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**Sponsor:** UK Natural Environment Research Council, JABBS Foundation

**Project title**: *Data and code supporting "Air-parcel residence times in a mature forest: observational evidence from a free-air CO2 enrichment experiment"*.

The following files have been archived:

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| **File name** | **File description (Short description of content, sample size, format, any linking between different types of data, i.e. survey and interviews/focus groups)** |
| means1.a.csv | Time-averaged residence time and meteorological observations. See explanation of variables in the appendix below.**.a** suffix refers to the leaf-on period.**1** refers to array 1 at BIFoR FACE. |
| means4.a.csv | Time-averaged residence time and meteorological observations. See explanation of variables in the appendix below.**.a** suffix refers to the leaf-on period.**4** refers to array 4 at BIFoR FACE. |
| means6.a.csv | Time-averaged residence time and meteorological observations. See explanation of variables in the appendix below.**.a** suffix refers to the leaf-on period.**6** refers to array 6 at BIFoR FACE. |
| means1.b.csv | Time-averaged residence time and meteorological observations. See explanation of variables in the appendix below.**.b** suffix refers to the leaf-off period.**1** refers to array 1 at BIFoR FACE. |
| means4.b.csv | Time-averaged residence time and meteorological observations. See explanation of variables in the appendix below.**.b** suffix refers to the leaf-off period.**4** refers to array 4 at BIFoR FACE. |
| means6.b.csv | Time-averaged residence time and meteorological observations. See explanation of variables in the appendix below.**.b** suffix refers to the leaf-off period.**6** refers to array 6 at BIFoR FACE. |
| leafon\_means.csv | means1.a.csv, means4.a.csv, and means6.a.csv in a single file |
| leafoff\_means.csv | means1.b.csv, means4.b.csv, and means6.b.csv in a single file |
| downes\_phenocam.csv | Phenocam data for calculating the GCC used in fig02.The relevant columns are gcc\_mean (the mean green chromatic coordinate) and the time stamp. |
| venting.RData | R data file for plotting figures 10 and 11. Includes high-frequency wind data from 27 August 2019, which is cumbersome to save as a .csv file.Calculations are full documented in the supporting R script. |
| project\_src.zip | Source code for producing the figures in the main text.The Python script for figure 02 loads the downes\_phenocam.csv phenocam data for the greenness index.The R scripts for figures 03-09 load the residence time .csv files above.The R script for figures 10,11 loads the venting.RData file. This data saves the user time, because some of the processing is slow. The R script documents how each of the dataframes is calculated. |

**Publications**: *"Air-parcel residence times in a mature forest: observational evidence from a free-air CO2 enrichment experiment"* by Edward J. Bannister et al. (2022) [in submission]

**Appendix – explanation of variables for the time-averaged residence time files**

**dateper –** timestamp of each averaging period

**WS** – wind speed measured at the 2D sonic on the northernmost tower of each array

**TAIR** – air temperature in the array

**BP** – barometric pressure in each array

**CBASE** – ambient CO2 mixing ratio

**CGRAB** – 5-second average CO2 mixing ratio

**C1MIN** – 1-min rolling average CO2 mixing ratio

**C5MIN** – 1-min rolling average CO2 mixing ratio

**EW** – East-west wind velocity components(for calculating wind direction)

**NS** – North-south wind velocity components(for calculating wind direction)

**FLOW** – CO2 flow rate into the fumigation arrays (g (CO2) s-1)

**MCO2** – mass of CO2 in each fumigation array (g)

**TRES** – air-parcel residence time for that averaging period (s)

**WD** – wind direction (degrees)

**u\_star** – friction velocity (m s-1) calculated from the met tower observations

**met\_WS** – wind speed (m s-1) calculated from the met tower observations

**met\_WD** – wind direction (degrees) calculated from the met tower observations

**TKE** – turbulence kinetic energy (m2 s-2) calculated from the met tower observations

**T\_sonic** – sonic air temperature (K) calculated from the met tower observations

**T\_flux** – kinematic temperature flux (K m s-1) calculated from the met tower observations

**obukhov** – Obukhov length (m) calculated from the met tower observations

**tau\_norm** – normalised residence time $τ/τ\_{c}$