Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2020-389-AC1, 2021

Biogeosciences
Discussions
Open Access

Interactive comment on "A survey of proximal methods for monitoring leaf phenology in temperate deciduous forests" *by* Kamel Soudani et al.

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Received and published: 7 April 2021

We are very grateful to the two referees for their constructive criticism, which helped to improve the manuscript. Please find below our responses point by point to comments and questions and a detailed account of the changes made to the first version of the manuscript.

- General comment: The study is designed carefully, and has an exhaustive discussion covering a range of relevant previous studies. There are no major concerns from my side, except a few specific comments listed below.

We are pleased with this positive feedback on our work.

- comments: L9-10: But there have been some (e.g., PhenoCam network; Milliman et al. 2019). Milliman, T., Seyednasrollah, B., Young, A.M., Hufkens, K., Friedl, M.A., Frolking, S., Richardson, A.D., Abraha, M., Allen, D.W., Apple, M. and Arain, M.A., 2019. PhenoCam Dataset v2. 0: Digital Camera Imagery from the PhenoCam Network, 2000–2018. ORNL Distributed Active Archive Center.

Thank you for this remark. Our sentence was not clear. We wanted to emphasize that the monitoring of phenology on EC flux sites was not systematic at their beginning, although it is a very important variable to interpret the temporal variability of fluxes and carbon stocks in the concerned ecosystems. Indeed, the phenocam network, which started in the early 2000s, was the first to implement routine monitoring of phenology at carbon flux measurement sites in the USA through standards protocols of image acquisition and extraction of phenological dates. This strongly stimulated the installation of similar networks in Europe (http://european-webcam-network.net/) and other countries (Australia, Japan for examples). We have referred to Phenocam network in our introduction in the first version of our manuscript, citing in particular the papers of Richardson, 2019; Klosterman et al. 2014 and Sonnentag et al. 2012. In this version, we added the paper by Richardson and colleagues (2018) which present the dataset documented in Milliman et al. (2019). In this version, we explicitly refer to the data acquired within the Phenocam framework by citing the Richardson et al. 2018 and Milliman et al. 2019.

Richardson, A.D., Hufkens, K., Milliman, T., Aubrecht, D.M., Chen, M., Gray, J.M., Johnston, M.R., Keenan, T.F., Klosterman, S.T., Kosmala, M., Melaas, E.K., Friedl, M.A., Frolking, S., 2018. Tracking vegetation phenology across diverse North American biomes using PhenoCam imagery. Sci Data 5, 1–24.

Milliman, T., Seyednasrollah, B., Young, A.M., Hufkens, K., Friedl, M.A., Frolking, S., Richardson, A.D., Abraha, M., Allen, D.W., Apple, M. and Arain,

M.A. et al., 2019. PhenoCam Dataset v2.0: Digital Camera Imagery from the PhenoCam Network, 2000-2018. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1689

We also have modified L9-L10 as follows:

" Yet, tree phenology has rarely been monitored in a consistent way throughout the life of a flux tower site."

- L25-26: There are ongoing debates on how such a temperature-driven control has been changed, and about other factors controlling vegetation phenology like photoperiod and chilling requirements.

We fully agree with the reviewer's comment. This is the first sentence of the introduction and we just wish here to introduce the subject by remembering the prominent effect of temperature, not entering the details of the control of leaf phenology.

- L34: How about satellite-based observations? Now their spatial coverages span 3 to 500

To avoid needlessly burdening the text, we have deliberately chosen not to refer to spatial remote sensing because we have focused our study on in situ methods. Nevertheless, we have cited in this manuscript our studies on vegetation phenological metrics extraction using satellite data time-series (Soudani et al. 2018 and Hmimina et al. 2013).

- L100-104: The dates derived from the extrema of the third derivative are quite comparable with the dates from amplitude thresholds. However, these are not identical, and their relationships depend on the rate of increase/decrease in vegetation index during growing/senescence phase.

We agree with this remark. Indeed, the dates at 10% and 90% are not identical to the extrema of the third derivative. For the numerically determined 10% and 90% during spring and fall phenological transitions, there is indeed a small shift. During spring phase, the 10% date comes slightly later than the first maximum of the third derivative and the 90% date is slightly earlier than the second maximum of the third derivative. During the fall, 10% date during the decay phase is later than the date determined from the third derivative (first minimum) and the 90% decay date is slightly earlier. We agree that the difference depends on the rate of change in vegetation index. However, the 10% and 90% phenological stages remain interesting because they span the spring and winter transition phases, but the determination of the corresponding dates is less robust than the date at the inflection point. We have changed the text as follows:

L100: "For these two dates u and v, Vv(t) is very close to 50% of its total amplitude of variation, in spring and autumn respectively."

L103-104: "SOS, MOS and EOS for the start, middle, and end of leaf onset (budburst) in spring and SOF, MOF and EOF for the start, middle and end of leaf senescence in autumn, corresponding approximately to 10%, 50% and 90% of total amplitude during the increase and the decline in canopy greenness in spring and autumn, respectively."

- L343: For Fig. S5, could it be possible to show the relationships of OBS with others? That

It is not possible to establish the same type of relationship between OBS and the other variables. These relationships are established from daily measurements. Observations are made twice a week during the spring and once a week during the fall.

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