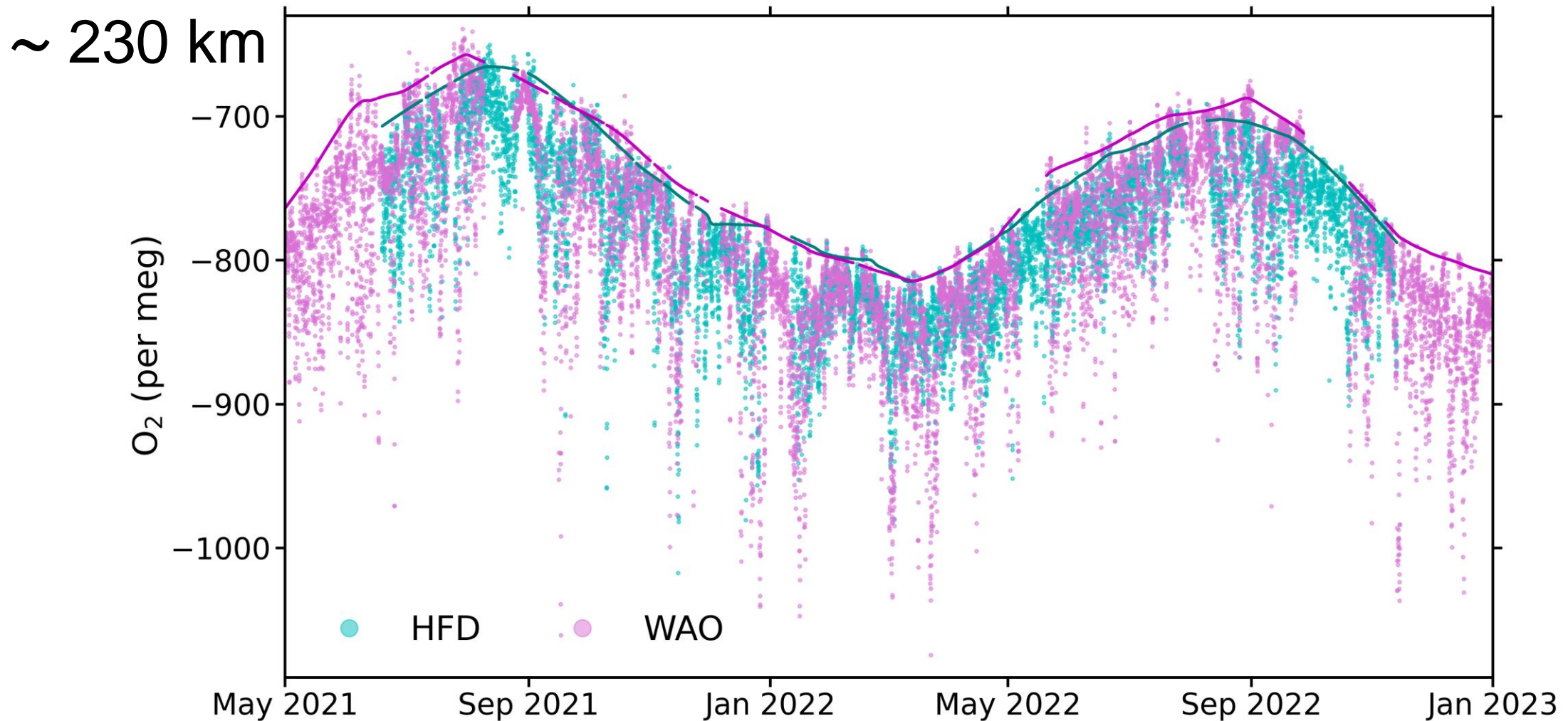


Heathfield – CO₂, O₂ & APO

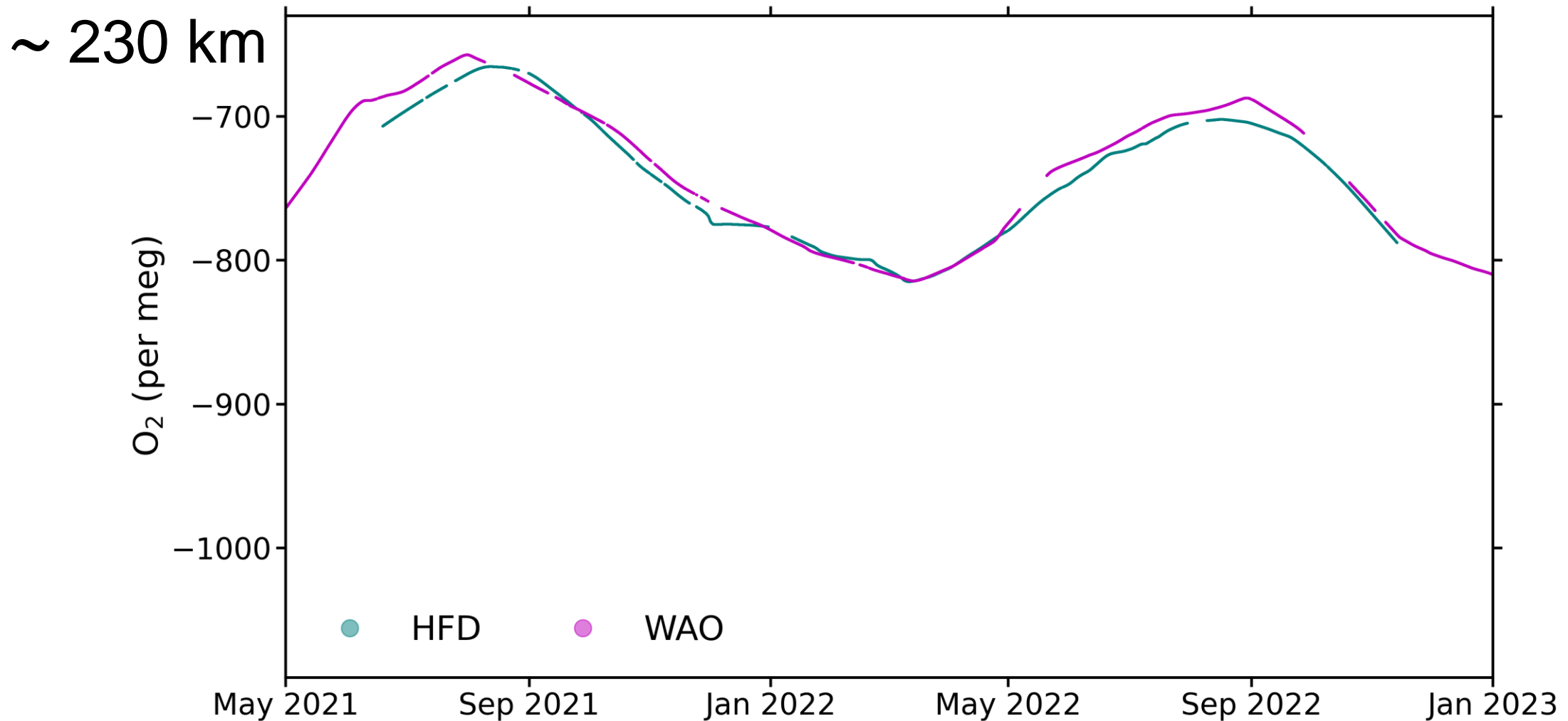


Note: CO₂ & O₂ y-axes are visually comparable, APO y-axis is half the O₂ y-axis

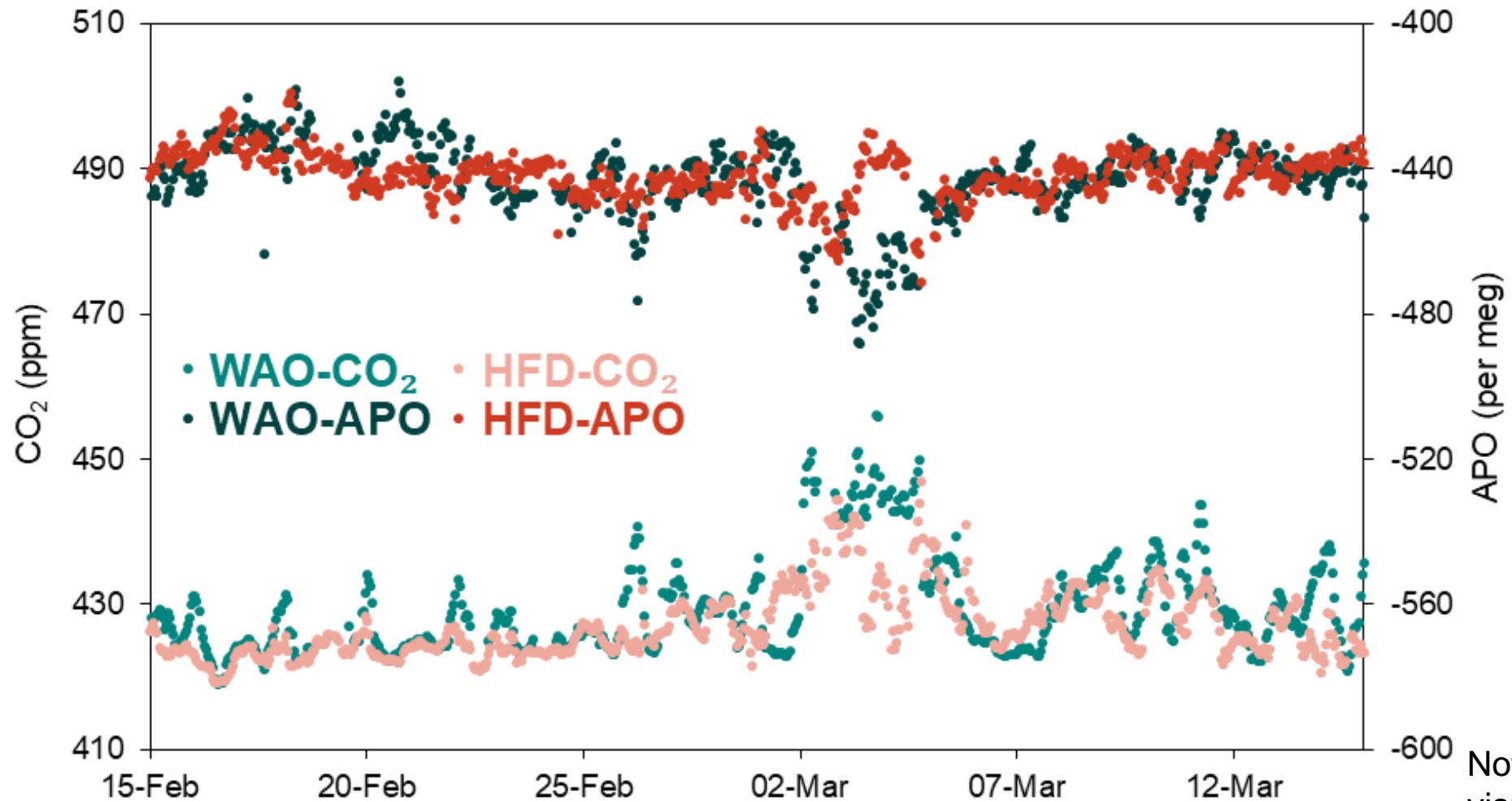
Heathfield vs Weybourne : O₂



Heathfield vs Weybourne : O₂



Heathfield & Weybourne events



Note: y-axes are not visually comparable

NAME III (version 7.1)

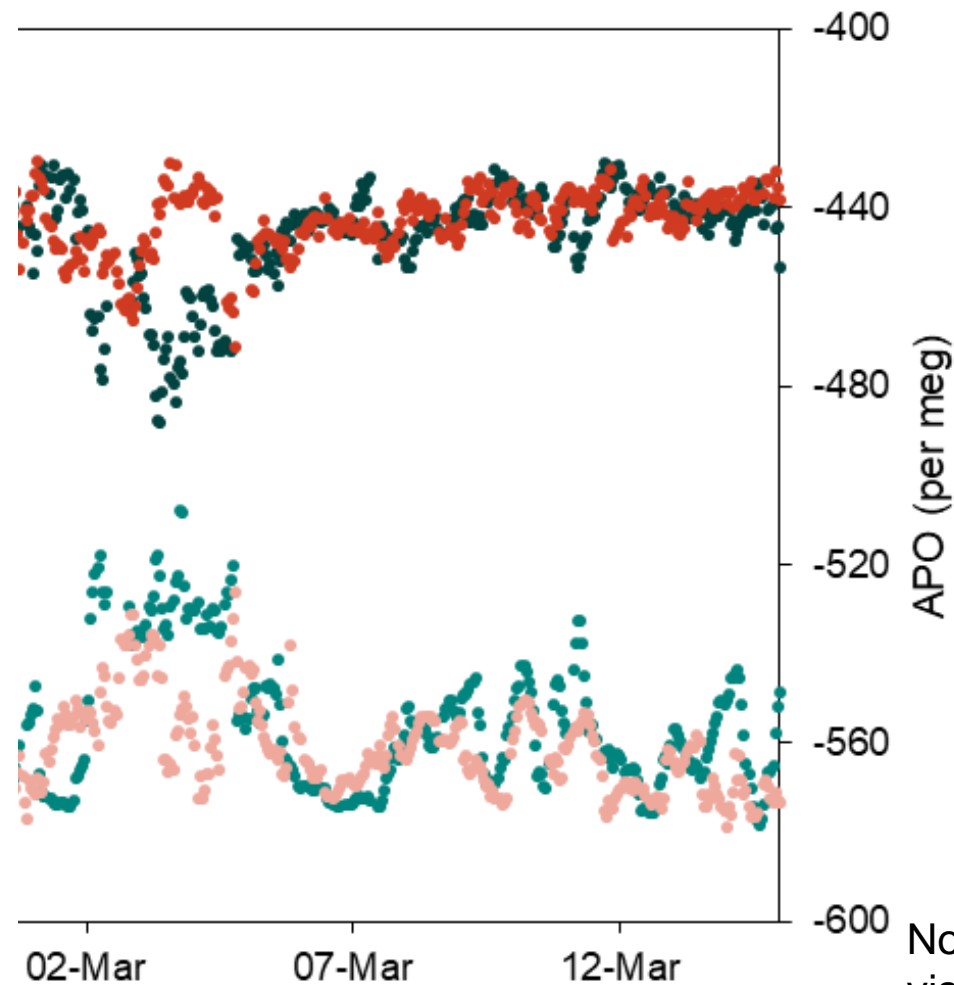
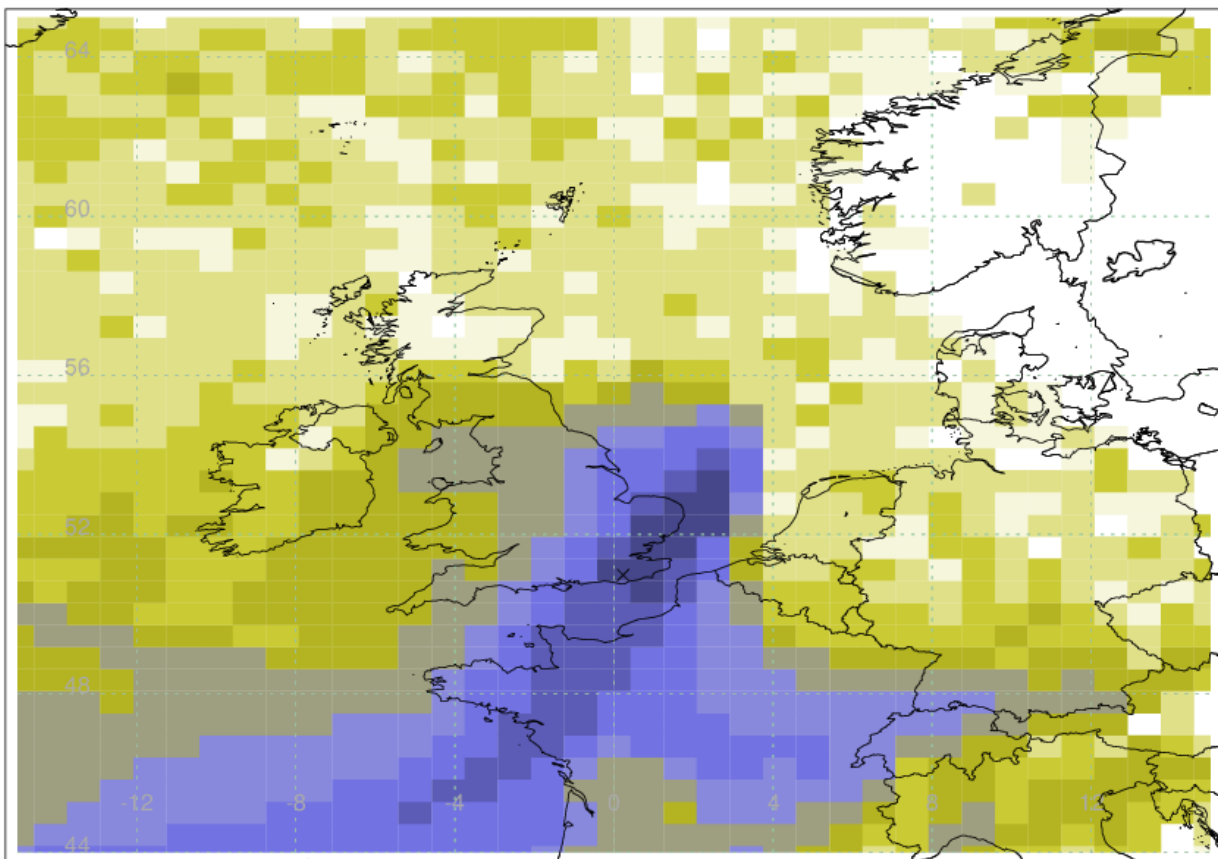


Back Run Time Integrated Air concentration

From 0 - 100m agl

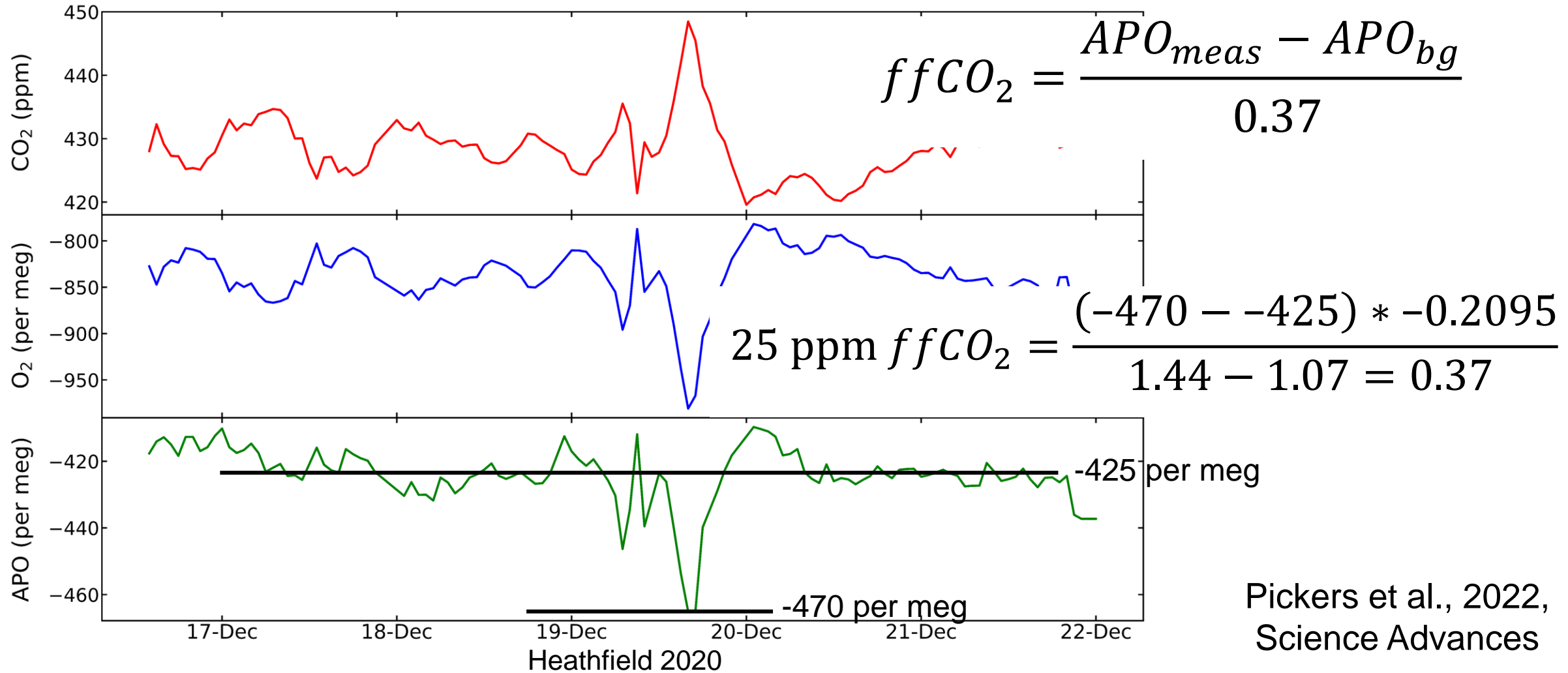
0900Z 01/03/2022 to 1500Z 01/03/2022

Heybourne events



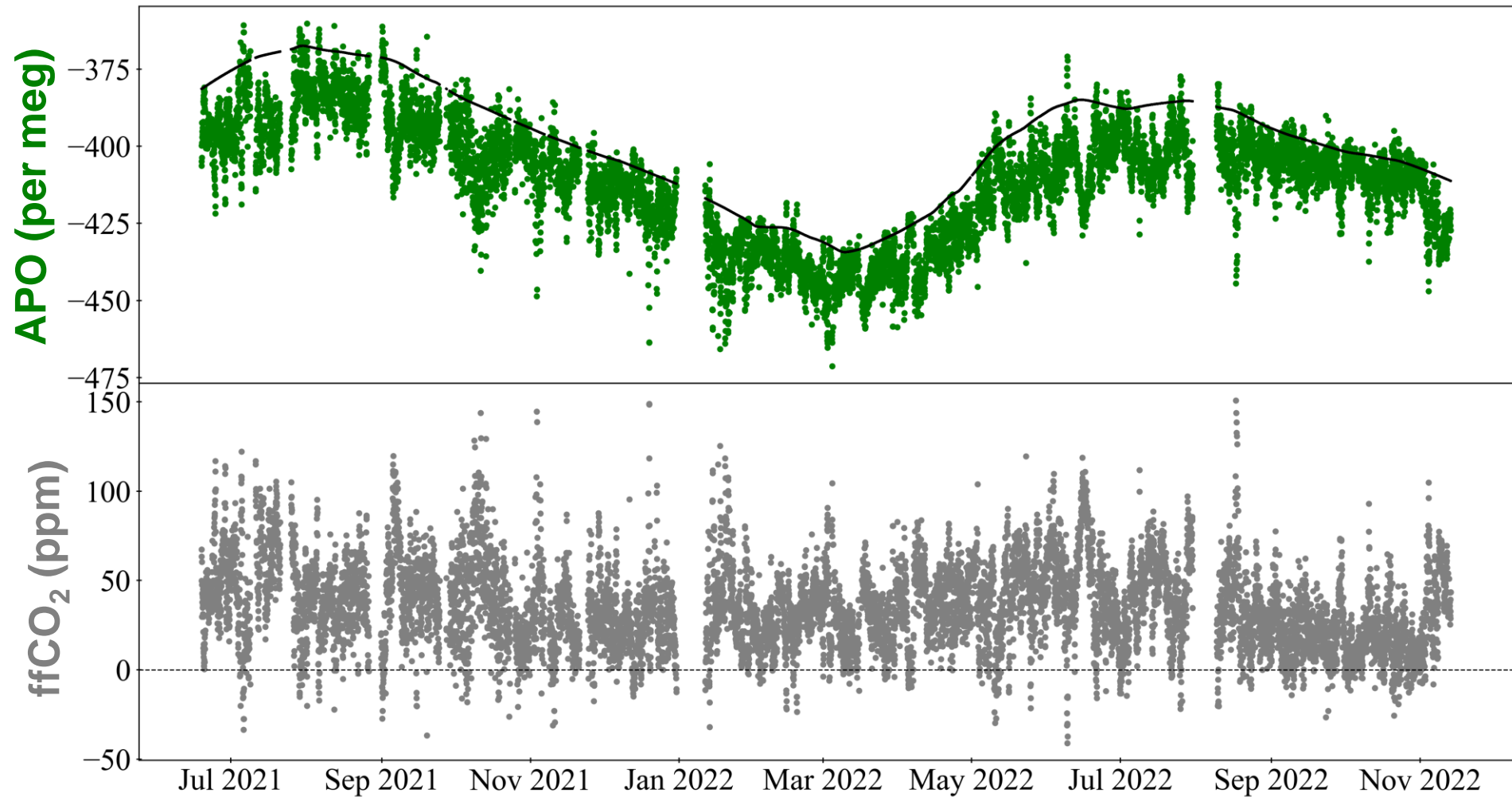
Note: y-axes are not visually comparable

Quantifying ffCO₂

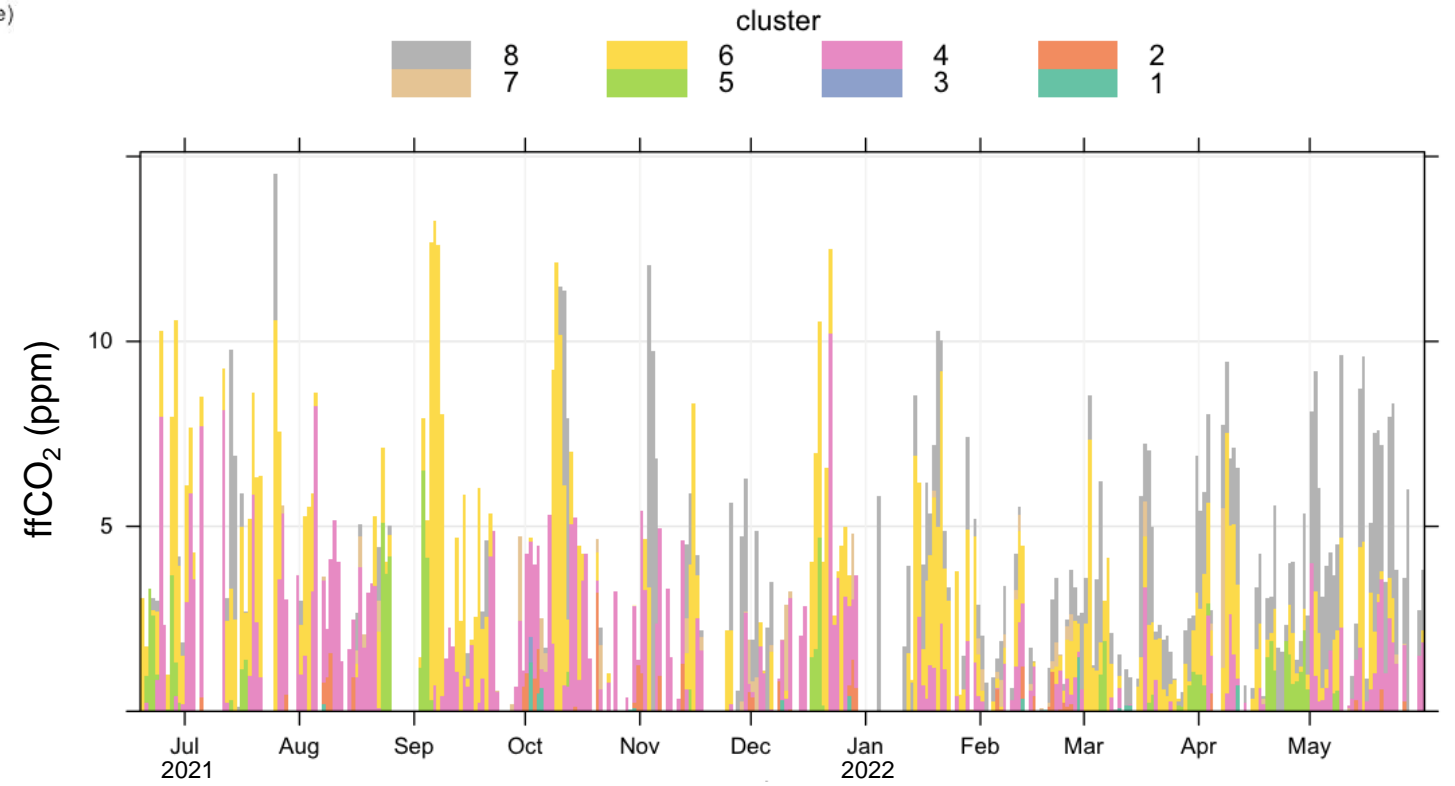
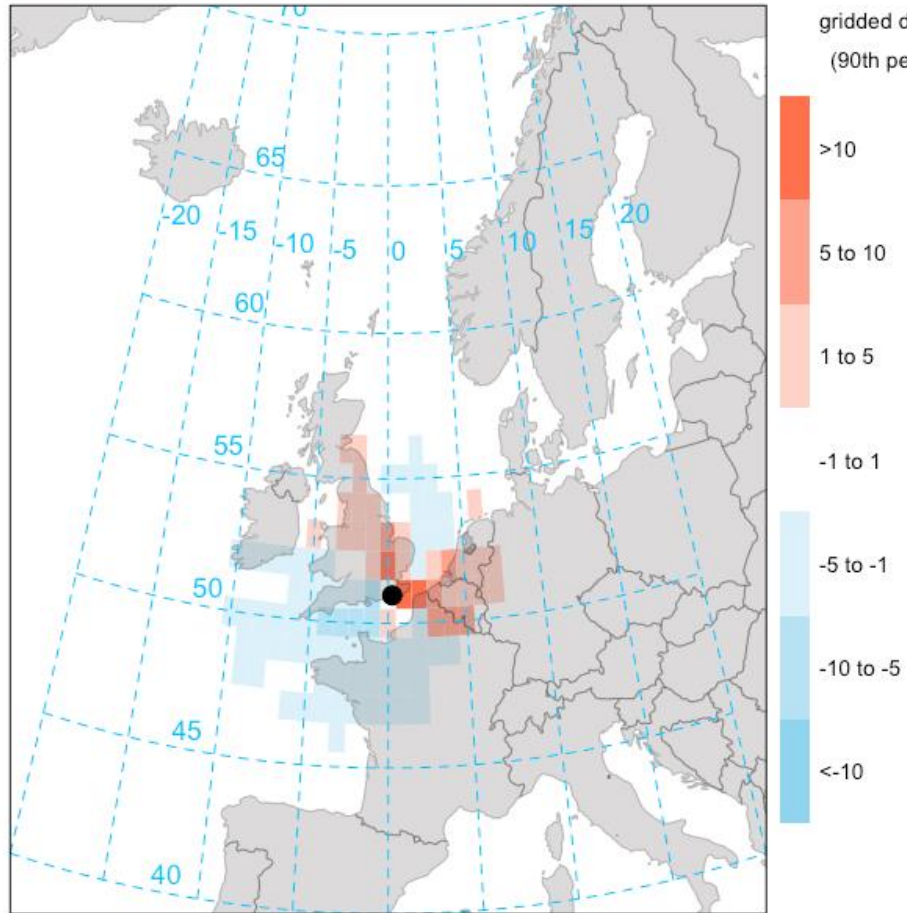


Pickers et al., 2022,
Science Advances

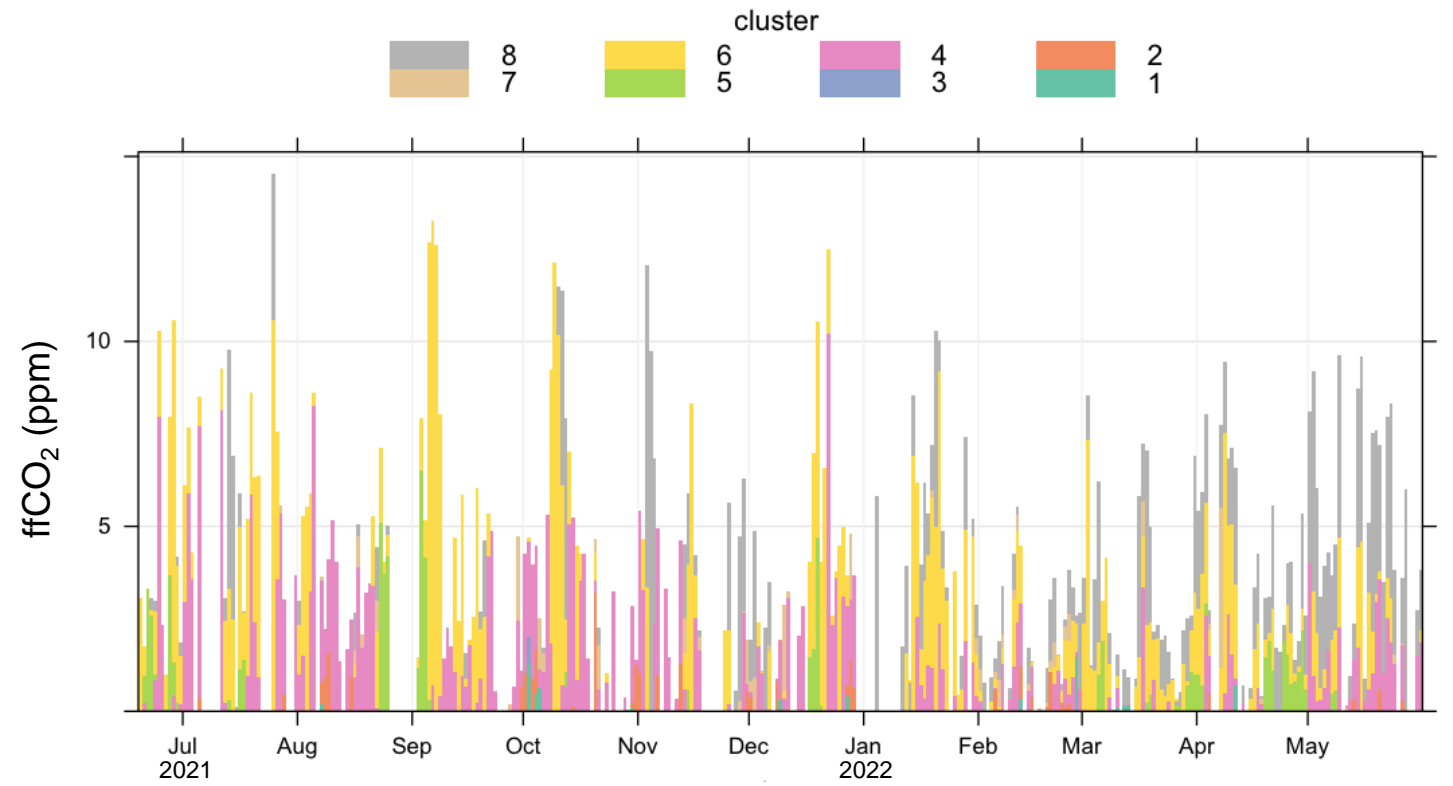
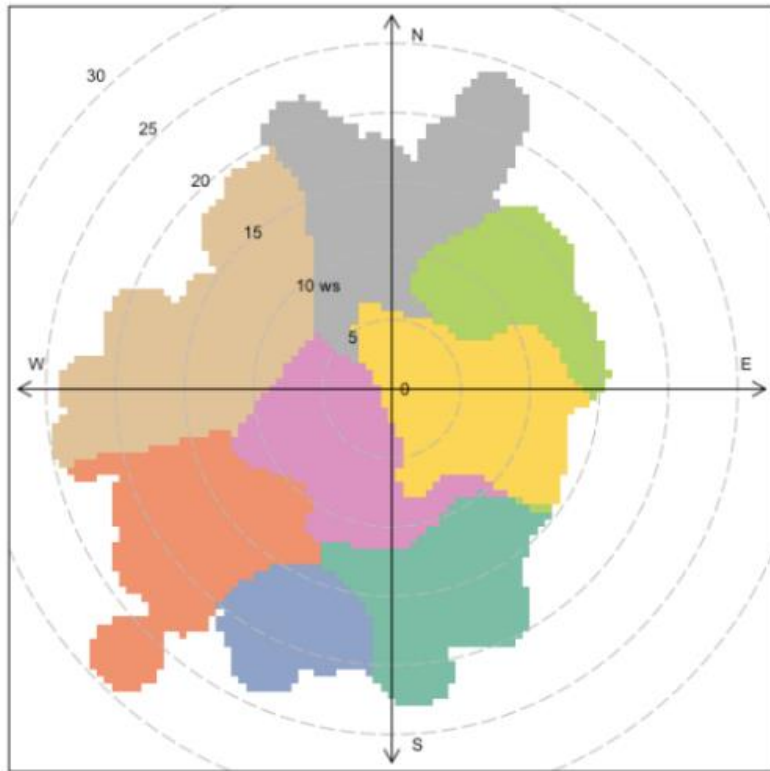
Heathfield ffCO₂



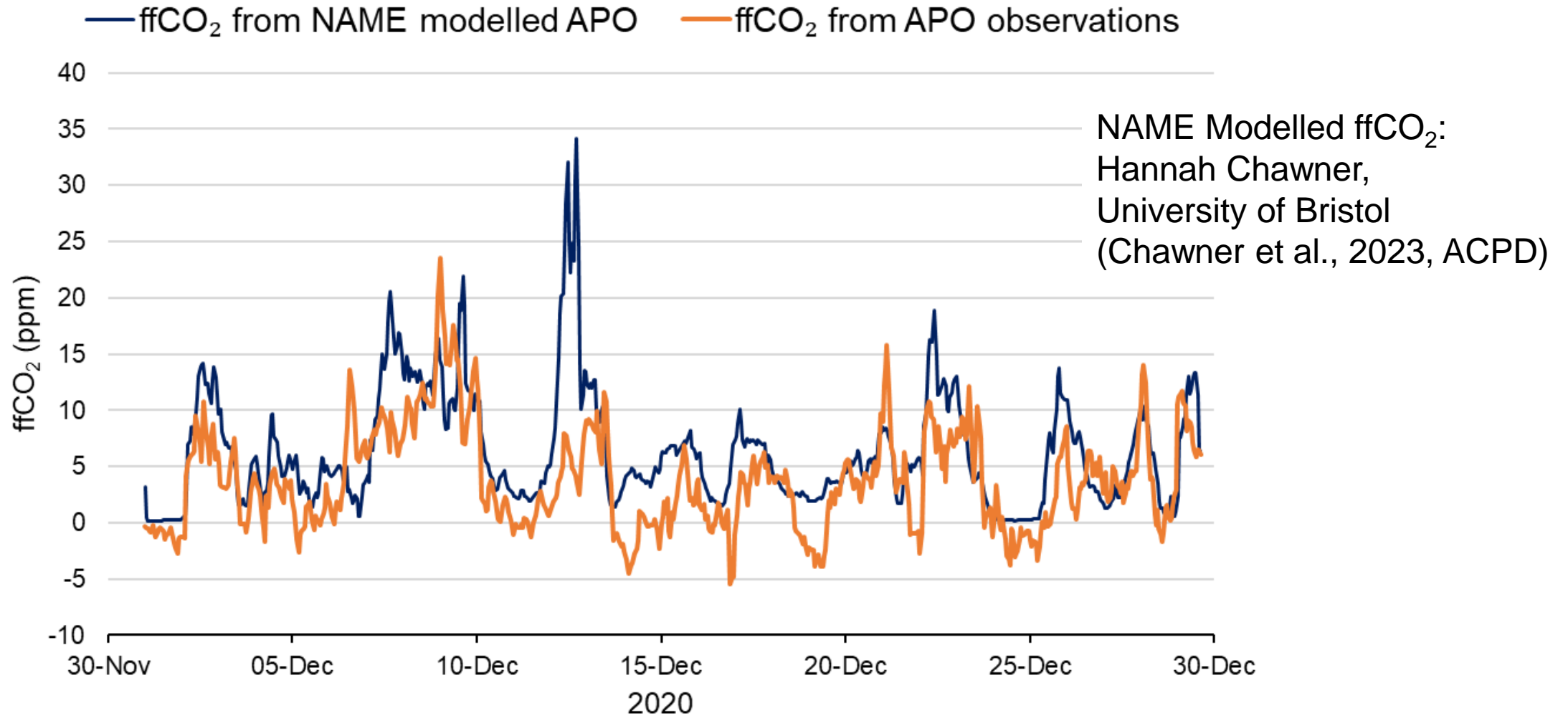
Heathfield ffCO₂



Heathfield ffCO₂

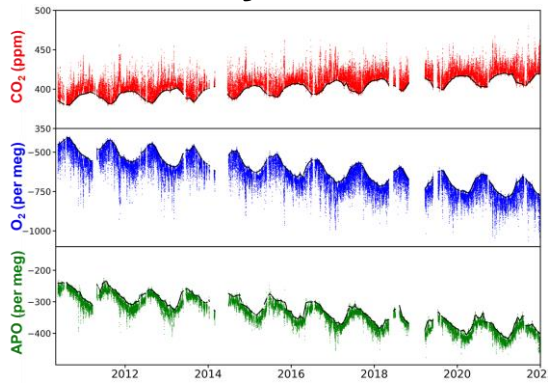


Weybourne ffCO₂ example

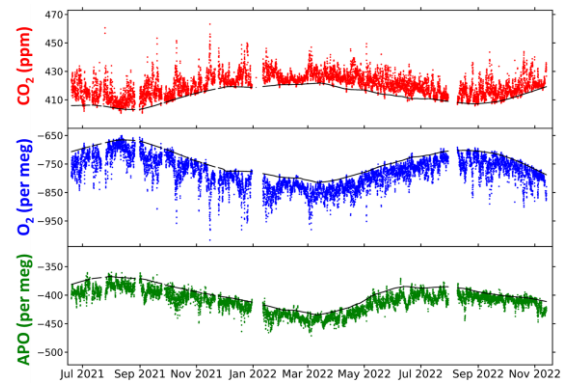


Summary

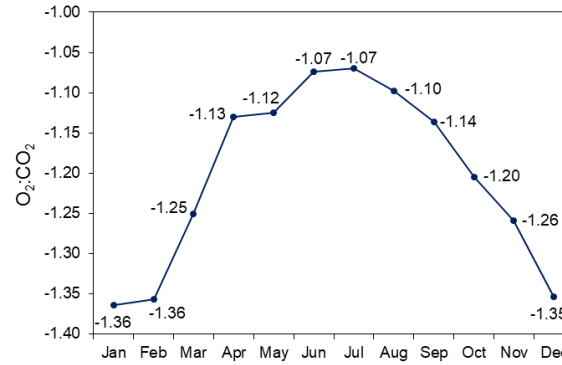
Weybourne



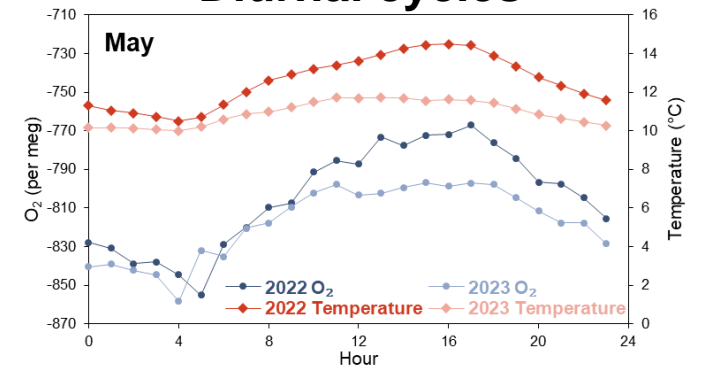
Heathfield



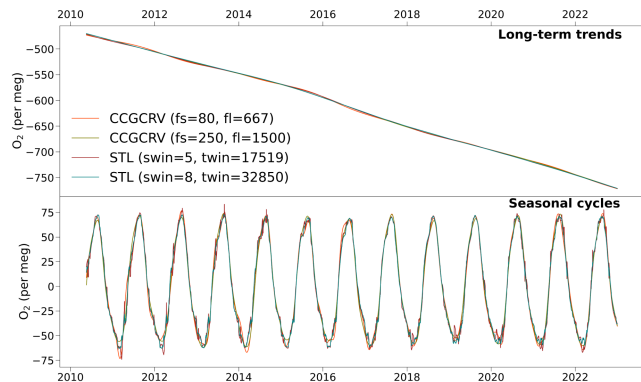
Seasonal ratios



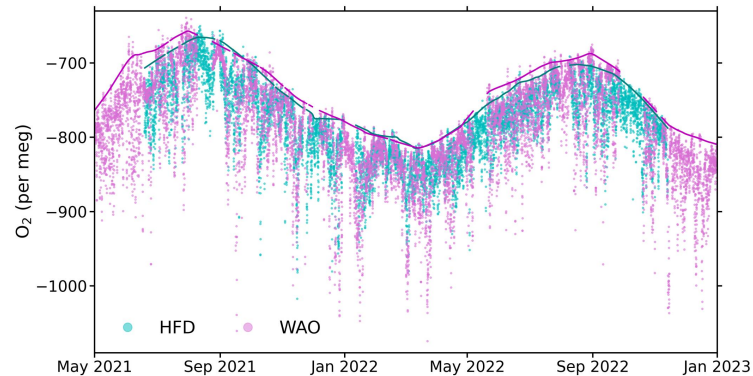
Diurnal cycles



Trends & seasonal cycles



Weybourne vs Heathfield



ffCO₂

