**Titel:**

Biomass burning combustion efficiency: Understanding spatial resolution and environmental drivers in biomass burning combustion efficiency using TROPOMI satellite data

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**Abstract**

In recent years, record-breaking wildfires have occurred globally, with projections indicating a dramatic increase in their frequency and intensity in the future. These wildfires present serious risks to the environment by releasing harmful pollutants and various greenhouse gases, which significantly contribute to air pollution and climate change. To accurately predict emissions of such gases, a comprehensive understanding of combustion efficiency is essential. Due to TROPOMI’s capability to measure trace gases such as NO2 and CO with high spatial resolution and global coverage, it has been used in various studies to analyse combustion efficiency. The study used NO2 and CO column concentrations measured by TROPOMI to estimate Mole Density Ratio (MDR), which is a proxy of combustion efficiency, over two devastating wildfires that occurred in California in 2020. By using TROPOMI data, aggregated to various resolutions using the super-observation approach, the study assessed the spatial and temporal limits of TROPOMI-derived MDR. It evaluated changes in MDR values across various vegetation types by integrating higher resolution land classification data from MODIS. Additionally, it explored the relationship between MDR and environmental indicators such as drought conditions and soil moisture. Super-observations resulted in significantly different MDR values with those estimated at TROPOMI resolution. The findings indicated that there was loss of information regarding MDR when super-observations were used. Furthermore, there was no clear link found on the impact of environmental factors such as soil moisture and drought conditions on MDR. Finally, a detailed land use characterisation provided deeper insights into the effect of burning various types of vegetation on the MDR. However, to be able to fully interpret the effect of super-observations and environmental factors on MDR, a more extensive analysis is suggested.