

## ***Interactive comment on “2-D tomography of volcanic CO<sub>2</sub> from scanning hard target differential absorption LIDAR: The case of Solfatara, Campi Flegrei (Italy)” by Manuel Queißer et al.***

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Dear Referee,

on behalf of the co-authors I thank you for the time you took to review the manuscript. A detailed response will follow after the discussion phase. Due to time constraints this is just a very brief comment.

Clearly, the manuscript needs further work and the points you raised are a helpful guideline. I agree with almost all of them. However, I am quite convinced about the inversion result, simply because it converged to a result that agrees with previous work (see references given in the manuscript), both in terms of the distribution of the CO<sub>2</sub>

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and the computed flux!

Thanks to hard data we can directly compare the inversion result with the CO<sub>2</sub> concentrations and fluxes. If this does not yield meaningful errors then I do not know. A measure for the inversion error has been given using the least square error. It is true that in the general case contribution of the inversion error should be included in the flux computation I guess. But this was not the scope of this work, which was a first attempt, taking a standard solver (the LSQR) and see if we get a meaningful result rather than coming up our own inversion routine and compute the covariance matrix. Since the result is promising we shall do that in the future.

We attempted to explain why the resolution is not greater, and even stated that we tried a higher resolution and gave the result, obviously this needs to be explained better. But it has to do with uniqueness and converging to local minima. We tested uniqueness. We had the luxury to know how the CO<sub>2</sub> concentration map should look like qualitatively. This yielded higher resolutions unsuitable, because it yielded unrealistic maps. It is curious that Pedone et al., whose approach we adopted, used only 4x4 grid as well (without saying why as far as I remember).

"The large chi square (norm) of the inversion (around 18%, page8, line 26) is an indication that the inversion has problems." > We have explained why that might be, namely due to the poor ray coverage at the edge. The data was not acquired for that purpose.

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