

## ***Interactive comment on “Exchange of CO<sub>2</sub> in Arctic tundra: impacts of meteorological variations and biological disturbance” by Efrén López-Blanco et al.***

### **Anonymous Referee #2**

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The article “Exchange of CO<sub>2</sub> in Arctic tundra: impacts of meteorological variations and biological disturbance” by Lopez-Blanco and co-authors presents eight years of eddy covariance measurements from a tundra site in Greenland. The data set is rich and the authors apply current and appropriate methods in data analysis to derive gap-filled net carbon fluxes, as well as to partition these fluxes into the photosynthetic and respiration components. The authors attempt to analyze gap-filling procedures and use auto chamber data towards these efforts. The undertaken analyses reveal valuable insight into the behavior of tundra carbon cycling in response to environmental variability from hourly to inter annual scales. Novel methods are applied to analyze the role of environmental drivers of C cycling as well as biological factors such as a pest outbreak. In

C1

general, the manuscript is a solid and valuable contribution. Greater attention to grammar, structure, and clarity will greatly improve the article. In some cases, additional justification for statements or references to literature are needed. The comments that follow provide suggestions for addressing these concerns before publication.

#### General comments:

There is too much repetition in portions of the manuscript (specific comments identify some of these sections), and efforts to reduce repetition will increase the readability of the paper.

More attention is needed to grammar throughout the manuscript. Importantly please pay close attention to the correct use of singular or plural nouns. Here are some examples where they should be switched (but please address on a case by case basis):

Singular case instead: temperatures -> temperature, exchanges -> exchange, budgets -> budget, precipitations -> precipitation, references -> reference, evidences -> evidence

Data: plural -> data are rare

Capitalize Earth and Arctic when proper nouns

With respect to figure 6, what causes the different direction (clockwise vs counter-clockwise) in the hysteresis observed in 2010 vs 2012 vs 2013? It would be interesting to know the whether the causes for early versus late season decoupling of GPP and Reco are the same or different.

#### Specific comments:

Abstract: I find the use of meteorology and climate to be a bit conflicting here. Please ensure whether you mean meteorology or climate with reference your conclusions in this study.

P2L69: The terminology “C balance state” does not carry an immediate clear meaning.

C2

Does this refer to the annual balance of net carbon exchange? Clarify what C state refers to and how relates to fluxes versus carbon stocks and over which time frames. What is your definition of C uptake and C storage, and over what time frame?

P2L52: Eddy covariance data can include other types of gases, so good to specify: Eddy covariance measurements of CO<sub>2</sub>

P3L82: Resiliency in which sense? Should clarify right away.

P3: Sections of the end of the introduction are too detailed to be placed in the introduction and should be moved to the materials and methods section. Please separate material between L82-91 into intro vs methods as appropriate

P3L116: clarify what 5+5 min means

P3L120: spell out km if used in this sentence

P5L184: Please clarify what is meant by “sums the variable’s importance up to 1”. This sentence could be clearer

P5L198: Check grammar: “also exposed a larger variability”

P6L205: what is a non-lap year?

P6L216: measurement period

P6L223 & Fig S4: The largest GPP and Reco were found in wetter and warmer years, but what is the statistical measure to support a “tendency towards larger GPP and Reco during wetter and warmer years”? For example, for Reco, half of warmer/wetter are larger and half are smaller than colder/drier.

P6L228: perhaps be more specific about what the response to the outbreak was in terms of fluxes (not really a response of measurements, but of actual fluxes). Just GPP?

P7L281: I wouldn’t use “momentarily” to describe hourly data

C3

P7L285: What is meant by “although Tair appeared to be the less limiting factor”. It seems that Tair is the most important variable for Reco, but I’m not sure how it would be limiting or not

P8L1286: Check grammar in the last sentence. I wouldn’t use “catch”. Please elaborate on what the connection here is. Why would a decrease in PAR’s importance are sense here?

P8L293: What tendency is that? Also, don’t use ‘mirror effect’. Use clearer language.

P8L298: I’m not sure this sentence is a natural conclusion from your results: “Thus, the effects on C balance of warming from climate change are not straightforward to infer.” Would these processes not be predicted by models? If so, then it could be misleading to state that it is difficult to infer. Provide some context from current literature here if in fact current understanding would have missed this.

P8L303: a bit redundant with ‘growing season’ twice

P8L314: outbreak of what?

P8L317, L330: check grammar

P8L322: shortest-lasting, longest-lasting

P9L337: This first two sentences are very unclear as written

P9 section 4.2: I don’t find this analysis of gap filling to be very informative because estimates regarding which method is best are not testable. Why not test the performance of the gap-filling on years where you have good data coverage by creating artificial gaps and testing model performance against real data? I would find that exercise to be much more compelling and would help you determine which method to apply in years where data is really missing.

P9L365: How was the filtering done? This is not clear.

C4

P10: I would avoid using 'interesting' so much as a way to describe your observations. It would be more informative to put in context with extant literature. You should not just repeat results here that are listed elsewhere, but put into context. For example, this is done in the latter half of the L380-387 paragraph, but not the first part. The first half of the conclusion is a bit repetitive as well - should not be a repetition of abstract, should be more general.

Table S1: Avoid using N°

Where is Figure S1?

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