Reviewer comments:

R: The authors revised the manuscript according to the reviewers' comments. However, some modifications were made with quite minimalistic effort. Concerning a central issue raised in my original review:

"There is a quite striking difference between the showcase examples in Fig. 4, where plume direction changes significantly within rather short distance, and the mean rotated plume in Fig. 7, where the overall effect is rather weak. I.e. besides the examples in Fig. 4, there are many days without observable plume curvature or even opposite direction. It would be important to understand why the effect is strong on some days and not present on others, and I would like to ask the authors to look for key variables that might explain this different behaviour (e.g., season, pressure & temperature). And as the Coriolis force itself is well understood, it would be desirable to relate the observed curvature to the actual Coriolis force. If this is not possible, please discuss why".

The authors refer to possible future studies. I do not expect the current paper to answer all open questions; however, I definitely expect the authors to extend the discussion and at least mention these open questions and current shortcomings of our understanding. The discrepancy between the extreme showcases and the average curvature has to be pointed out. Concerning the Ekman spiral, this has just been added sloppily. It is now mentioned in lines 100 ff, but is not discussed any further in the rest of the paper. No references are provided. Do the authors think that the showcases they found are showing an Ekman spiral? This should at least be mentioned in the discussion and/or conclusion.

A: We apologise for the shortcomings of our reply to this comment and we fully accept the reviewers concerns with how we addressed the original comment. We are grateful to the reviewer for re-iterating this point, as the improvements made have re-enforced our understanding and improved our discussion of the processes involved. We have supplemented the following sections, highlighted in blue, including references.

- Section 2.5
- Section 3.2
- Section 4

R: A new figure was added as part of the existing Fig. 4. This suggests that Fig. 4c actually shows Ekman spirals - is this the intention of the authors? If not, I recommend to separate the figure of the Ekman spiral. In the current version, the figure caption has not been modified and does not describe panels (a) and (b).

- The figures have been separated and issues with the caption have been fixed

Editor comments:

R: Clarify why we need to track to the plume to the distances where the Coriolis Effect becomes evident to determine the emissions.

A: In order to correctly quantify emissions from an aggregate of a plume, we much consider the plume along its entire trajectory in order for the chemical lifetime assumptions and Gaussian fitting procedure to work. Omitting a section of the plume would be discarding results and would lead to an underestimation of emissions. It just so happens that the plumes lifetime allows for transport over a range where the Coriolis force begins to act on it. We do not consider the whole plume so that the Coriolis force can be seen, but rather we must consider the whole plume to properly quantify emissions, and across this range we get curvature due to the Coriolis force. Another reason for tracking/evaluating plumes over the whole length (10skm) is that these plumes show emissions averaged over several hours of discharge and dispersion. The resulting emission estimates are therefore more likely to be a representative sample of the source performance, compared to a short section of the plume (say, <1km) which is more of a "snapshot" that may not be so representative. Effective regulation requires representative evidence, so that emission estimates based on longer plumes are more compelling as evidence of source performance than estimates based on shorter subsections of the plume.

R: Though in line 172, ERA-5 model resolution is now mentioned but this should be described in an earlier section (Section 2.4) too. I believe time interpolation is also made. Was the wind information applied to the exact emission position only and not for the downwind regions for the analysis? For this particular emission position how were the wind direction and speed interpolated in space and time from the original ERA-5 field?

A: A description of the ERA5 data products used was added to Section 2.4, including a description of the interpolation. "We used the ERA-5 hourly data on pressure levels (Hersbach et al., 2020), interpolated spatially using a 2D piecewise cubic approach from a 0.25◦x 0.25◦grid to each sites coordinates and temporally to the overpass of TROPOMI for each day".
Interpolation of these wind fields is a common step for this kind of analysis, see below:
https://doi.org/10.5194/essd-13-2995-2021
https://doi.org/10.5194/amt-13-2131-2020
https://doi.org/10.5194/acp-22-2745-2022
https://doi.org/10.5194/amt-13-205-2020

R: Lines 41-43. What is the relationship between the TROPOMI version 2.2.0 algorithm and the S5P-PAL product?

A: S5P-PAL takes the existing S5P dataset and reprocesses it using the v2.2.0 processor, so all the data used was produced using the same processor. A few clarifying remarks have been added to 41-45 to try to make this clearer.

R: Please check if your figures 1, 3 and 7 with maps/aerial images require a copyright statement/image credit and add it to the figures (or captions) (https://publications.copernicus.org/for_authors/manuscript_preparation.html#mapsaerials). If

these figures were entirely created by the authors, there is no need to add a copyright statement or credit. In that case it is important that you confirm this explicitly by email.

A: Figures 1 and 3 were produced by the authors using Python, with border information provided by NaturalEarth. Their website states: “No permission is needed to use Natural Earth. Crediting the authors is unnecessary.” (https://www.naturalearthdata.com/about/terms-of-use/). Figure 7 uses map tiles provided by Stamen and OpenStreetMaps. We have added this credit to the figure caption. Please let us know if there is anything further required.