

Supplementary Information:

Current model capabilities and future predictive pathways of wildfires under a changing climate

Cynthia H. Whaley, Yang Li, Isabelle Valiquette, Sophie Kiley, Ruth Digby

Supplementary Note 1 Literature review methods

The scope for the literature in this review includes studies that predict or project fire characteristics (e.g., burned area, biomass burning emissions, fire risk, etc) out to the 2050-2100 time frame, globally or regionally, and the publications that include those models' historical evaluation. Additional fire characteristics like changing intensity of fires, fire season length, frequency of fires, etc are discussed when the studies provide them. These typically come from LSMs, ESMs, and statistical or ML models. There are other types of models that have published future fire projections, which were usually highly region-specific models, such as forest management models (e.g. [1–3]), but we consider those beyond the scope of this review. Also beyond the scope of this review are modelling frameworks which are used only to simulate historical or present day fires. Those include dozens of chemical transport models and regional air quality models, for which other reviews and publications have covered their results (e.g. [4–7]). An active field of research is using future meteorology from climate models as drivers of CTM simulations, but this is not the focus of the current review.

To find papers within the scope of the review, keyword searches using Scopus, Web of Science, and Google Scholar included (*“earth system model*” OR “ESM”*) AND (*“future” OR “predict*” OR “project*” OR “scenario*”*) AND (*“climate change” OR “global warming”*) AND (*“biomass burning” OR “fire” OR “burned area”*), changing the model type and fire parameters as needed. We also used Google Scholar Labs with natural language prompts to assist with generating a more curated collection of publications. In total, we compiled and organized ~360 papers for this review. ~105 are categorized for background information on observed wildfire-climate processes (Section 2), ~64 are used for describing and evaluating different models (Section 3), and ~103 cover the main scope of projecting future wildfires (Section 4). The remaining papers include studies on model inter-comparisons, limitations, and other background material.

Table S1 summarizes the number of publications found for each model type, including model description/evaluation and future projection papers. There has been a shift from computing fire danger indices from ESMs' meteorological output to prognostically simulating fires themselves in ESMs. These are reflected in the two rows for ESMs in Table S1.

Table S1: Number of papers found from different modelling types

Type of model	number of papers	time span of papers
LSM	34	2005-2026
ESM prognostic	15	2014-2025
ESM fire indices	38	1994-2026
Stat/ML	59	1994-2026

Supplementary Note 2 Modelling systems

The fire modelling systems in this paper are often complex and overlapping. Here we spell out model acronyms (Table S2), and compile the different combinations of LSMs, their fire modules, and the ESMs they are embedded in (Table S3). We also include a table summarizing the various ML/stat model studies, highlighting the different ML methods used and regions they applied to (Table S4).

Table S2: Model acronyms

Acronym	full model name
ESMs	
AWI-ESM-1-1-LR	Alfred Wegener Institute Earth System Model
CanESM	Canadian Earth System Model
CESM2	Community Earth System Model version 2
CESM-WACCM	CESM-Whole Atmosphere Community Climate Model
CMCC-CM2-SR5 / CMCC-ESM2	Euro-Mediterranean Center on Climate Change models
CNRM-ESM2-1	Centre National de Recherches Météorologiques Earth System Model
E3SM-1-1 / E3SM-1-1-ECA	Energy Exascale Earth System Model
EC-Earth3-*	European community Earth system model
GISS E2.1	Goddard Institute for Space Studies ModelE ESM
GFDL-ESM4	Geophysical Fluid Dynamics Laboratory Earth System Model
MPI-ESM1-2-*	Max Planck Institute Earth System Model
MRI-ESM2-0	Meteorological Research Institute Earth System Model
NorCPM1	Norwegian Climate Prediction Model
NorESM2-*	Norwegian Earth System Model
TaiESM1-0	Taiwan Earth System Model
UKESM	United Kingdom Earth System Model
Land Surface Models (LSMs)	
CLASSIC	Canadian Land Surface Scheme including Biogeochemical Cycles
CLASS/CTEM	Canadian Land Surface Scheme/Canadian Terrestrial Ecosystem Model
CLM	Community Land Model
ELM	E3SM Land Model
ED	Ecosystem Demography
HAL1	Hydrology Atmosphere Landsurface, Haru (Japanese for spring)
ISBA-CTRIP	Interactions between Soil, Biosphere, and Atmosphere - Total Runoff Integrating Pathways
JSBACH3.2	Jena Scheme for Biosphere-Atmosphere Coupling in Hamburg
JULES	Joint UK Land Environment Simulator
LPJ-GUESS	Lund-Potsdam-Jena General Ecosystem Simulator
LM4.1	Land Model v4.1
MC2	Map-and-Cell dynamic global vegetation model
ORCHIDEE	Organizing Carbon and Hydrology in Dynamic Ecosystems
Fire Modules/Schemes	
FINAL	The FIRE model with coNstrained burn area and fire carbon emissions
GlobFIRM	The Global Fire Model
INFERNO	INteractive Fire and Emission algoRithm for Natural environments
Li	from Li et al. [8, 9, 10]
pyrE	<i>pyr</i> (Greek for fire), E for GISS model E
RESFire	Region-specific ecosystem feedback fire model
SPITFIRE	The SPread and InTensity of FIRE model

2.1 Machine Learning (ML) methods

The landscape of fire ML modelling now encompasses a broad range of methodologies, from traditional statistical regressions to sophisticated deep learning architectures. Traditional statistical approaches, such as Multiple Linear Regression (MLR), Logistic Regression, Generalized Additive Models (GAM), and Multivariate Adaptive Regression Splines (MARS), remain benchmarks due to their capability in forecasting fire-danger probabilities [49–52]. To capture non-linear relationships, researchers have widely adopted ensemble ML methods like Random Forest (RF), Support Vector Machines (SVM), and

Table S3: LSMs with process-based fire representation and key references for evaluation, intercomparison, and future projections. Also, when applicable, the ESM they are used in. All model acronyms are in Table S2.

LSM	fire module	evaluation/ intercomparison	future projections	used in ESM
LPJ	SPITFIRE	[11]	[1]	MPI-ESM
	SEVER-FIRE	[1]		N/A
LPJ	[12]	[13]	[14]	ModelE2-YIBs, GISS GCM3 [13]
LPJ	HAL[15]	[16]		MRI-ESM
LPJ-GUESS	SPITFIRE[17], SIMFIRE-BLAZE, GlobFiRM	[18, 19]	[11, 20]	MPI-ESM[16, 21]
			[19]	N/A
LPJ	mL-SPITFIRE or LMfire	[22]	[11, 23]	CNRM-ESM2-1, EC-Earth3[21]
CLM	CLM-CN, CLM-Fire	[8, 18, 19, 24]	[25–28]	MPI-ESM
	Li et al fire			NorESM, CCSM4
	RESFire	[30]		CESM [29]
MC2	built-in fire disturbance	[18, 19]	[31]	CESM
ORCHIDEE	SPITFIRE	[18, 19]	...	MC2 ESM
JSBACH	SPITFIRE	[19, 32, 33]	[32, 34]	IPSL-ESM
JULES	INFERNO	[18, 19, 35]	[36]	MPI-ESM, ECHAM-HAM
CABLE	CABLE-POP+fire			UKESM [37]
CTEM/CLASSIC	built-in fire disturbance	[18, 19, 38–40]	[41]	CanESM [42]
ED2	built-in fire disturbance			
LM4.1	FINAL[43], ED [44]	[45]		GFDL-ESM[16, 21]
	pyrE	[46]		GISS E2.1
YIBS	[12]	[47]	[48]	in GISS ModelE2-YIBS

Extreme Gradient Boosting (XGBoost) [53–55]. Furthermore, hybrid systems like the Adaptive Neuro-Fuzzy Inference System (ANFIS) and deep learning emulators (e.g., Convolutional Neural Networks (CNNs)) are increasingly used to handle the spatiotemporal complexities of fire spread while operating significantly faster than conventional physics-based simulations [56–58]. More complex architectures are also emerging, such as Attention-Fire models utilizing Long Short-Term Memory (LSTM) networks to adaptively weight important drivers over time [59], and hybrid systems that use ML to diagnose deficiencies in process-based Dynamic Global Vegetation Models (DGVMs) [60, 61].

Common inputs to ML models include temperature, precipitation, relative humidity, vapour pressure deficit, fire weather indices, fuel availability, biomass, topography, population density, road networks, and land use [51, 53, 56, 59, 62–64].

The best performance among ML models is reported for “optimized ensemble ML models” which combine multiple ML models through regionally-varying weighted averages. These models demonstrate significantly higher accuracy in reproducing annual dynamics, long-term declining trends, and annual variations of fire number, size, and burned area, compared to traditional process-based models [91].

Supplementary Note 3 Fire-related indices

The publications in Section 4.2.2 compute the fire-related indices listed in Table S5 using ESM outputs.

Supplementary Note 4 Future scenarios

The Special Report on Emissions Scenarios (SRES) future scenarios were socioeconomic storylines, with the A1 family of scenarios including rapid economic growth, peak population in mid-century, and fast technology development. The A1FI is for fossil-fuel intensive, A1T for non-fossil energy sources, and A1B for a balance of all sources. The A2 scenario is a high emissions scenario because of its large population growth and slow technological change. The B1 scenario was an optimistic storyline with lower emissions due to a transition to cleaner energy/technology [115].

Table S4: ML or statistical models that have provided future projections. RF=random forest, NN=neural network, DNN=deep NN, ANN=artificial NN, CNN=convolution NN, MARS=multivariate adaptive regression splines, XGBoost=extreme gradient boosting, BRT=boosted regression trees, AUC=area under curve, SEM=simple ensemble mean, GBM=gradient boosting decision tree, GLM=generalized linear model, GEE=generalized estimating equation, MLR=multiple linear regression, NSM=non-stationary model, BMA=bayesian model averaging

Model or model type	evaluation/ intercomparison	region	fire metric
RF[65]	compared with XGBoost and SVM[65]		probability
LightGBM[66]			BA, risk
RF[67]	compared with XGBoost[68]	global	emissions, occurrence
RF[68]		global	ignition probability
SEM[69]		global	danger
DNN[70]		global	
BMA[71]		global	
RF[54]	compared with XGBoost[54]	global	emissions
RF[72]		global	
ML[73]		global	
MaxEnt[74]	evaluation using AUC and comparison to climate models	global	probability, frequency
Light GBM	compared to SEM[75]	China	frequency, intensity
RF[75]		northeast China	season length
FLAM-Net		South Korea	
MARS[76]	[76], compared with MLR and RF[51]	boreal North America	
[77]		Canada	
CanLEAD-FWI[78]		Canada	danger, season length
downscaling[79]		western Canada	fire days, FWI
ANN	compared to GLM[80]	U.S.	emissions
PC2FM		U.S.	frequency, probability
GEE[80]		U.S.	risk, season length
MLR[81]		western U.S.	emissions
CNN[82]		western U.S.	
RF, BRT[83]	evaluated with AUC[85]	western U.S.	BA, frequency
regression[84]		western U.S.	season length, emissions
RF[85]		Southern California	fire days, season length
[64]	compared to MLR and MARS[51]	European Alps	danger
NSM[86]		Mediterranean Europe	BA
RF[51]		Mediterranean Europe	
GAM[52]		Mediterranean Europe	danger, emissions
downscaling[87]		Iberian Peninsula	
[88]		Greece	fire season
ML, MaxEnt[89]	compared to AUC[89]	Amazon	probability, risk
[90]		Brazilian Cerrado	danger
AttentionFire_v1.0[59]	compared with LSTM, ANN, RF, DNN	tropics	BA, emissions

The Representative Concentration Pathways (RCPs) are GHG concentration trajectories that result in radiative forcing levels (W/m^2) by 2100. These include RCP2.6 (low emissions), RCP4.5 (intermediate with emissions' peak around 2040), RCP6.0 (emissions stabilizing after 2100), RCP8.5 (high emissions, worse-case scenario).

The Shared Socio-economic Pathways (SSPs) represent future global developments out to 2100, and include SSP1 (sustainable), SSP2 (business as usual), SSP3 (regional rivalry), SSP4 (inequality), and SSP5 (fossil-fuel development). When combined with RCPs, the approximate radiative forcing and temperature levels in 2100 are estimated. E.g. SSP1-1.9 ($\sim 1.4^\circ\text{C}$ warming), SSP1-2.6 ($\sim 1.8^\circ\text{C}$), SSP2-4.5 ($\sim 2.7^\circ\text{C}$), SSP3-7.0 ($\sim 3.6^\circ\text{C}$), SSP5-8.5 ($\sim 4.4^\circ\text{C}$).

These future scenarios for CMIP projects are commonly the basis for future fire projections, and when we synthesize the results from the literature, we group SRES, RCP and SSP results into "low" (A1T, B1, RCP2.6, SSP1-2.6), "moderate" (A1B, RCP4.5, SSP2-4.5), and "severe" (A1FI, A2, RCP6, RCP8.5, SSP3-7.0, SSP5-8.5). Note that the 7 new scenarios for CMIP7 have similar names [116] (high,

Table S5: Description of fire-related indices

Keetch-Byram drought index (KBDI), a measure of soil moisture deficit, and a proxy for wildfire potential in [27, 92–94]
McArthur Forest Fire Danger Index (FFDI), an empirically derived weather-based index common in Australia and tropical regions [27, 95, 96]
Modified Nesterov Index (MNI), a meteorological fire-danger index used in Russia and Central Asia, and calculated from temperature, dew point, and precipitation [97]
Canadian Forest Fire Weather Index (FWI, [98]), an indicator of fire intensity based on meteorological conditions (used in [69, 77, 88, 99–104]), which includes components:
–Fine fuel moisture code (FFMC),
–Duff moisture code (DMC),
–drought code (DC), which track moisture in different forest floor layers (and used in [78, 103, 105–107])
–Initial spread index (ISI) for fire spread rate, based on winds, and,
–Buildup Index (BUI) for total fuel available ([78, 106, 108, 109])
Severity ratings, such as daily, monthly, and seasonal severity rating (DSR, MSR, SSR), used to weight higher FWI values and indicate greater suppression difficulty. Also cumulative severity rating (CSR) a weighted count of the number of days that are considered severe in a fire season [78, 99, 104, 107, 110, 111].
Potential spread days (PSD)
Extreme fire weather days (FWI exceeding the 95th percentile)
Fire season length (FSL) [79, 100, 103]
Fire potential, based on KBDI, as well as maximum temperature and precipitation [92], also used in Chile and Brazil to estimate hazard based on drought factors [112].
Fire probability, such as burn probability, conditional burn probability, and conditional flame length all are used to simulate fire spread and intensity [88, 113], and fire relative probability used in the Amazon for monthly fire occurrence [114].
Fire intensity describes how much energy a fire releases [111].

medium, medium-to-low, low, very low, and low-to-negative), but at the time of this publication, model results for fires are not yet available for those new scenarios.

Supplementary Note 5 Future fire projection data

The future fire projection data from the literature appear in Figures 4 (quantitative data on burned area and fire emissions from global studies) and Figure 5 (represented quantitative data from any fire metric from regional studies) of the main paper. Table S6 contains more details on where the data in Figures 4-5 came from, as well as additional quantitative data from the literature that was not possible to add to those figures.

Table S6: Quantitative data from the literature on future fire projections (end of century vs present day values), and, when possible, which figure in the main manuscript the data are represented in.

Ref	fire metric	scenario	region	reported data	percent change	figure	notes
[69]	risk	low	global	future: 28.95, present: 27.82	+4.06%	N/A	FWI (fwisa)
[69]	risk	moderate	global	future: 30.13, present: 27.82	+8.30%	N/A	
[69]	risk	high	global	future: 31.69, present: 27.82	+13.91%	N/A	
[69]	risk	high	global	future: 32.92, present: 27.82	+18.33%	N/A	
[103]	risk	high	global	+66.00%	+66.00%	N/A	mean fire weather increase in frequency and duration

Ref	fire metric	scenario	region	reported data	percent change	figure	notes
[68]	risk	moderate	global	+50.00%	+50.00%	N/A	lightning ignition risk global area with frequent fire prone conditions % increase in fire activity above preindustrial mean estimated from Fig 2a
[117]	risk	severe	global	+29.00%	+29.00%	N/A	
[118]	risk	low	global	future: 20%, present: 10%	+100%	N/A	
[118]	risk	moderate	global	future: 35%, present: 10%	+250%	N/A	
[118]	risk	severe	global	future: 14%, present: 10%	+40%	N/A	
[20]	emissions	moderate	global	future: 1.31 PgCyr ⁻¹ , 1.27 PgCyr ⁻¹ , 1.22 PgCyr ⁻¹ , 1.17 PgCyr ⁻¹ , 1.11 PgCyr ⁻¹ ; present: 1.28 PgCyr ⁻¹	-4.69%	Fig 4	
[20]	emissions	severe	global	future: 1.43 PgCyr ⁻¹ , 1.39 PgCyr ⁻¹ , 1.33 PgCyr ⁻¹ , 1.28 PgCyr ⁻¹ , 1.22 PgCyr ⁻¹ ; present: 1.28 PgCyr ⁻¹	+3.91%	Fig 4	
[67]	emissions	moderate	global	future: 2.4 PgCyr ⁻¹ , present: 2.0 PgCyr ⁻¹	+20%	Fig 4	
[67]	emissions	severe	global	future: 3 PgCyr ⁻¹ , present: 2.0 PgCyr ⁻¹	+50%	Fig 4	
[28]	emissions	low	global	future: 2535 Tgyr ⁻¹ , present: 2017 Tgyr ⁻¹	+25.68%	Fig 4	
[28]	emissions	severe	global	future: 2552 Tgyr ⁻¹ , present: 2017 Tgyr ⁻¹	+26.52%	Fig 4	1.5C warming, averaged all species
[45]	emissions	low	global	+8%	+8%	Fig 4	
[45]	emissions	moderate	global	+52%	+52%	Fig 4	
[45]	emissions	severe	global	+57%	+57%	Fig 4	
[72]	emissions	severe	global	future: 4.0 x 10 ³ Tgyr ⁻¹ , present: 2.7 x 10 ³ Tgyr ⁻¹	+48.2%	Fig 4	
[72]	emissions	severe	global	future: 2.8 x 10 ³ Tgyr ⁻¹ , present: 2.0 x 10 ³ Tgyr ⁻¹	+40%	Fig 4	
[25]	emissions	moderate	global	+17%	+17%	Fig 4	
[25]	emissions	moderate	global	+62%	+62%	Fig 4	
[48]	emissions	low	global	10-15.4%	+12.67%	Fig 4	

Ref	fire metric	scenario	region	reported data	percent change	figure	notes
[48]	emissions	moderate	global	15.1-22.5%	18%	Fig 4	2C warming, average for all species
[42]	burned area	moderate	global	+0.70%	+0.70%	Fig 4	prognostic lightning
[42]	burned area	severe	global	+26%	+26%	Fig 4	prognostic lightning
[42]	burned area	moderate	global	+7.8%	+7.8%	Fig 4	climatological lightning
[42]	burned area	severe	global	+42%	+42%	Fig 4	climatological lightning
[77]	burned area	low	global	+0.32 km ² yr ⁻¹ , present: 305 km ²	+8.91%	Fig 4	present-day values estimated from Fig 13
[77]	burned area	severe	global	+0.27 km ² yr ⁻¹ , present: 305 km ²	+7.52%	Fig 4	
[77]	burned area	severe	global	+0.89 km ² yr ⁻¹ , present: 305 km ²	+24.80%	Fig 4	
[67]	burned area	moderate	global	-6.0 Mha yr ⁻² , present: 466.6 Mha yr ⁻¹	-108%	Fig 4	
[67]	burned area	severe	global	+0.8 Mha yr ⁻¹	+16.00%	Fig 4	
[28]	burned area	low	global	+0.73 Mkm ² , present: 5.2 Mkm ² yr ⁻¹	+14.04%	Fig 4	present-day values estimated from Fig 2a
[28]	burned area	severe	global	+0.68 Mkm ² , present: 5.2 Mkm ² yr ⁻¹	+13.08%	Fig 4	
[1]	burned area	low	global	-0.03 Mha yr ⁻² , present: -4.85 Mha yr ⁻²	0%	Fig 4	
[1]	burned area	moderate	global	-1.69 Mha yr ⁻² , present: -4.85 Mha yr ⁻²	-20%	Fig 4	
[1]	burned area	severe	global	-0.58 Mha yr ⁻² , present: -4.85 Mha yr ⁻²	-10%	Fig 4	
[1]	burned area	severe	global	+0.88 Mha yr ⁻² , present: -4.85 Mha yr ⁻²	+11%	Fig 4	
[119]	burned area	low	global	future: 578.5 Mha, present: 587.6 Mha, -1.6%	-1.6 %	Fig 4	
[119]	burned area	low	global	future: 591.0 Mha, present: 587.6 Mha, +0.6%	+0.6%	Fig 4	
[119]	burned area	low	global	future: 606.8 Mha, present: 587.6 Mha, +3.3%	+3.3%	Fig 4	

Ref	fire metric	scenario	region	reported data	percent change	figure	notes
[119]	burned area	severe	global	future: 848.6 Mha, present: 587.6 Mha, +44.4%	+44.4%	Fig 4	
[119]	burned area	severe	global	future: 875.7 Mha, present: 587.6 Mha, +49.0%	+49.0%	Fig 4	
[70]	burned area	low	global	future: 465.86 Mha, present: 326.83 Mha	+42%	Fig 4	
[70]	burned area	moderate	global	future: 507.46 Mha, present: 326.83 Mha	+55%	Fig 4	
[70]	burned area	severe	global	future: 617.43 Mha, present: 326.83 Mha	+89%	Fig 4	
[70]	burned area	severe	global	future: 695.24 Mha, present: 326.83 Mha	+113%	Fig 4	
[65]	burned area	low	global	+5.50%	+5.50%	Fig 4	
[65]	burned area	moderate	global	+9.30%	+9.30%	Fig 4	
[65]	burned area	severe	global	+13.20%	+13.20%	Fig 4	
[65]	burned area	severe	global	+16.10%	+16.10%	Fig 4	
[120]	burned area	moderate	global	future: 2.89 Mkm ² , present: 3.43 Mkm ²	-15.74%	Fig 4	
[120]	burned area	moderate	global	future: 3.16 Mkm ² , present: 3.43 km ²	-7.9%	Fig 4	
[120]	burned area	severe	global	future: 3.16 Mkm ² , present: 3.43 km ²	-7.9%	Fig 4	
[120]	burned area	severe	global	future: 3.42 Mkm ² , present: 3.43 Mkm ²	-0.3%	Fig 4	
[34]	fire season length	severe	Fennoscandia	+52 days	+50%	Fig 5	
[34]	fire season length	moderate	Fennoscandia	+20 days	+20%	N/A	
[11]	burned area	severe	Europe	1.8 times increase			
[41]	burned area	severe	Canada	future: 11.7 Mha, present: 2.5 Mha	+414%	Fig 5	
[23]	emissions	moderate	Western US forests	+53%	+53%		wildfire smoke PM concentrations
[23]	emissions	severe	Western US forests	+100%	+100%		
[32]	emissions	low	Tropics	future: 0.78 Tgyr ⁻¹ , present: 1.11 Tg yr ⁻¹	-30%	Fig 5	wildfire BC emission fluxes
[32]	emissions	moderate	Tropics	future: 0.95 Tgyr ⁻¹ , present: 1.11 Tg yr ⁻¹	-14.4%	Fig 5	
[32]	emissions	moderate	Tropics	future: 0.70 Tgyr ⁻¹ , present: 1.11 Tg yr ⁻¹	-37%	Fig 5	
[25]	emissions	moderate	Southern Hemisphere South America	+0.20 TgCyr ⁻¹ , +0.57 TgCyr ⁻¹		Fig 5	results from two models
[26]	burned area	moderate	EU	+39.2%	+39.2%	Fig 5	
[26]	emissions	moderate	EU	+88.6%	+88.6%	Fig 5	

Ref	fire metric	scenario	region	reported data	percent change	figure	notes
[31]	mean fire interval	moderate	Pacific NW USA	-38.9%	-38.9%	Fig 5	fire module includes a fire suppression option
[31]	mean fire interval	severe	Pacific NW USA	-50.8%	-50.8%	Fig 5	
[31]	burned area	moderate	Pacific NW USA	+16.1%	+16.1%	Fig 5	
[31]	burned area	severe	Pacific NW USA	+18.6%	+18.6%	Fig 5	
[42]	burned area	moderate	Northern mid-latitudes	+7.8%	+7.8%	Fig 5	climatological lightning
[42]	burned area	moderate	Northern mid-latitudes	+15%	+15%	Fig 5	prognostic lightning
[42]	burned area	severe	Northern mid-latitudes	+16%	+16%	Fig 5	climatological lightning
[42]	burned area	severe	Northern mid-latitudes	+48%	+48%	Fig 5	prognostic lightning
[42]	burned area	moderate	Tropics	+7%	+7%	Fig 5	climatological lightning
[42]	burned area	moderate	Tropics	-1.5%	-1.5%	Fig 5	prognostic lightning
[42]	burned area	severe	Tropics	+41%	+41%	Fig 5	climatological lightning
[42]	burned area	severe	Tropics	+23%	+23%	Fig 5	prognostic lightning
[42]	burned area	moderate	Arctic	+15%	+15%	Fig 5	climatological lightning
[42]	burned area	moderate	Arctic	-21%	-21%	Fig 5	prognostic lightning
[42]	burned area	severe	Arctic	+132%	+132%	Fig 5	climatological lightning
[42]	burned area	severe	Arctic	+5%	+5%	Fig 5	prognostic lightning
[78]	Changes in FPMC	low	Canada	+1.0%	+1.0%	N/A	spatial mean percent difference of 95th percentile of daily values for MJJAS season
[78]	Changes in FPMC	moderate	Canada	+1.5%	+1.5%	N/A	
[78]	Changes in FPMC	severe	Canada	+2.4%	+2.4%	N/A	
[96]	seasonal FWI	moderate	Northern California	+62.47%	+62.47%	Fig 5	

Ref	fire metric	scenario	region	reported data	percent change	figure	notes
[96]	seasonal FWI	severe	Northern California	+63.63%	+63.63%	Fig 5	
[96]	seasonal FWI	moderate	Southern California	+48.61%	+48.61%	Fig 5	
[96]	seasonal FWI	severe	Southern California	+50.19%	+50.19%	Fig 5	
[121]	annual fire occurrence	moderate	Cascade Range	+63%	+63%	N/A	
[121]	annual fire occurrence	severe	Cascade Range	+122%	+122%	N/A	
[121]	annual fire occurrence	moderate	Coastal CA Mountains	+38%	+38%	N/A	
[121]	annual fire occurrence	severe	Coastal CA Mountains	+67%	+67%	N/A	
[122]	FFMC	low	Eastern Canada	future: 79.0, present: 79.5	-0.6%	Fig 5	
[122]	FFMC	moderate	Eastern Canada	future: 79.5, present: 79.5	0%	Fig 5	
[122]	FFMC	severe	Eastern Canada	future: 80.9, present: 79.5	+1.8%	Fig 5	
[90]	risk	low	Brazilian Cerrado	future: 14.83, present: 13.58	+9.20%	Fig 5	Corrected fire season averaged DSR
[90]	risk	moderate	Brazilian Cerrado	future: 17.05, present: 13.58	+25.55%	Fig 5	
[90]	risk	severe	Brazilian Cerrado	future: 21.11, present: 13.58	+55.45%	Fig 5	
[90]	burned area	low	Brazilian Cerrado	future: 9.01 Mha, present: 8.11 Mha	-11.10%	Fig 5	
[90]	burned area	moderate	Brazilian Cerrado	future: 11.27 Mha, present: 8.11 Mha	+38.96%	Fig 5	
[90]	burned area	severe	Brazilian Cerrado	future: 15.82 Mha, present: 8.11 Mha	+95.07%	Fig 5	
[97]	risk	low	Central Asia	+32%	+32%	Fig 5	
[97]	risk	moderate	Central Asia	+84%	+84%	Fig 5	
[97]	risk	severe	Central Asia	+146%	+146%	Fig 5	
[110]	risk	moderate	Canada, Russia	2-3 times increase	+100-200%	Fig 5	
[101]	risk	moderate	Mediterranean Basin	+14%	+14%	Fig 5	frequency of heat-induced fire-weather
[75]	risk	severe	Northeast China	+57.1%	+57.1%	N/A	
[114]	risk	moderate	Brazilian Amazon	+21.3%	+21.3%	Fig 5	increase in area with fire relative probability (FRP) ≥ 0.3 (%)
[114]	risk	severe	Brazilian Amazon	+113.5%	+113.5%	Fig 5	

Ref	fire metric	scenario	region	reported data	percent change	figure	notes
[88]	risk	moderate	SW Greece	future: 28.52, present: 21.25	+34.2%	N/A	FWI averaged across 6-month range
[87]	burned area	moderate	Iberian Peninsula	2-3 x increase	+100-200%	N/A	
[102]	risk	moderate	Contiguous US	future: 47 days/year, present: 28.5 days/year	+64.91%	Fig 5	number of annual days of synchronous fire danger
[51]	burned area	low	EU-Mediterranean	future: 671346 ha, present: 404113 ha	+66%	Fig 5	increase in Seasonal Severity Rating (SSR)
[51]	burned area	severe	EU-Mediterranean	future: 969910 ha, present: 404113 ha	+140%	Fig 5	
[51]	risk	low	EU-Mediterranean	future: 6.64, present: 5.3	+25%	Fig 5	
[51]	risk	severe	EU-Mediterranean	future: 7.34, present: 5.3	+38%	Fig 5	
[85]	large fire days	moderate	Southern California	future: 58 days/year, present: 36 days/year	+61%	N/A	
[85]	large fire days	severe	Southern California	future: 71 days/year, present: 36 days/year	+97%	N/A	
[64]	forest fire hazard	low	European Alps	+15.5%	+15.5%	N/A	
[64]	forest fire hazard	moderate	European Alps	+30.6%	+30.6%	N/A	
[64]	forest fire hazard	severe	European Alps	+35.4%	+35.4%	N/A	
[52]	burned area	low	Mediterranean, Chania province	+18%	+18%	Fig 5	
[52]	burned area	moderate	Mediterranean, Chania province	+25%	+25%	Fig 5	
[52]	burned area	severe	Mediterranean, Chania province	+21%	+21%	Fig 5	
[57]	burned area	severe	Corisca	+21%	+21%	N/A	
[83]	burned area	moderate	Western US	future: $115.3 \cdot 10^4$ ha, present: $96.5 \cdot 10^4$ ha	+116%	N/A	
[84]	burned area	moderate	Western US	future: 14059 km^2 , present: 6508 km^2	+19.5%	N/A	
[84]	emissions	moderate	Western US	future: 238 GgCyr^{-1} , present: 133 GgCyr^{-1}	+78.9%	N/A	organic carbon emissions mid-century projections
[62]	burned area	moderate	Western US	+54%	+54%	N/A	

Ref	fire metric	scenario	region	reported data	percent change	figure	notes
[62]	emissions	moderate	Western US	+40%	+40%	N/A	organic carbon aerosol concentrations increase forest area projected to have increase in fire occurrence average increase in fire occurrence average area expected to have an increase in burned area stationary model
[123]	risk	across scenarios	China	+60-70%	+60-70%	Fig 5	
[123]	risk	across scenarios	China	+16.7%	+16.7%	Fig 5	
[123]	burned area	across scenarios	China	+63-64%	+63-64%	Fig 5	
[86]	burned area	low	Mediterranean Europe	+54%	+54%	Fig 5	
[86]	burned area	moderate	Mediterranean Europe	+87%	+87%	Fig 5	
[86]	burned area	severe	Mediterranean Europe	+187%	+187%	Fig 5	
[76]	burned area	severe	Alaska	4x increase per decade	+40% per year	Fig 5	
[76]	burned area	severe	Western Canada	5.7x increase per decade	+57% per year	Fig 5	averaged across three models
[81]	emissions	low	Western North America	+81%	+81%	N/A	
[81]	emissions	moderate	Western North America	+122%	+122%	N/A	
[81]	emissions	severe	Western North America	+212%	+212%	N/A	
[82]	lightning-ignited fire days	Western US	severe	+2.13 days		N/A	average taken across all subregions for mid-century vs present, range from different models "
[113]	fire frequency	severe	Southern California, central coast	-0.23 to +0.36 num/1000km ²		N/A	
[113]	fire frequency	severe	Southern California, southern coast	-0.11 to +0.41 num/1000km ²		N/A	
[113]	fire size	severe	Southern California, central coast	-3.19 to +5.43 km ²		N/A	"

Ref	fire metric	scenario	region	reported data	percent change	figure	notes
[113]	fire size	severe	Southern California, southern coast	-3.07 to +04.28km ²		N/A	"

References

- [1] Wu, C., Venevsky, S., Sitch, S., Mercado, L.M., Huntingford, C., Staver, A.C.: Historical and future global burned area with changing climate and human demography. *One Earth* **4**(4), 517–530 (2021) <https://doi.org/10.1016/j.oneear.2021.03.002>
- [2] Williams, N.G., Lucash, M.S., Ouellette, M.R., Brussel, T., Gustafson, E.J., Weiss, S.A., Sturtevant, B.R., Schepaschenko, D.G., Shvidenko, A.Z.: Simulating dynamic fire regime and vegetation change in a warming Siberia. *Fire Ecology* **19**(1), 33 (2023) <https://doi.org/10.1186/s42408-023-00188-1>
- [3] Corning, S., Krasovskiy, A., Kiparisov, P., Pedro, J.S., Viana, C.M., Kraxner, F.: Anticipating Future Risks of Climate-Driven Wildfires in Boreal Forests. *Fire* **7**(4), 144 (2024) <https://doi.org/10.3390/fire7040144>
- [4] Goodrick, S.L., Achtemeier, G.L., Larkin, N.K., Liu, Y., Strand, T.M.: Modelling smoke transport from wildland fires: A review. *International Journal of Wildland Fire* **22**(1), 83–94 (2012) <https://doi.org/10.1071/WF11116>
- [5] Paugam, R., Wooster, M., Freitas, S., Val Martin, M.: A review of approaches to estimate wildfire plume injection height within large-scale atmospheric chemical transport models. *Atmospheric Chemistry and Physics* **16**(2), 907–925 (2016) <https://doi.org/10.5194/acp-16-907-2016>
- [6] Pavlovic, R., Chen, J., Anderson, K., Moran, M.D., Beaulieu, P.-A., Davignon, D., Cousineau, S.: The FireWork air quality forecast system with near-real-time biomass burning emissions: Recent developments and evaluation of performance for the 2015 North American wildfire season. *Journal of the Air & Waste Management Association* **66**(9), 819–841 (2016) <https://doi.org/10.1080/10962247.2016.1158214>
- [7] Jones, M.W., Abatzoglou, J.T., Veraverbeke, S., Andela, N., Lasslop, G., Forkel, M., Smith, A.J.P., Burton, C., Betts, R.A., Van Der Werf, G.R., Sitch, S., Canadell, J.G., Santín, C., Kolden, C., Doerr, S.H., Le Quéré, C.: Global and Regional Trends and Drivers of Fire Under Climate Change. *Reviews of Geophysics* **60**(3), 2020–000726 (2022) <https://doi.org/10.1029/2020RG000726>
- [8] Li, F., Zeng, X.D., Levis, S.: A process-based fire parameterization of intermediate complexity in a Dynamic Global Vegetation Model. *Biogeosciences* **9**(7), 2761–2780 (2012) <https://doi.org/10.5194/bg-9-2761-2012>
- [9] Li, F., Levis, S., Ward, D.S.: Quantifying the role of fire in the Earth system – Part 1: Improved global fire modeling in the Community Earth System Model (CESM1). *Biogeosciences* **10**(4), 2293–2314 (2013) <https://doi.org/10.5194/bg-10-2293-2013>
- [10] Li, F., Lawrence, D.M., Bond-Lamberty, B.: Impact of fire on global land surface air temperature and energy budget for the 20th century due to changes within ecosystems. *Environmental Research Letters* **12**(4), 044014 (2017) <https://doi.org/10.1088/1748-9326/aa6685>
- [11] Wu, M., Knorr, W., Thonicke, K., Schurgers, G., Camia, A., Arneth, A.: Sensitivity of burned area in Europe to climate change, atmospheric CO₂ levels, and demography: A comparison of

- two fire-vegetation models. *Journal of Geophysical Research: Biogeosciences* **120**(11), 2256–2272 (2015) <https://doi.org/10.1002/2015JG003036>
- [12] Pechony, O., Shindell, D.T.: Fire parameterization on a global scale. *Journal of Geophysical Research: Atmospheres* **114**(D16) (2009) <https://doi.org/10.1029/2009JD011927>
- [13] Tian, C., Yue, X., Zhu, J., Liao, H., Yang, Y., Lei, Y., Zhou, X., Zhou, H., Ma, Y., Cao, Y.: Fire–climate interactions through the aerosol radiative effect in a global chemistry–climate–vegetation model. *Atmospheric Chemistry and Physics* **22**(18), 12353–12366 (2022) <https://doi.org/10.5194/acp-22-12353-2022>
- [14] Huang, Y., Wu, S., Kaplan, J.O.: Sensitivity of global wildfire occurrences to various factors in the context of global change. *Atmospheric Environment* **121**, 86–92 (2015) <https://doi.org/10.1016/j.atmosenv.2015.06.002>
- [15] Yukimoto, S., Kawai, H., Koshiro, T., Oshima, N., Yoshida, K., Urakawa, S., Tsujino, H., Deushi, M., Tanaka, T., Hosaka, M., Yabu, S., Yoshimura, H., Shindo, E., Mizuta, R., Obata, A., Adachi, Y., Ishii, M.: The meteorological research institute earth system model version 2.0, mri-esm2.0: Description and basic evaluation of the physical component. *Journal of the Meteorological Society of Japan. Ser. II* **97**(5), 931–965 (2019) <https://doi.org/10.2151/jmsj.2019-051>
- [16] Allen, R.J., Samset, B.H., Wilcox, L.J., Fisher, R.A.: Are Northern Hemisphere boreal forest fires more sensitive to future aerosol mitigation than to greenhouse gas-driven warming? *Science Advances* **10**(13), 4007 (2024) <https://doi.org/10.1126/sciadv.adl4007>
- [17] Thonicke, K., Spessa, A., Prentice, I.C., Harrison, S.P., Dong, L., Carmona-Moreno, C.: The influence of vegetation, fire spread and fire behaviour on biomass burning and trace gas emissions: Results from a process-based model. *Biogeosciences* **7**(6), 1991–2011 (2010) <https://doi.org/10.5194/bg-7-1991-2010>
- [18] Li, F., Val Martin, M., Andreae, M.O., Arneth, A., Hantson, S., Kaiser, J.W., Lasslop, G., Yue, C., Bachelet, D., Forrest, M., Kluzek, E., Liu, X., Mangeon, S., Melton, J.R., Ward, D.S., Darmenov, A., Hickler, T., Ichoku, C., Magi, B.I., Sitch, S., van der Werf, G.R., Wiedinmyer, C., Rabin, S.S.: Historical (1700–2012) global multi-model estimates of the fire emissions from the Fire Modeling Intercomparison Project (FireMIP). *Atmospheric Chemistry and Physics* **19**(19), 12545–12567 (2019) <https://doi.org/10.5194/acp-19-12545-2019>
- [19] Hantson, S., Kelley, D.I., Arneth, A., Harrison, S.P., Archibald, S., Bachelet, D., Forrest, M., Hickler, T., Lasslop, G., Li, F., Mangeon, S., Melton, J.R., Nieradzick, L., Rabin, S.S., Prentice, I.C., Sheehan, T., Sitch, S., Teckentrup, L., Voulgarakis, A., Yue, C.: Quantitative assessment of fire and vegetation properties in simulations with fire-enabled vegetation models from the Fire Model Intercomparison Project. *Geoscientific Model Development* **13**(7), 3299–3318 (2020) <https://doi.org/10.5194/gmd-13-3299-2020>
- [20] Knorr, W., Arneth, A., Jiang, L.: Demographic controls of future global fire risk. *Nature Climate Change* **6**(8), 781–785 (2016) <https://doi.org/10.1038/nclimate2999>
- [21] Li, F., Song, X., Harrison, S.P., Marlon, J.R., Lin, Z., Leung, L.R., Schwinger, J., Marécal, V., Wang, S., Ward, D.S., Dong, X., Lee, H., Nieradzick, L., Rabin, S.S., Séférian, R.: Evaluation of global fire simulations in CMIP6 Earth system models. *Geoscientific Model Development* **17**(23), 8751–8771 (2024) <https://doi.org/10.5194/gmd-17-8751-2024>
- [22] Pfeiffer, M., Spessa, A., Kaplan, J.O.: A model for global biomass burning in preindustrial time: LPJ-LMfire (v1.0). *Geoscientific Model Development* **6**(3), 643–685 (2013) <https://doi.org/10.5194/gmd-6-643-2013>

- [23] Li, Y., Mickley, L.J., Liu, P., Kaplan, J.O.: Trends and spatial shifts in lightning fires and smoke concentrations in response to 21st century climate over the national forests and parks of the western United States. *Atmospheric Chemistry and Physics* **20**(14), 8827–8838 (2020) <https://doi.org/10.5194/acp-20-8827-2020>
- [24] Kloster, S., Mahowald, N.M., Randerson, J.T., Thornton, P.E., Hoffman, F.M., Levis, S., Lawrence, P.J., Feddesma, J.J., Oleson, K.W., Lawrence, D.M.: Fire dynamics during the 20th century simulated by the Community Land Model. *Biogeosciences* **7**(6), 1877–1902 (2010) <https://doi.org/10.5194/bg-7-1877-2010>
- [25] Kloster, S., Mahowald, N.M., Randerson, J.T., Lawrence, P.J.: The impacts of climate, land use, and demography on fires during the 21st century simulated by CLM-CN. *Biogeosciences* **9**(1), 509–525 (2012) <https://doi.org/10.5194/bg-9-509-2012>
- [26] Migliavacca, M., Dosio, A., Camia, A., Hobourg, R., Houston-Durrant, T., Kaiser, J.W., Khabarov, N., Krasovskii, A.A., Marcolla, B., San Miguel-Ayanz, J., Ward, D.S., Cescatti, A.: Modeling biomass burning and related carbon emissions during the 21st century in Europe. *Journal of Geophysical Research: Biogeosciences* **118**(4), 1732–1747 (2013) <https://doi.org/10.1002/2013JG002444>
- [27] Peng, X., Yu, M., Chen, H., Zhou, B., Shi, Y., Yu, L.: Projections of wildfire risk and activities under 1.5 °C and 2.0 °C global warming scenarios. *Environmental Research Communications* **5**(3), 031002 (2023) <https://doi.org/10.1088/2515-7620/acbf13>
- [28] Bhattacharai, H., Val Martin, M., Sitch, S., Yung, D.H.Y., Tai, A.P.K.: Global wildfire patterns and drivers under climate change. *Biogeosciences* **22**(23), 7591–7610 (2025) <https://doi.org/10.5194/bg-22-7591-2025>
- [29] Verjans, V., Franzke, C.L.E., Lee, S.-S., Kim, I.-W., Tilmes, S., Lawrence, D.M., Vitt, F., Li, F.: Quantifying CO₂ forcing effects on lightning, wildfires, and climate interactions. *Science Advances* **11**(7), 5088 (2025) <https://doi.org/10.1126/sciadv.adt5088>
- [30] Sarangi, C., Qian, Y., Leung, L.R., Zhang, Y., Zou, Y., Wang, Y.: Projected increases in wild-fires may challenge regulatory curtailment of PM_{2.5} over the eastern US by 2050. *Atmospheric Chemistry and Physics* **23**(2), 1769–1783 (2023) <https://doi.org/10.5194/acp-23-1769-2023>
- [31] Sheehan, T., Bachelet, D., Ferschweiler, K.: Projected major fire and vegetation changes in the Pacific Northwest of the conterminous United States under selected CMIP5 climate futures. *Ecological Modelling* **317**, 16–29 (2015) <https://doi.org/10.1016/j.ecolmodel.2015.08.023>
- [32] Veira, A., Lasslop, G., Kloster, S.: Wildfires in a warmer climate: Emission fluxes, emission heights, and black carbon concentrations in 2090–2099. *Journal of Geophysical Research: Atmospheres* **121**(7), 3195–3223 (2016) <https://doi.org/10.1002/2015JD024142>
- [33] D’Onofrio, D., Baudena, M., Lasslop, G., Nieradzik, L.P., Wärlind, D., von Hardenberg, J.: Linking Vegetation-Climate-Fire Relationships in Sub-Saharan Africa to Key Ecological Processes in Two Dynamic Global Vegetation Models. *Frontiers in Environmental Science* **8** (2020) <https://doi.org/10.3389/fenvs.2020.00136>
- [34] Kinnunen, O., Backman, L., Aalto, J., Aalto, T., Markkanen, T.: Projected changes in forest fire season, the number of fires, and burnt area in Fennoscandia by 2100. *Biogeosciences* **21**(21), 4739–4763 (2024) <https://doi.org/10.5194/bg-21-4739-2024>
- [35] Teixeira, J.C.M., Burton, C., Kelley, D.I., Folberth, G.A., O’Connor, F.M., Betts, R.A., Voulgarakis, A.: Improving historical trends in the INFERNO fire model using the Human Development

Index. EGU sphere, 1–43 (2025) <https://doi.org/10.5194/egusphere-2025-3066>

- [36] Burton, C., Kelley, D.I., Jones, C.D., Betts, R.A., Cardoso, M., Anderson, L.: South American fires and their impacts on ecosystems increase with continued emissions. *Climate Resilience and Sustainability* **1**(1), 8 (2022) <https://doi.org/10.1002/cli2.8>
- [37] Teixeira, J.C., Folberth, G.A., O’Connor, F.M., Unger, N., Voulgarakis, A.: Coupling interactive fire with atmospheric composition and climate in the UK Earth System Model. *Geoscientific Model Development* **14**(10), 6515–6539 (2021) <https://doi.org/10.5194/gmd-14-6515-2021>
- [38] Arora, V.K., Boer, G.J.: Fire as an interactive component of dynamic vegetation models. *Journal of Geophysical Research: Biogeosciences* **110**(G2) (2005) <https://doi.org/10.1029/2005JG000042>
- [39] Arora, V.K., Melton, J.R.: Reduction in global area burned and wildfire emissions since 1930s enhances carbon uptake by land. *Nature Communications* **9**(1), 1326 (2018) <https://doi.org/10.1038/s41467-018-03838-0>
- [40] Melton, J.R., Arora, V.K., Wisernig-Cojoc, E., Seiler, C., Fortier, M., Chan, E., Teckentrup, L.: CLASSIC v1.0: The open-source community successor to the Canadian Land Surface Scheme (CLASS) and the Canadian Terrestrial Ecosystem Model (CTEM) – Part 1: Model framework and site-level performance. *Geoscientific Model Development* **13**(6), 2825–2850 (2020) <https://doi.org/10.5194/gmd-13-2825-2020>
- [41] Curasi, S.R., Melton, J.R., Arora, V.K., Humphreys, E.R., Whaley, C.H.: Global climate change below 2 °C avoids large end century increases in burned area in Canada. *npj Climate and Atmospheric Science* **7**(1), 228 (2024) <https://doi.org/10.1038/s41612-024-00781-4>
- [42] Whaley, C., Etten-Bohm, M., Schumacher, C., Akingunola, A., Arora, V., Cole, J., Lazare, M., Plummer, D., Von Salzen, K., Winter, B.: A new lightning scheme in the Canadian Atmospheric Model (CanAM5.1): Implementation, evaluation, and projections of lightning and fire in future climates. *Geoscientific Model Development* **17**(18), 7141–7155 (2024) <https://doi.org/10.5194/gmd-17-7141-2024>
- [43] Rabin, S.S., Ward, D.S., Malyshev, S.L., Magi, B.I., Shevliakova, E., Pacala, S.W.: A fire model with distinct crop, pasture, and non-agricultural burning: Use of new data and a model-fitting algorithm for FINAL.1. *Geoscientific Model Development* **11**(2), 815–842 (2018) <https://doi.org/10.5194/gmd-11-815-2018>
- [44] Moorcroft, P.R., Hurtt, G.C., Pacala, S.W.: A Method for Scaling Vegetation Dynamics: The Ecosystem Demography Model (ed). *Ecological Monographs* **71**(4), 557–586 (2001) [https://doi.org/10.1890/0012-9615\(2001\)071\[0557:AMFSVD\]2.0.CO;2](https://doi.org/10.1890/0012-9615(2001)071[0557:AMFSVD]2.0.CO;2)
- [45] Kloster, S., Lasslop, G.: Historical and future fire occurrence (1850 to 2100) simulated in CMIP5 Earth System Models. *Global and Planetary Change* **150**, 58–69 (2017) <https://doi.org/10.1016/j.gloplacha.2016.12.017>
- [46] Mezuman, K., Tsigaridis, K., Faluvegi, G., Bauer, S.E.: The interactive global fire module pyrE (v1.0). *Geoscientific Model Development* **13**(7), 3091–3118 (2020) <https://doi.org/10.5194/gmd-13-3091-2020>
- [47] Yue, C., Ciais, P., Cadule, P., Thonicke, K., van Leeuwen, T.T.: Modelling the role of fires in the terrestrial carbon balance by incorporating SPITFIRE into the global vegetation model ORCHIDEE – Part 2: Carbon emissions and the role of fires in the global carbon balance. *Geoscientific Model Development* **8**(5), 1321–1338 (2015) <https://doi.org/10.5194/gmd-8-1321-2015>
- [48] Tian, C., Yue, X., Zhu, J., Liao, H., Yang, Y., Chen, L., Zhou, X., Lei, Y., Zhou, H., Cao, Y.:

Projections of fire emissions and the consequent impacts on air quality under 1.5 °C and 2 °C global warming. *Environmental Pollution* **323**, 121311 (2023) <https://doi.org/10.1016/j.envpol.2023.121311>

- [49] Preisler, H.K., Westerling, A.L.: Statistical model for forecasting monthly large wildfire events in western united states. *Journal of Applied Meteorology and Climatology* **46**(7), 1020–1030 (2007)
- [50] Phelps, N., Woolford, D.G.: Comparing calibrated statistical and machine learning methods for wildland fire occurrence prediction: A case study of human-caused fires in lac la biche, alberta, canada. *International journal of wildland fire* **30**(11), 850–870 (2021)
- [51] Amatulli, G., Camia, A., San-Miguel-Ayanz, J.: Estimating future burned areas under changing climate in the EU-Mediterranean countries. *Science of The Total Environment* **450–451**, 209–222 (2013) <https://doi.org/10.1016/j.scitotenv.2013.02.014>
- [52] Van Der Schriek, T., Varotsos, K.V., Karali, A., Giannakopoulos, C.: Wildfire Burnt Area and Associated Greenhouse Gas Emissions under Future Climate Change Scenarios in the Mediterranean: Developing a Robust Estimation Approach. *Fire* **7**(9), 324 (2024) <https://doi.org/10.3390/fire7090324>
- [53] Sheriff, R., Meer, M.S., Aslam, R.W., Said, Y.: Machine Learning-Based Forest Fire Susceptibility Mapping Using Random Forest and CART Models. *Rangeland Ecology & Management* **102**, 96–109 (2025) <https://doi.org/10.1016/j.rama.2025.06.004>
- [54] McNorton, J.R., Di Giuseppe, F., Pinnington, E., Chantry, M., Barnard, C.: A Global Probability-Of-Fire (PoF) Forecast. *Geophysical Research Letters* **51**(12), 2023–107929 (2024) <https://doi.org/10.1029/2023GL107929>
- [55] Alkhatib, R., Sahwan, W., Alkhatieb, A., Schütt, B.: A Brief Review of Machine Learning Algorithms in Forest Fires Science. *Applied Sciences* **13**(14), 8275 (2023) <https://doi.org/10.3390/app13148275>
- [56] Jaafari, A., Zenner, E.K., Panahi, M., Shahabi, H.: Hybrid artificial intelligence models based on a neuro-fuzzy system and metaheuristic optimization algorithms for spatial prediction of wildfire probability. *Agricultural and Forest Meteorology* **266–267**, 198–207 (2019) <https://doi.org/10.1016/j.agrformet.2018.12.015>
- [57] Allaire, F., Mallet, V., Filippi, J.-B.: Emulation of wildland fire spread simulation using deep learning. *Neural Networks* **141**, 184–198 (2021) <https://doi.org/10.1016/j.neunet.2021.04.006>
- [58] Lattimer, B.Y., Hodges, J.L., Lattimer, A.M.: Using machine learning in physics-based simulation of fire. *Fire Safety Journal* **114**, 102991 (2020) <https://doi.org/10.1016/j.firesaf.2020.102991>
- [59] Li, F., Zhu, Q., Riley, W.J., Zhao, L., Xu, L., Yuan, K., Chen, M., Wu, H., Gui, Z., Gong, J., Randerson, J.T.: AttentionFire_v1.0: Interpretable machine learning fire model for burned-area predictions over tropics. *Geoscientific Model Development* **16**(3), 869–884 (2023) <https://doi.org/10.5194/gmd-16-869-2023>
- [60] Forkel, M., Andela, N., Harrison, S.P., Lasslop, G., van Marle, M., Chuvieco, E., Dorigo, W., Forrest, M., Hantson, S., Heil, A., Li, F., Melton, J., Sitch, S., Yue, C., Arneeth, A.: Emergent relationships with respect to burned area in global satellite observations and fire-enabled vegetation models. *Biogeosciences* **16**(1), 57–76 (2019) <https://doi.org/10.5194/bg-16-57-2019>
- [61] Kavhu, B., Forrest, M., Hickler, T.: Development of a statistical model for global burned area simulation within a DGVM-compatible framework. *Biogeosciences* **22**(22), 7001–7030 (2025) <https://doi.org/10.5194/bg-22-7001-2025>

- [62] Spracklen, D.V., Mickley, L.J., Logan, J.A., Hudman, R.C., Yevich, R., Flannigan, M.D., West-
erling, A.L.: Impacts of climate change from 2000 to 2050 on wildfire activity and carbonaceous
aerosol concentrations in the western united states. *Journal of Geophysical Research: Atmospheres*
114(D20) (2009)
- [63] Pham, B.T., Jaafari, A., Avand, M., Al-Ansari, N., Du, T.D., Yen, H.P.H., Phong, T.V., Nguyen,
D.H., Le, H.V., Mafi-Gholami, D., Prakash, I., Thuy, H.T., Tuyen, T.T.: Performance Evaluation
of Machine Learning Methods for Forest Fire Modeling and Prediction. *Symmetry* **12**(6) (2020)
<https://doi.org/10.3390/sym12061022>
- [64] Gerberding, K., Schirpke, U.: Mapping the probability of forest fire hazard across the European
Alps under climate change scenarios. *Journal of Environmental Management* **377**, 124600 (2025)
<https://doi.org/10.1016/j.jenvman.2025.124600>
- [65] Yang, X., Urban, M.C., Su, B., Zhong, Z., Wu, C., Chen, D.: Wildfire risk for species under climate
change. *Nature Climate Change*, 1–9 (2026) <https://doi.org/10.1038/s41558-026-02600-5>
- [66] Yang, C., Yao, P., Wang, Q., Wang, S., Xing, D., Wang, Y., Zhang, J.: XGBoost-Based Suscep-
tibility Model Exhibits High Accuracy and Robustness in Plateau Forest Fire Prediction. *Forests*
17(1) (2026) <https://doi.org/10.3390/f17010074>
- [67] Zhao, J., Zheng, B., Ciais, P., Chen, Y., Gasser, T., Canadell, J.G., Zhang, L., Zhang, Q.: Global
warming amplifies wildfire health burden and reshapes inequality. *Nature* **647**(8091), 928–934
(2025) <https://doi.org/10.1038/s41586-025-09612-9>
- [68] Shmuel, A., Lazebnik, T., Glickman, O., Heifetz, E., Price, C.: Global lightning-ignited wildfires
prediction and climate change projections based on explainable machine learning models. *Scientific*
Reports **15**(1), 7898 (2025) <https://doi.org/10.1038/s41598-025-92171-w>
- [69] Gallo, C., Dieppois, B., Quilcaille, Y., Chiriaco, M.V., Fulé, P.Z., Drobyshev, I., San-Miguel-Ayanz,
J., Blackett, M., Eden, J.M.: Future Impacts of Climate Change on Global Fire Weather: Insight
from Weighted CMIP6 Multimodel Ensembles. *Journal of Climate* (2025) <https://doi.org/10.1175/JCLI-D-24-0540.1>
- [70] Zhang, G., Wang, M., Yang, B., Liu, K.: Current and Future Patterns of Global Wildfire Based
on Deep Neural Networks. *Earth’s Future* **12**(2), 2023–004088 (2024) <https://doi.org/10.1029/2023EF004088>
- [71] Wang, X., Di, Z., Zhang, W., Zhang, S., Sun, H., Tian, X., Meng, H., Wang, X.: Evaluation and
Projection of Global Burned Area Based on Global Climate Models and Satellite Fire Product.
Remote Sensing **16**(24), 4751 (2024) <https://doi.org/10.3390/rs16244751>
- [72] Yu, Y., Mao, J., Wullschleger, S.D., Chen, A., Shi, X., Wang, Y., Hoffman, F.M., Zhang, Y., Pierce,
E.: Machine learning-based observation-constrained projections reveal elevated global socioeco-
nomic risks from wildfire. *Nature Communications* **13**(1), 1250 (2022) <https://doi.org/10.1038/s41467-022-28853-0>
- [73] Wang, S.S.-C., Qian, Y., Leung, L.R., Zhang, Y.: Interpreting machine learning prediction of
fire emissions and comparison with FireMIP process-based models. *Atmospheric Chemistry and*
Physics **22**(5), 3445–3468 (2022) <https://doi.org/10.5194/acp-22-3445-2022>
- [74] Moritz, M.A., Parisien, M.-A., Batllori, E., Krawchuk, M.A., Van Dorn, J., Ganz, D.J., Hayhoe,
K.: Climate change and disruptions to global fire activity. *Ecosphere* **3**(6), 1–22 (2012) <https://doi.org/10.1890/ES11-00345.1>
- [75] Debulois, S.G.P., Sun, M., Li, M.: Projection of fire weather index in Daxing’anling, Northeast

- China using a machine learning-based CMIP6 multi-model ensemble. *Climatic Change* **179**(3), 47 (2026) <https://doi.org/10.1007/s10584-026-04140-5>
- [76] Balshi, M.S., McGuire, A.D., Duffy, P., Flannigan, M., Walsh, J., Melillo, J.: Assessing the response of area burned to changing climate in western boreal North America using a Multivariate Adaptive Regression Splines (MARS) approach. *Global Change Biology* **15**(3), 578–600 (2009) <https://doi.org/10.1111/j.1365-2486.2008.01679.x>
- [77] Wang, Y.: The Effect of Climate Change on Forest Fire Danger and Severity in the Canadian Boreal Forests for the Period 1976–2100. *Journal of Geophysical Research: Atmospheres* **129**(4), 2023–039118 (2024) <https://doi.org/10.1029/2023JD039118>
- [78] Van Vliet, L., Fyke, J., Nakoneczny, S., Murdock, T.Q., Jafarpur, P.: Developing user-informed fire weather projections for Canada. *Climate Services* **35**, 100505 (2024) <https://doi.org/10.1016/j.cliser.2024.100505>
- [79] Jain, P., Tye, M.R., Paimazumder, D., Flannigan, M.: Downscaling fire weather extremes from historical and projected climate models. *Climatic Change* **163**(1), 189–216 (2020) <https://doi.org/10.1007/s10584-020-02865-5>
- [80] An, H., Gan, J., Cho, S.J.: Assessing Climate Change Impacts on Wildfire Risk in the United States. *Forests* **6**(9), 3197–3211 (2015) <https://doi.org/10.3390/f6093197>
- [81] Xie, Y., Lin, M., Decharme, B., Delire, C., Horowitz, L.W., Lawrence, D.M., Li, F., Séférian, R.: Tripling of western US particulate pollution from wildfires in a warming climate. *Proceedings of the National Academy of Sciences* **119**(14), 2111372119 (2022) <https://doi.org/10.1073/pnas.2111372119>
- [82] Kalashnikov, D.A., Abatzoglou, J.T., Davenport, F.V., Labe, Z.M., Loikith, P.C., Touma, D., Singh, D.: Projections of Lightning-Ignited Wildfire Risk in the Western United States. *Earth's Future* **13**(8), 2025–006108 (2025) <https://doi.org/10.1029/2025EF006108>
- [83] Liu, Z., Wimberly, M.C.: Direct and indirect effects of climate change on projected future fire regimes in the western United States. *Science of The Total Environment* **542**, 65–75 (2016) <https://doi.org/10.1016/j.scitotenv.2015.10.093>
- [84] Yue, X., Mickley, L.J., Logan, J.A., Kaplan, J.O.: Ensemble projections of wildfire activity and carbonaceous aerosol concentrations over the western United States in the mid-21st century. *Atmospheric Environment* **77**, 767–780 (2013) <https://doi.org/10.1016/j.atmosenv.2013.06.003>
- [85] Dong, C., Williams, A.P., Abatzoglou, J.T., Lin, K., Okin, G.S., Gillespie, T.W., Long, D., Lin, Y.-H., Hall, A., MacDonald, G.M.: The season for large fires in Southern California is projected to lengthen in a changing climate. *Communications Earth & Environment* **3**(1), 22 (2022) <https://doi.org/10.1038/s43247-022-00344-6>
- [86] Turco, M., Rosa-Cánovas, J.J., Bedia, J., Jerez, S., Montávez, J.P., Llasat, M.C., Provenzale, A.: Exacerbated fires in Mediterranean Europe due to anthropogenic warming projected with non-stationary climate-fire models. *Nature Communications* **9**(1), 3821 (2018) <https://doi.org/10.1038/s41467-018-06358-z>
- [87] Sousa, P.M., Trigo, R.M., Pereira, M.G., Bedia, J., Gutiérrez, J.M.: Different approaches to model future burnt area in the Iberian Peninsula. *Agricultural and Forest Meteorology* **202**, 11–25 (2015) <https://doi.org/10.1016/j.agrformet.2014.11.018>
- [88] Kalabokidis, K., Palaiologou, P., Gerasopoulos, E., Giannakopoulos, C., Kostopoulou, E., Zerefos, C.: Effect of Climate Change Projections on Forest Fire Behavior and Values-at-Risk in

- Southwestern Greece. *Forests* **6**(6), 2214–2240 (2015) <https://doi.org/10.3390/f6062214>
- [89] De Santana, M.M.M., De Vasconcelos, R.N., Mariano Neto, E., Da Franca Rocha, W.D.J.S.: Machine Learning Model Reveals Land Use and Climate’s Role in Amazon Wildfires: Present and Future Scenarios. *Fire* **7**(10), 338 (2024) <https://doi.org/10.3390/fire7100338>
 - [90] Silva, P.S., Bastos, A., Libonati, R., Rodrigues, J.A., DaCamara, C.C.: Impacts of the 1.5 °C global warming target on future burned area in the Brazilian *Cerrado*. *Forest Ecology and Management* **446**, 193–203 (2019) <https://doi.org/10.1016/j.foreco.2019.05.047>
 - [91] Zhang, Y., Mao, J., Ricciuto, D.M., Jin, M., Yu, Y., Shi, X., Wulschleger, S., Tang, R., Liu, J.: Global fire modelling and control attributions based on the ensemble machine learning and satellite observations. *Science of Remote Sensing* **7**, 100088 (2023) <https://doi.org/10.1016/j.srs.2023.100088>
 - [92] Liu, Y., Stanturf, J., Goodrick, S.: Trends in global wildfire potential in a changing climate. *Forest Ecology and Management* **259**(4), 685–697 (2010) <https://doi.org/10.1016/j.foreco.2009.09.002>
 - [93] Liu, Y., L. Goodrick, S., A. Stanturf, J.: Future U.S. wildfire potential trends projected using a dynamically downscaled climate change scenario. *Forest Ecology and Management* **294**, 120–135 (2013) <https://doi.org/10.1016/j.foreco.2012.06.049>
 - [94] Gannon, C.S., Steinberg, N.C.: A global assessment of wildfire potential under climate change utilizing Keetch-Byram drought index and land cover classifications. *Environmental Research Communications* **3**(3), 035002 (2021) <https://doi.org/10.1088/2515-7620/abd836>
 - [95] Golding, N., Betts, R.: Fire risk in Amazonia due to climate change in the HadCM3 climate model: Potential interactions with deforestation. *Global Biogeochemical Cycles* **22**(4) (2008) <https://doi.org/10.1029/2007GB003166>
 - [96] Avila, T.C., Lafferty, D.C., Stover, M., Guerrero, S., Samantula, C., Wing, I.S., Sriver, R.L.: Downscaled CMIP5 projections of physical fire risk understate historical trends. *Environmental Research Letters* **20**(8), 084025 (2025) <https://doi.org/10.1088/1748-9326/ade892>
 - [97] Zong, X., Tian, X., Yin, Y.: Impacts of Climate Change on Wildfires in Central Asia. *Forests* **11**(8) (2020) <https://doi.org/10.3390/f11080802>
 - [98] Fargeon, H., Pimont, F., Martin-StPaul, N., De Caceres, M., Ruffault, J., Barbero, R., Dupuy, J.-L.: Projections of fire danger under climate change over France: Where do the greatest uncertainties lie? *Climatic Change* **160**(3), 479–493 (2020) <https://doi.org/10.1007/s10584-019-02629-w>
 - [99] Bedia, J., Herrera, S., Camia, A., Moreno, J.M., Gutiérrez, J.M.: Forest fire danger projections in the Mediterranean using ENSEMBLES regional climate change scenarios. *Climatic Change* **122**(1), 185–199 (2014) <https://doi.org/10.1007/s10584-013-1005-z>
 - [100] Abatzoglou, J.T., Williams, A.P., Barbero, R.: Global Emergence of Anthropogenic Climate Change in Fire Weather Indices. *Geophysical Research Letters* **46**(1), 326–336 (2019) <https://doi.org/10.1029/2018GL080959>
 - [101] Ruffault, J., Curt, T., Moron, V., Trigo, R.M., Mouillot, F., Koutsias, N., Pimont, F., Martin-StPaul, N., Barbero, R., Dupuy, J.-L., Russo, A., Belhadj-Khedher, C.: Increased likelihood of heat-induced large wildfires in the Mediterranean Basin. *Scientific Reports* **10**(1), 13790 (2020) <https://doi.org/10.1038/s41598-020-70069-z>
 - [102] Abatzoglou, J.T., Juang, C.S., Williams, A.P., Kolden, C.A., Westerling, A.L.: Increasing Synchronous Fire Danger in Forests of the Western United States. *Geophysical Research Letters* **48**(2),

2020–091377 (2021) <https://doi.org/10.1029/2020GL091377>

- [103] Quilcaille, Y., Batibeniz, F., Ribeiro, A.F.S., Padrón, R.S., Seneviratne, S.I.: Fire weather index data under historical and shared socioeconomic pathway projections in the 6th phase of the Coupled Model Intercomparison Project from 1850 to 2100. *Earth System Science Data* **15**(5), 2153–2177 (2023) <https://doi.org/10.5194/essd-15-2153-2023>
- [104] Wang, S.S.-C., Leung, L.R., Qian, Y.: Projection of Future Fire Emissions Over the Contiguous US Using Explainable Artificial Intelligence and CMIP6 Models. *Journal of Geophysical Research: Atmospheres* **128**(14), 2023–039154 (2023) <https://doi.org/10.1029/2023JD039154>
- [105] Bergeron, Y., Flannigan, M.D.: Predicting the effects of climate change on fire frequency in the southeastern Canadian boreal forest. *Water, Air, and Soil Pollution* **82**(1), 437–444 (1995) <https://doi.org/10.1007/BF01182853>
- [106] Flannigan, M.D., Logan, K.A., Amiro, B.D., Skinner, W.R., Stocks, B.J.: Future Area Burned in Canada. *Climatic Change* **72**(1), 1–16 (2005) <https://doi.org/10.1007/s10584-005-5935-y>
- [107] Flannigan, M., Cantin, A.S., De Groot, W.J., Wotton, M., Newbery, A., Gowman, L.M.: Global wildland fire season severity in the 21st century. *Forest Ecology and Management* **294**, 54–61 (2013) <https://doi.org/10.1016/j.foreco.2012.10.022>
- [108] Calheiros, T., Pereira, M.G., Nunes, J.P.: Assessing impacts of future climate change on extreme fire weather and pyro-regions in Iberian Peninsula. *Science of The Total Environment* **754**, 142233 (2021) <https://doi.org/10.1016/j.scitotenv.2020.142233>
- [109] Carvalho, A., Flannigan, M.D., Logan, K.A., Gowman, L.M., Miranda, A.I., Borrego, C.: The impact of spatial resolution on area burned and fire occurrence projections in Portugal under climate change. *Climatic Change* **98**(1), 177–197 (2010) <https://doi.org/10.1007/s10584-009-9667-2>
- [110] Stocks, B.J., Fosberg, M.A., Lynham, T.J., Mearns, L., Wotton, B.M., Yang, Q., Jin, J.-Z., Lawrence, K., Hartley, G.R., Mason, J.A., McKENNEY, D.W.: Climate Change and Forest Fire Potential in Russian and Canadian Boreal Forests. *Climatic Change* **38**(1), 1–13 (1998) <https://doi.org/10.1023/A:1005306001055>
- [111] Flannigan, M.D., Stocks, B.J., Wotton, B.M.: Climate change and forest fires. *Science of The Total Environment* **262**(3), 221–229 (2000) [https://doi.org/10.1016/S0048-9697\(00\)00524-6](https://doi.org/10.1016/S0048-9697(00)00524-6)
- [112] Ciocca, I., Fernández, A., Jaque, E., Justino, F., Shumacher, V., da Silva, A.S., Muñoz, A., de la Barrera, F.: Increased wildfire hazard along South-Central Chile under the RCP8.5 scenario as revealed by high-resolution modeling. *Environmental Research Letters* **18**(3), 034023 (2023) <https://doi.org/10.1088/1748-9326/acba33>
- [113] Dye, A.W., Gao, P., Kim, J.B., Lei, T., Riley, K.L., Yocom, L.: High-resolution wildfire simulations reveal complexity of climate change impacts on projected burn probability for Southern California. *Fire Ecology* **19**(1), 20 (2023) <https://doi.org/10.1186/s42408-023-00179-2>
- [114] Fonseca, M.G., Alves, L.M., Aguiar, A.P.D., Arai, E., Anderson, L.O., Rosan, T.M., Shimabukuro, Y.E., Aragão, L.E.O.e.C.: Effects of climate and land-use change scenarios on fire probability during the 21st century in the Brazilian Amazon (2019) <https://doi.org/10.1111/gcb.14709>
- [115] IPCC (ed.): Emissions Scenarios: Summary for Policymakers; a Special Report of IPCC Working Group III, Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change Special Report. WMO, UNEP, Geneva, Switzerland (2000)
- [116] Van Vuuren, D.P., O'Neill, B.C., Tebaldi, C., Sanderson, B.M., Chini, L.P., Friedlingstein, P.,

- Hasegawa, T., Riahi, K., Govindasamy, B., Bauer, N., Eyring, V., Fall, C.M.N., Frieler, K., Gidden, M.J., Gohar, L.K., Högnér, A., Jones, A.D., Kikstra, J., King, A., Knutti, R., Kriegler, E., Lawrence, P., Lennard, C., Lowe, J., Mathison, C., Mehmood, S., Nicholls, Z., Prado, L.F., Zhang, Q., Rose, S.K., Ruane, A.C., Sandstad, M., Schleussner, C.-F., Seferian, R., Sillmann, J., Smith, C., Sörensson, A.A., Panickal, S., Tachiiri, K., Vaughan, N., Vishwanathan, S.S., Yokohata, T., Zecchetto, M., Ziehn, T.: The Scenario Model Intercomparison Project for CMIP7 (ScenarioMIP-CMIP7). *Geoscientific Model Development* **19**(7), 2627–2656 (2026) <https://doi.org/10.5194/gmd-19-2627-2026>
- [117] Senande-Rivera, M., Insua-Costa, D., Miguez-Macho, G.: Spatial and temporal expansion of global wildland fire activity in response to climate change. *Nature Communications* **13**(1), 1208 (2022) <https://doi.org/10.1038/s41467-022-28835-2>
- [118] Pechony, O., Shindell, D.T.: Driving forces of global wildfires over the past millennium and the forthcoming century. *Proceedings of the National Academy of Sciences* **107**(45), 19167–19170 (2010) <https://doi.org/10.1073/pnas.1003669107>
- [119] Krause, A., Kloster, S., Wilkenskjaeld, S., Paeth, H.: The sensitivity of global wildfires to simulated past, present, and future lightning frequency. *Journal of Geophysical Research: Biogeosciences* **119**(3), 312–322 (2014) <https://doi.org/10.1002/2013JG002502>
- [120] Knorr, W., Jiang, L., Arneth, A.: Climate, CO₂ and human population impacts on global wildfire emissions. *Biogeosciences* **13**(1), 267–282 (2016) <https://doi.org/10.5194/bg-13-267-2016>
- [121] Gao, P., Terando, A.J., Kupfer, J.A., Morgan Varner, J., Stambaugh, M.C., Lei, T.L., Kevin Hiers, J.: Robust projections of future fire probability for the conterminous United States. *Science of The Total Environment* **789**, 147872 (2021) <https://doi.org/10.1016/j.scitotenv.2021.147872>
- [122] Wotton, B.M., Flannigan, M.D., Marshall, G.A.: Potential climate change impacts on fire intensity and key wildfire suppression thresholds in Canada. *Environmental Research Letters* **12**(9), 095003 (2017) <https://doi.org/10.1088/1748-9326/aa7e6e>
- [123] Li, F., Lawrence, D., Rogers, B., Burton, C., Huang, H., Jiang, Y., Kaiser, J., Kasoar, M., Lee, H., Leung, R., Nieradzick, L., Wang, A., Ward, D., Ce, L., Li, Y., Lin, Z., Voulgarakis, A., Xue, Y.: The Fire Modeling Intercomparison Project (FireMIP) for CMIP7. *EGUsphere*, 1–31 (2025) <https://doi.org/10.5194/egusphere-2025-6115>