GENERAL COMMENTS

Estimating the emission amounts is more challenging than detecting the enhancement due to large uncertainty in wind speed and direction. Retrieving plume heights, wind height and direction is difficult from a snapshot of satellite data. The measurement technique and analytical method described here are unique. The authors are measuring the plume structure with an imaging spectrometer and a wind lidar and then comparing with a model. The paper demonstrates the difficulty and importance of field measurements. 5-day data set with various weather condition are very valuable for scientific community. Minor revisions will help readers' understanding. I recommend publication after revisions.

Thank you very much for the positive judgement of our work and the helpful comments.

SPECIFIC COMMENTS

(1) Page 2, Line 33, analogue techniques

An additional explanation on "analogue techniques" is helpful.

The techniques for estimating methane and carbon dioxide emissions from satellite and airborne imagery are identical in most respects, although there may be differences in detail, e.g. the use of nitrogen dioxide as a plume mask proxy for carbon dioxide. As the paper only deals with carbon dioxide, we have removed the part "using analogue techniques".

(2) Page 4, Figure 1

Descriptions such as the height of the chimney, distance between three chimneys, and distance between spectrometers and the chimneys in the figure or the figure caption will helpful.

We added the sentence

"The observed chimneys are 200 m (left) and 180 m (right) high and are approximately 3.2 km away from the camera."

to the caption. Exact distances between camera and the observed chimney are listed in table 1.

(3) Page 8, Line 185, "sparsity constraint on enhancement"

A brief description will help readers without referring the paper.

We added the sentence

"The sparsity constraint sets enhancements below the detection limit to zero, which enables the matched filter to iteratively remove the target signal from the background clutter estimation."

To line 187 of the manuscript.

(4) Page 25, Line 507 “Favorable observation condition”

Disadvantage of this observation is a weak scattered light as a light source. Scattering depends on the geometry of the sun, target, and observer. Is the back-scattered geometry such as “the sun is behind the observer” favorable?

Since Rayleigh scattering is inefficient in the SWIR spectral range, the largest contribution of light comes from scattering at aerosols. The Henyey-Greenstein phase function for aerosol scattering is asymmetric and favors forward scattering, with typical asymmetry parameters above 0.5 [1], between 0.76 and 0.82 at the measurement days according to AERONET (table 1 in manuscript). Therefore, the back-scattered geometry is not advantageous with respect to the illumination. Yet, the sun should be far away from the field of view to avoid strong gradient inside the image. Thus, a sun behind or above the observer is favorable.
For the same reasons cameras operating in the UV/VIS range also prefer the sun in the back, while they also profit from an increased illumination due to Rayleigh-backscattering.

(5) Supplement P2, Figure 2 the right panel

Do colors in the right panel mean something?

We believe you mean Figure S1, the wind lidar data. No, the colors have no meaning, we removed them to avoid confusion.

TECHNICAL CORRECTIONS

No specific comments.

[1] Pandolfi, M. *et al.* A European aerosol phenomenology – 6: scattering properties of atmospheric aerosol particles from 28 ACTRIS sites. *Atmos. Chem. Phys.* **18**, 7877–7911 (2018), https://doi.org/10.5194/acp-18-7877-2018.