**Atmospheric
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Discussions

# *Interactive comment on* "TomoSim: a tomographic simulator for DOAS" *by* Rui Valente de Almeida et al.

**Rui Valente de Almeida et al.**

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Discussion paper

# Reply to Anonymous Referee 1

Rui Valente de Almeida

June 24, 2020

I would like to thank the reviewer for taking the time to once again thoroughly read our work and for the several notes that he or she took, which will contribute in making this a stronger article. Many of the points that were raised were very correct and indeed target some ambiguities that passed through our internal review. Others, however, I think were misunderstood or misread by the reviewer. I will only include those numbers in this reply. If a number is not present in this reply, then it is safe to assume that it will figure in the revised version.

**1** This article's introduction was written with a particular implicit structure in mind. This approach was to briefly touch the following topics in the By this order: Study context, Problem, Objective, Methods, Results, Conclusion. While I do agree that the introduction could be made better by rewriting some paragraphs (and not exactly changing the information therein), I also think that including the referee's observation would not fit into this structure. This information could perhaps be included in the Tomography section of the article. Moreover, comparing this system to other monitoring tactics would not be fair, since in this paper we only mention a simulation system.

**2** FCT NOVA and Compta are some of our affiliations. I think the reviewer might have misread this.

**3, 23, 26** The lack of parameters in this image was done on purpose and to avoid graphical confusion. The single intention of this figure was to show the very glaring differences between parallel and fan-beam geometries.

**11** True, although a point could be made that the first DOAS application used only 2 to 4 points.

**15** Since the light is scattered in the atmosphere, not all of it enters the detector. $A$ denotes the fraction that does.

**18** The linear and non-linear process is mentioned in the text. The polynomial coefficients are determined through a linear equation system, but then the shift and stretch require a non-linear approach.

**19, 39** I do not agree with the referee in this point, because further explanation of the system matrix is almost the same as explaining the iterative process as a whole, and this would result in an awkward structure in the end if done earlier than what is already.

**22** No, it is an algorithm.

**25** I originally found this to be just out of scope, but I can include it.

**27** This is a very difficult sketch to make and I do not think I have the skills to draw it. I will search and see if it exists in the literature so that I can point to it, but I will not include it in the text due to copyright restrictions.

**28** The explanation that the referee is looking for comes a little bit further.

**30** Could the referee please clarify what exactly is meant by this note?

**31** This is a matter of style and context. By having some context in the topic's intro-duction, the text flows better. Besides, even if we would deem the historical note superfluous, I do not think that it hurts the whole text in any way.

**33** p and g reference the projections and the sinogram column vector. Since this was addressed before, I did not think it necessary to re-explain what they were. I can change this, however.

**34** This is explained in the text. The RSNG comes from the simulated measurements, which correspond to the setup trace gas quantities.

**35** When we started this study, the first tests we made were with the Shepp Logan phantom. Then, because of the steep gradients of this phantom, we have created the other one. For this reason, it is fair to consider that the SHepp Logan phantom was an important motivator for an important part of this article.

**36** It is a bit redundant, but again is a matter of context and flow.

**37** This sentence acts as an introductory part of this section.

**38** This number comes from the manufacturer's manual.

**40, 44** The angular interval between projections is a parameter for the experiment. This is mentioned in the text.

**41** Horizontal, but the elevation is also a parameter. THis is also mentioned in the text.

**42** Can the referee please clarify what is not clear? The ROI is marked on the image, in the interior part of the circular trajectory, so I am not sure if this is what was meant.

**43** This is mentioned in the text. Concentration is a simulation parameter and is repre-sented linearly by a scale between 0 and 255.

**45, 46** As the text describes, these images are meant as a visual guide for error comparison. Absolute values for these images (what the scales would allow us to see) are of limited interest. I could include them in the final revision, nonetheless.

**47** Projection numbers are dependent on the projection interval ($360/\Delta$), as mentioned in the text. I will try to make this clearer.