Reply on RC3
Alejandro Miranda et al.

Author comment on "The Landscape Fire Scars Database: mapping historical burned area and fire severity in Chile" by Alejandro Miranda et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2021-467-AC3, 2022

Below I noted some points which could be addressed to improve the article (some of them are described more in detail later in the line-by-line comment section):

1) It is recommended a deeper review of the CONAF existing fire/BA data be added: a section detailing the BA data CONAF products before the creation of this database, so the contribution of the new database is better understood. This would help in the comparison of the number of fires reconstructed (Table 2) that suggests there is a more accurate source available. Also, it would be beneficial to add detailed information about the source of the point database employed to reconstruct the fires.

R: We include the following paragraph in section 2.1 Data seeding to address the observations: L 109: “To construct our historical database of fire scars, we used a subset of the public wildfire database provided by Corporación Nacional Forestal (CONAF). This agency records and stores information on all fires (> 0.01 ha) regarding their location, date, causes, area affected by land use, date and time of first control and suppression of fire, among other variables. The georeferencing system used by CONAF until 2003 assigned each fire to the center of a 1x1 km alphanumeric grid, based on the subdivision of 1:50,000 scale maps of the Military Geographic Institute (IGM). After 2003, the location of each fire and estimation of their burned area began to be carried out with the help of a Global Positioning System (GPS).”

2) The methodology employed to map burned areas is not totally clear; even though the code is available for GEE users, a nice feature that ensures reproducibility. Firstly, it is not clear when ‘mosaic’ or ‘median’ reducers are employed to reduce imagecollections to images. If the ‘median’ were employed, this would reduce the noise but would soften the burned signal as well, an important feature for severity mapping. Secondly, the way an analyst define the threshold to map the burned area is not clearly defined - I guessed this is an interactive process based on visual assessment, however it is not clearly detailed. In addition, when describing the mapping process in GEE, it is convenient to address the difficulties encountered before writing them in the discussion section (for example, when there are neighbouring fire events, or when omission or commission errors are found in the mapping exercise). Finally, a statistical analysis of the RdNBR thresholds employed in different years/regions would be interesting, although maybe it is beyond the scope of this paper.
R: Median method for reducing image collections does not reduce noise; avoid extreme values (shadows, snow, clouds) by selecting the median value for each pixel. We applied the mosaic reducer for each image collection to get a unique image of the landscape conditions at moments as close as possible before and after a fire event. We applied the median reducer instead when this reducer did not provide good quality pixel values.

An interactive process defines the threshold as the referee mentioned. We include the sentence L 171: "This is an interactive process (fire by fire) based on visual assessment of the best RdNBR value that delimitates each individual fire scar".

We have addressed the difficulties and limitations in section 3.2 Limitations and other observations regarding the Landscape Fire Scars Database before the discussion section.

The evaluation of threshold variation in different years/regions is beyond the scope of the paper; however, the individual RdNBR is provided in the dataset for future assessment.

3) Authors define a 10 ha limit for reconstructing the fire perimeters. This is a very big area, in excess of 100 Landsat pixels, and it would be convenient to discuss and justify this choice carefully.

R: We agreed with the reviewer comment, this is why we add an explanation that justifies the cut-off threshold of 10 ha:

L116: “The 10 ha cut-off threshold was chosen since those fires represent more than 93% of the burned area according to the CONAF official information for 1985-2018 period. In addition, small fires are usually confounded with agricultural burning, a traditional cultural practice done by Chilean farmers.

4) In the validation process, a database of 194 fire scar perimeters has been employed as a comparison source (2015-2018 years), only 78 of them reconstructed. Omitting 60% of the fire scars gives the impression that many fires are not reconstructed for various reasons (and theoretically not because of a lack of images in those years). In addition, Table 2 shows that 66.6% of fires are reconstructed (hence, omission of 33%). The above should be clearly addressed and discussed, as it is an important limitation of the database.

R: There are two main reasons to not use all the scars from Brull (2018). The first is because it was difficult to know which fire scar from Brull corresponds to the scar of our database. This is because the first one did not have the same Ids values as the base we generated (FireID) and only some of those scars shared the same other information to find it (fire name, start date, etc). To effectively compare two scars caused by the same fire, we used two different combinations of conditions using the information of the name, start date, administrative region, and season in which the fire occurred. If these conditions were not met, we preferred not to use the fire. The second reason is due to the condition that each fire in the Brull (2018) database had to be located at least 300 meters from another fire in the same season to compare only individual fire scars. These two reasons decreased the number of scars available for a fair comparison. Regarding the 33% of fires omitted, we addressed it in the first two points of section 3.2 (L301) and we also mentioned that the reason was the unavailability of satellite images due to cloud cover and the lower availability of images in developing countries and in southern hemisphere high latitude regions. This limitation of the Fire Scar Database is now addressed in point (i) Historical image availability in the Discussion section (L351). We include a new figure 5 showing Chile's temporal trend of cloud-free pixels.

5) It seems the accuracy of the assessment is not clearly established. When considering the 78 fires perimeters, I was expecting to see validation metrics comparing those perimeters database/ manually derived. I found only one paragraph (section 3.1) on the
accuracy of the perimeters, plus the metrics shown are not clear ("global accuracy result is 0.79"). Section 2.3 refers to the methodology followed to carry out an accuracy assessment with the Closeness Index, however no results derived from this methodology for the 78 patches are shown, only some illustrative results in Figure 4. For completeness, I would also add error matrix derived metrics (user/producer accuracy or complementary omission/commission errors) in order to have similar metrics comparable to other research studies. Also convenient, I would add comparative information between your approach and coarse/resolution BA products (MCD64A1, FIRECCI products, GABAM; or the global wildfire dataset (https://doi.org/10.6084/m9.figshare.10284101) This would give an idea of the accuracy of the database to potential users.

R: The global accuracy we mentioned in the text is the mean of the calculated Closeness Index for the 78 CONAF fire scars. We make it clear in the text, showing the closeness value and adding the omission and commission errors. The formula used to calculate omission and commission error was:

\[
\text{Commission error} = \frac{FP}{FP+TP} \\
\text{Omission error} = \frac{FN}{FN+TP},
\]

\(FP = \text{false positive area, } FT = \text{true positive area, and } FN = \text{false negative area.}\)

We include the following sentence in 2.3 section (L226):

“To assess the accuracy of our framework we include the evaluation of commission and omission error calculated as follow; commission error = FP/(FP+TP) and omission error = FN/(FN+TP), where FP is the spatial explicit false positive area of the generated fire scar compared with reference polygon of Brull (2018), FN is the false negative area and TP is the true positive area.” The results of the new evaluation is at the end of 3.1 section (L309) “Finally, we found a commission error = 7% and an omission error = 28%.”

Chile's Landscape Fire Scars Database is a high-resolution individual fire scar data. The global datasets have annual or monthly burned area, and as we pointed out in the introduction, Roteta et al., (2019) evaluation show a large discrepancy between local and global estimates of the burned area. Because of this and different spatial resolutions, we think a numerical comparison is beyond the scope of this research.

6) The lack of availability of Landsat imagery is one of the sources of omission of the database. It would be interesting to follow up doing an imagery availability analysis across Chile through the years. Linked to this, the regional availability depending on the cloud cover mentioned in the text could be better contextualized.

We added the pixel and free-cloud pixel availability per year for Landsat per year in the new Figure 5.

About the data publicly available:

1) It was straight forward to download the database - I download it without any problem.

R: We appreciate the positive review.

2) It is reassuring the quality control described in the manuscript warrants file-
concordance between fires.

R: We appreciate the positive review.

3) It would be helpful to upload the information within this database to the GEE servers so that users may be able to use and assess it directly (for example an asset with the perimeters and severity). I would emphasise in the manuscript the reason why this database is important. For example, to me, it is not clear why post- and pre-imagery is added, and why the NBR/ RdNBR is included (I can only guess most of the people will use the perimeters/Severity associated from the process).

R: The main reason to provide the image is the transparency of the source of information. Any user can visually interpret the individual fire scar using the pre and post-image. Global datasets do not provide this information, so users can’t evaluate the precision of individual fire scar data. Additionally, some users may have a specific objective as evaluating the land cover change or landscape connectivity before the fire occurrence. Providing the image can help users take advantage of the work already done.

[Line by line comments]

Line 56 -> I would add an additional reference to the fire_cci BA products (MERIS/ AVHRR / MODIS /OLCI based).

https://doi.org/10.1016/j.rse.2015.03.011 /

https://doi.org/10.1016/j.rse.2019.111493

https://doi.org/10.5194/essd-10-2015-2018

https://www.mdpi.com/2072-4292/13/21/4295

https://doi.org/10.3390/rs13214295

R: We include the references.

Line 60 (or 69)-> I would include a link to the GABAM database (Landsat, 30m) (although it is later referenced)

https://vapd.gitlab.io/post/gabam/

https://doi.org/10.3390/rs11050489

R: It is already included

Line 97 -> It would be a good addition to upload the database to GEE and share the assets.

R: The dataset is not only available for GEE users. The data is all in Pangaea repository. GEE users can easily upload after they filter what they need.

Line 106 -> Figure 1 does not correspond to the study site but to the methodological workflow

R: Reference erased

Line 112 -> the link does not point to a web page with burned area statistics but to a
general web page to the CONAF.

R: Reference erased; we provide the point data. It is included in the Pangaea page as FireScar_CL_Summary_1985-2018.xlsx

Line 119-> I’m not a GEE expert but I believe GEE native language is not Javascript (it is the most popular client library because of the code editor https://code.earthengine.google.com/ )

R: To avoid confusion, we erase that part.

Line 120 -> Incorrect reference: it refers to Figure 1 and not Figure 2

R: Corrected

Line 133 -> "We use the atmospherically corrected surface reflectance and orthorectified images from Landsat 5 (1984-2013), 7 (1999-) and 8 (2013-)” The collection and GEE tag could be indicated

R: We include in the text L139: “We use the atmospherically corrected surface reflectance and orthorectified images from Landsat 5 (1984-2013) "LANDSAT/LT05/C01/T1_SR", 7 (1999-) "LANDSAT/LE07/C01/T1_SR" and 8 (2013-) "LANDSAT/LC08/C01/T1_SR"

Line 140 -> ‘Pixels of snow, clouds, and cloud shadows are excluded from each image on the basis of the pixel quality band provided by Landsat.’ I think these methodological details should be covered more in detail.

R: This is a standard procedure. The QA band indicates which pixels are covered by snow, clouds, or clouds shadows used as a binary mask of good and bad quality of the surface reflectance. We clarify in the text (L147).

Line 141 -> “For each image collection, we applied either the mosaic or the median reducer function to get a unique image of the landscape conditions at moments as close as possible before and after a fire event.” This affirmation must be clarified. How do you get the closest burning date with the median reducer? In principle, employing the median reducer would decrease the burned signal strength

R: We include a phrase to clarify it "This can be done by sorting the image by its date, obtaining the closer good quality pixels“ (L150).

Median method for reducing image collections does not reduce the burned signal strength, avoiding extreme values by selecting the median value for each pixel. We applied the mosaic reducer for each image collection to get a unique image of the landscape conditions at moments as close as possible before and after a fire event. When this reducer did not provide a good quality pixel, we applied the median reducer instead.

Line 151 -> “This index has shown better results in Mediterranean areas” Does this sentence refer to mapping burned areas or to burning severity?

R: We refer to burning severity. The index shows better results in the threshold definition between severity classes, therefore, we can expect better results between burned and unburned areas as well as we see empirically.

Line 187: “the event's severity is calculated from the RdNBR in a continuous raster format and categorized based on the ranges proposed by Miller and Thode (2007).” I think it would help writing down the ranges proposed in the manuscript
Table 1: RdNBR is not fully described (square root of what in the divider?)

R: Corrected

Line 169 -> "Step (iv) involved the selection of the RdNBR index value for each wildfire that best captures the burned area based on visual interpretation." . Please reword and clarify what this sentence mean.

R: We add the following sentence “This is an interactive process (fire by fire) based on visual assessment of the best RdNBR value that delimitates each individual fire scar.”


R: Done

Line 206: What was the spatial distribution of the evaluation samples? If the minimum size was 200 ha and 60% were not mapped by the database (78/194), the omission of the database seems high. It would be important to calculate the omission percentage both in number and area percentage.

R: The complete answer is in Q4.

Line 210: Why not use error matrix based traditional metrics like User/producer accuracy (or the complementary Omission, commission errors)? I understand the usefulness of the polygon-based comparison due to both source and validation being polygons but I believe having and omission/commission rate would be more significant.

R: We now include the omission and commission error.

Line 256: “Using the data for all 12,250 fires recorded by CONAF between 1985 and 2018 with a burned area greater than 10 ha,“. How is this information collected in CONAF? A description of the methods employed would be helpful.

R: We include an original data description in section 2.1 Data seeding

Table 2: “R is the number of reconstructed fire scars contained in our database, and UR is the number of fire scars in the database that could not be reconstructed due to the unavailability of satellite images.” R and UR are not listed in the table. Are those the Yes/No columns? Please edit.

R: The referee is correct. Now is the correct reference in the text.

Line 260: A typical map of the number of Landsat scenes available across Chile would be interesting to understand changes through the years.

R: We added the pixel availability per year of Landsat in Figure 5.

Line 270: “The total number of fires >0.01 ha exhibits a positive linear relationship with the total number of fires > 10 ha also recorded by CONAF between 1985 and 2018 (R2 = 0.86).” I cannot establish between which two variables this relationship is performed. First, I think it would be helpful to clarify what is the CONAF dataset. Then, the slope and intercept of the regression would add valuable information about the tendency of over/
under estimation.

R: We add a more complete description of CONAF dataset in L109.

Line 272: “indicating that the distribution of the reconstructed data is regionally representative (Table 2, Figure 2)” -> please add the scatterplots as the reader may expect them.

R: We already have many images, including fig 5 by the suggestion of referee 3, so we provide the data in the table.

Line 290: Fire scar evaluation: Line 298: “Nevertheless, the global accuracy result is 0.79” This is an important result but it is not easily understood: is it the aggregated 78 ‘Dnorm’ value? Please specify.

R: Done.

L313: Nevertheless, the global accuracy assessment derived from the Closeness Index and calculated as the mean of the individual D_norm result in a value of 0.79.

Line 300: Some of the limitations addressed here are new for the reader, I think they should be noted before in the results/methodology sections. For example, issues like having more than one fire event in neighbouring areas should have been addressed in the methodology section. The same applies for problems related to commission errors.

R: We disagree with the review. These observations come from the complete process experience and are general for the framework. This limitation section is only a “take into account” for the researcher that may be starting the process. Putting this in the methodology may be confusing because it does not apply to all cases.

Line 381: I would make clearer 5 days temporal resolution starts in 2017 with the second satellite, and that although some bands are at 10 m spatial resolution, critical bands accurate BA mapping like SWIR are at 20 m.

R: Done.

Line 390 "No evident pattern associated with the latitudinal or vegetation-type change was observed in applying the threshold value to identify scars”. It would be interesting to analyse the validity of the threshold values throughout various regions/years in Chile.

R: Wepreciate the comment, however we believe that this point is out of the scope of the paper, and should be address in a specific research.

Figure 2: Instead of using negative longitudes and latitudes, it is preferable to use South / West. For clarity, avoid adding the background shadows in the detailed maps.

R: Weprecipate the comment, however, the map is consistent with the data provided in the fire scar dataset.

Figure 3: I appreciate this is a plot to illustrate the computed variables, however I would include also information about the place/date of the fires illustrated.

R: We include the place/date of the fires illustrated in the caption of Fig.3.

Figure 4: I would define ‘Dnorm’ in the footnote for clarity.
R: Done