

Review Comments on “**Observation operator and detection limits for MODIS and VIIRS Fire Radiative Power products**”, authored by Mikhail Sofiev and Rostislav Kouznetsov

General Comments:

This manuscript presents a comprehensive assessment of the detection limits and observation operators (OOp) for MODIS and VIIRS fire radiative power (FRP) products. The authors conducted a large-scale analysis based on extensive satellite fire observations and proposed a framework to characterize satellite fire detection capability and observation uncertainty, which is potentially valuable for atmospheric chemistry modeling and data assimilation applications.

However, several aspects of the methodology and interpretation require further clarification before publication. In particular, the calculation methods and definitions of several key parameters in the proposed observation operators are not sufficiently described, which affects the reproducibility of the approach. The validation of the proposed OOp framework is mainly based on comparisons with the original satellite products, and additional independent validation or uncertainty analysis would improve the robustness of the conclusions. Moreover, some discussions regarding the comparison with previous satellite fire detection studies and the global omission error estimates remain largely qualitative and would benefit from more quantitative analyses or representative case studies.

Overall, this manuscript addresses an important topic and provides a potentially useful framework for representing satellite fire observation uncertainties. I recommend **major revision** and suggest that the authors address the following comments to improve the methodological clarity, reproducibility, and scientific robustness of the manuscript.

Major Comments:

Section 3.4, the treatment of aerosol and thin-cloud attenuation is simplified using an exponential attenuation relationship. Please provide further justification for this assumption and discuss its limitations, considering that MODIS/VIIRS FRP retrievals involve multi-spectral algorithms and atmospheric corrections.

Line 296, the methodology for calculating the “mean cloud cover for the MODIS overpass hours” shown in Figure 7a is unclear. Please specify the MODIS cloud product used, the temporal sampling strategy, the cloud mask algorithm, and the aggregation method used to derive the gridded cloud fraction. Since cloud obscuration is a key component of the proposed grid-level observation operator, this information is essential for evaluating the reproducibility and uncertainty of the results.

Section 4.2, The evaluation of the proposed observation operators is mainly based on comparisons with the original MODIS and VIIRS datasets. However, such an evaluation only demonstrates internal consistency. An independent validation dataset (e.g., higher-resolution fire observations or alternative satellite products) would be valuable to assess the reliability of the proposed observation operators. If such data are unavailable, the limitations associated with the lack of independent validation should be discussed.

Section 5.2, the omission error estimates are presented as global statistics, but the uncertainty associated with these estimates is not discussed. Please provide brief sensitivity analyses or/and uncertainty estimates considering factors such as spatial averaging scale, fire-season definition, and cloud-screening criteria.

Section 5.3, the comparison with SEVIRI and VIIRS sensitivity is mainly qualitative. More quantitative evidence is needed to support the conclusions, such as statistical comparison using collocated observations, case studies of representative fire events, or additional analysis demonstrating the consistency between the proposed detection limits and previous SEVIRI/VIIRS assessments.

Minor Comments:

Line 36–37, “It allowed” should be “It allows”.

Line 42, “(Schroeder et al., 2008)” should be “Schroeder et al. (2008)”.

Line 66, “every type of observation requires own OOp” should be “every type of observation requires its own OOp”.

Line 77–78, this sentence is presented as a standalone paragraph. Please consider merging it with the surrounding text for better paragraph structure and readability.

Line 89, “ These are discussed in section 5”, what is discussed in section 5, please specify.

Line 96, dataset citation information should also be provided in the Code and Data Availability section.

Line 106, please specify the unit of FRP threshold ($P_p > 500$).

Equation 3, please clarify the definition and units of parameters in the equation, since it appears to represent different quantities for MODIS and VIIRS.

Line 140, “Figure 3-1 of (Nishihama et al., 1997)” should be “Figure 3-1 in Nishihama et al. (1997)”.

Line 146, “Figure 1, (Schroeder et al., 2014b)” should be “Figure 1 in Schroeder et al. (2014b)”.

Line 155, the authors shall specify why I-band observation is chosen in this study, instead of M-band observation.

Line 157, for better readability, consider separating the MODIS and VIIRS swath geometry into two independent figures.

Line 189, the statement “the FRP distribution densities (Figure 2, Figure 3)” is ambiguous. Please specify which subplot(s) of the figures are being referred to.

Line 279, “Denoting aerosol column optical depth AOD” should be “Denoting aerosol column optical depth (AOD)”.

Line 295, the parameter “ β_{miss} ” is introduced without a clear definition. Please provide its definition and explain its physical meaning.

Figure 7a, the terminology of Figure 7a should be consistent with the main text. Please clarify whether the colorbar represents cloud fraction or missing pixel fraction due to cloud obscuration.

Line 388, the term “Collection 5” is not clearly defined. Please specify which dataset collection is referred to and provide relevant details.

Line 541–548, the citation of the dataset appears to be repeated. Please check and remove the redundant citation.