**Responses to Reviewer 2**

This paper provides a dataset of partitioned water and carbon fluxes from NEON tower datasets. This is a unique dataset providing estimates of partitioning using multiple approaches, with estimates of uncertainty across a wide domain of land covers. The data could support a number of studies on controlling factors of water and carbon fluxes that are hard to glean from bulk (NEE and ET) flux data. The products are provided as easy to use csv files with sufficient metadata.

We thank the reviewer for the positive assessment of the paper and for the suggestions. We have taken the comments into account and revised the manuscript accordingly. In particular, we emphasized the limitations of the dataset, which should be taken into account by future users.

I have a few comments and suggestions below, but my main concerns are:

- There is a long history of partitioning of NEE based on models such as nighttime respiration. Many of these partitioning approaches are regularly operationalized for ecosystems studies on GPP and respiration. I am surprised that data for these more typical methods (not based on flux theory) are not included in the dataset.
  We agree with the reviewer that these methods are important and should have been mentioned in the manuscript. However, we did not include them in the dataset because (i) our focus was on methods that partition ET in addition to $CO_2$, and (ii) on methods that rely on turbulence principles. In addition, while the two mentioned approaches partition GPP and ecosystem respiration, the methods implemented in the dataset partition $CO_2$ into plant net photosynthesis and below canopy respiration. This distinction is now clearly explained in the manuscript, where we warn the users to consider these definitions for future analyses and product comparison. Therefore, we chose not to incorporate these two methods into the dataset. That said, we have now discussed these methods in the introduction, and we further elaborate in the conclusion that such methods could be applied and compared to our product, similar to other ET partitioning algorithms.

- This is very much an experimental dataset and while the authors acknowledge this, I am concerned that users might grab the data and use it with insufficient caution. I would consider a name for the paper that notes this is "experimental" and clearly distinguished this product from other NEE partitioning approaches (mentioned above).
  To address the reviewer's concern, we have revised the title of the paper, which now reads "Observational partitioning of water and CO$_2$ fluxes at NEON sites: a five-year dataset of soil and plant components for spatial and temporal analysis". Moreover, a discussion on the assumptions and limitations associated with the datase were incorporated throughout the manuscript.

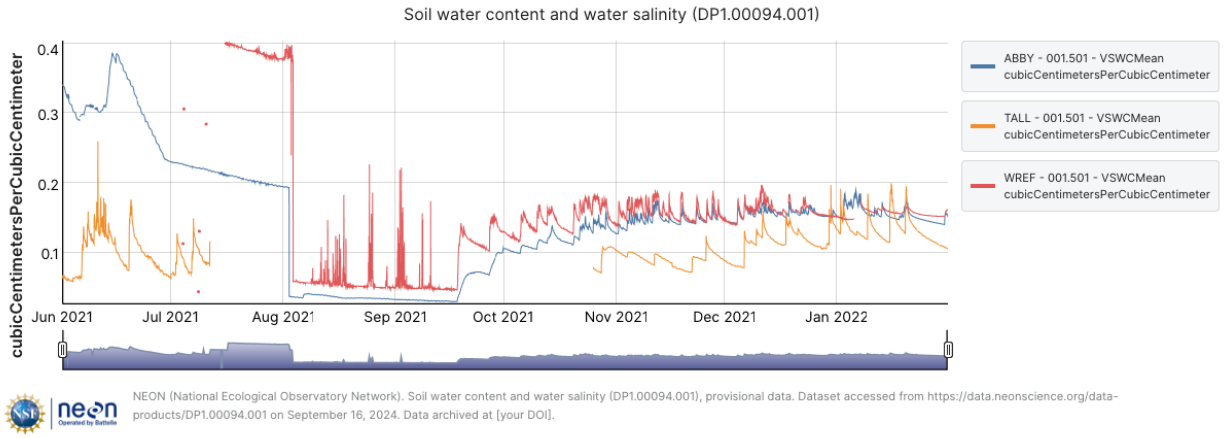
25: There are a wider arrange of partitioning approaches such as isotopes (carbon and water), carbonyl sulfide, solar induced fluorescence, nighttime respiration etc…. A deeper acknowledgment of these approaches and how the approach her is independent is needed. Also, can you partitioning ET with a lysimeter or is this just an estimate of ET?

We agree with the reviewer that there are several 'direct' approaches to estimate one or more components of ET and/or $CO_2$. We had discussed these other methods and compared them to the direct methods we use in this paper in our previous work (Zahn et al, Agr and For Met, 2022) but as we mentioned the focus of the present dataset is strictly on "turbulence" methods for partitioning. In the revised paper, we clarify this focus, discuss other methods, and explain the advantages and disadvantages of turbulence methods in comparison to alternatives. The other methods the reviewer highlights are often difficult to implement on a large spatial and temporal scale and can be prohibitively expensive, limiting their ability to generate comprehensive datasets. This challenge was the primary motivation for focusing on turbulence-based methods, as they offer broader applicability. We have revised the following paragraph to reflect this idea and to discuss these additional techniques:

> "Eddy-covariance (EC) is a reliable approach to continuously monitor evapotranspiration (ET) and net CO2 (F c) fluxes across ecosystems in a standardized manner. However, the separate measurement of the ecosystem individual components, namely plant transpiration (T) and soil evaporation (E), as well as plant gross primary production (GPP) and ecosystem respiration (Reco), is still difficult. Traditional measurement techniques, such as sap-flow and lysimeters, often lack the temporal and spatial resolution necessary for capturing ET flux components comprehensively (Kool et al., 2014; Stoy et al., 2019). Other techniques, such as soil chambers (Kool et al., 2014), stable isotopes (Good et al., 2014), and carbonyl sulfide as a tracer for plant fluxes (Wohlfahrt et al., 2011), are not yet deployable at large spatial and temporal scales. Additionally, all of these methods carry their own uncertainties, can be logistically challenging to implement, and are often costly to scale up. Partitioning of CO2 fluxes into GP P and Reco can also be done based on night-time CO2 flux extrapolation (Reichstein et al., 2005) and light-response curves (Lasslop et al., 2010); this method has been widely implemented and is part of FLUXNET products (Pastorello et al., 2020). Nonetheless, it cannot partition ET components. As a result, there is a scarcity of datasets representing temporal and spatial variability of both ET and CO2 flux components across a broad range ecosystems and weather conditions."

67: It was confusing to me why soil moisture was excluded from the predictor set. What does it mean to say it was "noisy". I would assume soil moisture data would not be so noisy.

> Visual inspection revealed irregular missing periods and numerous discontinuities. Since these periods would need to be excluded from gap-filling, their removal would significantly reduce data availability. Below, we provide an example of such a period for three sites. While it may be feasible to clean the data for short-term studies, automating this process for a 5-year period across 47 sites would be challenging and result in considerable data loss.
>
> In addition, omitting soil moisture does not significantly affect the attribution of the importance of the other factors that were included.




82: Should say "CO2 flux"

We have corrected this typo.

125: Was canopy height adjusted for grasslands during the growing season or is that considered a constant in the model?

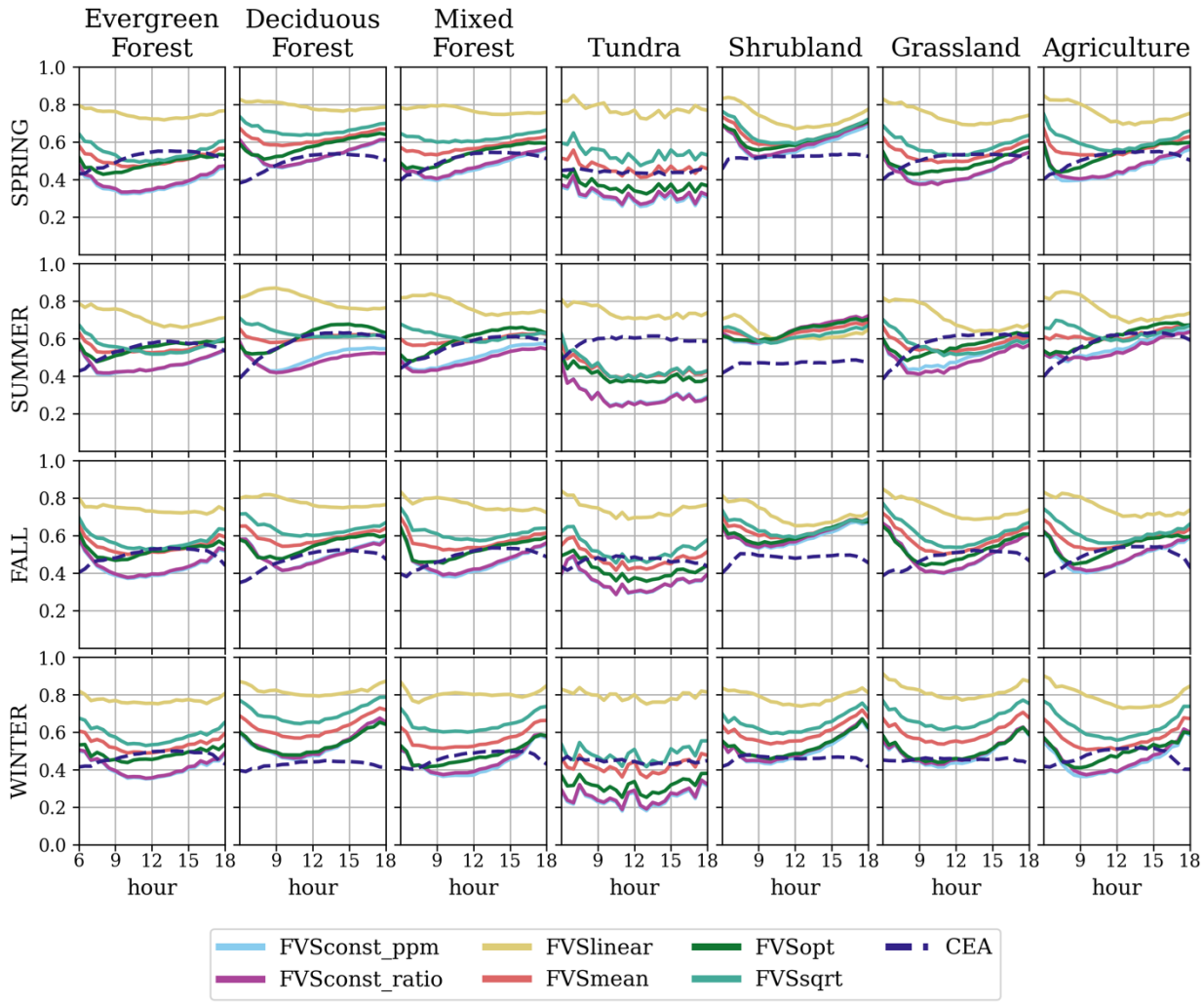
The canopy height (h) was assumed to be constant in the model. However, its only role is in calculating the stability parameter and in the Monin-Obukhov function used to parameterize WUE for the FVS method. Although we did not perform sensitivity tests, we believe the impact of this assumption is minimal, as the Monin-Obukhov functions themselves carry inherent uncertainties, particularly when implemented in the roughness sublayer right above the plant canopy.

150: Was stomatal saturation estimated with IR/skin temperature or air temperature?

It was estimated using air temperature. This is now clarified in the manuscript.

414: I am a little concerned about the use of the term "remarkable" especially when the diurnal cycle of T/ET with FVS seems to be totally inverted relative to the other approaches. I agree that the consistency is generally quite impressive but some core differences are present.

We agree with the reviewer that the diurnal cycle has some differences, namely early morning and late afternoon – this can be caused by the water-use efficiency parameterizations as used by the FVS method, which has been shown to be quite variable – sometimes by many orders of magnitude – early in the morning. This is now discussed in the manuscript. In addition, we included a new figure (shown below) that compares the different outputs of FVS based on different water-use efficiency models and CEA, showing that FVS obtained using Wopt – which is the least "empirical" approach – is in better agreement with CEA.


Evergreen Forest
Deciduous Forest
Mixed Forest
Tundra
Shrubland
Grassland
Agriculture
SPRING
SUMMER
FALL
WINTER
1.0
0.8
0.6
0.4
0.2
0.0
6
9
12
15
18
hour
FVSconst_ppm
FVSconst_ratio
FVSlinear
FVSmean
FVSopt
FVSsqrt
CEA