Replies to Referee #1

This study evaluates historical and projected changes in extreme fire weather across Europe, assesses the performance of EURO-CORDEX simulations in fire weather calculations, and demonstrates the added value of bias adjustment in improving FWI-based projections under different global warming levels. Overall, it shows that extreme fire weather is already intensifying and is projected to become more widespread, more frequent, and more severe with increasing warming.

The manuscript is very well written, methodologically thorough, and clearly structured. I particularly appreciate bias-adjustment exercise, which substantially improves confidence in the projections. The study is comprehensive and makes a meaningful contribution to the fire–climate literature.

I have noted a few minor points and some methodological clarifications that, in my view, would further strengthen the paper. Addressing these would enhance the scientific rigor and improve clarity, but they do not alter the overall conclusions. Based on this, I would recommend acceptance subject to minor revisions.

We sincerely appreciate the thoughtful consideration and positive evaluation of our manuscript by the reviewer and would like to thank them for their helpful comments. Below, we respond to each comment and address all the issues raised by the reviewer. Reviewer comments are shown in blue, our responses in black, and the proposed changes in red.

Comments:

1. The study mentions earlier Europe-wide assessments based on smaller ensembles. We also have multiple global studies with similar results over Europe. I think it is important to explicitly articulate the added value or knowledge gap addressed by the larger ensemble and bias-adjustment based approach. A short paragraph clarifying the added value is necessary to help round off the storyline.

Thank you for the recommendation. In the revised version, we propose to organize the paragraphs explaining the added value as given below to make it clearer. For consistency, we add the entire storyline here, but we show the changes we plan to make in red for your reference:

"In addition to global-scale studies that show a projected increase in fire weather extremes across the continent (e.g., Abatzoglou et al., 2019; Jones et al. 2022), two recent pan-European scale studies projected widespread increases in extreme fire weather under the impacts of climate change (El Garroussi et al., 2024; Hetzer et al., 2024). Both studies relied on global climate model outputs from the sixth phase of the Climate Model Intercomparison Project (CMIP6) (Eyring et al., 2016) and applied statistical downscaling techniques to reach the target resolution (~31 km in El Garroussi et al. (2024) and ~9 km in Hetzer et al. (2024)). However, since statistically downscaled fields still inherit the climate change signal from driving global climate models (GCMs) and do not incorporate fine-grid scale physical processes, they may not fully capture important regional scale phenomena, such as snow-albedo feedback in mountainous regions (Maraun et al., 2017), potentially leading to a loss of physical consistency and biased results. To address this limitation, dynamically downscaled regional climate models (RCMs) offer an alternative approach as they refine the large-scale circulation response obtained from GCMs to finer scales by explicitly simulating sub-GCM grid-scale processes (Giorgi, 2019). Consistent with this, a recent study found that RCMs from the Coordinated Regional Climate Downscaling Experiment (CORDEX) more accurately reproduce historical fire weather trends than GCMs participating in CMIP5 and CMIP6 (Nogherotto et al., 2026).

Many studies have used RCMs from the Coordinated Regional Climate Downscaling Experiment - European Domain (EURO-CORDEX) (Jacob et al., 2014) to project fire weather danger across Europe in a warming climate, but many of them relied on relatively smaller ensemble sizes (e.g., de Rigo et al., 2017; Galizia et al., 2023), which limits the characterization of model uncertainty. Moreover, they were often limited to specific regions, such as Greece (Rovithakis et al., 2022), France (Fargeon et al., 2020; Varela et al., 2019), or the Iberian Peninsula (Bento et al., 2023; Calheiros et al., 2021). In addition to these in previous studies, simulations in the EURO-CORDEX framework have been found to exhibit systematic biases relative to observations and reanalysis, with an overall tendency to be too cold, too wet, and too windy (Vautard et al., 2021). Since extreme fire weather is a multivariate phenomenon driven by the combined effect of these fields, biases in them may compound and amplify the *overall uncertainty in fire weather indices and associated outcomes. Accordingly, these fields need to be adjusted for biases to increase confidence in decision-making regarding the impacts of extreme fire weather in a warming climate.*

Therefore, despite the growing literature on projections of extreme fire weather in Europe, important gaps remain in terms of better representing regional details and uncertainty through the use of larger RCM ensembles, as well as increasing confidence in projections by bias-adjusting atmospheric fields. To address these research gaps, we use a relatively large ensemble from the EURO-CORDEX framework (Jacob et al., 2014), consisting of 33 GCM-RCM chains and aim to comprehensively assess projections of extreme fire weather danger at a pan-European scale in a warming climate. We focus on projected changes at 2 °C and 3 °C global warming levels (GWLs) and rely on scenario simulations based on the Representative Concentration Pathway (RCP) 8.5. Fire weather is quantified using the Canadian Forest Fire Weather Index (FWI) System (Van Wagner, 1987), as it relies solely on daily meteorological input fields and has been shown to perform well in Europe, especially in the Mediterranean (Carvalho et al., 2008; Jones et al., 2022; San-Miguel-Ayanz et al., 2012; Viegas et al., 1999). Prior to calculating projected fire weather danger, model input fields are bias adjusted using quantile delta mapping (QDM) (Cannon et al., 2015), with ERA5-Land reanalysis data (Muñoz-Sabater et al., 2021) serving as reference."

2. While the manuscript provides a thorough assessment of fire weather, it does not look into how closely the calculated FWI signals translate into actual fire occurrences across the study region. Although the role of factors other than FWI is discussed later, a plot showing the actual fire-occurrence pattern across the study region (perhaps next to Figure 1) would help clarify the linkage between FWI and real-world fire regimes. In other words, are the regions identified as experiencing strong fire-weather signals also those where fires are climatically constrained and responsive to FWI, or are these areas where other limiting factors (fuel availability, land use, ignition sources, suppression capacity) dominate? Without this context, there is a risk of interpreting increases in fire weather in regions where fire occurrence may remain structurally limited.

Thank you for the recommendation. In the revised version, we propose adding a new panel next to Figure 1 showing the 21-year climatology of the total annual burned area fraction, displayed as a percentage to the grid cell area. This figure will use burned area data from the Global Fire Emissions Database version 5 (GFED5; Chen et al., 2023) for the period 2002-2022. To further improve the robustness, we will also mask out the regions that are considered unburnable (e.g., barren land/sparse vegetation or urban areas) by using the Land Cover data from Copernicus. Therefore, a new section will be introduced in the revised version of the manuscript which is described below in red:

"2.1.3 Burned Area and Land Cover Data

In order to provide a historical context for the projected changes in fire weather, we use burned area data from the fifth version of the Global Fire Emissions Database (GFED5; Chen et al., 2023). This dataset provides a monthly burned area record from 2002 to 2022 at a 0.25° grid resolution, and is derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) MCD64A1 burned area product (Chen et al., 2023). We used GFED5 burned area data to present the climatology of the total annual burned area fraction relative to the grid cell area across Europe (Figure 1b).

We also obtained Global Land Cover data from Copernicus (Buchhorn et al., 2020) for 2019 at a 100 m grid resolution to mask out regions that are considered unburnable. Similar to what was done for the EURO-CORDEX simulations, we first interpolated this field to the ERA5-Land grid resolution using first-order conservative remapping. Then, land areas classified as containing more than 80% of urban/built-up, bare or sparse vegetation, snow and ice, or water were considered unburnable (Abatzoglou et al., 2019). Finally, this interpolated unburnable land mask was applied to all fire weather-related analyses throughout the study."

The figure will be mentioned in the Discussion as follows (only the red parts are new):

"Although extreme fire weather conditions, as represented by the FWI, are projected to intensify in terms of both frequency and magnitude, it is important to emphasize that the FWI is a fire weather rating metric and not a measure of fire occurrence. In fact, fire weather creates conditions that may enhance the susceptibility of landscapes to other key wildfire drivers, namely ignition, fuel dryness, and fuel continuity (Pausas and Keeley, 2021). Burned area climatology from the past two decades (Figure 1b) reveals that fire occurrence has remained structurally limited in some regions, such as parts of Scandinavia, possibly due to a

combination of bioclimatic and anthropogenic factors. However, it remains unclear whether these factors will remain unchanged in Europe in the future. In general, FWI provides the most meaningful danger information in regions where fire activity is limited by fuel dryness rather than by vegetation productivity (Jones et al., 2022). The strongest relationships between FWI and burned area are observed in ecosystems with intermediate moisture availability (Jones et al.,2022), including boreal and evergreen forests (Abatzoglou et al., 2018; Bedia et al., 2015), as well as in Mediterranean Europe (Calheiros et al., 2020; Carvalho et al., 2008; Fox et al., 2018; Jones et al., 2022; Urbieta et al., 2015)."

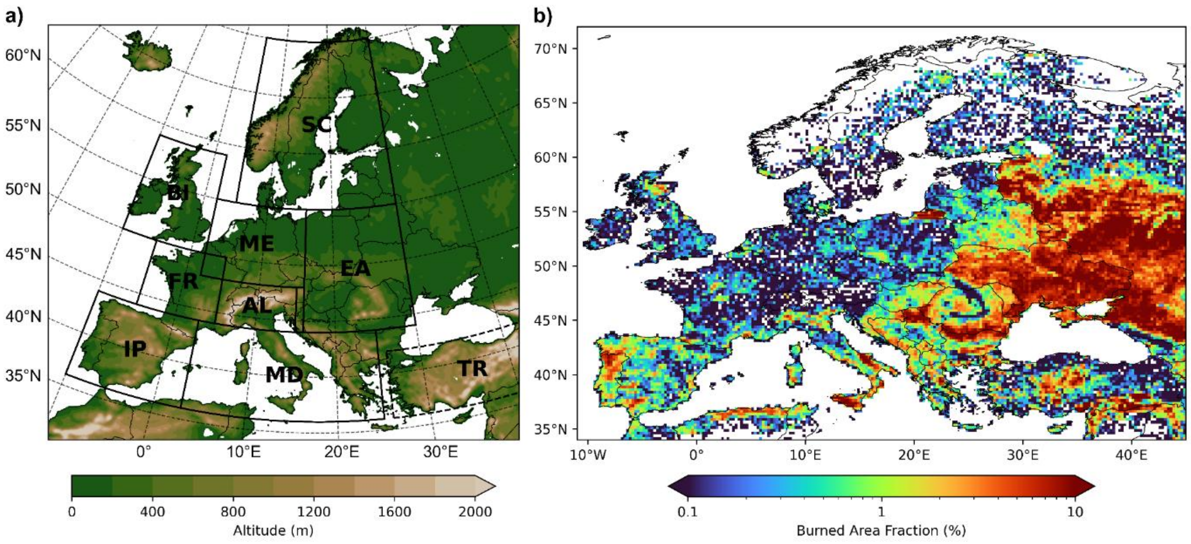

Figure 1. a) PRUDENCE regions investigated in this study, based on the definitions of Christensen and Christensen (2007) and shown with surface altitude data from COSMO-CLM in the EURO-CORDEX domain (Sørland et al., 2021). BI = British Isles, SC = Scandinavia, FR = France, ME = Mid-Europe, AL = Alps, EA = Eastern Europe, IP = Iberian Peninsula, MD = Mediterranean, TR = Turkey. Note that Turkey is included here in addition to the previously defined regions. **b)** Climatology of the annual total burned area fraction relative to the grid cell area (%yr-1), calculated for the period 2002-2022 based on GFED5 (Chen et al., 2023). The figure aims to provide a historical context to the projected changes in fire weather extremes from a burned area perspective.

3. I am concerned about the choice of using mean daily relative humidity in the FWI calculations. The proxy-selection framework is appreciated, and it is helpful that daily combinations are benchmarked against the original noon-time FWI using ERA5-Land. That said, I still wonder about the physical consistency of using mean daily relative humidity in the FWI formulation. The system is fundamentally designed around 12:00 local time, when fuel moisture is typically close to its daily minimum and atmospheric demand is highest. Given the *strong diurnal cycle and nonlinear influence of RH on the fuel moisture codes, using mean RH (even if it minimizes percentile bias) could potentially dampen extremes especially under climate change where diurnal characteristics may shift. A brief discussion of the following points would help separate statistical performance from process-level robustness and increase confidence in the methodological choice. Was daily minimum RH explicitly tested in the proxy evaluation, and how did it perform spatially and seasonally relative to mean RH? When identifying the optimal combination, was the sensitivity to RH assessed independently, or could the reduced 95th percentile bias partly be because of compensating effects from the other variables? More generally, is optimizing only against the 95th percentile sufficient to ensure that the overall distribution and physical behavior of FWI are preserved, particularly in the upper tail?]*

Thank you very much for your detailed comment. In the submitted version, we explicitly evaluated the sensitivity to the choice between minimum and mean relative humidity (please refer to the comparison between Figures 3a vs. 3c and 3b vs. 3d). However, we agree that these differences were not clearly explained. Therefore, we propose to add the following text at the end of the first paragraph in Section 3.1 for the revised version (note that the first sentence was already included in the submitted version):

"At the European scale, combinations that include mean relative humidity generally underestimate extreme fire weather danger (Figures 3a and 3b), while those that include minimum relative humidity tend to overestimate it (Figures 3c and 3d). Regarding the magnitude of the bias, using minimum relative humidity instead of mean relative humidity increases the absolute bias when the accompanying variable is maximum wind (Figures 3a and 3c), whereas it decreases the bias when the accompanying variable is mean wind (Figures 3b and 3d)."

In addition, as Reviewer #2 also suggested discussing the selection of mean relative humidity, we propose adding the following paragraph on the possible implications of this choice in the discussion section:

"The proxy variable combination we selected to represent the original noon-time FWI calculation at daily resolution may have resulted in a possible underestimation of the baseline climatological values (as shown in Figure 3). However, a recent study found that all

combinations at daily resolution overestimate the trend in FWI_{95d} *relative to the original noon-time calculation (Matteo et al., 2025; note that, in addition to minimum/mean relative humidity, they tested the dependence on maximum/mean temperature, whereas we tested maximum/mean wind speed). We also calculated the difference between the trends from the original calculation and those from the proxy combination selected for daily resolution and found that the daily combination overestimates the average trend in* FWI_{95d} *over Europe by about 17% (results not shown). Therefore, although our analysis revealed an underestimation of the extreme portion of the FWI distribution due to the use of mean relative humidity, it is still possible that the projected trends are overestimated. Similar to Matteo et al., (2025), we therefore suggest that the next generation of climate model simulations should include more sub-daily outputs to better estimate risks related to compound hazards in a warming climate."*

Finally, to address the reviewer's concern about optimizing only against the 95th percentile, we evaluated the sensitivity across different percentiles, and the results remain qualitatively similar. We will add the following sentence to Section 3.1, along with the corresponding figures in the Supplementary Materials:

"Sensitivity tests show that this spatial pattern of bias between the different combinations does not depend on the 95th percentile threshold and is qualitatively similar across other parts of the distribution (Figures D1 – D5)."

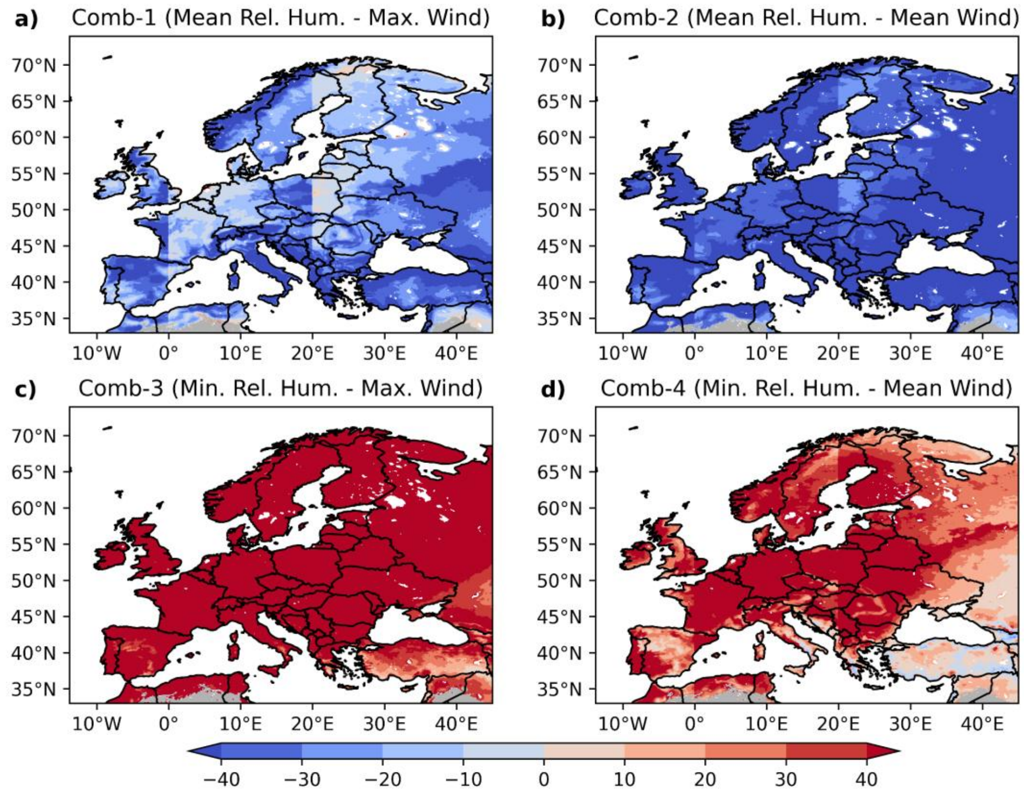

Figure D1. Relative percentage bias of the 50th percentile of FWI calculated using the four input variable combinations **a)** Comb-1, **b)** Comb-2, **c)** Comb-3, and **d)** Comb-4, compared to the original noon-time FWI calculation based on ERA5-Land reanalysis data. Daily maximum temperature and daily precipitation are common to all combinations. The time period analyzed is 1950-2023. Areas classified as unburnable are shown in gray. Note that the artifacts near 0° and 20° longitudes result from the concatenation operation described in Section 2.2.4. Details of the variables used in all combinations are given in Table C1.

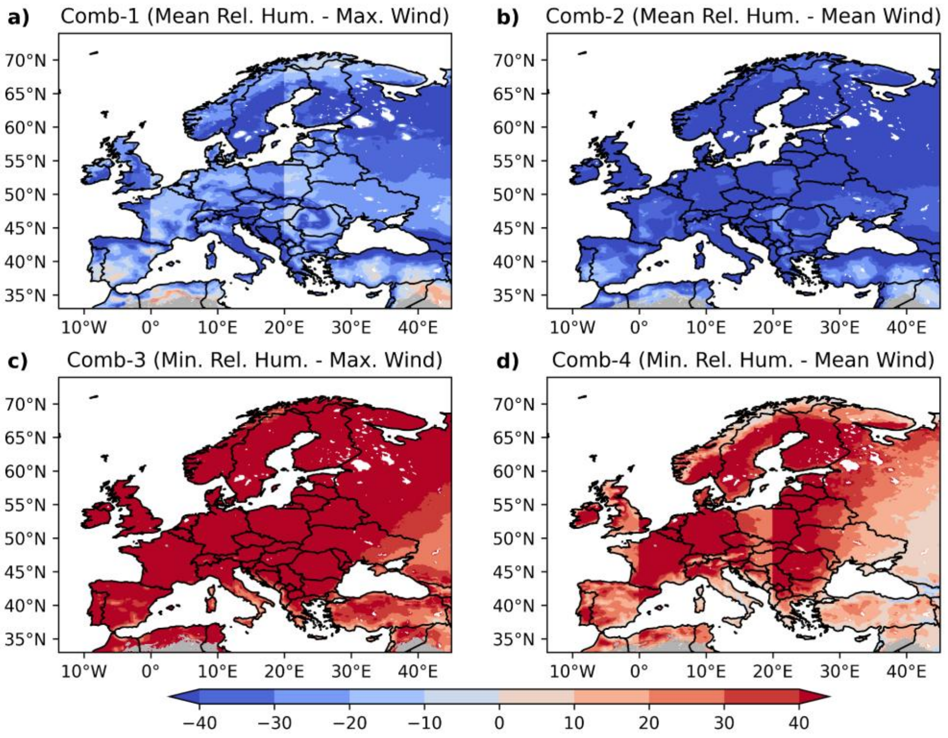

Figure D2. Same as in Figure D1, but for the 75th percentile.

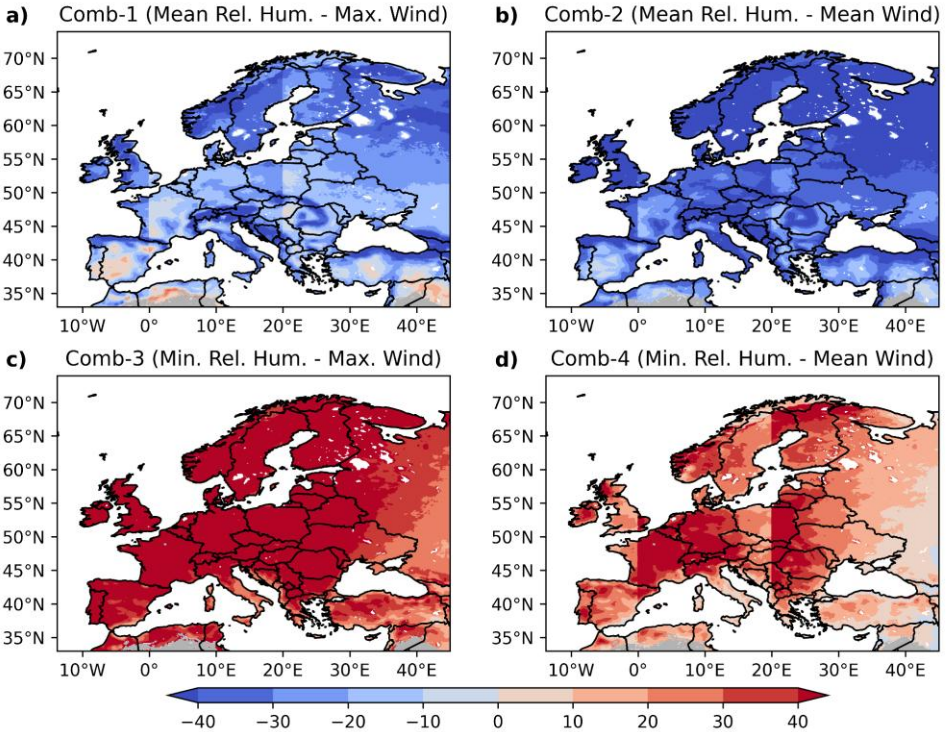

Figure D3. Same as in Figure D1, but for the 90th percentile.

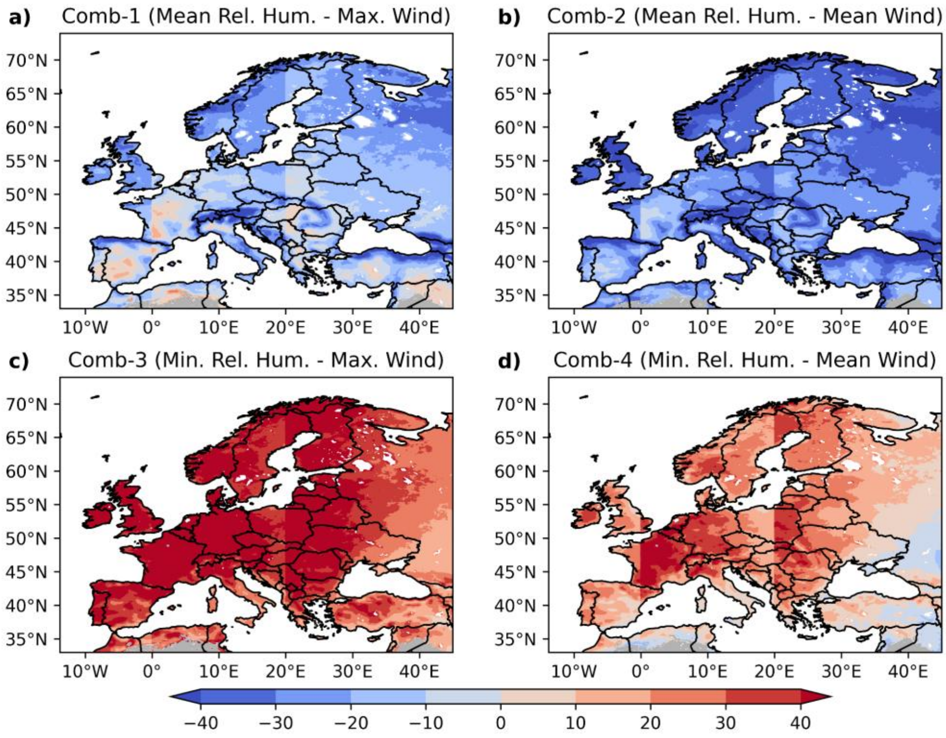

Figure D4. Same as in Figure D1, but for the 99th percentile.

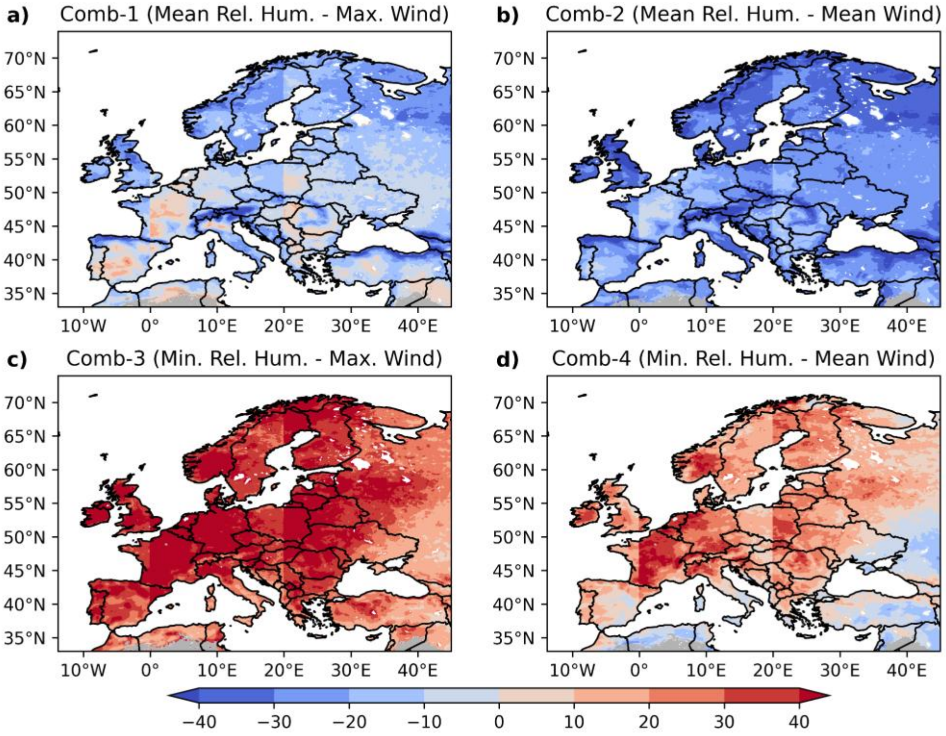

Figure D5. Same as in Figure D1, but for the 99.9th percentile.

4. Is there any particular reason for northward expansion of fire-prone conditions. The authors should clarify more on this at this point.

Thank you for your comment. In the submitted version, we concluded that this northward expansion is mostly associated with thermodynamic factors. However, we agree that this part may not have been explained in sufficient detail. Therefore, in the revised version, we propose to clarify our methodology for linking fire weather extremes to meteorological drivers (note that this remains associational and does not constitute a formal attribution statement). Specifically, we propose to add the following as a new section (2.2.6) in the Methodology:

"2.2.6 Composite Analysis of Meteorological Conditions during Extreme Fire Weather Days

In order to characterize the average background conditions associated with the extreme fire weather days, we created composites of the meteorological conditions. To this end, we first calculated the 99th percentile of FWI for each grid cell and each warming level (reference period, +2 °C and +3 °C GWLs) using the 30-year period corresponding to that climate state. Then, days exceeding this threshold during each warming level ($FWI > FWI^{99}$) were identified and used as a mask to extract the meteorological conditions that correspond to these extreme fire weather days. Finally, these meteorological fields were averaged over all exceedance days within each period and across the PRUDENCE regions for each model chain in the ensemble.

We created these composites for daily maximum temperature, 30-day accumulated antecedent precipitation, daily mean relative humidity, daily maximum wind speed, and VPD, as well as for FWI system sub-components (ISI and BUI), all of which are conditioned on days when FWI exceeds FWI^{99}. Changes in these meteorological composites were then analyzed to diagnose the association between extreme fire weather and its drivers in a warming climate."

To clarify the association between fire weather extremes and their drivers, we propose to include the following paragraphs in Section 3.6 on Evaluation of Potential Drivers (note that the first paragraph was already included in the submitted version, but it is repeated here for coherence):

"To disentangle the contributions of wind speed and dryness conditions, Figure 10 shows VPD plotted against maximum wind speed across PRUDENCE regions. The VPD-wind speed pairs

correspond to the averaged values for the days when FWI exceeds its 99th percentile during the reference period (1971–2000), as well as at 2 °C and 3 °C GWLs for each model in the EURO-CORDEX ensemble. The medians of maximum wind speeds are projected to either decrease or remain largely unchanged across all PRUDENCE regions, except in southern Europe, where a very slight increase (less than 2%) is projected, but likely not significant. In contrast, the median VPD, which reflects the thermodynamic effects of temperature and relative humidity through atmospheric drying, is projected to increase across all regions, with particularly strong increases in central and southern Europe. In southern European regions, the projected increase in the median VPD on days when FWI exceeds its 99th percentile at 3 °CGWL relative to the reference period is almost 40%, with some models projecting changes greater than 70% (Figures 10g-10i).

Similarly, Figure D13 shows the association between 30-day accumulated antecedent precipitation and fire weather extremes. There is a trend towards decreasing precipitation totals as GWL increases across regions for these conditional days in the ensemble median (except for Scandinavia). The decreasing precipitation totals may be more critical for regions such as France, in contrast to southern Europe, where the baseline climatology during extreme fire weather days is already very dry. Therefore, further drying in these regions might not increase fire weather danger as much as increases in temperature, as also reported in El Garroussi et al. (2024). However, to better discern the role of precipitation in intensifying fire weather extremes, a more targeted analysis is needed, as there is no model agreement in the change signal in many regions (e.g., Eastern Europe).

Therefore, there is evidence to suggest that projected changes in FWI in southern Europe are primarily associated with an increase in fuel aridity due to thermodynamic drivers rather than changes in wind speeds. This may also indicate that the projected changes in ISI in southern Europe (Figure 9) are largely influenced by increased surface layer fuel dryness (FFMC), rather than wind speed. Precipitation is also an important contributor in regions such as France, but its role is more difficult to assess in many other regions due to the higher uncertainty.

In addition to showing the distribution of the model statistics across the PRUDENCE regions, we also present the spatial pattern of the ensemble median changes in the variables of interest at 2 °C and 3 °C GWLs relative to the reference period (Figure 11). The pattern of changes in *extreme FWI (mean FWI on days when FWI > FWI^{99}) shows a high spatial correlation with changes in VPD on these days (~0.85 for both GWLs), which is higher than the individual correlations with maximum temperature and relative humidity. The decline in 30-day accumulated precipitation is also evident in regions such as France and suggests that these events occur under drier antecedent conditions, especially at 3 °C GWL, but this is less relevant for southern regions. Changes in maximum wind speed are weak and spatially heterogeneous. Overall, the northward expansion of more extreme fire weather danger in a warming climate in Europe is associated with stronger atmospheric moisture demand through increasing VPD (or increasing temperature and decreasing relative humidity), with compounding effects from declining precipitation in regions such as France. However, these relationships should be interpreted with caution, as they represent spatial co-variations rather than formal attribution statements."*

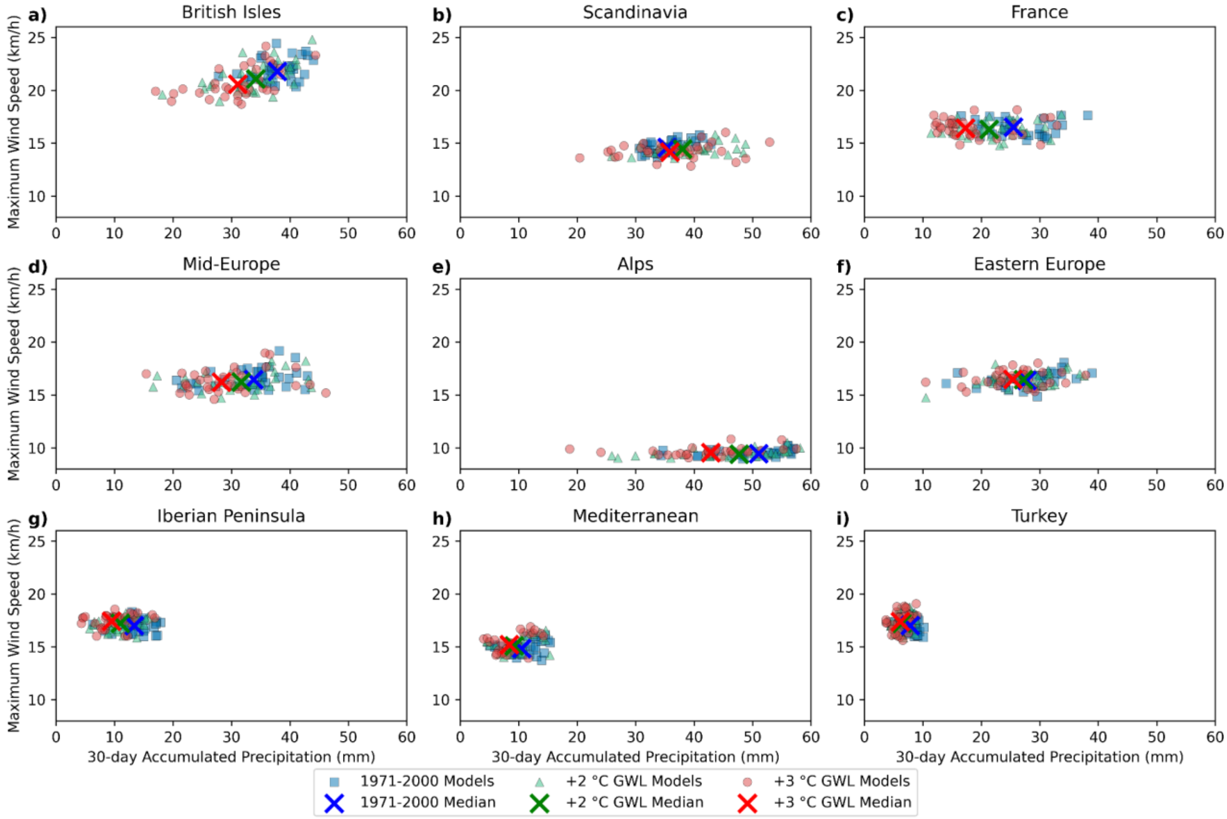

Figure D13. Accumulated 30-day antecedent precipitation (mm) vs. maximum wind speed (km/h) composites for the PRUDENCE regions. Accumulated precipitation and maximum wind speed averages are shown for days when the FWI exceeds its 99th percentile. Blue squares denote the reference period (1971-2000), green triangles correspond to 2 °C GWL, and red circles represent 3 °C GWL. All values are spatially aggregated and area-weighted averaged over the PRUDENCE regions, namely **a)** British Isles, **b)** Scandinavia, **c)** France, **d)** Mid-Europe,

e) Alps, **f)** Eastern Europe, **g)** Iberian Peninsula, **h)** Mediterranean, and **i)** Turkey. Each value corresponds to a bias adjusted EURO-CORDEX model; crosses indicate ensemble medians.

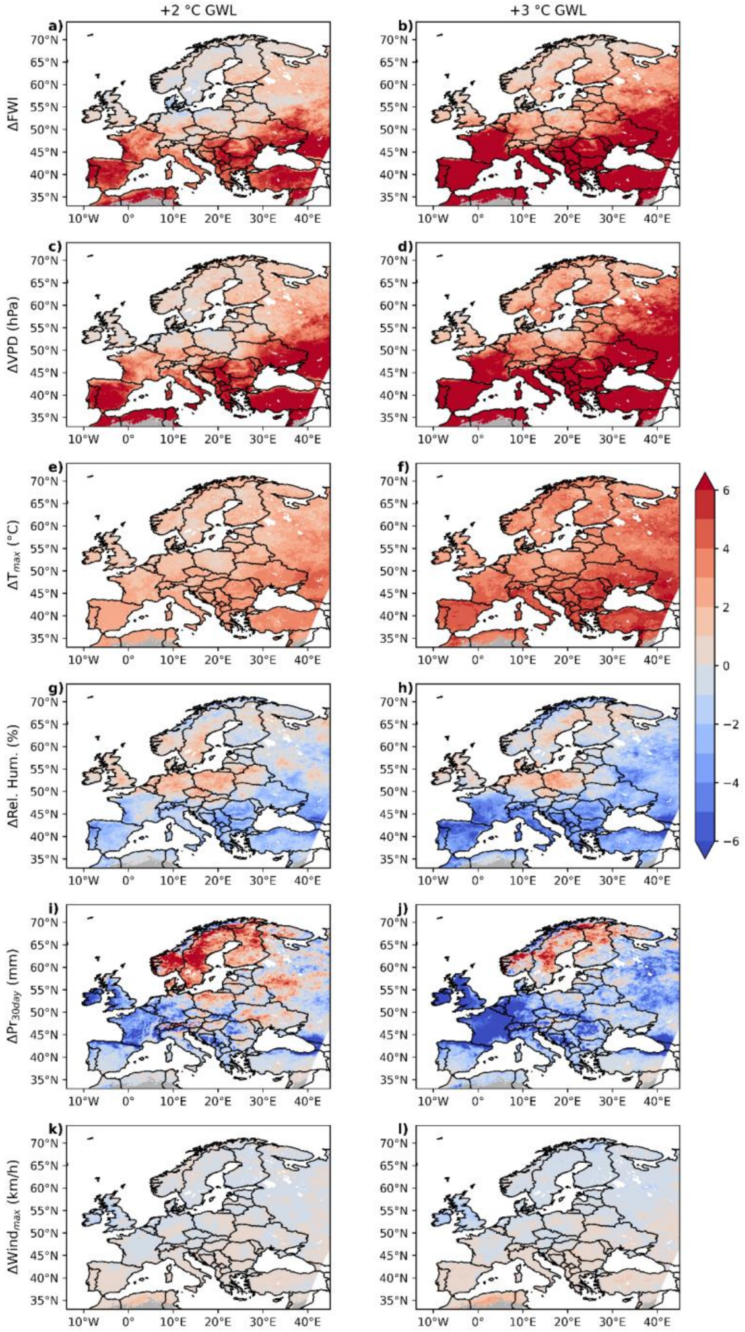

Figure 11. Spatial patterns of the composites based on the ensemble median of 33 bias-adjusted EURO-CORDEX models, shown as changes relative to the reference period (1971-2000) at +2 °C (left panels) and +3 °C GWL (right panels). Composites are created by averaging delta changes of **a, b)** FWI (unitless), **c, d)** VPD (hPa), **e, f)** daily maximum temperature (°C), **g, h)** daily mean relative humidity (%), **i, j)** 30-day antecedent accumulated precipitation (mm), **k, l)** daily maximum wind speed (km/h) on days when FWI exceeds its 99th percentile.

5. Were any particular criteria (such as performance of projections over Europe) used to identify the models?

No specific selection criterion was applied to identify the models; rather, we aimed to obtain the largest ensemble available from the ESGF DKRZ nodes at the time of the analysis. However, during the revision, we noticed a quality issue with one of the model chains in the relative humidity simulation, and we decided to remove this chain from the ensemble. In the revised version, we will explicitly state this in Section 2.1.2:

"We considered a set of 33 GCM-RCM chains from the EURO-CORDEX framework (Jacob et al., 2024) to quantify future changes in extreme fire weather in Europe (note that the largest ensemble available during the data curation phase of this study in December 2024 included 34 model chains, from which we removed one due to quality issues)."

6. Line 13: Relative increases in frequency generally exceed those in magnitude; do the authors mean that the frequency is projected to increase more than frequency? It is not clear.

We will make this sentence clear in the revised version:

"Relative increases in frequency-based metrics generally exceed those in magnitude-based metrics."

7. Lines 22-25: Is it appropriate to compare fire emissions averaged over 1997–2016 with fossil fuel emissions from a single year (2024)? Perhaps the time periods could be aligned, or a brief justification added?

Thank you for your suggestion. We will align the dates with the recently published metrics and rewrite the sentence to address the uncertainty and the difference between these numbers:

"Despite considerable uncertainty, recent data indicate that global mean carbon emissions from fires were estimated at 3.4 PgCyear^{-1} during the period 2002-2022 (van der Werf et al., 2025, note that this figure includes all types of fires), which is approximately 30.6% of the magnitude of global anthropogenic CO2 emissions in 2022 (Bowman et al., 2020; Friedlingstein et al., 2023)."

8. Line 85 onwards: Could the authors clarify at this point which hourly values were actually used from ERA5-Land (e.g., noon values for CFFDRS calculations and daily mean/max/min for bias correction)? It appears, however, that at this point it would help to avoid confusion, as different applications require different temporal aggregations.

Thank you for your suggestion. We will clarify this by explicitly stating which variables are used for each purpose. Specifically, we propose to add the following paragraph to Section 2.1.1:

"ERA5-Land reanalysis data were used for several purposes throughout the study, which can be summarized as follows:

- *The hourly atmospheric fields were first used to calculate the original noon-time (12:00) FWI. These fields were then aggregated to the daily scale to estimate the most suitable proxy input variable combination to replace the original noon-time FWI calculation at the daily scale (see Table C1 for a complete list of variables used).*
- *The historical climatology of FWI metrics and the associated trends were calculated using the selected daily proxy input combination.*
- *The daily atmospheric fields derived from GCM-RCM chains were bias-adjusted using the daily aggregated ERA5-Land values as a reference."*

9. Line 101: Given the current emphasis on multi-scenario assessments, is there a particular reason for focusing solely on the RCP8.5 scenario?

We agree that when the focus is on Global Warming Levels (GWLs) rather than specific emission pathways, a multi-scenario assessment could in principle be considered. For this reason, we initially examined simulations under both RCP8.5 and RCP4.5 scenarios. However, a substantial fraction of the RCP4.5 simulations does not reach the +3 °C GWL during the 21st century.

Since many of these simulations do not reach the +3 °C GWL threshold, including them would result in different sample sizes for the +2 °C and +3 °C GWLs. To minimize the risk of sampling bias and to ensure equal sample sizes for both GWLs, we decided to focus exclusively on the RCP8.5 scenario.

We had already included a line in the caption of Table 1 in the first submitted version:

"All scenario simulations follow RCP8.5, so that all models reach the 3 °C GWL during the 21st century."

To further address your concern, we will add the following sentence to the main text in Section 2.1.2 of the revised version:

"We focus exclusively on the RCP8.5 scenario as all simulations reach both GWL thresholds within the 21st century under this pathway, which allows for consistent ensemble sizes and a robust comparison across warming levels."

10. Line 200: Could the authors comment on the degree of correlation or redundancy among these indices? A brief assessment (e.g., spatial correlation or variance partitioning) would help clarify whether each metric adds distinct process-relevant information (frequency, duration, intensity, seasonality) or whether some are effectively reflecting the same underlying signal in different forms.

Thank you for your comment. Following your recommendation, we evaluated the spatial correlation between the climatologies of these fields and found that correlations are generally high across Europe (>0.70; the trends of these fields are also spatially correlated). This is expected, as they respond similarly to the same underlying large-scale climate drivers. However, despite these correlations and shared variance, each metric is designed to characterize different patterns of fire weather danger:

FWI_{95d} : frequency of extreme fire weather conditions at the local scale,

FWI_{fwsl} : duration of the fire season,

FWI_{fs} : average (or sustained) fire weather conditions during the peak season

FWI_{max} : magnitude of the peak intensity of local fire danger

Hence, while these metrics are spatially correlated and respond similarly to a common climate driver over the large domain, they are not completely redundant in terms of process representation. For example, the duration of the fire season can be short even when local fire danger is high, or the average fire weather conditions during the peak fire season may be high, while the peak intensity is not necessarily very extreme. By showing the signal across these correlated but distinct metrics, we consider that our results can be used by a broader community, who may be more familiar with different metrics for their specific applications. Therefore, we propose keeping these metrics in the manuscript, and including the following sentence in the relevant section to emphasize the issue raised by the reviewer:

"Note that despite the high spatial correlation among these metrics due to their dependence on the same climatic drivers, each of them captures a different dimension of fire weather danger from a process- and impact-based perspective."

11. Section 3.4 As rightly pointed out by the authors in a previous section, climatologically low FWI values may result in large relative percentage changes in FWIfwsl or FWI95d. This could be a bit misleading. In the region-wise analysis, we do see some presentation in absolute terms. The authors may consider normalizing the metrics in this section to better contextualize and refine the percentages.

Thank you for your comment. In order to address this and Reviewer #2's last comment, we propose to include two additional figures, similar to Figures 6 and 7, in the Supplementary material, but focusing on the absolute changes instead of relative percentage changes (please see below). We will also include the following sentence in the Captions of Figures 6 and 7 to address the issue.

"Absolute changes are shown in Figure D11 to facilitate interpretation in regions where relative changes may be amplified by climatologically low baseline values."

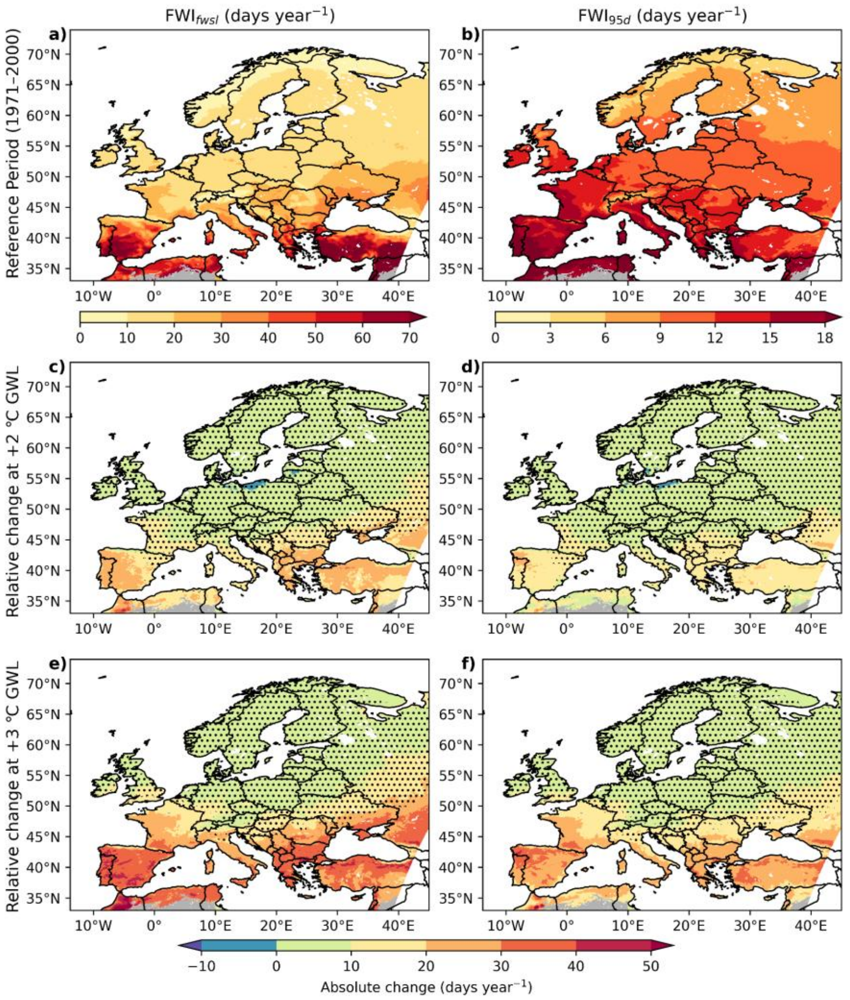

Figure D11. *Patterns of frequency-based extreme fire weather metrics and their projected absolute changes in Europe based on the ensemble median of 33 bias-adjusted EURO-CORDEX models. The left panels show the fire weather season length (FWI_{fwsl}) and the right panels show the number of days per year exceeding the 95th percentile FWI (FWI_{95d}) relative to the reference period (1971-2000).* ***a, b)*** *Reference period patterns with a separate colorbar shown below,* ***c, d)*** *absolute changes relative to the reference period at +2 °C GWL and* ***e, f)*** *absolute changes relative to the reference period at +3 °C GWL. Note that the reference period is already 0.46 °C warmer than the preindustrial period. Areas without stippling indicate regions where at least 66% of the models project statistically significant changes according to a t-test ($p < 0.05$) and agree on the sign of change. Areas classified as unburnable are shown in gray.*

References (only those that were not included in the submitted version)

Buchhorn, M., Smets, B., Bertels, L., Roo, B. D., Lesiv, M., Tsendbazar, N.-E., Herold, M., and Fritz, S.: Copernicus Global Land Service: Land Cover 100m: collection 3: epoch 2019: Globe, https://doi.org/10.5281/zenodo.3939050, 2020.

Chen, Y., Hall, J., van Wees, D., Andela, N., Hantson, S., Giglio, L., van der Werf, G. R., Morton, D. C., and Randerson, J. T.: Multi-decadal trends and variability in burned area from the fifth version of the Global Fire Emissions Database (GFED5), Earth System Science Data, 15, 5227–5259, https://doi.org/10.5194/essd-15-5227-2023, 2023.

Friedlingstein, P., O'Sullivan, M., Jones, M. W., Andrew, R. M., Bakker, D. C. E., Hauck, J., Landschützer, P., Le Quéré, C., Luijkx, I. T., Peters, G. P., Peters, W., Pongratz, J., Schwingshackl, C., Sitch, S., Canadell, J. G., Ciais, P., Jackson, R. B., Alin, S. R., Anthoni, P., Barbero, L., Bates, N. R., Becker, M., Bellouin, N., Decharme, B., Bopp, L., Brasika, I. B. M., Cadule, P., Chamberlain, M. A., Chandra, N., Chau, T.-T.-T., Chevallier, F., Chini, L. P., Cronin, M., Dou, X., Enyo, K., Evans, W., Falk, S., Feely, R. A., Feng, L., Ford, D. J., Gasser, T., Ghattas, J., Gkritzalis, T., Grassi, G., Gregor, L., Gruber, N., Gürses, , Harris, I., Hefner, M., Heinke, J., Houghton, R. A., Hurtt, G. C., Iida, Y., Ilyina, T., Jacobson, A. R., Jain, A., Jarníková, T., Jersild, A., Jiang, F., Jin, Z., Joos, F., Kato, E., Keeling, R. F., Kennedy, D., Klein Goldewijk, K., Knauer, J., Korsbakken, J. I., Körtzinger, A., Lan, X., Lefèvre, N., Li, H., Liu, J., Liu, Z., Ma, L., Marland, G., Mayot, N., McGuire, P. C., McKinley, G. A., Meyer, G., Morgan, E. J., Munro, D. R., Nakaoka, S.-I., Niwa, Y., O'Brien, K. M., Olsen, A., Omar, A. M., Ono, T., Paulsen, M., Pierrot, D., Pocock, K., Poulter, B., Powis, C. M., Rehder, G., Resplandy, L., Robertson, E., Rödenbeck, C., Rosan, T. M., Schwinger, J., Séférian, R., Smallman, T. L., Smith, S. M., Sospedra-Alfonso, R., Sun, Q., Sutton, A. J., Sweeney, C., Takao, S., Tans, P. P., Tian, H., Tilbrook, B., Tsujino, H., Tubiello, F., van der Werf, G. R., van Ooijen, E., Wanninkhof, R., Watanabe, M., Wimart-Rousseau, C., Yang, D., Yang, X., Yuan, W., Yue, X., Zaehle, S., Zeng, J., and Zheng, B.: Global Carbon Budget 2023, Earth System Science Data, 15, 5301–5369, https://doi.org/10.5194/essd-15-5301-2023, 2023.

Matteo, A., Garnés-Morales, G., Moreno, A., Ribeiro, A. F. S., Azorin-Molina, C., Bedia, J., Di Giuseppe, F., Dunn, R. J. H., Herrera, S., Provenzale, A., Quilcaille, Y., Torres-Vázquez, M. , and Turco, M.: Challenges in assessing Fire Weather changes in a warming climate, npj Climate and Atmospheric Science, 8, 284, https://doi.org/10.1038/s41612-025-01163-0, 2025.

Nogherotto, R., Raffaele, F., Giuliani, G., and Coppola, E.: Has the fire weather index emerged? Insights from global and regional climate models, Weather and Climate Extremes, 51, 100 861, https://doi.org/10.1016/j.wace.2026.100861, 2026.

van der Werf, G. R., Randerson, J. T., van Wees, D., Chen, Y., Giglio, L., Hall, J., Vernooij, R., Mu, M., Binte Shahid, S., Barsanti, K. C., Yokelson, R., and Morton, D. C.: Landscape fire emissions from the 5th version of the Global Fire Emissions Database (GFED5), Scientific Data, 12, 1870, https://doi.org/10.1038/s41597-025-06127-w, 2025.