Review of the paper "Retrieving 3D distributions of atmospheric particles using Atmospheric Tomography with 3D Radiative Transfer – Part 1: Model description and Jacobian calculation" by Jesse Loveridge, Aviad Levis, Larry Di Girolamo, Vadim Holodovsky, Linda Forster, Anthony B. Davis, Yoav Y. Schechner.

Regarding this manuscript, I want to make some comments that are actually **not mandatory** for the authors. They can take into account my comments or not. If not, the article can be published in its **current form**. Over time, the authors have made an important contribution in this field so that now, they do not have to be hindered by technical details.

1. I do not understand why the side domains have periodic boundaries. A domain with these conditions is a domain that repeats itself infinitely in both directions. But, for example, D_3 is connected with D_1. In my opinion, a heterogeneous 3D domain embedded within a horizontally infinite medium can be modeled with periodic and open boundary conditions. In Fig. 8 of Evans' paper it is shown that for a Gaussian cloud, the flux computed with periodic boundaries for a 12-km domain agrees with that computed for open boundaries for a 3 km domain. Thus, in the case of periodic boundaries, the domain must be larger to diminish the contribution of the incoming radiance at the domain edges. That's all. However, because you need the domain D_3 to model the position of a sensor outside the cloud domain, I would consider that the domains D_3 and D_1 are connected by continuity, and I would impose open boundary condition on the left boundary of D_3. In other words, I would consider the computational domain $D_3 \cup D_1 \cup D_7$ as a whole, and impose open boundary conditions on the left boundary of D_3 and the right boundary of D_7.

2. In the case of satellite measurements, the main problem is the discretization of the domain above the clouds, which is usually meant up to 50-60 km. To connect the two domains (clear and cloudy), the idea used by Pincus and Evans for the parallelization of SHDOM can be used (the two domains communicate with each other through the boundary conditions).

3. I understand that the authors are fans of Martin. Indeed, Martin is an exceptional mathematician and his formalism is a mathematical delicacy. However, I think that it cannot be easily understood by a physicist or an engineer. For this reason, I want to suggest you to use a formalism that is more appropriate to Evans' implementation. By transforming Evans' implementation into a mathematical language, it is very easy to linearize the model's equations. In this way, different approximations for derivatives calculation, including the single-scattering approximation, become very clear.