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Comment on amt-2021-106

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Referee comment on "Field testing two flux footprint models" by Trevor W. Coates et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-106-RC1, 2021

This is a short paper and reports a comparison of two flux footprint models using an artificial CO2 source of a limited areal extension as a known emission source. Technically I judge that everything is correctly made. The results show that both flux print models yield a recovery rates that is statistically not different from one. I could sit back contentedly and rejoice that my simple Footprint Tool based on the KM algorithm still produces satisfactory results. Nevertheless, I think it is appropriate to address some warnings. The findings are based in total on 59 valid 10 minutes intervals. They were divided into three fetch-dependent groups. 10 minutes is a short time interval for EC analysis. Consequently, the variability in the recovery rate is large and the fact that the recovery rates are statistically not different from 1 cannot be a strong statement.

I had a look at the data given in the supplement. It is striking that three consecutive data points or one 30-minute value of the KM based recovery data for the 30m fetch group are clearly < 1 whereas the other four values are above 1, of course on average around 1. The bls based recovery rates for this group is clearly higher but does not reflect the distinction in two groups. I guess this is the typical behavior of real turbulence. This reminds me the flux simulation with a large eddy simulation approach that demonstrated the possibility of persistent structures lasting longer time that are inexistent in the KM or bls world. This information was presented during a workshop on ammonia measurements (Hensen et al, 2015). I recall the sentence*:From the LES simulations we can assume that for time averaging below 15 minutes integration the effect of streaky structures might be detectable on the plot scale. For multi hour averaging on the other hand, the effect might cancel out."*

Footprint corrections are always necessary in case a measured flux over areas with different emissions must be interpreted. The new generation of researchers are generally well trained in computing languages such as R I recommend the use of a bls model because it tends to force the user to think about the micrometeorological boundary conditions. A special package made by Christoph Häni is available (Reference below)

Reference:

the R package bLSmodelR (Häni et al., 2018), available at https://github.com/ChHaeni/bLSmodelR

Hensen, A.; Neftel, A.; Famulari, D.; Carozzi, M.; Jonker, H.; Erisman, J.W.; Huijsmans, J.; Mosquera, J.; Lantinga, E.; Berkhout, A.J.C.; Haan, B. de; International Workshop on Ammonia Measurements (IWAM)
ECN-E--14-052 april 2015; 47 pag.