Reply to Reviewer #2

(Referee comment on "Biases in estimated vegetation indices from observations under cloudy conditions" by K. Wolf et al. (egusphere-2025-2082),https://doi.org/10.5194/egusphere-2025-2082-RC2, 2025)

We would like to thank the Reviewer for taking the time to review the manuscript and for providing comments that helped us improve it. Below, we respond to the Reviewer's comments. For clarity, the Reviewer's comments are in **bold** and the changes to the manuscript are *in italics*. Please note that some additional changes have also been made to improve the writing and style.

This manuscript reports on the effect of clouds on the derivation of vegetation indices from remote sensing platforms in a radiative transfer modelling approach. Basically it is a sensitivity study on how clouds contribute to the incoming radiation and what effect it might have on the calibration conditions for deriving the reflectance values and consequently on the computation of the various VI with Sentinel 2 bands as example for different solar zenith angles.

Overall, it is an interesting and relevant study since it brings our attention to the basics of using reflectance values and its impact on derived vegetation indices. It is important that we do not forget the basics of RS data. The preprint is very well written and well-documented, with nice figures.

Thank you for the generally positive feedback.

To my opinion, the authors should elaborate a bit more on the consequences of the effect on biases in values of VI's. They briefly touch the impact on LAI derived from EVI, but the authors should add some paragraph how it could impact remotely sensed derived biophysical properties such as GPP, green water fluxes etc with proper referencing. This would make the paper even more relevant. Perhaps, indicating some of the effects as percentages can increase the visibility.

We added a subsection titled "3.4 Implication of biases in vegetation indices on estimated biophysical properties" in accordance with the Reviewer's suggestion. The added subsection discusses the impact of biases in the enhanced vegetation index (EVI) and the normalized differential vegetation index (NDVI) on the estimation of gross primary production, fresh and dry biomass, vegetation water content, and leaf area index. We added relevant citations in which the correlations between EVI, NDVI, and the biophysical properties are derived. Due to the length of the subsection, we would like to direct the Reviewer to the track changes file.

In lines 117, 306 and others, the authors directly link NDVI to vegetation health. I would refrain from that, since NDVI essentially says something about the "greenness" of the

vegetation, but not necessarily on its health. It can be used for vegetation health, but it is not synonymous for health.
We considered the Reviewer's comment and rewrote all instances where the NDVI was directly linked with "vegetation health". The sentences were rephrased as follows:
"The greatest variability is found for $\theta = 25^{\circ}$, where NDVI increases from 0.87 to 0.91 with increasing τ , which could be interpreted as an overestimation of vegetation health."
"For $\tau_{cal} = 0$ an extreme increase of τ_{mea} from 0 to 40 results in a decrease in NDVI from 0.87 to 0.84, which could be interpreted as an underestimation of vegetation health"
"In both cases, the inferred ground-truth vegetation health would be overestimated."

Furthered, I only have few minor/textual comments

Normally, numbers less than 10 are written as text; So less than one; equals one, etc
We followed the suggestion of the Reviewer and scanned the text for these mistakes. However, during previous submissions to Copernicus journals, phrases like "...ranges from 0 to 1..." were accepted by copy-editing and typesetting. Therefore we kept this stile of writing. Similarly, we ket instance such as "...smaller than 1", since those were also accepted by Copernicus copy-editing and type-setting. The Copernicus guidelines say: "For items other than units of time or measure, use words for cardinal numbers less than 10; use numerals for 10 and above (e.g. three flasks, seven trees, 6 m, 9 d, 10 desks)."

If one uses for instance 0.29, also use 0.20 and not 0.2 (see L338, but also elsewhere): always use the same amount of decimals for the same property
We acknowledge this comment. However, we did not find a specific guideline that says that all values have to use the same number of digits. The SI-guidelines say that trailing zeros should be used when one wants to imply a certain precision of, e.g., a measuring device. During previous submissions to Copernicus journals, trailing zeros have been removed. Since there are no clear rules, we would like to leaf it to typesetting and copy-editing of the journal.

I do not know the policy of the journal, but normally the cited references in the text are first ordered chronologically and then alphabetically
We agree with the Reviewer that citations should be in chronological order. This was an error on our part, and we have corrected the order of the citations.

Abstract: add more on possible consequences;
In line with the Reviewer's first comment, we added the following sentence to the abstract:
"Other estimates of biophysical properties derived from EVI, such as gross primary product, fresh and dry biomass, or vegetation water content, are similarly affected."

Captions Fig 1. Replace “‘relate” with “connect”
We followed the Reviewer's suggestion.

L30: specify what tau is under the text of Eq 1; see lines 45-47; this should come earlier in the text
The Reviewer is right and the definition of the cloud optical thickness is given earlier in the text.
"The cloud optical thickness τ(λ) is a measure of the extinction of radiation for a vertical path through the cloud, serving as vertical coordinate."

L61: “attempts”? This is not a proper use of the word here;
The word "attempts" has been replaced with "allows." The sentence now reads:
"Using a RP enables transfer calibration."

L67: In general, it is a “transfer function” rather than a factor, although used as a factor;
To be more precise, we followed the suggestion of the Reviewer and replaced "transfer factor" with "transfer function".

L76: Should be “requires frequent calibrations of the transfer function”;
We partially adopted the Reviewer's suggestion and modified the sentence as follows: "...requires frequent RP overflights to obtain updated transfer functions."

L217: remove “the“ before Appendix A;
"The" has been removed.

L224: “valueS”;
The typo has been corrected.

L270-271: “ARE close to zero”
The sentence has been corrected.

Figure 5: Why is the symbol of NDII missing in the upper right panel?
The second Reviewer had a similar comment in this regard. Figure 5 has now been revised with the markers in the correct position and a completed legend, and the intensity of the color scale has been adjusted to enhance the legibility of the markers.

L281, 324 and other lines: I would refrain of using the term “exemplary”; it echoes a bit as “exemplary behavior or punishment”; Perhaps use “illustrates”?
Based on the Reviewer's suggestion, all instances of "exemplary" have been rephrased.

L345: Should be “The effect of changes in fdir”;
The text has been modified as suggested.

L378-379: “… was between 0 and 40,” and “.. ranged …”; Remove “were covered”:
The text has been modified as suggested.

L406: remove comma after NDWI
As suggested, the comma was removed.

L407: twice increase, increasing;
The second instance of "twice" was removed.