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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Signs of reduced biospheric activity with progressing global warming: evidence from long-term records of atmospheric CO_2 mixing ratios in Central-Eastern Europe" *by* Łukasz Chmura et al.

Anonymous Referee #2

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In their paper 'Signs of reduced biospheric activity with progressing global warming: evidence from long-term records of atmospheric CO2 mixing ratios in Central-Eastern Europe' Chmura et al. analyse time series of atmospheric CO2 from two stations in central Eastern Europe with respect to changes in the fluxes to the atmosphere causing changes in the annual amplitudes of the seasonal cycle of the atmospheric CO2 concentrations. They postulate that the reduction in the amplitude as seen by the observations at both the Kasprowy Wierch and the Hegyhatsal stations are caused mainly caused by a reduction in biospheric activity during periods of extreme weather,

ie. droughts.

The manuscript is mostly well written and concise, unfortunately too concise, which is the main problem of this manuscript.

The authors did not analyse all the potential contributions that can lead to changes in the seasonal cycle amplitude, they only discuss reduced photosynthesis for an increase in the summer minimum and reduced fossil emissions for a decrease in the winter maximum. They do not even mention all the other influencing factors such as changes in ecosystem respiration, changes in the growing season length, changes in land use, CO2 fertilisation (surely plays a role over the 24 year period) other changes in fossil fuel emission than reduced emissions from heating due to warmer winters.

The author also do not sufficiently support their hypothesis with other data sources. They only use results from CarbonTracker, however, integrated over the Transcom Europe region, which covers the whole geographical Europe extending eastwards to the Ural. This is a much larger region than what the footprints of the two analysed stations cover. Both the biospheric fluxes as well as the fossil fuel emissions used in CarbonTracker are available per grid-cell and analysing those data for the footprint regions of the stations would be more meaningful. Additional data sources (e.g. fossil fuel emissions from EDGAR, biospheric fluxes from the Global Carbon Project) for analysing the changes in emissions in Central-Eastern Europe are available, for instance, at the ICOS Carbon Portal.

Another aspect that is not discussed at all in the manuscript is how their findings of a reduced seasonal cycle amplitude relates to previous publications reporting an increased seasonal cycle amplitude in the northern hemisphere, e.g. Graven et al., 2013, and Forkel et al., 2015. Since this manuscript is rather contradicting these previous results, the changes in the seasonal cycle amplitude at the two stations subject of this paper need to be set in context with the other studies.

Detailed comments:

L34-35: It is not obvious why future climate predictions from numerical climate models rely on high-quality observations of atmospheric CO2 concentrations?

L 50ff: Why 'this' lack of representation, there hasn't been any mention of any lacks before.

L 121-122: Do you mean by 'periods of interest' that you have calculated footprints over the whole 24 year period? I assume that this is the period of interest.

L 133: What do you mean by constant 5 cell x 5 cell weighting field?

L134-135: Please explain the approach and not only provide a reference, especially if it is only similar and not the same approach!

L137: How about consistency in datasets when using ERA-interim for climate extreme detection and NCEP for footprint analysis?

L 144: Why do you use only the uppermost soil layer? Is this the soil moisture layer which affects plant water stress? Plants usually have much deeper roots and access to soil water at deeper layers.

References Graven et al., 2013. Enhanced Seasonal Exchange of CO2 by Northern Ecosystems Since 1960, Science 341 (6150), 1085-1089, DOI: 10.1126/science.1239207 Forkel et al., 2016. Enhanced seasonal CO2 exchange caused by amplified plant productivity in northern ecosystems, Science 351 (6274), 696-699, DOI: 10.1126/science.aac497

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