



Supplement of

Wildfire air pollution hazard during the 21st century

Wolfgang Knorr et al.

Correspondence to: Wolfgang Knorr (wolfgang.knorr@nateko.lu.se)

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Supplementary Information

Table S1: Countries/regions used for scaling GFED4.1s wildfire emissions.

Code	Country name	World region	grid cells on 1-degree grid	non-crop cells ¹	Code	Country name	World region	grid cells on 1-degree grid	non-crop cells	longitude range	latitude range
AGO	Angola		100	100	ARM	Armenia		4	4		
BEN	Benin		10	6	AZE	Azerbaijan		7	6		
BWA	Botswana		46	46	GEO	Georgia		6	6		
BFA	Burkina Faso		23	21	KAZ	Kazakhstan		213	206		
BDI	Burundi		3	3	KGZ	Kyrgyzstan		16	16		
CMR	Cameroon		37	35	TJK	Tajikistan		8	8		
CAF	Central African Republic		49	46	TKM	Turkmenistan		35	35		
TCO	Chad		100	100	UZB	Uzbekistan		35	32		
COG	Congo		24	24	BLR	Belarus	Eastern Europe,	16	14		
ZAR	Congo, Dem. Republic		176	176	BGR	Bulgaria	Russia and Central Asia (ERCA)	10	8		
CIV	Cote d'Ivoire		25	24	LLI	Latvia and Lithuania		10	5		
ERI	Eritrea		12	12	ROM	Romania		19	10		
ETH	Ethiopia		90	89	RUS-SW			78	32	W of 60°E	S of 52°N
GAB	Gabon		20	20	RUS-NW			212	150	W of 55°E	N of 52°N
GHA	Ghana		18	13	RUS-C	Russian Federation		553	506	not in other RUS	
GIN	Guinea		20	20	RUS-SE			232	232	E of 110°E	S of 60°N
GNB	Guinea-Bissau		1	1	RUS-NE			327	327	E of 110°E	N of 60°N
KEN	Kenya	Sub-Saharan Africa (SSA)	41	40	UKR	Ukraine		47	5		
LSO	Lesotho		1	1	YUA	Serbia, Montenegro, Bosnia, Macedonia		13	11		
LBR	Liberia		5	5	CHN-W			348	342	W of 105°E	
MDG	Madagascar		43	43	CHN-E	China	Developing East Asia (DEAS)	283	211	E of 105°E	S of 43°N
MWI	Malawi		10	10	CHN-N			122	103		N of 43°N
MLI	Mali		106	106	PRK	North Korea		10	8		
MRT	Mauritania		80	80	MNG	Mongolia		131	131		
MOZ	Mozambique		61	60	BTN	Bhutan		4	2		
NAM	Namibia		66	66	KHM	Cambodia		14	13		
NER	Niger		94	80	IND	India		256	50		
NGA	Nigeria		74	40	IDN	Indonesia		125	116		
SEN	Senegal		17	16	LAO	Laos		18	18		
SLE	Sierra Leone		5	5	MYS	Malaysia	South and South-East Asia (SSEA)	23	23		
SOM	Somalia		55	55	MMR	Myanmar		44	36		
ZAF	South Africa		99	98	NPL	Nepal		12	8		
SDN	Sudan		207	199	PAK	Pakistan		58	44		
TGO	Togo		2	1	PHL	Philippines		16	14		
UGA	Uganda		16	13	LKA	Sri Lanka		4	4		
TZA	Tanzania		73	72	THA	Thailand		42	30		
ZMB	Zambia		63	63	VNM	Viet Nam		27	22		
ZWE	Zimbabwe		30	30	PNG	Papua New Guinea		31	31		
DZA	Algeria		189	184	AUS-SW			18	16	W of 120°E	S of 30°S
EGY	Egypt		77	76	AUS-E	Australia	Australia and New Zealand (AUN)	200	178	E of 140°E	S of 18°S
LYB	Libya		131	131	AUS-C			317	316	not in other AUS	
MAR	Morocco		56	49	AUS-N			76	76		N of 18°S
TUN	Tunisia	Developing Middle East and North Africa (DMNA)	14	11	NZL	New Zealand		22	22		
AFG	Afghanistan		53	52	CAN-W			385	341	W of 100°W	
IRN	Iran		134	129	CAN-C	Canada		192	185	100...80°W	
IRQ	Iraq		37	31	CAN-E			176	176	E of 80°W	
JOR	Jordan		6	6	USA-W	United States of America	North America (NOA)	314	294	W of 100°W	
SAU	Saudi Arabia		154	154	USA-E			372	222	E of 100°W	
SYR	Syria		15	9	ALK			116	116		N of 50°N
TUR	Turkey		57	44	CRI	Costa Rica		3	3		
YEM	Yemen		31	31	CUB	Cuba		7	5		
AUT	Austria		7	7	DOM	Dominican Republic		4	4		
BNL	Benelux		5	3	GTM	Guatemala		15	15		
CRS	Croatia and Slovenia		3	2	HTI	Haiti		2	2		
CZE	Czech Republic		5	3	HND	Honduras		9	9		
DNK	Denmark		6	3	MEX-W	Mexico		120	115	W of 95°W	
EST	Estonia		4	4	MEX-SE			19	19	E of 95°W	
FIN	Finland		28	27	NIC	Nicaragua		8	8		
FRA	France		41	24	PAN	Panama		6	6		
DEU	Germany		32	29	ARG	Argentina	Latina America and Caribbean (LAC)	230	207		
GRC	Greece	High-income Europe (HEUR)	10	9	BOL	Bolivia		88	88		
HUN	Hungary		7	2	BRA-W			197	192	W of 49°W	S of 5°S
ISL	Iceland		7	7	BRA-E	Brazil		316	294	E of 49°W	
IRL	Ireland		5	4	BRA-N			161	161		N of 5°S
ITA	Italy		23	11	CHL	Chile		61	60		
NOR	Norway		31	31	COL	Colombia		88	88		
POL	Poland		25	11	ECU	Ecuador		19	19		
PRT	Portugal		6	5	GUF	French Guiana		6	6		
SVK	Slovakia		6	2	GUY	Guyana		15	15		
ESP	Spain		40	24	PRY	Paraguay		28	28		
SWE	Sweden		39	39	PER	Peru		100	100		
CHE	Switzerland		2	2	SUR	Suriname		11	11		
GBR	United Kingdom		19	13	URY	Uruguay		15	15		
					VEN	Venezuela		73	73		
					ISR	Israel		4	4		
					JPN	Japan		28	28		
					KOR	South Korea		6	6		
					OMN	Oman		26	26		
					ARE	United Arab Emirates		8	8		
					MDA	Republic of Moldova ²		4	0		
					BGD	Bangladesh ²		10	1		
					GRL	Greenland ³		31	31		

¹Cells with less than 50% cropland fraction in past or future scenarios

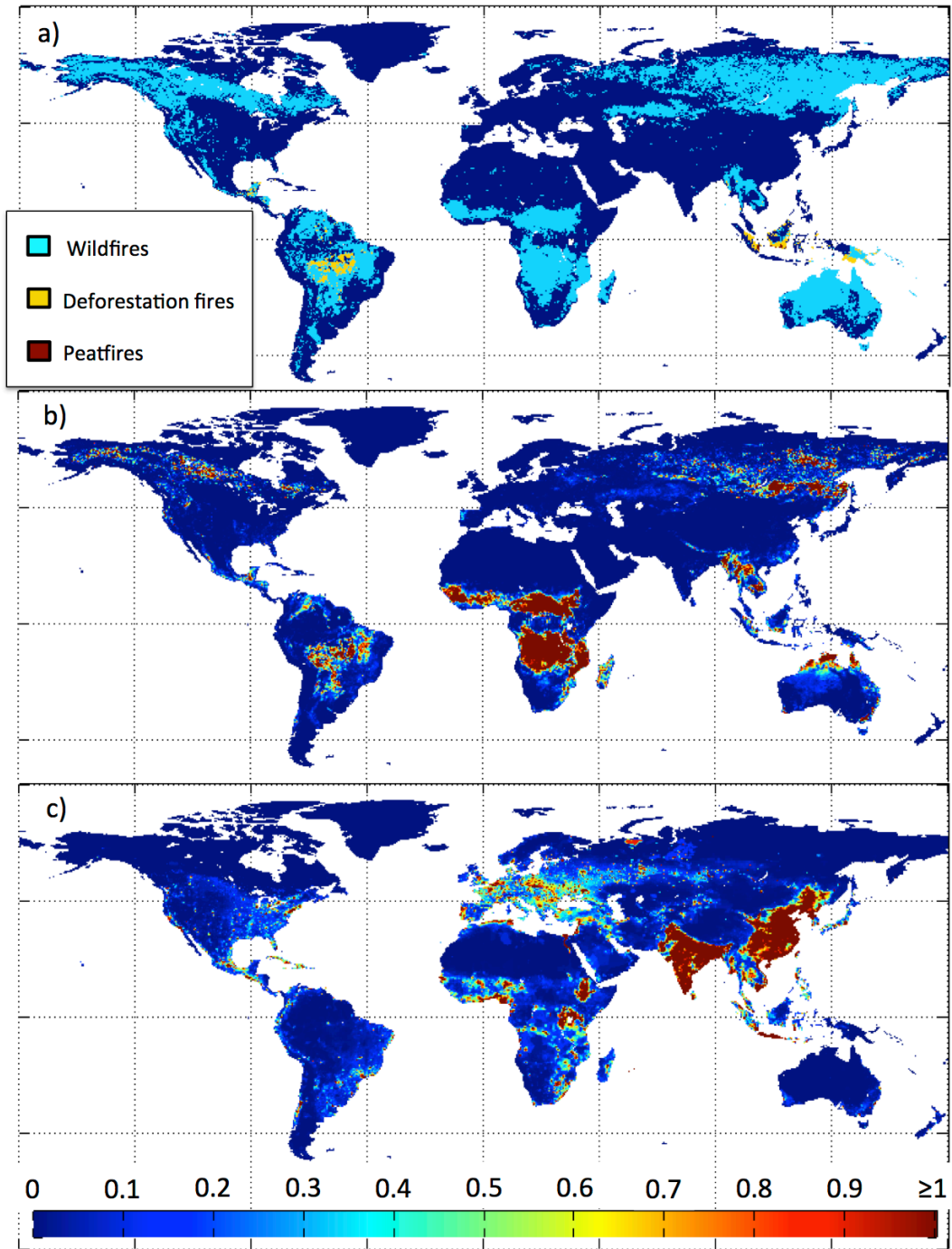
²Constant emissions assumed because dominated by croplands

³Constant emissions assumed because zero current wildfire emissions in some simulations

4 *Table S2: Current PM_{2.5} Emissions [Gg/yr] by world region from various sources*

Region	Wildfire	Deforestation	Peat Fire	Anthropogenic
SSA	14,973	538	0	5,864
LAC	3,138	1,886	0	2,534
ERCA	2,832	0	18	2,490
SSEA	1,593	1,499	598	10,392
AUN	1,536	22	0	186
NOA	1,349	0	30	1,462
DEAS	364	17	0	13,324
HEUR	31	0	0	1,630
DMNA	7	0	0	1,561
Global	25,842	3,968	646	40,370

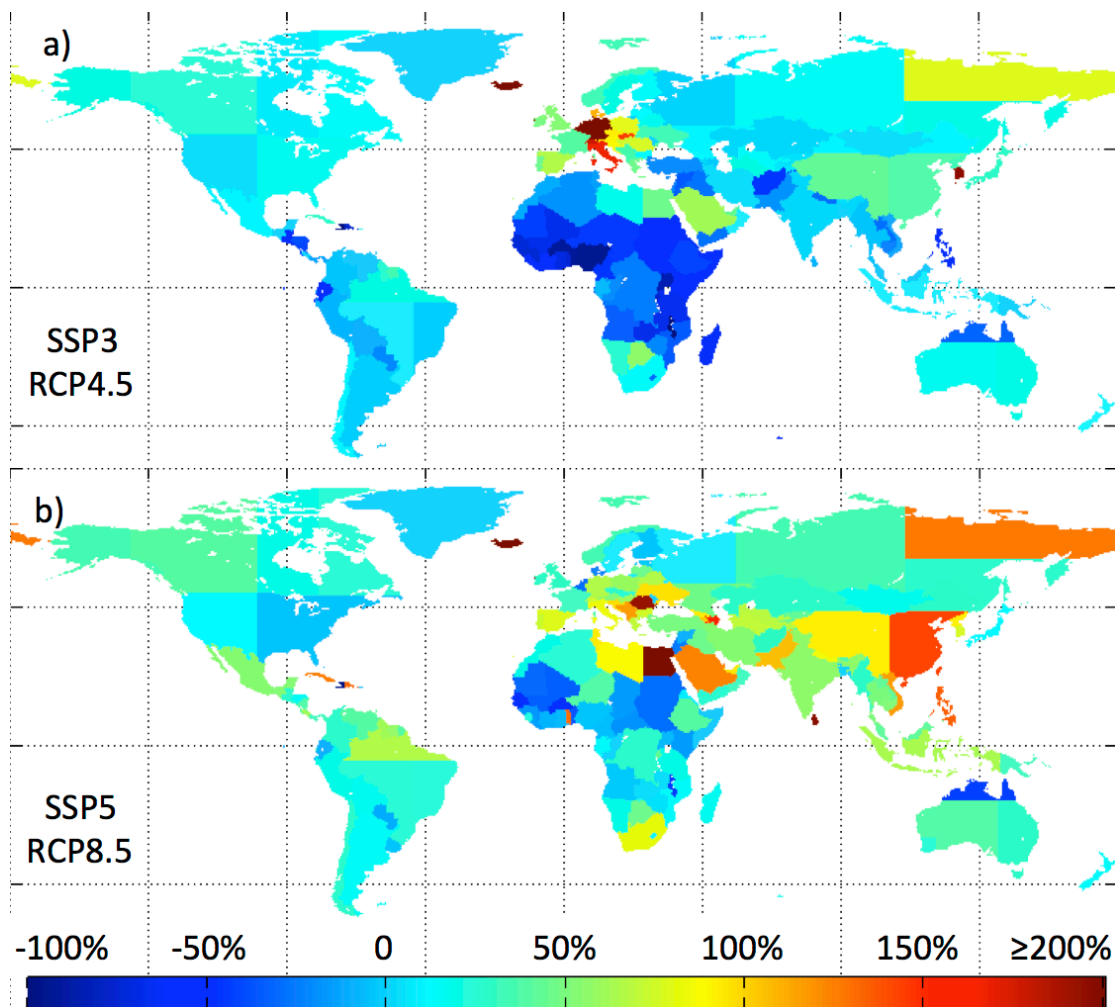
5 *SSA: Sub-Saharan Africa, LAC: Latin America & Caribbean, ERCA: Eastern Europe, Russia &*
6 *Central Asia, SSEA: South & Southeast Asia, AUN: Australia & New Zealand, NOA: North*
7 *America, DEAS: Developing East Asia, HEUR: High-income Europe, DMNA: Developing*
8 *Middle-East & North Africa.*



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10 *Figure S1: a) Largest current source of PM_{2.5} emissions (dark blue areas: either*
 11 *emissions are zero, or anthropogenic emissions are the largest source); b) current*
 12 *wildfire and c) anthropogenic emissions in g PM_{2.5} m⁻² yr⁻¹. Average annual PM_{2.5}*
 13 *emissions 1997 to 2014 are from GFED4.1s, or ECLIPSE GAINS 4a for 2010, CLE*
 14 *scenario (anthropogenic).*
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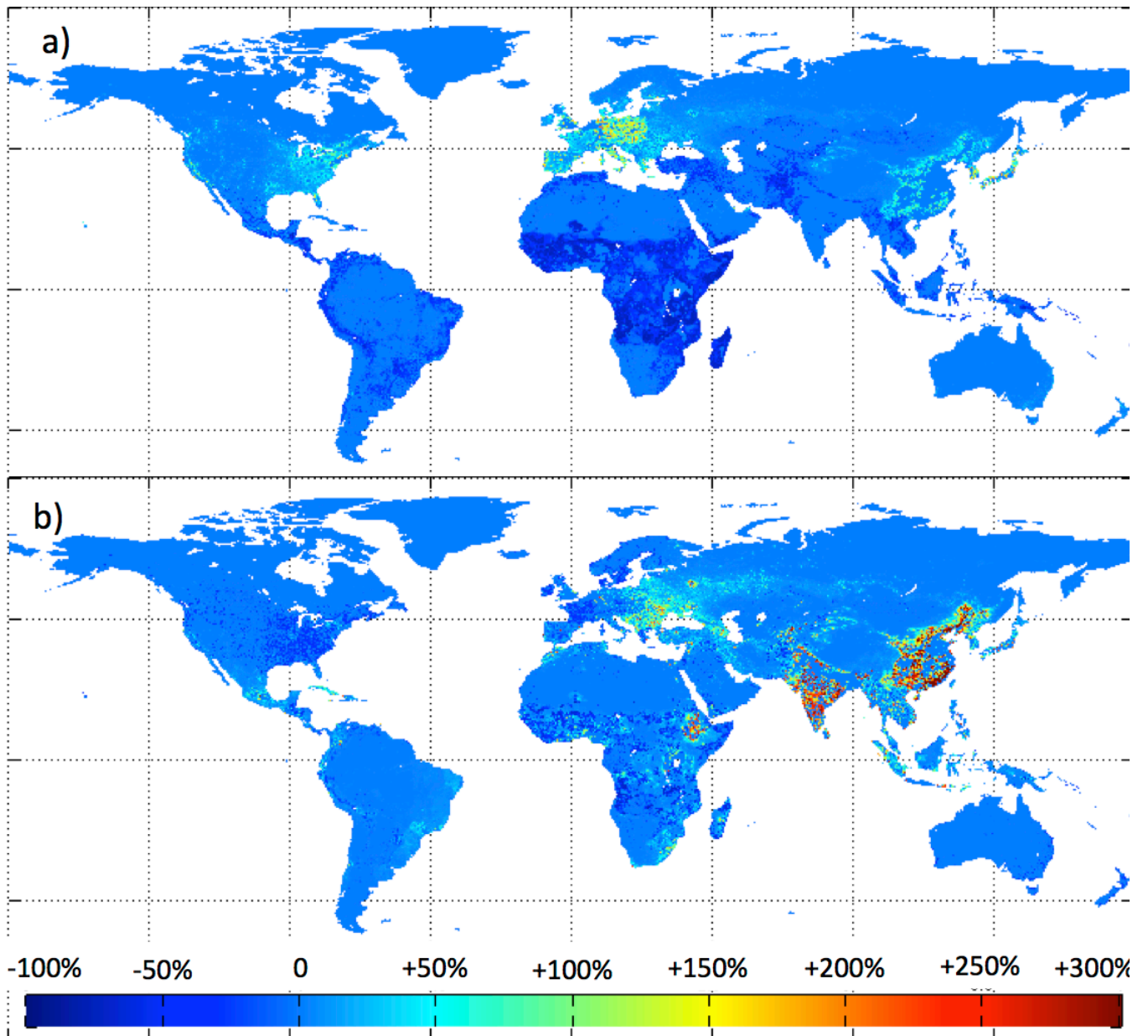
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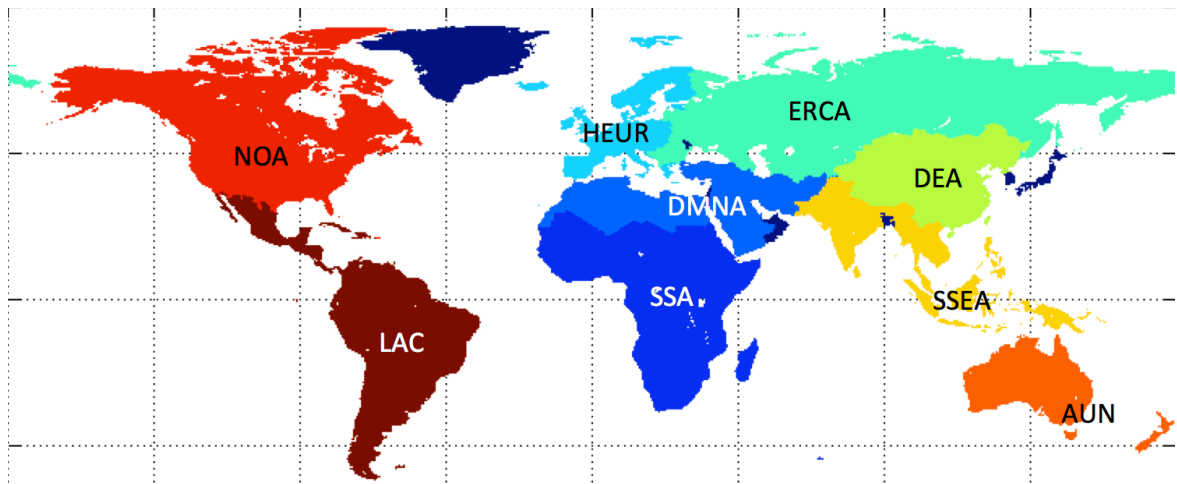
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Figure S2: Relative change in annual PM_{2.5} emissions from current (1997-2014 mean) to 2090 (2080 to 2100 mean) by country/region. a) SSP3 globally high population growth (high-income countries: low population growth) with slow urbanisation and RCP4.5 climate scenario, b) SSP5 globally low population growth (high-income countries: high population growth) with slow urbanisation, RCP8.5 climate scenario.



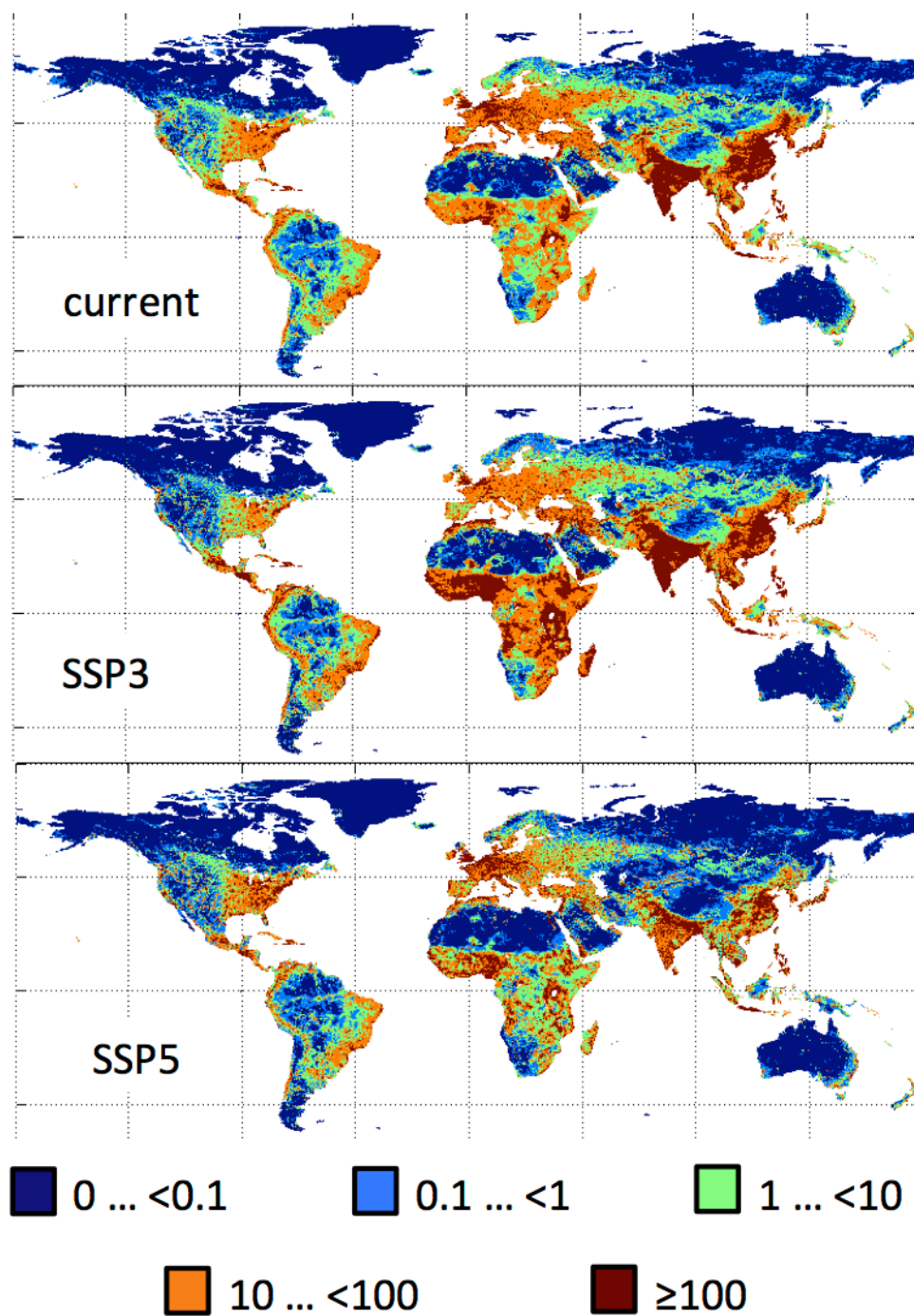
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24 *Figure S3: Relative change in wildfire emissions due to changes in population density only, between*
 25 *2010 and 2090, according to Equ. 2. a) SSP3, b) SSP5 demographic scenario.*



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27 *Figure S4: World regions used in the analysis. Dark blue: not included.*



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29 *Figure S4: Population density categories for current (2010) and future (2090) conditions for the SSP3*
 30 *and SSP3 demographic scenarios.*

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