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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A dedicated flask sampling strategy developed for ICOS stations based on CO_2 and CO measurements and STILT footprint modelling" *by* Ingeborg Levin et al.

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Comment on:
A dedicated flask sampling strategy developed for ICOS stations based on CO2 and CO measurements and STILT footprint modelling" by Ingeborg Levin et al.

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General comments

I think this is a very interesting and much needed research, helping the scientific measuring and modelling community. The paper discusses the potential uses of flask measurements for C14, measurements that are getting more and more important in climate research and proposes a sampling strategy for these measurements. The proposed sampling strategy for these flask measurements is justified with extensive research. To my knowledge, such a sampling strategy has not been created in such detail and with such justification before. Therefore, I recommend that this paper is published with minor revisions.

Specific comments

Especially in the introduction, the English is unclear and needs a revision.

Throughout the paper, the aims are discussed shortly thrice. One, more elaborate explanation would be better for me.

The introduction is unclear. In line 40-45, it is unclear why the measurements by Keeling are mentioned. Also a link between marine and terrestrial measurements is needed. The first two paragraphs should therefore be rewritten.

In Section 2.3, only STILT is mentioned. For stack emissions, STILT could introduce biases due to the representation on a grid. Therefore, a plume model might be needed for emissions from e.g. power plants. I would like to see a few sentences added that discuss this, either in Sect. 2.3 or in a discussion section.

In line 246, the '1/t filling approach' is mentioned. What is meant is unclear and should be explained or a reference should be added.

Line 290-295: Nighttime transport models are very erroneous. However, the integrated

flask samples are filled for two weeks. Does the limited capability of the nighttime transport not limit the usefulness of these integrated samples for modelers (as described in the aims), if they are also filled during night. (c.f. Line 294-295). I would like to see explained why the flasks are not only filled during well-mixed conditions.

Line 420 needs additional explanation: why are conditions with low ambient variability best suited to meet aim 1? It states that this is explained in the previous section, but this is unclear. Therefore, I would like to see this explicitly explained in the previous section.

In Section 4.2, only the results using flask measurements at 13.00 LT are shown. However, afternoon mixing conditions persist through about 16h in winter. Why are the flasks only filled at 13h? An analysis with the footprints for other times in the afternoon would add much information. I would like to see a paragraph (possibly including a figure), explaining the differences between sampling at 13h and other afternoon hours, and an explanation on why 13h is chosen.

In section 4.3, it is explained that mostly the winter C14 measurements are of interest. However, in winter time, the biosphere fluxes are small. Contrary, in summertime, the biosphere is very active and partitioning between biosphere and anthropogenic fluxes is very hard. C14 can help with this. Therefore, summertime flask samples are also very informative. I would like to see a sentence explaining, and possibly countering, this limitation.

Technical corrections

r. 37: How often can these events be expected?
r. 53: The mentioned process understanding needs more elaboration.
r. 50: These fluxes however, . . .
r. 81: ICOS flask sampling strategy might change in the future

r. 224: six
r. 350: in-situ
r. 369: suited to meet aim 1 (ongoing quality control at class 1 stations).
r. 420-421: Replace the could
r. 427: As expected, the regional coverage . . .
r. 493: In this summer month: What summer month?
r. 518: The mix of abbreviations and full names is confusing. A table with full name, location and abbreviation would help
r. 562: working successfully

Figures and Tables:

Table 1: This table is very full and therefore it is hard to find the needed information. A histogram might be more intuitive. This, however, is up to the authors to decide.

Figure 1: For better overview, it might be useful to indicate the sites in this figure.

Figure 2: The photograph of the sampler is superfluous. More explanation on the schematic is needed in the caption/text.

Figures 3 and 4 should be combined.

Figure 5: The title above the subfigures is very small and therefore unreadable.

Figure 6: The font and subplots are too small to read. It is also unclear what the main message of this figure is.

Figure 7: The x-axis could do with only one scale, also increasing the amount of space for the figures. Same goes for the y-axis

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