Response to RC2

Thank you for the editor's review, which will greatly help us to improve the manuscript significantly. Please find below our responses to the editor's remarks. We will repeat these in italics and add our respective responses in normal letters.

Dear authors,

thank you for submitting this concept paper to AMT, which has now been in the discussion stage for almost a year. After receiving the first review on 12th April, 2023, I contacted several other potential reviewers to provide a second opinion, some of whom provided feedback on aspects of the paper, but not a full review. Therefore, I now provide an editor review, summarizing external as well as my own feedback. First, I think that the concept of the paper is compelling in that it addresses the need for tracking key geophysical variables (in this case, spectral shortwave radiation from 200-1100 nm) at a stability that might enable tracking climate change – in this case, potentially over a full solar cycle. The prospect of cross-calibrating lower-accuracy sensors in orbit that the proposed high-accuracy sensor would under-fly mirrors similar ongoing efforts in the UK, the US, and elsewhere for establishing what could become a constellation of climate-observing satellite sensors in the future (in my own view). Specifically for this paper, the connection to vegetation remote sensing at a high accuracy is innovative, although it remains unclear in the manuscript why this requires an unprecedented high absolute accuracy. Usually, adequate relative accuracy is sufficient for vegetation remote sensing.

Thank you for this summary. We will respond to your and other reviewers' criticisms in a revised version in order to describe the concept of the instrument more clearly.

The stated goal of the paper is to describe the concept for an instrument that measures spectral outgoing radiation in a wavelength range from 200 to 1100 nm (a subset of the solar wavelength range) at a certain stability over a full solar cycle –building on a previous instrument that flew on the international space station for nine years. Stability (as opposed to accuracy) seems to be the primary focus. Clearly, the authors have deep expertise in instrumentation, and there is significant heritage for the instrument concept in general from measuring the incoming radiation, which will now be brought to bear for studying the outgoing radiation. However, several aspects of the paper are confusing. It is unclear whether it the paper is truly meant as a proposal paper or as an initial concept paper. If it were a proposal, then specific elements would need to be included that are expected for a proposal (starting with a science question or a few science questions, deriving required observations and their attributes such as accuracy, stability, time range, spatial coverage, orbit etc., then showing that the proposed instrumentation can fulfil these requirements). If it were not a proposal but a concept paper, then it should be labelled as such so that the reader knows what to expect. As written, the direction remains unclear. The abstract seems to convey different goals than addressed in the paper later on; the introduction lists a few (valuable) science applications for the proposed technology, but there is no clear path from those to derived instrument requirements.

Thank you for pointing this out. In the revised version we will make the purpose of the paper more clear.

The confusion became apparent in the first reviewer's assessment. A few of the reviewer's questions were addressed by the authors in their responses, but several key questions remained so far unanswered, and there is no point-by-point response posted to the first reviewer's comments. It is possible that there is a misunderstanding as to what the paper entails. This was partially addressed in the authors' responses, but again, not in direct response to the reviewer's questions (point-by-point response).

We have also submitted a point-to-point response to the reviewers´ comments now.

The paper probably needs to be restructured, starting with the requirements given a set of science questions or objectives (this could be done with a science traceability matrix, which contains key elements such as stability, accuracy, precision), followed by an instrument description that shows how exactly those requirements are met or (if they are not met), what the path is towards fulfilling them. When rewriting the paper, it is important to not overly rely on previous publications that describe this path for a different instrument (as done currently). The new paper needs to stand on its own because (while based on a previous instrument), this is an entirely new application with different goals, requirements, and implementation strategy. The challenge will be to reconcile the various science applications that are mentioned in the introduction. For example, tracking changes in vegetation processes over time has different requirements than, for example, studying the Earth Energy Imbalance. The former requires relative accuracy of observed radiances, the latter absolute accuracy of irradiances.

Thank you. We will completely restructure and modify the paper.

As noted above, it is suggested that the authors provide (1) a clear derivation of the requirements of the mission (stability, accuracy, spectral/spatial resolution etc.) given a range of science questions or objectives, (2) describe in sufficient detail how the instrument / mission concept will be meeting them, while also considering the first reviewer's questions in this regard (comments about Line 36, 79-87, 85 etc.).

Summarizing, I would like to echo the first reviewer's recommendation to formulate the mission/instrument goals more clearly and then go the step-by-step process of a typical mission/instrument proposal.

Thank you. We will rewrite the paper according to your and the reviewer´s suggestions.