Review of

Global Soil Consumption of Atmospheric Carbon Monoxide…

by Liu et al., 2018

I find the revised version of the paper significantly improved. I have few comments, mostly technical. I recommend publication after these are addressed.

Main comment - lines 403 – 406 and Table 5

The effect of the SOC on the gross uptake flux seems too large (Table 5). A note confirming this has been added in this version of the manuscript (lines 403 – 406) but there is still no explanation given.

The 30% extra SOC increases the gross production, which makes more CO available in the soil, which in turn leads to an increase in the gross CO consumption from the soil. But, for an increase in SOC of 30%, the production increases by about 10Tg/year, and the gross consumption increases by 28 Tg/year! This means that an extra 18 Tg /year is taken from the atmosphere. I do not understand how this happens, as I think an increase in soil CO concentration cannot lead to an increase in the uptake of CO from atmosphere. (An increase of uptake from the atmosphere would actually need a decrease in the CO concentration in the upper layer of soil.) Also, from Eq. 2.x, it is clear that the uptake is related to SOC only via the CO soil concentration.

Please explain and/or correct if this is an error.

Technical and text comments

line 23: CO deposition velocity – net or gross?

line 25: why will deposition velocity increase? which are the main factors? Add a short explanation, e.g. "mainly due to xxx" xxx = increase in temperature?

line 54: since you just shown negative values, I think it is belter to specify here what are the negative fluxes, e.g. (<u>negative</u> values represent <u>deposition</u> <u>from atmosphere to soil</u>)

lines 55 – 56: "All existing estimates have large uncertainties ranging from -16 to -640 Tg CO yr-1" is this the range for estimates, or for uncertainties? – unclear, please reformulate

lines 56 – 57: "the estimates of CO dry deposition velocities also have large uncertainties, ranging from 0 to 4.0mm s−1" – is this the range for estimates, or for uncertainties? – unclear, please reformulate

lines 145 – 147: I think a piece of text is missing here. D is calculated using the method of Potter. Equations 2 – 4 are not related to D, but to the production and consumption rates P and O. Please check.

from line 155 till the end of this section: it is unclear what some of the numbers represent. E.g. why Vmax is a range and not one value? It would be good to explain here shortly that Vmax (also other parameters) are ecosystem specific, and that's why there are multiple values. This is shown later in Sect 2.3 but not clear here.

Also, are the Vmax values taken from Whalen & Reeburgh, 2001, or optimized in this work? If they are optimized in this work (as described in Sect. 2.3) then remove the reference to Whalen & Reeburgh (line 156). The same for kCO, and all the parameters optimized in this work – the way some of the references are given now suggests that the values are taken from those papers.

lines 210 – 211: "uptakes", "depositions" and "emissions" should be "uptake", "deposition" and "emission"

line 260: I suggest to state here explicitly that the CO surface concentration is constant in time.

lines 314 – 315: I think the ranges should be given with the lower value first, e.g. "-180 to -197" should be "-197 to -180"; same for -145 to -163. Same for the following: abstract; lines 373 – 374, 483

lines 343 – 345: Fig. 9 does not show consumption, production and net flux

line 351: replace "from RCP2.6 to 8.5" by "from RCP2.6 to RCP8.5"

line 355: Table 5 should be Table 4

lines 450 – 452: What is meant here by "derived CO concentration"? – is it the constant, latitude dependent CO derived with the function 5? Please clarify. Also, if this is the case, a lower than real CO concentration will lead to an underestimation of CO deposition, and not to an overestimation, correct?

Table 5 – please check the sign of the % values. I think for Consumption and Net flux all the % values have the wrong sign. E.g. the change in consumption from baseline to (CO + 30%) should be + 11% (-164.14 - (-147.65) / (-147.65) = 11.17).

Fig. 3. I find it difficult to see some of the plots, in particular the measurement data in plots a2 and c2. Also the x-axis labels of a1, b1, c1 and d1 are difficult to see at normal page zoom.

Fig. 9 caption: remove the first "Future"

Fig. 12. typo in all x-axes labels, should be "concentration"