This manuscript presents the FLiES-SIF ver. 1.0 model, a 3-D radiative transfer model for SIF, and provides sensitivity analyses of the model to LAI, VZA, and fluorescence yield. Despite the recent advances in remote sensing of SIF, the impact of 3-D canopy structure on SIF signal is not well understood. Thus, the radiative transfer model for 3-D canopy and the sensitivity analysis presented here is of interest to the SIF community and has the potential to improve the estimation of SIF from satellite platforms.

Overall, the efforts to simulate SIF in 3-D canopy are important. However, the manuscript needs to be improved to make it a better contribution to the community. Below listed the major concerns, followed by some detailed comments.

1/ The lack of leaf physiology. This model does not have a leaf fluorescence module that is based on key parameters that control the SIF emission. For example, Vcmax or Chl. This is particularly important for the estimation of SIFyield, as the relationship between SIFyield and APAR depends on Vcmax and Chl. Without the leaf physiology component, the model has a limited use for the correction of satellite SIF data.

While running 3-D radiative transfer model can be computationally expensive, our computers have also advanced quite significantly in the past 10 years since the first publication of FLiES (Kobayashi and Iwabuchi 2008). Adding a photosynthesis module to the model will put this model to a higher level.

If adding a photosynthesis module is difficult at this point, I would at least ask the authors run a much more extensive simulation in SCOPE to estimate the potential uncertainties in Figure 7.

2/ The lack of details for the readers to evaluate and (potentially) reproduce. Information on the following processes / models / parameters are needed:

- How were the SCOPE runs conducted? What are the parameters used in the SCOPE run?
- In Section 3.4., the authors mentioned that they used the Farquhar model to obtain data on the photosynthetic rate. How exactly was it done?
- Section 2.2.2., how was fs determined? Where was the data source that gave the full SIF spectra?

3/ Overall structure of section 2. It would make the readers' job easier if there is an overarching paragraph and a diagram (not Figure 2) showing each component of the model, and how they are interconnected. For example, provide the description of canopy representation and some basic assumptions (e.g., turbid media) at the beginning of the section, as this information is essential for readers to understand some of the equations. This section in the current form reads like that each subsection is disconnected.

4/ The unit for SIF. Whenever SIF from a specific wavelength is simulated, it should be in the unit for spectral radiance, which is mw/m2/sr/nm. Check figures like Figure 9.

5/ The benefit of 3-D modeling. Just for the benefit for the readers, can you provide some sensitivity analysis of SIF simulations to different canopy structures? This is perhaps one of the key novelties compared with 1-D models.

General comments:

1/ Please provide continuous line numbers, instead of numbers every five lines.

2/ L3: have revealed instead of have been revealed

3/ L9-10: "due to the lack of complexity" should describe 1-D models, not the 3-D models.

4/ L11: the → a.

5/ Line 33: Frankenberg et al. 2011 used GOSAT, not GOSAT 1&2.

6/ Line 49: “fluorescence signals enhanced by …”. Be more specific, is it total fluorescence signal, or the fluorescence signal observed by the sensor? The former is weakened by reabsorption during multiple scattering.

7/ L52: the causality – this word here is confusing.

8/ L58: DART-SIF is not the only available 3D model. There is at least also FluorFlight and FluorWPS.

9/ L83: top of canopy instead of atmosphere?

10/ L96: this sentence needs rewording. If the canopy is sparse, we would expect less attenuation. Do you mean more attenuation by the trunk?

11/ L99: forcing leaves to absorb all the photons does not make much biological sense here. Even for tropical forest, fPAR is 0.99 not 1. Please clarify.

12/ L123: what does it mean by “negligibly small”? Please quantify.

13/ L128: $d\Omega_L$is redundant as you have $d\theta_L d\varphi_L$

14/ L141: should be $G(\Omega_L)+G(\Omega_j)$?

15/ L156: The integration should probably be for $\exp(-\tau s(\theta,\varphi))|\Omega\cdot\Omega_L|\sin\theta d\theta d\varphi$, please check this equation.

16/ L185: Write down this equation as some readers may not have access to the original paper.

17/ L251: Why is this limited to sunlit condition? Seems a spherical integration is also needed for shaded condition.

18/ L253: Is there a test on how well this method performs? It seems to me large zenith angles are underrepresented. How about a simulation test: Do a more precise numerical integration (e.g., average of 50 directions) and compare the result with the result from their proposed method (average of the five selected angles).

19/ L282: the fluorescence quantum efficiency of 0.04 seems to be too high. SCOPE used to have it as 0.02 and has to change it to 0.01 because the simulated SIF values were too high when using 0.02.

20/ L301: “shows the” instead of “shows that the”

21/ L338: $APAR_{app}$ instead of $APAR_c$?

22/ L363: the index for the equation is missing

23/ L372: in instead of inn

24/ L430: “the proposed model can ….” It has the potential but it cannot do what is stated in this sentence as of now because the lack of leaf physiology.

25/ Figure 17: The sequence of upper and lower panels in the caption is not consistent with the figure: “Upper and lower figures indicate SZA dependency (LAI = 3.0) and LAI dependency (SZA=20°), respectively