

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-129

Anonymous Referee #2

Referee comment on "Impact of 3D radiative transfer on airborne NO₂ imaging remote sensing over cities with buildings" by Marc Schwaerzel et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-129-RC2>, 2021

This paper looks to address the 3-d radiative transfer effects of urban landscapes on NO₂ retrievals. The authors use monte carlo simulations from MYSTIC for a simplified urban landscape in Zurich to examine the impacts of buildings AMF calculations (so called 3D-box AMF). This is a very interesting study with significant implications to airborne retrievals. The only part the authors don't seem to address is how they would account for such 3-d effects in actual airborne retrievals. Many of the assumptions they make in this study would likely not be applicable to real world retrievals. Maybe this will come in a later paper, but it would make the paper stronger to explain how this could be translated into actual retrievals.

General Comments:

1. The authors note that 50% of the NO₂ sensitivity is from outside the ground pixel for a nadir viewing geometry. They also note that the urban canopy module in MYSTIC currently only supports Lambertian reflections. Could the authors elaborate on how the Lambertian assumption would effect their results? Would it be a safe assumption that accounting for specular reflection you would have less light scattering in from outside the ground pixel?
2. The simple assumptions about albedo seem to not be very realistic. It would be nice to do simulations with more reasnoable albedos or at least provide some discussion on the possible errors from making these assumptions about the albedo.

Minor Comments:

Pg 1 Ln 18. "by fuel combustion by traffic, heating systems...", suggest changing to "by fuel combustion, traffic, heating systems..."

Pg 2 Ln 53. Please spell out MYSTIC completely, the Monte carlo code for the phYSically correct Tracing of photons In Cloud atmospheres

Pg 8 Ln 186 "The reflectance was set to 0.1", please clarify that you are referring to surface reflectance, not top of atmosphere reflectance

Pg 15, Fig 10 It is curious that the building in the bottom right of the figure shows now shadowing effects despite the sun being to the west. Can you explain why this building is not effect by shadows effects. Even if it was in the shadow of the building to the west, one would still expect and impact on SCDs.

Pg 15 Line 316 "with 19% and 24% for simulations without aerosols and without and with buildings, respectively". This statement is a bit confusing. I suspect you mean 19% from outside the optical path with no aerosol/no building and 24% from outside the optical path with no aerosol/with building, but it is not clear

Pg 15 Line 317 should be "The effect becomes more.."