Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2018-100-RC1, 2018

Biogeosciences Discussions

Interactive comment on "Plant responses to volcanically-elevated CO_2 in two Costa Rican forests" *by* Robert R. Bogue et al.

Anonymous Referee #1

Received and published: 24 April 2018

n this paper, the authors investigate the potential use of tree wood carbon stable isotopes as proxies for elevated CO2 exposure in a volcanic environment. The approach has a great potential for understanding the effect of elevated CO2 on plant 's physiology. This study, however, suffers from high uncertainty in the methods applied to analyze the 13C from the tree core, There is no clear chronological constrain for tree growth of the time frame (presented here as the 3 growth years) and thereby on the resolution discussed in the analyses. Below are detailed comments. It is never clear how the tree 13C data match the resolution for the soil CO2 flux (as presented in Figure). The methods and results need more details in order to contextualize the implications of the documented elevated CO2 signature.

Line 50: you introduce rubisco without defining what it is. Line 73. "It is" instead of "it

was" unclear

In the Investigated locations and sampling strategy section: there is no reference to figure 1 where sampling transects are described.

section 2.2 title: "Species studied" replace by "studied tree species"

The authors describe that the sampling for isotopes was conducted using a drill and drilling holes in the outermost 5 cm. Was this at any specific resolution? or just aimed at generating wood powder for analyses?

The authors estimated that the outermost 5 cm correspond to the last 2-3 years? what is this assumption based on? Lines 232-233: Are there any information about the canopy height, it seems that the 0-100 m would be the most appropriate level. Does the model captures finer vertical differences in the CO2 concentration within the canopy for e.g. between 10m and 40 m?

Lines 250-252. The measurements in this study reveal that CO2 levels are high based on CO2 fluxes data. The ecosystem growing in this environment are certainly exposed to those high CO2 concentration levels, however, the results described in this section do not show the link to stomatal conductance and chlorophyll concentrations.

The CO2 concentration level are measured at soil level, do you expect the concentration to remain similar at higher canopy level, say $\sim$ 15-20 m?

Lines 265-266: the 13C values for A. acuminata and O. xalapensis are identical (statistically not different). Was the difference between the two species and B. nitidia tested statistically?

The following sentences are confusing. As CO2 flux increased, the wood cores contained progressively higher amounts of 13C for two of the three species. Tree core δ13C showed no relationship with stomatal conductance for any species.

As CO2 fluxes increased over time or spatially? how was that tested in the case of

time? There is no mention of stomatal conductance data or else and here a brief description of the relationship between 13C and stomatal conductance?

In the discussion, the authors argue that the existing significant correlation between the 13C in the trees and soil does not imply that trees were incorporating the heavy volcanic CO2. The values of tree's 13C should reflect the incorporation of eCO2

Line 312, Why is it assumed to be 400 ppm? if it is the atmospheric value is 400 ppm for the particular period: several years from tree rings then it should be referenced to from atmospheric measurements (Mauna Loa for example).

the sections 4.3 and 4.4 are very speculative as the results presented and discussed in the paper are exploratory and bear some weaknesses in the sample processing, particularly the tree cores age and investigated period. These two sections can be shortened and merged.

Line 422. The statement of identifying areas of dense old-growth forest is not based on any chronological framework. They are potentially old but the methods used in this study did not provide any dating of the trees.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2018-100, 2018.