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Comment on amt-2022-39

Anonymous Referee #2

Referee comment on "Real-world wintertime CO, N₂O, and CO₂ emissions of a central European village" by László Haszpra et al., Atmos. Meas. Tech. Discuss.,
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Review of the manuscript: " Real-world wintertime CO, N₂O and CO₂ emissions of a Central European village" by László Haszpra et al. (Atmos. Meas. Tech. Discuss. ,
<https://doi.org/10.5194/amt-2022-39>)

The paper proposes an original analysis of CO, CO₂ and N₂O eddy flux measurements made from a tall tower, in order to identify surface emissions at the scale of a village. The presentation of the measurement site, the eddy-fluxes and concentration measurements as well the tools used for the footprint calculations are short but rather clear. The approach is really interesting, and represents an interesting valorization of flux measurements. Very clearly, the main question concerns the uncertainties in the emission estimates, both by the bottom-up method and derived from the eddy flux measurements. Consequently, the main general comment would be to give as much as possible an estimate of the ranges of possible values considering the main identified uncertainties.

Few specific comments:

Introduction: could you provide an estimate of the percentage of CO₂ emissions related to villages less than few thousands inhabitants either at the scale of Hungary or Europe ?

"we removed all flux values for the periods when the top of the boundary layer was below 100 m": Given that you have vertical profile measurements of trace gases and meteorological data, wouldn't it be possible to derive the periods with low boundary layer height from observations rather than from ERA5 ?

"The emission densities of CO, N₂O, and CO₂ obtained for the natural landscape are 139 ng m⁻² s⁻¹, 5.9 ng m⁻² s⁻¹, and 12 µg m⁻² s⁻¹, respectively": according to the criteria used for the PBL development I guess your methods favors daytime events, compared to

nighttime. Still do you have cases for the night ? If so do you see a difference between day and nighttime fluxes ? I do not expect strong diurnal variability for the natural fluxes in wintertime, but for the anthropogenic emissions it must very significant.

"Our concept assumes that both the "natural" landscape ... are homogeneous from the point of view of emission density": would it be possible to elaborate on this assumption especially for CO₂ ?

Table 2: The estimation of the emissions by the so-called bottom-up method is well explained in the text, but given the assumptions (at some point in the text an uncertainty of a factor of 2 is considered) , it would be preferable to give the range of possible emissions rather than a precise value.

Concerning the N₂O, it would be interesting to develop the discussion to develop if it is realistic to have an order of magnitude of difference because of the uncertainties on the burning of waste?

The section on the representativeness of the tall tower as regard of atmospheric mole fractions measurements appears decoupled from the main discussion of the paper, but still this is an interesting contribution, but it might make more sense to have this discussion first in the paper.