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Interactive comment on "A study of synthetic $^{13}CH_4$ retrievals from TROPOMI and Sentinel 5/UVNS Part 1: non scattering atmosphere" *by* Edward Malina et al.

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In this manuscript the authors investigate whether new and future satellite instruments have sufficient precision to provide scientifically valuable data on the isotopic composition of tropospheric methane (CH4). Unfortunately, the precision requirement for isotope information from satellite retrievals assumed in the study (10 per mill) is inadequate for scientific interpretation. The choice of this requirement goes back to Malina et al. (2018) , explained in Figure 1 there, but this figure and interpretation are misleading.

Although the range of isotope source signatures is correct, a satellite instrument will never observe CH4 from a pure source, but only an elevation above a relativley high

background. The (larger) elevations in total column CH4 from TROPOMI are of the order of 100 ppb (for strong elevations) so about 5% above background. Even if this additional CH4 comes from a single source with an isotope signature that is strongly different from the background d13C value of -47 per mill (e.g. biogenic CH4 may be 30 per mill depleted), this would only change the d13C value of the total column by 5% * 30 per mill, thus 1.5 per mill. This is the order of magnitude of isotope variations that was suggested before by isotope specialists as minimum target precision, e.g. by Nisbet et al. (2016), cited in the manuscript. Isotope signals of 10 per mill as assumed in the present manuscript and by Malina et al. (2018) are usually not even observed with in-situ techniques in the boundary layer, unless measurements are performed directly in the plume of a huge local source (e.g. Röckmann et al., 2016, Zazzeri et al., 2016).

The comparison to the way too loose requirements from Malina et al. (2018) leads to the misleading conclusion that that isotope retrievals from space with scientifically relevant precision are within reach for tropospheric CH4. Using a realistic precision requirement, an adequate conclusion would be that scientifically valuable isotope retrievals for CH4 are beyond the performance limits of current and planned instruments.

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