Assessment of paper March 12 2025

TanSat-2 A new satellite for accurate mapping solar induced chlorophyll fluorescence at both red and far-red bands with high spatial-temporal resolution

By Henry Buijs PhD.

Principal criteria

Scientific significance is ***excellent***

Scientific Quality is ***excellent***

Presentation quality ***Good***

The authors realize that Global observations of chlorophyll fluorescence (SIF) as first observed in ground reflected solar spectra measured by the Japanese GOSAT satellite can serve as a proxy for monitoring vegetation for photosynthetic activity as well as monitoring an significant part of the terrestrial carbon cycle.

The paper deals with modeling the measurement parameters in support of the development of a new satellite, TanSat-2, that permits to more accurately map chlorophyll fluorescence and thereby obtain a more accurate inventory of terrestrial vegetation and its effect on the Carbon cycle.

The paper is well organized.

Part 1 provides an introduction and background to the current status of realization in the subject field.

Part 2 Materials; provides the background to the work presented including the parameters of the planned TanSat-2 mission, simulation experiments and data, and an end to end orbit simulation dataset.

Part 4 Results; explains clearly that the analysis method is based on empirical data. It includes an independent validation with data not used in the modeling.

Part 5. Discussion.

The issue of cloud interference is of considerable importance. Especially over a wide swath as is planned for TanSat-2. The fraction of clear sky measurements gets to be quite small. Adding a cloud imaging camera could be beneficial to permit processing of identified cloud-free segments of each swath. The statement of not having incorporated rotational Raman scattering is probably not required since this occurs mainly at shorter wavelengths and is quite likely negligible in both regions of SIF. However, having made a statement about rotational Raman scattering, it is recommended that the authors make a cursory evaluation of its significance.

The first part of the paper deals with the derivation of a mathematical model that permits accurate computation of the intensity of fluorescence validated with a subset of available satellite data. The derivation follows well established mathematical methods such principal component analysis and is verified with additional satellite data. The model is used to guide the development of Tansat-2 including a planned elliptical orbit that, according to the authors, shall somewhat favor the more

populated Northern hemisphere. This is a problematic part of the paper. The highly elliptical orbit suggested for Tansat-2A does not appear to me an optimal choice. Whereas it will limit the global coverage to favor the Northern Hemisphere, and be Sun-synchronized around mid-day, it will seriously affect the uniformity of ground coverage. Near the apogee of the orbit, the swath size will be ten times larger than at perigee and the orbital motion will be significantly slower than at perigee.

I feel that the sun-synchronous elliptical orbit with an apogee approximately 10x higher than the perigee is not efficient and may lead to field of view aberrations that could compromise the accuracy of measurements. As well the swath width at apogee is much wider than at perigee making its ground coverage incomplete and difficult to fill out. I recommend that the authors describe in more detail the observational consequences of their choice of orbit. It seems to me that a near circular sun-synchronous orbit is more advantageous despite the overpass of more territory that is of less interest.

I recommend that the paper is important enough to be published.

Does the paper address relevant scientific questions within the scope of AMT? Yes

Does the paper present novel concepts, ideas, tools, or data? Yes

Are substantial conclusions reached? Yes

Are the scientific methods and assumptions valid and clearly outlined? Yes

Are the results sufficient to support the interpretations and conclusions? Some questions remain

Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes

Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes

Does the title clearly reflect the contents of the paper? Yes

Does the abstract provide a concise and complete summary? Yes

Is the overall presentation well structured and clear? Yes

Is the language fluent and precise? Yes

Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes

Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes see text above

Are the number and quality of references appropriate? Yes

Is the amount and quality of supplementary material appropriate? Yes