Supporting materials

The impact of COVID-19 lockdown on surface air quality changes in major African countries

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Table S1 Stringency index weighted average of MAM and JJA seasons in major African countries

Country name	Subregion	Season	
		MAM	JJA
Angola	CA	63.22	77.01
Cameroon	CA	52.79	60.04
Central African Rep.	CA	53.28	58.57
Chad	CA	55.32	68.46
Congo	CA	68.67	69.39
Dem. Rep. Congo	CA	64.65	67.12
Gabon	CA	66.88	80.46
Burundi	EA	13.01	12.95
Djibouti	EA	67.95	55.10
Ethiopia	EA	60.98	80.56
Kenya	EA	74.54	80.21
Madagascar	EA	62.94	68.84
Malawi	EA	47.56	61.40
Mozambique	EA	45.20	75.61
Rwanda	EA	71.35	73.72
S. Sudan	EA	63.20	82.16
Somalia	EA	49.13	35.40
Tanzania	EA	39.67	30.43
Uganda	EA	72.72	85.95
Zambia	EA	43.59	48.31
Zimbabwe	EA	67.85	77.02
Algeria	NA	66.86	74.77
Egypt	NA	67.19	75.85
Libya	NA	78.02	92.13
Morocco	NA	78.25	73.64
Sudan	NA	68.54	77.04
Tunisia	NA	74.33	30.29
Botswana	SA	64.94	56.62
eSwatini	SA	70.01	79.65
Lesotho	SA	65.60	64.37
Namibia	SA	55.33	58.20
South Africa	SA	70.33	77.05
Benin	WA	52.05	41.84
Burkina Faso	WA	65.19	29.73
Cote d'Ivoire	WA	61.46	52.38
Gambia	WA	63.56	68.63
Ghana	WA	56.01	56.94
Guinea	WA	60.69	74.46
Liberia	WA	68.87	68.79
Mali	WA	54.14	48.35

Country name	Subregion	Season	
		MAM	JJA
Mauritania	WA	62.97	51.21
Niger	WA	44.35	23.75
Nigeria	WA	65.43	77.58
Senegal	WA	61.87	51.07
Sierra Leone	WA	54.52	43.63
Togo	WA	58.45	52.61

Figure S1: Map showing the study of selected African countries and their subregions. The different colors represent different regions of Africa, namely Northern Africa (NA) is light orange, Western Africa (WA) is green, Central Africa (CA) is orange, Eastern African (EA) is light blue and Southern Africa (SA) is dark blue.

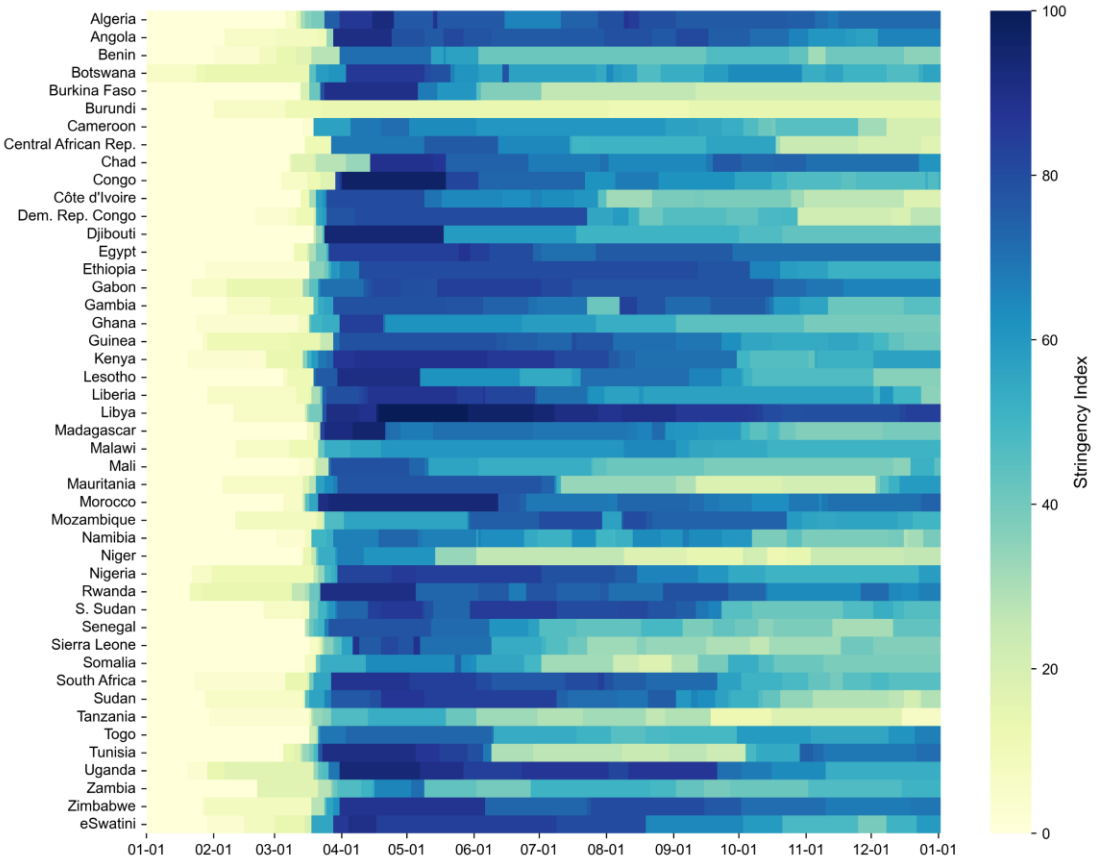

Figure S2: Time distribution of containment stringency index for major African countries in 2020.

Figure S3: Long-term seasonal air quality trends in Africa from 2005 to 2019 for (a-g) CO, NO_2, SO_2, MDA8 O_3, sulfate aerosol, nitrate aerosol and ammonium aerosol.

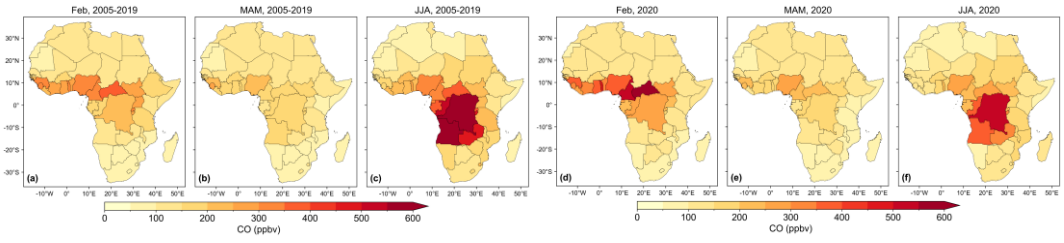

Figure S4: Spatial distribution of CO concentrations in February, MAM, and JJA of previous multiple year average from 2005 to 2019 (a-c), and those in 2020 (d-f).

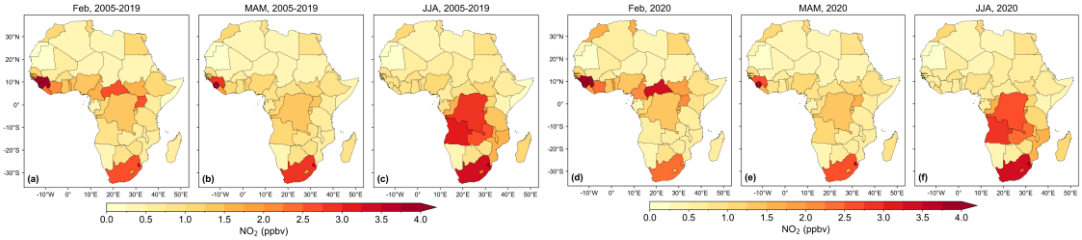

Figure S5: Same as Figure S3, but for NO_2.

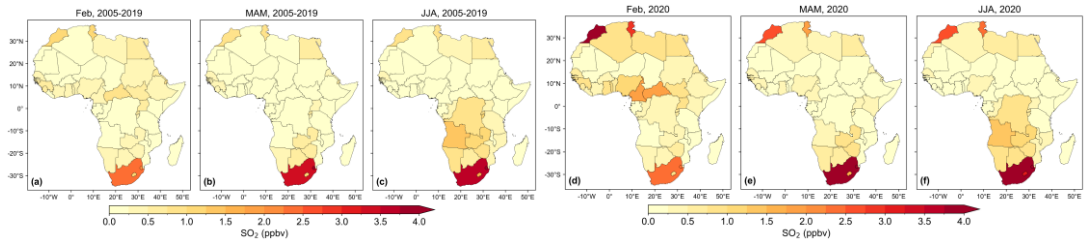

Figure S6: Same as Figure S3, but for SO_2.

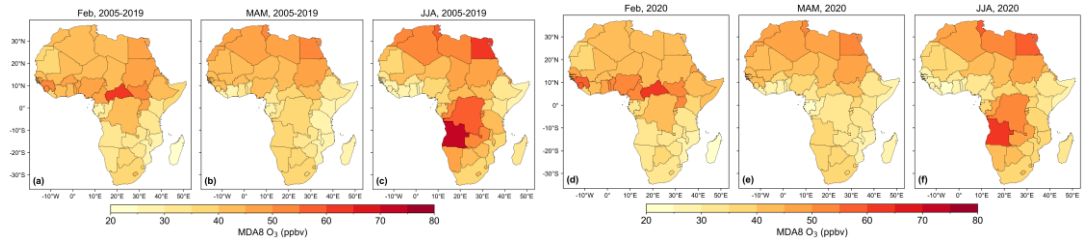

Figure S7: Same as Figure S3, but for MDA8 O_3.

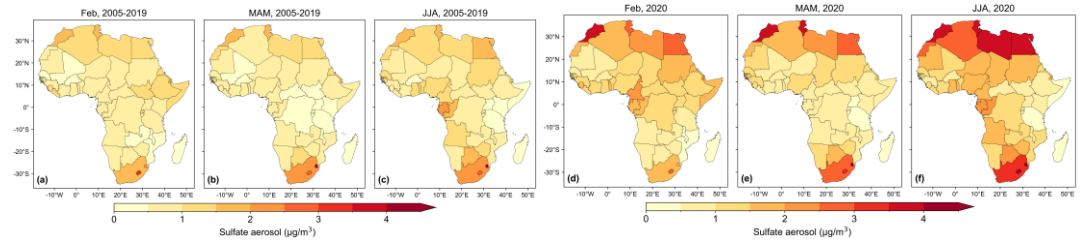

Figure S8: Same as Figure S3, but for sulfate aerosol.

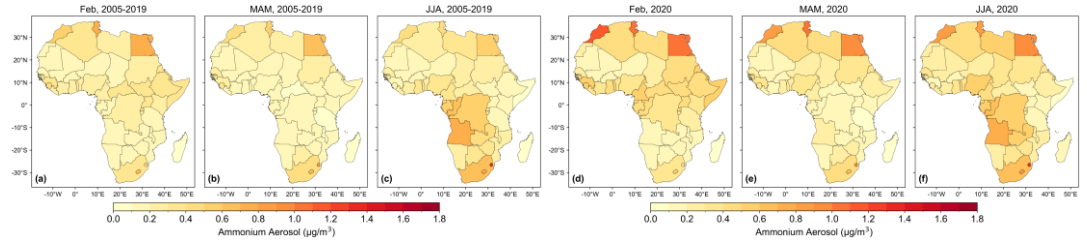

Figure S9: Same as Figure S3, but for ammonium aerosol.

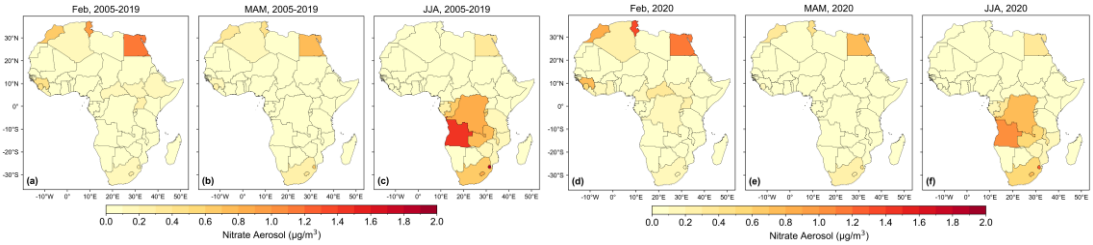

Figure S10: Same as Figure S3, but for nitrate aerosol.

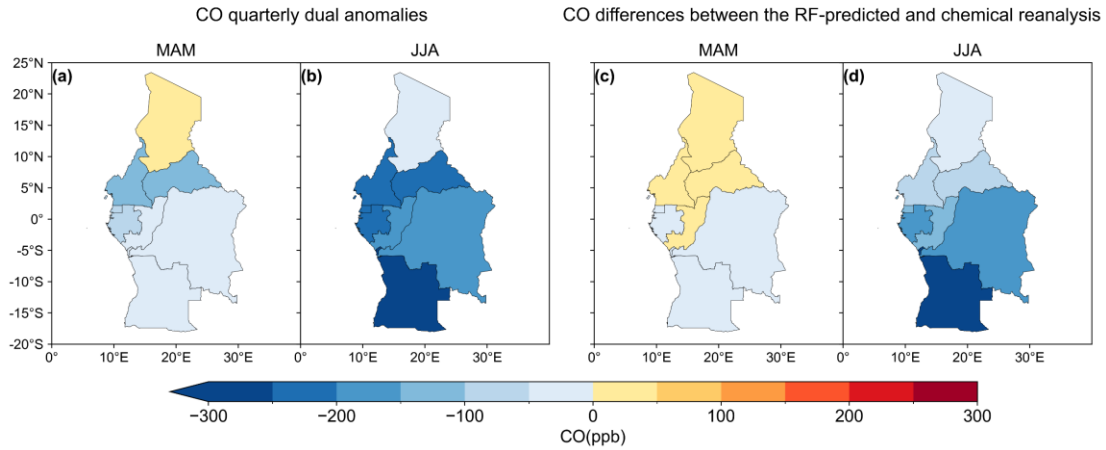

Figure S11: Spatial distribution of CO quarterly dual anomalies in CA region estimated directly from the chemical reanalysis data (a, b), and the differences between chemical reanalysis and the RF-predicted CO for MAM and JJA in 2020 (c, d). The units are ppbv.

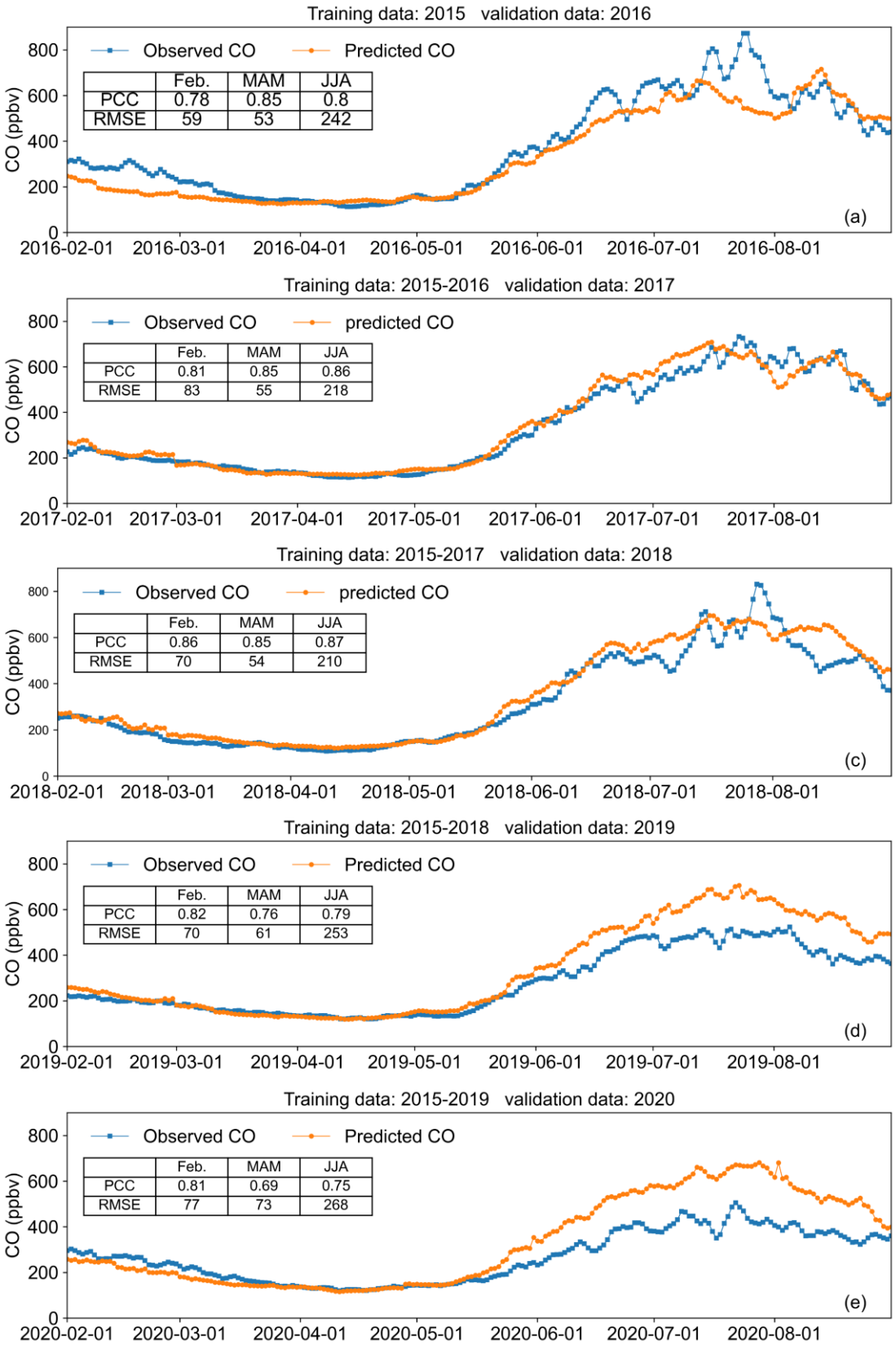

Figure S12: Time series comparisons between the observed (dashed blue line) and predicted (square orange line) average CO in CA. Figure a-e represents the results of five different time-split sequence validation sets.

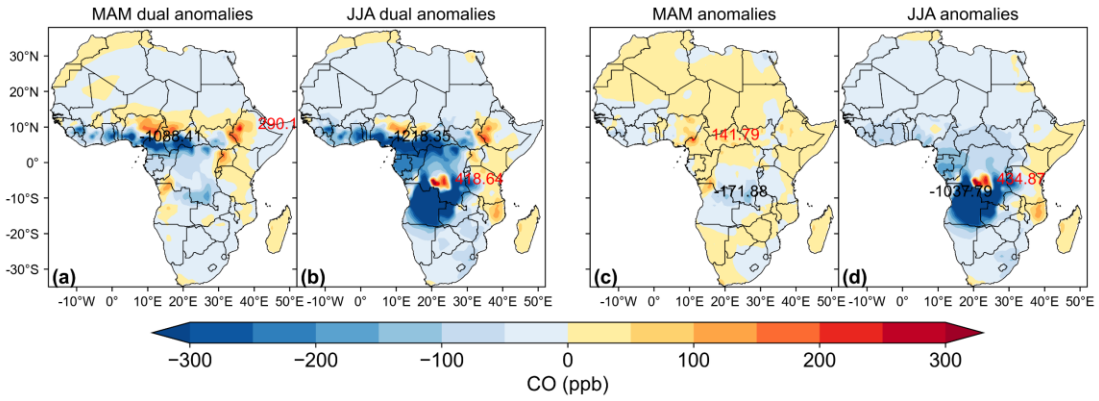

Figure S13: Spatial distribution of CO quarterly dual anomalies (a, b), and quarterly anomalies (c, d) in MAM and JJA in African countries at grid level. The differences were calculated between 2020 and 15-year average (2005-2019). The units are ppbv.

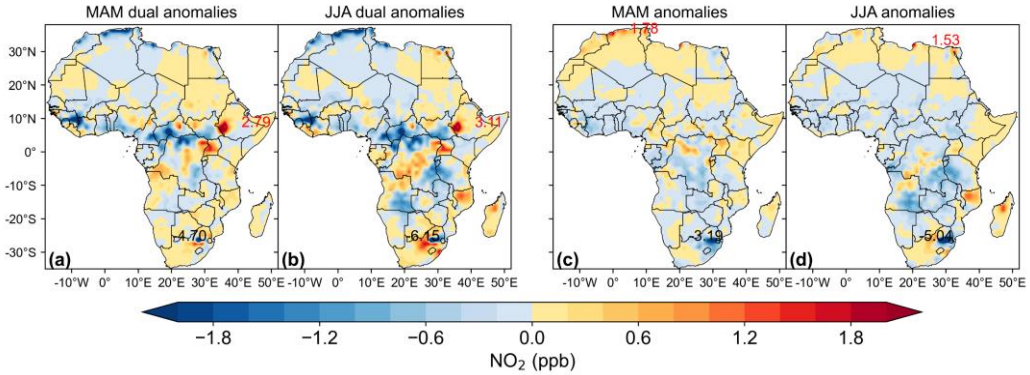

Figure S14: Same as Figure S12, but NO_2. The units are ppbv.

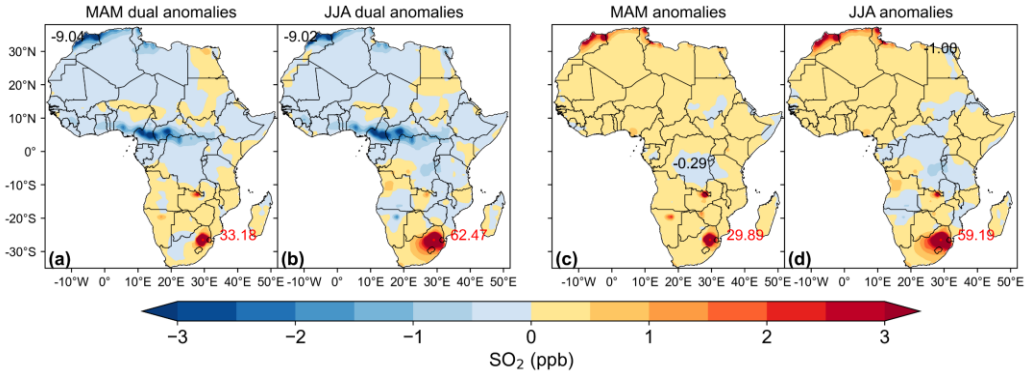

Figure S15: Same as Figure S12, but SO_2. The units are ppbv.

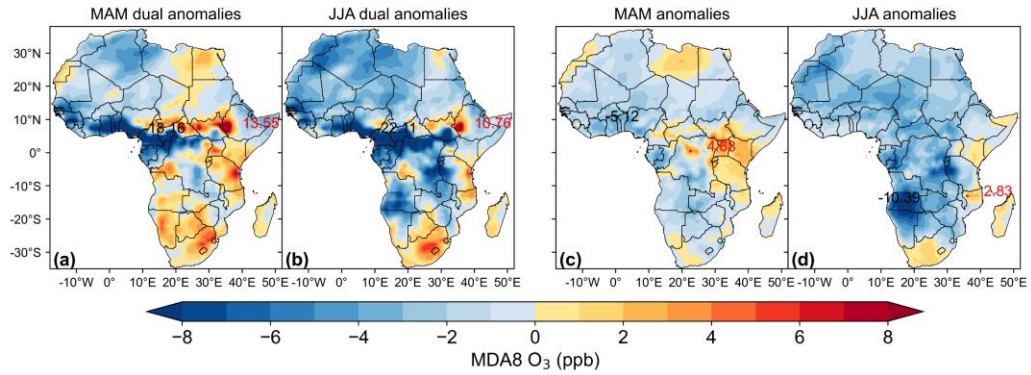

Figure S16: Same as Figure S12, but MDA8 O_3. The units are ppbv.

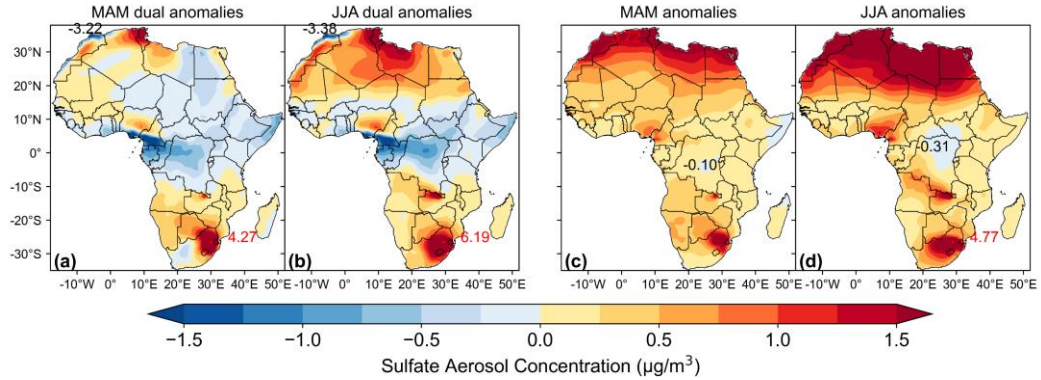

Figure S17: Same as Figure S12, but sulfate aerosol. The units are μg/m^3.

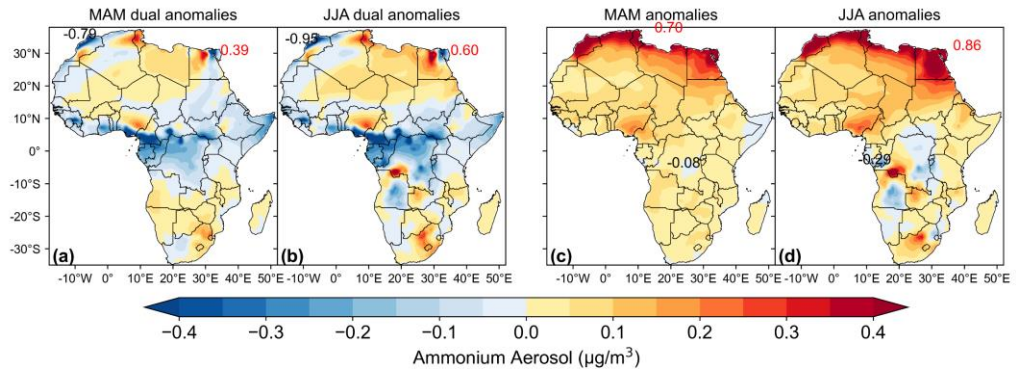

Figure S18: Same as Figure S12, but ammonium aerosol. The units are μg/m^3.

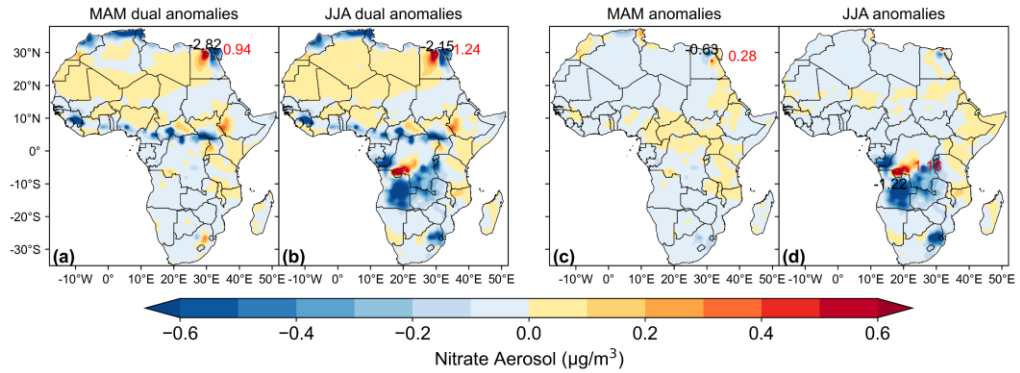

Figure S19: Same as Figure S12, but nitrate aerosol. The units are μg/m^3.

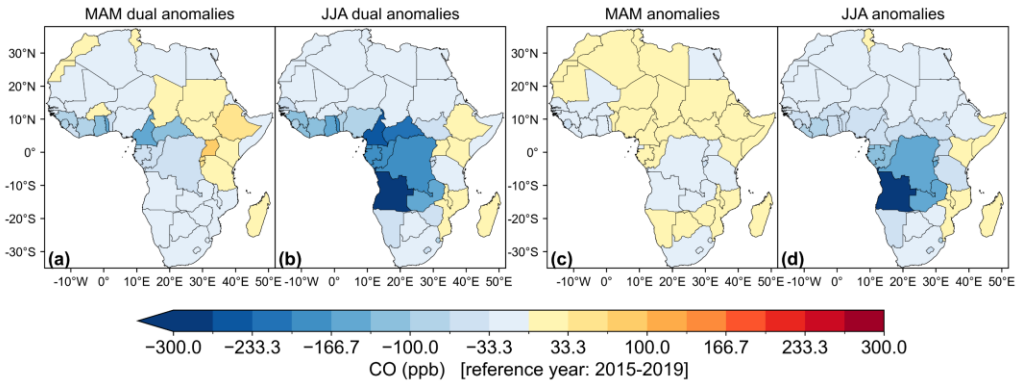

Figure S20: Spatial distribution of CO quarterly dual anomalies (a, b), and quarterly anomalies (c, d) in MAM and JJA in African countries at country level. The differences were calculated between 2020 and 5-year average (2015-2019). The units are ppbv.

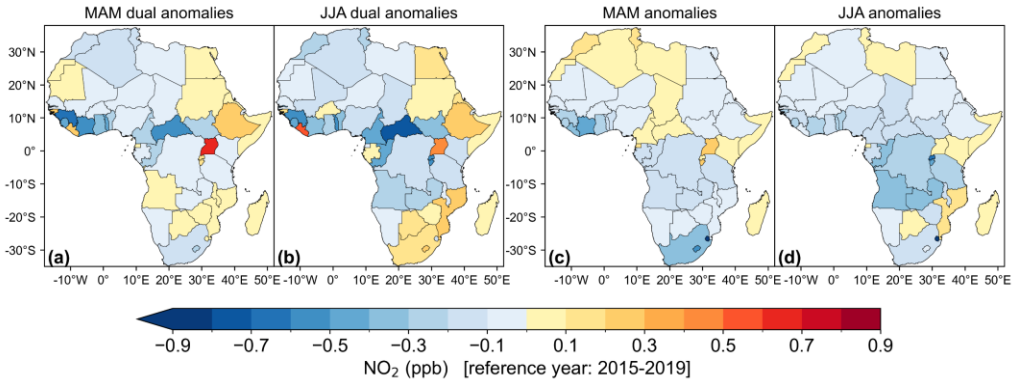

Figure S21: The same as Fig. S19, but for NO_2. The units are ppbv.

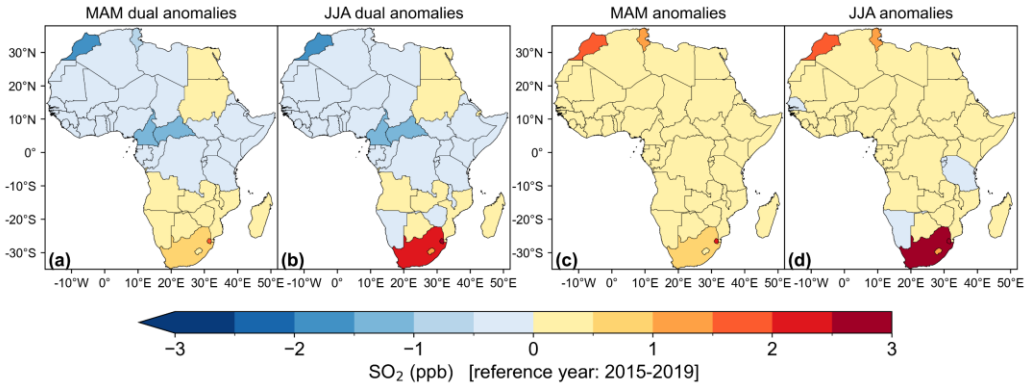

Figure S22: The same as Fig. S19, but for SO_2. The units are ppbv.

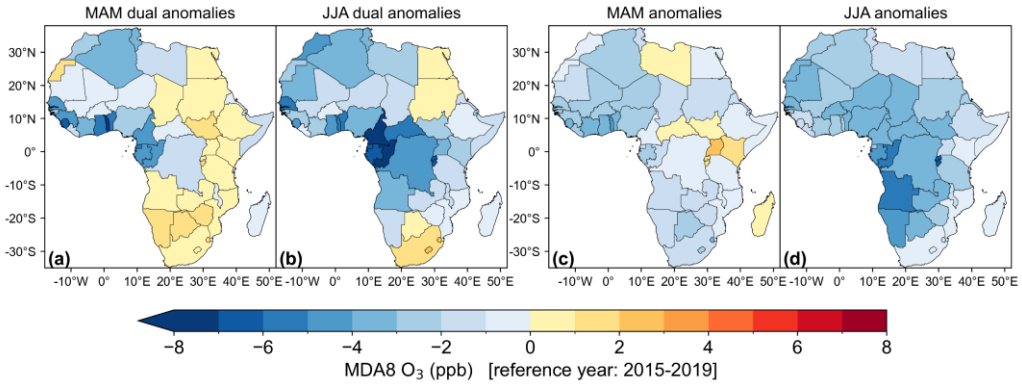

Figure S23: The same as Fig. S19, but for MDA8 O_3. The units are ppbv.

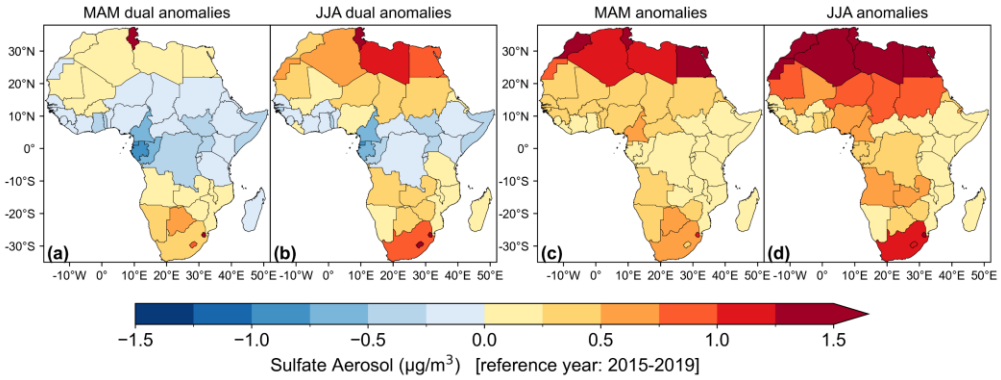

Figure S24: The same as Fig. S19, but for sulfate aerosol. The units are μg/m^3.

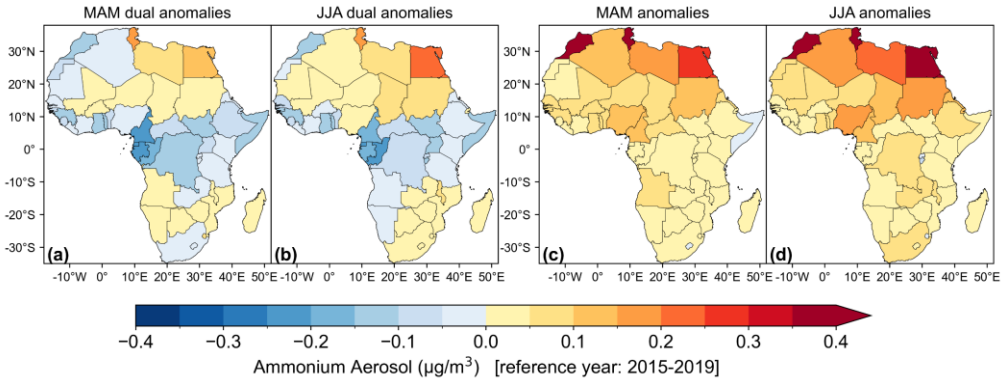

Figure S25: The same as Fig. S19, but for ammonium aerosol. The units are μg/m^3.

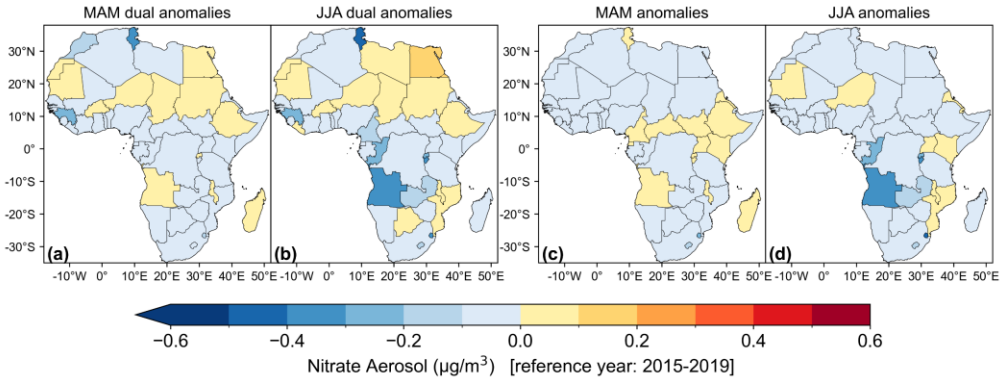

Figure S26: The same as Fig. S19, but for nitrate aerosol. The units are μg/m^3.

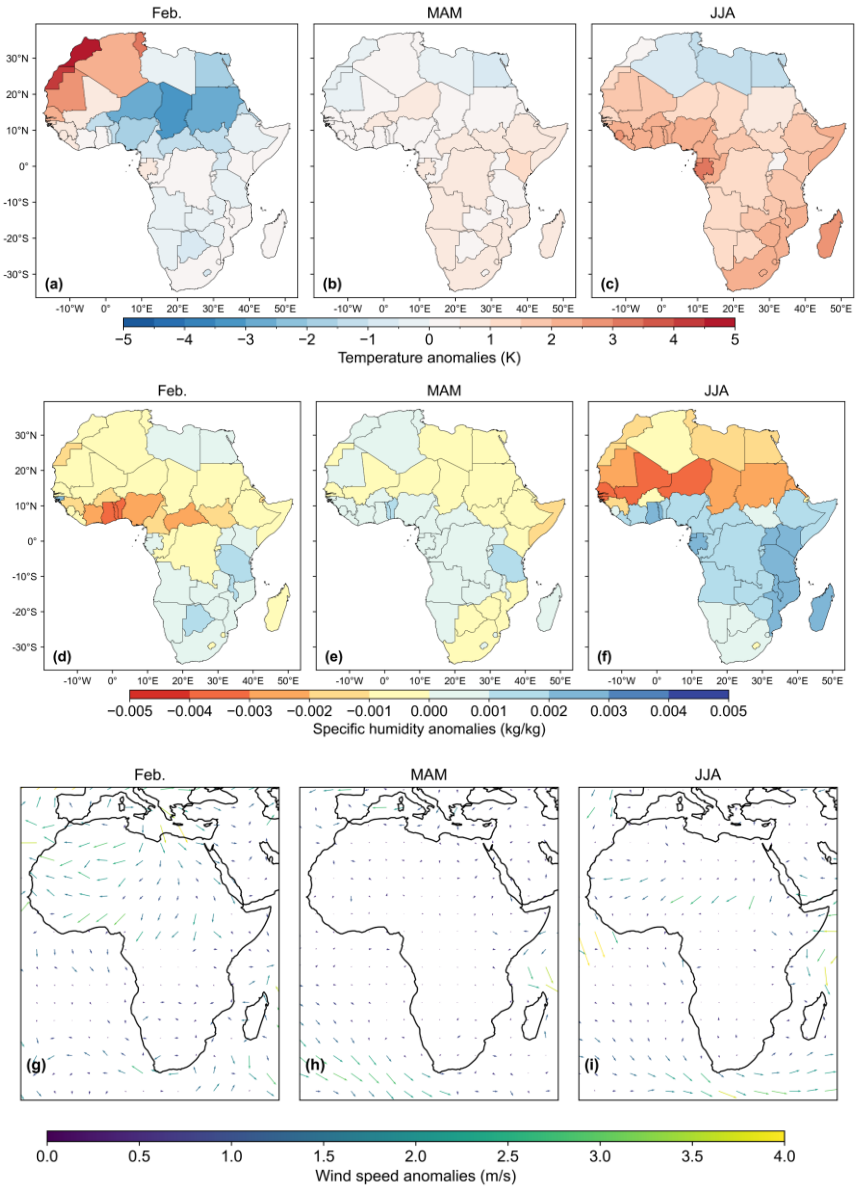

Figure S27: Spatial distribution of (a-c) 2-m temperature (d-f) specific humidity anomalies for Feb., MAM and JJA in African countries and (g-i) wind direction anomalies in African major continents. The differences were calculated between 2020 and 5-year average (2015-2019).

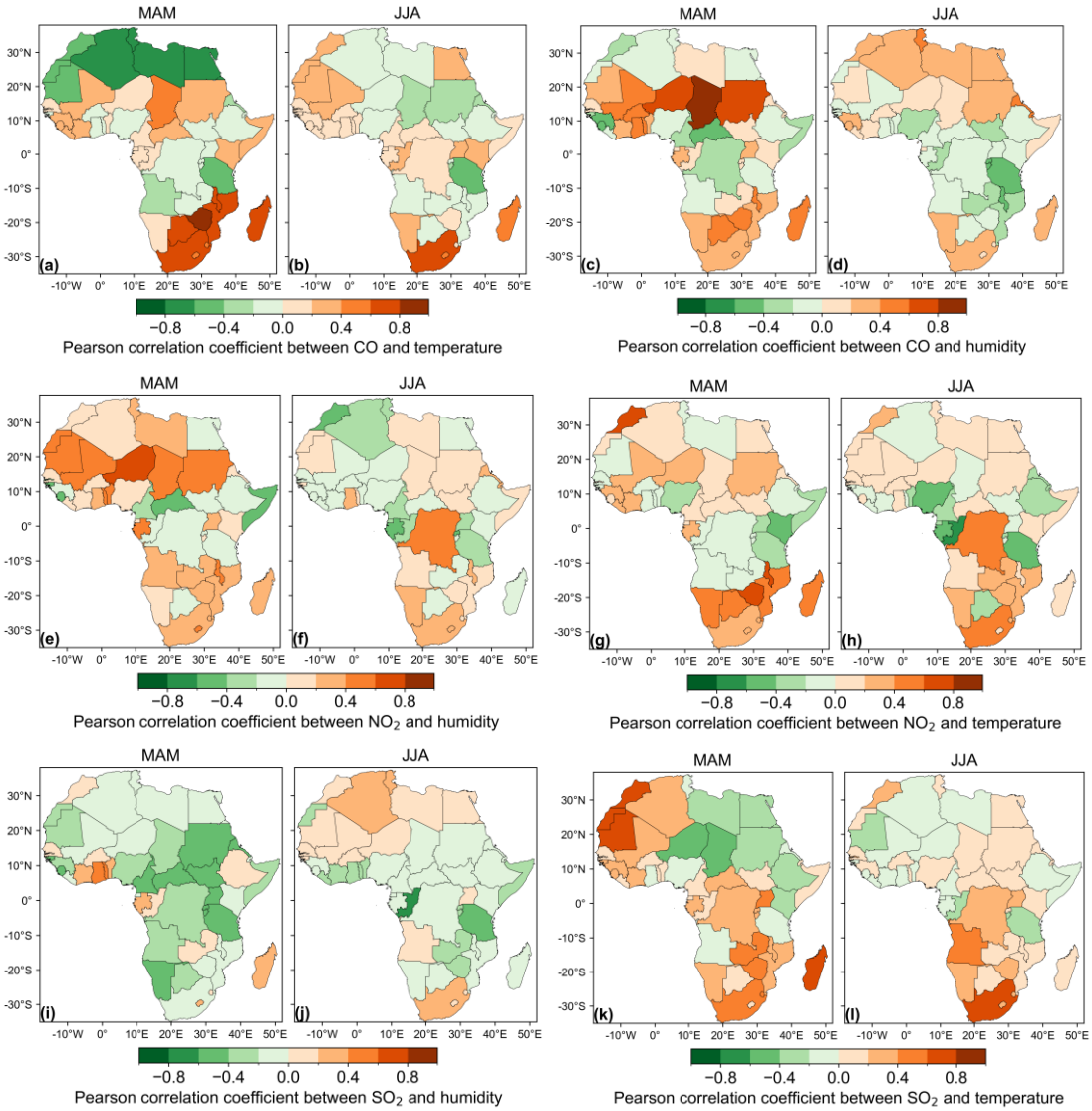

Figure S28: Pearson correlation coefficient of (a, b) CO and T, (c, d) CO and humidity, (e, f) NO_2 and humidity, (g, h) NO_2 and T, (i, j) SO_2 and humidity, (k, l) SO_2 and T for MAM and JJA in African countries.

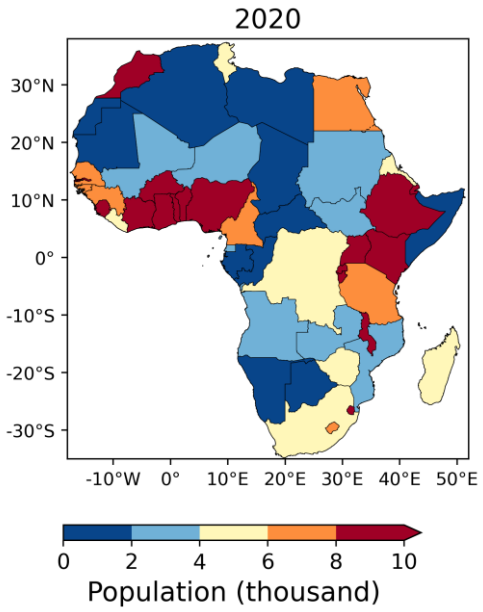

Figure S29: Population in 2020 in African countries. Units are thousand.

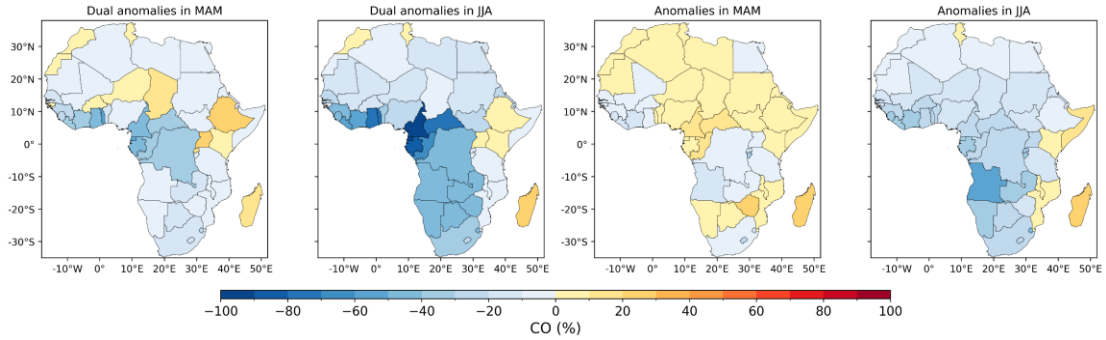

Figure S30: Spatial distribution of CO percentage quarterly dual anomalies (a, b), and percentage quarterly anomalies (c, d; calculated between 2020 and 15-year average from 2005-2019) in MAM and JJA in African countries.

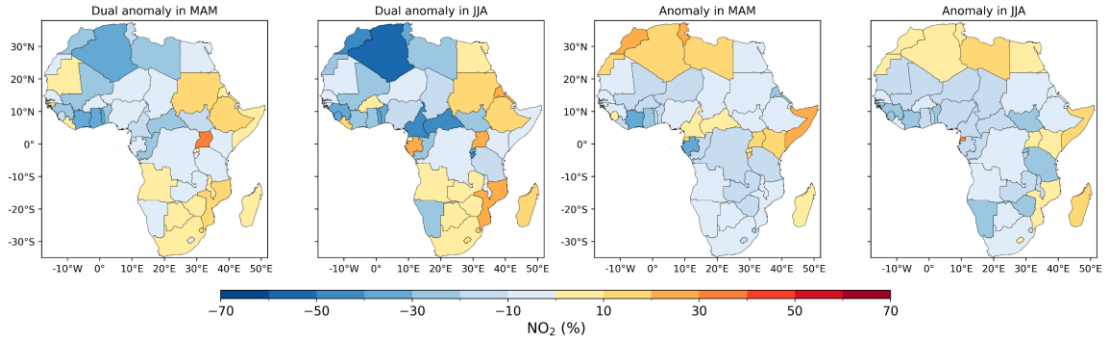

Figure S31: The same as Fig. S29, but for NO_2.

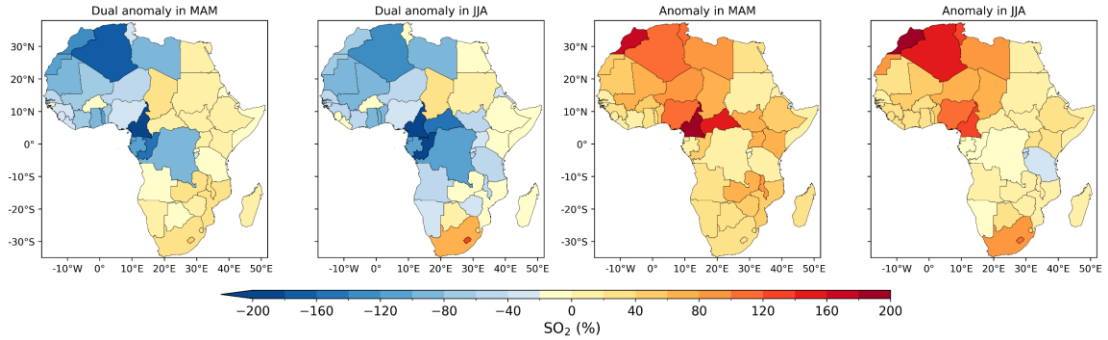

Figure S32: The same as Fig. S29, but for SO_2.

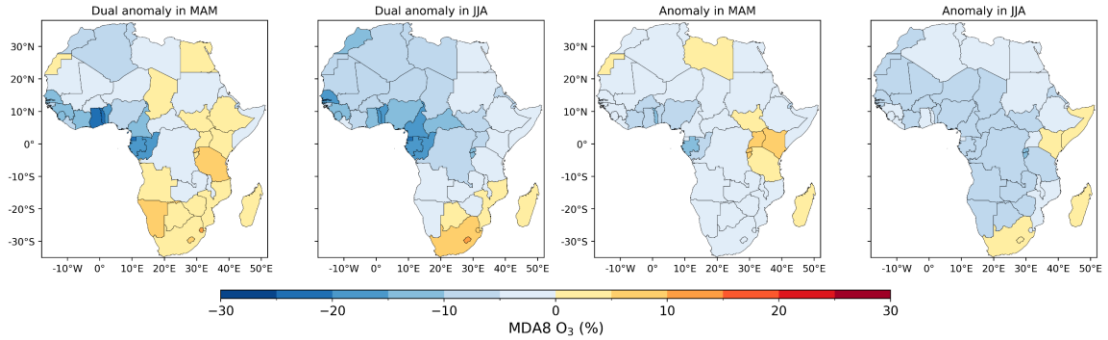

Figure S33: The same as Fig. S29, but for MDA8 O_3.

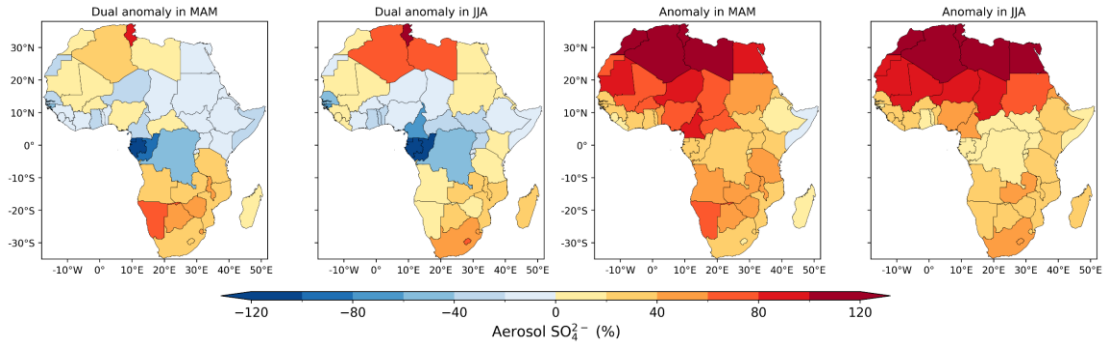

Figure S34: The same as Fig. S29, but for sulfate aerosol.

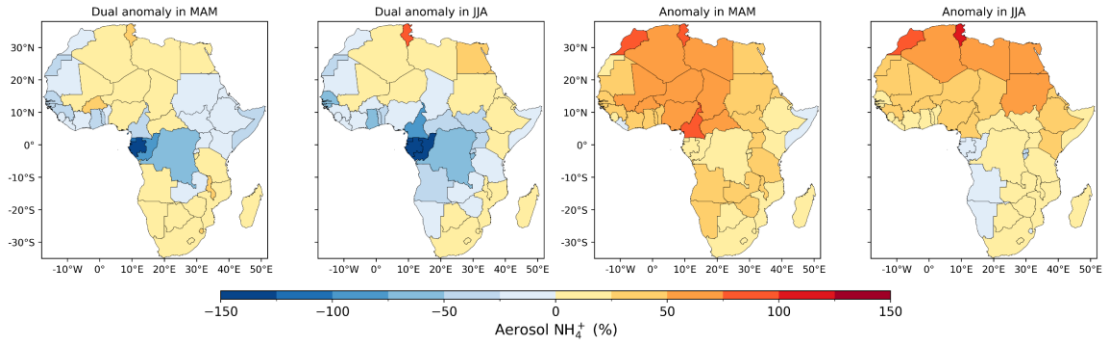

Figure S35: The same as Fig. S29, but for ammonium aerosol.

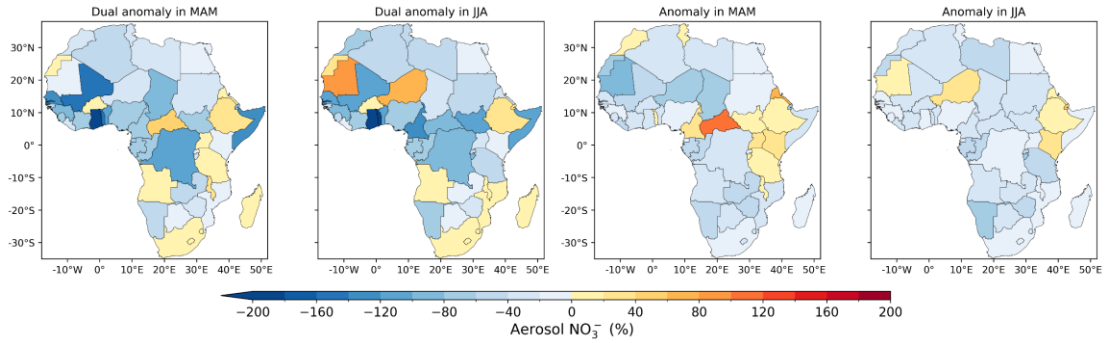

Figure S36: The same as Fig. S29, but for nitrate aerosol.