Atmospheric Chemistry and Physics Discussions

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Comment on acp-2022-599

Anonymous Referee #1

Referee comment on "Identifying and accounting for the Coriolis effect in satellite NO_2 observations and emission estimates" by Daniel A. Potts et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-599-RC1, 2022

Summary of Paper

Potts et al have used TROPOMI data to study the impact of the Coriolis Effect on emission estimates of NOx. They use 17 sites of power stations and industry which are each a large source of NO_x emissions, 9 of which show an expected curvature from the Coriolis Effect when aggregating plume observations over the site and applying a wind rotation correction. The authors show an example of where not accounting for the Coriolis affect and the resulting curvature of the aggerated plumes leads to an under-estimation of emissions of around 9%. They also provide evidence of where local topography dominate the wind fields and therefore the curvature of the plume cannot be related to the Coriolis Effect.

Comments

I think this is an interesting and generally well written paper which I recommend to be published. The authors have clearly shown the impact to emission estimates the Coriolis Effect can have. Below are some comments I think should be addressed before publication.

In the abstract, results and conclusions you mention studying 17 sites, 9 of which show an effect, 5 do not, and two are unusual. This adds up to 16 sites – what happened to the last one?

Section 2.1 – More detail is needed on what data you used from the TROPOMI record. What time period are you using? Is it all available data (which isn't straight from launched in October 2017, but spring 2018), or a subset? Also, what sort of region to use to cover these plumes? Does this change depending on the site choice? Roughly how many observations do you get per site? (If you include this last point, I would perhaps calculate a rough statistic based on the percentage of cloudy days in a sample of days if the full dataset is difficult to process)

Line 57 – Are the 17 sites chosen the only ones available that match all the criteria or are these a sub section?

Figure 2 – this looks like it could be useful to the reader but not referenced in the text anywhere

A general comment is that it would be good to expand on how this can be used more widely (possibly in the conclusion). You mention in the paper how your calculations could be used by regulators and operators but what steps are needed between your case studies and a more general approach? Could your method be applied to plumes across the globe and not require manually checking each one?

Related to this, how do you determine what counts as 'expected' when looking at the plume? Is this the authors judgement or is there a quantitive statistic?

Some discussion in section 4 on the impact of time period of the plume aggregation would be good to see. I assume you've used all possible plumes, but do you think this technique would work with a years worth of data? Or a months? (assuming good data). Could this even be used for any curving plume from a single day?

General formatting – There are a few occasions where the references aren't in chronological order

General formatting – There are inconsistencies with the NO_2 subscript (e.g. figure 5, figure 6 caption, figure 9, figure 10, line 117) which need addressing.