General comments

Thanks for the authors' responses to my comments to the original submission. I'm glad to see that the authors have clarified the methodology, highlighted that the dataset isn't a complete BA inventory, and discussed the limitations of proposed methods and resultant dataset. As the authors have specifically clarified that the commission and omission errors are only applied to indicate the agreement between the product and reference BAs for those limited samples, I am not very concerned about it. However, I still have some concerns about the revised manuscript and the dataset.

Response:

We sincerely appreciate the reviewer's constructive feedback to help us improve our manuscript. We have carefully addressed the remaining concerns by further refining the manuscript description, clarifying the strengths and limitations of the dataset, and improving the discussion of its appropriate applications. We have also included additional analyses in the manuscript comparing our product with the 30 m Global Forest Loss Due to Fire (Fire_GFL) dataset developed by Hansen's group.

Major comments

1. Spatial agreement. In the CONUS, the full agreement is only about 28% and areas from only GlobMap or BAECV together (groups 2&4) account for ~46% over those large fires (>200ha) that were mapped by both datasets (Table 4a). Across the CONUS, most large fires are in the West CONUS. I'm very curious to see what factors contribute to such a large proportion for groups 2&4. Those numbers are concrete but difficult to understand the reasons behind. Moreover, it is very surprising to see the full agreement between the GlobMap and regional BA in Brazil (large-65.5%, small-51.4%) is much higher the CONUS (large-28.1%, small 22.5%) even though forest fires in Brazil are more likely to be obscured by frequent clouds than the West CONUS. Why? The authors may give some fire examples to illustrate it. I also have some suggestions on this part for the authors' consideration. First, please clarify how the BA percentage in each group is calculated. Although a conceptual framework of spatial agreement is given in Fig.4, it is still confusing. Second, strongly recommend separately report percentages for each group instead of summing up groups 2&4 and 1&5. It would help to pinpoint which dataset mapped more areas. Also, I would not call the groups 2 and 4 "partial agreement" because those parts are mapped by only one dataset. Instead, you could provide statistics about the fires mapped by both datasets and meanwhile give percentages for groups 2, 3, and 4. Third, besides the BAECV BA product, want to mention that the Landsat-based MTBS data provides both fire perimeters and fire-severity maps. Patches can be easily extracted by excluding those

"unburned to low severity" pixels. Fourth, sum of percentages of five groups for smaller fires in Europe do not come to 100% (Table 4a).

Response:

We thank the reviewer for this constructive comment. We agree that the spatial agreement analysis required additional clarification, particularly regarding the interpretation of different agreement categories and the factors contributing to regional differences. In the revised manuscript, we have improved the description and presentation of the spatial agreement analysis.

First, we have clarified how we calculate the contribution of each spatial agreement group. The reported percentages are now explicitly defined as the proportion of burned pixels belonging to each agreement category relative to the total burned area across all groups. We have added this clarification in the **Methods** (**Lines 286 – 290**) as below:

"We summarized the relative contribution of each group separately for smaller (< 200 ha) and larger (> 200 ha) fire patches. The relative contribution was calculated as the proportion of burned area assigned to each group relative to the total burned area across all five groups, as follows:

$$Contribution_i = \frac{BA_i}{\sum_{i=1}^{5} BA_i} \times 100\%,$$

where $Contribution_i$ represents the relative contribution of Group *i*, and BA_i represents the burned area of Gorup *i* (*i* = 1…5)."

We also revised the caption of **Fig. 4** (**Lines 292 - 296**) accordingly:

"Figure 4. Conceptual framework of the spatial agreement analysis based on one-to-one matching of individual fire patches between two products. After matching corresponding fire patches, burned pixels were classified into five spatial groups. Groups 1 and 5 represent product-specific fire patches uniquely detected by one product. Groups 2 and 4 reflect within-patch extent differences, where corresponding fire patches are identified by both products by portions of the burned extent are detected by only one product. Group 3 represents shared burned extent detected by both products."

Second, following the reviewer's suggestion, we no longer combine categories representing areas detected by only one dataset in **Table 4**. Instead, we separately report the proportions of each agreement group in the updated table. We have also revised the terminology to provide more precise descriptions of the five groups. Specifically, we have changed "full agreement" to "shared burned extent", "partial agreement" to "within-patch extent differences", and "disagreement" to "unique patches".

Third, we further investigated the contrasting spatial agreement patterns between CONUS and Brazil by examining representative fire examples. The lower agreement observed in CONUS is likely associated with differences in fire characteristics, mapping strategies, and the treatment of fire boundaries among datasets. In western CONUS, many large fires contain complex internal heterogeneity, mixed burn severity, and irregular boundaries, which can lead to differences in mapped perimeters between products. In contrast, fires in Brazil often occur as large, spatially continuous burned areas with relatively distinct spectral signatures, which may result in higher spatial agreement despite more challenging cloud conditions.

Additionally, we identify the Monitoring Trends in Burn Severity (MTBS) as a valuable direction for future independent assessment of GlobMap FFP, though a comprehensive comparison with MTBS is beyond the scope of the current global product evaluation. We have added discussion of MTBS as an important Landsat-based reference dataset that provides both fire perimeters and burn severity information. The related text in **Lines 516 – 524** now reads:

"Compared with coarse-resolution burned area products, Landsat-based fire products or management inventories can provide improved representations of fire boundaries and severity patterns, features that are often obscured in MODIS-scale products (Miranda et al., 2022; Hawbaker et al., 2020). For example, the Monitoring Trends in Burn Severity (MTBS) dataset provides Landsat-derived fire perimeters and severity classifications across the United States, from which fire patches can be extracted by excluding unburned and low-severity areas. Such information is increasingly recognized as critical for understanding post-fire regeneration, biodiversity persistence, habitat fragmentation, and ecosystem resilience under changing fire conditions (Meddens et al., 2016). Yet, existing fire inventories are generally limited to specific regions and periods. GlobMap FFP complements such products by providing a globally consistent reconstruction of forest fire patches over nearly four decades."

2. Another available global Landsat-based forest fire dataset for comparison. Not sure if the authors are aware of a global Landsat-based forest fire area dataset from Dr. Matthew C. Hansen's group (https://www.frontiersin.org/journals/remote-sensing/articles/10.3389/frsen.2022.825190/full). The dataset is available on google earth engine (https://glad.earthengine.app/view/global-forest-loss-due-to-fire#lon=-122.13906466052318;lat=40.82772304858869;zoom=8;). Although this dataset only spans last two decades, it is a valuable, independent 30m data for comparison.

Response:

We thank the reviewer for pointing out this valuable independent Landsat-based burned-area dataset developed by Hansen's group. We agree that comparison with other Landsat-based products provides important information regarding the consistency and uncertainty of GlobMap FFP. We have now evaluated the relationship between GlobMap FFP and the Global Forest Loss Due to Fire dataset (referred to as Fire_GFL; Tyukavina et al., 2021) and added these results to the revised manuscript. Specifically, we compared their annual burned area (**Figure R1**) and spatial agreement (**Figure R2**) across the fourteen GFED regions globally, and added those results to the revised manuscript. Here Fire_GFL was not adopted for temporal agreement comparison, because its temporal attributes correspond to fire-induced forest loss rather than burned area occurrence when compared to other products.

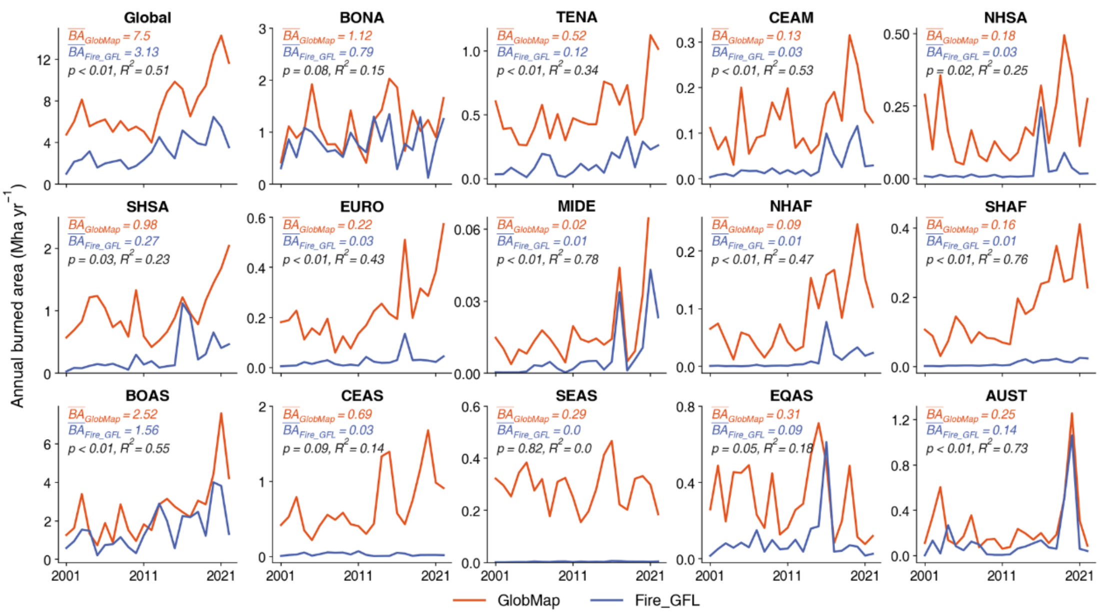

Figure R1. Comparison of annual forest burned area estimates between GlobMap and Fire_GFL from 2001 to 2022. Burned area was summarized for global forests and the fourteen GFED regions. Annual burned area estimates from GlobMap and Fire_GFL are shown in orange and purple, respectively, with the corresponding multi-year mean values indicated in each subplot. Linear regression relationships between the two products are also denoted.

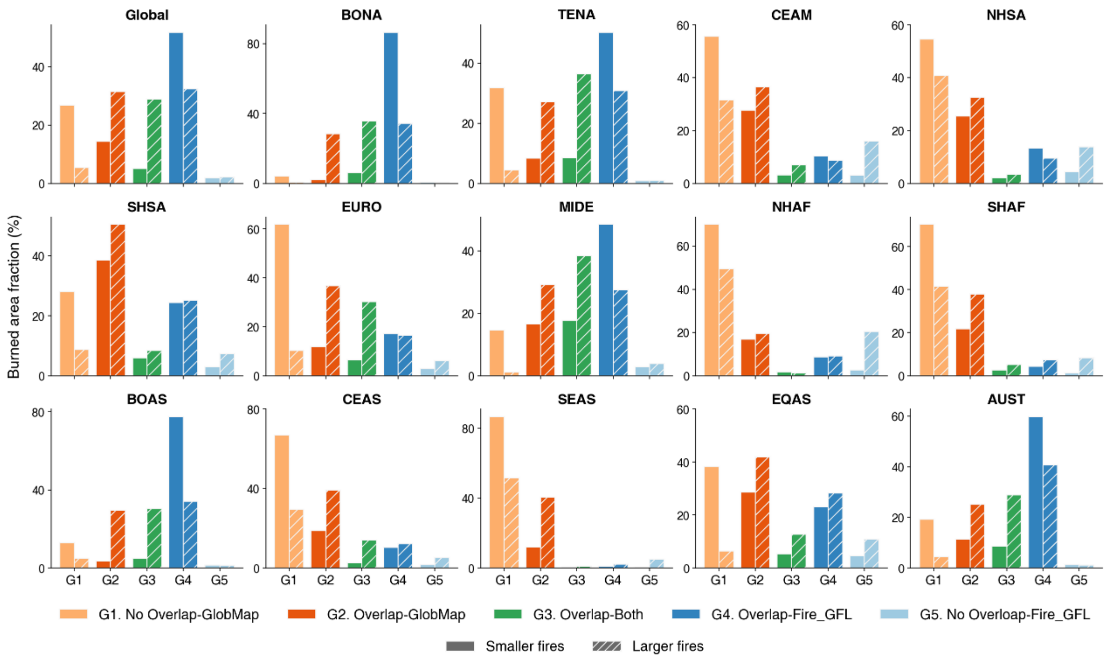

Figure R2. Spatial agreement patterns between GlobMap and Fire_GFL during 2001 and 2021 globally and across GFED regions. Light orange, dark orange, green, dark blue, and light blue colors represent Groups 1 – 5 (Fig. 4). Bars with solid fills represent smaller fire patches, while those with diagonal patterns represent larger ones.

We have included the introduction of this product in the **Methods** (**Lines 144 - 145, 147 – 149, and 271; Table 1**). We have also described the consistency and discrepancy patterns between the two products in terms of annual burned area and spatial agreement in the **Results** (**Lines 385 – 392, and 430 – 437**).

References:

Tyukavina A, Potapov P, Hansen MC, Pickens AH, Stehman SV, Turubanova S, Parker D, Zalles V, Lima A, Kommareddy I, Song X-P, Wang L and Harris N (2022) Global Trends of Forest Loss Due to Fire From 2001 to 2019. Front. Remote Sens. 3:825190.

3. The GlobMap Annual BA in the CONUS and TENA (GFED) are not very different, so are in Europe vs. EURO (GFED). The two regions - CONUS and GFED region TENA nearly overlap each other. So are the two regions - Europe (from the EFDM) and GFED region EURO. Why are the annual BA estimates of those regions (CONUS vs. TENA, and Europe vs. EURO) in Fig. 6a&c and Fig. 7 very different? And why are the spatial agreement bar charts in Fig 8 and Fig 9 for the CONUS and TENA very different (so are Europe and EURO)?

Response:

We thank the reviewer for pointing out this issue. The differences in annual burned area estimates and spatial agreement metrics between the regional comparisons (CONUS vs. TENA, and Europe vs. EURO) are partly related to differences in the spatial extent and regional definitions used in the comparisons.

For CONUS and TENA, the two regions largely overlap, and the annual burned area estimates are generally comparable; the remaining differences mainly reflect slight differences in regional boundaries. The discrepancy is larger for the Europe comparison. The EFDM product covers a larger European domain that includes additional countries, such as Ukraine and Moldova (Senf et al., 2021), whereas the GFED EURO region does not include these areas under its regional definition. Because fire activity varies substantially within Europe, particularly across regions with different disturbance regimes and observation conditions, these differences in spatial extent can influence both annual burned area estimates and spatial agreement statistics.

To avoid direct interpretation of these comparisons as identical regional assessments, we have added the following sentence to clarify the differences between regional product domains and GFED regions in the **Methods** (**Lines 276 - 279**):

"Because regional burned area products and GFED regions were developed using different spatial frameworks, their geographic extents are not always identical. Comparisons involving regional products and GFED regions were conducted within broadly comparable domains rather than exactly matching boundaries."

Reference:

Senf, C., Seidl, R. Mapping the forest disturbance regimes of Europe. Nat Sustain ***4****, 63–70 (2021).*

4. Because this dataset is not a complete BA inventory, I would not think it is suited for studying long-term forest fire regime as claimed in the Abstract and Discussion. Fire regime analyzes involving fire size and frequency. Instead, the authors should emphasize that users should be cautious about any usage of this dataset for long-term analyses due to data incompleteness.

Response:

We thank the reviewer for this important comment. We agree that the term "long-term fire regime dynamics" used in the original manuscript could imply a more complete characterization of fire occurrence, frequency, and recurrence than can be directly supported by GlobMap FFP. In the revised manuscript, we have refined the Abstract, Discussion, and Conclusions to clarity the intended scope and positioning of this product and to ensure that its scientific applications and limitations are clearly defined.

Specifically, we have replaced references to "long-term fire regime dynamics" with terms such as "long-term changes in forest fire spatial patterns" and "fire patch structure". The revised manuscript now emphasizes that GlobMap FFP provides a spatially explicit characterization of fire patch distribution, geometry, and spatial organization across global forests.

For example, we have revised the background sentence in the Abstract (**Lines 12-13**) as below:

"Understanding long-term changes in forest fire patterns requires consistent information on the distribution, extent, and structure of fire patches across broad spatial and temporal scales."

We have also revised the last sentence of the Abstract (**Lines 30-31**) as below:

"This dataset is particularly suited for regional ecological analyses, studies of fire patch morphology and spatial organization, and investigations of long-term changes in fire patch patterns."

In addition, we have added further clarification in the Discussion regarding the limitations associated with repeated burning and temporal aggregation. Because GlobMap FFP retains a single representative observation within each compositing interval, repeated burning at the same location during the same interval cannot be explicitly reconstructed. Therefore, the dataset should not be used to directly estimate fire frequency or recurrence, particularly in frequently burned ecosystems. Instead, its primary value lies in providing long-term, spatially explicit information on fire patch structure and landscape-scale spatial organization that complements existing burned area products.

Other minors

Fig 12. Please specify the false color band combination for (a & d). Also, the magenta polygons in (a & b) are barely visible as they are blended with warm-colored burned areas.

Response:

We have modified Figure 12 caption to include the false color band combination. We have also changed the polygon color to make it more visible. The updated figure is shown as **Figure R4** below:

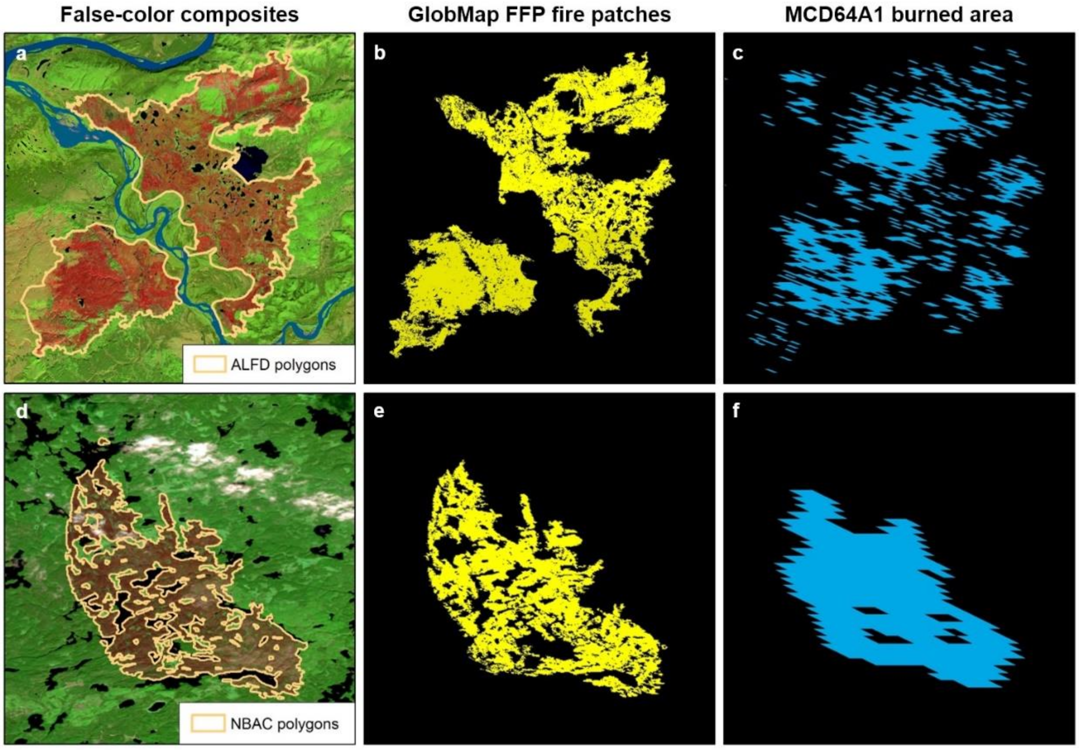

Figure R3. Examples of GlobMap FFP fire patch delineation and comparisons with Landsat false-color composites (SWIR2-NIR-Red), regional fire perimeter data, and MCD64A1 burned area at two forest sites. Alaska, US: (a) Landsat false-color composite acquired on September 1, 2015, overlaid with fire perimeters from the Alaska Large Fire Database (ALFD); (b) GlobMap FFP fire patches; (c) MCD64A1 burned area. Eastern Canada: (d) Landsat false-color composite acquired on October 26, 2019, overlaid with fire perimeters from the National Burned Area Composite (NBAC); (e) GlobMap FFP fire patches; (f) MCD64A1 burned area.