

Reply to Reviewer 3 Comments

Manuscript: *CONFEX: A Database for CONUS Fire EXtent (essd-2026-116)*

**Reviewer comments are in red, author responses are in blue, and revised manuscript sections are in black.*

General Comment: This manuscript presents the CONUS Fire EXtent (CONFEX) dataset, a VIIRS-based wildfire event product (2012–2024) that derives fire perimeters, ignition locations, and temporal attributes using a spatio-temporal clustering framework. The dataset addresses an important gap between hotspot-based detections and perimeter-based inventories, offering higher temporal resolution and event-level characterization. The methodology is generally well described and technically sound, and the dataset has clear potential value for fire regime analysis, ignition modeling, and risk assessment. However, several issues related to spatial interpretability, validation, and uncertainty need to be addressed before publication. Hence, the reviewer recommended a major revision with comments attached:

General Response: We thank Reviewer 3 for the thoughtful and constructive feedback. We appreciate the recognition that the CONFEX dataset addresses an important gap between hotspot-based detections and perimeter-based inventories. The manuscript has been revised to improve clarity, strengthen validation, and better describe uncertainty, regional performance differences, and methodological structure.

MAJOR COMMENTS

Reviewer comment: “1. All figures throughout the manuscript lack latitude/longitude grids or coordinate ticks, making it difficult to identify the geographic location of the presented results. For a geospatial data paper, this significantly limits its interpretability, reproducibility, and usability by the community.”

Response: We thank the reviewer for this advice. We agree that this is an important issue for a geospatial data paper. All map figures have been updated to include latitude/longitude grids or coordinate ticks, improving geographic interpretability, reproducibility, and usability.

Revised manuscript updated figure example:

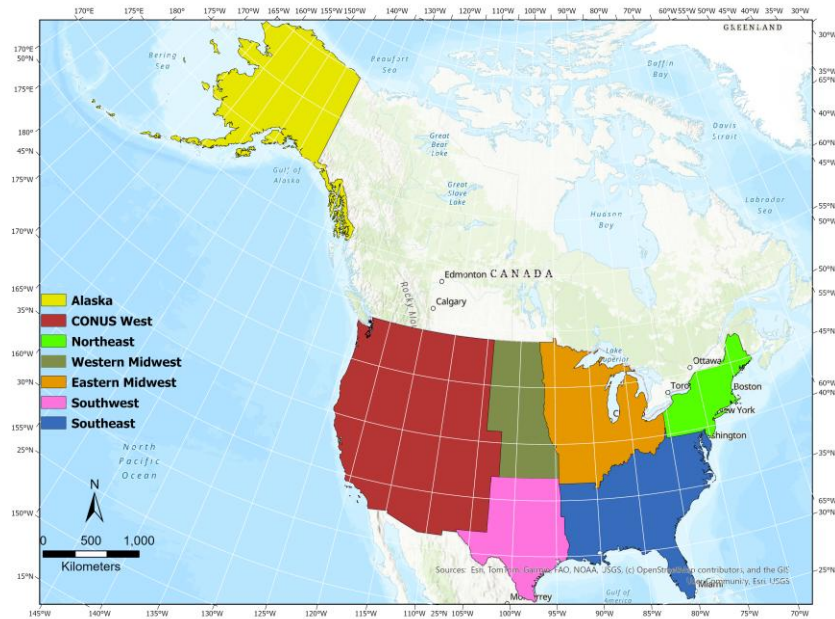


Figure 2: Different regions of CONUS and Alaska based on MTBS and US Census Bureau (EPSG:102008 (North America Albers Equal Area Conic)) Basemap/imagery credit: Sources: VCGI, Esri, TomTom, Garmin, FAO, NOAA, © OpenStreetMap contributors and the GIS community | Powered by Esri.

Reviewer comment: “2. The methodology is technically sound but not well written and at times difficult to follow. The section lacks a clear structure and mixes conceptual explanations, implementation details, and justification within the same paragraphs, which reduces readability. Moreover, key steps such as feature construction, clustering, and perimeter reconstruction are not clearly separated, and some explanations (e.g., clustering method comparison) are overly detailed relative to their importance. A clearer, stepwise organization would significantly improve comprehension. I recommend restructuring the methodology into clearer subsections and also performing thorough language editing to improve clarity and readability”

Response: We reorganized the Data and Methods section into clearly separated subsections: Data Sources and Preprocessing, Geospatial Framework and Projections, Spatiotemporal Clustering Algorithm, Post-processing and Quality Control, and Threshold Tuning. Redundant conceptual explanations were reduced, additional implementation details were moved to the Supplement where appropriate, and the workflow is now presented sequentially from input data through clustering, perimeter reconstruction, filtering, and validation.

Reviewer comment: “3. The dataset derives fire perimeters from clustered VIIRS detections, but there is no quantitative assessment of positional uncertainty of perimeters, centroid accuracy, and sensitivity of geometry to clustering parameters. Validation is primarily based on F1 scores, which do not fully capture spatial errors.”

Response: We thank the reviewer for this important suggestion. We agree that F1 scores alone do not fully describe spatial uncertainty or perimeter-geometry error. In the revised manuscript, we added text in the Dataset Limitations section clarifying that CONFEX perimeters, centroids, and ignition attributes have uncertainty arising from VIIRS spatial resolution and geolocation uncertainty, hotspot density and arrangement, missed detections due to cloud, smoke, low-intensity combustion, and sensitivity to clustering and alpha-shape parameters. We also expanded the validation interpretation beyond strict object-level F1 scores by adding area-level agreement, split/fragmentation diagnostics, merge diagnostics, dominance diagnostics, and near/far unmatched-CONFEX diagnostics. These additions do not eliminate the need for future independent positional-uncertainty assessment, but they provide a more complete spatial interpretation of where CONFEX perimeters agree with reference perimeters and where disagreement arises from fragmentation, merging, boundary effects, or unmatched detections.

Revised manuscript addition (Dataset Limitations/Discussion): “There is inherent uncertainty in CONFEX perimeter geometry, centroid location, and ignition timing and location because the product is derived from clustered VIIRS active-fire detections rather than direct field observations. This uncertainty is influenced by VIIRS pixel-size variation from 375 m at nadir to approximately 1 km at swath edges (Schroeder et al., 2014), geolocation uncertainty, hotspot density and arrangement, missed detections due to cloud, smoke, low-intensity combustion, and quality-control filtering, as well as sensitivity to clustering and alpha-shape parameters. Therefore, ignition attributes should be interpreted as first-detection proxies, centroids as detection-derived geometric summaries, and perimeters as VIIRS-derived event envelopes rather than exact burned-area boundaries.”

Reviewer comment: “4. The manuscript reports low performance in the Eastern CONUS, attributed mainly to false positives. However, the discussion does not sufficiently explore underlying causes, such as 1) prevalence of prescribed burns, 2) smaller and fragmented fires, 3) lower fire intensity affecting VIIRS detectability. Please expand discussion linking algorithm assumptions to regional fire regimes”

Response: We thank the reviewer for this important comment. We agree that lower validation agreement in the Eastern CONUS requires clearer interpretation and should not be attributed simply to false positives. In the revised manuscript, we expanded the Results and Discussion to link regional performance differences to reference-data coverage, regional fire-regime characteristics, and event-delineation differences. We now clarify that many unmatched CONFEX detections are isolated from same-year reference perimeters, indicating that they are often spatially disconnected from mapped MTBS, GeoMAC, or WFIGS fire perimeters rather than merely near-boundary errors. We also emphasize that eastern fire regimes contain substantial prescribed-burn activity, smaller and more fragmented fires, and lower-intensity burning, all of which can reduce representation in reference perimeter datasets and complicate VIIRS-based event delineation. The revised discussion therefore presents lower eastern CONUS agreement as evidence of reference incompleteness and event-delineation differences, rather than as a simple false-positive interpretation or as a strength of the algorithm.

Revised manuscript addition (Discussion): “Clean one-to-one rates decline sharply from Alaska (36.8%) to CONUS West (5.3%) and are below 1.5% in all eastern regions. These low rates do not imply that the remaining detections are false. Rather, they indicate that in CONUS regions, the vast majority of CONFEX detections have no nearby MTBS counterpart, or no nearby FRAP counterpart within California, consistent with reference incompleteness for small-fire and prescribed-burn activity that falls below MTBS mapping thresholds or outside FRAP reporting scope. Eastern fire regimes also include substantial prescribed burning, smaller and more fragmented fires, and lower-intensity combustion, which can reduce VIIRS detection continuity and complicate event delineation from active-fire detections.”

Major Comment 5: Parameter tuning generalization

Reviewer comment: “5. The clustering parameters (distance, time, alpha) are tuned using California 2020 only. This raises concerns about applicability to Eastern CONUS or Alaska. Please discuss parameter transferability and potential regional sensitivity.”

Response: We thank the reviewer for this important comment. We agree that California-only tuning would not be sufficient for applying the workflow across CONUS and Alaska. In the revised manuscript, the tuning framework was expanded to region-specific calibration across seven regions: Alaska, CONUS West, Southwest, Southeast, Northeast, Eastern Midwest, and Western Midwest. This revision addresses parameter transferability by selecting clustering distance, temporal, and alpha-shape thresholds separately for broad regional groups rather than assuming that a single California-derived parameter set applies everywhere.

Revised manuscript text: “We tuned the clustering distance, temporal-window, and alpha-shape thresholds using MTBS reference perimeters, which apply different mapping thresholds in the western and eastern United States. The parameter-tuning validation was performed separately across seven broad regions to provide a practical regional framework for applying different clustering thresholds across CONUS and Alaska, while broadly reflecting known differences in fire regimes and MTBS East-West mapping thresholds. More detailed regionalization using pyromes or EPA Level III ecoregions was not adopted because these units are much more finely resolved and many fire perimeters cross ecoregion boundaries, which would complicate perimeter generation and validation at the national scale (Figure 2; Short et al., 2014; Daassi et al., 2026; U.S. EPA, 2015; Short et al., 2020).”

MINOR COMMENTS

Reviewer comment: “Introduction is way too long as a data paper, could be truncated.”

Response: We thank the reviewer for this suggestion. The Introduction has been shortened and refocused to better fit a data description paper. Broad historical discussion and less directly relevant background material were removed or condensed, while the revised Introduction now focuses on the need for CONFEX, the distinction between active fire, burned area, and perimeter products, and the specific gap addressed by the dataset.

Revised manuscript text: “The CONUS Fire Extent (CONFEX) database was developed to address the lack of a spatially consistent, moderately high-resolution fire event product for the entirety of CONUS and Alaska. To date, no publicly available dataset provides high-temporal-resolution (twice-daily), event-level fire perimeters at 375 m spatial resolution across CONUS and Alaska using the VIIRS S-NPP active fire product.”

Reviewer comment: “Figure 1 is essentially a table.”

Response: We thank the reviewer for pointing this out. The former Figure 1 has been converted into a table describing the VIIRS channels used in the 375 m active fire detection algorithm.

Revised manuscript text: “Table 2. Channels used in the 375 m active fire detection algorithm (adapted from Schroeder & Giglio, 2016).”

Reviewer comment: “Figures 8–9: labels of (a)–(c..) were missing.”

Response: We thank the reviewer for noting this issue. The figure panels have been corrected by adding the missing subplot labels so that each panel can be clearly referenced in the caption and text.

Reviewer comment: “Clarify distinctions between ‘event,’ ‘cluster,’ and ‘fire perimeter.’”

Response: We thank the reviewer for this important clarification request. The revised Methods section now clarifies that a cluster is the group of VIIRS hotspot detections identified by DBSCAN, a fire event is the interpreted event object represented by that cluster after filtering and attribution, and a fire perimeter is the polygon geometry generated from the cluster detections.

Revised manuscript text: “Each cluster is taken as a candidate fire event. In this study, a cluster refers to the group of VIIRS hotspot detections identified by DBSCAN, a fire event refers to the retained geospatial object represented by that cluster after filtering and attribution, and the fire perimeter refers to the polygon geometry generated from the cluster detections. The final dataset consists of geospatial fire-event objects, each corresponding to a single cluster. Attributes include ignition time and location, end time and location, burned area, and centroid coordinates of the final event perimeter.”

Reviewer comment: “Clearly describe dataset structure and availability.”

Response: We thank the reviewer for this suggestion. The revised manuscript now describes the structure of the final dataset more clearly, including the geospatial fire-event objects and the accompanying CSV summary table. The Data Availability section has also been updated to describe the released dataset files more clearly.

Revised manuscript text: “The final dataset consists of geospatial fire-event objects, each corresponding to a single cluster. Attributes include ignition time and location, end time and location, burned area, and centroid coordinates of the final event perimeter. Moreover, the algorithm generates a CSV file in which each row corresponds to a summary of the most important attributes of each cluster’s geodata frame.”