This study proposed a radiative transfer model over rugged terrains based on the theory of stochastic radiation transfer, named GSV-SRTS. The synthesis of GSV and SRT represents an advancement in modeling soil-canopy interactions in mountainous regions. The experimental framework is robust, including both rigorous comparisons with sophisticated DART simulations and multi-scale validation using actual satellite imagery. To further enhance the manuscript's clarity, impact, and readiness for publication, the following specific suggestions are offered concerning the depth of theoretical explanations, the interpretation of key results, and overall presentation. My suggestions and comments are as follows:

Major Comments:

1. The paper conceptualizes the 3D canopy structure as a spatial stochastic process, described by an indicator function and Poisson distribution. Could you specify in more detail how this stochasticity is specifically embedded into the solution process of the radiative transfer equations (Eq. 2, 3), rather than just as a parameter input ?

2. The results show a distinct reflectance peak in the hotspot direction. What are the similarities and differences in the mechanisms of the hotspot effect simulated by the GSV-SRTS model under sloping terrain conditions compared to flat terrain? How does the model capture the influence of topography on the hotspot signature? Please add an explanation in the appropriate section.

3. The model simulations perform good correlation with the high-resolution imagery. Does this mean the model's strength lies in resolving sub-pixel structural heterogeneity and soil spatial variability? For medium-to-low resolution pixels, where this heterogeneity is averaged, does using GSV-SRTS still offer an advantage over simpler homogeneous models? If so, what are the main advantages?

4. The authors have provided code and data. Regarding the model implementation, what are the key details and stability of the numerical method (e.g., discrete ordinate method, iterative scheme) used to solve the coupled SRT equations (e.g., Eq. 12)? This is important for other researchers to reproduce or modify the model.

5. Generally speaking, the global irradiance received by mountainous surfaces includes direct irradiance, diffuse irradiance, and reflected irradiance from the surrounding terrain. However, the proposed GSV-SRTS model seems to only consider the first two components and does not account for the

surrounding-reflected radiation contribution to the target pixel. This limitation needs to be pointed out in the conclusion.

Minors:

1. Terms such as "heterogeneous landscapes," "discontinuous canopies," and "patchy landscapes" are used in the paper. In the context of this study, could you more clearly define the spatial scales and structural characteristics these terms refer to, in order to avoid reader confusion?
2. The study area selected for this research features complex topographic conditions and high vegetation heterogeneity. How did the authors conduct field measurements to ensure the representativeness of the data obtained? Please supplement the explanation.
3. The paper clearly introduces the GSV and SRT modules, but could the beginning of the Methods section (Section 2.1) more explicitly elaborate on the core physical motivation and necessity for coupling the soil spectral vector (GSV) with the sloping terrain stochastic radiative transfer (SRT) theory? In other words, why is this coupling crucial for accurately simulating radiative transfer in heterogeneous mountainous landscapes?
4. In Section 3.1, the sentence "Finally, the remote sensing observations from different sensors were utilized for model evaluation to evaluate the suitability..." contains redundant phrasing and an unnecessary comma. Please change the sentence and check the full text.
5. In Section 3.3, the construction "was set ranging from" is grammatically awkward, as the verb "set" typically takes a preposition like "to" for a fixed value. Additionally, starting a sentence with "And" is generally avoided in formal writing. Please check the full text for similar issues and make necessary revisions.
6. There is a minor tense inconsistency appears in Section 4.1: "The results showed that GSV-SRTS achieves the highest R^2 value..." The main verb "showed" is past tense, while "achieves" is present. For consistency in describing results, it is recommended to use the past tense.
7. In Section 4.4, the clause "which capture finer details in the microscale scenarios" is incorrectly linked to "the ability of the SRT theory and GSV model." The sentence structure is unclear.
8. There are issues with the citation format in several places, such as on page 2, line 41: sloping terrain (SLCT) (Verhoef and Bach, 2007) (Verhoef and Bach, 2012);

lines 51-52: Zeng et al. developed a RT model specifically designed for patchy landscapes based on SRT theory (Zeng et al., 2020).